TECHNICAL MANUAL
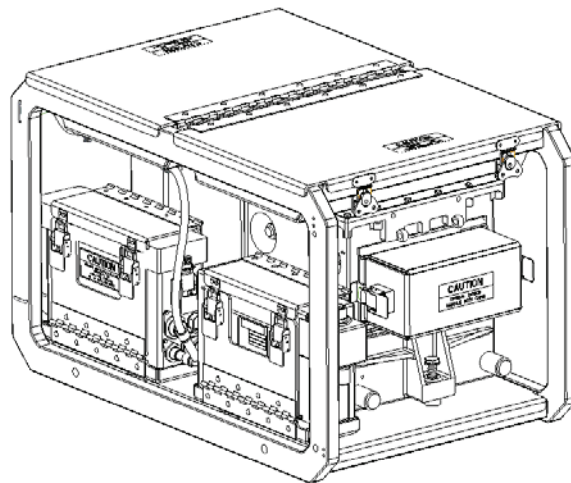
OPERATOR AND FIELD MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR

SURVEYING INSTRUMENT AZIMUTH: IMPROVED POSITION AND AZIMUTH DETERMINING SYSTEM (IPADS) M111
NSN: 6675-01-515-4610
P/N: 7050004-9
LIN: S69925

PROVIDED UNDER CONTRACT NUMBER:
DAAE20-03-D-0150
Manufactured By: L3 Communications Corporation

Approved for public release; distribution is unlimited

HEADQUARTERS, DEPARTMENT OF THE ARMY

WARNING SUMMARY

This warning summary contains general safety warnings and hazardous material warnings that must be understood and applied during operation and maintenance of this equipment. Failure to observe these precautions could result in serious injury or death to personnel. Also included are explanations of safety and hazardous materials icons used within the technical manual.

FIRST AID

For first aid information, refer to FM 4-25.11. Refer to the label and/or material safety data sheet (MSDS) for first aid information on hazardous materials. Fire extinguisher(s), first aid kit and eye wash/shower station should be close at hand (or easily accessible) in case of an emergency.

EXPLANATION OF SAFETY WARNING ICONS

 ELECTRICAL   Electrical wire to hand with electricity symbol running through hand shows that shock hazard is present.

 EXPLOSION   Rapidly expanding symbol shows that the material may explode if subjected to high temperatures, sources of ignition or high pressure.

 HEAVY OBJECT   Human figure stooping over heavy object shows physical injury potential from improper lifting technique.

 HOT AREA   Hand over object radiating heat shows that part is hot and can burn.

 SHARP OBJECT   Pointed object in hand shows that a sharp object presents a danger to limb.

GENERAL SAFETY WARNINGS DESCRIPTION

WARNING

To avoid the risk of driving accidents, the driver's attention must be focused at all times on safe driving. Prolonged diversion of driver's attention to the CDU screen while driving should be avoided.

In the SUSV the IPADS CDU must be secured to the CDU Mast to avoid becoming a crash hazard. The IPADS CDU operator shall always wear the Kevlar helmet or Army Combat Helmet (ACH) while the SUSV is in motion. Lock the CDU in a position that is the furthest away from head during operations.

WARNING SUMMARY – Continued

WARNING

Ensure that the BCU is not connected to AC power before opening the BCU cover.

WARNING

The IPADS transit case, with IPADS inside, weighs 195 lbs (88.5 kg); and must be lifted by mechanical means. Back injury may occur if the case is manually lifted.

IPADS weighs approximately 135 lbs (61.4 kg); use at least four persons to lift and move it.

The empty transit case weighs 60.0 lbs (27.3 kg); use two people to lift.

IPADS floor plate weighs approximately 48 lbs (21.8 kg); use at least two persons to lift onto HMMWV cargo bed.

The SUSV winch weighs approximately 130 lbs. Use three persons to lift it out of the front car.

Frame assembly weighs 46 lbs (21 kg); use two people to lift.

WARNING

If operator must crawl under vehicle to install flange nut, do not touch the exhaust pipe. Contact with hot vehicle exhaust pipe can cause severe burns.

WARNING

The newly drilled holes contain sharp burrs. Wear gloves to prevent injury.

WARNING

To prevent injury to personnel while working on batteries, all rings, watches, bracelets, etc., must be removed.

Disconnect negative battery cable before working with or around batteries. The negative cable is the cable that attaches to the current shunt in the battery box, Figure 2-13.

Protect the negative battery cable from accidental contact with other battery cables or posts.

When finished with work, connect negative battery cable last.

EXPLANATION OF HAZARDOUS MATERIALS ICONS

CHEMICAL — Drops of liquid on hand shows that the material will cause burns or irritation to human skin or tissue.

EXPLOSION — Rapidly expanding symbol shows that the material may explode if subjected to high temperatures, sources of ignition or high pressure.

FIRE — Flame shows that a material may ignite and cause burns.

VAPOR — Human figure in a cloud shows that material vapors present a danger to life or health.

HAZARDOUS MATERIALS DESCRIPTION

WARNING

BATTERY HYDROGEN GAS

BCU contains acid-filled batteries that may generate hydrogen gas. Keep heat and ignition sources away.

WARNING

BATTERY ACID

Do not allow battery liquid to touch skin or clothing. If battery liquid touches skin, flush area immediately with water. If it touches the eyes, flush immediately with water for 30 minutes and seek medical attention without delay.

WARNING

DENATURED ALCOHOL

Denatured alcohol is flammable and gives off harmful vapors. Use only in well-ventilated areas away from open flames and sparks. Avoid prolonged or repeated inhalation of vapors.

WARNING SUMMARY – Continued

WARNING

FLAMMABLE PACKAGING

The foam in the IPADS transit case is flammable. Do not expose to open flame or ignition sources. Extinguish burning foam with water spray, CO_2, foam, or dry chemical fire extinguisher.

Stay Alert, Stay Alive

LIST OF EFFECTIVE PAGES

Dates of issue for original and updated pages/work packages are:

Original.. 0   15 August 2007

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 28 AND TOTAL NUMBER OF PAGES FOR CHAPTERS AND APPENDICES IS 292 CONSISTING OF THE FOLLOWING:

Page No.	*Change No.
Cover	0
a – c...	0
d blank	0
A	0
B blank..	0
i – iv...	0
1-1 – 8-1..	0
8-2 blank	0
A-1 – J-5	0
J-6 blank	0
INDEX-1 – INDEX-9........................	0
INDEX-10 blank...............................	0

*Zero in this column indicates an original page or work package.

ARMY TM 9-6675-349-13&P   **HEADQUARTERS**
MARINE CORPS TM 11039A-OI/1 **DEPARTMENT OF THE ARMY**
WASHINGTON D.C., 15 AUGUST 2007

OPERATOR AND FIELD
MAINTENANCE MANUAL

FOR

SURVEYING INSTRUMENT AZIMUTH:
IMPROVED POSITION AND AZIMUTH
DETERMINING SYSTEM (IPADS) M111
NSN: 6675-01-515-4610
PN: 7050004-9
LIN: S69925

*Supersedes TM 9-6675-349-12&P dated 1 October 2005

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (Recommended Changes to Publications and Blank Forms), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is http://aeps.ria.army.mil. If you need a password, scroll down and click on "ACCESS REQUEST FORM". The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or E-mail your letter or DA Form 2028 direct to: AMSTA-LC-CI Tech Pubs, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The email address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

Marine Corp users shall submit NAVMC Form 10772 (Recommended Changes to Technical Publications/Logistics-Maintenance Data Coding) to: Commander, Marine Corps System Command, ATTN: PM FSS, 2200 Lester Street, Quantico, VA 22134-6050. Recommended changes may be sent by fax (DSN 378-3550, Commercial (703) 432-3550), or by naval message (in any format, only one publication per message). A reply will be furnished to you. Marine Corps users/maintainers should also provide an informational copy to: Commander, Marine Corps Logistics Bases (Code 850), 814 Radford, Albany, GA 31704-1128.

TABLE OF CONTENTS

Approved for public release; distribution is unlimited.

LIST OF ILLUSTRATIONS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

SECTION I. GENERAL INFORMATION

1-1. Scope.

This manual contains information and guidance for the operation and maintenance of the Improved Position and Azimuth Determining System (IPADS).

a.   Type of Material.
     This manual provides operating instructions and operator and unit maintenance instructions. The Maintenance Allocation Chart in Appendix D assigns maintenance on each part and assembly. Maintenance that cannot be performed because of the need for tools, equipment, or supplies will be referred to a higher maintenance category.

b.   Purpose of Equipment.
     The IPADS is a highly mobile, self-contained survey instrument that supports field artillery operations.

1-2. Maintenance Forms and Records.

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS). Marine Corps users shall refer to TM 4700-15/1.

NOTE

This equipment is not covered by Equipment Serviceability Criteria (ESC).

1-3. Destruction of Army Material to Prevent Enemy Use.

Army and Marine Corps users, refer to Army TM 750-244-2 for procedures for destruction of this equipment to prevent enemy use.

1-4. Administrative Storage.

Refer to TM 740-90-1 for procedures, forms and records, and inspections required during administrative storage of this equipment. Marine Corps users shall refer to MCO 4450.7.

1-5. Calibration.

No scheduled calibration is required.

1-6. Reporting Equipment Improvement Recommendations (EIR).

EIRs can and must be submitted by anyone who is aware of an unsatisfactory condition with the equipment design or use. It is not necessary to show a new design or list a better way to perform a procedure, just tell why the design is unfavorable or why a procedure is difficult. EIRs may be submitted on SF (Standard Form) 368 (Product Quality Deficiency Report). Mail directly to:

Armament Research, Development & Engineering Center
ATTN: AMSRD-QEP-A
Rock Island, IL 61299-7300

Marine Corps users may submit EIRs and Quality Deficiency Reports in accordance with MCO 4855.10B. Mail directly to:

Commanding General
Marine Corps Logistics Command (code 808)
Albany, GA 31704-5000

A reply will be sent directly to you.

SECTION II. DESCRIPTION AND DATA

1-7. Purpose of IPADS.

The IPADS is a self-contained inertial surveying system capable of rapidly determining accurate position, elevation, and azimuth when used in ground survey operations. IPADS is used to conduct field artillery surveys critical to the fire-control function, providing a common survey for weapons and target acquisition systems. It will determine the true or grid azimuth lines used to orient weapons and target acquisition systems.
The system may be installed in and operate from an M998, M1097, or M1123 series High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV) and M973 series Small Utility Support Vehicle (SUSV). IPADS may be utilized within any vehicle capable of carrying it, supplying required power, and making periodic stops at five or ten minute intervals.

1-8. Description.

IPADS is described in Figures 1-1 through 1-8.

1–9. Differences Between Models.

There is only one model of the IPADS.

1–10. Capabilities and Features.

- Self-contained
- Mobile (may be used with land vehicles)
- Two–person crew
- Horizontal position
- Elevation
- Azimuth
- Built–in self–test circuits

1-11. Tabulated Data.

A list of components required for use of IPADS in ground vehicles is given in table 1-1. IPADS characteristics and performance data are given in Table 1-2.

1-12. Items Comprising Operable Equipment.

All items illustrated and listed in Figure 1-1 through figure 1-8 are required for operable equipment.
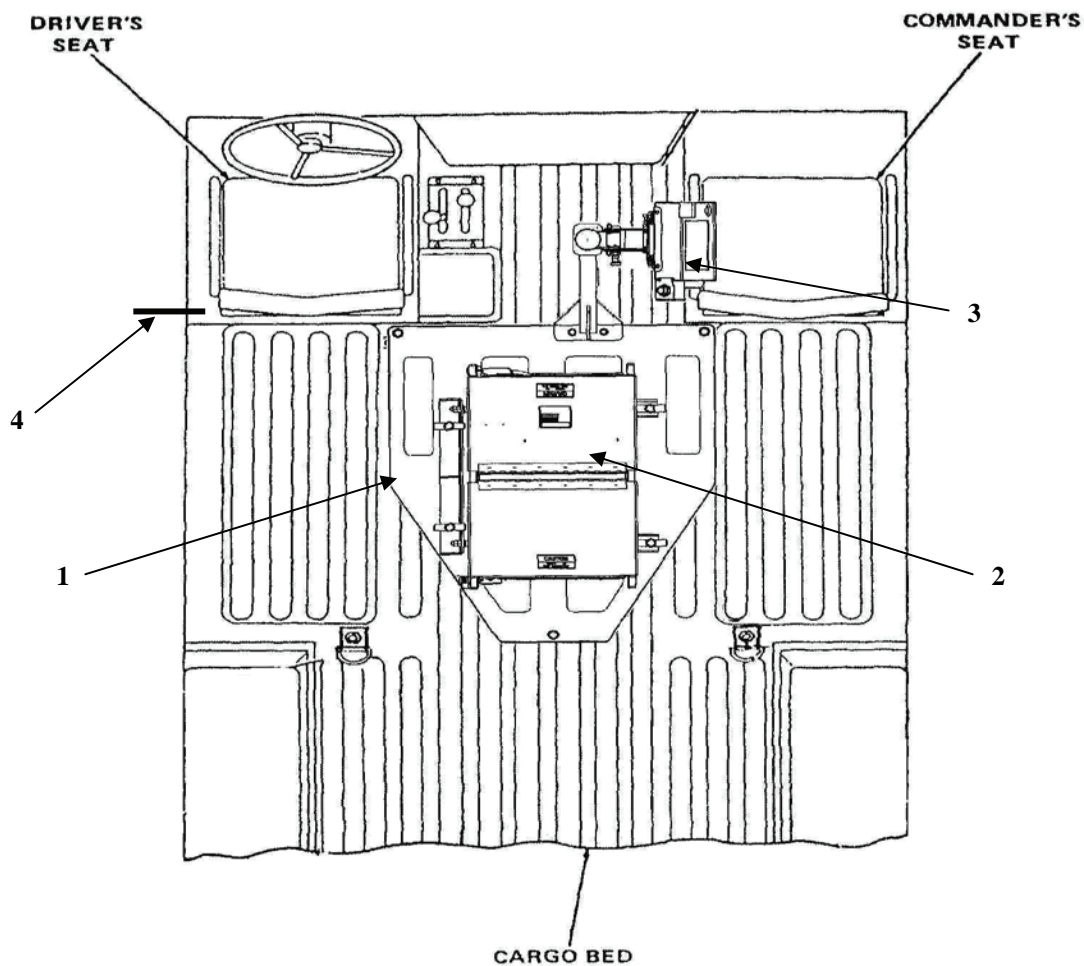
Figure 1-1 – Location and Description of IPADS in M998 / M1123 / M1097 High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV)

Legend for Figure 1-1 – Location and Description of IPADS in M998 / M1123 / M1097 High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV)

Index No.	Nomenclature	Description
1	HMMWV mounting kit	Contains the mounting hardware and electrical cable needed to install IPADS in a HMMWV.
2	IPADS assembly	Contains the basic electronic components for IPADS, including navigation unit (CPNU), standby battery power (BCU), wiring harness, control and display unit (CDU), and storage space for tools and cables.
3	Control and Display Unit	Contains computer, keyboard, and graphic display for operator entry and display of survey data and system commands (CDU).
4	Plumb bob bracket	Bracket to hang plumb bob above survey point.

1-12. Items Comprising Operable Equipment – Continued
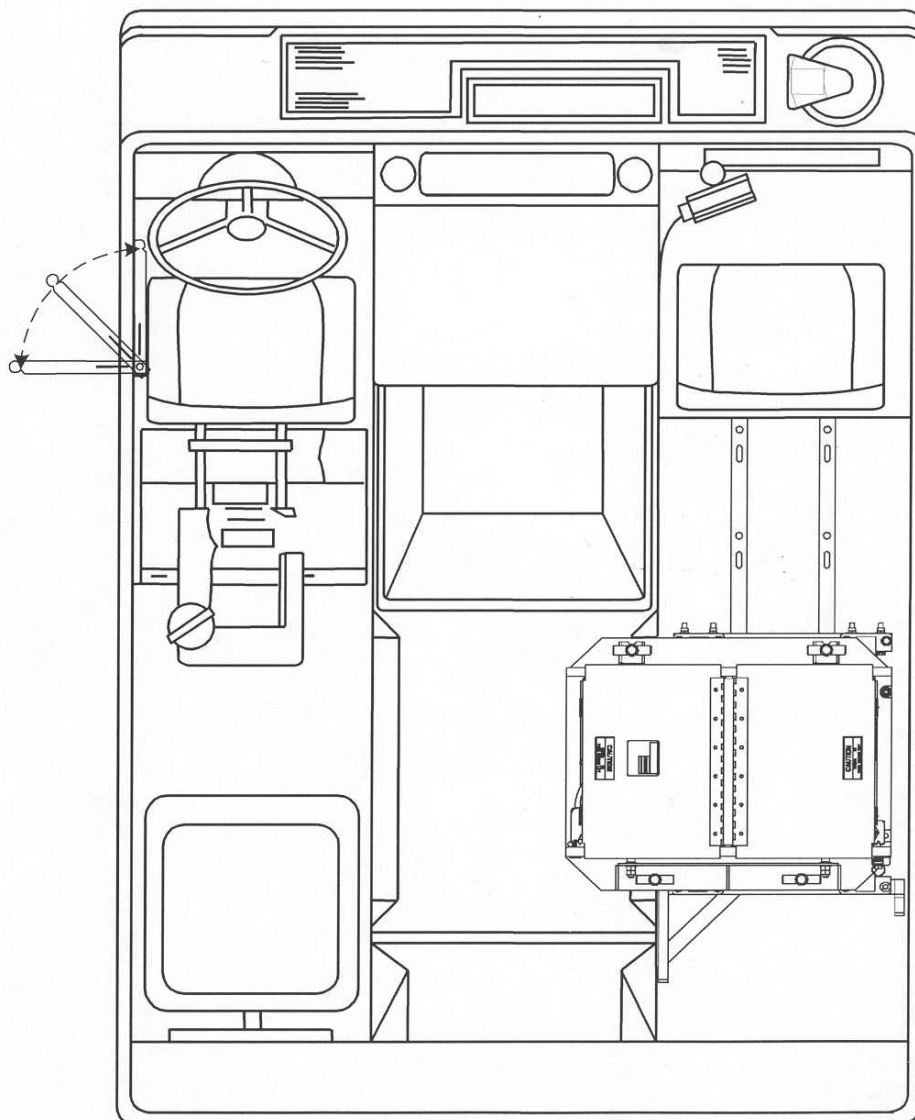
Figure 1-2 – Location and Description of IPADS in M973 Small Utility Support Vehicle (SUSV)

Legend for Figure 1-2 – Location And Description Of IPADS in M973 Small Utility Support Vehicle (SUSV)

Index no.	Nomenclature	Description
1	SUSV Mounting kit	Contains the mounting hardware and electrical cable needed to install IPADS in a SUSV.
2	IPADS assembly	Contains the basic electronic components for IPADS, including navigation unit (CPNU), standby battery power (BCU), control and display unit (CDU), wiring harness, and storage space for tools and cables.
3	Control and Display Unit	Contains computer, keyboard, and graphic display for operator entry and display of survey data and system commands (CDU).
4	Plumb bob arm	Arm to hang plumb bob above survey point.
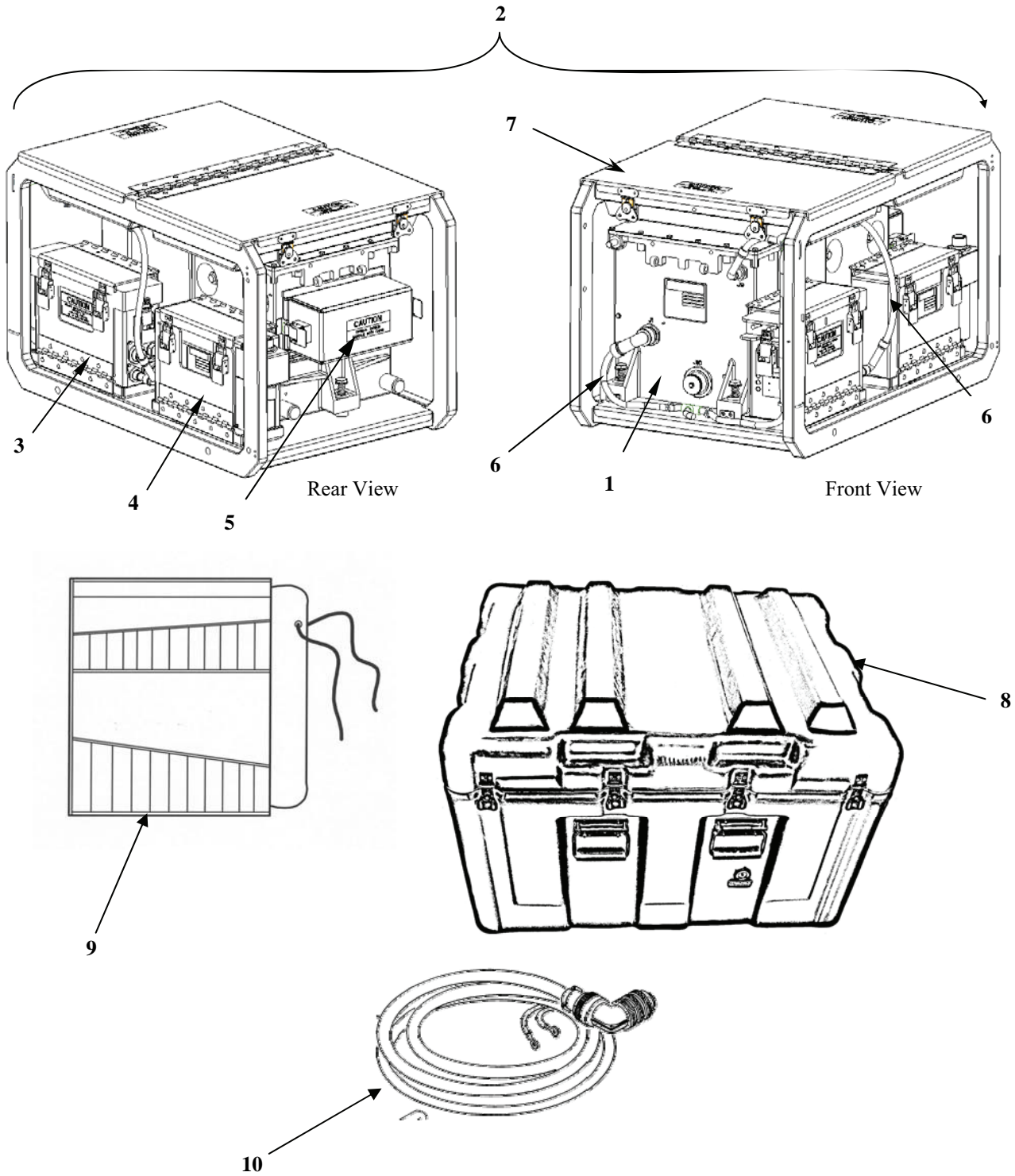
2

Rear View

Front View

3

4

5

7

6

6

1

6

8

9

10

Figure 1-3 – Location and Description of IPADS Assembly Components

1-12. Items Comprising Operable Equipment – Continued

Legend for Figure 1-3 -– Location and Description of IPADS Assembly Components

Index no.	Nomenclature	Description
1	Compact Position & Navigation Unit (CPNU)	Contains the gyroscope and accelerometer sensors and associated electronics necessary to maintain the survey coordinate frame and measure distance traveled to each coordinate axis. Also contains porro prism for auto-reflection.
2	IPADS assembly	Contains the basic electronic components for IPADS, including CPNU, standby battery power (BCU), control and display unit (CDU), wiring harness, and storage space for tools and cables.
3	Battery and Charger Unit (BCU)	Contains IPADS backup batteries and associated switching and charging electronics.
4	Control and Display Unit (CDU)	Contains computer, keyboard, and graphic display for operator entry and display of survey data and system commands (CDU). CDU is mounted outside of IPADS assembly on mounts during operation.
5	Porro Prism and Cover	Used for auto reflection.
6	IPADS Harness Assembly (W-114)	Interconnects BCU, CDU and CPNU.
7	Storage Boxes	Provides storage for IPADS accessory and tool kit, see Figure 1-5 for detail.
8	Shipping and Storage Container, IPADS	Container for shipping and storing the IPADS during transit and extended storage when not installed in vehicle.
9	Tool Kit	Tools needed to install and maintain IPADS assembly.
10	Power Cable (W-116-1)	Provides DC power to IPADS from vehicle batteries.

Figure 1-4 — Basic Issue Items
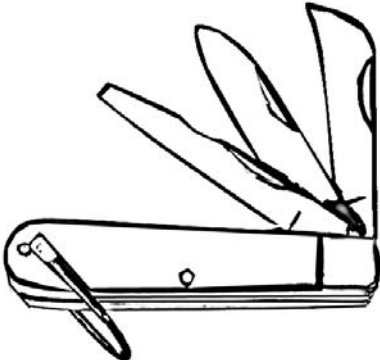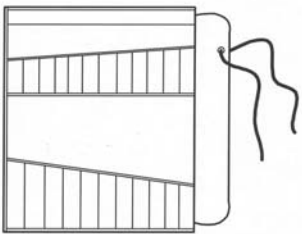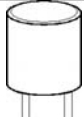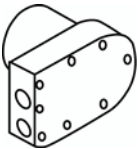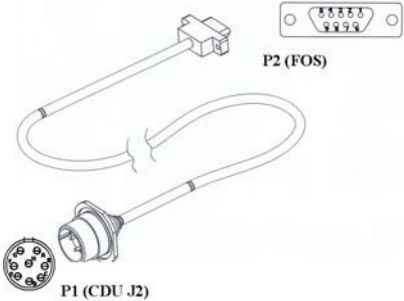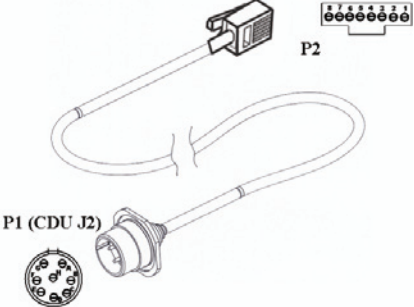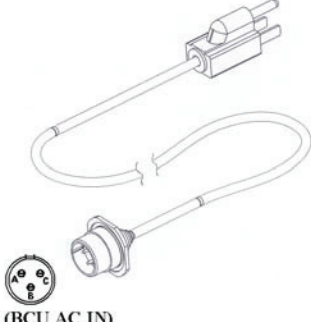
Item Number	Item
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

Figure 1-4 — Basic Issue Items

Item Number	Item
12	
13	
14	
15	
16	
17	
18	
19	

Figure 1-4 – Basic Issue Items

Item Number	Item
20	
21	P2 (FOS) P1 (CDU J2)
22	P2 P1 (CDU J2)
23	P1 (BCU AC IN)
24	

1-12. Items Comprising Operable Equipment – Continued

Legend for Figure 1-4 – Basic Issue Items

ILLUSTRATION		NATIONAL STOCK NUMBER	DESCRIPTION PART NUMBER (CAGEC)	UNIT OF ISSUE	QUANTITY REQUIRED
FIG	ITEM				
1-5	1	5210-01-367-7283	Plumb bob, brass 8 oz. (63474) 108	EA	1
1-5	2	5120-01-522-5473	Plumb bob String 25yds (39428) 2178A8	Roll	1
1-5	3	6230-00-264-8261	Flashlight 90˚angle (1CSX9) MX-991/U	EA	1
1-5	4	5975-00-899-4606	Strap, Tiedown, Elect.(Nylon) (81343) MS3367-5-0	Bundle	1
1-5	5	5975-01-523-4302	Strap, Cable W/Buckle (Velcro) (34054) 6912K54	EA	5
1-5	6	7920-00-205-1427	Brush, Dusting, Lens (80244) 7920-00-205-1427	EA	1
1-5	7	5120-01-335-1294	Wrench, Open End 5/8 inch (55719) OSH20B	EA	1
1-5	8	5120-01-474-5182	Handle, Ratchet Wrench 3/8 inch (55719) F936	EA	1
1-5	9	5120-01-429-3597	Socket Set, Socket (68D9G) 211SFY (12 Point) Set to include: • 1/4 inch • 5/16 inch • 3/8 inch • 7/16 inch • 1/2 inch • 9/16 inch • 5/8 inch • 11/16 inch • 3/4 inch • 13/16 inch • 7/8 inch	EA	1
1-5	10	5120-01-428-7830	Pliers, Needle Nose (55719) 196BCP	EA	1
1-5	11	5120-01-300-1152	Screwdriver, Cross Tip 3-3/4 inch (55719) GSDDP22	EA	1
1-5	12	5120-01-290-8231	Screwdriver, Crosstip 8-13/32-inch (55719) GSDDP42	EA	1
1-5	13	5120-01-335-1235	Wrench, Box and Open End 9/16-inch (55719) OEX18B	EA	1
1-5	14	5120-01-367-3356	Wrench, Box and Open End 3/4-inch (55719) OES24B	EA	1

Legend for Figure 1-4 – Basic Issue Items – Continued

ILLUSTRATION		NATIONAL STOCK NUMBER	DESCRIPTION PART NUMBER (CAGEC)	UNIT OF ISSUE	QUANTITY REQUIRED
FIG	ITEM				
1-5	15	5110-01-399-9317	Knife, Pocket, Electrician's (1CV05) 18535	EA	1
1-5	16	5140-01-528-1311	Roll, Tools & Accessories (39428) 6389A11	EA	1
1-5	17	5920-01-493-6642	Fuse, Cartridge (0JR59) 373150041	EA	5
1-5	18	5120-01-335-1233	Wrench, Box and Open 7/16-inch (55719) OEX14B	EA	1
1-5	19		Field and Sustainment Maintenance Manual for the IPADS TM 9-6675-349-13&P	EA	1
1-5	20	5935-00-567-0128	Connector Plug Electrical, NATO (61090) TGC2338	EA	1
1-5	21	5995-01-519-0653	Cable Assembly, Special, W136 (FOS) (1NZ85) 7204136-9	EA	1
1-5	22	5995-01-522-2631	Cable Assembly, Special, W143 (REPROGRAMMING) (1NZ85) 7204143-9	EA	1
1-5	23	5995-01-493-8358	Cable, Charging, BCU (1NZ85) ABP-ACC-TR-1	EA	1
1-5	24	5120-01-263-6436	Hex Key, 5/16" L Handle (3A054) 57185A17	EA	1

1-12. Items Comprising Operable Equipment – Continued

Table 1-1 – Components Required for Use of IPADS in Combat Vehicles

Nomenclature	Part No/NSN	Quantity Required	M998 HMMWV	M1123/ M1097 HMMWV	M973 Series SUSV
IPADS Assembly	7050004-9	1	X	X	X
Mounting Kit, HMMWV	7204154-9	1	X	X	
Floor Plate	7204108-1	1	X	X	
Floor Plate Hardware			X	X	
1/2-13 X 3 L screw	MS35307-419	3			
1/2 locking washer	MS35338-143	3			
1/2 flat washer	MS15795-818	3			
CDU Support Arm Assembly	7204155-9	1	X	X	
CDU Support Arm Hardware			X	X	
3/8-16, 1" screw	MS35307-360	4			
3/8 flat washer	MS15795-814	4			
CDU Mount Assembly	7204149-9	1	X	X	X
Alignment Bracket Assembly	7204151-9	1	X	X	X
Mounting Clamp	7204108-4	2	X	X	X
T-Handle	7204108-3	4	X	X	X
T-Handle Hardware			X	X	X
5/8 washer	98370A035	2			
Plumb Bob Bracket	7204108-8	1	X	X	
PB Bracket Thumbscrew 5/16-18 X 1L	91744A583	1	X	X	
Power Cable W116	7204116-1	1	X	X	
Plug, NATO	TGC2338	1	X	X	X
M1123/M1097 Hardware				X	
1/2 flange nut	94758A033	3			
Mounting Kit, SUSV	7204144-9				X
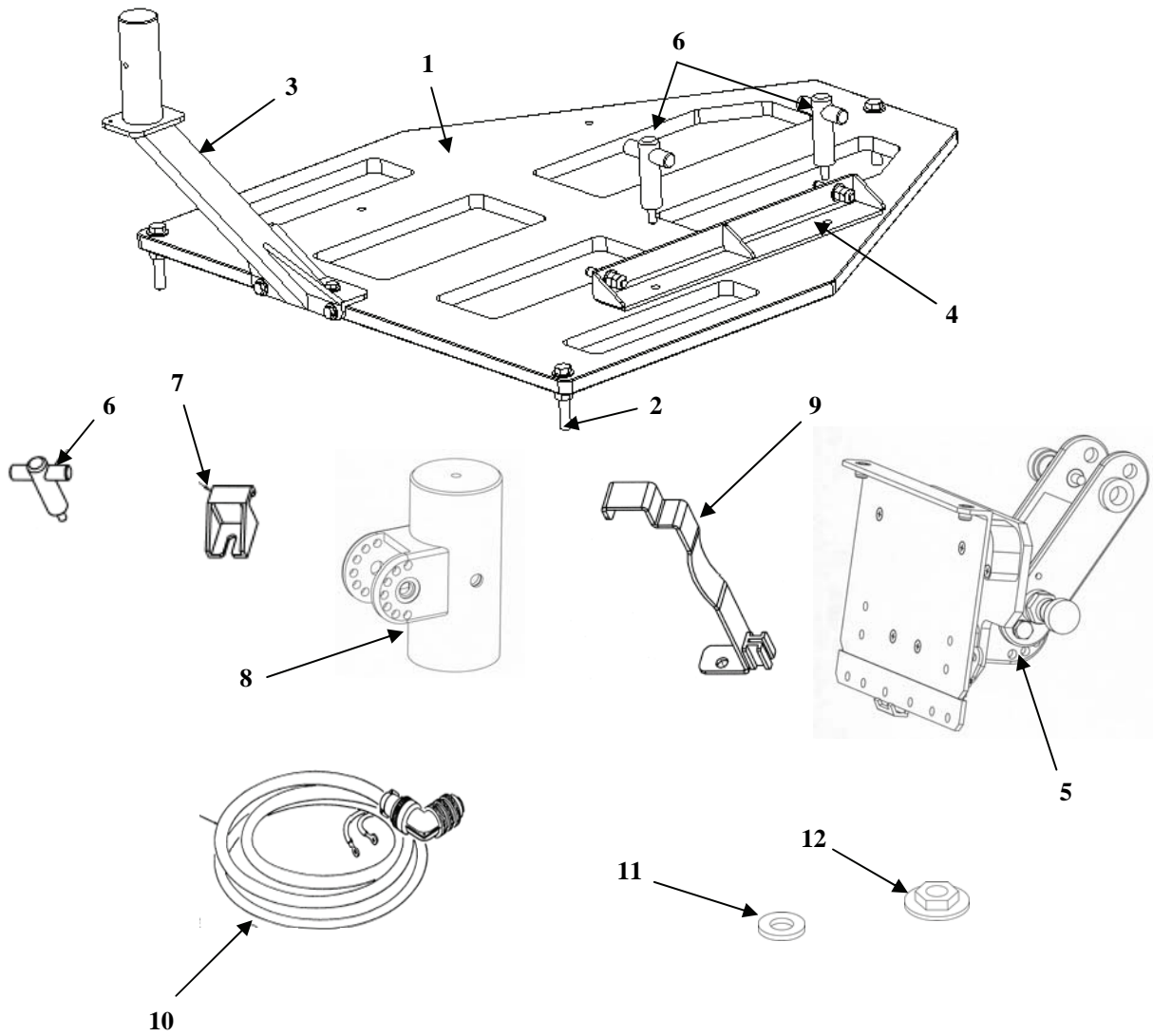
Figure 1-5 – Description HMMWV Installation Kit Components

1-12. Items Comprising Operable Equipment – Continued

Legend for Figure 1-5 – Description HMMWV Installation Kit Components

Index no.	Nomenclature	Description
1	Floor Plate	Mounts the IPADS Frame to the cargo bed of HMMWV.
2	Floor plate hardware	Three each 1/2-inch diameter by 3-inch long bolts, lock washers and flat washers. Three each 1/2-inch flanged nut used on M1123 and M1097 HMMWVs.
3	CDU Support Arm Assembly	Mounts CDU and its CDU mount assembly to the floor plate
4	Alignment Bracket Assembly	Secures the IPADS Frame (BCU and CDU side) to the floor plate.
5	CDU Mount Assembly	Attaches to CDU indexer mast for mounting the CDU to CDU support arm assembly.
6	T-Handle (four each)	Secures IPADS alignment bracket assembly and mounting clamps to floor plate.
7	Mounting clamp (two each)	Secures the IPADS assembly (CPNU side) to the floor plate.
8	CDU indexer mast	Attaches to the CDU mount assembly for mounting the CDU to the CDU support arm assembly.
9	Plumb bob bracket	HMMWV bracket to hang plumb bob over survey marker.
10	Power cable (W-116-1)	Connects IPADS to HMMWV.
11	Washer, Flat (two each)	Used with T-handle bolts to secure alignment bracket to the floor plate.
12	Nut, Flange	Used during installation of IPADS to secure the floor plate.
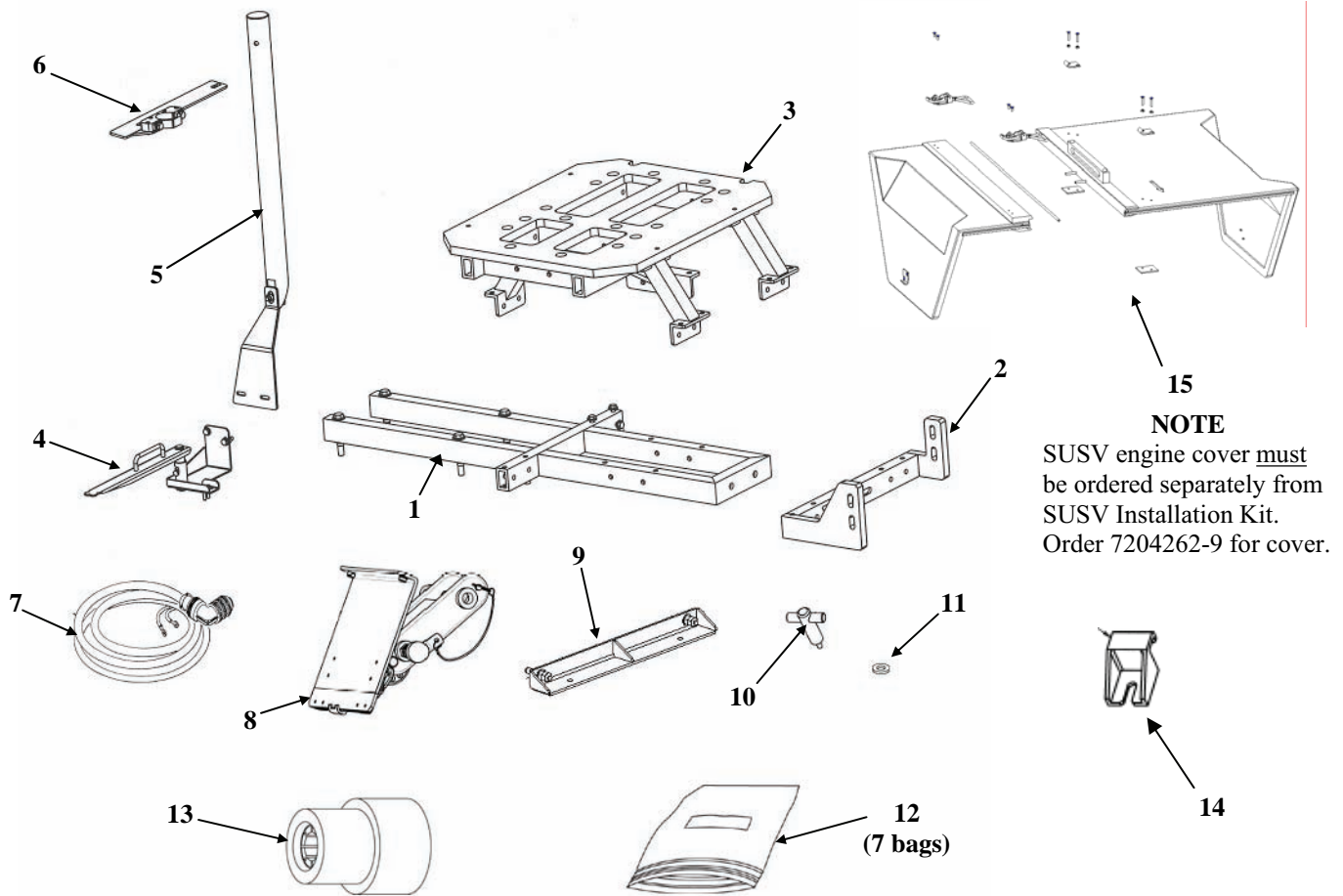
Figure 1-6 – Description SUSV Installation Kit Components (7204144-9)

Legend for Figure 1-6 – Description SUSV Installation Kit Components

Index No.	Nomenclature	Description
1	Rear Rail Assembly	Bolted structure that orients and supports IPADS in correct position in SUSV. Contains numerous fastening hardware for field assembly.
2	Front Rail Assembly	Bolted structure that orients and supports IPADS in correct position in SUSV. Contains numerous fastening hardware for field assembly.
3	Center Frame Assembly	Bolted structure that orients and supports IPADS in correct position in SUSV. Contains numerous fastening hardware for field assembly.
4	Plumb Bob Assembly	Rotating arm used to hang plumb bob to establish position reference point in SUSV.
5	CDU Shaft Assembly	Hardware that supports the Control and Display Unit (CDU) for operator entry and display of survey data and system commands (CDU). Allows CDU to swivel between driver and IPADS operator.

Index No.	Nomenclature	Description
6	CDU Panel Assembly	Hardware that supports the Control and Display Unit (CDU) for operator entry and display of survey data and system commands (CDU). Allows CDU to swivel between driver and IPADS operator.
7	Power Cable W116-3	Provides power from SUSV to IPADS.
8	CDU Indexer	Holds CDU upright and in place.
9	Alignment Bracket Assembly	Holds IPADS in place on the SUSV mounting plate.
10	T-handle Bolts (four each)	Secures alignment bracket assembly and mounting clamps to SUSV mounting plate.
11	T-handle Washer (two each)	Use with T-handle bolts to secure alignment bracket to mounting plate.
12	Connecting Hardware	Fasteners including bolts, nuts, and washers used to connect the IPADS mounting assemblies to the SUSV.
	Rear Assembly Right Bolts	• 2 7/16-20X2.5-inch bolts • 4 7/16-inch diameter washers • 2 7/16-inch locknuts
	Rear Assembly Left Bolts	• 2 7/16-20X1.5-inch bolts • 2 7-16-inch diameter washers
	Front to Rear Assembly Bolts	• 2 1/2-13X3.5-inch bolts • 4 1/2-inch diameter washers • 2 1/2-inch locknuts
	Front Rail Assembly Bolts	• 4 1/2-13X3.0-inch bolts • 8 1/2-inch diameter washers • 4 1/2-inch locknuts
	Center Frame Assembly Bolts, Long	• 10 3/8-16X3.0-inch bolts • 20 3/8-inch diameter washers • 10 3/8-inch locknuts
	Center Frame Assembly Bolts, Short	• 10 3/8-16X2.5-inch bolts • 20 3/8-inch diameter washers • 10 3/8-inch locknuts
	Plumb Bob Assembly Bolts	• 2 M6 bolts • 2 M6 washers • 2 M8 bolts • 4 M8 washers • 2 M8 locknuts
13	SUSV NATO Plug Adapter	Connects the NATO plug to the SUSV NATO outlet.
14	Mounting Clamp (two each)	
15	SUSV Modified Engine Cover	Not part of SUSV Installation Kit. Must be ordered separately. 7204262-9

2, 3

1
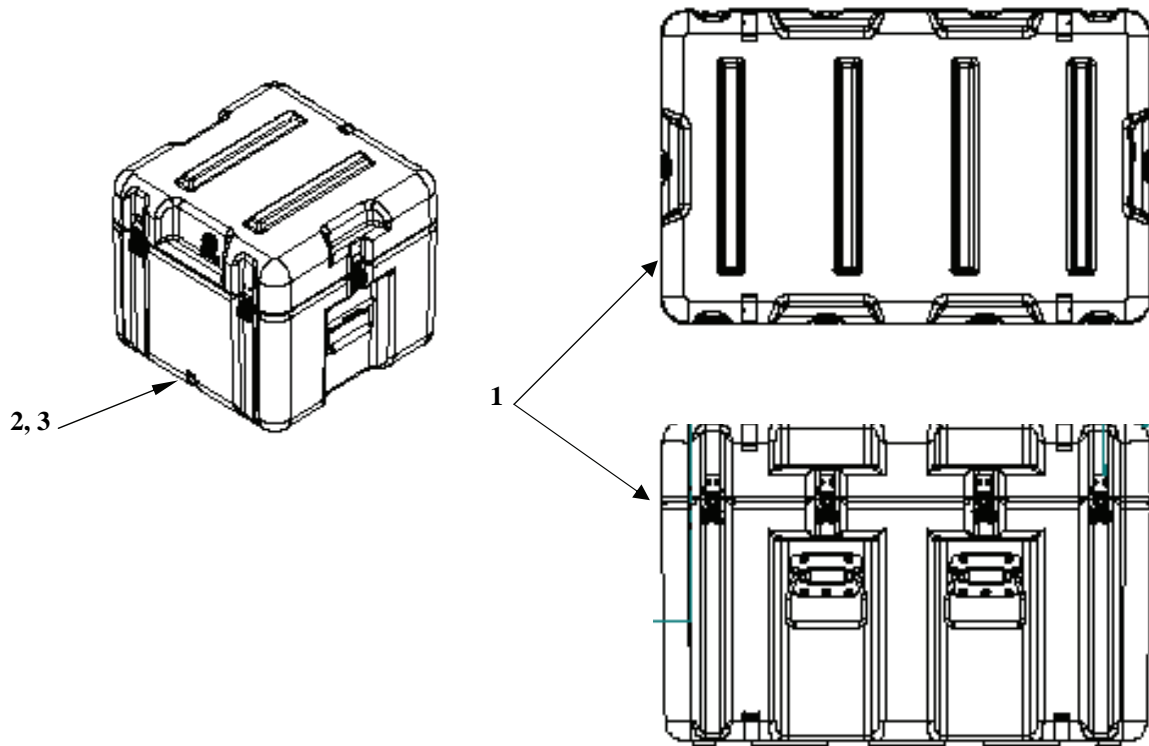
Figure 1-7 – IPADS and LRU Transit Cases

ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	7158019-1	CASE, TRANSIT, IPADS	1
2	7158019-4	SHIPPING AND STORAGE, BCU	1
3	7158019-5	SHIPPING AND STORAGE, CDU	1

1-12. Items Comprising Operable Equipment – Continued
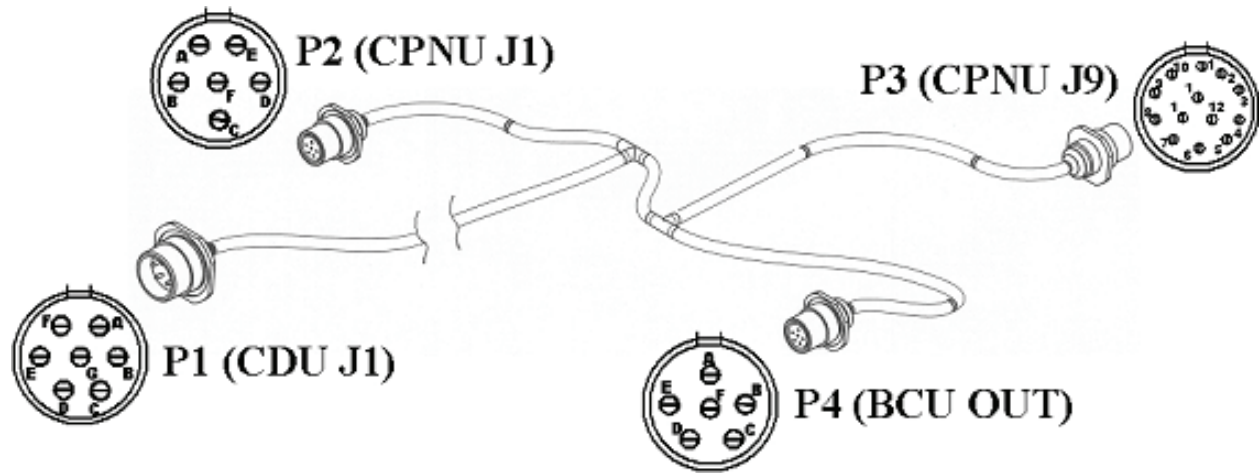
Figure 1-8 – W114 - IPADS Harness Cable
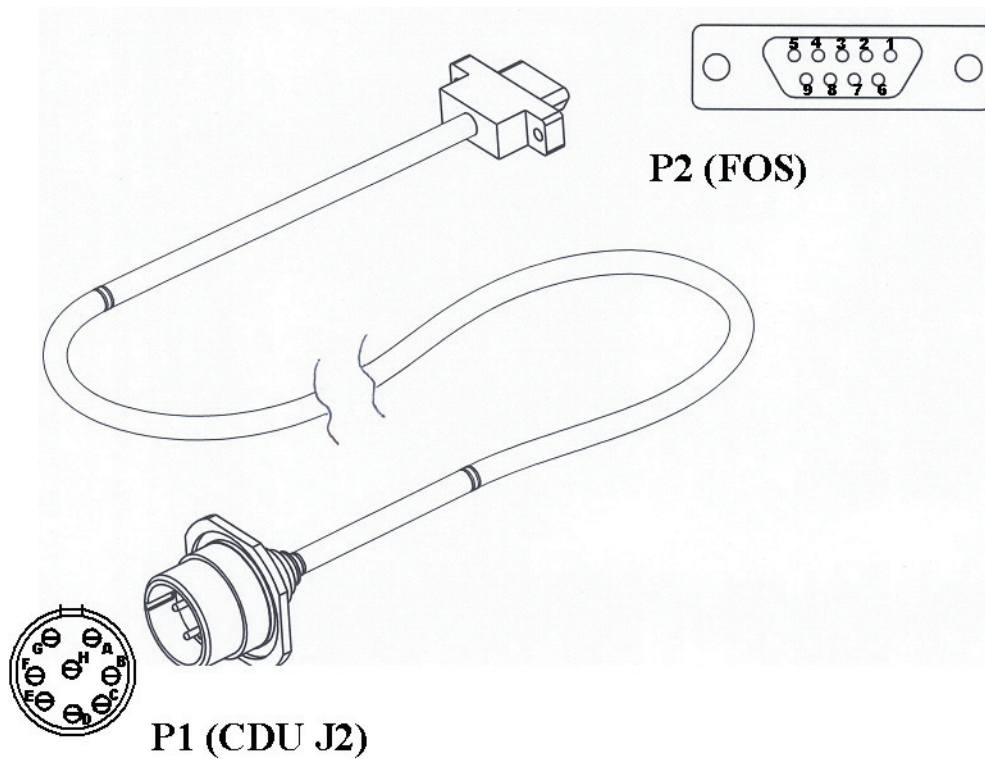
Figure 1-9 – W136 - FOS Cable

P1 (BCU AC IN)
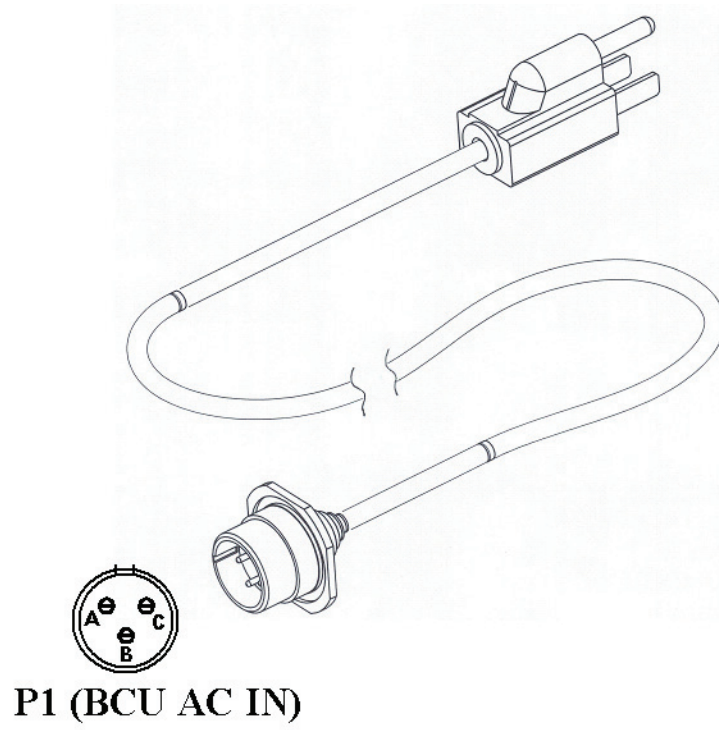
Figure 1-10 – ABP-ACC-TR-1 - AC Power Cable

1-12. Items Comprising Operable Equipment – Continued
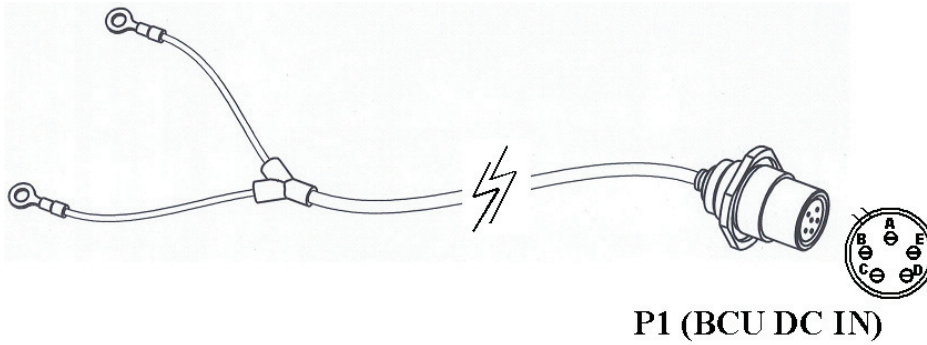
Figure 1-11 – W116-1 - HMMWV Power Cable
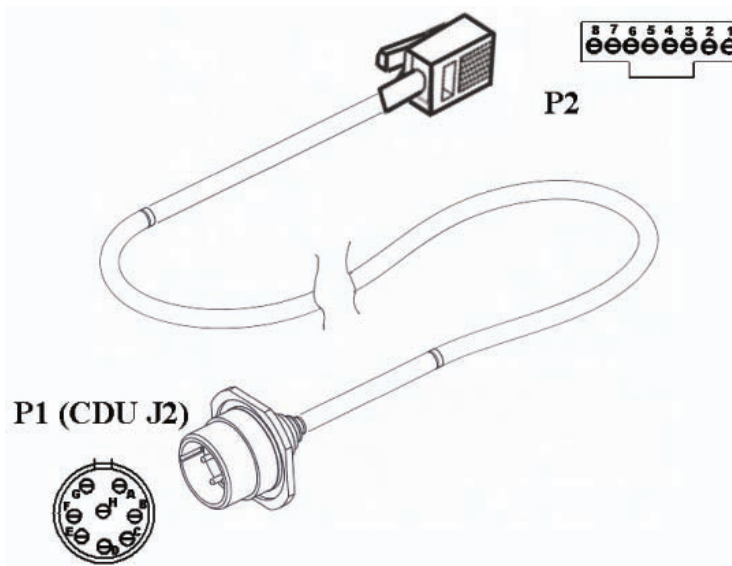
Figure 1-12 – W143 - Reprogramming Cable
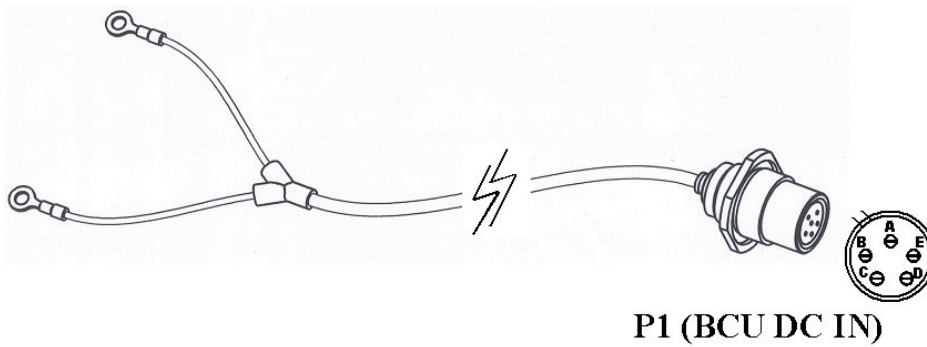
Figure 1-13 – W116-3 – SUSV Power Cable

Table 1-2 – Characteristics and Performance Data

Item	Item Value			
IPADS Transit Case				
Height	609.6 mm (24.0 in)			
Width	876.3 mm (34.5 in)			
Depth	698.5 mm (27.5 in)			
Weight	27.3 kg (60 lb)			
IPADS Frame with Components Installed				
Height	398.8 mm (15.7 in)			
Width	647.7 mm (25.5 in)			
Depth	408.9 mm (16.1 in)			
Weight	61.4 kg (135 lb)			
Ambient Temperature Limits without CDU:				
Operation	-46° to +52°C (-50° to +125°F)			
Storage	-46° to +71°C (-50° to +160°F)			
CDU Ambient Temperature Limits:				
Operation	-30° to +52°C (-22° to +125°F)			
Storage	-40° to +71°C (-40° to +160°F)			
Altitude Limits:				
Operation	-150 to +3,000 meters (–500 to +10,000 feet), mean sea level			
Transportation	-150 to +15,000 meters (–500 to +50,000 feet), mean sea level			

Warm-up, Initialization, and Alignment Time	10 minutes, increasing to:
	  15 minutes below –20°C (–5°F)
	  20 minutes in latitudes greater than 65N or S and temp above -20°C (–5°F)
	  25 minutes in latitudes greater than 65N or S and temp below -20°C (–5°F)			

Optical Azimuth Transfer Limits:	24 meters from porro prism			
Position Transfer Limits (with plumb bob): Vehicle	±15° pitch and roll			
Power Requirements: (24 VDC):	> 10°C and fully charged batteries	Power Requirements: (24 VDC):	> 10°C and fully charged batteries	Power Requirements: (24 VDC):
Steady State Load	104 watts (3.7 amps)	Steady State Load	104 watts (3.7 amps)	Steady State Load

1-12. Items Comprising Operable Equipment – Continued

Table 1-2– Characteristics and Performance Data – continued

Item		Item Value			
Total Mission Duration:		Unlimited			
Survey Area		75 kilometer radius from last update point			
Total Mission Distance		221 km from last update point			
Surveying Accuracy		1:3000 to 1:5000			
Latitude of Operation		**0° - 65° N/S**		**65° - 75° N/S**	
Survey Order		**4th**	**5th**	**4th**	**5th**
Initialization Time (in minutes)		10.0	10.0	20.0	20.0
Hot Start Initialization Time (in minutes)		5.0	5.0	10.0	10.0
Zero-Velocity Update Interval (in minutes)		5.0	10.0	5.0	10.0
Horizontal Position Vehicles	CEP meters	4.0	7.0	4.0	7.0
Altitude Vehicles	PE meters	2.0	3.0	2.0	3.0
Azimuth Error Vehicles	PE mils	0.4	0.4	0.6	0.6

CHAPTER 2

SERVICE UPON RECEIPT AND INSTALLATION

SECTION I. SERVICE UPON RECEIPT OF EQUIPMENT

2-1. General.

    a.   IPADS is shipped in three containers. These contain the IPADS end item, spare parts, and base plate.

    b.   Theodolite, tripods, and other survey equipment required to effectively operate the IPADS are unit Table of Organization and Equipment (TO&E) items.

2-2. Removal of IPADS From Transit Case.
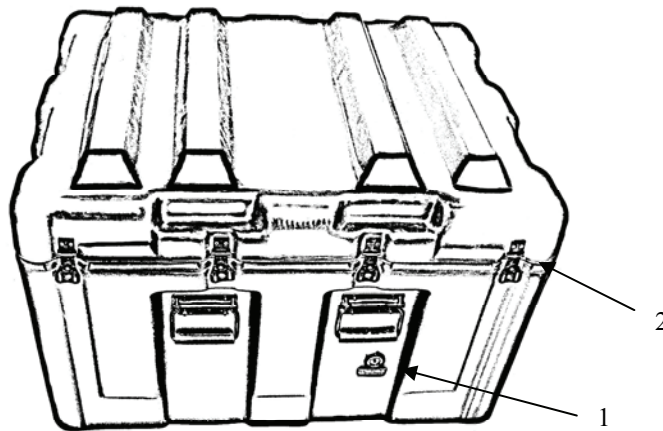
Figure 2-1 – IPADS Transit Case

WARNING

The IPADS transit case, with IPADS inside, weighs 195 lbs (88.5 kg); and must be lifted by mechanical means. Back injury may occur if the case is manually lifted.

CAUTION

IPADS contains electronic units; use extreme care when handling.

2-2. Removal of IPADS From Transit Case - Continued

a.   Press pressure relief valve, Figure 2-1, (1) until air pressure is equalized.

b.   Release eight latches, Figure 2-1, (2).

c.   Swing open transit case cover.

WARNING

IPADS weighs approximately 135 lbs (61.4 kg); use at least four persons to lift and move it.

CAUTION

The empty transit case with cover open is top heavy. Support cover so transit case does not tip over.

d.   Lift IPADS upwards until it clears the transit case and move it to a smooth, flat surface.

e.   Inspect IPADS components, cables, and connectors. If damaged, components must be replaced. Cables must be replaced if frayed or otherwise damaged. Components or cables are exchanged through the supply system, paragraph 4-6.

f.   Close transit case cover and secure latches.

WARNING

The empty transit case weighs 60.0 lbs (27.3 kg); use two people to lift.

g.   Store empty transit case.

2-3. Checking Unpacked Equipment.

a.   Inspect equipment for damage that may have incurred during shipment. If the equipment has been damaged, report the damage on SF 364 (Report of Discrepancy (ROD)). Marine Corps users will report damage as prescribed by SECNAV 4355.18A and DLAI.4140.55, Reporting of Supply Discrepancies.

b.   Check the equipment against the packing slip to see if shipment is complete. Army personnel report discrepancies in accordance with SF 361, Transportation Discrepancy Report. Marine Corps personnel will submit SF 361, as prescribed by Marine Corp Users Manuals, UM 4400-123 and -124.

c.   Check to see whether the equipment has been modified. (Equipment that has been modified will have the Modification Work Orders (MWO) number near the nomenclature plate.) Check also to see whether all currently applicable MWOs have been applied. (Current MWOs applicable to the equipment are listed in AR 750-10, Army Modification Program; for Marine Corps users, in SL l-2 or SL 1-3.)

d.   For dimensions, weights, and volume of unpackaged items, see Table 1-2 or SB 700-20.

CAUTION

- It is very important to make sure that the IPADS storage case and the IPADS are moisture free/"bone" dry before storing the IPADS for longer than 30 days.

- Ensure that following exposure to salt spray or salt fog, that IPADS is rinsed with clean, fresh water and allowed to dry before placing the IPADS into its dry transit/storage case.

e. When using or storing the IPADS in the field, the case should be kept as dry as possible and the unit wiped clean prior to placement into the case. If fungal growth is noted, wipe the area with a wet cloth (with some soap if possible) or use alcohol wipes.

2-4. IPADS Batteries.

BCU battery packs are shipped inside BCU when delivered, requiring no installation. Packs may be installed in BCU for up to three months provided they are not stored in a discharged state (Battery Good indicator not lit when connected to external power). Perform a 24-hour charge cycle prior to use.

WARNING

BCU contains acid-filled batteries that may generate hydrogen gas. Keep heat and ignition sources away. Do not allow battery liquid to touch skin or clothing. If battery liquid touches skin, flush area immediately with water. If it touches the eyes, flush immediately with water for 30 minutes and seek medical attention without delay.

2-4. IPADS Batteries – Continued

CAUTION

Do not store battery packs in a discharged state or in a hot place. Permanent loss
of capacity might occur if battery packs are placed in storage for an extended
period of time (greater than 3 months) without charging.

If batteries need to be replaced, see Figures 2-2 through 2-4 and perform IPADS battery installation as follows:

**Latches
(2 Total)**

**BCU Input
Connector**

**BCU Output
Connector**

**BCU
Cover**

BCU
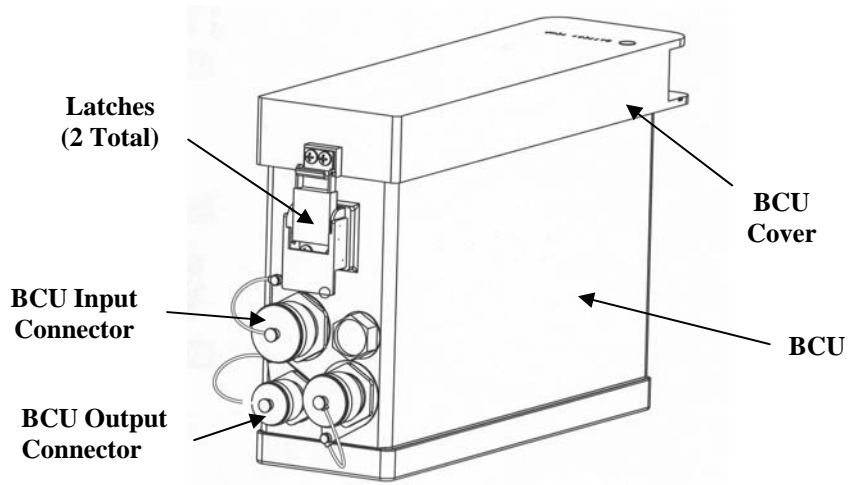
Figure 2-2 – BCU Component Identification

**6-32 Screw
(4x)**
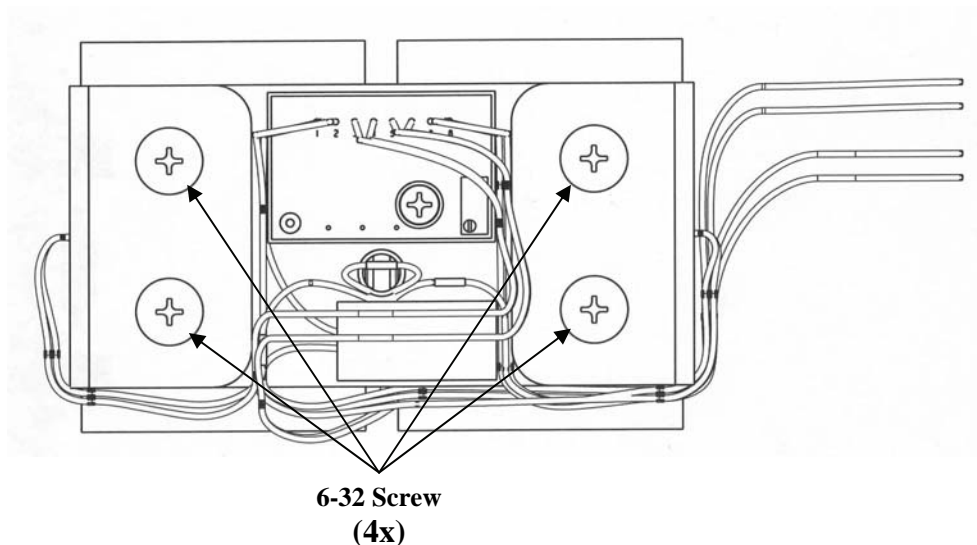
Figure 2-3 – BCU Heater Removal

a. Turn **DC INPUT** and **OUTPUT** switches to OFF position and remove external power, AC or DC, from BCU.

b. Unlatch BCU cover by releasing latch on each side, Figure 2-2. Cover will not be removable due to securing lanyard and wiring attached to cover.

c. Loosen, but do not remove, four 6-32 screws using crosstip screwdriver, Figure 2-3.

d. Disconnect each battery pack cable from receptacle by pressing the lock lever on the battery connector.

e. Remove heater assembly from BCU, Figure 2-4.

CAUTION

The BCU heater is permanently attached to the BCU via harness. Care should be taken when removing or installing heater to avoid damage to harness.

f. Remove battery packs from cavity, Figure 2-4.
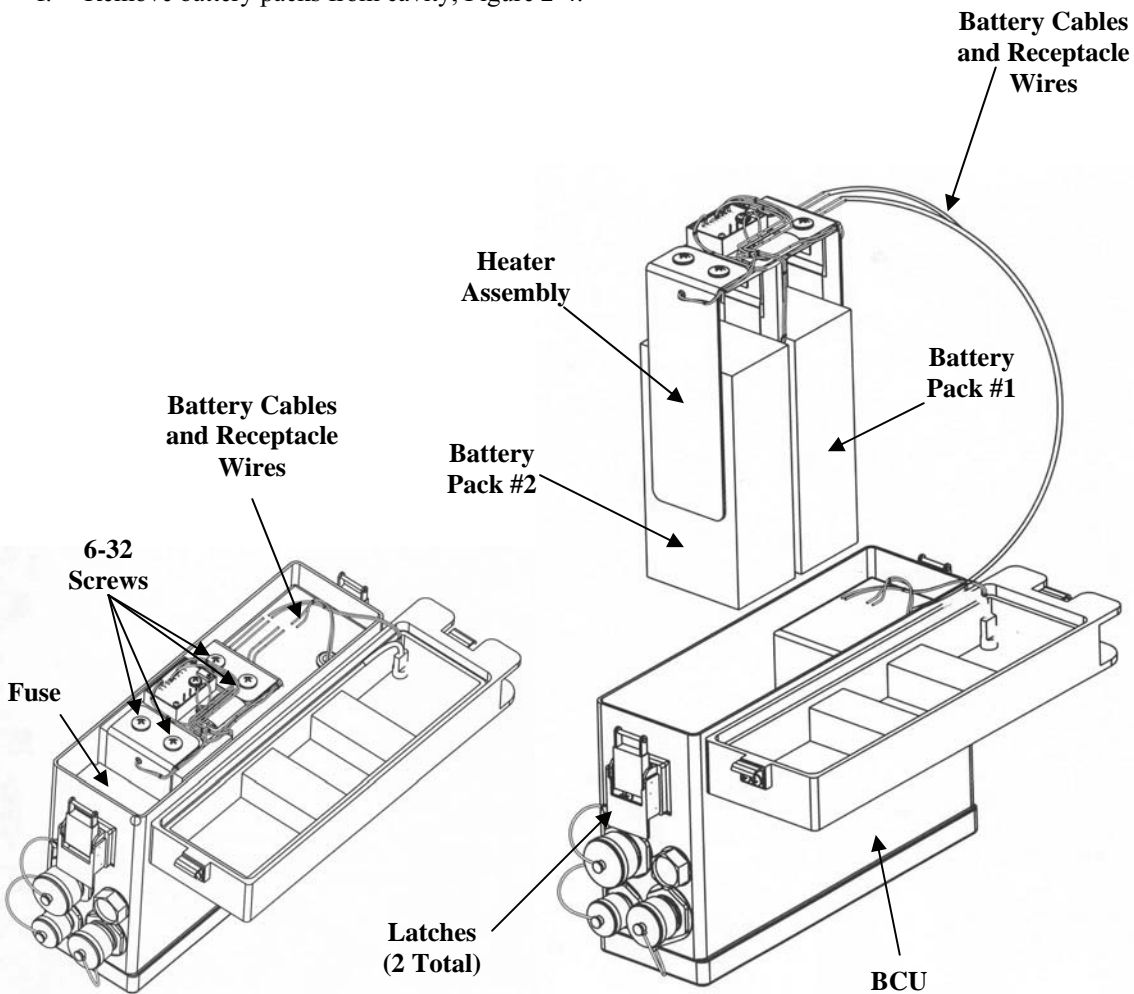
Figure 2-4 – BCU Battery Pack Installation

2-4. IPADS Batteries – Continued

h.   Install IPADS battery packs as follows:

CAUTION

Do not pinch battery cable or receptacle wires between cover and chassis,
Figure 2-4.

(1)   Turn **DC INPUT** and **OUTPUT** switches on the BCU cover to OFF position and remove external power, AC or DC, from BCU.

(2)   With cover open and heater assembly removed, install battery packs into cavity, Figure 2-4.

(3)   Install heater assembly over battery packs and tighten four screws, Figure 2-3.

(4)   Connect battery pack connector to one of the unit's battery receptacles, Figure 2-4.

(5)   Verify battery connector is locked to the receptacle.

(6)   Connect second battery similar to BCU heater removal, paragraph 2-4c and d.

(7)   Latch BCU cover, Figure 2-2.

(8)   Charge new batteries for a minimum of 24 hours.

2-5. Packing IPADS.

CAUTION

- Remove batteries from BCU before packaging IPADS for shipping or storage beyond 90 days.

- Do not store battery packs in a discharged state or in a hot place. Permanent loss of capacity might occur if battery packs are placed in storage for an extended period of time (greater than 3 months) without charging.

- To prevent damage, an IPADS must be placed in a transit case when shipped or stored.

NOTE

Packaged BCU batteries may be shipped by normal transportation means without restriction provided the battery is protected against short circuits and securely packaged. For all modes of transportation, each battery and outer package must be labeled: "Non-Spillable" or "Non-Spillable Battery." This label must be visible during transportation.

a.   Remove BCU batteries, paragraph 2-4.

b.   Press transit case pressure relief valve until air pressure is equalized.

WARNING

The foam in the IPADS transit case is flammable. Do not expose to open flame or ignition sources. Extinguish burning foam with water spray, CO2, foam, or dry chemical fire extinguisher.

CAUTION

The empty transit case with cover open is top heavy. Support cover so transit case doesn't tip over.

c.   Unlatch eight latches and open transit case cover.

d.   Ensure harness assembly W114 is stowed to prevent pinching of cable.

e.   When using or storing the IPADS in the field, the case and cushioning should be kept as dry as possible and the unit wiped clean prior to placement in the case. If fungal growth is noted, wipe the area with a wet cloth and soap or use an alcohol wipe.

WARNING

IPADS weighs approximately 135 lbs (61.4 kg); use at least four persons to lift and move it.

f.   Position IPADS inside transit case.

g.   Close transit case cover and secure its latches.

SECTION II. SECTION II: INSTALLATION OF IPADS INTO HMMWV

2-6. Vehicle Configuration.

CAUTION

Any vehicle used with IPADS must supply at least 100 amperes at 24 VDC for IPADS operation. (Generator/Alternator Kit, Part No. 11630593, Manufacturer Code 19207, NSN 2920-00-413-4338 is recommended for HMMWV series vehicles equipped with a generator/alternator rated at 60 amperes. Installation instructions are in TM 9-2320-362-14&P.)

a. Identify which kit components are used with each vehicle. IPADS operators install the components.

b. The installation kit components required for using IPADS in the M1097 (Truck, Utility: Heavy Variant, 4 x 4,) M1123 (Truck, Utility: Heavy Variant, 10,300 GVW, 4 x 4) and M998 (Truck, Utility: Cargo/Troop Carrier, 1-1/4 Ton, 4 x 4) series High Mobility Multipurpose-Wheeled Vehicles (HMMWV) are listed and described in Figure 1-5. There are differences in vehicle preparation and IPADS floor plate installation for the HMMWV variants.

c. If not installed, operators must install batteries in the BCU, paragraph 2-4.

2-7. Tools Required for Installation.

Tools required for installation are in the IPADS basic issue items shown in Figure 1-4.

2-8. Install IPADS in High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV).

NOTE

Installation differences between the HMMWV variants are noted in the following procedures.

a. **Prepare HMMWV for Installation.**

If a cargo bulkhead is installed immediately behind the driver and commander's seats, remove as follows:

(1) Using the 3/4-inch combination wrench, remove two bolts securing cargo bulkhead to the vehicle bed.

(2) Use l/2-inch socket and open-end wrenches; remove two bolts from vehicle side pillars.

(3) After removing bulkhead, install two bolts in vehicle side pillars. Retain vehicle bed bolts for installation.

(4) Store cargo bulkhead and two bolts.

(5) If vehicle is equipped with two l/2-inch thick wooden noise abatement plates located between the two front seats and two rear seats, remove and store with associated hardware. Remove fire extinguisher and bracket from forward plate and reinstall on deck between two front seats where it had previously been mounted.

(6) If vehicle is equipped with a communication mount for the SINCGARS radio and an external speaker, the lower shelf that holds the speaker will need to be temporarily modified in order to remove the front two cross tip screws under the speaker stand. Proceed as follows:

    (a) Using a 7/16-inch socket and a 7/16-inch box end wrench, remove the two bolts that support the front of the speaker shelf.

    (b) Elevate the speaker shelf to gain access to the front two cross tip screws that secure the wooden noise abatement board. Using a 3-inch cross tip screw driver, remove the two cross tip screws and finish the removal of the noise abatement board.

    (c) When the noise abatement board has been removed, install the speaker shelf back to its original form using the two 7/16-inch bolts.

(7) If the vehicle has a PADS installation kit installed, remove it.

b. **Remove Cargo Tiedown Ring:**

NOTE

- The M998 has threaded inserts under the cargo floor to secure the cargo tiedown ringbolts. The cargo tiedown ringbolts are secured by nuts and lockwashers under the cargo floor of the M1097 and M1123. Removal of M1097 and M1123 cargo tiedown rings requires a ¾-inch wrench for the nuts in addition to the 3/4-inch combination wrench needed for the bolts.

- An individual vehicle may or may not have cargo tiedown rings installed at the three IPADS floor plate attachment points, Figure 2-5. Remove any cargo tiedown rings from those locations as follows.

2-8. Install IPADS in High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV) – Continued
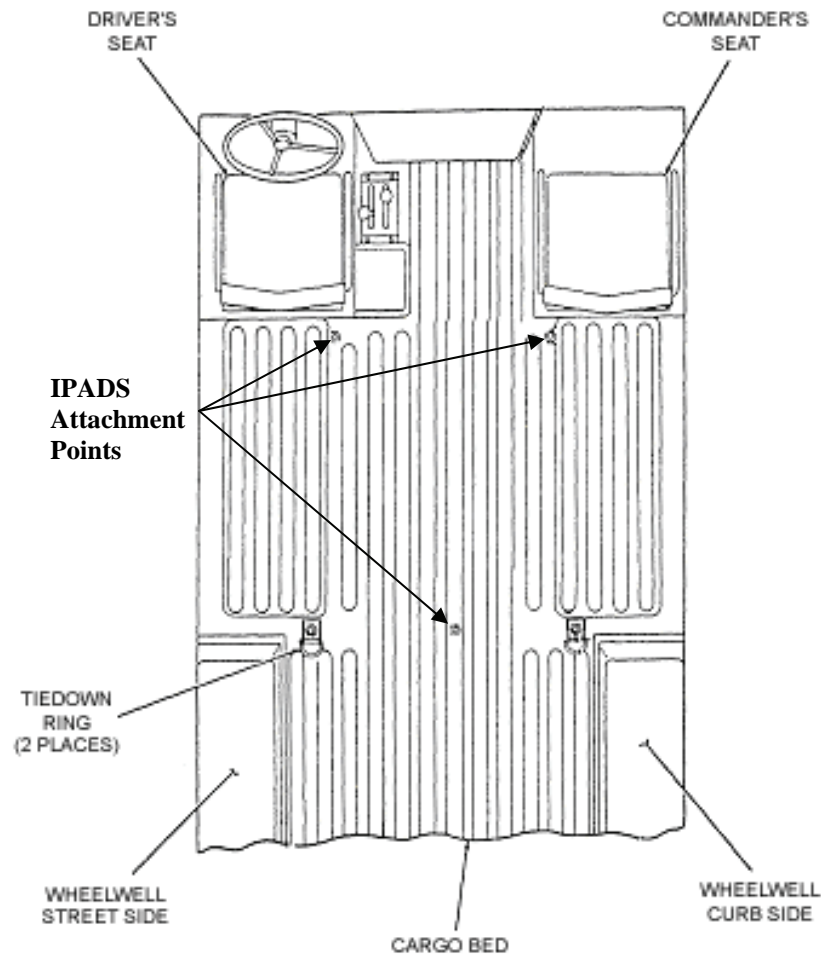
Figure 2-5 – IPADS Floor Plate Alignment

(1) Using 3/4-inch socket, remove tiedown ring and bolt near the center of cargo bed.

(2) Using 3/4-inch combination wrench, remove two tiedown rings and bolts behind driver and commander's seats.

(3) Store removed cargo tiedown rings and hardware.

c. **Install Floor Plate:**

WARNING

- IPADS floor plate weighs approximately 48 lbs (21.8 kg); use at least two persons to lift onto HMMWV cargo bed.

- If operator must crawl under vehicle to install flange nut, do not touch the exhaust pipe. Contact with hot vehicle exhaust pipe can cause severe burns.

3/8-16 x 1"L Screw
(4x)

3/8 Washer
(4x)

1/2 Lock Washer
(3x)

1/2-13 Flange Nut
(3x)

1/2 Flat Washer
(3x)

1/2-13 x 3"L Screw
(3x)

THIS SIDE UP

THIS SIDE UP
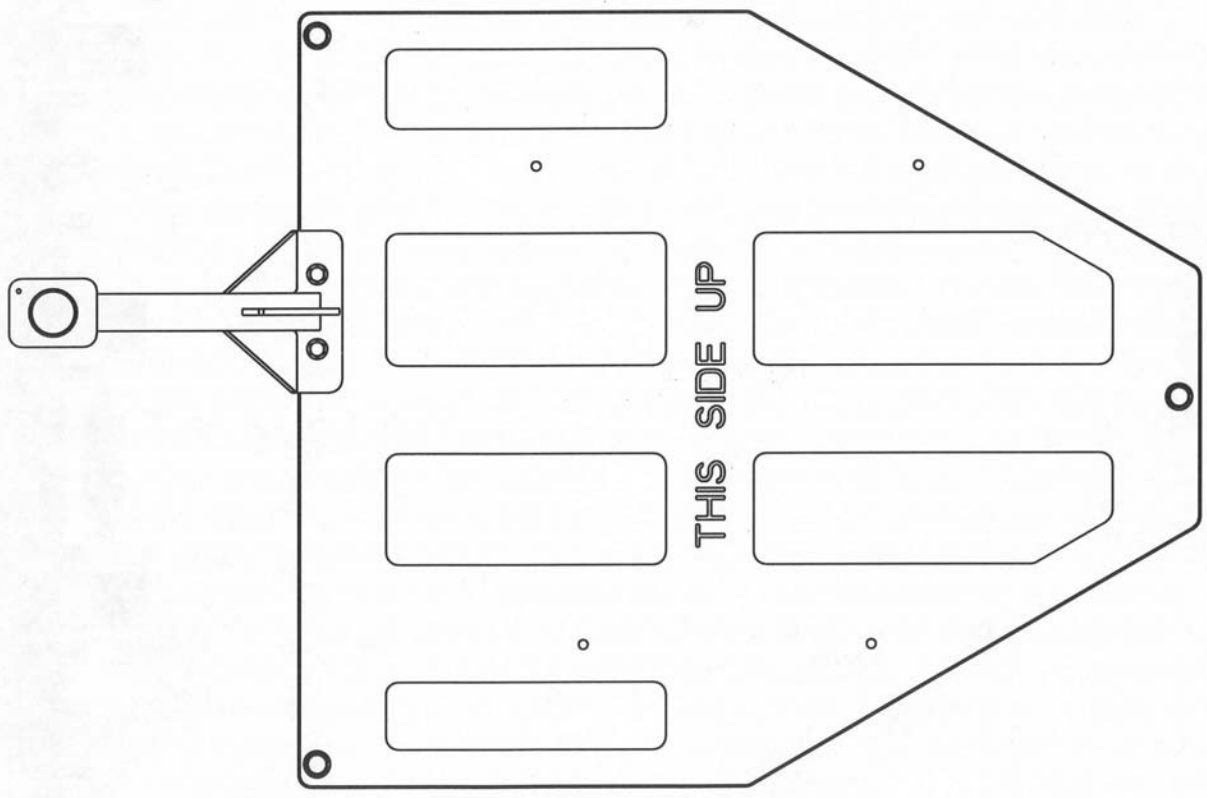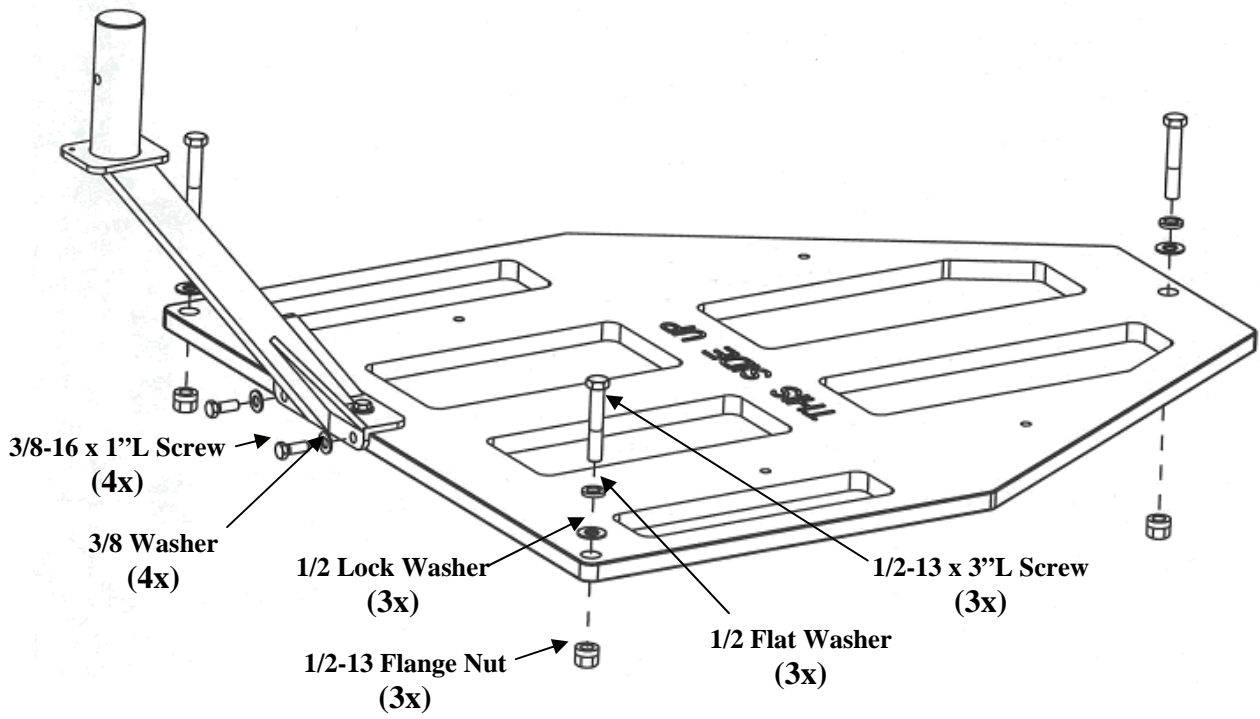
Figure 2-6 – IPADS Floor Plate Installation with CDU Arm and Alignment Bracket

2-8. Install IPADS in High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV) – Continued

(1) Place floor plate over three existing holes, Figure 2-5, in vehicle cargo bed, two forward and one to the rear. Ensure "THIS SIDE UP" is visible.

(2) Using 9/16-inch wrench, install and tighten four 3/8-16 UNC-2B by 1-inch long screws and flat washers to secure CDU support arm to floor plate.

(3) For M998, install three l/2-13UNC-2A by 3-inch long bolts, with flat and lock washers, through floor plate holes into threaded inserts under vehicle cargo bed, Figure 2-6. Finger-tighten only.

NOTE

If any of the threaded inserts under the vehicle cargo bed are missing install the floor plate using flange nuts.

(4) For M1097 and M1123, install three l/2-13UNC-2A by 3-inch long screws, flat washers, and lock washers through floor plate holes into holes in vehicle cargo bed.

(5) With CDU support arm in place, apply a small amount of forward force (towards radio) to ensure all three floor plate holes and 1/2-inch bolts are aligned.

(6) Using 3/4-inch wrench, tighten the three l/2-inch screws securing floor plate to vehicle cargo bed.

d. **Install IPADS:**

WARNING

IPADS weighs approximately 135 lbs (61.4 kg); use at least four persons to lift and move it.

CAUTION
DO NOT lift the IPADS unit using the porro prism cover.
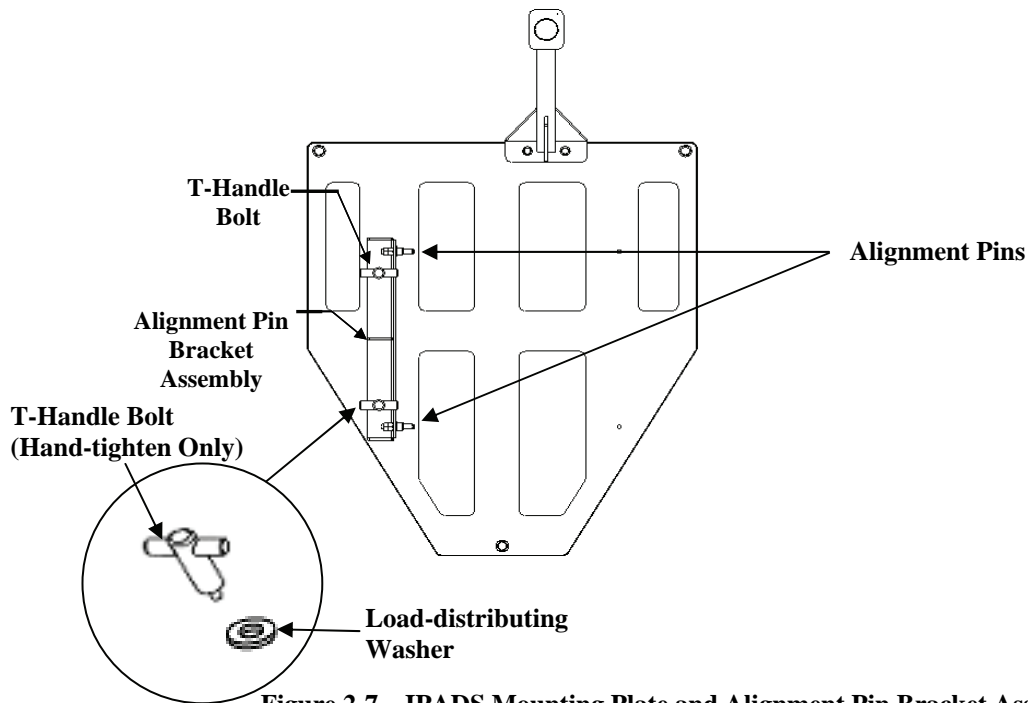
Figure 2-7 – IPADS Mounting Plate and Alignment Pin Bracket Assembly

(1) Locate alignment pin bracket assembly, Figure 2-7, and place it over the two threaded inserts on the left side of floor plate with alignment pins facing the right passenger side of the vehicle.

(2) Place one load distributing washer between alignment bracket assembly and T-handle bolt.

(3) Hand tighten alignment pin bracket to floor plate with two T-handle bolts, Figure 2-7, and two washers.

CAUTION

Ensure that all T-handle bolts are only **HAND TIGHTENED**.

(4) Place IPADS frame on floor plate. Ensure the Porro Prism Assembly (PPA) and cover face towards the rear of the vehicle.

2-8. Install IPADS in High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV) – Continued
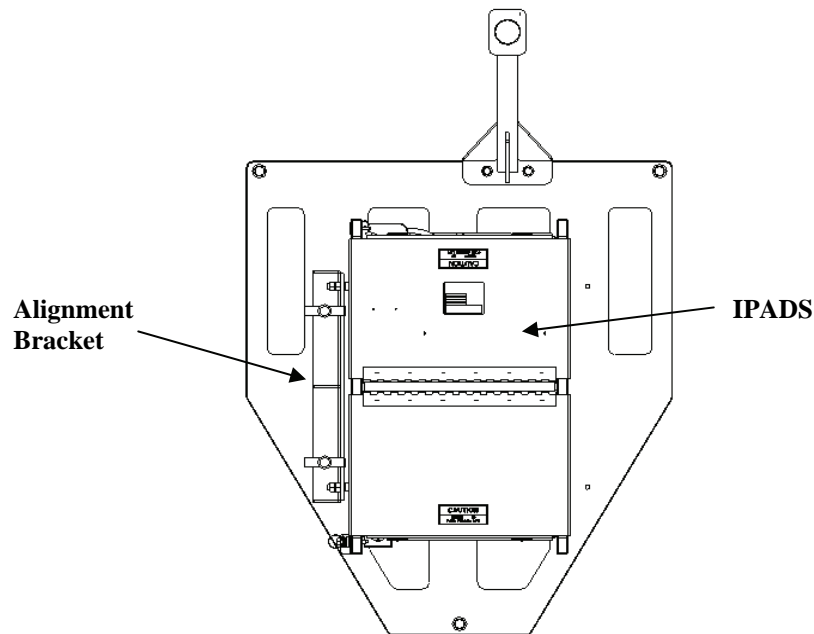
Figure 2-8 – IPADS Mounting onto Alignment Bracket Assembly

(5) Slide IPADS frame onto pins of alignment bracket assembly. Ensure pins of alignment bracket are fully engaged in alignment pinholes in bottom rail of the IPADS frame. If alignment pins do not fit freely into receptacles, adjust as follows:

e. **Alignment Pin Adjustment.**

NOTE

The alignment pin bracket must be installed on IPADS floor plate before adjustment.
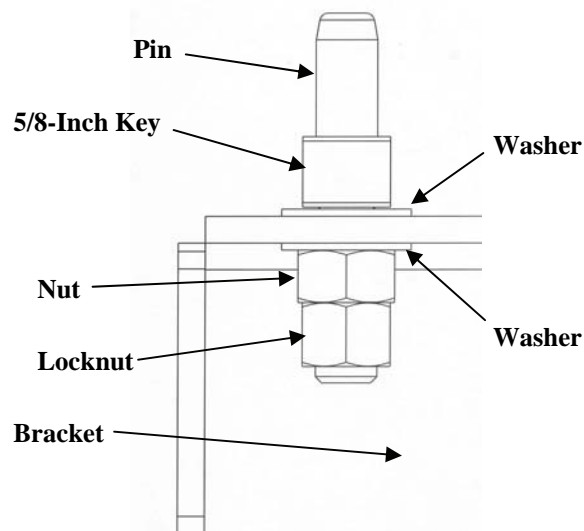
Figure 2-9 – Alignment Pin Adjustment

(1) Hold alignment pin with 5/8-inch open-end wrench.

(2) Loosen locking nut with 5/8-inch wrench followed by nut with 11/16-inch wrench.

(3) Position alignment pin until it mates freely with the pinhole in the frame's bottom rail.

(4) Hold the position of the alignment pin with 5/8-inch wrench and tighten both nut and locknut.

(5) Repeat steps (1) through (4) for the other alignment pin, if necessary.

f.   **Secure Mounting Brackets and T-Handles.**

Secure opposite rail of the IPADS frame not secured by alignment pin bracket to floor plate with two mounting brackets and two T-handle bolts, Figure 2-10.

- **Brackets**
- **T-Handle Bolts**
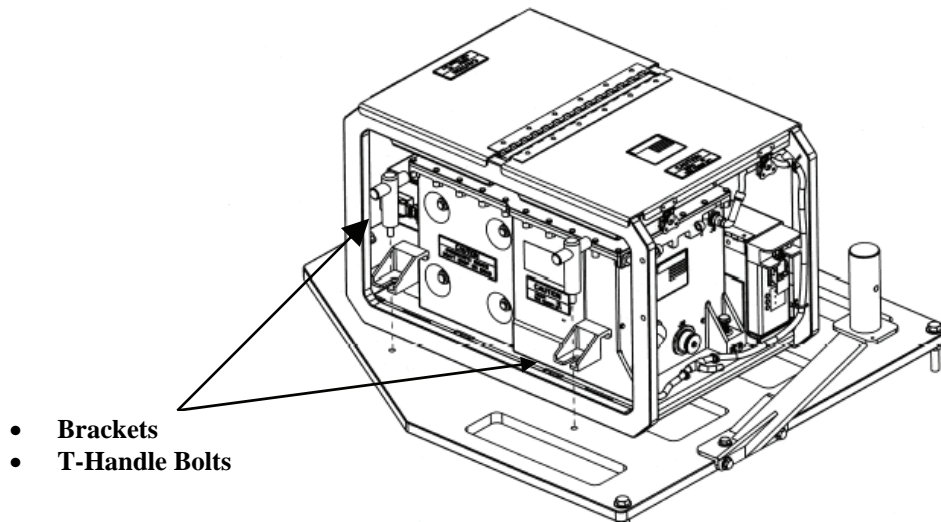
Figure 2-10 – Mounting Brackets and T-Handle Bolts Installation

2-8. Install IPADS in High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV) – Continued

   g.   **Install Plumb Bob Bracket.**

NOTE

- Install plumb bob bracket on driver's side of vehicle approximately 13 1/2 inches forward of the rear of driver's door edge, Figure 2-12.

- To hold bracket in place, tighten thumbscrew in drain hole below first recess in body panel, Figure 2-12.
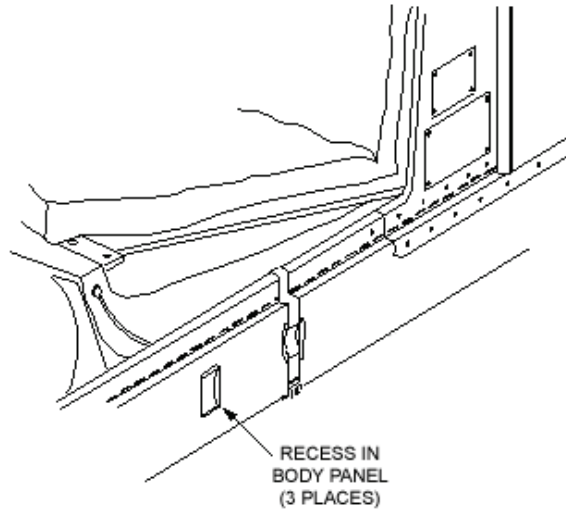
Figure 2-11 – HMMWV Plumb Bob Mount Location
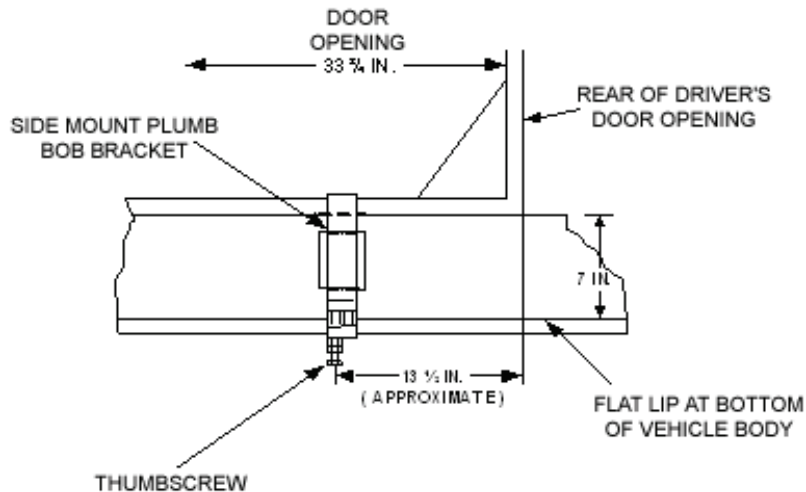
Figure 2-12 – HMMWV Plumb Bob Dimensional Reference

h.   **Installation of the W116-1 IPADS DC power cable:**

CAUTION

- Disconnect negative battery cable before working with or around batteries. The negative cable is the cable that attaches to the current shunt in the battery box, Figure 2-13.

- Protect the negative battery cable from accidental contact with other battery cables or posts.

CAUTION

If the wiring inside the HMMWV's battery box does not reflect Figure 2-13 or if additional communication equipment is connected to the battery box, consult your maintenance to verify the location of +24VDC. **IPADS requires +24VDC for operation.**

NOTE

- IPADS can be attached to vehicle power by direct connection to the batteries or by using the IPADS NATO plug attachment, Figure 2-17. The W116-1 cable, which connects to the vehicle battery terminals, is recommended for permanent installations. A NATO plug attachment, which connects to the vehicle's NATO slave receptacle located under the passenger's seat, may be used with W116-1 cable for temporary installations or vehicle to vehicle transfers.
- The NATO plug attachment is for temporary use only.
- Use caution when using the NATO plug attachment. It is very easy to dislodge the plug assembly, causing IPADS to lose vehicle power.
- If using the NATO plug, the front commander's seat does not need to be removed.

(1) Remove front commander's seat by opening latch and lifting seat out of vehicle.

NOTE

- The HMMWV battery terminals may be covered with a plastic boot, Figure 2-14. To gain access to the terminal, pop the black center of the cover out using a flat blade screwdriver.

- If the battery terminals were covered with a plastic boot, use the pocketknife to cut a hole into the side of the plastic boot, Figure 2-14. Route branch of IPADS DC power cable through the hole cut in the plastic boot before attaching to the battery connectors.

2-8. Install IPADS in High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV) – Continued

    (2) First Wire (Black).

        In the HMMWV locate the CURRENT SHUNT, Figure 2-13 (1).

        (a) Follow the wire from the CURRENT SHUNT to the connecting battery terminal (5), Figure 2-13. Connect the black lead of W116-1 to this terminal.

        (b) If the battery plastic boots are installed in the vehicle, use the pocket knife to cut a hole into the side of the plastic boot covering the terminal, Figure 2-14. This facilitates insertion of the battery cable for providing DC power to the IPADS.

        (c) Route the end of each cable branch through two l-inch holes in transmission tunnel, under vehicle body, and through 1 l/2-inch hole in battery box. This hole is located just below current shunt mounted on the inside wall of vehicle battery compartment

        (d) To connect the black lead to the battery terminal (5), use a 9/16" wrench to install the black wire, to the side of the terminal marked IPADS cable (3), Figure 2-13.

    (3) Second Wire (Red).

        In the HMMWV locate the BATTERY INTERCONNECT CABLE, Figure 2-13 (2).

CAUTION

    The BATTERY INTERCONNECT CABLE and the terminals at both ends are to be left alone. They will not be connected to the IPADS equipment, as damage will occur.

        (a) Connect the red wire (5) of the IPADS cable to the remaining HMMWV battery terminal (3), Figure 2-13.

        (b) If the battery plastic boots are installed in the vehicle, use the pocketknife to cut a hole into the side of the plastic boot covering the terminal, Figure 2-14. This facilitates insertion of the battery cable for providing DC power to the IPADS.

        (c) To connect the red wire to the battery terminal, (5) use a 9/16" wrench to install the red wire, to the side of the terminal marked IPADS Cable (3), Figure 2-13.

    (4) Replace commander's seat; latch in place.

    (5) Attach W116-1 connector P1 to IPADS BCU DC input connector, Figure 2-16.

(1)
CURRENT SHUNT

(2)
BATTERY INTERCONNECT
CABLE

FORWARD
BATTERY

(3)
IPADS Cable

(4)
Vehicle Cable

(5)
Battery Terminal
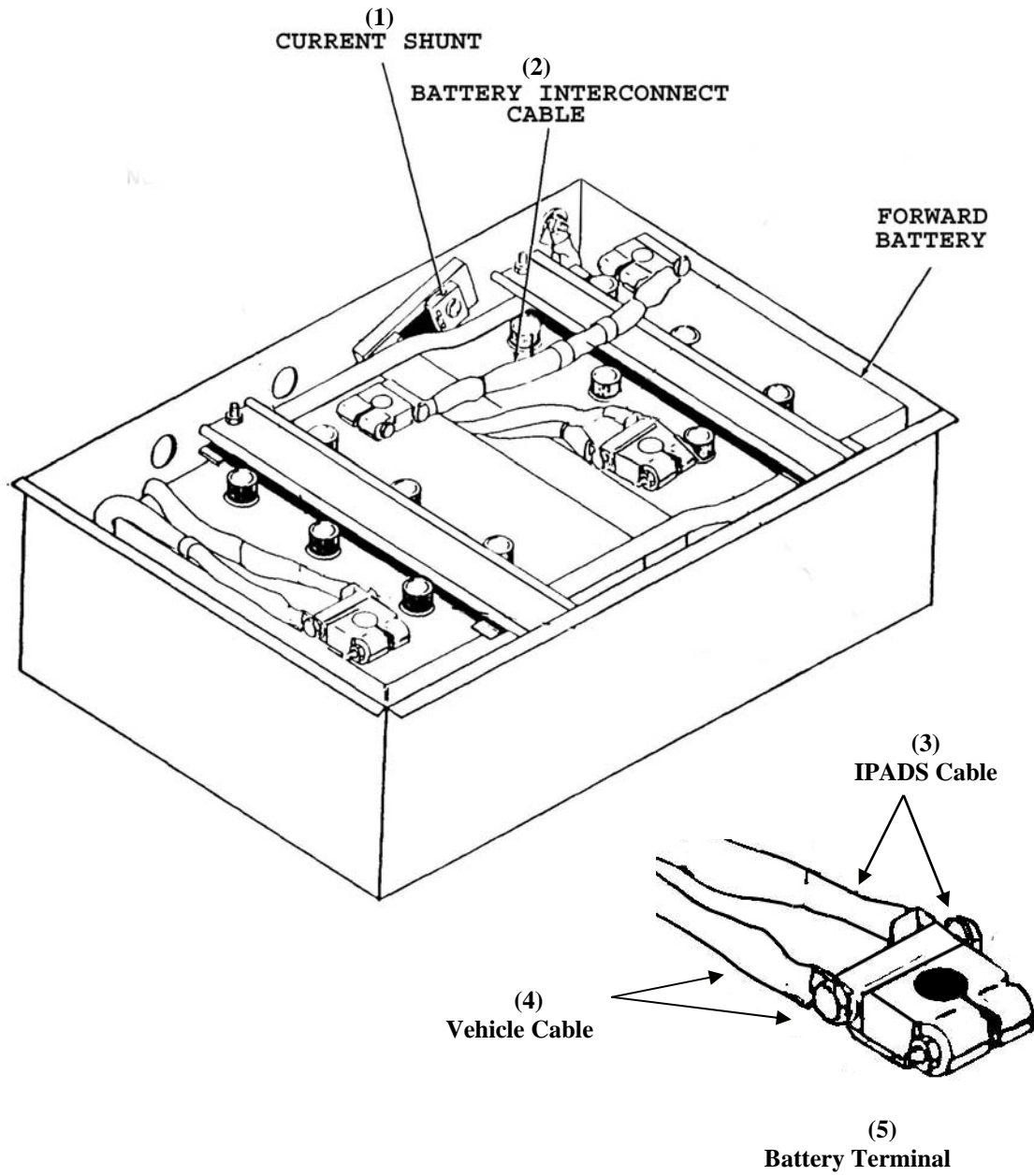
Figure 2-13 – HMMWV Battery Box and Terminal

2-8. Install IPADS in High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV) – Continued

**W116 Cable to HMMWV
Battery Terminals**

**Plastic Boot
Assembly**
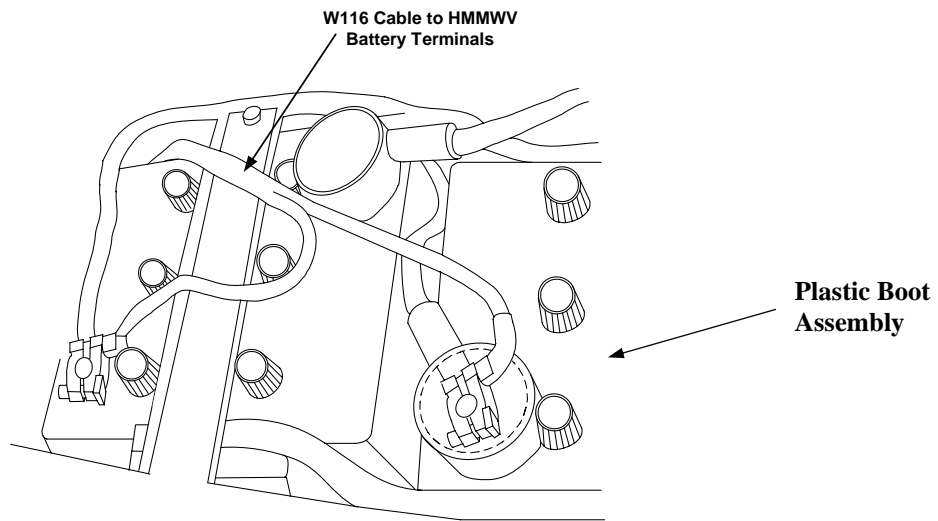
Figure 2-14– HMMWV Battery Terminal with Plastic Boot

**IPADS Frame Storage
Compartment**
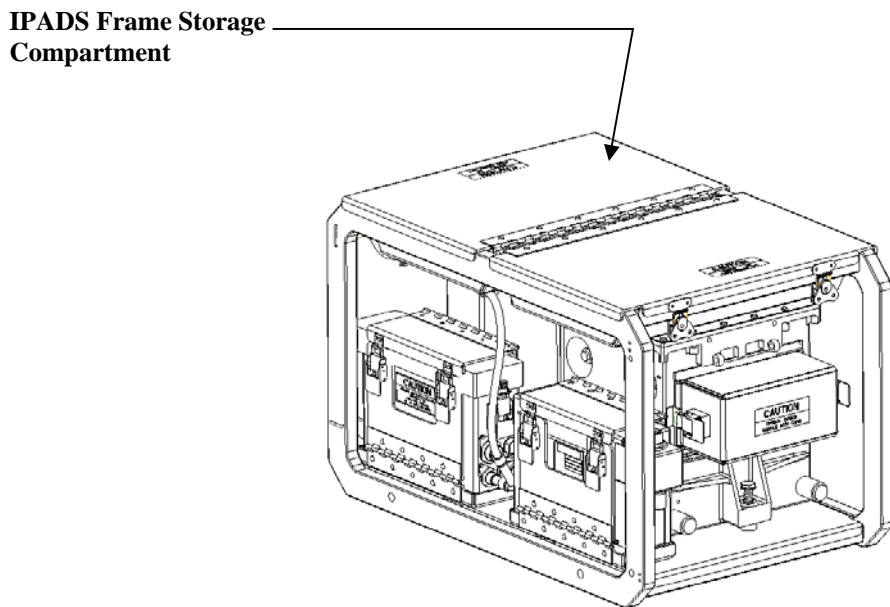
Figure 2-15 – IPADS Assembly

BCU DC Input
Connector
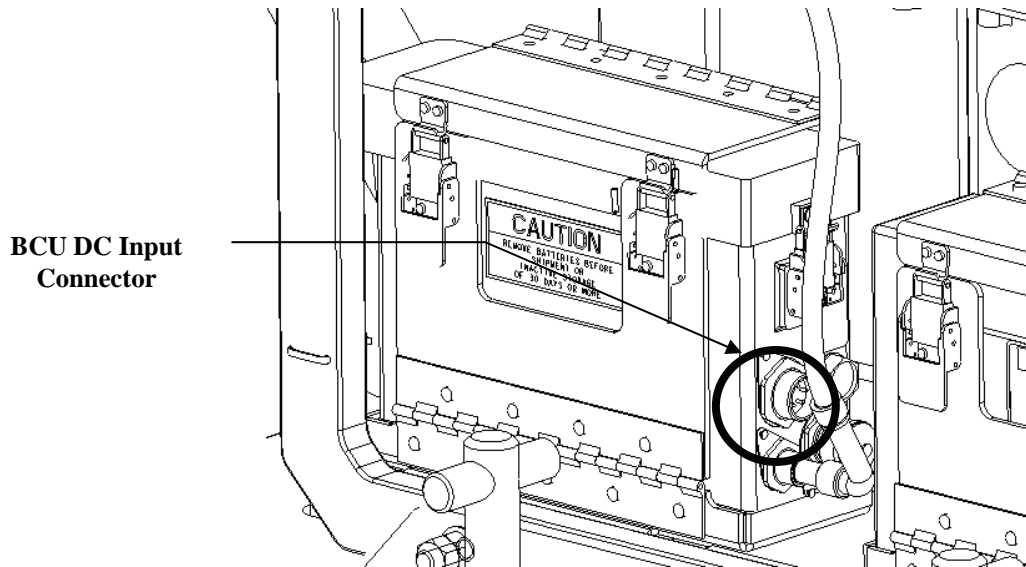
Figure 2-16 – DC Power Input into the BCU

NOTE
If using the vehicle's NATO power, use the following steps:

BLACK
(-)   RED
               (+)
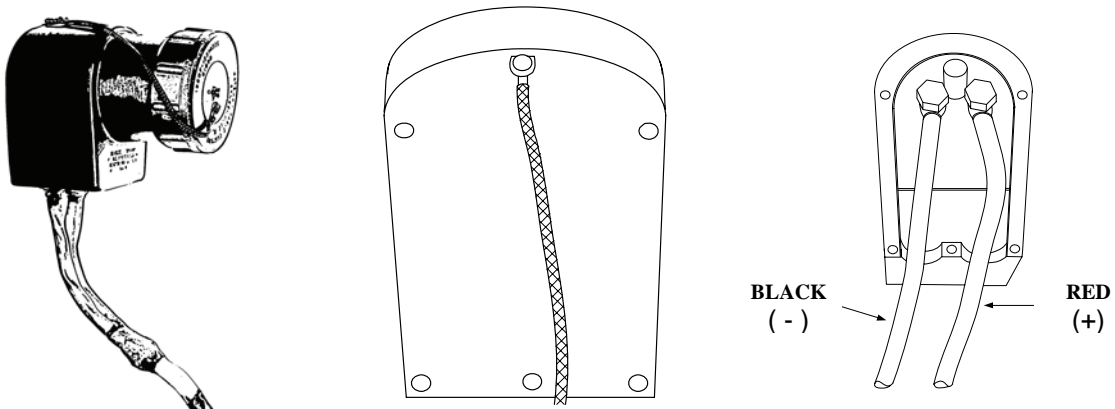
Figure 2-17 – DC Power Cable with NATO Plug Installed

2-8. Install IPADS in High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV) – Continued

    i.   **Install NATO Plug.**

Obtain IPADS power cable, Figure 1-5 item 10, and NATO connector, Figure 2-17, from installation kit. Using an adjustable wrench and flat-tip or cross-tip screwdriver, install two lugs of power cable to the connector.

    (1) Remove back of connector and terminal bolts.

    (2) Install red-banded lug (wire marked positive) of power cable to positive terminal of connector (center post).

    (3) Install black-banded lug (wire marked negative) of power cable to negative terminal of connector.

    (4) Tighten hardware to secure lugs.

    (5) Replace back of connector and tighten all screws.

    (6) Plug NATO plug into NATO receptacle under right passenger seat of HMMWV.

    (7) Attach W116-1 connector P1 to IPADS BCU DC input connector, Figure 2-16.

    j.   **Install Control and Display Unit (CDU).**

    (1) Install CDU mount assembly onto CDU indexer, Figure 2-18.

    (2) Tighten socket head cap screw until indexer and linkage assembly make contact on both sides. Once reached, loosen nut approximately one turn or until indexer and linkage assembly rotate without binding.

    (3) Install CDU mount assembly onto CDU support arm and secure with quick release pin, Figure 2-19.

    (4) Remove CDU from storage compartment in IPADS frame, Figure 1-3 (item 4). Connect W114 connector P1 to J1 connector on CDU, Figure 3-2.
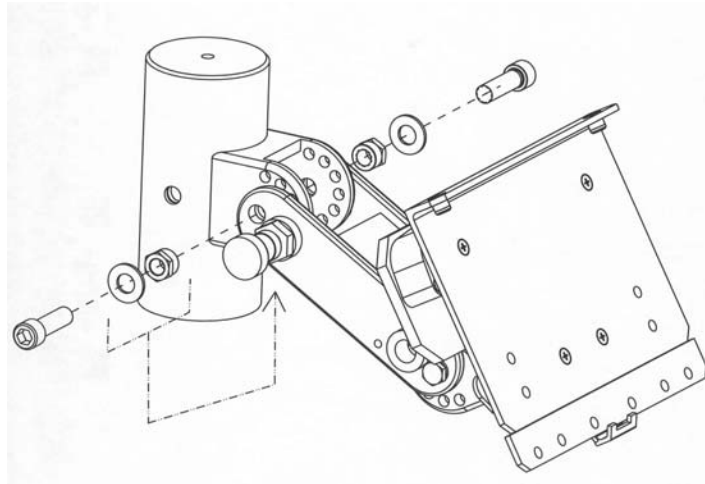
Figure 2-18 – CDU Mount Installation on Indexer

Quick Release Pin
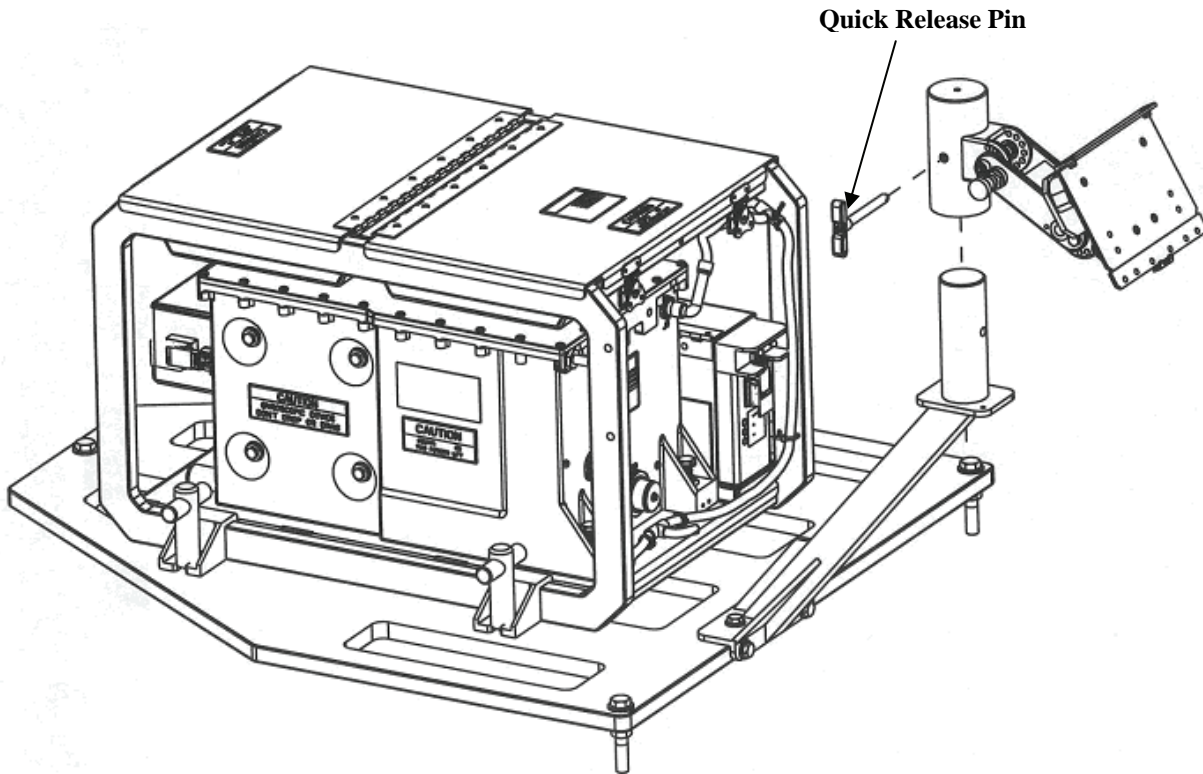
Figure 2-19 – CDU Mount Installation on Support Arm

2-8. Install IPADS in High-Mobility Multi-Purpose Wheeled Vehicle (HMMWV) – Continued

(5) Attach CDU to CDU mount assembly by aligning two pins located on CDU mount assembly with CDU and secure using two locking latches on CDU mount assembly, Figures 2-20 and 2-21.
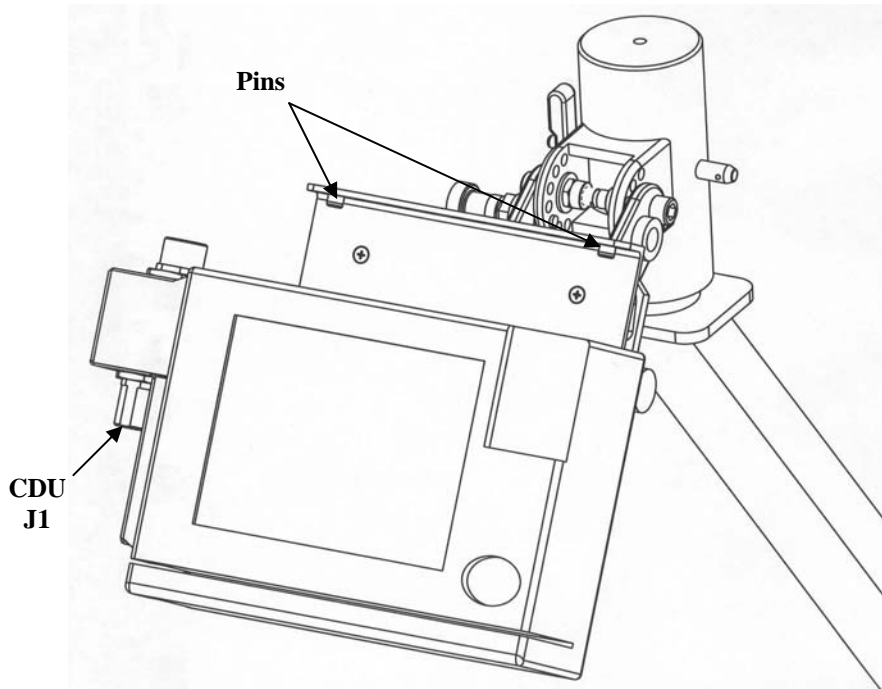
Figure 2-20 – CDU Installation onto Holder Pins
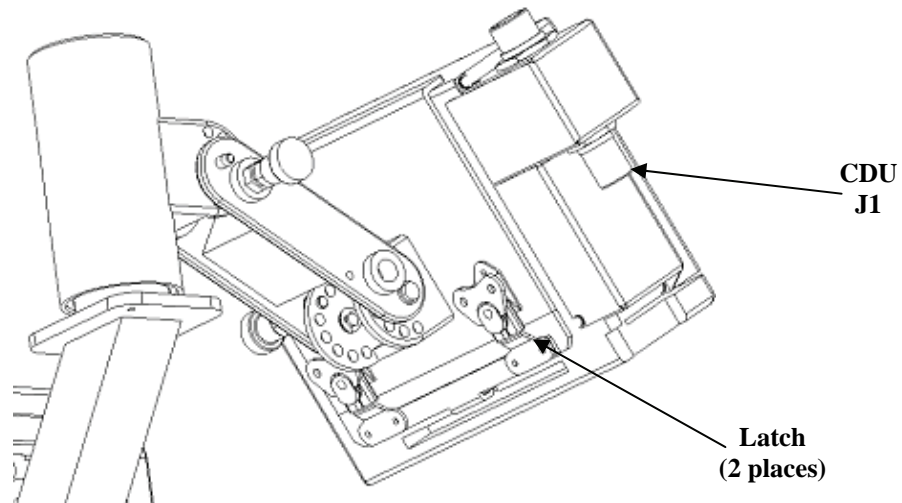
Figure 2-21 – Locking CDU onto Holder via Latches

(6) Release IPADS harness cable from cable strap on frame. Connect W114 connector P1 to J1 connector on CDU, Figure 3-2.

SECTION III. INSTALLATION OF IPADS INTO SUSV

2-9. Install IPADS in M973 Series Small Utility Support Vehicle (SUSV).

Front of Vehicle ⟶
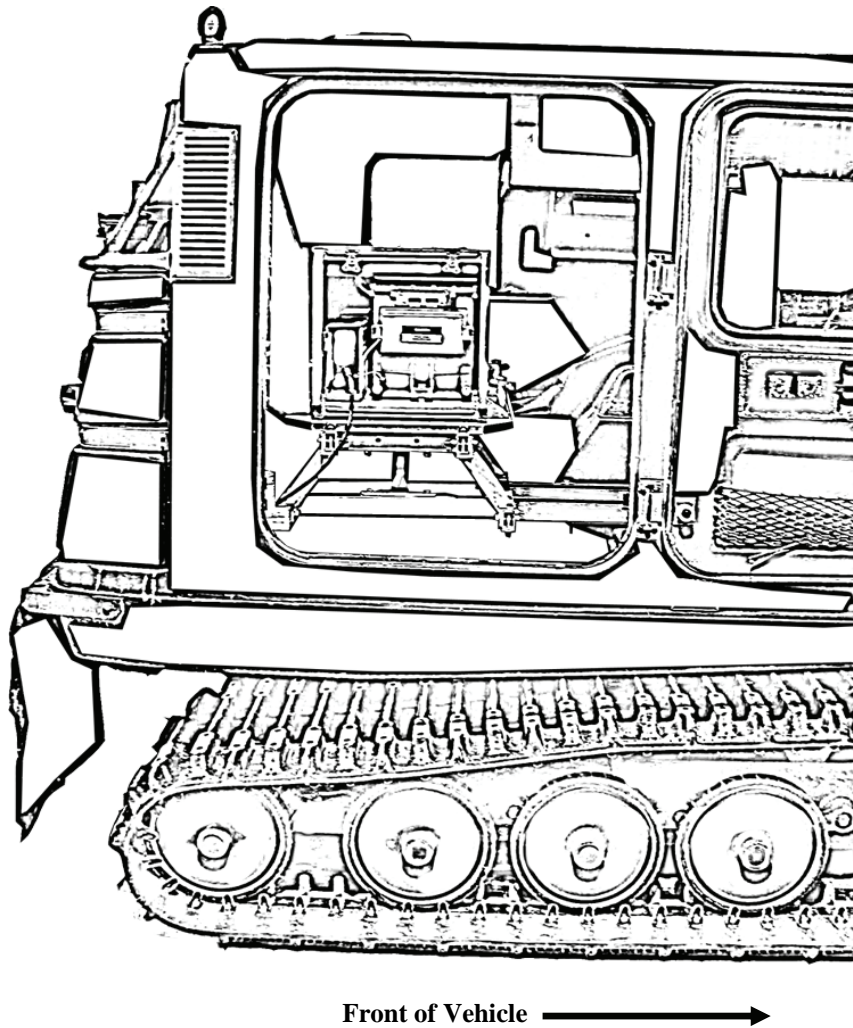
Figure 2-22 – IPADS Installed in SUSV

NOTE

- Due to the variety of parts used in the installation of IPADS into the SUSV, organize parts, especially bolts, screws, nuts, and washers, before installation.
- There are 2 kits that need to be ordered so the IPADS can be properly installed into the SUSV.
  - ITEM 1, SUSV Installation Kit (NSN 5340-01-523-6532)
  - ITEM 2, SUSV Engine Cover (NSN 2510-01-541-3655)
- SUSV BII can be found in the SUSV TMs, TM 9-2350-285-34 and TM 9-2350-285-24&P.

2-9. Install IPADS in M973 Series Small Utility Support Vehicle (SUSV) - Continued

a. **Preparation of Vehicle for IPADS Installation.** Work should be performed in a heated, enclosed workshop free of grit, grime, dirt and dust. Ambient working temperature should be 15°C (60°F) or higher. All work to install IPADS will be performed in front car. Installation of IPADS into the SUSV requires IPADS, SUSV, and Organization Tool Kits. All tool kits must be complete. Prepare vehicle for installation as follows:
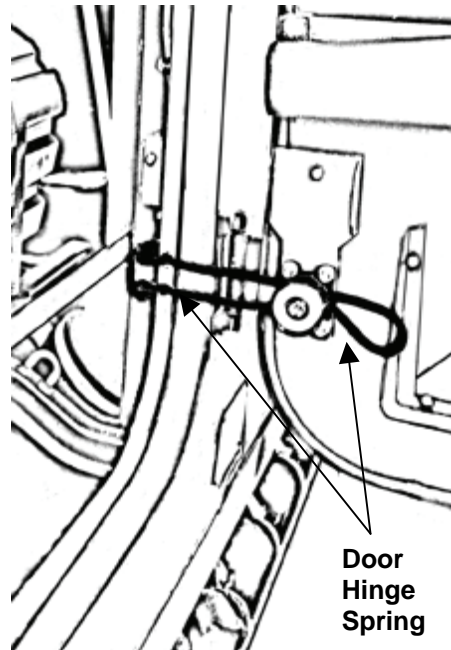
Figure 2-23 – SUSV Door Hinge

(1) **Unhinge All SUSV Doors.** Use 6-inch pliers from SUSV BII kit to unhinge the spring.
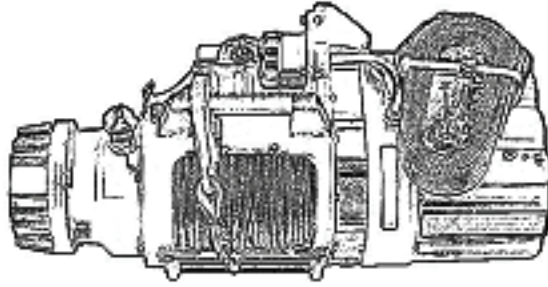
Figure 2-24 – SUSV Winch

(2) **Removal of Winch.** Winch is located in back seat area on right-hand side.

WARNING

The SUSV winch weighs approximately 130 lbs. Use three persons to lift it out of the front car.

(a) Remove rubber floor mat from the rear passenger-side and put it in the rear car.

(b) Release two rear latches locking seat in place. Slide right rear seat forward for temporary rest for winch.

(c) Release latch straps securing winch by pulling on release levers.

(d) Remove winch retaining pin from underside of winch plate.

(e) Using three persons, lift winch out of SUSV (using rear seat as a rest if necessary) and secure winch and retaining pin in rear car. Secure in rear car with cargo tie-down straps.

2-9. Install IPADS in M973 Series Small Utility Support Vehicle (SUSV) – Continued
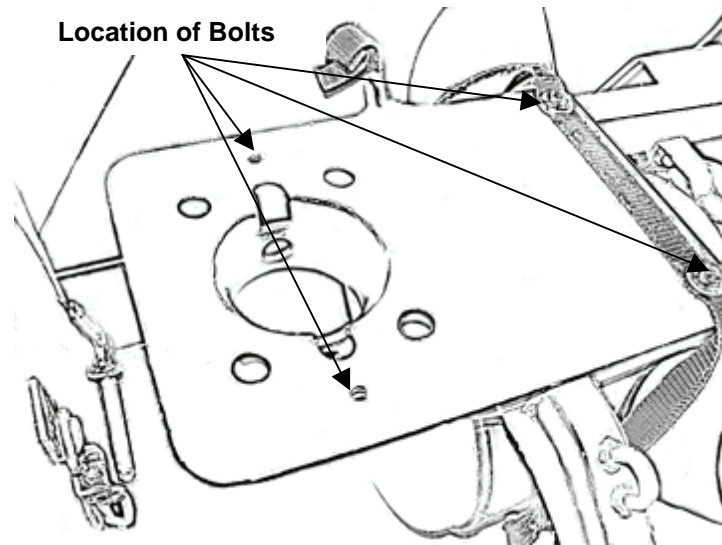
Figure 2-25 – Winch Plate

(3) **Removal of Winch Plate.**

NOTE

Unless specified, store all parts removed from the SUSV with the SUSV BII.

(a) Using 13-mm open-end wrench from SUSV BII and ½-inch socket from IPADS BII, remove four bolts securing winch plate onto winch mounting brackets.

(b) Place nuts, bolts, and straps in a plastic bag and mark "For attaching winch plate behind passenger seat. Install with 13-mm open-end wrench and socket."

(c) Remove winch plate and stow in rear car.

(4) **Removal of Rear Passenger-side Seat and Toolbox.**

CAUTION

Toolbox may contain stowed items. Use caution when removing from vehicle.

(a) If not already done, release two rear latches locking seat in place and slide seat forward until end of seat/storage toolbox clears rear wall.

(b) Using two persons, lift and remove seat from vehicle.

(c) Stow seat and toolbox in rear car. Secure with belt assembly to tie-down points in floor well.

(5) **Removal of Transmission Access Cover.**

(a) Cover extends half-length of front car.

(b) Unlatch fasteners at locations over its length.
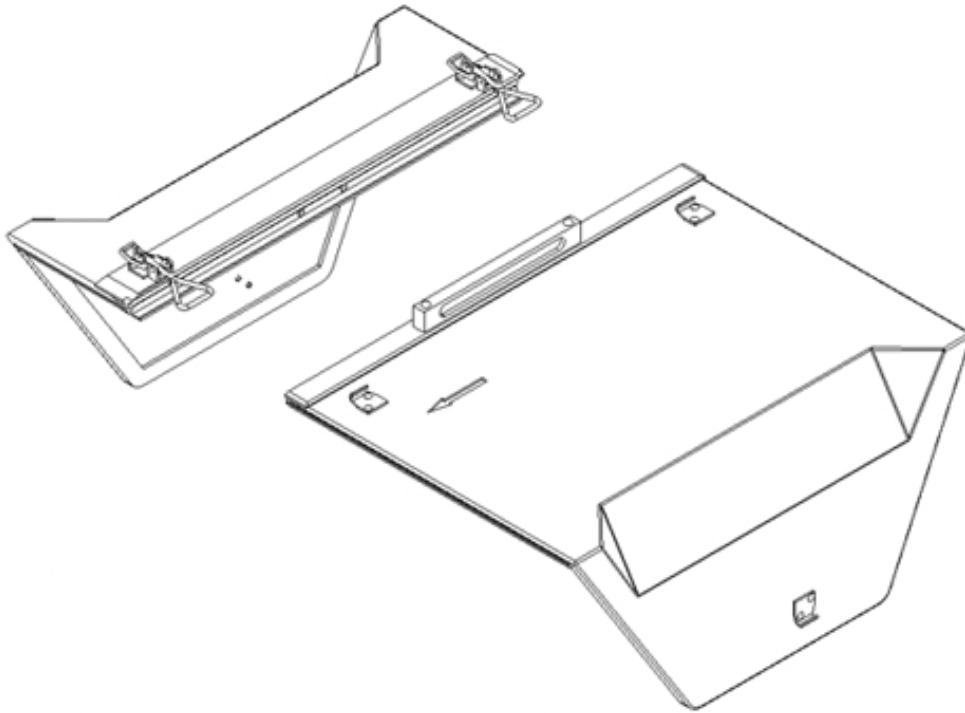
Figure 2-26 - Modified Transmission Access Cover (NSN 2510-01-541-3655)

    a.   Removal of the Transmission Access Cover
        1)   Unlatch hinge from latch tongue located in the rear passenger section on the driver side of the SUSV.
        2)   Unlatch two hinges located on top of cover.
        3)   Remove the hinge from the latch tongue.
        4)   Using the cover handle (and the metal handle on top as an optional aide) pull the larger section of the access cover completely away from the transmission area.
        5)   Place the section of the access cover in a safe area where neither personnel nor the cover can be damaged.
    b.   Perform PMCS according to SUSV regulations.
    a.   Replacing the cover
        1)   Place cover on metal channels.
        2)   Firmly mate two halves of cover together using guide pins.
        3)   Re-latch top two hinges in tongue latches.
        4)   Re-latch hinge from latch tongue located in the rear passenger section on the driver side of the SUSV.

(c) Remove original one piece cover and store in secured area. The modified SUSV transmission cover (NSN 2510-01-541-3655) which is not included with the IPADS SUSV installation kit shall be placed on driver side of vehicle for later installation.

NOTE

If IPADS installation kit is removed from the SUSV, the modified cover is to remain with the IPADS installation kit for installation into another SUSV. The original access cover is to be replaced into the SUSV if IPADS is removed from SUSV.

2-9. Install IPADS in M973 Series Small Utility Support Vehicle (SUSV) – Continued
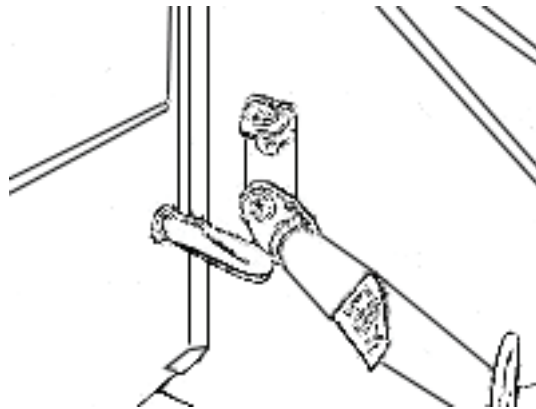
Figure 2-27 –Rear Passenger-side Seat Belt and Tie-down Ring Assembly

(6) **Removal of Rear Passenger-side Seat Belt and Tie-Down Ring Assembly.**
For further detail on removing seat belts refer to SUSV manual 9-2350-385-20 p. 10-52.

    (a) Remove two bolts securing seat belt and tie-down ring nearest to the door using 17-mm open-end wrench from the SUSV BII kit.

    (b) Remove two bolts and locknuts securing seat belt and tie-down ring nearest to the transmission using 16-mm open-end wrench from the SUSV BII kit.

NOTE

Inboard bolts go through the hull and have locking nuts on the inside. These nuts are located behind the right rear wall and can be accessed once transmission cover is removed.

    (c) Place nuts, bolts, collar, seat belt bracket and seat belt assembly in a plastic bag and mark "For attaching right rear seat belt assembly."

(7) **Removal of Engine Compartment Access Panel.**

    (a) Open right front door and release clips holding engine access panel. Using a flat-tip screwdriver, loosen five slotted captive screws and remove engine compartment access panel, Figure 2-28.

    (b) Place screws in a plastic bag and mark "Front right engine panel retaining screws."

    (c) Set engine compartment access panel aside for later installation.

(8) **Removal of Heater Access Cover.**

    (a) Using 10-mm open-end wrench and socket from the SUSV BII, remove four bolts securing heater access cover and brace located just forward of the engine access panel, Figure 2-28.

    (b) Using 10-mm open-end wrench from SUSV BII, loosen, but do not remove, two bolts securing brace to front wall.

    (c) Place cover, nuts, washer, and bolts in a plastic bag and mark "Heater access cover. Use 10-mm open-end wrench and socket." Tie bag and stow in SUSV toolbox.

NOTE

- Keep panel nearby for reinstallation.
- If the SUSV does not have a heater access cover, remove lower two bolts and nuts on brace using 10-mm open-end wrench and socket from SUSV BII.

Engine Compartment
Right Access Panel
(Heater Access Panel)

Captive
Screw
(5 Places)

Dash Panel
Handle

Brace

Mounting
Bolts
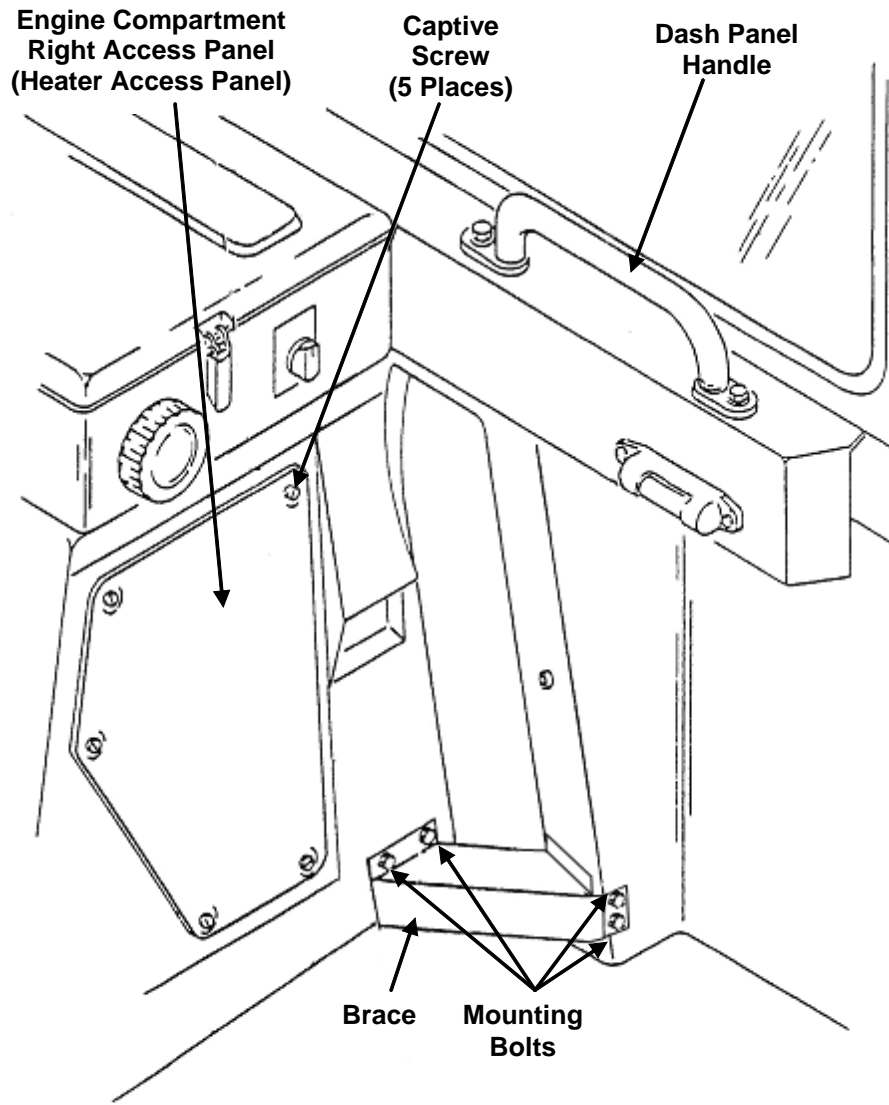
Figure 2-28 – Removal of SUSV Engine Compartment Access Panel, Brace,
and Dash Panel Handle

(9) **Removal of Dash Panel Handle.**

    (a) Using 13-mm open-end wrench and socket from SUSV BII, remove two bolts holding dash panel handle on dash panel on right-hand side of vehicle, Figure 2-38.

    (b) Place bolts, washers, and locknuts in a plastic bag and mark "For attaching dash panel handle. Install with 13-mm open-end wrench and socket."

2-9. Install IPADS in M973 Series Small Utility Support Vehicle (SUSV) – Continued
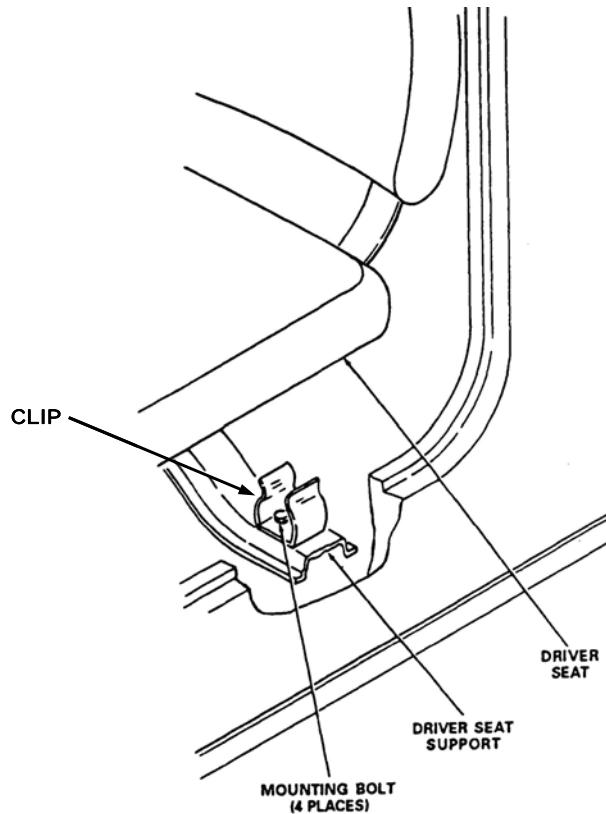
Figure 2-29 – Removal of Clips from Driver's Seat Support

(10) **Removal of Clips from Driver's Seat Support.**

    (a) Open front driver-side door. Using 10-mm socket wrench from SUSV BII, remove two bolts securing clip to driver's seat support, Figure 2-29.

    (b) Remove the clips and place in a plastic bag marked "Clip to driver's seat support. Reinstall with 10-mm socket wrench". Tie bag and stow in SUSV toolbox.
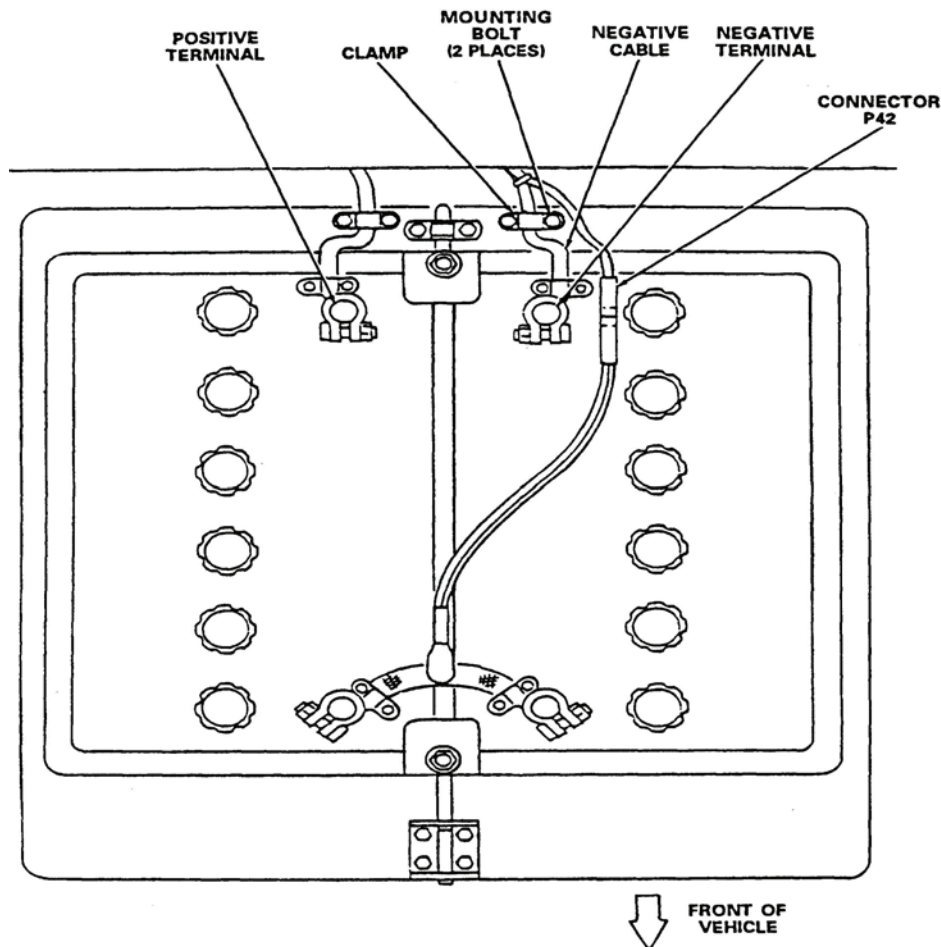
Figure 2-30– SUSV Battery Terminal Connections

(11) **Removal of Rear Driver-side seat/Battery Box Cover**

CAUTION

- To prevent injury to personnel or damage to equipment, remove all rings, watches, bracelets, etc.

- Disconnect negative battery cable before working with or around batteries. The negative cable is labeled in Figure 2-30.

- Protect the negative battery cable from accidental contact with other battery cables or posts

- When finished with work, connect negative battery cable last.

(a) Release latches locking rear driver-side seat/battery box cover in place.

(b) Lift and remove seat from vehicle. Set seat aside for later installation.

(c) Disconnect cable to negative battery terminal (outboard end of battery) using 1/2-inch open-end wrench from IPADS BII, Figure 2-30.

(d) Disconnect connector P42.

2-9. Install IPADS in M973 Series Small Utility Support Vehicle (SUSV) – Continued
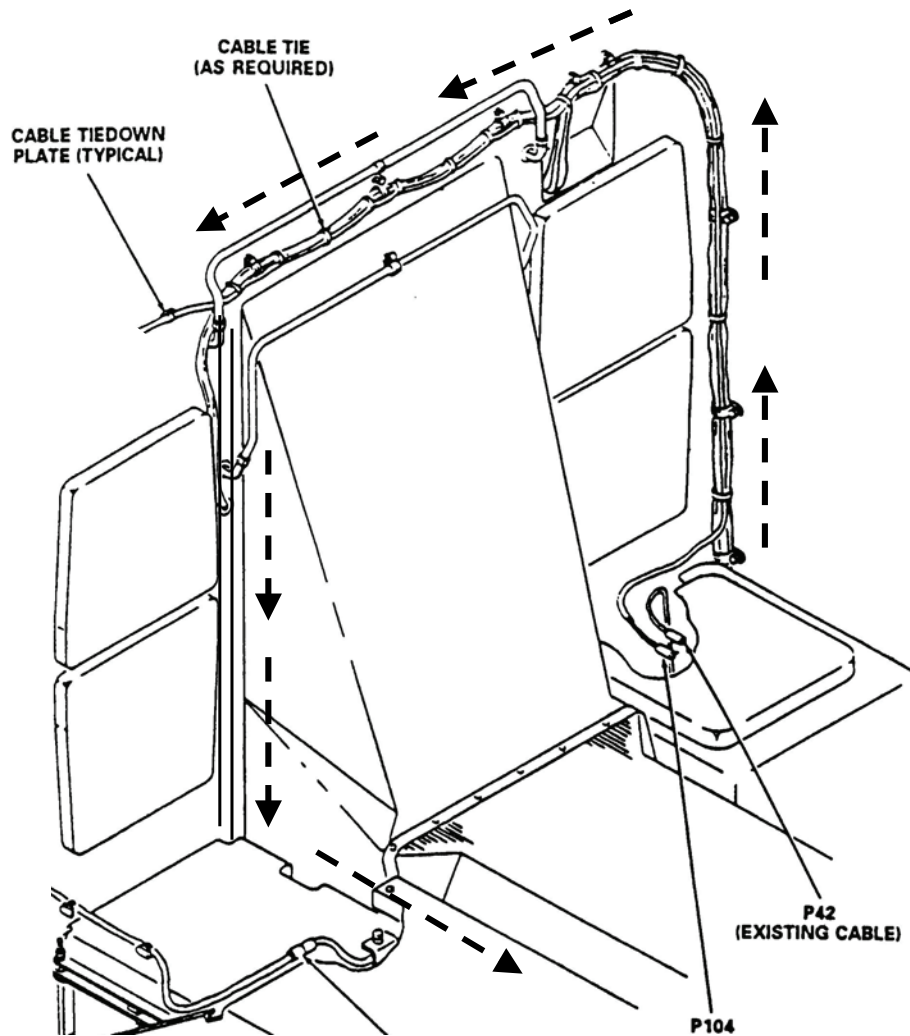
Figure 2-31 – W116-3 Power Cable Routing

b. **W116-3 Power Cable Installation.**

CAUTION

- To prevent injury to personnel or damage to equipment, remove all jewelry.

- Disconnect negative cable before working with or around batteries. Refer to Figure 2-30 for identification.

- Protect the negative cable from accidental contact with other battery cables or posts.

- When finished with work, connect negative cable last.

(1) Obtain cable W116-3 and cable ties from the installation kit.

(2) Route the harness loosely with BCU cable connector P1 adjacent to the BCU area and the red and black leads adjacent to the vehicle battery area. Install the cable in the rear area of the vehicle and secure loosely with the cable ties. See Figure 2-31 for cable routing.

(3) Connect the red lead to the positive (+) battery terminal using a 1/2-inch wrench, Figure 2-30.

(4) Connect the black lead to the negative (-) battery terminal using a 1/2-inch wrench, Figure 2-30.

(5) Check harness routing to be sure it is not pulled tight in any area.

(6) Tighten all cable ties.

(7) Reinstall the left rear seat/battery cover and secure.
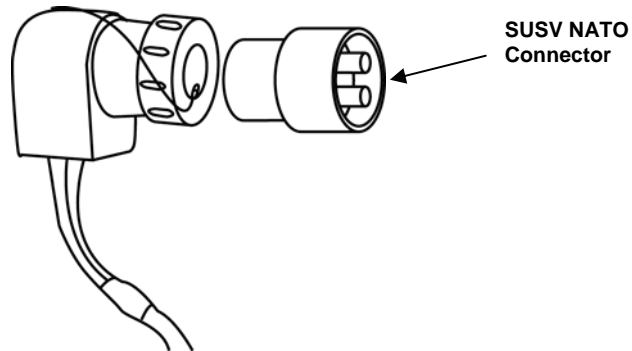
Figure 2-32– NATO Plug and SUSV NATO Connector

c. **NATO Plug Installation**

If the SUSV NATO connector will be used to power IPADS, use the following instructions:

(1) Obtain IPADS power cable, Figure 1-6 item 7, and NATO connector, Figure 1-6 item 13, from installation kit.

(2) Remove back of connector and terminal bolts, Figure 2-17, page 2-21.

(3) Install red-banded lug (wire marked positive) of power cable to positive terminal of connector (center post).

(4) Install black-banded lug (wire marked negative) of power cable to negative terminal of connector.

(5) Tighten hardware to secure lugs.

(6) Replace back of connector and tighten all screws.

(7) Plug NATO plug into SUSV NATO connector, Figure 2-32 (remove cap from NATO plug).

(8) Plug NATO plug with SUSV NATO connector into NATO receptacle behind and below the driver seat in the SUSV.

2-9. Install IPADS in M973 Series Small Utility Support Vehicle (SUSV) – Continued

    d. **SUSV IPADS Modifications**. Before IPADS can be installed, the SUSV winch mounting rails must be drilled to provide mounting holes for securing frame assembly onto vehicle. These operations must be performed by direct support maintenance personnel in accordance with TM 5-6675-308-34 or Marine Corps TM 08837A-34/2.

NOTE

    Check if the holes for the front rail assembly have already been drilled into the winch mounting brackets. If the holes have already been drilled, go to paragraph 2-9e.
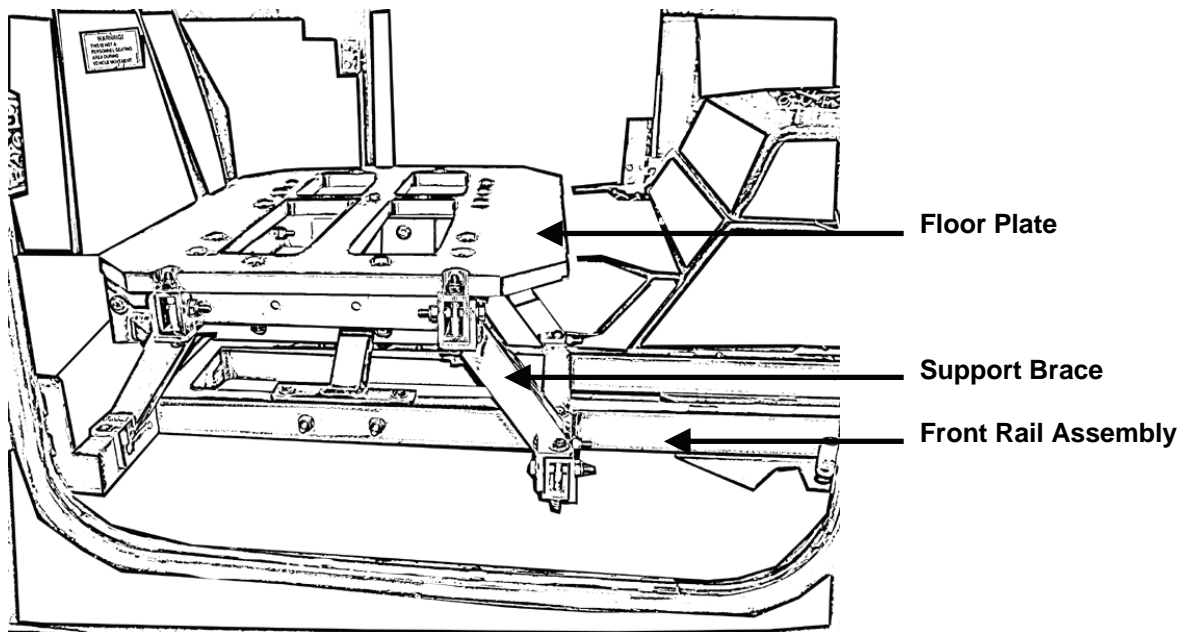
Figure 2-33 – Frame Assembly Shown Installed
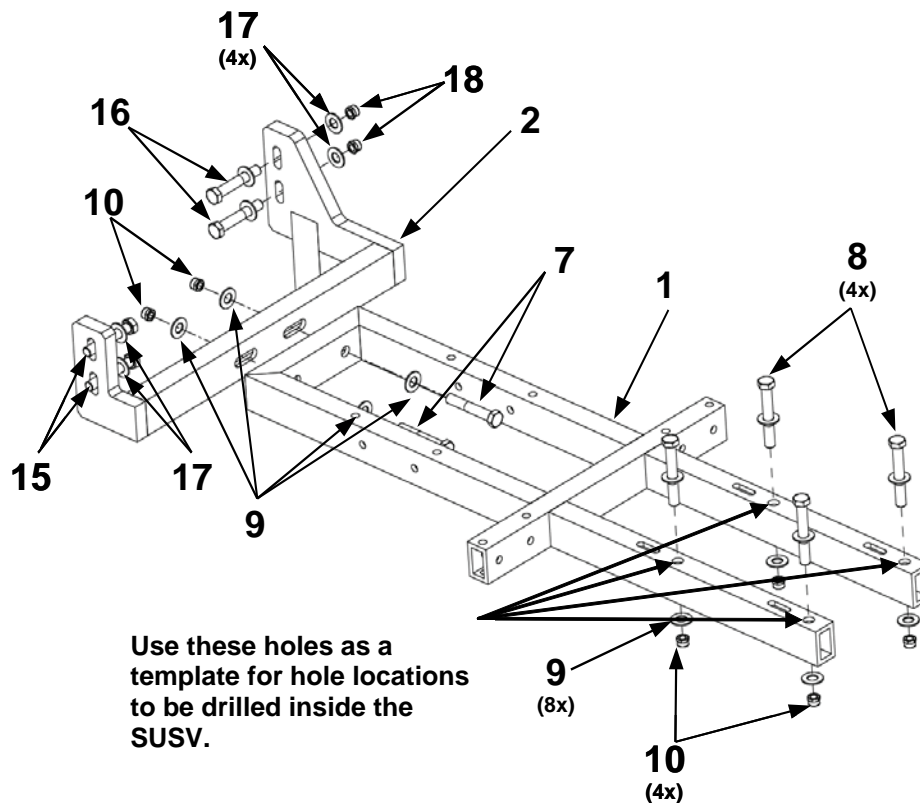
Figure 2-34– Rail Assembly

(1) Assemble rear rail assembly (2) and front rail assembly (1) using two 1/2-20X3-1/2-inch hex head screws (7), four 1/2-inch washers (9), and two 1/2-20-inch locknuts (10), Figure 2-34.

(2) Set the assembled pieces on top of the winch mounting brackets.

(3) Using 5/8-inch wrench, attach the rear rail assembly (2) to the seat belt-threaded holes nearest to the door using two 7/16-20X1-1/2-inch screws (15) and two 7/16-inch washers (17).

(4) Using 5/8-inch wrench, attach the rear rail assembly (2) to the seat belt-threaded holes nearest to the transmission using two 7/16-20X2-1/2-inch screws (16), four 7/16-inch washers (17), and two 7/16-20-inch locknuts (18).

(5) Make sure the front rail assembly (1) is flush with the winch mounting bars.

(6) Use a pen to mark the four holes that will be drilled in the winch mounting brackets.

(7) Remove the front rail assembly (1) prior to drilling.

(8) Mark center of the four holes drawn in step 6 using a center punch.

(9) Drill the pilot holes using 5/16-inch drill bit.

(10) Drill the holes again using a 9/16-inch drill bit.

2-9. Install IPADS in M973 Series Small Utility Support Vehicle (SUSV) – Continued

WARNING

The newly drilled holes contain sharp burrs. Wear gloves to prevent injury.

(11) Go to step e(1).

e. **Installation of Mounting Brackets.**

NOTE

Make sure the holes for the front rail assembly have been drilled into the winch mounting brackets. If the holes have not been drilled, go to paragraph 2-9d(1).

(1) Install IPADS Modified SUSV transmission access cover (NSN 2510-01-541-3655) as the transmission access cover would typically be installed.

(2) Assemble rear rail assembly (2) and front rail assembly (1) using two 1/2-20X3-1/2-inch hex head screws (7), four 1/2-inch washers (9), and two 1/2-20-inch locknuts (10), figure 2-43. Do not tighten bolts completely to allow for adjustment.

(3) Set the assembled pieces on top of the winch mounting bracket rails.

(4) Align rear rail assembly (2) with the seat belt-threaded holes.

(5) Using 5/8-inch wrench, attach the rear rail assembly (2) to the seat belt-threaded holes nearest to the door using two 7/16-20X1-1/2-inch screws (15) and two 7/16-inch washers (17). Do not tighten bolts completely to allow for adjustment.

(6) Using 5/8-inch wrench, attach the rear rail assembly (2) to the seat belt-threaded holes nearest to the transmission using two 7/16-20X2-1/2-inch screws (16), four 7/16-inch washers (17), and two 7/16-inch locknuts (18). Do not tighten bolts completely to allow for adjustment.

(7) Align front assembly (1) with the four holes previously drilled in the winch mounting brackets.

WARNING

The newly drilled holes contain sharp burrs. Wear gloves to prevent injury.

(8) Using 3/4-inch wrench and adjustable wrench, attach front rail assembly (1) to the winch mounting brackets using four 1/2-20X3-inch bolts (8), eight 1/2-inch washers (9), and four 1/2-20-inch locknuts (10). Use adjustable wrench to secure nuts on underside of rail. Tighten until snug plus 1/4 turn.

(9) Using 5/8-inch wrench and socket tighten screws (15) nearest the door and screws (16) nearest the transmission securing the rear rail assembly.

(10) Ensure that front rail (1) and rear rail (2) are aligned with each other and level using a level from a maintenance shop, once bolted. Adjust as needed.
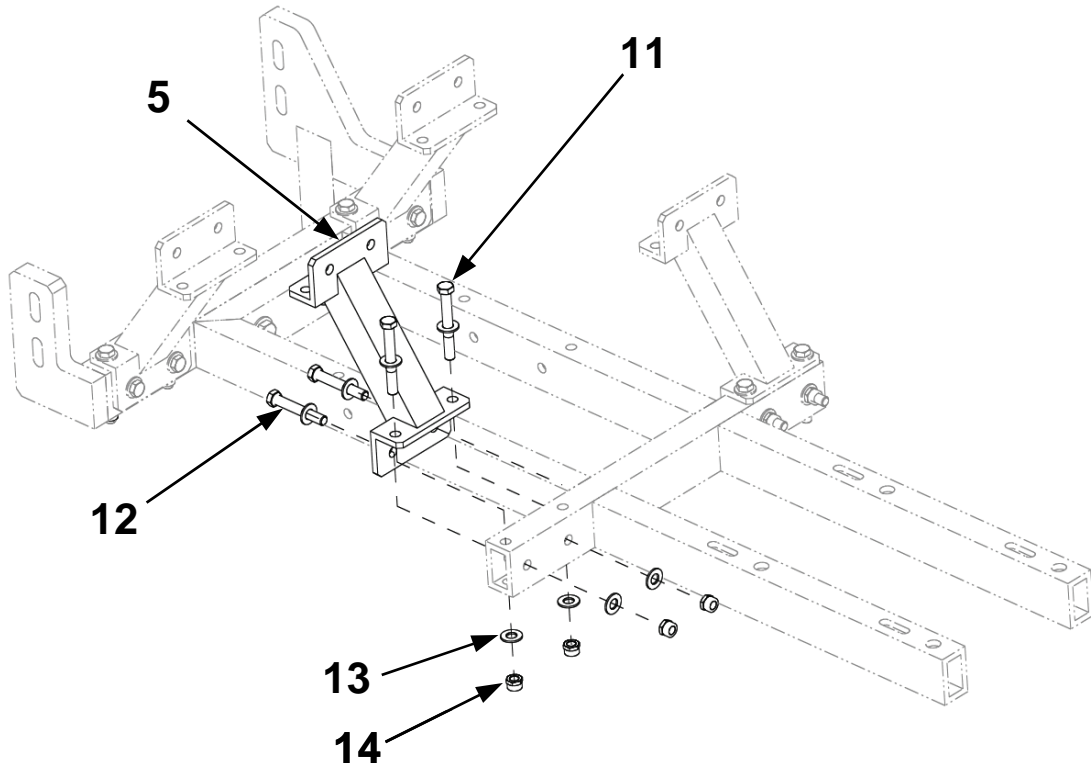
Figure 2-35 – Support Brace Assembly

f. **Support Brace Assembly.**

NOTE

- If the support brace and floor plate assembly was shipped preassembled, go to paragraph 2-9i.

- When installing the support brace assembly, the bolts must be installed with the heads on the flange side and the nuts on the opposite side, Figures 2-35 through 2-38.

(1) Assemble support brace (5) to rail assembly using two 3/8-16X3-inch hex bolts (11), two 3/8-16X2-1/2-inch hex bolts (12), eight 3/8-inch washers (13), and four 3/8-16-inch locknuts (14), Figure 2-44. Do not tighten bolts completely to allow for adjustment.

(2) Repeat step 1 for the three remaining support braces (5).

2-9. Install IPADS in M973 Series Small Utility Support Vehicle (SUSV) - Continued
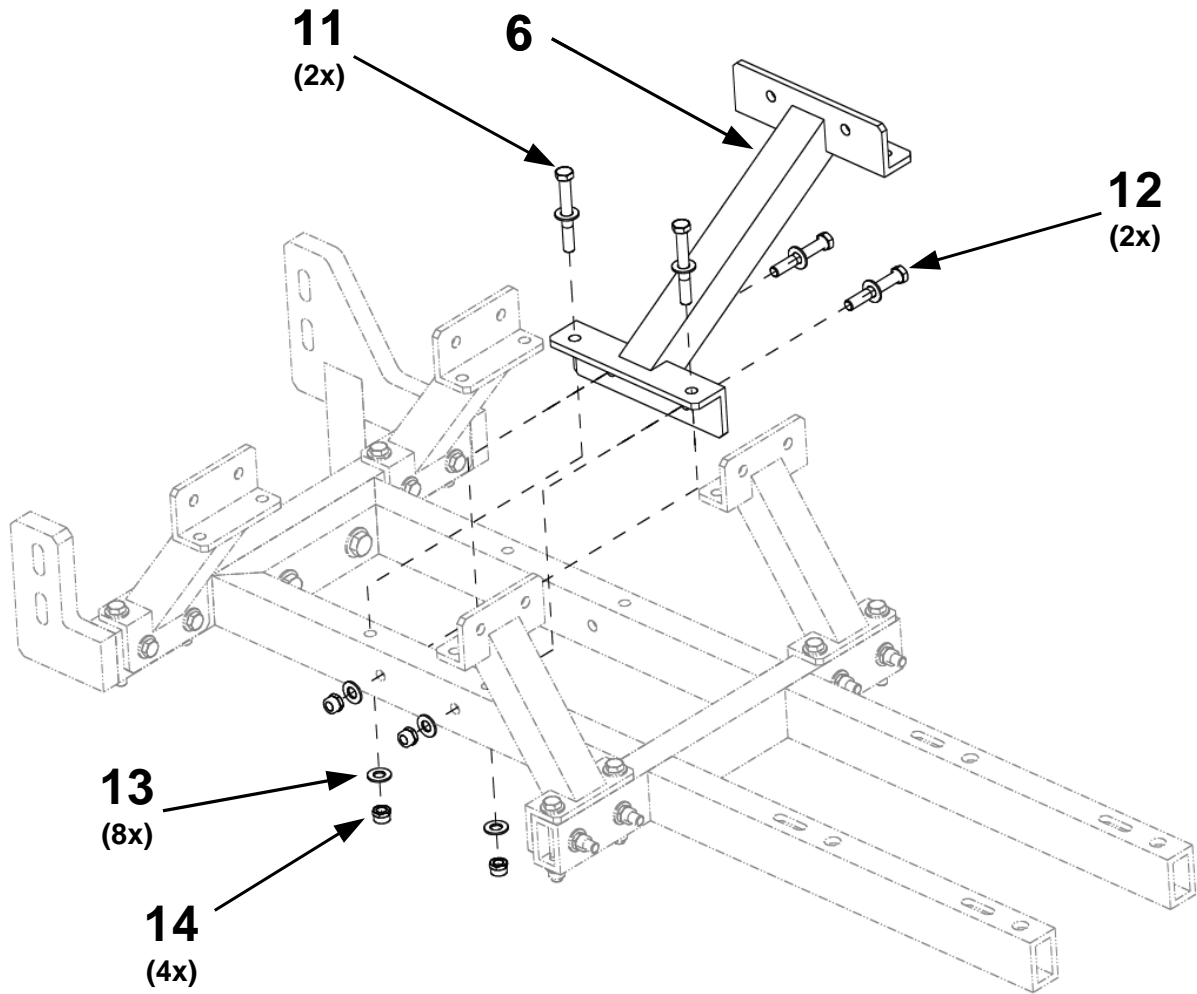
Figure 2-36 – Cross Brace Assembly

g. **Cross Brace Assembly**

NOTE

When installing the cross brace assembly, the bolts must be installed with the
heads on the flange side and the nuts on the opposite side, Figure 2-36.

(1) Assemble cross brace (6) to rail assembly using two 3/8-16X3-inch hex bolts (11), two
3/8-16X2-1/2-inch hex bolts (12), eight 3/8-inch washers (13), and four 3/8-16-inch locknuts (14),
Figure 2-46.

(2) Do not tighten bolts completely to allow for adjustment.
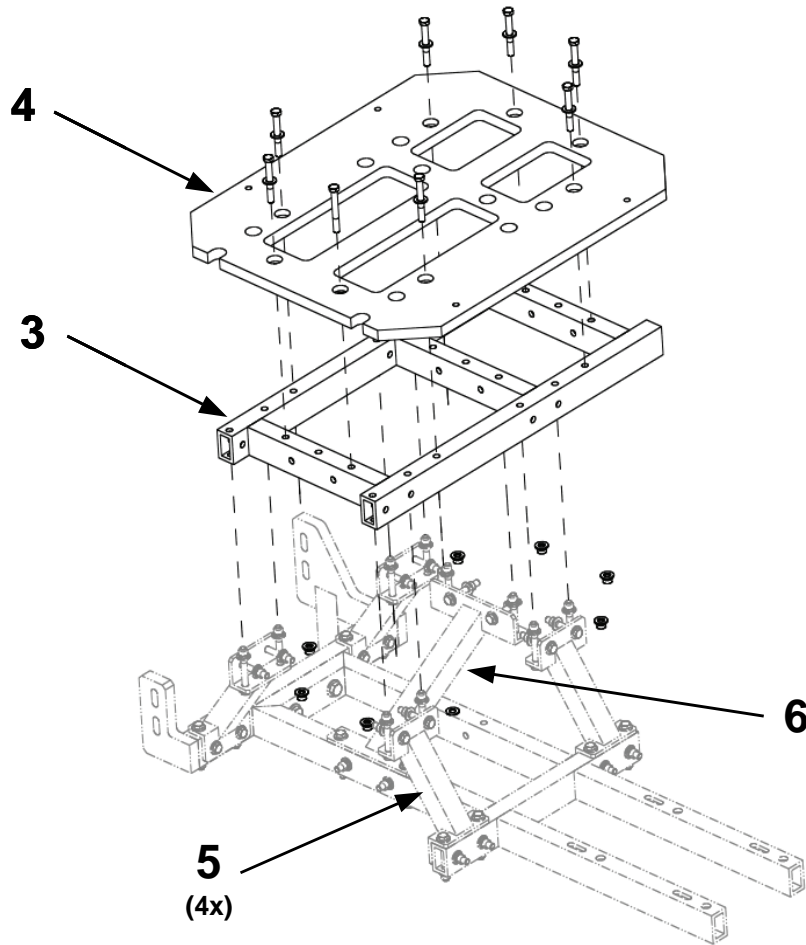
Figure 2-37 – Center Rail and Floor Plate Assembly

h. **Center Rail and Floor Plate Assembly.**

(1) Assemble center rail assembly (3) to four support braces (5) and cross brace (6) using 4 3/8-16X3-inch hex bolts (11), 4 3/8-16X2-1/2-inch hex bolts (12), 16 3/8-inch washers (13), and 8 3/8-16-inch locknuts (14), Figure 2-37.

(2) Using 9/16-inch wrench, tighten all 3/8-inch bolts from steps c through e until snug plus 1/4 turn.

(3) Assemble floor plate (4) onto center rail assembly (3) using 8 3/8-16X3-inch bolts (11), 16 3/8-inch washers (13), and 8 3/8-16-inch washers (14). Ensure "THIS SIDE UP" faces the roof of the SUSV.

(4) Tighten all remaining bolts from steps f through h as described in step (3).

2-9. Install IPADS in M973 Series Small Utility Support Vehicle (SUSV) - Continued
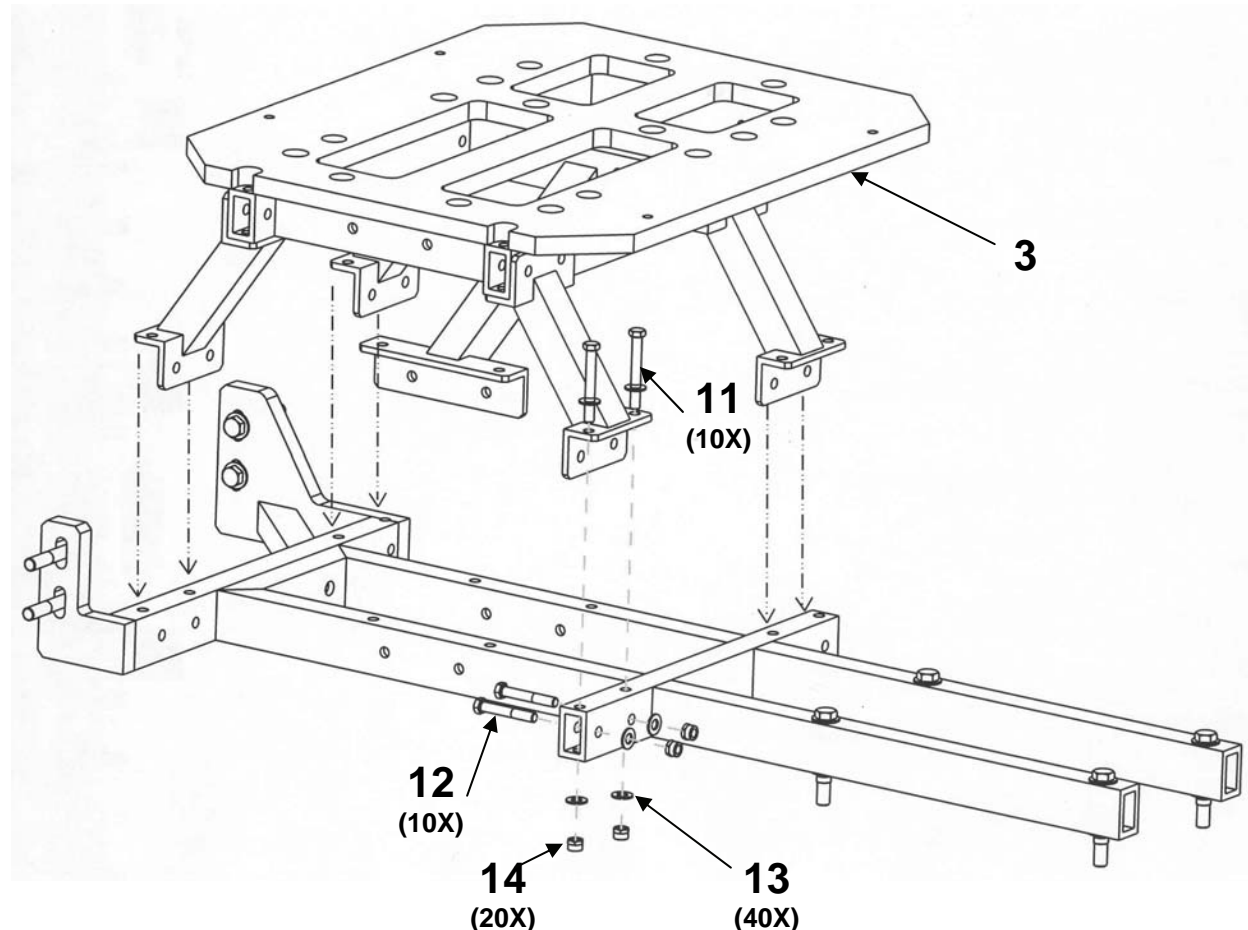
Figure 2-38 – Support Brace and Floor Plate Assembly Preassembled

i.   **Installation of support brace and floor plate assembly when shipped preassembled.**

WARNING

Center frame assembly weighs 46 lbs (21 kg); use two people to lift.

NOTE

- Insert longer bolts (3/8-16 x 3-in) through long side of rectangular tube and shorter bolts (3-8-16 x 2-1/2-in) through short side (cross section).

- When installing the support brace and floor plate assembly, the bolts must be installed with the heads on the flange side and the nuts on the opposite side, Figure 2-38.

(1) Install the support brace and floor plate assembly (3) using 10 3/8X3-inch hex bolts (11), 10 3/8X2-1/2-inch hex bolts (12), 40 3/8-inch washers (13), and 20 3/8-inch locknuts (14), Figure 2-38. Do not tighten bolts completely to allow for adjustment.

(2) When all bolts, washers, and locknuts have been installed, tighten all bolts snug plus 1/4 turn.
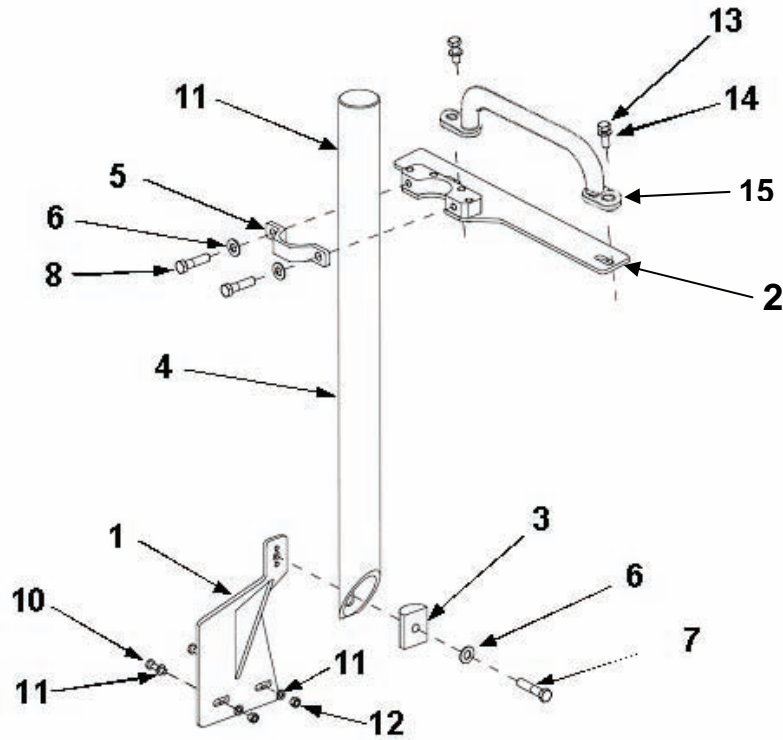
Figure 2-39 – CDU Mount Installation Components
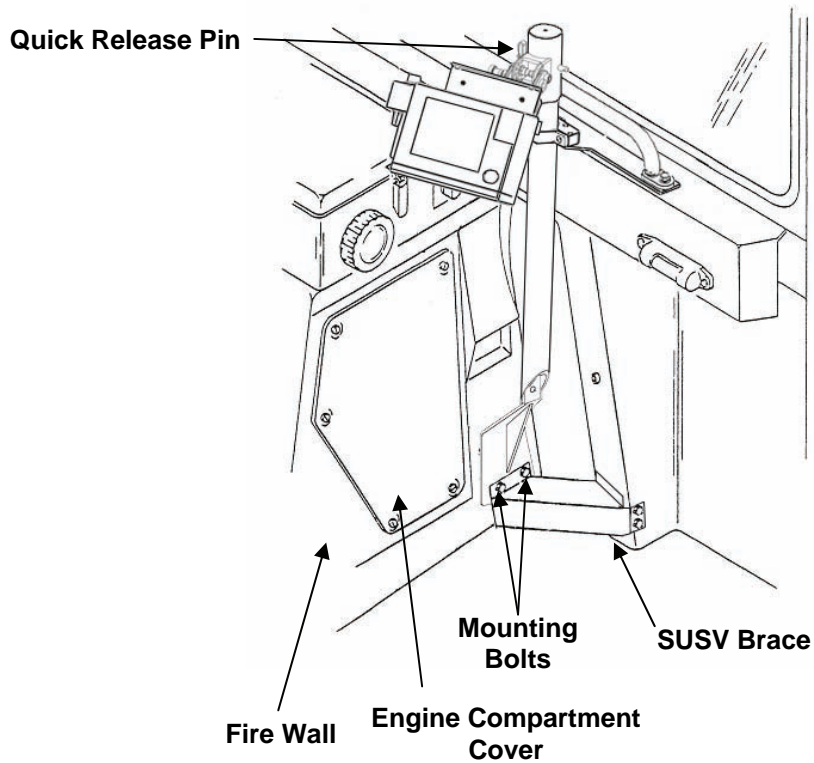
Figure 2-40– CDU Mount Installed

2-9. Install IPADS in M973 Series Small Utility Support Vehicle (SUSV) - Continued

WARNING

The IPADS CDU must be secured to the CDU Mast to avoid becoming a crash hazard. The IPADS CDU operator shall always wear the Kevlar helmet or Army Combat Helmet (ACH) while the SUSV is in motion. Lock the CDU in a position that is the furthest away from head during operations.

j. **CDU Mount Installation.**

(1) Using 10-mm socket and adjustable wrench install lower plate (1) onto the firewall and reinstall SUSV brace onto the lower plate (1) using original bolts (10), washers (11), and locknuts (12), Figure 2-39. Use the original brace holes, Figure 2-40. Hand-tighten only to allow for adjustment.

(2) Install dash panel handle on top of CDU panel assembly (2) in the location the dash panel handle (15) was previously installed, Figures 2-39 and 2-40, using original bolts (13) and washers (14). Hand-tighten.

(3) Remove bolts (8) and washers (6) attaching clamp (5) to CDU panel assembly.

(4) Fit clamp (5) around tube at the top and attach to CDU panel assembly (2) using original bolts (8) and washers (6) previously removed, Figures 2-39 and 2-40. Hand-tighten only to allow for adjustment.

(5) Check that all hardware is in place without stress. Adjust brackets to ensure shaft is upright, plumb, and straight from viewing position.

(6) Tighten bolts securing SUSV brace using a 10-mm wrench and socket until snug plus 1/4 turn, Figure 2-40.

(7) Tighten 3/8-inch screws (7) using a 9/16-inch wrench and socket until snug plus 1/4 turn, Figure 2-39.

(8) Tighten bolts securing dash panel handle using a 13-mm wrench and socket until snug plus 1/4 turn, Figure 2-40.
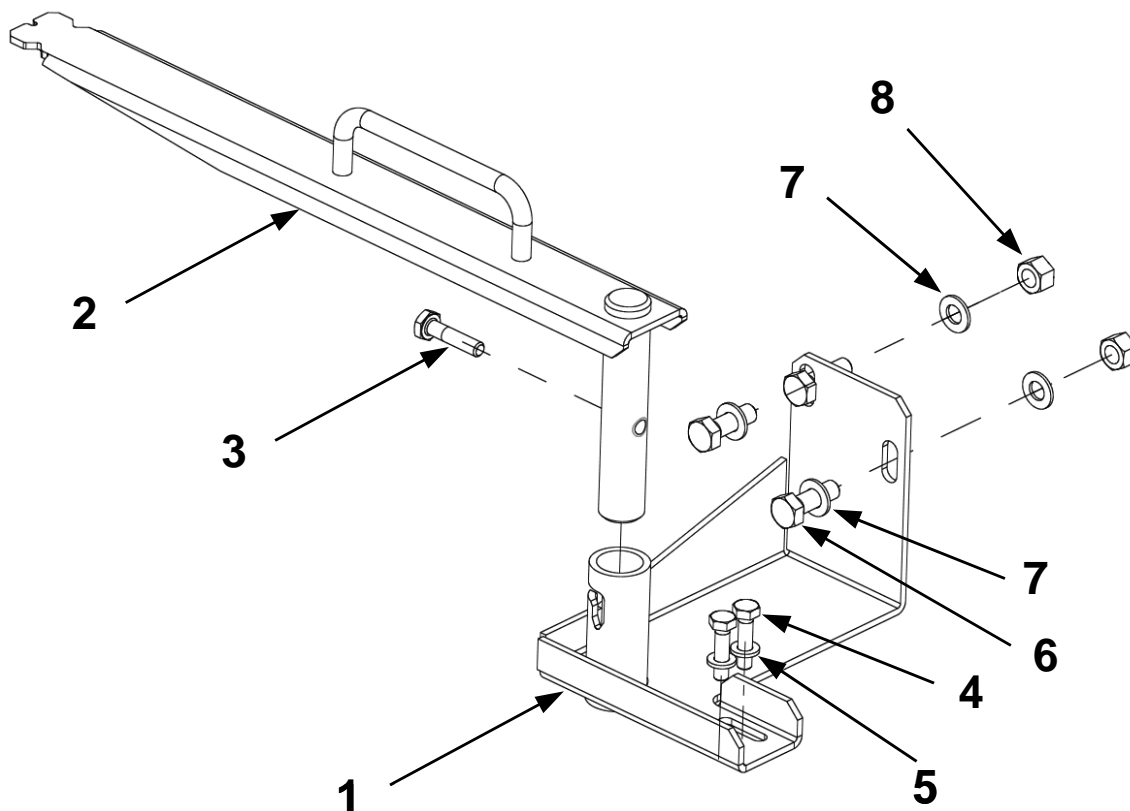
Figure 2-41 – Plumb Bob Installation Components

k. **Plumb Bob Assembly Installation.** The plumb bob assembly fits just inside the driver's side front door of the vehicle.

(1) Install plumb bob bracket (1) on the driver's seat support located inside the driver's door using two M6 hex head screws (4), two M6 washers (5), two M8 hex head screws (6), four M8 washers (7), and two M8 locknuts (8), Figure 2-41.

(2) Tighten M6 screws using a 10-mm wrench until snug plus 1/4 turn.

(3) Tighten M8 screws using a 13-mm wrench until snug plus 1/4 turn.

(4) Install plumb bob arm (2) into bracket shaft so that the 1/4-28X1-1/8-inch hex head screw (3) for rotating the plumb bob arm is located to the front of the vehicle, Figure 2-41.

(5) Insert hex head screw (3) into threaded hole in plumb bob arm (2) and tighten, allowing for free movement within guide.

2-9. Install IPADS in M973 Series Small Utility Support Vehicle (SUSV) – Continued
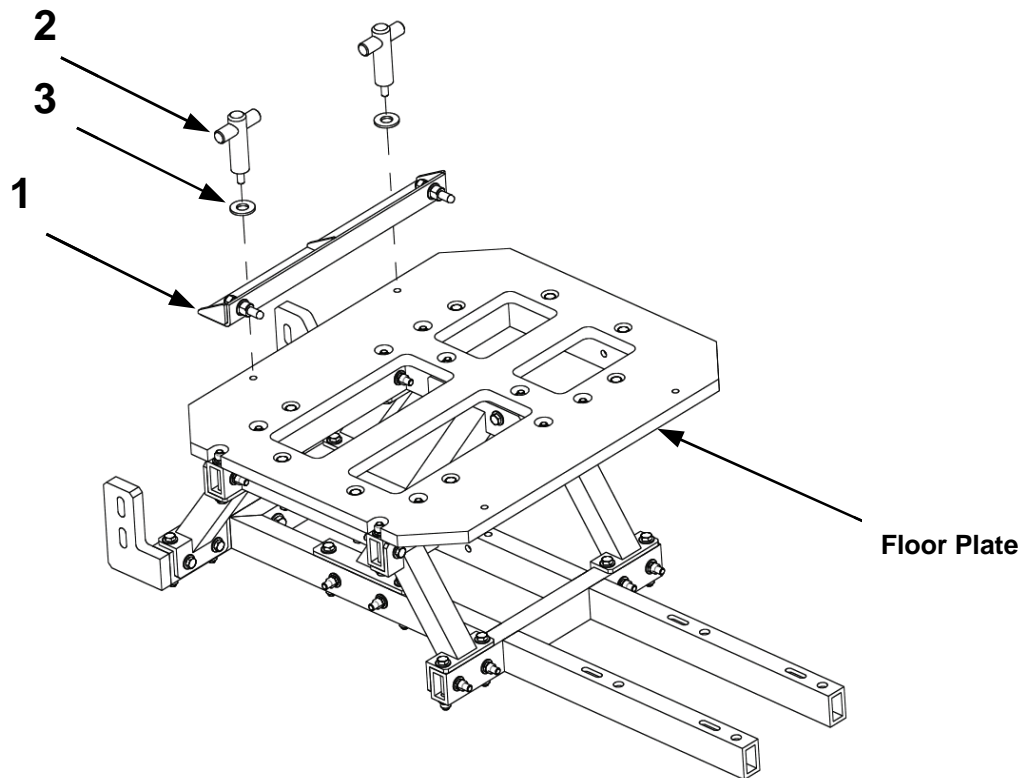
Figure 2-42– IPADS Preparation with Alignment Bracket

l.   **IPADS Preparation.**

   (1) Obtain the IPADS unit along with the following items from the HMMWV installation kit, Figure 1-5:

      (a) Alignment bracket assembly (1).

      (b) T-handle bolts (2).

      (c) Load distributing washers (3).

   (2) Place alignment bracket assembly (1) over the two threaded inserts on the left side of the floor plate with alignment pins facing the front of the vehicle, Figure 2-42.

   (3) Secure rail of the IPADS frame to the floor plate with two T-handle bolts (2) and two load distributing washers (3), Figure 2-42. Hand-tighten bolts plus 1/4 turn.

WARNING

IPADS weighs approximately 135 lbs (61.4 kg); use at least four persons to lift and move it.

CAUTION

   •   Ensure that all T-handle bolts are only hand-tightened and alignment pins are loose.

   •   DO NOT lift the IPADS unit using the porro prism cover.

IPADS

Alignment
Bracket
Assembly

Porro Prism
Assembly
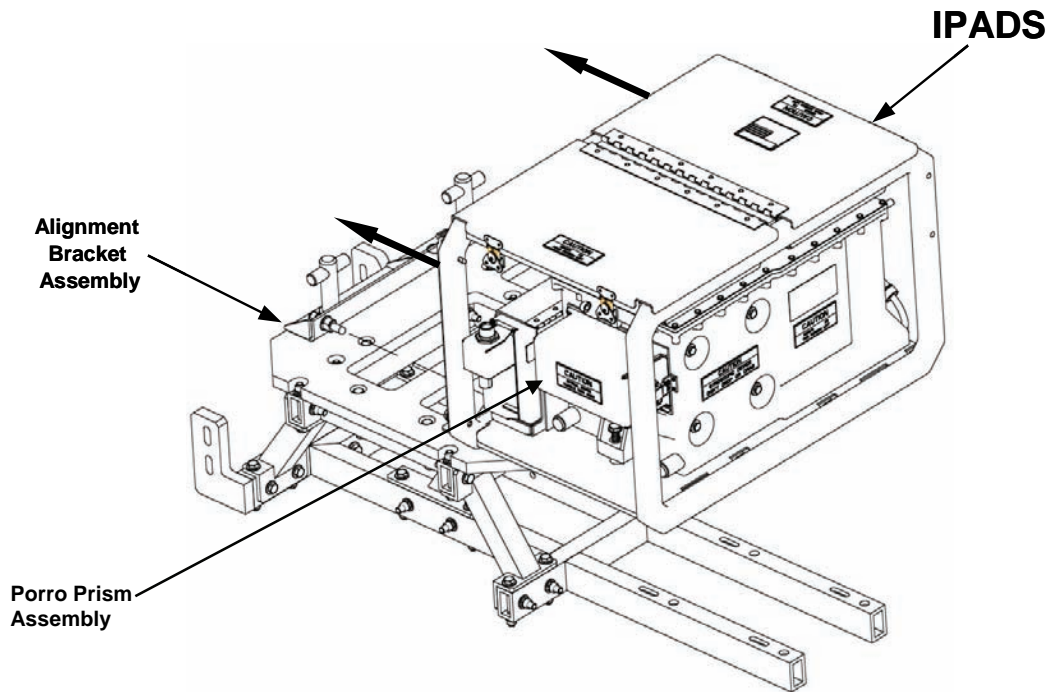
Figure 2-43 – IPADS Mounting onto Alignment Bracket Assembly

(4) Lift and place IPADS unit onto floor plate. Ensure the porro prism assembly and cover face towards the rear right passenger door of the vehicle, Figures 2-22 and 2-43.

(5) Slide IPADS frame onto pins of alignment bracket assembly. Ensure pins of alignment bracket are fully engaged in alignment pinholes in bottom rail of the IPADS frame. If alignment pins do not fit freely into receptacles, refer to Figure 2-8, for adjustment procedures.

(6) Tighten alignment pins.

2-9. Install IPADS in M973 Series Small Utility Support Vehicle (SUSV) – Continued
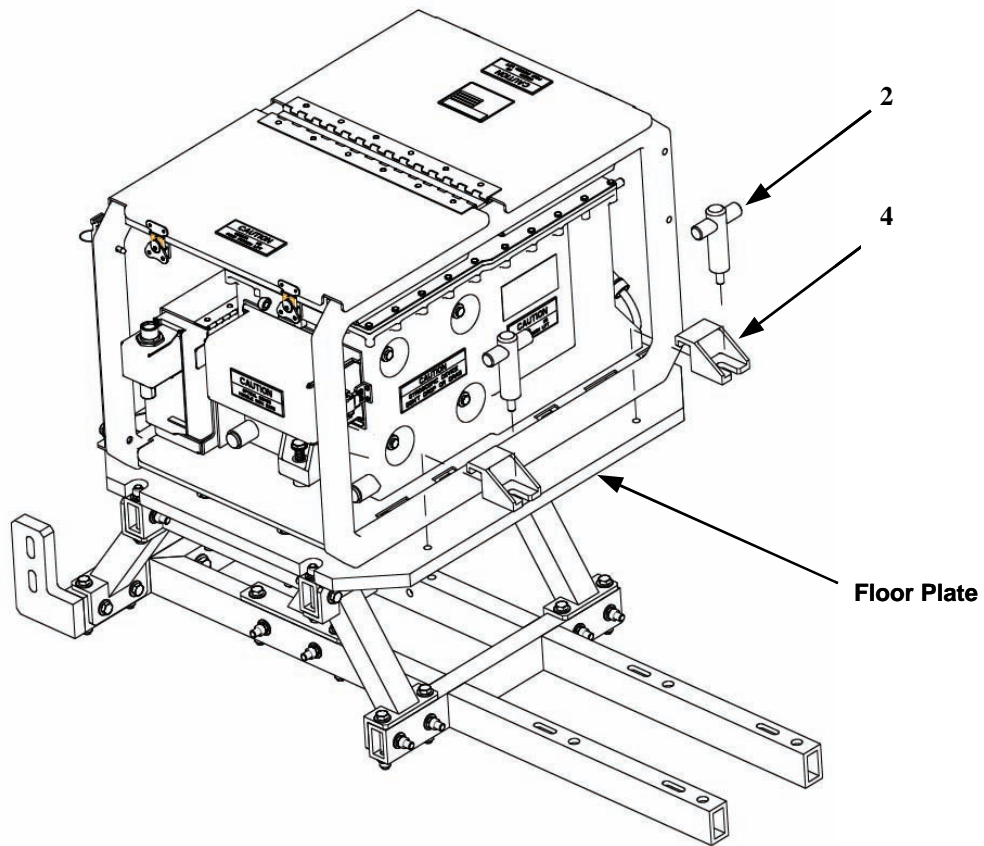
Figure 2-44 – Mounting Clamps and T-Handle Installation

(7) Secure front rail of the IPADS frame to the floor plate with two mounting clamps (4), two T-handle bolts (2), and two load distributing washers (3), Figure 2-44. Hand-tighten bolts plus 1/4 turn.

CAUTION

Ensure that all T-handle bolts are only hand tightened.
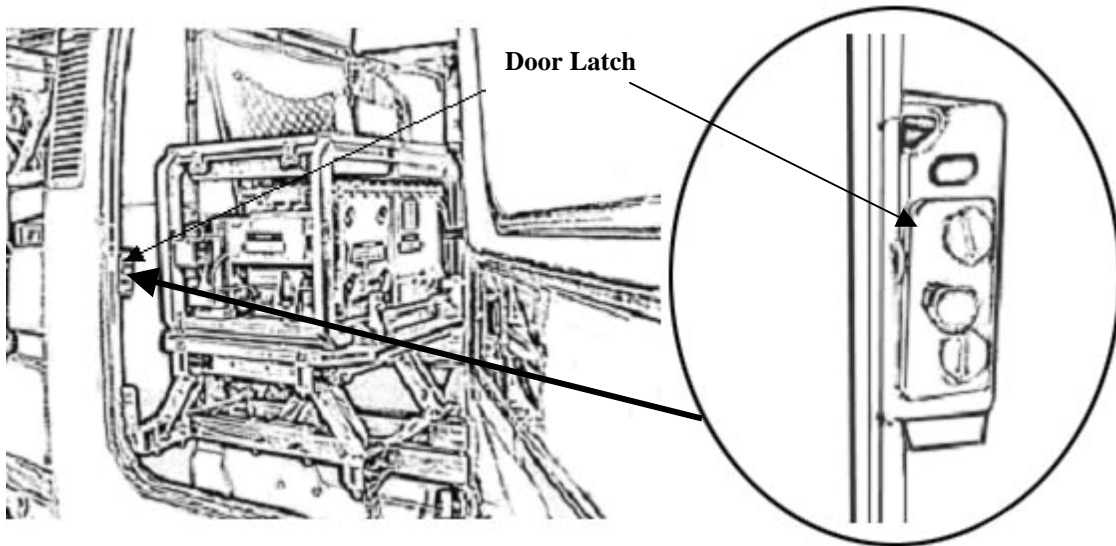
Figure 2-45 – Door Latch

(8) If the rear passenger-side door does not close after installing IPADS, adjust door latch, Figure 2-45.

m. **CDU Installation.**

(1) Remove CDU from storage compartment in IPADS frame.

(2) Release IPADS harness cable from cable strap on frame. Route W114 between engine cover and passenger seat. Connect W114 connector P1 to J1 connector on CDU.

(3) Attach CDU to bracket assembly by aligning two pins located on CDU plate with CDU and secure using two locking latches on CDU plate, Figures 2-20 and 2-21.

(4) Connect W116-3 power cable (from either the battery or NATO outlet) to IPADS.

(5) Re-hinge all doors for operation.

SECTION IV. PRELIMINARY ADJUSTMENT OF EQUIPMENT

2-10. Changing Vehicles.

a.   The operator must determine the type of vehicle used with IPADS. Each vehicle type will have a different set of dimensions associated with the plumb bob suspension point. The last vehicle used will be displayed.
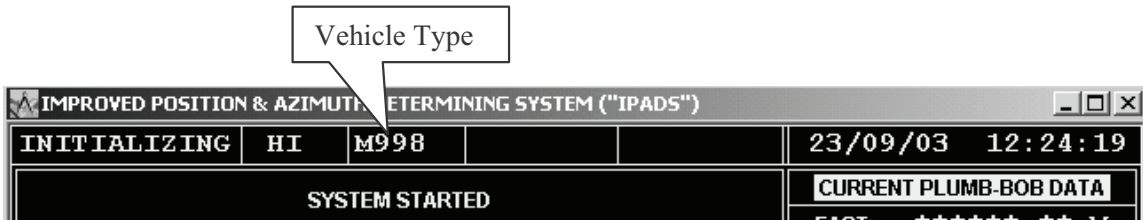
Figure 2-46 – Vehicle Type Identification

b.   If the displayed vehicle type is correct, the operator may proceed with system initialization.

c.   A change of selected vehicle may be effected at any time by following the procedure of paragraph 3-11b.

d.   Adding a new vehicle reference point may be accomplished with great care in the measurement techniques and entered into the system using the instructions in paragraph 3-11b.

2-11. Preliminary Checks and Services.

After completing an IPADS installation with all equipment mounted and connected, make the following checks:

a.   Cables connected as in Figures 2-13 and 2-14, cables properly routed, and connections tight.

b.   IPADS frame secured firmly to floor plate.

c.   No physical obstructions to observing the PPA from outside the vehicle.

CHAPTER 3

OPERATING INSTRUCTIONS

SECTION I. CONTROLS AND INSTRUMENTS

3-1. Damage from Improper Setting.

No combination of control settings will cause damage to the equipment or create a hazard to personnel.

3-2. Field Controls, Indicators, and Connectors.

IPADS controls, indicators, and connectors are illustrated in Figures 3-1 through 3-5.

a. **BCU.** The BCU has switches to control input power (DC INPUT) and output power (Output) to the CDU and CPNU, Figures 3-1. There are indicators for input power, battery charge state and battery temperature, and connectors for both input and output power, Figure 3-1.
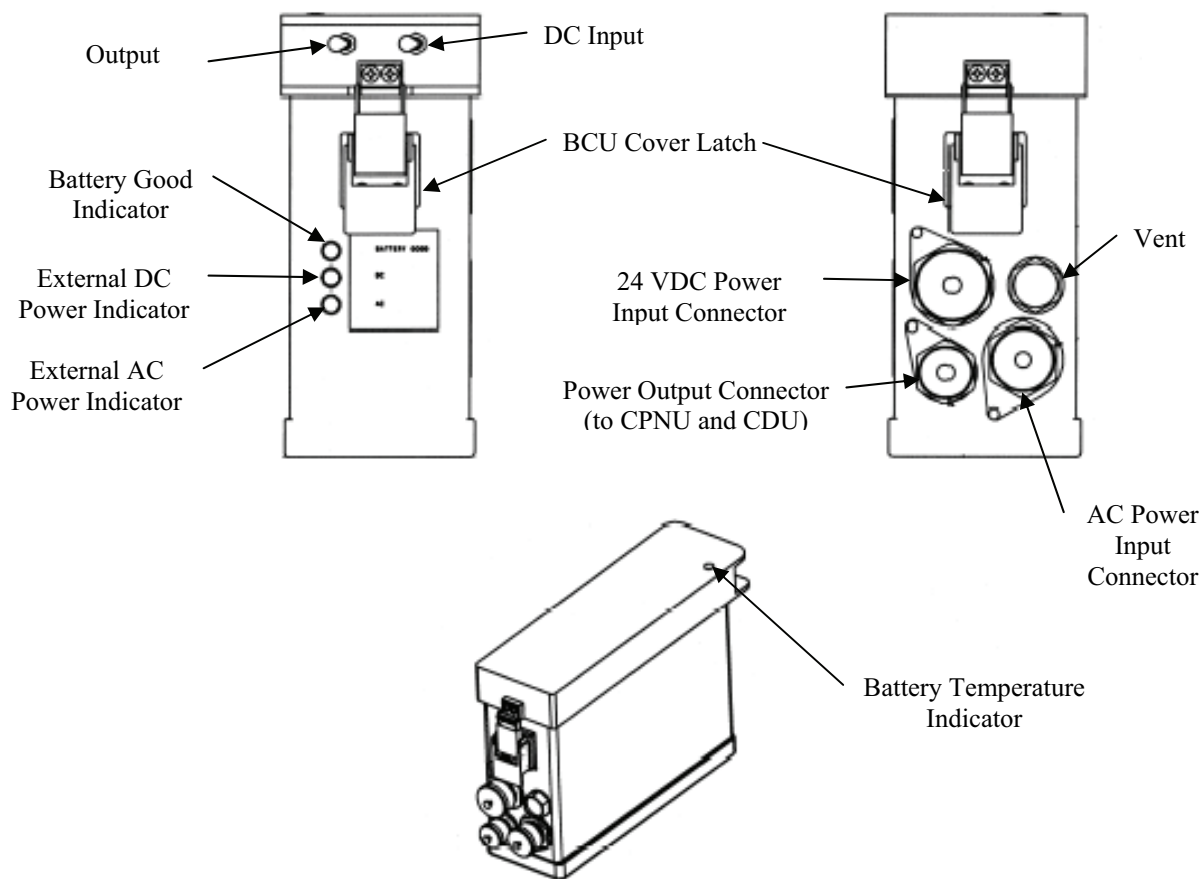
Figure 3-1 – BCU Field Controls, Indicators, and Connectors

3-2. Field Controls, Indicators, and Connectors - Continued

Legend for Figure 3-1 – BCU Field Controls, Indicators, and Connectors and Functions

Item	Function
DC INPUT Switch	Controls DC power from the vehicle to IPADS. Does not control AC power.
Output Switch	Controls power from the BCU to the CPNU and CDU.
Battery Good Indicator	When illuminated, indicates BCU internal batteries are charged to 80 percent of full capacity or greater.
External DC Power Indicator	When illuminated, indicates BCU is receiving DC power from the vehicle and the input power switch is ON.
External AC Power Indicator	When illuminated, indicates BCU is receiving external AC power.
Battery Temperature Indicator	When illuminated, and when the Battery Good Indicator is illuminated, there is enough power to support the IPADS for inter-vehicle transfer. NOTE The Battery Temperature Indicator is always on unless one or more of the following conditions occur: • The battery has been stored at temperatures approaching 50º F or below. • The battery heater is not working properly. • The AC power cable is used.
24 VDC INPUT Power Connector	Connects to cable providing 24 VDC Input power from the vehicle.
AC Input Power Connector	Connects to AC power cable that is normally stowed in one of the IPADS storage compartments.
Output Power Connector	Connects to IPADS Wiring Harness W114 to provide power to the CPNU and CDU.
Latch	Two latches secure the BCU cover to the BCU. The cover is opened to inspect and replace the AC fuse and batteries, paragraphs 4-10 and 4-11.
Vent	Releases excessive pressure in the BCU in the event of catastrophic battery failure.

b. **CDU**. The CDU is the primary operator interface with the IPADS. CDU controls, indicators, and connectors are shown in Figure 3-2.

CAUTION

- Permanent damage to the IPADS CDU Active Matrix Liquid Crystal Display (AMLCD) screen may result from exposure to temperatures below -40 º F.

- Permanent damage to the IPADS CDU hard disk drive (HDD) may result from operation at temperatures below –22 º F.

NOTE

If possible, the IPADS CDU should be positioned so direct sunlight does not shine on the screen. Direct sunlight on the CDU makes it difficult to read the display.
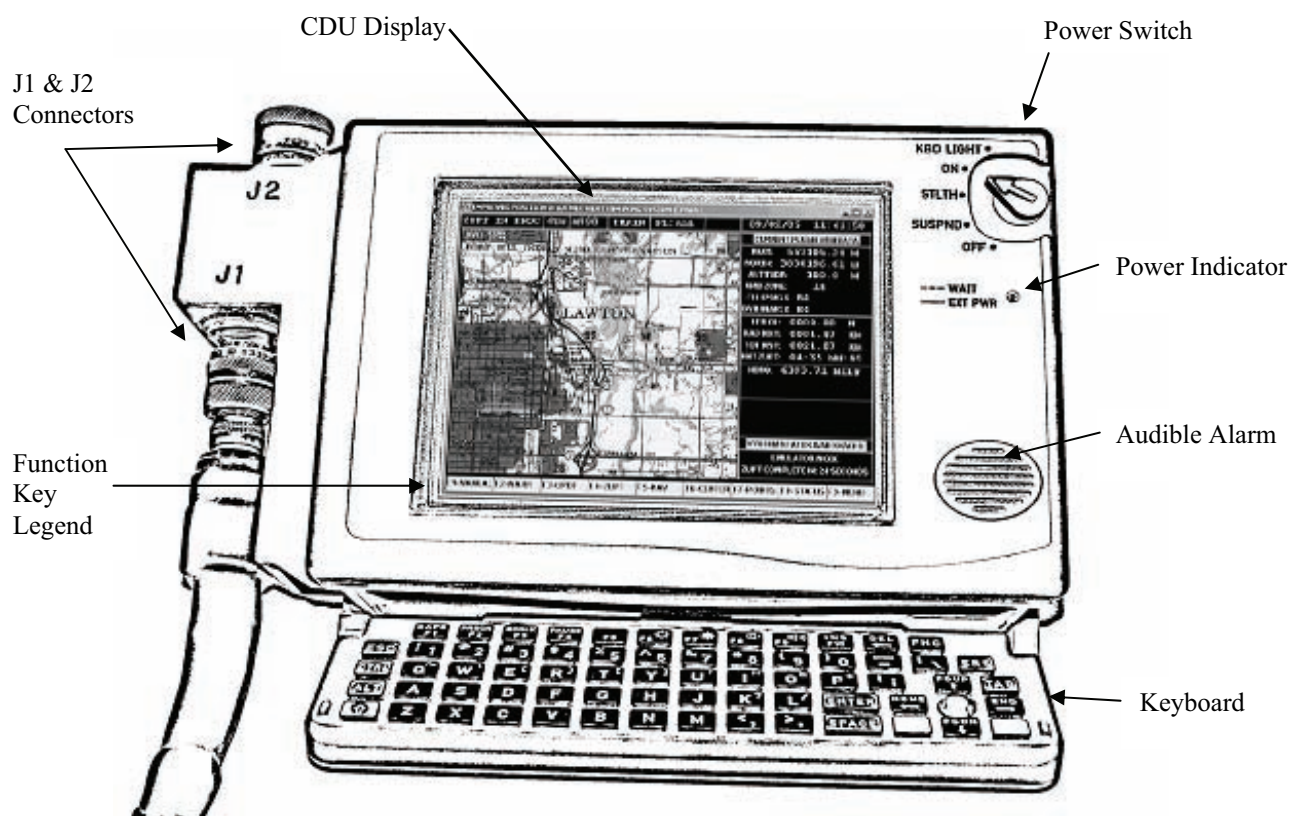
Figure 3-2 – CDU Field Controls, Indicators, and Connectors

Legend for Figure 3-2 – CDU Field Controls, Indicators, and Connectors	
Item	**Function**
Power Switch	Controls CDU power and operating modes.
KBD LIGHT	Turns CDU on and keyboard is illuminated for use in reduced visibility conditions.
ON	Turns CDU on and keyboard is not illuminated. Usual setting for IPADS daytime operation.

Legend for Figure 3-2 – CDU Field Controls, Indicators, and Connectors	
Item	**Function**
STLTH	Stealth mode. CDU display intensity, keyboard illumination, and audible alarm volume are reduced to minimize detection in the dark.
SUSPND	Suspend mode not used for IPADS.
OFF	Turns only CDU off. Does not control power of other IPADS components.
Keyboard	Provides data and control function entry, Figure 3-3.
Display	Liquid crystal video display (LCD).
Power Indicator	Green light emitting diode (LED) indicator.
Steady on	CDU is operating with power from the BCU.
Flashing	CDU is warming up at low temperatures. CDU is operational when indicator stops flashing.
Off	CDU is not receiving power from BCU or the CDU power switch is in the OFF position.
Audible Alarm	Provides audible alert that a critical operation is required or completed.
Connector J1	Connects to wiring harness W-114 to connect CDU to BCU.
Connector J2	Connects to FOS data cable W-136 and reprogramming cable W-143.

NOTE

- IPADS displays all alphabetic characters in uppercase.

- Bolding in the text of this document identifies actions to be performed by pressing keys or function key legends; e.g., Press **Enter.**

- Temperatures below 32° F may require a warm up period before the CDU is operational.
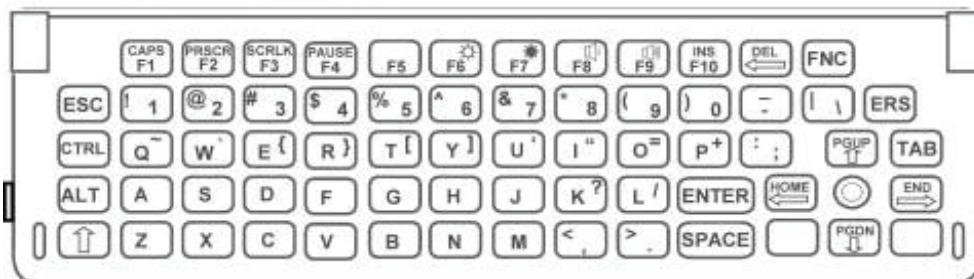
Figure 3-3 – CDU Keyboard

(1) The CDU keyboard layout is shown in Figure 3-3 and is more compact than a standard office QWERTY keyboard. Some keys are not located in the same place as on a normal office keyboard. Some keys have added functions that are indicated by a yellow legend at the top of the key. FNC must be pressed simultaneously with these keys to access the additional function. The unique keys used with IPADS are described in Table 3-1.
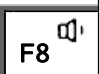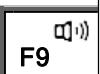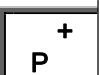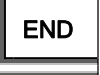
NOTE
A flashing function key legend on the display means that the function requires immediate attention.

(2) IPADS uses function keys F1 through F9 to perform various operations, Table 3-2. When a function key (F1 through F9) is active, a legend will be displayed on the bottom line of the display. The possible legends are listed and their functions described in appendix G.

Table 3-1 – Special Keys Used on IPADS

Key(s)	Function
FNC	Used simultaneously with another key to activate yellow top function on the other key.
⇧	Shift key
FNC F6 ✿	Decrease display brightness
FNC F7 ✸	Increase screen brightness
FNC F8	Decrease audible alarm volume
FNC F9	Increase audible alarm volume
DEL ←	Backspace
FNC DEL ←	Delete
FNC P +	+ (plus sign)
FNC PGUP	Page up
FNC PGDN	Page down
FNC HOME	Home
FNC END	End
FNC ERS	Initiate Emergency Zeroize

3-2. Field Controls, Indicators, and Connectors - Continued

Table 3-2 – IPADS Function Key Legend By Screen

Screen	F1	F2	F3	F4	F5	F6	F7	F8	F9
MENU	MANUAL		UPDATE				POINTS	STATUS	SHUTDN
MENU	MANUAL	MARK	UPDATE	ZUPT	NAV	MAP	POINTS	STATUS	SHUTDN
MENU	MANUAL	MARK	UPDATE	ZUPT	NAV AID	MAP	POINTS	STATUS	SHUTDN
IPADS MODE	OPERNL	TRAIN	EMULAT	ZUPT					MENU
VEHICLE TYPE	M998	M1123	M973		OTHER				MENU
VEHICLE TYPE		USE ALL							EXIT
SURVEY ORDER	4TH	5TH							MENU
ELLIPSOID/ DATUM			FLAT	MINOR					EXIT
ELLIPSOID/ DATUM		USE ALL	FLAT	MINOR					CANCEL
ELLIPSOID				ZUPT					CANCEL
DATUM				ZUPT					CANCEL
DISPLAY OPTIONS	GRID	TRUE		ZUPT					MENU
DISPLAY OPTIONS	UTM	DMS	D.D	ZUPT					MENU
DISPLAY OPTIONS	MILS	DMS	D.D	ZUPT					MENU
DISPLAY OPTIONS	ON	OFF		ZUPT					MENU
ZONE FUNCTION	NORMAL	WEST GZ	EAST GZ	ZUPT					EXIT
DATE/TIME		USE ALL		GET TIME					MENU
DATE/TIME		USE ALL		ZUPT					MENU
MARK	2 POS	1 POS	T AZ	T SCP					EXIT
MARK WAIT									CANCEL
MARK 2 POS									CANCEL
MARK 2 POS	MRK EOL								CANCEL
MARK 1 POS									EXIT
MARK T AZ									EXIT
MARK T SCP									EXIT
MARK T AZ		USE ALL							EXIT
MARK T SCP		USE ALL							EXIT
UPDATE	UPDT-PB	UPDT-T		ZUPT					EXIT
UPDATE PB		NEW	SEL PT.	ZUPT					EXIT
UPDATE T				ZUPT					EXIT
UPDATE T		NEW	SEL PT.						EXIT
NAVIGATON AID	MANUAL	MARK	UPDT	ZUPT	NAV	MAP	POINTS	STATUS	MENU
NAVIGATON AID	MANUAL	MARK	UPDT	ZUPT	STOP NAV	MAP	POINTS	STATUS	MENU
STATUS	MANUAL	ALARM		ZUPT					EXIT
MAP	MANUAL	MARK	UPDT	ZUPT	NAV	CENTER	POINTS	STATUS	MENU
MAP	MANUAL	MARK	UPDT	ZUPT	NAV AID	CENTER	POINTS	STATUS	MENU
POINT LIST		NEW	SEL. PT	FILTER	DEL ALL	SND PNT	SND ALL		EXIT
POINT LIST		NEW		FILTER	DEL ALL	SND PNT	SND ALL		EXIT
POINT EDITOR	USER	WAY	SCP	ZUPT					EXIT
POINT EDITOR		USE ALL							EXIT
ALL					ZONE				

Training Mode

Vehicle or Zoom

Filter

FOS Status

Survey Order

Mode

Interactive Area

Date & Time

Current Position

Survey Status

Vehicle Heading

Navigation Data

Status & Operator Messages

Instruction Line

Function Key Legends
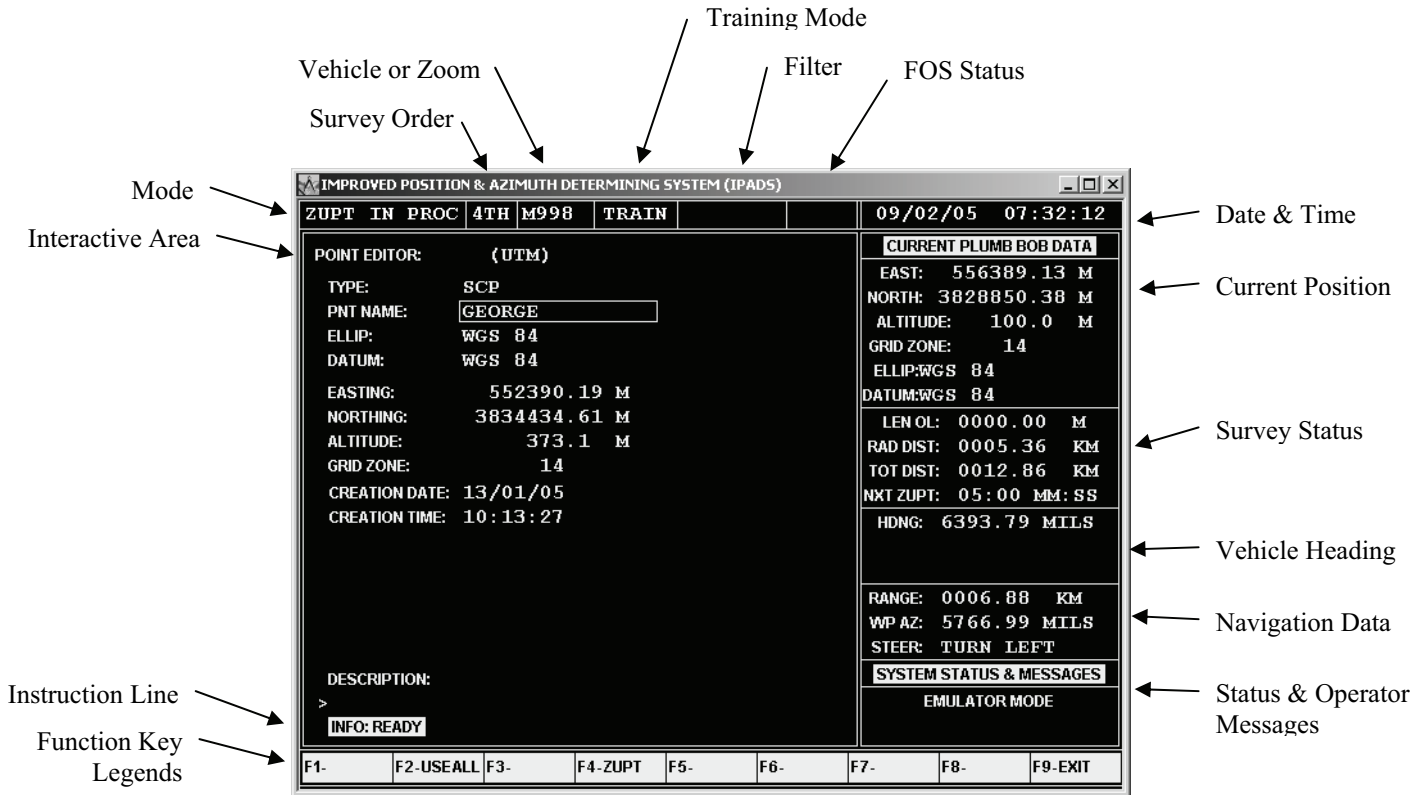
Figure 3-4 – IPADS Display Page

Legend for Mode Box of Figure 3-4 – IPADS Display Page

Area	Description
Mode	Current IPADS operational mode. Indications are listed below.
INITIALIZING	Appears momentarily during power up indicating that IPADS software is initializing.
CPNU INIT	Once IPADS software is initialized, CPNU INIT is displayed indicating CDU communications ports are initialized and CDU is attempting to establish communications with CPNU.
ALIGNING NNN	CPNU is aligning. NNN is a countdown, in seconds, to completion.
POS UPD REQ	CPNU failed hot start and position update is required.
ZUPT IN PROC	The vehicle is stopped and IPADS is performing ZUPTs.
NAVIGATION	The vehicle is moving.
P1 -> P2	IPADS is performing a two-position azimuth mark operation.
SYS SHUTDOWN	Appears momentarily during shutdown indicating IPADS is performing an orderly software shutdown. Operator must wait for IT IS NOW SAFE TO SHUTDOWN before turning off power.
SYS INACTIVE	Appears briefly after SYS SHUTDOWN. Indicates IPADS software was successfully shutdown and Windows shutdown is in progress.
CPNU FAILURE	CPNU failure has occurred, see paragraph 4-5, Field Troubleshooting.
CPNU SHUTDN	If power is recycled on the CDU (e.g. using the CDU power switch) while the CPNU remained powered up following a normal shutdown (F9 on MENU), CPNU SHUTDN is displayed. This indicates CPNU had received a proper shutdown command, but was not power off. Shutdown IPADS fully then power up as described in paragraph 3-6.

Legend for Mode Box of Figure 3-4 – IPADS Display Page

Area	Description
Survey Order	Current IPADS survey order. Indications are listed below.
4TH	Fourth order equivalent, 5 minutes between ZUPT stops.
5TH	Fifth order equivalent, 10 minutes between ZUPT stops.
DGR	Degraded, paragraph 3-14.
Vehicle or Zoom	Current IPADS vehicle or map zoom value. Indications are listed below.
M998	M998 HMMWV
M1123	M1123 or M1069 HMMWV
M973	M973 SUSV
OTHER	User defined vehicle
Zoom value	Momentarily shows zoom value when zooming in or out on map display, paragraph 3-30(2).
Operating Mode	The entire mode will be in white.
TRAIN	Notifies the user that IPADS is in training mode.
(blank)	Notifies the user that IPADS is in normal operating mode (tactical mode)
Filter	Type of points selected for display. Indications are listed below.
FL: ALL	All points in the IPADS database are displayed.
FL: MISN	All points established by IPADS during the current mission are displayed.
FL: SCP	All survey control points (SCP) are displayed.
FL: WAY	All waypoints are displayed.
FL: MARK	All marked points are displayed.
FL: USER	All user-defined points are displayed.
Date & Time	Date and time in dd/mm/yy hh:mm:ss format for the time zone last set, paragraph 3-11g.
Current Position	Current position of plumb bob reference point in the selected position format, paragraph 3-11b.
Survey Status	
LEN OL	Length of two-position azimuth orienting line in M or KM, depending on length.
RAD DIST	Straight line distance from last position update, in M or KM, depending on distance.
TOT DIST	Total distance traveled from last position update, in M or KM, depending on distance.
NXT ZPT	Time to next required ZUPT in mm:ss format.
Vehicle Heading	Current heading (azimuth) of the vehicle in the selected angle format, paragraph 3-11e(2).
Navigation Data	
RANGE	Straight-line distance to navigation way point in M or KM, depending on distance.
WP AZ	Azimuth to navigation waypoint in selected angle format.
STEER	Steering instructions to place vehicle on vector to the navigation waypoint.

Legend for Mode Box of Figure 3-4 – IPADS Display Page -Continued

Area	Description
Status & Operator Messages	Current IPADS status information and messages to the operator.
Function Key Legends	Labels for the active function keys F1 through F9, Table 3-2.
Instruction Line	Instructions to the operator. Not shown on map display.
Interactive Area	Active area of the display for data entry and display of data, map, and navigation aid.

(3) The CPNU has connectors for power and data and a porro prism assembly used for offset position and azimuth transfers in conjunction with a theodolite or total station instrument. Field controls and connectors are shown in Figure 3-5.

Front View
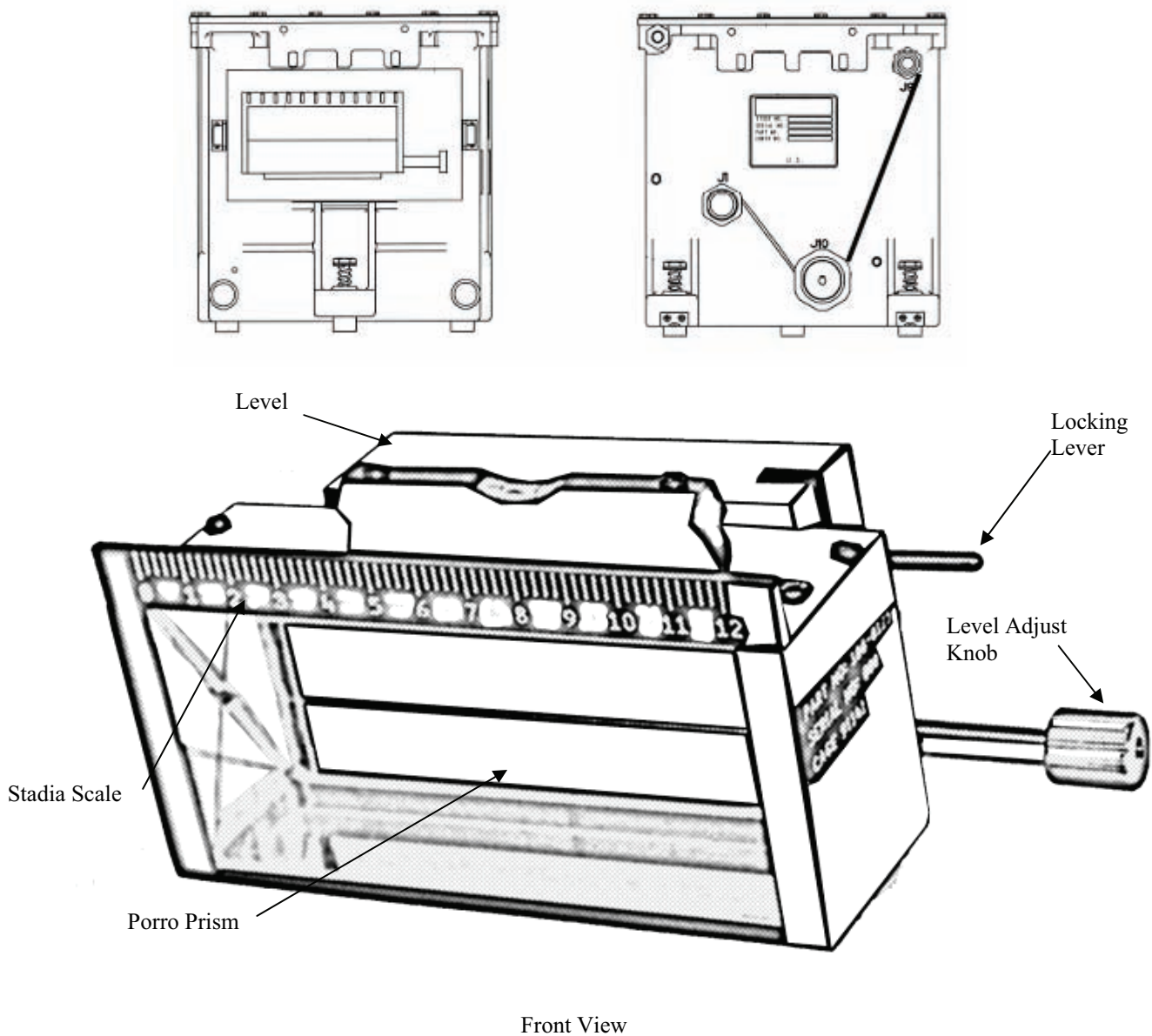
Figure 3-5 – CPNU / PPA Field Controls and Connectors

3-2. Field Controls, Indicators, and Connectors - Continued

Legend for Figure 3-5 – CPNU / PPA Field Controls and Connectors

Item	Function
Connector J1	Connects wiring harness W114 P2 to provide power to the CPNU from the BCU.
Connector J9	Connects wiring harness W114 P3 to exchange digital data with the CDU.
Connector J10	Connects to depot level test equipment.
Porro Prism	An optical prism used to achieve auto-reflection with a theodolite or total station instrument.
Stadia Scale	Used to determine distance from theodolite to IPADS using the stadia lines in the theodolite reticle.
Level	Used to determine when the porro prism is level.
Locking Lever	Locks the level adjust knob to prevent rotation of the porro prism during travel.
Level Adjust Knob	Rotates the porro prism to level it for auto-reflection and stow it for travel. Pressing the knob down disengages the adjustment mechanism allowing coarse adjustment.
Screw (3 each)	Secures CPNU to IPADS frame.

SECTION II. OPERATION UNDER USUAL CONDITIONS

3-3. General.

IPADS is ALWAYS operated from a land vehicle.

NOTE

The following conventions are used in this manual:

- Bolding of the text in this document identifies actions to be performed by pressing keys or function key legends; e.g., Press **Enter**.

- Keys that are pressed simultaneously have no separator between them; e.g., **FNC DEL**.

- A series of keys that are pressed sequentially are separated by commas; e.g., **A, B, and C**.

- Messages and instructions displayed on the CDU are capitalized; e.g., INFO: POSITION UPDATE REQUIRED

- Flashing text on the display is enclosed in quotation marks, e.g., "GO".

!!! SURVEY CONTROL POINT (SCP) NAME LENGTH LIMITATION !!!
There is a known feature in AFATDS that limits the length of the Survey Control Point (SCP) Name to 8 characters. IPADS and FOS will accept, process, and transmit SCP names of up to 15 characters. But when the SCP message is received at AFATDS, the SCP names will be truncated (shortened) to the first 8 characters. IPADS can automatically generate 15-character long SCP names, but they look identical when shortened to 8 characters. To prevent the loss of SCP name data, the following solution is recommended:
AT THE IPADS AND FOS, LIMIT YOUR SURVEY CONTROL POINT NAMES TO 8 CHARACTERS OR LESS. CHANGE IPADS GENERATED 15-CHARACTER SCP NAMES TO YOUR OWN CHOICE OF NAMES UP TO 8 CHARACTERS LONG BEFORE TRANSMITING TO AFATDS.

3-4. General Use of CDU

a.   The CDU is the main interface between the operator and IPADS. After system turn on, paragraph 3-6, the CDU display interactive area shows MENU, Figure 3-6. This chapter describes operations that involve using the CDU keyboard and observing information displayed on the CDU display. Displayed information is organized in different "pages". All pages share a general format that includes the following lines and areas:

(1) Mode line contains fields reserved for indicators, Figure 3-4.

(2) Status area (right side of page) contains fields reserved for current data, Figure 3-4.

(3) Function key legend (bottom of page) identifies the active function keys (F1 through F9), Table 3-2.

(4) Interactive area (left side of page) displays information that is based on the operation being performed. Figure 3-6 shows the interactive area of the MENU.
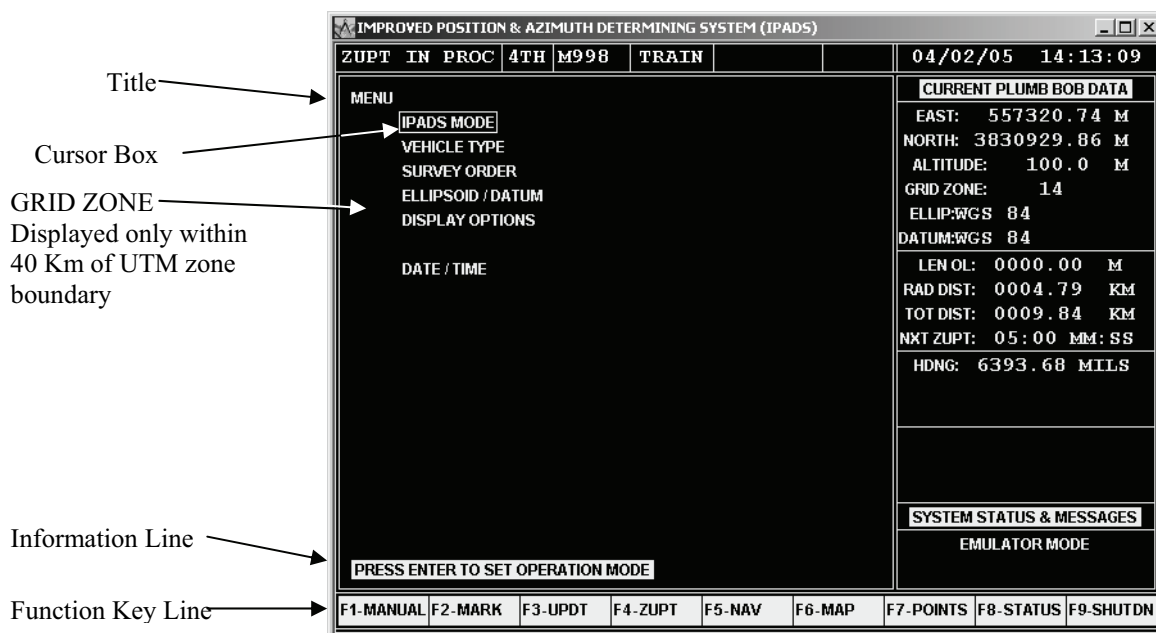
Figure 3-6 – MENU Interactive Area

b.   **All pages provide the following common functionality:**

(1) Information line provides instructions for user action or information on an operation that was performed, except when map is displayed.

(2) A cursor box surrounds an active field, Figure 3-6.

(3) Navigation on a page; Pressing ↑ or ↓ moves the cursor box through the active user entry fields on the page.

(4) Pressing **FNC DEL** clears the active data entry field.

(5) Data fields have fixed formats with decimal points and delimiters in fixed locations.

(6) Characters enter a field from the right.

(7) ⇐ (backspace) to delete the last character entered.

(8) For example, the actions required to set time from 14:38:22 to 16:39:00 are:

3-4. General Use of CDU. - Continued

Operation	Action	Display
Select TIME SET field	See paragraph 3-33g	TIME SET: 14:38:22
Clear field	Press **FNC DEL**	TIME SET: 00:00:00
Enter 1	Press **1**	TIME SET: 00:00:01
Enter 6	Press **6**	TIME SET: 00:00:16
Enter 3	Press **3**	TIME SET: 00:01:63
Enter 9	Press **9**	TIME SET: 00:16:39
Enter 0	Press **0**	TIME SET: 01:63:90
Enter 6 (Error)	Press **6**	TIME SET: 16:39:06
Clear erroneous 6	Press ⇦	TIME SET: 01:63:90
Enter 0	Press **0**	TIME SET: 16:39:00

(9) Navigation between pages - All other pages can be reached from three main pages: MENU, MAP, and NAVIGATION AID. Any page can be exited by pressing **F9** until MENU is reached.

3-5. IPADS Mission Procedure.

The mission begins with pre-turn-on checks and services, followed by configuration and initialization. Next, IPADS is updated using the position and altitude update procedure. IPADS then performs a series of marks, where position, altitude, and azimuth are recorded. You can end a mission by performing an update, data recall, or shutdown. Paragraph 3-4 references paragraphs where mission phases are explained in detail. If a malfunction occurs, refer to paragraph 4-5, Field Troubleshooting.

NOTE

- IPADS CDU can be configured for normal operation, or two training modes. One of the training modes uses a complete IPADS, and the other only requires the CDU or desktop (emulator). Procedures below are for normal operation or training with a complete IPADS. See paragraph 3-33 for emulator operation (without CPNU).
- Points created using the normal operation mode will not be available in the training modes, and vice versa.
- Switching from normal operation mode to the training modes requires operator confirmation. Upon confirmation, CDU will be shut down. Recycle power using the BCU OUTPUT switch.
- When changing from training modes to normal operation mode the time/date will not restore to the normal operation mode.

3-6. Turn On and Turn Off Sequences.

a. **Turn On Sequence.** Perform the following steps to turn on IPADS:

(1) Set BCU power input switch **(DC INPUT)** to **ON** to apply power to IPADS, paragraph 3-2.

(2) Set BCU power output switch **(OUTPUT)** to **ON** to turn on IPADS, paragraph 3-2. CDU power indicator flashes or illuminates steadily.
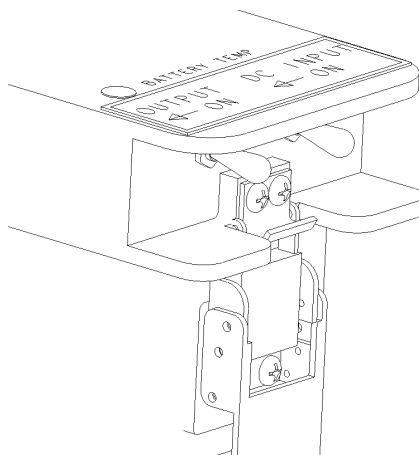
Figure 3-7 BCU Power Switches

(3) When CDU power indicator illuminates steadily, observe that Windows and IPADS software boot up.

(4) When IPADS is turned on, the IPADS MODE screen is displayed with function key, legends F1-OPERNL, F2-TRAIN, F3-EMULAT, F4-ZUPT. If the IPADS MODE screen does not display when IPADS is turned on, refer to paragraph 4-5, Field Troubleshooting.
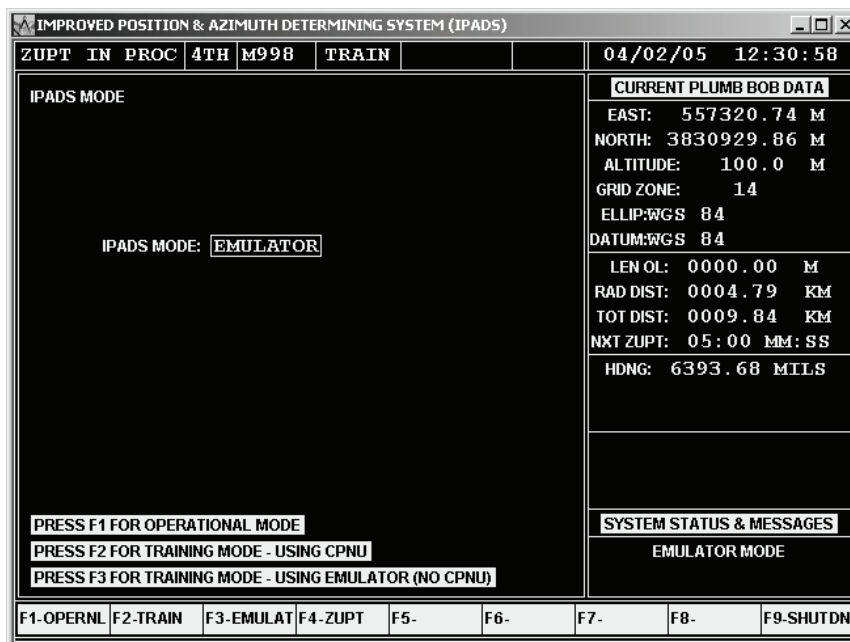
(5) The user must determine which mode IPADS will be operated. The operator may choose from the following:

   (a) For tactical operations press **F1 -** "PRESS F1 FOR OPERATIONAL MODE"

   (b) For training using the CPNU press **F2 –** "PRESS F2 FOR TRAINING MODE – USING CPNU"

   (c) For training NOT using the CPNU press **F3 –** "PRESS F3 FOR TRAINING MODE – USING EMULATOR (NO CPNU)"

3-6. Turn On and Turn Off Sequences - Continued

NOTE

- When changing between the different modes the operator will be required to reboot IPADS. After restart, IPADS will be in the desired mode.

- When changing from the training modes to the tactical mode IPADS will not update the date or time. The operator will need to verify that the time and date are set correctly when changing modes and every time the IPADS is operated.

- The operator can verify which mode IPADS is operating in by looking at the top mode bar, Figure 3-4, and see whether or not it is white and the word train is present. In the training mode the top mode bar will be white in color and the word "TRAIN" will be in the forth box from the left.

- In the tactical environment the top mode bar is yellow and the word "TRAIN" is not present.

b. **Turn Off Sequence.** Perform the following steps to turn off IPADS:

CAUTION

IPADS saves information during shutdown. Improper shutdown may cause next turn-on to perform recovery operations.

NOTE

IPADS performs "hot start" alignment within five minutes when not moved since previous shutdown. If "hot start" is planned for next mission, wait until vehicle is parked and secured at next mission turn-on point before turning IPADS off. Vehicle must be parked on a firm and stable surface to minimize motion that could cause "hot start" rejection.

(1) Press **F9** until MENU is displayed. Function key legend shows F9-SHUT DN.

(2) Press **F9**.

(3) Press **Y** to confirm shutdown or press any other key to cancel.

(4) Observe that IPADS software closes and Windows performs an orderly shutdown.

(5) When the screen displays IT IS NOW SAFE TO SHUTDOWN, leave CDU power switch in ON position and set BCU power output switch **(OUTPUT)** to **OFF,** Figure 3-7.

(6) Set BCU power input switch **(DC INPUT)** switch to **OFF**, Figure 3-7.

(7) IPADS is now powered off (if any of the turnoff procedures fail, refer to paragraph 4-5, Field Troubleshooting).

3-7. Display Technical Manual.

When function key line shows F1-MANUAL, this technical manual can be displayed by pressing **F1**, Figure 3-8. The manual may be searched using search features of Adobe Acrobat Reader ™. Close Acrobat Reader ™ to return to IPADS software.

NOTE

The paper copy of the technical manual takes precedence over the electronic copy displayed by IPADS. If the electronic copy of the technical manual contradicts the paper copy, follow the paper copy of the manual.

F1 Button
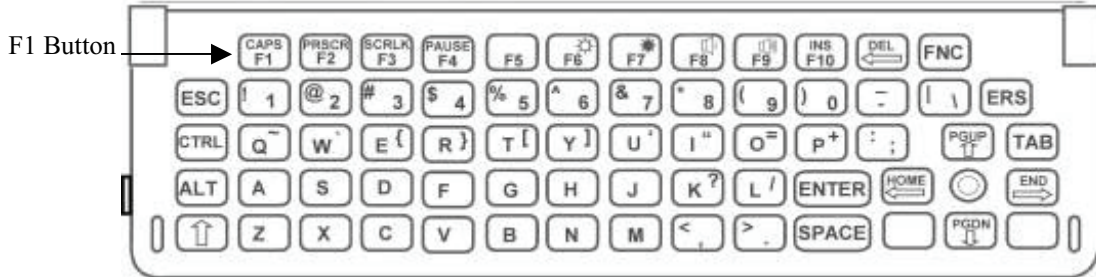
Figure 3-8 – CDU Keyboard Layout

3-8. IPADS Status Display.

When function key line shows F8-STATUS, STATUS page can be displayed by pressing **F8**. A message flashes and audible alarm sounds when a condition requiring immediate attention occurs. STATUS shows CDU and CPNU software versions, CPNU BIT STATUS, and any error or warning messages. Press **F9** to exit STATUS.

CPNU BIT status
CDU software version

CPNU BIT status
CPNU software version

CPNU elapsed time
indicator

Error message line
Warning message line

IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)						
ZUPT IN PROC	4TH	M998	TRAIN		09/02/05	07:34:08

STATUS
   CDU
      STATUS: EMULATION
      SW VER: 7314126-04

   CPNU
      STATUS: PASS
      SW VER: EMULATION
      ETI: 0.0 HRS

CURRENT PLUMB BOB DATA
EAST: 556389.13 M
NORTH: 3828850.38 M
ALTITUDE: 100.0 M
GRID ZONE: 14
ELLIP:WGS 84
DATUM:WGS 84

LEN OL: 0000.00   M
RAD DIST: 0005.36 KM
TOT DIST: 0012.86 KM
NXT ZUPT: 05:00 MM:SS

HDNG: 6393.79 MILS

RANGE: 0006.88 KM
WP AZ: 5766.99 MILS
STEER: TURN LEFT

SYSTEM STATUS & MESSAGES
EMULATOR MODE

PRESS F2 TO TEST AUDIBLE ALARM; F9 TO EXIT

F1-MANUAL	F2-ALARM	F3-	F4-ZUPT	F5-	F6-	F7-	F8-	F9-EXIT

3-9. Brightness Setting.

Adjust CDU display brightness and keyboard lighting for ambient light conditions or blackout operation as follows:

a. **Dim Display.**

Press **FNC** F6 ☼ to dim CDU display. Each press of **FNC** F6 ☼ decreases brightness slightly until full dark is reached. Release **FNC** F6 ☼ when desired brightness is reached.

b. **Brighten Display.**

Press **FNC** F7 ✷ to brighten CDU display. Each press of **FNC** F7 ✷ increases brightness slightly until full brightness is reached. Release **FNC** F7 ✷ when desired brightness is reached.

c. **Keyboard Lighting.**

Set CDU power switch to **KBD LIGHT** to illuminate keyboard for operation in the dark. Set CDU power switch to **ON** to turn off keyboard illumination.

d. **Stealth Mode.**

An alternate method to dim display is to set CDU power switch to **STLTH**. This also dims keyboard lighting and reduces audible alarm loudness. Set CDU power switch to **ON** or **KBD LIGHT** to restore normal brightness and loudness.

3-10. Audible Alarm.

Turn audible alarm on and off from the STATUS Screen. When audible alarm is on, set volume as follows:

a. **Lower volume**

Press **FNC** F8 🔉 to decrease volume. Each press of **FNC** F8 🔉 decreases volume slightly until fully off. Release **FNC** F8 🔉 when desired volume is reached.

b. **Raise volume**

Press **FNC** F9 🔊 to increase volume. Each press of **FNC** F9 🔊 increases volume slightly until full on is reached. Release **FNC** F9 🔊 when desired volume is reached.

c. **Test alarm**

Perform the following steps to test audible alarm:

(1) From MENU, MAP, or NAVIGATION AID page, press **F8-STATUS**. STATUS page is displayed. Function key legend shows F2-ALARM and F9-EXIT.

(2) Press **F2**.

(3) If audible alarm is turned on, audible alarm should sound and IF ALARM IS NOT AUDIBLE PRESS FNC F9; PRESS ANY KEY TO SILENCE is displayed.

    (a) If audible alarm sounds, press any key. Audible alarm goes silent.

    (b) If audible alarm does not sound, verify it is turned on and press **FNC** F9 🔊 to raise volume.

    (c) Press **F9** to exit STATUS page.

(4) If audible alarm is turned off, display should read ALARM IS DISABLED; PRESS Y TO CONFIRM TEST; OTHER KEY TO CANCEL is displayed.

    (a) Press **Y** to initiate test. Audible alarm should sound and IF ALARM IS NOT AUDIBLE PRESS FNC F9; PRESS ANY KEY TO SILENCE is displayed.

    (b) If audible alarm sounds, press any key. Audible alarm goes silent.

(c) If audible alarm does not sound, verify it is turned on and press **FNC9** 🔊 _____ to raise volume.

(d) Press **F9** to exit STATUS page.

3-11. Configuration.

NOTE

IPADS retains configuration settings after shutdown. It is not necessary to reconfigure IPADS for settings that do not change from previous mission unless changing from training mode to tactical mode.

IPADS MUST be configured for the current mission including: normal operation mode or training, vehicle type, survey order, ellipsoid and datum, display settings, grid zone (if using UTM coordinates and operating within 40 km of a zone boundary) and date and time. IPADS is configured from MENU, Figure 3-6.

a. **IPADS Mode.**

IPADS indicates it is in one of the two training modes by displaying the word TRAIN on the top, Figure 3-4. In addition, the top line font will be white when in a training mode. In normal operations, the top line font will be amber and the word TRAIN will not be displayed. IPADS indicates it is in EMULATOR MODE in SYSTEM STATUS & MESSAGE area of display.

Perform the following steps to change among the modes of operation:

```
┌────────────────────────────────────────────────────────────────────────┐
│ ⩜ IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)      _│□│✕│     │
├────────────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC │4TH│M998│  TRAIN  │          │ 04/02/05   14:13:09 │      │
│                                                                          │
│  MENU                                          │ CURRENT PLUMB BOB DATA │ │
│      ┌IPADS MODE┐                              │  EAST:   557320.74 M   │ │
│       VEHICLE TYPE                             │ NORTH: 3830929.86 M    │ │
│       SURVEY ORDER                             │  ALTITUDE:    100.0  M │ │
│       ELLIPSOID / DATUM                        │ GRID ZONE:     14      │ │
│       DISPLAY OPTIONS                          │  ELLIP:WGS 84          │ │
│                                                │ DATUM:WGS 84           │ │
│       DATE / TIME                              │  LEN OL:  0000.00   M  │ │
│                                                │ RAD DIST: 0004.79   KM │ │
│                                                │ TOT DIST: 0009.84   KM │ │
│                                                │ NXT ZUPT:  05:00 MM:SS │ │
│                                                │  HDNG:  6393.68 MILS   │ │
│                                                │                        │ │
│                                                │ SYSTEM STATUS & MESSAGES│ │
│                                                │    EMULATOR MODE       │ │
│  PRESS ENTER TO SET OPERATION MODE             │                        │ │
├────────────────────────────────────────────────────────────────────────┤
│ F1-MANUAL│F2-MARK│F3-UPDT│F4-ZUPT│F5-NAV│F6-MAP│F7-POINTS│F8-STATUS│F9-SHUTDN│
└────────────────────────────────────────────────────────────────────────┘
```

(1) Scroll to IPADS MODE on MENU and press **ENTER**. IPADS MODE screen is displayed.

3-11. Configuration - Continued

```
┌──────────────────────────────────────────────────────────────────────────┐
│ ▲ IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)      _□×          │
├──────────────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC 4TH M998  TRAIN           │ 04/02/05  12:30:58               │
│                                        ┌─────────────────────────┐         │
│ IPADS MODE                             │  CURRENT PLUMB BOB DATA  │         │
│                                          EAST:   557320.74 M              │
│                                          NORTH: 3830929.86 M              │
│                                          ALTITUDE:   100.0  M             │
│                                          GRID ZONE:    14                 │
│                                          ELLIP:WGS 84                     │
│          IPADS MODE: [EMULATOR]          DATUM:WGS 84                      │
│                                           LEN OL:  0000.00   M            │
│                                           RAD DIST: 0004.79  KM           │
│                                           TOT DIST: 0009.84  KM           │
│                                           NXT ZUPT: 05:00 MM:SS           │
│                                            HDNG:  6393.68 MILS            │
│                                                                            │
│                                                                            │
│ ┌──────────────────────────────────┐  ┌─────────────────────────┐         │
│ │ PRESS F1 FOR OPERATIONAL MODE     │  │ SYSTEM STATUS & MESSAGES │         │
│ │ PRESS F2 FOR TRAINING MODE - USING CPNU │   EMULATOR MODE                │
│ │ PRESS F3 FOR TRAINING MODE - USING EMULATOR (NO CPNU) │                  │
├──────────────────────────────────────────────────────────────────────────┤
│ F1-OPERNL │F2-TRAIN│F3-EMULAT│F4-ZUPT│F5-│F6-│F7-│F8-│F9-SHUTDN           │
└──────────────────────────────────────────────────────────────────────────┘
```

    (2) User must choose which mode to operate IPADS.

        (a) F1-Operational Mode

        (b) F2-Training Mode using CPNU

        (c) F3-Training Mode using emulator (no CPNU)

    (3) Press **F1**, **F2**, or **F3** (PRESS Y TO SWITCH MODE/RESTART CDU is displayed). Press **Y** (Pressing Y will shut down CDU software).

    (4) When the screen displays IT IS NOW SAFE TO SHUTDOWN, set BCU power output switch(**OUTPUT**) to **OFF,** Figure 3-7.

    (5) To restart IPADS, set BCU power output switch (**OUTPUT)** switch back to **ON**, Figure 3-7.

  b. **Vehicle Type.**

IPADS must be configured for the host vehicle to accurately reference the position of the plumb bob reference point. IPADS supports three vehicles listed below and an additional vehicle (OTHER) with operator entered parameters. Current vehicle selection is shown in third field of mode line.

NOTE

      When changing from training modes to normal operation mode, the vehicle type needs to be updated with current settings.

Display	Vehicle	Plumb Bob Reference Point
M998	M998 HMMWV	Left side driver plumb bob
M1123	M1123 or M1097 HMMWV	Left side driver plumb bob
M973	M973 SUSV	Left side driver plumb bob

Perform the following steps to change vehicle type:

    (1) Scroll to VEHICLE TYPE on MENU and press **ENTER**. Function key line shows F1-M998, F2-M1123, F3-M973, F4-UH-60, and F5-OTHER.
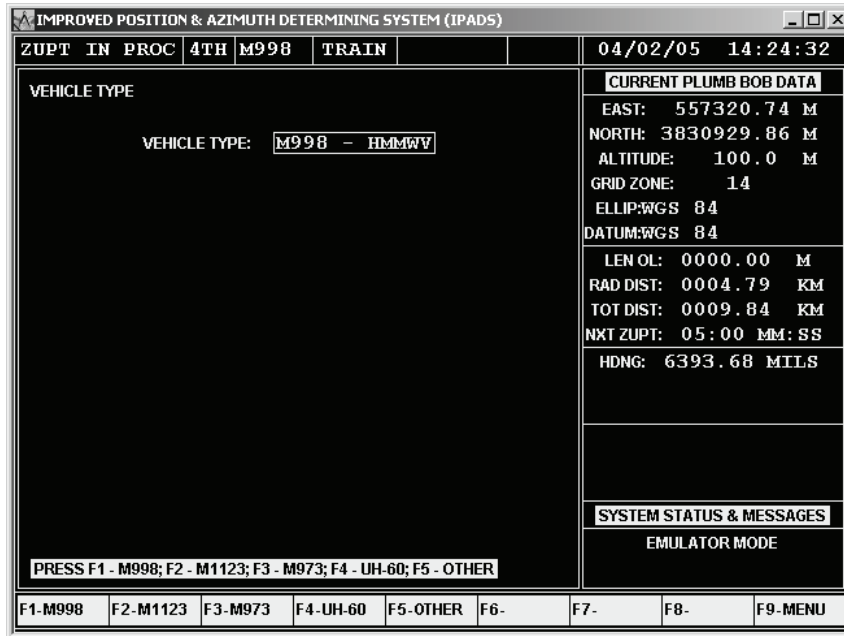
(2) Press function key corresponding to host vehicle.

CAUTION

IPADS is not authorized for operation in UH-60 helicopters. Do not select F4-UH-60.

(3) If a standard vehicle was selected, MENU is displayed with selected vehicle shown on mode line.

(4) If OTHER was selected, unique vehicle parameters are displayed with function key legend F9-EXIT. If parameters are correct, press **F9**. MENU is displayed with OTHER on mode line. If parameters are not correct, the operator must enter the desired vehicle lever arm as follows:

REF PT: ALIGNMENT BRACKET MOUNTING HOLE AT BOTTOM OF IPADS FRAME, BCU SIDE
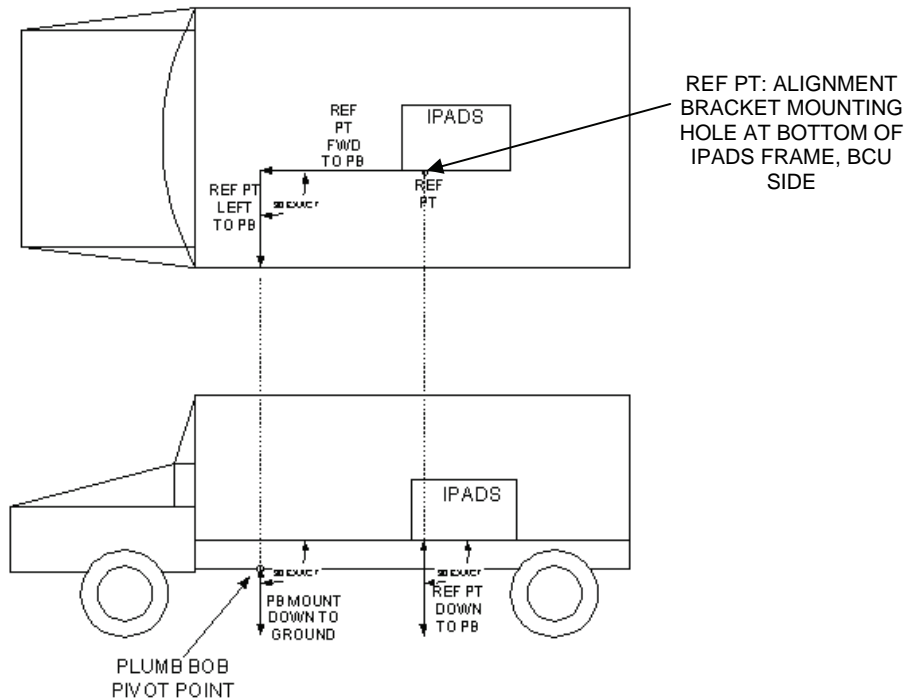
3-11. Configuration - Continued

      (a) Measure the distances shown to be input into IPADS. Measurements are to be made from the reference point on the IPADS frame to the location on the ground where the plumb bob is dropped. The IPADS reference point is located at the center of the alignment hole on the bottom of the IPADS frame, on the BCU side.

NOTE

All lever arm entries must be in centimeters to the nearest millimeter.

      (b) On the VEHICLE TYPE page, enter the lever arm values.

  c. **Survey Order.**

IPADS supports two orders of survey: fourth order equivalent (4TH) using five-minute intervals between ZUPTs; and fifth order equivalent (5TH), using ten-minute intervals between ZUPTs. To obtain IPADS specified accuracy for battalion survey, the operator must perform 5TH order survey. For division artillery survey, the operator must perform 4TH order survey. Current survey order is shown in second field of mode line. Perform the following steps to change survey order:

Scroll to SURVEY ORDER on MENU and press **ENTER**. Function key line will display F1-4TH, and F2-5TH. Press function key corresponding to mission survey order. MENU is displayed with selected survey order shown on the mode line.

```
IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)          _ □ ×
┌──────────────────────────────────────────────────────────────────────┐
│ ZUPT IN PROC │4TH│M998│ TRAIN │          │          │ 04/02/05  14:28:08 │
├──────────────────────────────────────────────────────────────────────┤
│ SURVEY ORDER                            │   CURRENT PLUMB BOB DATA      │
│                                         │  EAST:   557320.74 M          │
│                                         │ NORTH: 3830929.86 M           │
│                                         │ ALTITUDE:    100.0  M         │
│                                         │ GRID ZONE:      14            │
│                                         │  ELLIP:WGS 84                 │
│                                         │ DATUM:WGS 84                  │
│            SURVEY ORDER: 4TH            │  LEN OL:  0000.00   M         │
│                                         │  RAD DIST: 0004.79  KM        │
│                                         │  TOT DIST: 0009.84  KM        │
│                                         │ NXT ZUPT:  05:00 MM:SS        │
│                                         │  HDNG:  6393.68 MILS          │
│                                         │                               │
│                                         │   SYSTEM STATUS & MESSAGES    │
│                                         │      EMULATOR MODE            │
│ PRESS F1 OR F2 TO SET SURVEY ORDER      │                               │
├──────────────────────────────────────────────────────────────────────┤
│F1-4TH │F2-5TH │F3- │F4-ZUPT│F5- │F6- │F7- │F8- │F9-MENU │
└──────────────────────────────────────────────────────────────────────┘
```

  d. **Ellipsoid and Datum.**

CAUTION

    • Ellipsoid and datum can be changed at any point during a mission. Datum shifts have unknown associated errors. Do not initialize and close IPADS surveys at SCPs on different datums. SCPs on different datums likely were established by different, unconnected surveys. Closing at an SCP on a different datum may introduce significant error into adjusted coordinates.

- IPADS can store two sets of user-defined datum parameters for each predefined ellipsoid and for each of two user-defined ellipsoids. Verify parameters are for the intended datum when selecting a user-defined datum. Incorrect parameters may introduce significant position error.

(1) **Change Ellipsoid and Datum**

IPADS must be configured for the datum of initial update SCP. Ellipsoid and datum can be changed later if output of coordinates on a different datum is required. Datums are associated with ellipsoids. IPADS supports the ellipsoids and associated datums in Table 3-3. IPADS accepts entry of user defined ellipsoid and datum parameters, paragraph 3-11d(4). Ellipsoid and datum currently in use are identified in CURRENT PLUMB BOB DATA area of display. Perform the following steps to change ellipsoid and datum:
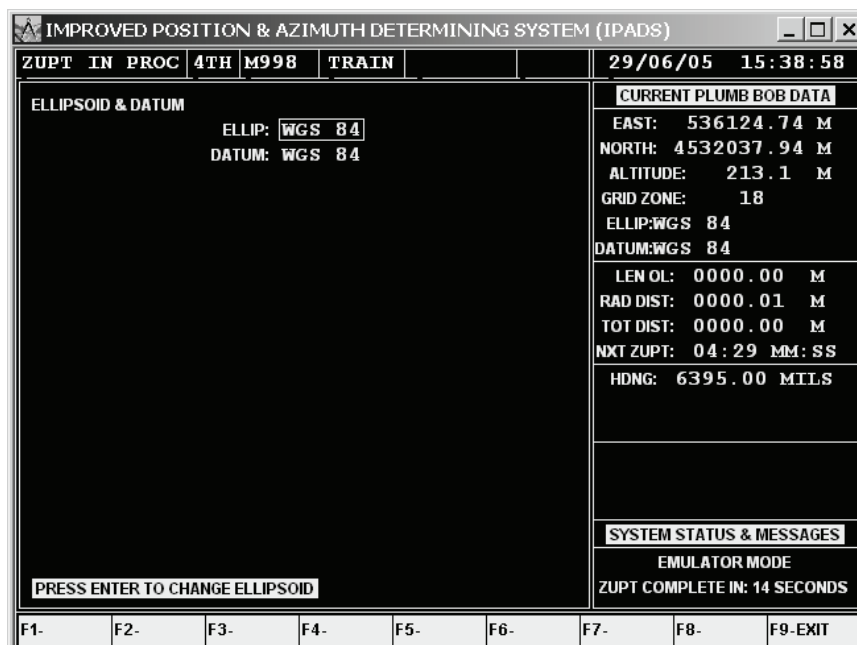
3-11. Configuration – Continued

Table 3-3 – Ellipsoids and Datums Supported by IPADS

Ellipsoid		Associated Datum	
ID*	Display Name	ID*	Display Name
AA	AIRY 1830	OGB-M	OSGB 36 (MEAN)
		OGB-A	OSGB 36 (ENG)
		OGB-B	OSGB 36(ENG&WL)
		OGB-C	OSGB 36 (SCOT)
		OGB-D	OSOB 36 (WALES)
			USER DEFINED n
AN	AUSTRALIAN NATL	ANO	ANNA 1 ASTRO 65
		AUA	AUSTRLN GEOD 66
		AUG	AUSTRLN GEOD 84
			USER DEFINED n
BR	BESSEL 1841	BUR	BUKIT RIMPAH
		BAT	DJAKARTA BATAV
		EST	ESTONIA
		GSE	GUNUNG SEGARA
		HER	HERMANNSKOGEL
		MAS	MASSAWA
		TOY-A	TOKYO (JAPAN)
		TOY-B1	TOKYO (KOREA)
		TOY-C	TOKYO (OKINAWA)
		CCD	S-JTSK
		TOY-M	TOKYO (MEAN)
			USER DEFINED n
BN	BESSEL (NAMIBIA)	SCK	SCHWARZECK
			USER DEFINED n
CC	CLARKE 1866	AMA	AM SAMOA 1962
		BER	BERMUDA 1957
		CAC	CAPE CANAVERAL
		GUA	GUAM 1963
		LCF	L C 5 ASTRO 61
		LUZ-A	LUZON (PHILPNS)
		LUZ-B	LUZON (MIND IL)
		NAS-C	NA 27 (CONUS)
		NAS-B	NA 27 (WEST US)
		NAS-A	NA 27 (EAST US)
		NAS-D	NA 27 (ALASKA)
		NAS-V	NA 27 (ALN IS E)
		NAS-W	NA 27 (ALN IS W)
		NAS-Q	NA 27 (BAHAMAS)
		NAS-R	NA 27 (SAN SLV)
		NAS-E	NA 27 (CANADA)
		NAS-F	NA 27 (ALB&BC)
		NAS-G	NA 27 (E CANDA)
		NAS-H	NA 27 (MAN&ONT)
		NAS-I	NA 27 (NW TERR)
		NAS-J	NA 27 (YUKON)
		NAS-O	NA 27 (CANL ZN)
		NAS-P	NA 27 (CARIBAN)

Ellipsoid		Associated Datum	
ID*	Display Name	ID*	Display Name
CC - cont		NAS-N	NA 27 (C AMER)
		NAS-T	NA 27 (CUBA)
		NAS-U	NA 27 (GREENLD)
		NAS-L	NA 27 (MEXICO)
		OHA-M	OLD HWN (MEAN)
		OHA-A	OLD HWN (HAWAI)
		OHA-B	OLD HWN (KAUAI)
		OHA-C	OLD HWN (MAUI)
		OHA-D	OLD HWN (OAHU)
		PUR	PUERTO RICO
			USER DEFINED n
CD	CLARKE 1880	ADI-M	ADINDAN (MEAN)
		ADI-E	ADINDAN (BURK)
		ADI-F	ADINDAN (CAMRN)
		ADI-A	ADINDAN (ETHOP)
		ADI-C	ADINDAN (MALI)
		ADI-D	ADINDAN (SENEG)
		ADI-B	ADINDAN (SUDAN)
		AIA	ANTIGUA IL AST
		ARF-M	ARC 1950 (MEAN)
		ARF-A	ARC 1950 (BOTS)
		ARF-H	ARC 1950 (BURU)
		ARF-B	ARC 1950 (LESO)
		ARF-C	ARC 1950 (MALA)
		ARF-D	ARC 1950 (SWZL)
		ARF-E	ARC 1950 (ZAIR)
		ARF-F	ARC 1950 (ZAMB)
		ARF-G	ARC 1950 (ZIMB)
		ARS-M	ARC 1960 (MEAN)
		ARS-A	ARC 1960 (KENA)
		ARS-B	ARC 1960 (TANZ)
		PHA	AYABELLE LIGHT
		CAP	CAPE
		CGE	CARTHAGE
		DAL	DABOLA
		DID	DECEPTION IS
		FOT	FT THOMAS 1955
		LEH	LEIGON
		LIB	LIBERIA 1964
		MIK	MAHE 1971
		MER	MERCHICH
		MIN-A	MINNA (CAMRN)
		MIN-B	MINNA (NIGERIA)
		ASM	MONTSERRAT IL
		MPO	M'PORALOKO
		NAH-A	NAHRWAN (OMAN)
		NAH-B	NAHRWAN (UAE)
		NAH-C	NAHRWAN (SAUDI)

Ellipsoid		Associated Datum	
ID*	Display Name	ID*	Display Name
CD - cont		NSD	NOR SAHARA 1959
		FAH	OMAN
		PTB	POINT 58
		PTN	POINTE NOIRE 48
		SRL	SIERRA LEONE 1960
		VOI	VOIROL 1874
		VOR	VOIROL 1960
		MVS	VITI LEVU 1916
			USER DEFINED n
EB	EVEREST (BRUNEI)	TIL	TIMBALAI 1948
			USER DEFINED n
EA	EVEREST (1830)	IND-B	INDIAN (BANGLD)
		INF-A	INDIAN 1954
		ING-A	IND 1960 (VIET)
		ING-B	IND 1960 (CS IS)
		INH-A1	INDIAN 1975
		KAN	KANDAWALA
			USER DEFINED n
EC	EVEREST (1956)	IND-I	INDIA & NEPAL
			USER DEFINED n
EF	EVEREST (PAKIS)	IND-P	INDIAN (PAKIS)
			USER DEFINED n
EE	EVEREST (1948)	KEA	KERTAU 1948
			USER DEFINED n
RF	GRS 80	NAR-A	NA 83 (ALASKA)
		NAR-E	NA 83 (ALUT IS)
		NAR-B	NA 83 (CANADA)
		NAR-C	NA 83 (CONUS)
		NAR-H	NA 83 (HAWAII)
		NAR-D	NA 83 (MX&C AM)
		SIR	SIRGAS
			USER DEFINED n
HE	HELMERT	OEG	OLD EGYPT 1907
			USER DEFINED n
HO	HOUGH 1960	ENW	WAKE-ENIWETOK
			USER DEFINED n
ID	INDONESIAN 1974	IND	INDONESIAN 1974
			USER DEFINED n
IN	INTERNATIONAL	AIN-A	AIN ABD 70 (BAR)
		AIN-B	AIN ABD 70 (SAU)
		ASC	ASCENSION IL 58
		ATF	ASTRO BEACON E
		SHB	ASTRO DOS 71/4
		TRN	ASTRO TERN IL
		ASQ	ASTRO STA 1952
		IBE	BELLEVUE IGN
		BID	BISSAU
		BOO	BOGOTA OBSERVTY
		CAZ	CAMP AREA ASTRO

Ellipsoid		Associated Datum	
ID*	Display Name	ID*	Display Name
IN - cont		CAO	CANTON ASTRO 66
		CHI	CHATHAM IL 71
		CHU	CHUA ASTRO
		COA	CORREGO ALEGRE
		GIZ	DOS 1968
		EAS	EASTER IL 67
		EUR-M	EUR 50 (MEAN)
		EUR-E	EUR 50 (CYPRUS)
		EUR-F	EUR 50 (EGYPT)
		EUR-G	EUR 50 (BRT IL)
		EUR-B	EUR 50 (GREECE)
		EUR-H	EUR 50 (IRAN)
		EUR-S	EUR 50 (IRAQ)
		EUR-I	EUR 50 (SARDIN)
		EUR-J	EUR 50 (SICILY)
		EUR-L	EUR 50 (MALTA)
		EUR-C	EUR 50 (NOR&FN)
		EUR-D	EUR 50 (PGL&SP)
		EUR-A	EUR 50 (W EUR)
		EUR-T	EUR 50 (TUNISA)
		EUS	EUR 79
		GAA	GAN 1970
		GEO	GEOD DATUM 49
		GRA	GRACIOS BASE SW
		DOB	GUX 1 ASTRO
		HEN	HERAT NORTH
		HJO	HJORSEY 1955
		HKD	HONG KONG 1963
		HTN	HU-TZU-SHAN
		ISG	ISTS 061 AST 68
		IST	ISTS 073 AST 69
		JOH	JOHNSTON IL 61
		KEG	KERGUELEN IL 49
		KUS	KUSAIE ASTRO 51
		MID	MIDWAY ASTRO 61
		NAP	NAPARIMA BWI
		FLO	OBSERVIO MET 39
		OHI-M	OLD HWN (MEAN)
		OHI-A	OLD HWN (HAWAI)
		OHI-B	OLD HWN (KAUAI)
		OHI-C	OLD HWN (MAUI)
		OHI-D	OLD HWN (OAHU)
		PLN	PICO DE LAS NVS
		PIT	PITCAIRN AST 67
		POS	PORTO SANTO 36
		PRP-M	PR SA 56 (MEAN)
		PRP-A	PR SA 56 (BOLV)
		PRP-B	PR SA 56 (N CH)
		PRP-C	PR SA 56 (S CH)

Ellipsoid		Associated Datum	
ID*	Display Name	ID*	Display Name
IN -cont		PRP-E	PR SA 56 (ECUD)
		PRP-F	PR SA 56 (GUYN)
		PRP-G	PR SA 56 (PERU)
		PRP-H	PR SA 56 (VENZ)
		HIT	PR S CHILE 1963
		QAT	QATAR NATIONAL
		QUO	QORNOQ
		REU	REUNION
		MOD	ROME 1940
		SAE	SANTO DOS 1965
		SAO	SAO BRAZ
		SAP	SAPPER HILL 43
		SGM	SELVAGEM GRANDE
		TAN	TANANARIVE OBS
		TDC	TRISTAN AST 68
		WAK	WAKE ISLAND AST
		YAC	YACARE
		ZAN	ZANDERIJ
			USER DEFINED n
KA	KRASSOVSKY 1940	AFG	AFGOOYE
		PUK	PULKOVO 1942
		SPK-A	S-42 (HUNGARY)
		SPK-B	S-42 (POLAND)
		SPK-C	S-42 (CZECH)
		SPK-D	S-42 (LATVIA)
		SPK-E	S-42 (KAZAKSTN)
		SPK-F	S-42 (ALBANIA)
		SPK-G	S-42 (ROMANIA)
			USER DEFINED n
AM	MOD AIRY	IRL	IRELAND 1965
			USER DEFINED n
FA	MOD FISCHER 60	SOA	SOUTH ASIA
			USER DEFINED n
SA	SO AMERICAN 69	SAN-M	SA 69 (MEAN)
		SAN-A	SA 69 (ARGENTA)
		SAN-B	SA 69 (BOLIVIA)
		SAN-C	SA 69 (BRAZIL)
		SAN-D	SA 69 (CHILE)
		SAN-E	SA 69 (COLMBIA)
		SAN-F	SA 69 (ECUADOR)
		SAN-J	SA 69 (GALP IL)
		SAN-G	SA 69 (GUYANA)
		SAN-H	SA 69 (PARAGUA)
		SAN-I	SA 69 (PERU)
		SAN-K	SA 69 (TRN&TBG)
		SAN-L	SA 69 (VENEZLA)
			USER DEFINED n
WD	WGS 72		WGS 72
			USER DEFINED n

Ellipsoid		Associated Datum	
ID*	Display Name	ID*	Display Name
WD - cont			WGS 84
			USER DEFINED *n*
	USER DEFINED *n*		USER DEFINED *n*

* ID per NIMA TR 8350.2, third edition, January 2000 update.

n = index number 1 or 2.

NOTE

- A new datum must be selected if a new ellipsoid is selected.

- User defined ellipsoid and datum parameters are retained by IPADS until changed by operator.

- User defined datum shifts must be entered if a user-defined ellipsoid is selected.

- ELLIPSOID & DATUM page displays the second ellipsoid parameter (for user-defined ellipsoids) either as inverse flattening (FLAT) or semi-minor axis (MINOR).

3-11. Configuration - Continued

 (2) **Select ellipsoid and datum.**

Perform the following steps to set a predefined ellipsoid and datum or previously entered user-defined ellipsoid and datum parameters when ellipsoid is changed:

NOTE

- If the selected ellipsoid is user defined, ellipsoid parameters and function key legends F3-FLAT, F4-MINOR also will be displayed.

- If the selected datum is user defined, datum shifts also will be displayed.

 (a) Scroll to ELLIPSOID/DATUM on MENU and press ENTER. ELLIPSOID & DATUM page is displayed showing current ellipsoid and datum. Cursor box is on ELLIP field. Function key line shows **F9-EXIT**.

 (b) Press **ENTER** to initiate ellipsoid change. ELLIPSOID page is displayed with a partial list of available ellipsoids. Function key line shows F9-CANCEL.

 (c) If desired ellipsoid is not listed, press **FNC Pg Dn** to display next page or scroll to bottom of list and continue scrolling.

```
IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)          _ □ ×
ZUPT  IN  PROC  4TH M998    TRAIN                    09/02/05   07:35:14

ELLIPSOID                                      CURRENT PLUMB BOB DATA
     AIRY 1830                                   EAST:     556389.13 M
     AUSTRALIAN NATL                            NORTH: 3828850.38 M
     BESSEL 1841                                 ALTITUDE:    100.0   M
     BESSEL (NAMIBIA)                            GRID ZONE:      14
     CLARKE 1866                                  ELLIP:WGS 84
     CLARKE 1880                                DATUM:WGS 84
     EVEREST (BRUNEI)                             LEN OL:  0000.00   M
     EVEREST (1830)                               RAD DIST:  0005.36   KM
     EVEREST (1956)                               TOT DIST:  0012.86   KM
     EVEREST (PAKIS)                             NXT ZUPT:  05:00 MM:SS
     EVEREST (1948)                               HDNG:  6393.79 MILS
     GRS 80
     HELMERT
     HOUGH 1960                                  RANGE:  0006.88   KM
     INDONESIAN 1974                             WP AZ:  5766.99 MILS
     INTERNATIONAL                               STEER:  TURN LEFT
                                                SYSTEM STATUS & MESSAGES
  ELLIPSOIDS FROM 1 TO 16 OF 24                     EMULATOR MODE
  PRESS ENTER TO SELECT ELLIPSOID; F9 TO CANCEL

F1-      F2-      F3-      F4-ZUPT  F5-     F6-      F7-    F8-      F9-CANCEL
```

(d) Scroll to desired ellipsoid and press **ENTER**. DATUM page is displayed with a list of datums associated with selected ellipsoid. Function key line shows F9-CANCEL.

```
IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)          _ □ ×
ZUPT  IN  PROC  4TH M998    TRAIN                    09/02/05   11:43:00

DATUM      -   ELLIPSOID:    WGS 84             CURRENT PLUMB BOB DATA
     KOREAN GS 1995                             EAST:     557105.24 M
     WGS 84                                     NORTH: 3830196.61 M
     USER DEFINED 1                             ALTITUDE:    100.0   M
     USER DEFINED 2                             GRID ZONE:      14
                                                 ELLIP:WGS 84
                                               DATUM:WGS 84
                                                 LEN OL:  0000.00   M
                                                 RAD DIST:  0004.97   KM
                                                 TOT DIST:  0024.87   KM
                                                NXT ZUPT:  05:00 MM:SS
                                                 HDNG:  6393.71 MILS




                                                SYSTEM STATUS & MESSAGES
  DATUMS FROM 1 TO 4 OF 4                          EMULATOR MODE
  PRESS ENTER TO SELECT DATUM; F9 TO CANCEL

F1-      F2-      F3-      F4-ZUPT  F5-     F6-      F7-    F8-      F9-CANCEL
```

3-11. Configuration – Continued

        (e) If desired datum is not listed, press **FNC Pg Dn** to display next page or scroll to bottom of list and continue scrolling. Some ellipsoids have several pages of associated datums.

        (f) Scroll to desired datum and press **ENTER**. ELLIPSOID & DATUM page is displayed with new selections. Function key legends show F2-USE ALL, and F9-CANCEL.

        (g) If ellipsoid and datum selections are incorrect, press **F9** to cancel and retain current settings or repeat procedure with step 3-11d(2).

        (h) If selections are correct, press **F2**. INFO: SYSTEM ELLIPSOID AND DATUM HAVE BEEN SET is displayed with function key legend F9-EXIT.

        (i) Press **F9** to exit ELLIPSOID & DATUM page.

    (3) **Select datum.**

    Perform the following steps to set a predefined datum or previously entered user defined datum, when ellipsoid has not changed:

NOTE

- If the selected ellipsoid is user defined, ellipsoid parameters and function key legends F3-FLAT, F4-MINOR also will be displayed.

- If the selected datum is user defined, datum shifts also will be displayed.

        (a) Scroll to ELLIPSOID/DATUM on MENU and press **ENTER**. ELLIPSOID & DATUM page is displayed showing current ellipsoid and datum. Cursor box is on ELLIP field. Function key line shows F9-EXIT.

        (b) Scroll to DATUM field and press **ENTER**. DATUM page is displayed with a list of datums associated with the ellipsoid. Function key line shows F9-CANCEL.

        (c) If desired datum is not listed, press **FNC Pg Dn** to display next page or scroll to bottom of list and continue scrolling. Some ellipsoids have several pages of associated datums.

        (d) Scroll to desired datum and press **ENTER**. ELLIPSOID & DATUM page is displayed with new selection. Function key line shows F2-USE ALL, and F9-CANCEL.

        (e) If datum selection is incorrect, press **F9** to cancel and retain current settings or repeat procedure with step (a).

        (f) If selections are correct, press **F2**. INFO: SYSTEM ELLIPSOID AND DATUM HAVE BEEN SET is displayed with function key legend F9-EXIT.

        (g) Press **F9** to exit ELLIPSOID & DATUM page.

(4) **Enter user-defined ellipsoid and datum.**

Perform the following steps to enter user defined ellipsoid and datum parameters:

NOTE

- If the selected ellipsoid is user defined, ellipsoid parameters and function key legends F3-FLAT, F4-MINOR also will be displayed.

- If the selected datum is user defined, datum shifts also will be displayed.

(a) Scroll to ELLIPSOID/DATUM on MENU and press **ENTER**. ELLIPSOID & DATUM page is displayed, showing current ellipsoid and datum. Cursor box is on ELLIP field. Function key line shows F9-EXIT.

(b) Function key line shows F9-EXIT.

(c) Press **ENTER** to initiate ellipsoid change. ELLIPSOID page is displayed with a partial list of available ellipsoids. Function key line shows F9-CANCEL.

(d) Scroll to USER DEFINED 1 or USER DEFINED 2, as desired, on second page and press **ENTER**. DATUM page is displayed listing USER DEFINED 1 and USER DEFINED 2. Function key line shows F9-CANCEL.

(e) Scroll to USER DEFINED 1 or USER DEFINED 2, as desired, and press **ENTER**. ELLIPSOID & DATUM page is displayed with new selections. Function key line shows F2-USE ALL, F3-FLAT, F4-MINOR, and F9-CANCEL.

(f) Second ellipsoid parameter can be entered as semi-minor axis or inverse flattening (i/f). Current selection is displayed next to FLAT/MINOR. Press **F3** to enter inverse flattening or **F4** for semi-minor axis.

(g) Scroll to MAJOR field and enter semi-major axis value in meters.

(h) Scroll to FLAT or MINOR field and enter inverse flattening value in meters or semi-minor axis value in meters.

(i) Scroll to X-SHIFT field and enter x-axis datum shift value in meters.

(j) Scroll to Y-SHIFT field and enter y-axis datum shift value in meters.

(k) Scroll to Z-SHIFT field and enter z-axis datum shift value in meters.

(l) Verify entered parameters are correct. Scroll to an erroneous parameter and enter it or press **F9** to cancel and retain current settings.

(m) If all parameters are correct, press **F2**. INFO: SYSTEM ELLIPSOID AND DATUM HAVE BEEN SET is displayed with function key line F3-FLAT, F4-MINOR, and F9-EXIT.

(n) Press **F9** to exit ELLIPSOID & DATUM page.

3-11. Configuration – Continued

(5) **Select predefined ellipsoid and enter user-defined datum.**

Use this procedure to select a predefined ellipsoid and enter user-defined datum parameters.

NOTE

- If the selected ellipsoid is user defined, ellipsoid parameters and function key legends F3-FLAT, F4-MINOR also will be displayed.

- If the selected datum is user defined, datum shifts also will be displayed.

(a) Scroll to ELLIPSOID/DATUM on MENU and press **ENTER**. ELLIPSOID & DATUM page is displayed, showing current ellipsoid and datum. Cursor box is on ELLIP field. Function key line shows F9-EXIT.

(b) Press **ENTER** to initiate ellipsoid change. ELLIPSOID page is displayed with a partial list of available ellipsoids. Function key line shows F9-CANCEL.

(c) If desired ellipsoid is not listed, press **FNC Pg Dn** to display next page or scroll to bottom of list and continue scrolling.

(d) Scroll to desired ellipsoid and press **ENTER**. DATUM page is displayed with a list of datums associated with selected ellipsoid. Function key line shows F9-CANCEL.

(e) If USER DEFINED 1 and USER DEFINED 2 are not listed, press **FNC Pg Dn** to display next page, scroll to bottom of list and continue scrolling, or press **FNC END** to display last page. Some ellipsoids have several pages of associated datums.

(f) Scroll to USER DEFINED 1 or USER DEFINED 2, as desired, and press **ENTER**. ELLIPSOID & DATUM page is displayed with new selections. Cursor box is on X-SHIFT field. Function key line shows F2-USE ALL, and F9-CANCEL.

(g) Enter x-axis datum shift value in meters.

(h) Scroll to Y-SHIFT field and enter y-axis datum shift value in meters.

(i) Scroll to Z-SHIFT field and enter z-axis datum shift value in meters.

(j) Verify entered parameters are correct. Scroll to an erroneous parameter and enter it or press **F9** to cancel and retain current settings.

```
┌──────────────────────────────────────────────────────────────────────────┐
│ ⚠ IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)    [_][□][×]       │
├──────────────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC 4TH M998  TRAIN           │    29/06/05  16:58:52             │
│                                        │                                  │
│  ELLIPSOID & DATUM                     │    CURRENT PLUMB BOB DATA         │
│                  ELLIP: AIRY 1830      │   EAST:   536079.09 M            │
│                  DATUM: USER DEFINED 1 │  NORTH: 4526242.91 M             │
│                                        │   ALTITUDE:   213.1  M           │
│                                        │  GRID ZONE:    18                │
│                                        │   ELLIP:USER DEFINED 1           │
│                                        │  DATUM:USER DEFINED 1            │
│                                        │   LEN OL:  0000.00   M           │
│                                        │  RAD DIST: 0000.01   M           │
│               X-SHIFT: +0123           │  TOT DIST: 0000.00   M           │
│               Y-SHIFT  +0000           │  NXT ZUPT:  05:00  MM:SS          │
│               Z-SHIFT  +0000           │   HDNG:  6395.00 MILS            │
│                                        │                                  │
│                                        │                                  │
│                                        │                                  │
│                                        │   SYSTEM STATUS & MESSAGES        │
│                                        │      EMULATOR MODE               │
│  PRESS ENTER TO CHANGE ELLIPSOID       │                                  │
├──────────┬──────────┬───────┬──────┬──────┬──────┬──────┬──────┬──────────┤
│F1-       │F2-USEALL │F3-    │F4-   │F5-   │F6-   │F7-   │F8-   │F9-CANCEL │
└──────────┴──────────┴───────┴──────┴──────┴──────┴──────┴──────┴──────────┘
```
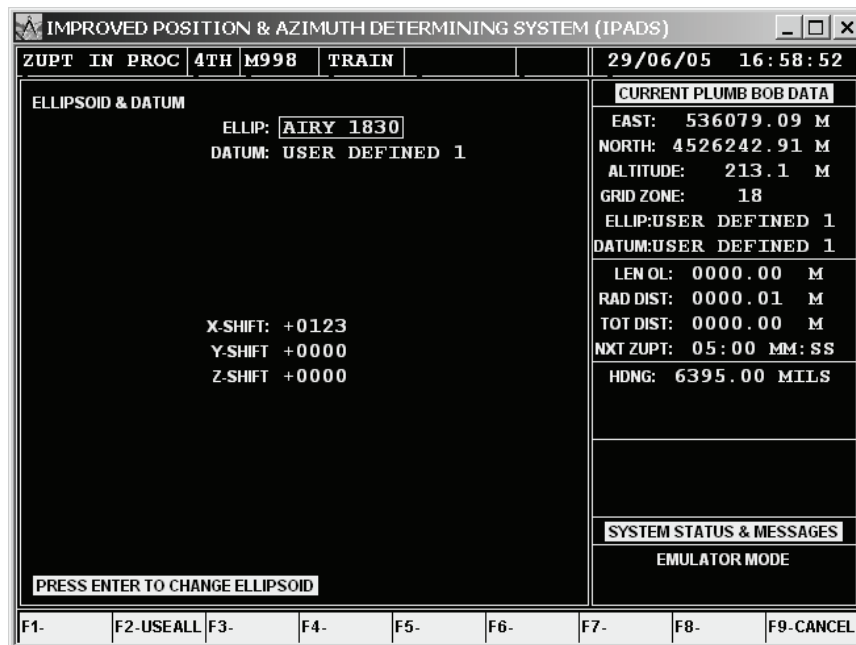
(k) If all parameters are correct, press **F2**. SYSTEM ELLIPSOID AND DATUM HAVE BEEN SET
is displayed. Function key line shows F9-EXIT.

(l) Press **F9** to exit ELLIPSOID & DATUM page.

e. **Display Options.**

IPADS display parameters can be set for: azimuth type, grid or true (geodetic); position coordinate format,
UTM or latitude and longitude in decimal degrees or degrees, minutes, and seconds; angle format in mils,
decimal degrees or degrees, minutes, and seconds; and audible alarm, on or off. Perform the following
steps to change display options:

NOTE

- Menu on DISPLAY OPTIONS page may be scrolled through using
↑ and ↓. This does not change current settings. Press **F9** to return to
MENU when all changes are made.

- Normal display settings for field artillery survey are: grid azimuth, UTM
coordinates, angles in mils, and audible alarm on.

3-11. Configuration – Continued
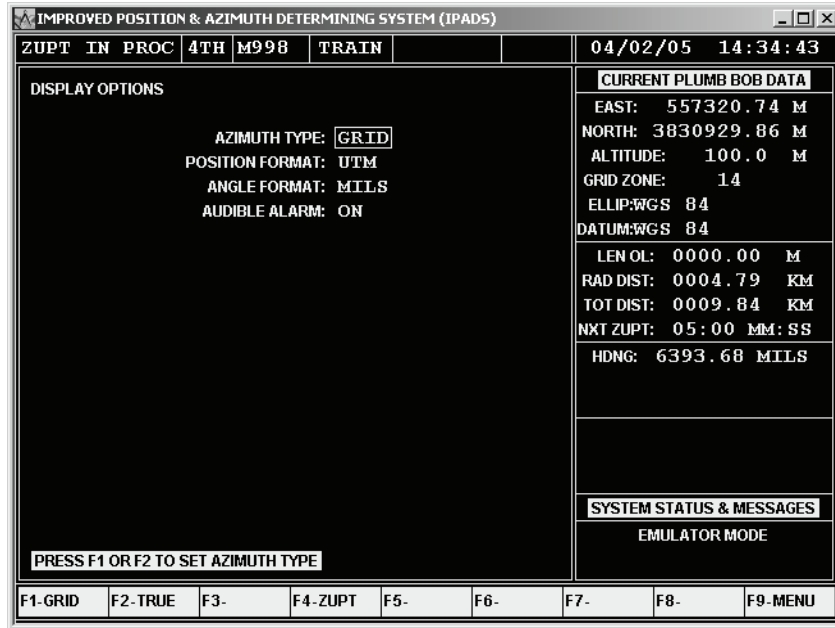
(1) Scroll to DISPLAY OPTIONS on MENU and press **ENTER**. DISPLAY OPTIONS page is displayed with cursor box on AZIMUTH TYPE field. Function key line shows F1-GRID, F2-TRUE, and F9-MENU.

(2) To change AZIMUTH TYPE, press **F1** for grid azimuth or **F2** for true (geodetic) azimuth

(3) To change POSITION FORMAT: press **F1** for UTM coordinates; **F2** for latitude and longitude in degrees, minutes and seconds; or **F3** for latitude and longitude in decimal degrees. POSITION FORMAT field and CURRENT PLUMB BOB DATA reflect the new format.

| **UTM Position Format** | **Degree, Minute, Second Position Format** | **Decimal Degree Position Format** |

(4) To change ANGLE FORMAT, press **F1** for mils, **F2** for degrees, minutes and seconds, or **F3** for decimal degrees. ANGLE FORMAT field and HDNG reflect the new format, cursor box moves to AUDIBLE ALARM field, and function key line shows F1-ON, F2-OFF, and F9-MENU.

| HDNG: 6398.59 MILS | HDNG: 359/49/18 DMS | HDNG: 359.822 DEG |

Mils Angle Format — **Degrees, Minutes, Seconds Angle Format** — **Decimal Degrees Angle Format**

(5) To turn AUDIBLE ALARM on or off, press **F1** for ON or **F2** for OFF. AUDIBLE ALARM field reflects the selection; cursor box will move to AZIMUTH TYPE field, function key line shows F1-GRID, F2-TRUE, and F9-MENU.

(6) Press **F9** to return to MENU when display options are set.

f. **Grid Zone**

GRID ZONE is displayed on MENU only when display position format is UTM and current IPADS position is within 40 kilometers of a UTM grid zone boundary. When operating within 40 kilometers of a UTM grid zone boundary, UTM coordinates can be displayed with respect to the normal grid zone or the extended zones east or west of the boundary. EXT after the zone number indicates UTM coordinates are relative to extended east or west zone. Perform the following steps to change grid zone reference:

NOTE

When position is marked in a grid zone overlap area, it is stored in the database for the displayed grid zone. The grid zone cannot be changed when the data is recalled from the database. Therefore, the desired grid zone should be set before performing a mark in a grid zone overlap area.

(1) Scroll to GRID ZONE on MENU and press **ENTER**. ZONE FUNCTION page is displayed with instruction PRESS F1 FOR NORMAL; F2 FOR WEST GZ (xx), F3 FOR EAST GZ (yy), where xx is the extended west zone number and yy is the extended east zone number. Function key line shows F1-NORMAL, F2-WEST GZ, F3 EAST GZ, and F9-EXIT.

```
┌─────────────────────────────┐
│ CURRENT PLUMB BOB DATA       │
├─────────────────────────────┤
│  EAST:    239632.00  M       │
│ NORTH:  4303840.50  M        │
│  ALTITUDE:   326.6   M       │
│  GRID ZONE:    18 EXT        │
│   ELLIP: WGS 84              │
│ DATUM: WGS 84                │
└─────────────────────────────┘
```

(2) Press **F1** to select display of UTM coordinates for the normal grid zone. The display will return to MENU and IPADS will automatically switch to the normal grid zone when a grid zone boundary is crossed.

(3) Press **F2** to select display of UTM coordinates for the western grid zone while IPADS is within the zone overlap area. The display will return to MENU.

(4) Press **F3** to select display of UTM coordinates for the eastern grid zone while IPADS is within the zone overlap area. The display will return to MENU.

(5) Press **F9** to return to MENU without changing the zone selection.

3-11. Configuration – Continued

NOTE

- When connected to FOS, IPADS time automatically sets to FOS time. There is no need to manually set IPADS time.

- IPADS time sets to that in TIME ENTRY field on DATE/TIME page when **F2-USE ALL** is pressed. To perform a time hack, enter (future) time of the time hack in the TIME ENTRY field and press **F2** at the time hack.

- Changing time zone by itself does not change displayed time. When time zone is changed, correct time for new time zone must be entered in TIME ENTRY field.

- Changing IPADS date and time also sets the computer system date and time. If running IPADS emulator software on a computer other than IPADS CDU, be careful that changing its system time does not adversely affect other applications.

g. **Date and Time**

Date and time are displayed on right side of mode line. Perform the following steps to change date and time:
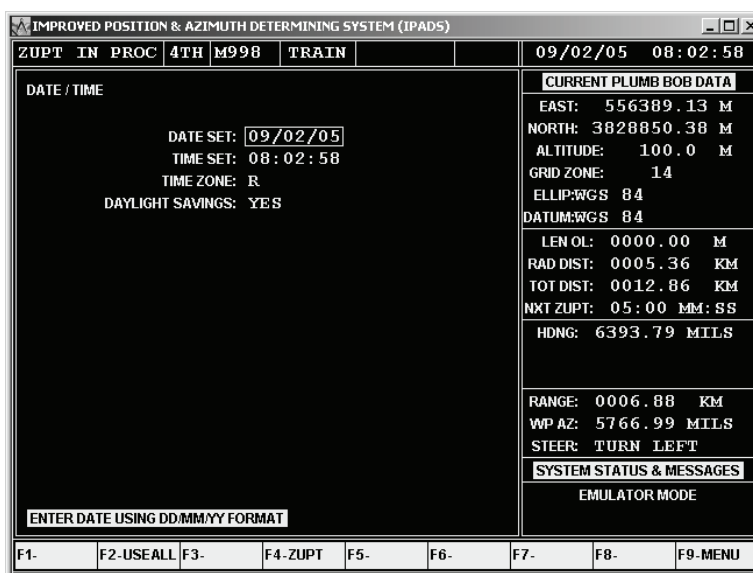
(1) Scroll to DATE/TIME on MENU and press **ENTER**. DATE/TIME page is displayed with cursor box on DATE SET field. Function key line shows F2-USE ALL and F9-MENU.

(2) Change date by entering today's date for desired time zone in DD/MM/YY format.

(3) Scroll to TIME SET field and enter correct time for desired time zone in 24 hour HH:MM:SS format.

(4) Scroll to TIME ZONE field and enter letter corresponding to desired time zone.

(5) Scroll to DAYLIGHT SAVINGS field. Function key line shows F2-USE ALL, F3-YES, F4-NO, and F9-MENU.

(6) Press **F3** to enable daylight savings time or **F4** to disable it.

(7) When settings are correct, press **F2-USE ALL** at the time hack. INFO: DATE AND TIME HAVE BEEN SET is displayed.

(8) Press **F9** to return to MENU.

3-12. Initialization, Hot Start.

CAUTION

IPADS must be initialized on a firm surface. Alignment failure can result from vehicle movement on soft surfaces such as mud, snow, or ice, and shocks caused by operator movement or wind gusts. Operator should ensure vehicle is off and stand clear of vehicle during alignment. Face vehicle into high winds and block wheels.

NOTE

IPADS should be left running even if the vehicle must be turned off. Hot start should only be used when it is absolutely necessary to shut down IPADS.

a.   IPADS must be initialized before it can survey. Two types of initialization are used, "normal" and "hot start." To save time, IPADS tries a "hot start" using position and azimuth stored at last shutdown. If IPADS senses motion since the last shutdown, it automatically switches to normal initialization where IPADS automatically aligns after operator enters approximate IPADS position.

b.   Initialization site must have a firm surface. Site horizontal position coordinates should be known to ±100 meters. Initialization takes 10-20 minutes depending upon temperature and latitude of operation.

NOTE

During initialization of the IPADS, the alignment countdown should appear in the upper left-hand corner of the control and display unit (CDU). If the alignment countdown does not appear in the upper left-hand corner, turn IPADS off and then back on. If this does not clear the problem, go to paragraph 4-5, Field Troubleshooting.

c.   **Pre-operations.**

(1)   With the IPADS operating in the survey mode, close and adjust the current survey, if a suitable high order SCP is available. If a high order SCP is not available, it is not necessary to close and adjust prior to shut down, but it is imperative not to move the vehicle after shutdown, in order to allow the IPADS to maintain the mission after power-up until a high order SCP is reached for mission closure.

(2)   With vehicle parked at a suitable site, apply emergency/parking brake and perform a single mark recording at the marked coordinates. With the operator outside the vehicle, power down the IPADS.

(3)   Do not allow excessive movement into or out of the vehicle. Excessive movement can interfere with Hot Start even with the system off.

d.   **Conducting operations.**

(1)   In order to perform a hot start, without moving or getting into the vehicle, turn on the vehicle and power up IPADS.

(2)   IPADS will internally and automatically check if a hot start is possible.

(a)   If IPADS can conduct a hot start it will automatically align using the last stored survey position and direction stored in the database.

(b)   If IPADS cannot conduct a hot start and the operator is certain that the vehicle was not moved, while in the UPDATE page the operator can press **F8** to confirm the previous position.

(c)   If the IPADS cannot conduct a hot start because the vehicle was moved, the operator must perform a normal initialization using the coordinates from the mark conducted in step 3-12c(1), then update at a known SCP.

3-12. Initialization, Hot Start - Continued

(3) Once alignment is completed IPADS can begin survey operations.

(4) If an adjustment was not conducted prior to performing a hot start, survey operations may continue as long as the vehicle was not moved while shutdown (i.e. hot start succeeds or operator confirms position by pressing **F8** in the UPDATE page).

e. **Post operations**.

Do not move the vehicle or readjust cargo: Excessive movement will prevent IPADS from being able to conduct a hot start.

f. **IPADS position initialization**.

IPADS requires position initialization if indicated by a flashing "F3-UPDT" on the function key line. IPADS does not need to be initialized at a SCP; however, initialization site horizontal coordinates must be accurate within ± 100 meters and altitude within ± 10 meters.

(1) When initialized with approximate coordinates, position must be updated at a SCP after alignment is finished and before starting the survey.

(2) Use vehicle plumb bob reference for initializing IPADS. If initializing IPADS at a SCP where survey marker is offset from the vehicle, use approximate initial coordinates. Theodolite can be set up over marker while IPADS is aligning and a theodolite position update performed when alignment is finished.

(3) Horizontal position and altitude are required for position initialization.

(4) Set ellipsoid, datum, and position coordinate type before entering initial position.

(5) The procedure to enter initial positions is similar for UTM and geodetic (latitude and longitude) coordinates

3-13. Entering Initial Position (UTM or Geodetic).

a. Perform the following steps to initialize position and altitude by selecting a point from the IPADS database, entering coordinates for a new point, or searching for a point name:

(1) Verify position format is set correctly, paragraph 3-11e(3)

(2) From MENU, press **F3**. UPDATE: page is displayed with PRESS F1 FOR PLUMB BOB; F2 FOR THEODOLITE on information line and F1-UPDT-PB, F2-UPDT-⚲, and F9-EXIT on function key line.

(3) Press **F1**. UPDATE: PLUMB BOB: UTM or geodetic page is displayed with cursor box on PNT NAME: field. Function key line shows F2-NEW, F3-SEL PT, and F9-EXIT.

b. Perform the following steps to select an existing point from database list:

CAUTION

If F5 (DEL ALL) is pressed, IPADS prompts PRESS Y TO DELETE DISPLAYED POINTS; OTHER KEY TO CANCEL. Pressing **Y permanently deletes all points in displayed list.**

(1) Press **F3**. POINT LIST page is displayed with function key lines F2-NEW, F3-SEL PT., F4-FILTER, F5-DEL ALL, and F9-EXIT.

```
┌────────────────────────────────────────────────────────────────────────┐
│ ⋒ IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)      _□X         │
├──────────────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC 4TH M998  TRAIN  FL:ALL          09/02/05  08:05:36          │
│                                                                            │
│  POINT LIST:    (UTM)                      ┌ CURRENT PLUMB BOB DATA ┐      │
│    NAME            EAST M     NORTH M   GZ  EAST:    556389.13  M          │
│  ──────────────  ──────.── ────────.── ───  NORTH: 3828850.38  M          │
│    FT BRAGG      670057.99 3892648.98   17  ALTITUDE:   100.0   M          │
│    RABBIT        553000.00 3833000.00   14  GRID ZONE:    14               │
│    UABBIT 2      562996.69 3834814.94   14   ELLIP:WGS 84                  │
│   ┌GEORGE        552390.19 3834434.61   14┐ DATUM:WGS 84                   │
│    ──────────────  ──────.── ────────.── ───  LEN OL:  0000.00   M         │
│    ──────────────  ──────.── ────────.── ───  RAD DIST: 0005.36   KM       │
│    ──────────────  ──────.── ────────.── ───  TOT DIST: 0012.86   KM       │
│    ──────────────  ──────.── ────────.── ───  NXT ZUPT: 05:00  MM:SS       │
│    ──────────────  ──────.── ────────.── ───   HDNG:  6393.79 MILS         │
│    ──────────────  ──────.── ────────.── ───                              │
│    ──────────────  ──────.── ────────.── ───                              │
│    ──────────────  ──────.── ────────.── ───  RANGE:  0006.88   KM         │
│    ──────────────  ──────.── ────────.── ───  WP AZ:  5766.99 MILS         │
│    ──────────────  ──────.── ────────.── ───  STEER:  TURN LEFT            │
│    ──────────────  ──────.── ────────.── ───  ┌ SYSTEM STATUS & MESSAGES ┐ │
│  ALL POINTS : FROM 1 TO 4 OF 4                      EMULATOR MODE          │
│  "001      " DELETED                                                       │
├──────────────────────────────────────────────────────────────────────────┤
│ F1-    F2-NEW   F3-    F4-FILTER F5-DEL ALL F6-   F7-   F8-    F9-EXIT      │
└──────────────────────────────────────────────────────────────────────────┘
```

(2) Point filter sets the type of points shown on POINT LIST page. Point filter type is displayed in fourth field of mode line and on POINT LIST page. Set point filter type by pressing **F4** until desired point filter type is displayed.

Filter Type	Mode Line	POINT LIST Page	Description
Mission	FL:MISN	MISSION FILTER	All unadjusted IPADS points established during current mission.
SCP	FL:SCP	ALL SCP	Unadjusted IPADS SCP (OS) before closure; Adjusted IPADS SCP (OS) after closure adjustment.
Waypoints	FL:WAY	ALL WAY PTS	Points created by the user as Navigation waypoints.
Mark	FL:MARK	ALL MARKED PTS	Unadjusted IPADS mark points (EOL) before closure; Adjusted IPADS mark points (EOL) after closure adjustment.
User Defined	FL:USER	ALL USERDEF	Unadjusted IPADS SCP (OS) and mark points (EOL) after closure adjustment.
All Points	FL:ALL	ALL POINTS	All points in IPADS database.

(3) Scroll to desired initialization point (e.g. point FT BRAGG) and press **F3**. UPDATE: PLUMB BOB: UTM or GEODETIC page is displayed with fields populated for the selected point.

3-13. Entering Initial Position (UTM or Geodetic) - Continued

```
┌─────────────────────────────────────────────────────────────────┐
│ ⟨W⟩ IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)  _ □ X │
├─────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC │4TH│M998│ TRAIN │        │   09/02/05   08:07:21    │
├─────────────────────────────────────────────┬───────────────────┤
│ POINT EDITOR:     (UTM)                      │ CURRENT PLUMB BOB DATA│
│                                              │ EAST:   556389.13 M │
│   TYPE:       USERDEF                        │ NORTH: 3828850.38 M │
│   PNT NAME:   FT BRAGG                        │ ALTITUDE:   100.0  M │
│   ELLIP:      WGS 84                         │ GRID ZONE:    14    │
│   DATUM:      WGS 84                         │  ELLIP:WGS 84       │
│                                              │ DATUM:WGS 84        │
│   EASTING:        670057.99 M                │                     │
│   NORTHING:      3892648.98 M                │  LEN OL: 0000.00   M │
│   ALTITUDE:           0.0  M                 │  RAD DIST: 0005.36  KM │
│   GRID ZONE:          17                     │  TOT DIST: 0012.86  KM │
│   CREATION DATE: 09/12/04                    │ NXT ZUPT: 05:00 MM:SS │
│   CREATION TIME: 21:01:40                    │  HDNG: 6393.79 MILS  │
│                                              │                     │
│                                              │                     │
│                                              │  RANGE: 0006.88  KM  │
│                                              │  WP AZ: 5766.99 MILS │
│   DESCRIPTION:                               │  STEER:  TURN LEFT   │
│   >                                          │ SYSTEM STATUS & MESSAGES│
│   INFO: READY                                │    EMULATOR MODE     │
├──────┬──────────┬─────┬────────┬────┬───────┼──────┬──────┬───────┤
│ F1-  │ F2-USE ALL│F3- │ F4-ZUPT │F5- │ F6-   │ F7-  │ F8-  │F9-EXIT│
└──────┴──────────┴─────┴────────┴────┴───────┴──────┴──────┴───────┘
```

    (4) PRESS Y TO UPDATE POSITION is displayed. If update coordinates are more than 100 meters from previous shutdown location, > 100 METERS FROM SHUTDOWN, PRESS Y TO UPDATE POSITION is displayed. Function key line shows F2-NEW, F3-SEL PT., and F9-EXIT.

    (5) If displayed coordinates are correct, press **Y**. Update is completed and INFO: POSITION UPDATE COMPLETED is displayed with function key legends F2-NEW, F3-SEL PT., and F9-EXIT.

    (6) If displayed coordinates are incorrect, press any other key to reject the update. Then press **F2** to enter coordinates for a new point, paragraph 3-13c(1), or press **FNC DEL** to clear PNT NAME field, then **F3** to select a different point from database list, paragraph 3-13f(1).

    (7) If displayed data are correct, press **F9** to return to MENU. Wait until alignment is complete before moving vehicle.

  c. Perform the following steps to enter coordinates for a new point:

    (1) Press **F2**. POINT EDITOR page is displayed with cursor box on a pre-assigned name and function key line shows F2-USE ALL and F9-EXIT.

```
┌──────────────────────────────────────────────────────────────────────────┐
│ ⋀ IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)        _ □ ✕      │
├──────────────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC │4TH│M998│ TRAIN │      │          │ 09/02/05  08:09:36       │
├──────────────────────────────────────────────┬───────────────────────────┤
│ POINT EDITOR:      (UTM)                       │  CURRENT PLUMB BOB DATA   │
│                                                │  EAST:    556389.13 M     │
│   TYPE:        USERDEF                          │ NORTH: 3828850.38 M       │
│   PNT NAME:    PNT000000000001                  │  ALTITUDE:    100.0  M    │
│   ELLIP:       WGS 84                           │ GRID ZONE:      14        │
│   DATUM:       WGS 84                           │  ELLIP:WGS 84             │
│                                                │ DATUM:WGS 84              │
│   EASTING:         000000.00 M                  │  LEN OL:  0000.00   M     │
│   NORTHING:      00000000.00 M                  │  RAD DIST: 0005.36  KM    │
│   ALTITUDE:          0000.0  M                  │  TOT DIST: 0012.86  KM    │
│   GRID ZONE:            00                      │ NXT ZUPT:  05:00 MM:SS    │
│   CREATION DATE: 00/00/00                       │  HDNG:  6393.79 MILS      │
│   CREATION TIME: 00:00:00                       │                           │
│                                                │                           │
│                                                │  RANGE:  0006.88   KM     │
│                                                │  WP AZ:  5766.99 MILS     │
│                                                │  STEER:  TURN LEFT        │
│   DESCRIPTION:                                  │  SYSTEM STATUS & MESSAGES │
│ >                                               │     EMULATOR MODE         │
│ PRESS ENTER TO ACCEPT NAME OR TYPE NEW NAME     │                           │
├──────┬────────┬───┬──────┬─────┬──────┬─────┬──────┬──────────┤
│F1-   │F2-USEALL│F3-│F4-ZUPT│F5-  │F6-   │F7-  │F8-   │F9-EXIT   │
└──────────────────────────────────────────────────────────────────────────┘
```

(2) Press **ENTER** to accept pre-assigned name or press **FNC DEL** to clear PNT NAME field and enter the new name.

(3) Verify ellipsoid is correct for coordinates being entered. If ellipsoid is incorrect, scroll to ELLIP field, press **ENTER**, and enter new ellipsoid and datum, paragraph 3-11d(5).

(4) Verify datum is correct for coordinates being entered. If datum is incorrect, scroll to DATUM field, press **ENTER**, and enter new datum, paragraph 3-11d(5).

d. For UTM coordinates, perform the following steps:

(1) Scroll to EAST field and enter easting value in meters.

(2) Scroll to NORTH field and enter northing value in meters.

(3) Scroll to ALTITUDE field and enter altitude value in meters.

(4) Scroll to GRID ZONE field and enter positive (+) UTM grid zone value for Northern Hemisphere or negative (-) UTM grid zone value for Southern Hemisphere.

(5) Optional – scroll to DESCRIPTION and enter a description of the point.

(6) Verify entered data. If it is correct, press **F2**. If not, scroll to incorrect field and enter correct data.

e. For GEODETIC coordinates, perform the following steps:

(1) Scroll to LAT field and enter latitude value. Press **N** for Northern Hemisphere, **S** for Southern.

(2) Scroll to LONG field and enter longitude value. Press **E** for Eastern Hemisphere, **W** for Western.

(3) Scroll to ALTITUDE field and enter altitude value.

(4) Optional – scroll to DESCRIPTION and enter a description of the point.

(5) Verify entered data. If it is correct, press **F2**. If not, scroll to incorrect field and enter correct data.

(6) UPDATE: PLUMB BOB: DEGREES or UPDATE: PLUMB BOB: D/M/S page is displayed populated with parameters for the new point. PRESS Y TO UPDATE POSITION is displayed. If update coordinates are more than 100 meters from previous shutdown location, > 100 METERS FROM SHUTDOWN, PRESS Y TO UPDATE POSITION is displayed. Function key line shows F2-NEW, F3-SEL PT., and F9-EXIT.

3-13. Entering Initial Position (UTM or Geodetic) - Continued

(7) If displayed coordinates are correct, press **Y**. Update is completed and INFO: POSITION UPDATE COMPLETED is displayed with function key line F2-NEW, F3-SEL PT., and F9-EXIT.

(8) If displayed coordinates are incorrect, press any other key to reject the update. Then press **F2** to enter coordinates for a new point, paragraph 3-13c, or press **FNC DEL**, to clear PNT NAME field and then **F3** to select a different point from database list, paragraph 3-13f.

(9) If displayed data are correct, press **F9** to return to menu. Wait until alignment is complete before moving the vehicle.

f. Perform the following steps to search for a point by name from POINT LIST, paragraph 3-28a.

(1) From MENU screen press **F3-UPDT**.

(2) Press **F1-UPDT-PB**.

(3) Scroll cursor down to PNT NAME and type in a point name that is already in the point list (e.g. point GEORGE).
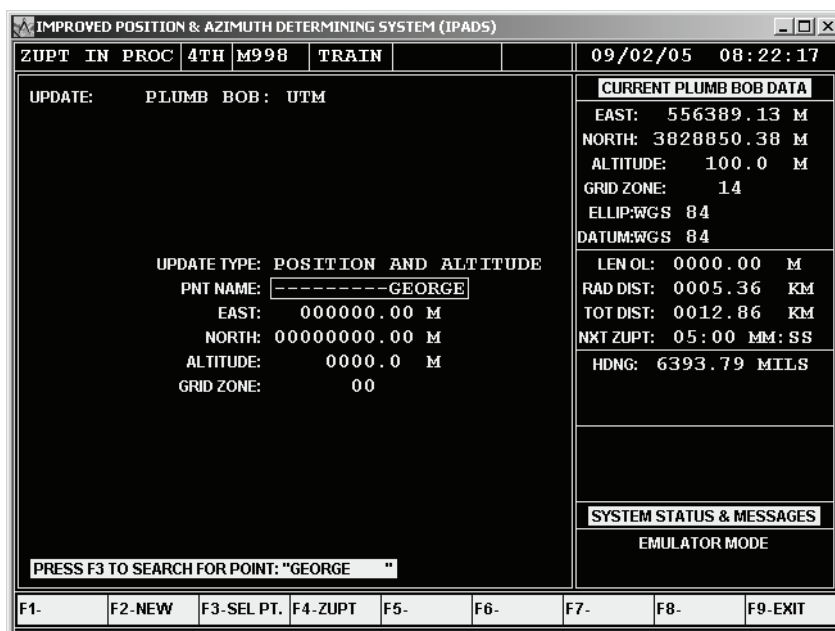
(4) Press **F3-SEL PT.**

```
┌──────────────────────────────────────────────────────────────────────────┐
│ ▒▓IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)      _│□│×│        │
├──────────────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC │4TH│M998│ TRAIN │         │ 09/02/05  08:18:18               │
│ ┌──────────────────────────────────────┐ ┌──────────────────────────────┐ │
│ │ UPDATE:      PLUMB BOB: UTM           │ │   CURRENT PLUMB BOB DATA      │ │
│ │                                       │ │  EAST:    556389.13 M         │ │
│ │                                       │ │  NORTH: 3828850.38 M          │ │
│ │                                       │ │   ALTITUDE:    100.0   M      │ │
│ │                                       │ │  GRID ZONE:     14            │ │
│ │                                       │ │   ELLIP:WGS 84                │ │
│ │                                       │ │  DATUM:WGS 84                 │ │
│ │     UPDATE TYPE: POSITION AND ALTITUDE│ │  LEN OL:  0000.00   M         │ │
│ │      PNT NAME: GEORGE                 │ │  RAD DIST: 0005.36   KM       │ │
│ │         EAST:    552390.19 M          │ │  TOT DIST: 0012.86   KM       │ │
│ │        NORTH:  3834434.61 M           │ │  NXT ZUPT: 05:00 MM:SS        │ │
│ │     ALTITUDE:      373.1  M           │ │   HDNG:  6393.79 MILS         │ │
│ │    GRID ZONE:       14                │ │                               │ │
│ │                                       │ │                               │ │
│ │                                       │ ├──────────────────────────────┤ │
│ │ ┌────────────────────────────────────┐ │  SYSTEM STATUS & MESSAGES     │ │
│ │ │> 100 METERS FROM CURRENT; PRESS Y TO │ │      EMULATOR MODE            │ │
│ │ │ UPDATE POSITION;                     │ │                               │ │
│ │ │NOTE: A 10 MINUTE RE-ALIGNMENT WILL   │ │                               │ │
│ │ │BE INITIATED                          │ │                               │ │
│ │ └──────────────────────────────────── │ └──────────────────────────────┘ │
│ ├──────────────────────────────────────────────────────────────────────── │
│ │F1-  │F2-NEW│F3-SEL PT.│F4-ZUPT│F5-  │F6-  │F7-  │F8-  │F9-EXIT            │
└──────────────────────────────────────────────────────────────────────────┘
```

NOTE

IPADS automatically inserts EAST, NORTH, ALTITUDE, and GRID ZONE information.

(5) If point name was not found in database, ERROR: POINT NOT FOUND; PRESS F2 TO CREATE POINT is displayed. Press **FNC DEL** followed by **F2** to enter coordinates for a new point, paragraph 3-13c(1); or press **FNC DEL** to clear PNT NAME field and then **F3** to select a point from database list, paragraph 3-13f(1), or reenter point name, paragraph 3-13c(1).

(6) PRESS Y TO UPDATE POSITION is displayed. If update coordinates are more than 100 meters from previous shutdown location, > 100 METERS FROM SHUTDOWN, PRESS Y TO UPDATE POSITION is displayed.

(7) If displayed coordinates are correct, press **Y**. Update is completed and INFO: POSITION UPDATE COMPLETED is displayed with function key line F2-NEW, F3-SEL PT., and F9-EXIT.

(8) If displayed coordinates are incorrect, press any other key to reject the update. Then press **FNC DEL** followed by **F1** and **F2** to enter coordinates for a new point, paragraph 3-13c, or press **FNC DEL**, to clear PNT NAME field and then **F3** to select a different point from database list, paragraph 3-13f(1).

(9) If displayed coordinates are correct, press **Y**, then press **F9** to return to MENU. Wait until alignment is complete before moving vehicle.

3-13. Entering Initial Position (UTM or Geodetic) - Continued

```
┌────────────────────────────────────────────────────────────────┐
│ W IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)  _ □ X  │
├────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC │4TH│M998│ TRAIN │FL:ALL │      │ 09/02/05  08:27:46│
├──────────────────────────────────────┬───────────────────────── │
│ POINT LIST:    (D/M/S)                │ ┌ CURRENT PLUMB BOB DATA ┐│
│   NAME           LAT D/M/S  LONG D/M/S│ │LAT: 34/35/59.756/N      ││
│   ------------- ---------- ---------- │LONG:098/23/06.110/W      ││
│                                       │   ALTITUDE:    100.0  M   ││
│ ┌FT BRAGG       35/09/45/N  79/07/58/W┐│                          ││
│  RABBIT         34/38/15/N  98/25/18/W │ ELLIP:WGS 84             ││
│  UABBIT 2       34/39/12/N  98/18/45/W │DATUM:WGS 84              ││
│  GEORGE         34/39/02/N  98/25/42/W │  LEN OL:  0000.00   M    ││
│  ------------- --/--/-- -  ---/--/-- - │ RAD DIST: 0005.36   KM   ││
│  ------------- --/--/-- -  ---/--/-- - │ TOT DIST: 0012.86   KM   ││
│  ------------- --/--/-- -  ---/--/-- - │NXT ZUPT:  05:00 MM:SS    ││
│  ------------- --/--/-- -  ---/--/-- - │  HDNG:  6393.79 MILS     ││
│  ------------- --/--/-- -  ---/--/-- - │                          ││
│  ------------- --/--/-- -  ---/--/-- - │                          ││
│  ------------- --/--/-- -  ---/--/-- - │                          ││
│  ------------- --/--/-- -  ---/--/-- - │                          ││
│  ------------- --/--/-- -  ---/--/-- - │                          ││
│  ------------- --/--/-- -  ---/--/-- - │                          ││
│  ------------- --/--/-- -  ---/--/-- - │ ┌ SYSTEM STATUS & MESSAGES┐│
│ ALL POINTS : FROM 1 TO 4 OF 4         │      EMULATOR MODE        ││
│ ┌INFO: READY┐                         │                           ││
├──────────────────────────────────────┴──────────────────────────┤
│F1-     │F2-NEW │F3-    │F4-FILTER│F5-DELALL│F6-   │F7-   │F8-   │F9-EXIT│
└────────────────────────────────────────────────────────────────┘
```

3-14. Zero-velocity Updates (ZUPTs).

CAUTION

Failure to perform ZUPTs when requested may cause survey mission failures. IPADS indicates degraded operation (DGR) when the time since the last ZUPT exceeds the ZUPT interval by 30 seconds.

NOTE

- ZUPTs should be performed whenever vehicle is stopped.

- NXT ZUPT shows the time remaining until a ZUPT stop is required.

- Frequent ZUPTs improve survey accuracy.

- Audible alarm is silenced by pressing any key.

a. ZUPTs are needed for accurate surveying. A ZUPT begins automatically during initialization. Thereafter, IPADS requests ZUPT stops at 5-minute intervals in 4TH order survey or 10-minute intervals in 5TH order survey. IPADS automatically performs a ZUPT at all mark and update procedures.

b. IPADS requests a ZUPT by flashing function key line F4-"ZUPT", flashing "NXT ZUPT" indicator, and sounding audible alarm 15 seconds before next required ZUPT. Sequence of operations to perform a ZUPT is:

Table 3-4 – ZUPT Operation

Operation	F4 Legend	NXT ZUPT Time	SYSTEM STATUS & MESSAGES
Stop vehicle and set brake.	ZUPT or "ZUPT"	Counts down or 00:00	
Press **F4**.	ZUPT or "ZUPT"	Counts down or 00:00	PRESS Y TO ZUPT
Press **Y**.	ZUPT or "ZUPT"	Counts down or 00:00	ZUPT COMPLETE IN: *xx* SECONDS
ZUPT completed.	ZUPT	05:00 or 10:00	"-GO-"
Vehicle moves.	ZUPT	Counts down	

   c.   Operator has 15 seconds to stop the vehicle and initiate a ZUPT. If a ZUPT is not initiated within 30 seconds of NXT ZUPT time becoming 00:00, survey order will change to DGR, PERF. ERROR; SEE STATUS will flash under SYSTEM STATUS & MESSAGES, and audible alarm will sound with a different tone than for a ZUPT request.

      (1) Press **F8** to display STATUS page and, depending on survey order, will show:

            ERROR: 4TH ORDER ZUPT INTERVAL EXCEEDED

            STOP AT AN SCP AND UPDATE POSITION AND ALTITUDE;

            OR SWITCH TO 5TH ORDER SURVEY (10 MINUTES BETWEEN ZUPTS); or

            ERROR: 5TH ORDER ZUPT INTERVAL EXCEEDED

            STOP AT AN SCP AND UPDATE POSITION AND ALTITUDE

      (2) Press **F9** to exit to previous page.

      (3) If 4TH order ZUPT interval was exceeded, a position update must be performed at a known SCP to restore survey accuracy, or you may switch to 5TH order with reduced accuracy, paragraph 3-14c.

      (4) If 5TH order ZUPT interval was exceeded, a position update must be performed at a known SCP to restore survey accuracy.

   d.   If vehicle moves before a ZUPT is completed, NXT TIME automatically reverts to the prior zero-velocity countdown time.

3-15. Updating.

NOTE

         An update may be cancelled any time before completion by pressing **F9**. A completed update cannot be eliminated.

   a.   Inserting accurate position and altitude data into IPADS is called updating. All updates are performed using known survey control points. IPADS must be updated after initialization before it can provide accurate survey data. The first update after initialization is called the initial update. The survey mission starts after the initial update. It is essential to update IPADS at the end of a survey mission.

   b.   At update completion, IPADS automatically adjusts all data recorded since the previous update. Adjusted data are stored in the SCP database filter. Unadjusted data are stored in the USER DEF database filter with the first character of the name changed to U.

   c.   After the operator has entered the known trig list position and altitude data of the survey control point into the IPADS, the system tests the difference between the update coordinates (trig list data) and the actual IPADS position coordinates. If the difference (error) is within the acceptable tolerance, the update is accepted.

3-16. Plumb Bob Position Update.

Perform the following steps to update and adjust UTM or Geodetic position and altitude by selecting a point from IPADS database, entering coordinates for a new point or searching for a point name:

NOTE

- Procedures for updating UTM or geodetic coordinates are similar. UTM will be used in the examples. See paragraph 3-13e for Geodetic coordinate entry.

- IPADS performs an update and adjusts previously marked points. If points were marked since the last update Maneuver vehicle to center plumb bob reference point over SCP survey marker.

a. Initiate a ZUPT, paragraph 3-14, Table 3-4.

b. Verify position format is set to format of update coordinates, paragraph 3-11e(3).

c. From MENU, MAP or NAVIGATION AID page, press **F3**. UPDATE page is displayed with PRESS F1 FOR PLUMB BOB; F2 FOR THEODOLITE on information line and F1-UPDT-PB, F2-UPDT-⦣, and F9-EXIT on function key line.

d. Press **F1**. UPDATE: PLUMB BOB: page is displayed with cursor box on PNT NAME: field and function key legend line shows F2-NEW, F3-SEL PT, and F9-EXIT.

```
┌──────────────────────────────────────────────────────────────────┐
│ ⛰ IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)   _ □ × │
├──────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC │4TH│M998│ TRAIN │      │      │ 01/07/05  13:17:44 │
│                                        ┌──────────────────────┐    │
│ UPDATE:      PLUMB BOB: UTM            │ CURRENT PLUMB BOB DATA│    │
│                                          EAST:    536079.09 M      │
│                                         NORTH: 4526242.91 M        │
│                                         ALTITUDE:   213.1  M       │
│                                         GRID ZONE:     18          │
│                                          ELLIP:USER DEFINED 1      │
│                                         DATUM:USER DEFINED 1       │
│              UPDATE TYPE: POSITION AND ALTITUDE   LEN OL: 0000.00 M│
│                PNT NAME: │──────────────│  RAD DIST: 0000.00 M     │
│                    EAST:      000000.00 M  TOT DIST: 0000.00 M     │
│                   NORTH: 00000000.00 M   NXT ZUPT: 05:00 MM:SS     │
│                ALTITUDE:       0000.0  M  HDNG: 6395.00 MILS       │
│                GRID ZONE:         00                               │
│                                        ┌──────────────────────┐    │
│                                        │ SYSTEM STATUS & MESSAGES   │
│                                           EMULATOR MODE            │
│ PRESS F2 FOR NEW PNT; F3 TO SELECT PNT; OR ENTER PNT NAME          │
│ F1-   │ F2-NEW │ F3-SEL PT. │ F4-ZUPT │ F5- │ F6- │ F7- │ F8- │ F9-EXIT │
└──────────────────────────────────────────────────────────────────┘
```

e. Perform the following steps to select an existing point from POINT LIST:

(1) Press **F3**. POINT LIST page is displayed with function key line F2-NEW, F3-SEL PT., F4-FILTER, F5-DEL ALL, and F9-EXIT.

CAUTION

If **F5** (DEL ALL) is pressed, IPADS prompts PRESS Y TO DELETE
DISPLAYED POINTS; OTHER KEY TO CANCEL. Pressing **Y** permanently
deletes all points in displayed list.

```
┌──────────────────────────────────────────────────────────────────────┐
│ ⚙ IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)      _ □ ✕    │
├──────────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC 4TH M998  TRAIN  FL:ALL        09/02/05  08:05:36         │
│                                                                        │
│  POINT LIST:    (UTM)                       CURRENT PLUMB BOB DATA      │
│    NAME           EAST M     NORTH M    GZ   EAST:    556389.13 M       │
│   ─────────────── ───────── ────────── ───  NORTH: 3828850.38 M        │
│    FT BRAGG       670057.99  3892648.98 17   ALTITUDE:    100.0  M      │
│    RABBIT         553000.00  3833000.00 14   GRID ZONE:    14           │
│    UABBIT 2       562996.69  3834814.94 14   ELLIP:WGS 84               │
│    GEORGE         552390.19  3834434.61 14   DATUM:WGS 84               │
│   ─────────────── ──────.── ────────.── ───   LEN OL:  0000.00   M      │
│   ─────────────── ──────.── ────────.── ───  RAD DIST: 0005.36   KM     │
│   ─────────────── ──────.── ────────.── ───  TOT DIST: 0012.86   KM     │
│   ─────────────── ──────.── ────────.── ───  NXT ZUPT: 05:00 MM:SS      │
│   ─────────────── ──────.── ────────.── ───   HDNG:  6393.79 MILS       │
│   ─────────────── ──────.── ────────.── ───                            │
│   ─────────────── ──────.── ────────.── ───                            │
│   ─────────────── ──────.── ────────.── ───  RANGE:  0006.88   KM       │
│   ─────────────── ──────.── ────────.── ───  WP AZ:  5766.99  MILS      │
│   ─────────────── ──────.── ────────.── ───  STEER:  TURN LEFT          │
│  ALL POINTS : FROM 1 TO 4 OF 4               SYSTEM STATUS & MESSAGES   │
│   "001      " DELETED                           EMULATOR MODE           │
├──────────────────────────────────────────────────────────────────────┤
│ F1-  F2-NEW  F3-  F4-FILTER F5-DELALL F6-  F7-  F8-  F9-EXIT            │
└──────────────────────────────────────────────────────────────────────┘
```

(2) Point filter sets the type of points shown on POINT LIST page. Point filter type is displayed in fourth field of mode line and on POINT LIST page. Set point filter type by pressing **F4** until desired point filter type is displayed.

(3) Scroll to desired update point (e.g. point GEORGE) and press **F3**. UPDATE: PLUMB BOB: UTM page is displayed with fields populated for the selected point. Function key line shows F2-NEW, F3-SEL PT., and F9-EXIT.

3-16. Plumb Bob Update - Continued

```
┌────────────────────────────────────────────────────────────────────┐
│ W IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)    _ □ X │
├──────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC │4TH│M998│ TRAIN │        │  09/02/05  08:18:18 │
├──────────────────────────────────────────────────────────────────┤
│  UPDATE:     PLUMB BOB: UTM              ┌CURRENT PLUMB BOB DATA┐ │
│                                          EAST:   556389.13 M     │
│                                          NORTH: 3828850.38 M     │
│                                          ALTITUDE:   100.0  M    │
│                                          GRID ZONE:     14       │
│                                           ELLIP:WGS 84           │
│                                          DATUM:WGS 84            │
│              UPDATE TYPE: POSITION AND ALTITUDE  LEN OL: 0000.00  M │
│              PNT NAME: │GEORGE          │  RAD DIST: 0005.36  KM │
│                  EAST:    552390.19 M      TOT DIST: 0012.86  KM │
│                 NORTH:  3834434.61 M     NXT ZUPT: 05:00 MM:SS │
│              ALTITUDE:       373.1 M      HDNG: 6393.79 MILS     │
│             GRID ZONE:        14                                 │
│                                                                  │
│                                                                  │
│                                          ┌SYSTEM STATUS & MESSAGES┐│
│  > 100 METERS FROM CURRENT; PRESS Y TO UPDATE POSITION;  EMULATOR MODE │
│  NOTE: A 10 MINUTE RE-ALIGNMENT WILL BE INITIATED              │
├──────────────────────────────────────────────────────────────────┤
│F1-   │F2-NEW  │F3-SEL PT.│F4-ZUPT│F5-  │F6-  │F7-  │F8-  │F9-EXIT │
└──────────────────────────────────────────────────────────────────┘
```

(4) Press **F3**.

(5) PRESS Y TO UPDATE POSITION will be displayed if no points to adjust exist. Press **Y**. Update is completed and INFO: POSITION UPDATE COMPLETED is displayed.

(6) If errors are within tolerance for adjustment, HPOS ERR = $x.x$ M; VPOS ERR = $x.x$ M; PRESS Y TO UPDATE/ADJUST POINTS is displayed. If errors are within tolerance, press **Y**. Update is completed and INFO: POSITION UPDATE COMPLETED is displayed.

(7) One of the following messages is displayed if update coordinates are more than 100 meters from IPADS location or error(s) exceeds adjustment tolerance:

- **>100 METERS FROM CURRENT; PRESS Y TO UPDATE POSITION
  NOTE: 10 MINUTE RE-ALIGNMENT WILL BE INITIATED.**

- **HPOS ERR = $x.x$ M; VPOS ERR = $x.x$ M;
  ERROR: RAD ERR TOO LARGE TO ADJUST; PRESS Y TO UPDATE POSITION
  NOTE: 10 MINUTE RE-ALIGNMENT WILL BE INITIATED**.

3-17. Theodolite Position Update.

Perform the following steps to update and adjust UTM or Geodetic position and altitude by selecting a point from IPADS database, entering coordinates for a new point, or searching for a point name:

NOTE

- Procedures for updating UTM or geodetic coordinates are similar. UTM will be used in the examples.

- Because IPADS is offset from the update SCP marker, CURRENT PLUMB DATA coordinates will differ from update SCP coordinates when update is completed.

a. Stop vehicle close to update SCP marker.

b. Exit vehicle and initiate a ZUPT, paragraph 3-14, Table 3-4.

c. Set up theodolite over SCP marker and achieve auto-reflection, paragraph 3-24(a).

d. Vehicle operator becomes the recorder for IPADS operator.

e. Measure and record vertical angle and offset distance, paragraph 3-24, subparagraphs b and d.

f. Verify position format is set to format of update coordinates, paragraph 3-11e(3), and angle format is set to format of theodolite, paragraph 3-11e(4).

g. From MENU, MAP or NAVIGATION AID page, press **F3**. UPDATE page is displayed with PRESS F1 FOR PLUMB BOB; F2 FOR THEODOLITE on information line and F1-UPDT-PB, F2-UPDT-⟂, and F9-EXIT on function key line.

h. Press **F2**. UPDATE: THEODOLITE: page is displayed with cursor box on DISTANCE TO PRISM field. Function key line shows F9-EXIT.
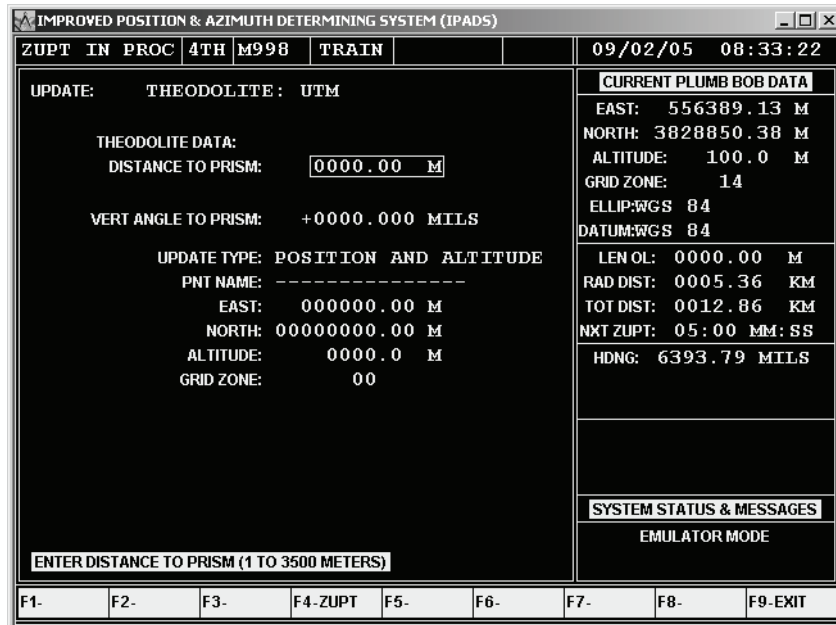
i. Enter distance to prism within the range of 1 to 3500 meters and press **ENTER**. Cursor box moves to VERT ANGLE TO PRISM field.

3-17. Theodolite Position Update - Continued

j. Enter vertical angle from the theodolite to the porro prism within the range of –1511 to 1511 mils and press **ENTER**. Cursor box moves to PNT NAME: field. Function key line shows F2-NEW, F3-SEL PT., and F9-EXIT.

   (1) Press **F1** to update position and altitude, **F2** to update position only, or **F3** to update altitude only. Cursor box moves to PNT NAME: field. Function key line shows F2-NEW, F3-SEL PT., and F9-EXIT.

   (2) Perform the following steps to select an existing point from POINT LIST. Press **F3**. POINT LIST page is displayed with function key line F2-NEW, F3-SEL PT., F4-FILTER, F5-DEL ALL, and F9-EXIT.

CAUTION

If **F5** (DEL ALL) is pressed, IPADS prompts PRESS Y TO DELETE DISPLAYED POINTS, OTHER KEY TO CANCEL Pressing **Y** permanently deletes all points in displayed list.
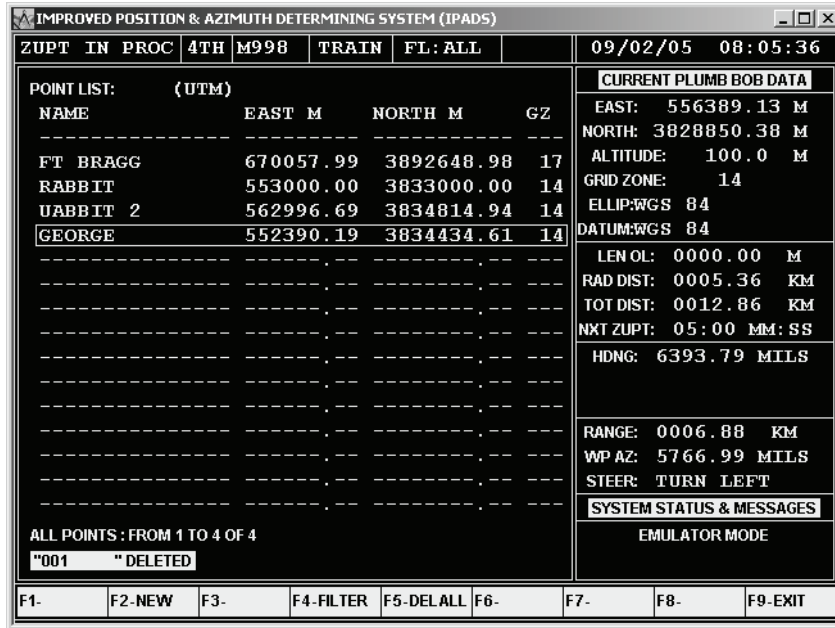
   (3) Point filter sets the type of points shown on POINT LIST page. Point filter type is displayed in fourth field of mode line and on POINT LIST page. Set point filter type by pressing **F4** until desired point filter type is displayed.

   (4) PRESS Y TO UPDATE POSITION will be displayed if no points to adjust exist. Press **Y**. Update is completed and INFO: POSITION UPDATE COMPLETED is displayed.

   (5) If points to adjust exist and errors are within tolerance for adjustment, HPOS ERR = *x.x* M; VPOS ERR = *x.x* M; PRESS Y TO UPDATE/ADJUST POINTS is displayed. If errors are within tolerance, press **Y**. Update is completed and INFO: POSITION UPDATE COMPLETED is displayed.

```
┌─────────────────────────────────────────────────────────────────────┐
│ 🖳 IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)    _ □ ×  │
├─────────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC 4TH M998  TRAIN                     09/02/05  08:49:45  │
├─────────────────────────────────────────┬───────────────────────────┤
│ UPDATE:      THEODOLITE: UTM             │  CURRENT PLUMB BOB DATA    │
│                                          │  EAST:    556389.13 M      │
│     THEODOLITE DATA:                     │  NORTH: 3828850.38 M       │
│     DISTANCE TO PRISM:   │0000.00  M│    │  ALTITUDE:   100.0  M      │
│                                          │  GRID ZONE:    14          │
│     VERT ANGLE TO PRISM:   +0000.000 MILS│  ELLIP:WGS 84              │
│                                          │  DATUM:WGS 84              │
│         UPDATE TYPE: POSITION AND ALTITUDE│ LEN OL: 0000.00   M       │
│         PNT NAME: GEORGE                 │  RAD DIST: 0005.36   KM    │
│            EAST:    552390.19 M          │  TOT DIST: 0012.86   KM    │
│           NORTH: 3834434.61 M            │  NXT ZUPT: 05:00 MM:SS     │
│         ALTITUDE:     373.1  M           │  HDNG: 6393.79 MILS        │
│         GRID ZONE:      14               │                           │
│                                          │                           │
│                                          │                           │
│                                          │  SYSTEM STATUS & MESSAGES  │
│                                          │      EMULATOR MODE         │
│ │ERROR: DISTANCE TO PRISM MUST BE 1 TO 3500 METERS│                  │
├──────┬──────┬──────┬─────────┬──────┬──────┬──────┬──────┬──────────┤
│ F1-  │ F2-  │ F3-  │ F4-ZUPT │ F5-  │ F6-  │ F7-  │ F8-  │ F9-EXIT  │
└──────┴──────┴──────┴─────────┴──────┴──────┴──────┴──────┴──────────┘
```

3-18. Update Errors.

    a.   While updating the system, IPADS tests the difference between the update coordinates (trig list data) and the actual IPADS position coordinates.

    b.   Depending on the difference and whether data will be adjusted, one of the following confirmation messages will be displayed:

- PRESS Y TO USE POSITION

- >100 METERS FROM CURRENT; PRESS Y TO UPDATE POSITION
  NOTE: 10 MINUTE RE-ALIGNMENT WILL BE INITIATED

- HPOS ERR = $x.x$ M; VPOS ERR = $x.x$ M;
  PRESS Y TO UPDATE / ADJUST POINTS

- HPOS ERR = $x.x$ M; VPOS ERR = $x.x$ M;
  ERROR: RAD ERR TOO LARGE TO ADJUST; PRESS Y TO UPDATE ONLY
  NOTE: 10 MINUTE RE-ALIGNMENT WILL BE INITIATED

    c.   Operator must decide whether the radial error is low enough to adjust data based on the distance traveled and time since the last update. Operator will check the probable reason and take the appropriate corrective action(s) for high radial errors, Table 3-5. Operator must decide whether to confirm update by pressing Y or cancel update by pressing F9.

NOTE

Update errors may occur at the initial SCP or at SCPs during the survey mission. This table is divided into two parts. Part I pertains to rejection at the initial update SCP. Part II comprises all other update rejections occurring during the survey mission or when closing the survey mission.

3-18. Update Errors - Continued

<table>
<tr><td colspan="2" align="center">**Table 3-5 - UPDATE ERROR TROUBLESHOOTING**

PART I</td></tr>
<tr><td colspan="2" align="center">Update Rejections at Initial Update SCP</td></tr>
<tr><td align="center">Reason for > 100 METERS FROM CURRENT message</td><td align="center">Operator Corrective Action</td></tr>
<tr><td>1. Operator entered coordinates incorrectly</td><td>a. If displayed coordinates are incorrect, enter the correct coordinates.
b. If displayed coordinates are correct, see part I, reason 2.</td></tr>
<tr><td>2. Accuracy of initialization coordinates is questionable</td><td>Check map spot or coordinates used to initialize system. If accuracy not within 100 meters, press **Y** to accept update. IPADS will align. If accuracy within 100 meters, see part I, reason 3.</td></tr>
<tr><td>3. Accuracy of initial update SCP is questionable</td><td>Press **F9** to cancel update. Proceed to another known SCP and update system.</td></tr>
<tr><td colspan="2" align="center">**PART II**</td></tr>
<tr><td colspan="2" align="center">Update Rejections During or Closing Survey Mission</td></tr>
<tr><td align="center">Reason for high radial error</td><td align="center">Operator Corrective Action</td></tr>
<tr><td>1. Operator entered coordinates incorrectly</td><td>a. If displayed coordinates are incorrect, enter the correct coordinates.
b. If displayed coordinates are correct, see part II, reason 2.</td></tr>
<tr><td>2. Accuracy of present SCP is questionable</td><td>a. Press **F9** to cancel update. Proceed to another known SCP and update system.
b. If update is accepted, continue with mission. The accuracy of the last SCP where update was rejected is questionable.
c. If update is rejected, the accuracy of the initial update SCP or the initialization data is questionable. See part II, reason 3.</td></tr>
<tr><td>3. Accuracy of initial update is questionable, or initialization data was incorrect</td><td>Troubleshoot all data. Update over known accurate SCP. IPADS will align.</td></tr>
</table>

3-19. PAE Code.

At completion of a mark, IPADS summarizes the results by displaying the following on the MARK page:

PAE *x x x* (*x* means the value does not matter for this illustration)

a. PAE stands for Position, Azimuth, Elevation (altitude). PAE code also is displayed on POINT EDITOR page when IPADS marked point data are displayed.

b. A " – " (dash) means the parameter in that PAE code location was not marked. A "d" or "D" means the parameter in that PAE code location was marked using the vehicle drivers interface (plumb bob) reference point. A "t" or "T" means the parameter in that PAE code location was marked using a theodolite. Lower case "t" or "d" indicates the data are not adjusted. Upper case "T" or "D" indicates the data are adjusted. An "E" indicates the data for that PAE code location may not meet accuracy requirements and should not be used. PAE codes are summarized below:

PAE Code	Meaning
PAE ---	Point has not been marked.
PAE t-t	Position and elevation have been marked, but not adjusted, using a theodolite.
PAE ttt	Position, azimuth and elevation have been marked, but not adjusted, using a theodolite.
PAE T-T	Position and elevation have been marked and adjusted using a theodolite.
PAE TtT	Position, azimuth and elevation have been marked and adjusted, using a theodolite.
PAE d-d	Position and elevation have been marked, but not adjusted, using drivers interface reference.
PAE ddd	Position, azimuth and elevation have been marked, but not adjusted, using drivers interface reference.
PAE D-D	Position and elevation have been marked and adjusted using drivers interface reference.
PAE DdD	Position, azimuth and elevation have been marked and adjusted, using drivers interface reference.
PAE E-E	Position and elevation have been marked but may not meet accuracy requirements.
PAE EEE	Position, azimuth and elevation have been marked but may not meet accuracy requirements.
PAE tEt	Position and azimuth have been marked, but not adjusted, using a theodolite. Azimuth has been marked but may not meet accuracy requirements.
PAE TET	Position and azimuth have been marked and adjusted using a theodolite. Azimuth has been marked but may not meet accuracy requirements.
PAE dEd	Position and azimuth have been marked, but not adjusted, using drivers interface reference. Azimuth has been marked but may not meet accuracy requirements.
PAE DED	Position and azimuth have been marked and adjusted using drivers interface reference. Azimuth has been marked but may not meet accuracy requirements.

    c.   An "E" in position and altitude indicates the radial or total distance traveled limit was exceeded or the travel time between ZUPTs was exceeded. The STATUS page will identify the cause. Accuracy can be restored by performing a position update at a known SCP. If exceeding the 4TH order ZUPT interval caused the error indication, the operator may elect to switch to 5TH order survey if the reduced accuracy is acceptable for the mission.

    d.   An "E" in azimuth of a 2-position azimuth mark indicates the distance between points was not at least 100 meters or the travel time between points was too long. This can be corrected by deleting the point from POINT LIST and repeating the mark.

NOTE

The IPADS will not adjust the azimuth of a two position mark. Azimuths given from a two position mark are never to be adjusted.

3-20. Data Recall.

IPADS assigns a point name (which may be changed by the user) to identify the data when a mark or update is completed.

    a.   The points may be reviewed in the POINT LIST page by pressing **F7** in the MENU, MAP, or NAVIGATION AID pages.

    b.   Point filter sets the type of points shown on POINT LIST page. Point filter type is displayed in fourth field of mode line and on POINT LIST page. Press **F4** until desired point filter type is displayed.

    c.   The point name appears in the NAME column of the list.

    d.   Scroll up or down the list until the point name is found.

NOTE

When UTM coordinates were recorded for a zone overlap area, they will be displayed for the zone (normal or extended) for which they were established.

3-20. Data Recall - Continued

Filter Type	Mode Line	POINT LIST Page	Description
Mission	FL:MISN	MISSION FILTER	All unadjusted IPADS points established during current mission.
SCP	FL:SCP	ALL SCP	Unadjusted IPADS SCP (OS) before closure; Adjusted IPADS SCP (OS) after closure adjustment. Known SCP
Way point	FL:WAY	ALL WAY PTS	Navigation way points entered by operator. They are used for navigation.
Mark	FL:MARK	ALL MARKED PTS	Points in the MARK list are for the second point (EOL) of a two-position azimuth. Unadjusted IPADS mark points (EOL) before closure; Adjusted IPADS mark points (EOL) after closure adjustment.
User Defined	FL:USER	ALL USERDEF	Unadjusted IPADS SCP (OS) and mark points (EOL) after closure adjustment. User Defined point could be a point established by GPS for an initiation point until a SCP can be located to adjust the mission.
All Points	FL:ALL	ALL POINTS	All points in IPADS database.

   e.   Press **ENTER** to recall all other data associated with the point, e.g. altitude, azimuth to one or two other points, PAE code, date and time of creation, and description.

3-21. Marking.

NOTE

- IPADS measures altitude at ground level under the plumb bob. If the survey marker is at a different height, adjust the altitude for the difference.

a.   The establishment of survey coordinates and azimuth with IPADS is called "marking". IPADS can store data for more than 360 positions. Marks are assigned names and are saved in the point database as discussed in paragraphs 3-27 and 3-28. The operator may change IPADS assigned names.

b.   Positions can be established using the plumb bob as reference or can be offset from the IPADS system using a theodolite (optical position mark, no azimuth).

c.   Azimuths to distant landmarks can be established using a theodolite (optical position and azimuth mark). An azimuth of a short line (100 to 1000 meters) can be established by marking both ends of the required azimuth line with IPADS (2-position azimuth mark using plumb bob) or using theodolite and performing an optical position and azimuth mark.

d.   An optical position and azimuth mark requires the operator to auto-reflect, measure a horizontal angle, vertical angle, and the offset distance with a theodolite, paragraph 3-24. Marking procedures are described in paragraphs 3-21, 3-22, 3-23, and 3-25.

e.   If the wrong vehicle has been selected for the vehicle in use, the effective position of the IPADS to the plumb bob reference point is incorrect and will provide incorrect mark/update information.

f.   IPADS automatically assigns point names and mark identifiers at mark completion. Operator should change assigned names and identifiers to more meaningful descriptors.

g.   After adjustment, IPADS stores adjusted data in the SCP and MARK POINT LISTS and unadjusted data in the USER DEF POINT LIST. First character in PNT NAME or MARK ID changes to "U" for unadjusted data. Where space permits, the first two characters of entered names and identifiers should be spaces to allow for unadjusted identification without changing the name or identifier.

3-22. Marking Position and Altitude Using Plumb Bob.

The following procedure establishes position and altitude coordinates of a point:

a.   Maneuver vehicle to place plumb bob over point to be established.

b.   Set ground vehicle's parking brake.

c.   When vehicle is stationary, command a ZUPT if IPADS remains in NAVIGATION mode.

d.   Extend plumb bob arm out vehicle door.

e.   Hang plumb bob.

f.   Press **F2**. SYSTEM STATUS & MESSAGES will show MARK – WAIT *x.x* SECONDS.

g.   At mark completion, MARK page shows data for the marked point with cursor box on PNT NAME field and INFO: MARK COMPLETE; PRESS ENTER TO EDIT POINT NAME is displayed. Function key line shows F9-EXIT.

h.   Press **ENTER** to change point name. POINT EDITOR page is displayed with data for the mark. Function key line shows F2-USE ALL and F9-EXIT.

CAUTION

AFATDS truncates SCP names to eight characters. If SCP data will be sent to AFATDS, keep SCP names to eight or fewer characters. See CAUTION in paragraph 3-28.

i.   Press **FNC DEL** to clear PNT NAME field, enter new name, and press **ENTER**. Cursor box moves to DESCRIPTION field.

j.   If desired, enter a point description up to 34 characters long.

k.   Press **F2** to accept the name and description changes. MARK page is displayed with new name. Record data.

l.   Set survey marker under plumb bob.

m.   Stow plumb bob and arm.

n.   Set and mark witness stake.

o.   Press **F9** to return to MENU, MAP, or NAVIGATION AID page.

p.   Proceed to next point.

3-23. Marking 2-Position Azimuth Using Plumb Bob.

The following procedure establishes position and altitude coordinates of a point and azimuth of an OL.

NOTE

- **IPADS will NOT adjust azimuth.**

- Vehicle must be able to travel quickly between both ends of the OL, 100 to 1000 meters long. If distance between OS and EOL is less than 100 meters or travel time exceeds 60 seconds, the accuracy of the computed azimuth may be degraded and PAE code will show E in azimuth location, meaning there is a probable error in azimuth.

a.   Maneuver ground vehicle to place plumb bob over point to be established.

b.   Set ground vehicle's parking brake.

c.   When vehicle is stationary, command a ZUPT if IPADS remains in NAVIGATION mode

3-23. Marking 2-Position Azimuth Using Plumb Bob - Continued

    d.   Extend plumb bob arm out vehicle door.

    e.   Hang plumb bob.

    f.   Set survey marker under plumb bob.

    g.   Stow plumb bob.

    h.   Press **F1**. MARK page shows PERFORMING TWO POSITION MARK. SYSTEM STATUS & MESSAGES will show MARK – WAIT *x.x* SECONDS. Function key line shows F9-CANCEL.

    i.   At OS mark completion, audible alarm sounds and MARK page shows data for the marked point OS (P1) MARKED; MOVE TO EOL (P2) POSITION and TIME IN P1 – P2 OPERATION *xx:xx*.

NOTE

You have 60 seconds to move to the EOL position and mark EOL. OL must be between 100 and 1000 meters long. Current OL length is displayed in LEN OL field.

    j.   Immediately after OS mark is completed, proceed to EOL position.

    k.   Function key line shows F1-MRK EOL and F9-CANCEL.

    l.   Maneuver ground vehicle to place plumb bob over EOL.

    m.   Set ground vehicle's parking brake.

    n.   When vehicle is stationary, press **F1** to mark EOL.

    o.   Press **FNC DEL** to clear PNT NAME field, enter new name, and press **ENTER**. Cursor box moves to mark identifier.

CAUTION

AFATDS truncates SCP names to eight characters. If SCP data will be sent to AFATDS, keep SCP names to eight or fewer characters. See CAUTION in paragraph 3-28.

    p.   Press **FNC DEL** to clear mark identifier, enter new identifier, and press **ENTER**. Cursor box moves to DESCRIPTION field.

    q.   If desired, enter a point description up to 34 characters long.

    r.   Press **F2** to accept the name and description changes. MARK page is displayed with new name and identifier. Record data.

    s.   Extend plumb bob arm out vehicle door.

    t.   Hang plumb bob.

    u.   Set survey marker under plumb bob.

    v.   Stow plumb bob and arm.

    w.   Set and mark witness stakes at OS and EOL.

    x.   Press **F9** to return to MENU, MAP, or NAVIGATION AID page.

    y.   Proceed to next point.

3-24. Theodolite Measurements.

Optical measurements may be performed any time in the survey mission, but must always be performed when an update SCP is inaccessible to the IPADS vehicle, when a position to be established is inaccessible to the IPADS vehicle, or when an azimuth line of less that 100 meters is required.

NOTE

- Color theodolite sight white with typewriter correction fluid to increase visibility.

- At night, illuminate theodolite sight with theodolite lighting kit.

- If possible, position IPADS so sunlight does not shine directly on porro prism. Operator will have difficulty performing auto-reflection if sun is reflected by porro prism.

- Stand directly behind the theodolite and look for your reflection in the Porro Prism mirror to achieve rough auto reflection.

a. **Auto-Reflection.** Prior to making any optical measurements, the IPADS operator must achieve auto-reflection. To achieve auto-reflection, perform the following procedure:

(1) Stop vehicle close to SCP or point to be established, exit vehicle, and initiate a ZUPT, paragraph 3-14, Table 3-4.

(2) Set up theodolite over SCP or point to be established. If an azimuth reading is required, set up range pole over azimuth marker, unless a distant aiming point (DAP) will be used.

(3) Uncover and roughly level porro prism.

(4) Vehicle operator makes certain ZUPT was completed and maneuvers vehicle so porro prism is visible from the theodolite and is within 24 meters.

(a). IPADS operator, standing behind the theodolite, instructs vehicle operator to slowly maneuver vehicle until theodolite is reflected in porro prism and auto-reflection is obtained.

(b). An alternate procedure is to keep vehicle stationary and move theodolite until auto-reflection is achieved.

(5) Vehicle operator exits vehicle, initiates a ZUPT, paragraph 3-14, and accurately levels porro prism, Table 3-4.

(6) IPADS operator checks if auto-reflection can still be achieved. If not, repeat steps (4) and (5).

(7) Focus theodolite so reflected image of theodolite front sight is centered on center vertical crosshair. Theodolite line-of-sight is now perpendicular to porro prism.

3-24. Theodolite Measurements - Continued
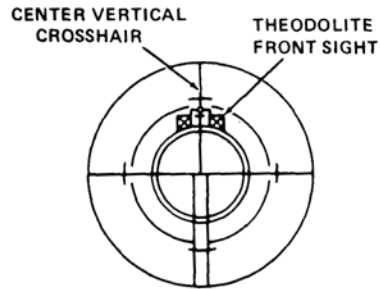
b. **Vertical Angle Measurement.**

(1) With theodolite auto-reflected on porro prism, point theodolite telescope so the center horizontal crosshair is on an edge of the porro prism.

(2) Measure and record vertical angle to porro prism.

(3) Plunge theodolite telescope, point it so the center horizontal crosshair is on the same edge as in step (1), and measure and record reverse vertical angle to porro prism.

(4) Repeat measurements if difference between direct and reverse pointings is greater than 0.2 mil.

(5) Mean direct and reverse pointings to obtain mean vertical angle.

c. **Mean Horizontal Angle Measurement.** Not required for position update or position, only mark.

(1) Auto-reflect on porro prism.

(2) Measure and record direct angle from porro prism clockwise to azimuth target.
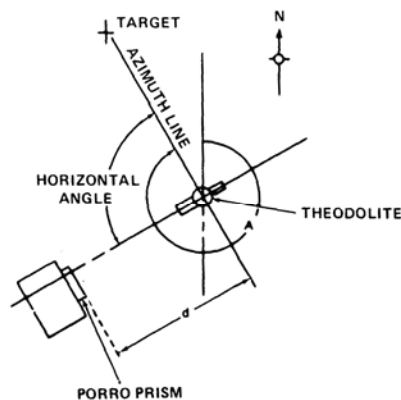
(3) Plunge theodolite telescope and measure and record reverse angle from azimuth target to porro prism (auto reflect).

(4) Repeat measurements if difference between direct and reverse pointings is greater than 0.2 mil.

(5) Mean direct and reverse pointings to obtain mean horizontal angle.

d. **Offset Distance Measurement.**

NOTE

At night, illuminate porro prism scale with flashlight. Porro prism has two scales for inverting and non-inverting instruments.

(1) Sight left stadia line on 0 and read distance from right stadia line for distances less than or equal to 12 meters.
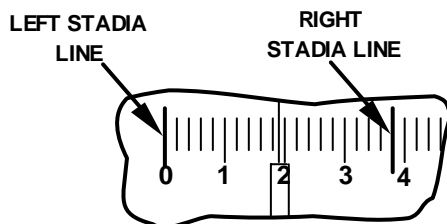
(2) For distances greater than 12 m (right stadia line will fall off the stadia scale) read the center vertical crosshair and multiply by two to obtain the distance between 12 m and 24 m.
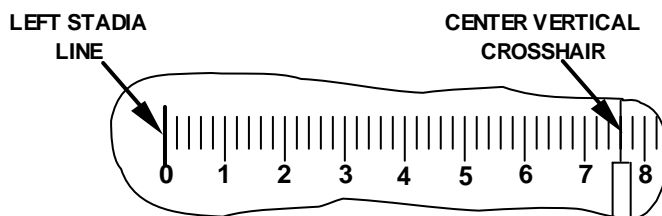
3-25. Marking Position, Azimuth, and Altitude Using Theodolite.

NOTE

- IPADS will not adjust azimuths obtained in position, azimuth, and altitude marks using a theodolite.

- IPADS can establish two OLs for an OS using a theodolite.

a. Stop vehicle close to point to be established.

b. Exit vehicle and initiate a ZUPT, paragraph 3-14, Table 3-4.

c. Set up theodolite over OS marker to be established and achieve auto-reflection, paragraph 3-24a.

d. If a short OL will be established, set up range pole over EOL marker.

e. Vehicle operator becomes the recorder for IPADS operator.

f. Measure and record offset distance, vertical angle and mean horizontal angle, paragraph 3-24, subparagraphs b, c, and d. If applicable, measure and record mean horizontal angle for second OL.

g. From MENU, MAP, or NAVIGATION AID page, press **F2**. MARK page will be displayed with function key legend showing F1-2POS, F2-1POS, F3- ⌒ AZ, F4- ⌒ SCP, and F9-EXIT.

h. Press **F3**. MARK page shows PERFORMING THEODOLITE AZIMUTH MARK. SYSTEM STATUS & MESSAGES will show MARK – WAIT *x.x* SECONDS. Function key line shows F9-CANCEL.

3-25. Marking Position, Azimuth, and Altitude Using Theodolite - Continued

i.   At mark completion, MARK page shows data for the marked point and ENTER DISTANCE TO PRISM (1 TO 3500 METERS) OR F2-USE ALL. Cursor box is on DISTANCE TO PRISM field. Function key line shows F2-USE ALL, and F9-EXIT.

j.   Enter measured offset distance (in meters) and press **ENTER**. Cursor box moves to HORIZ ANGLE TO EOL field.

k.   Enter measured mean horizontal angle and press **ENTER**. Cursor box moves to VERT ANGLE TO PRISM field.

l.   Enter measured vertical angle and press **F2**. MARK page shows data for the marked point with cursor box on HORZ ANGLE TO EOL field and INFO: AZ 1 MARKED; ENTER AZ 2 ANGLE OR MOVE TO PNT NAME TO EDIT. Function key line shows F2- USE ALL and F9-EXIT.

m.   If not establishing a second OL, scroll to PNT NAME field.

n.   To establish a second OL, press **FNC DEL** to clear HORZ ANGLE TO EOL field, enter second mean horizontal angle, and press **F2**. MARK page displays data for second OL and INFO: MARK COMPLETE; PRESS ENTER TO EDIT POINT & MARK NAMES. Cursor box moves to PNT NAME field. Function key line shows F9-EXIT.

o.   Press **ENTER** to change point name. POINT EDITOR page is displayed with data for the mark. Cursor box is on PNT NAME Field. Function key line shows F2-USE ALL and F9-EXIT.

CAUTION

AFATDS truncates SCP names to eight characters. If SCP data will be sent to AFATDS, keep SCP names to eight or fewer characters. See CAUTION in paragraph 3-28.

p.   Press **FNC DEL** to clear PNT NAME field, enter new name and press **ENTER**. Cursor box moves to MARK 1 IDENTIFIER.

q.   Press **FNC DEL** to clear MARK 1 IDENTIFER, enter new identifier and press **ENTER**. Cursor box moves to DESCRIPTION field or MARK 2 IDENTIFER if two OLs were established.

r.   Press **FNC DEL** to clear MARK 2 IDENTIFER, enter new identifier, and press **ENTER**. Cursor box moves to DESCRIPTION field.

s.   If desired, enter a point description up to 34 characters long.

t.   Press **F2** to accept the name and description changes. MARK page is displayed with new name and identifier. Record data.

u.   Drive witness stake(s) and stow theodolite and other equipment in vehicle.

v.   Press **F9** to return to MENU, MAP, or NAVIGATION AID page.

w.   Proceed to next point.

3-26. Adjacent Grid Zone.

NOTE

GRID ZONE is displayed on MENU only when display position format is UTM and current IPADS position is within 40 kilometers of a UTM grid zone boundary.

a. **Grid Zone Selection.**

When operating within 40 kilometers of a UTM grid zone boundary, UTM coordinates can be displayed with respect to the normal grid zone or the extended zones east or west of the boundary. EXT after the zone number indicates UTM coordinates are relative to extended east or west zone. Perform the following steps to change grid zone reference:

```
CURRENT PLUMB BOB DATA

 EAST:   239632.00 M

NORTH:  4303840.50 M

 ALTITUDE:  326.6   M

GRID ZONE:    18 EXT

  ELLIP: WGS 84

DATUM: WGS 84
```

(1) Scroll to GRID ZONE on MENU and press **ENTER**. ZONE FUNCTION page is displayed with instruction PRESS F1 FOR NORMAL; F2 FOR WEST GZ (xx); F3 FOR EAST GZ (yy), where xx is the extended west zone number and yy is the extended east zone number. Function key line shows F1-NORMAL, F2-WEST GZ, F3-EAST GZ, and F9-EXIT.

```
ZONE FUNCTION


          ZONE IN USE: NORMAL


PRESS F1 FOR NORMAL; F2 FOR WEST GZ (xx); F3 FOR EAST GZ (yy)
1-NORMAL │ 2-WEST GZ │ 3-EAST GZ │ 4-    │ 5-    │ 6-
```

(2) To change ZONE IN USE, press **F1** for normal zone, **F2** for extended west zone, or **F3** for extended east zone. Selection is displayed in ZONE IN USE field.

(3) If setting is correct, press **F9** to exit ZONE FUNCTION page.

b. **Grid Zone Boundary Crossing.**

IPADS sounds the audible alarm and flashes function key legend F5-ZONE when it crosses the boundary between two grid zones for the first time in a mission. Operator performs following steps when this occurs:

(1) Press **F5**. ZONE FUNCTION page is displayed with instruction PRESS F1 FOR NORMAL; F2 FOR WEST GZ (xx); F3 FOR EAST GZ (yy), where xx is the extended west normal zone number and yy is the extended east zone number. Function key legend shows F1-NORMAL, F2-WEST GZ, F3-EAST GZ, and F9-EXIT.

(2) Press **F1** for normal zone, **F2** for extended west zone, or **F3** for extended east zone. Selection is displayed in ZONE IN USE field.

(3) If setting is correct, press **F9** to exit ZONE FUNCTION page.

(4) IPADS will retain the new setting for subsequent crossings of the zone boundary. However, when IPADS goes outside the 40 km zone overlap area, operation automatically switches to normal zone.

3-27. Recording IPADS Data.

a. **Mark.** Record point name, mark identifier, PAE code, zone, easting, northing, altitude, grid azimuth (if measured), and distance for each position marked.

    (1) Record all mean-horizontal angles, vertical angles, and offset distances measured.

    (2) Also record all malfunctions which occur during the survey mission.

NOTE

IPADS does not adjust distances or azimuths.

b. **Update.** After any update (except the initial one), recall and record all adjusted data stored since the last update. The assistant operator should check all data.

c. For examples of recording IPADS data, refer to FM 6-2, chapter 8.

3-28. Data Management.

CAUTION

IPADS prompts PRESS Y TO DELETE DISPLAYED POINTS; OTHER KEY TO CANCEL when **F5** (DEL ALL) is pressed. Pressing **Y** permanently deletes all points in displayed list**.**

!!! SURVEY CONTROL POINT (SCP) NAME LENGTH LIMITATION !!!
There is a known issue in FOS that limits the length of the Survey Control Point (SCP) Name to 8 characters. IPADS and FOS will accept, process, and transmit SCP names of up to 15 characters. But when the SCP message is received at AFATDS from FOS, the SCP names will be truncated (shortened) to the first 8 characters. IPADS can automatically generate 15-character long SCP names, but they look identical when shortened to 8 characters. To prevent the loss of SCP name data, the following solution is recommended:
AT THE IPADS AND FOS, LIMIT YOUR SURVEY CONTROL POINT NAMES TO 8 CHARACTERS OR LESS. CHANGE IPADS GENERATED 15-CHARACTER SCP NAMES TO YOUR OWN CHOICE OF NAMES UP TO 8 CHARACTERS LONG BEFORE TRANSMITING TO AFATDS.

NOTE

- Operator can view, edit, delete, and enter new points in the IPADS POINT LIST. Operator can also import and export data to/from FOS, paragraph 3-29, subparagraphs d and e.

- When time permits, operator should enter data for update SCPs and navigation waypoints prior to proceeding on the mission. During the mission the applicable update or waypoint coordinates can just be recalled from stored data.

- Operator can enter points in the waypoint, SCP, or user defined lists. Since IPADS also enters points in the SCP and user defined lists, it is suggested that the operator enter update and navigation way points in the waypoint list to minimize the effort required to clean up the database after the mission.

- Operator must verify mission data has been accurately recorded and/or downloaded to FOS before deleting any data.

- Operator should delete points that will not be used again by IPADS after a mission or before starting the next mission.

- Points in the MARK list are for the second point (EOL) of a two-position azimuth. Unless there is need to consider the EOL as another SCP, points in the MARK list should be deleted and not exported to FOS. The first point of a two-position azimuth is considered the OS.

- An OS is an Orienting Station used to position howitzers for firing. The EOL is the end of orienting line where you get the azimuth from the first position to the other. The OS and EOL are marked points and **not for updating the IPADS**. Its data will be in the SCP file with OS coordinates and azimuth to EOL.

- IPADS automatically assigns a name to new points, whether entered by the operator or created by IPADS. Formats for assigned names are PNT*xxxxxxxxxxxx* for operator-entered points, SCP*xxxxxxxxxxxx* for IPADS marked points, and MRK*xxxxx* for azimuth mark identifiers, including the second point (EOL) of a two-position azimuth. *xxxxxxxxxxxx* and *xxxxx* are numbers which increment each time a new point is created.

- Operator should replace IPADS assigned names with more meaningful names.

a. Access POINT LIST by pressing **F7** from the MENU, MAP, or NAVIGATION AID page. POINT LIST page is displayed with function key line F2-NEW, F4-FILTER, F5-DEL ALL, and F9-EXIT.

3-28. Data Management - Continued

```
┌────────────────────────────────────────────────────────────────────────────┐
│ IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)          _ □ × │
├────────────────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC 4TH M998  TRAIN  FL:ALL          09/02/05  08:05:36 │
├──────────────────────────────────────────────┬─────────────────────────────┤
│ POINT LIST:    (UTM)                           │ CURRENT PLUMB BOB DATA      │
│   NAME           EAST M      NORTH M    GZ     │ EAST:   556389.13 M         │
│ ──────────────  ─────────  ──────────  ───    │ NORTH: 3828850.38 M         │
│                                                │ ALTITUDE:   100.0  M        │
│   FT BRAGG       670057.99  3892648.98  17     │ GRID ZONE:    14            │
│   RABBIT         553000.00  3833000.00  14     │ ELLIP:WGS 84                │
│   UABBIT 2       562996.69  3834814.94  14     │ DATUM:WGS 84                │
│   GEORGE         552390.19  3834434.61  14     │ LEN OL:  0000.00   M        │
│ ──────────────  ──────.──  ────────.──  ───   │ RAD DIST: 0005.36   KM      │
│ ──────────────  ──────.──  ────────.──  ───   │ TOT DIST: 0012.86   KM      │
│ ──────────────  ──────.──  ────────.──  ───   │ NXT ZUPT:  05:00 MM:SS      │
│ ──────────────  ──────.──  ────────.──  ───   │ HDNG:  6393.79 MILS         │
│ ──────────────  ──────.──  ────────.──  ───   │                             │
│ ──────────────  ──────.──  ────────.──  ───   │                             │
│ ──────────────  ──────.──  ────────.──  ───   │ RANGE: 0006.88   KM         │
│ ──────────────  ──────.──  ────────.──  ───   │ WP AZ: 5766.99 MILS         │
│ ──────────────  ──────.──  ────────.──  ───   │ STEER:  TURN LEFT           │
│ ──────────────  ──────.──  ────────.──  ───   │ SYSTEM STATUS & MESSAGES    │
│ ALL POINTS : FROM 1 TO 4 OF 4                  │      EMULATOR MODE          │
│ "001      " DELETED                            │                             │
├──────────────────────────────────────────────┴─────────────────────────────┤
│ F1-   F2-NEW  F3-   F4-FILTER  F5-DELALL F6-   F7-   F8-   F9-EXIT │
└────────────────────────────────────────────────────────────────────────────┘
```

b. Point filter sets the type of points shown on POINT LIST page. Point filter type is displayed in fourth field of mode line and on POINT LIST page. Press **F4** until desired point filter type is displayed.

Filter Type	Mode Line	POINT LIST Page	Description
All Points	FL:ALL	ALL POINTS	All points in IPADS database.
Mission	FL:MISN	MISSION FILTER	All unadjusted IPADS points established during current mission.
SCP	FL:SCP	ALL SCP	Unadjusted IPADS SCP (OS) before closure; Adjusted IPADS SCP (OS) after closure adjustment. `Known SCP`
Way point	FL:WAY	ALL WAY PTS	Navigation way points entered by operator. They are used for navigation.
Mark	FL:MARK	ALL MARKED PTS	Points in the MARK list are for the second point (EOL) of a two-position azimuth. Unadjusted IPADS mark points (EOL) before closure; Adjusted IPADS mark points (EOL) after closure adjustment.
User Defined	FL:USER	ALL USERDEF	Unadjusted IPADS SCP (OS) and mark points (EOL) after closure adjustment. User Defined point could be a point established by GPS for an initiation point until a SCP can be located to adjust the mission.

c. Perform the following steps to delete a single point from the displayed list:

(1) Scroll to point to be deleted.

(2) Press **FNC DEL**. IPADS prompts PRESS Y TO DELETE SELECTED POINT; OTHER KEY TO CANCEL.

(3) Press **Y** to permanently delete selected point from displayed list. "*Point name*" DELETED is displayed. Press any other key to cancel delete.

d. Perform the following steps to delete all points in the displayed list:

   (1) Press **F5**. IPADS prompts PRESS Y TO DELETE DISPLAYED POINTS; PRESS OTHER KEY TO CANCEL.

   (2) Press **Y** to permanently delete all points in displayed list. Press any other key to cancel delete.

e. Perform the following steps to view data for a point in displayed list:

   (1) Scroll to point to be displayed.

   (2) Press **ENTER**. POINT EDITOR page is displayed for selected point. For example, STATION AZ is selected from SCP list.

   (3) Press **F9** to return to POINT LIST page.

NOTE

   • Point name and point description for a stored point may be edited. **No other fields** may be changed. If coordinates for an operator entered point are incorrect, the point must be deleted, paragraph 3-28c, and correct data entered as a new point, paragraph 3-13f (5).

   • PNT NAME and DESCRIPTION fields will always be displayed on POINT EDITOR page. AZIMUTH field(s) will be displayed only if IPADS determined azimuth(s) for that point (two position or theodolite mark).

f. Perform the following steps to edit data for a point in displayed list:

   (1) Scroll to point to be displayed.

   (2) Press **ENTER**. POINT EDITOR page is displayed for selected point with cursor box on PNT NAME field.

   (3) Scroll to field(s) to be changed, press **FNC DEL** to clear field, and enter new name or description.

   (4) When all desired fields are changed, press **F2**. INFO: POINT WAS SUCCESSFULLY MODIFIED is displayed.

   (5) If data are correct, press **F9** to return to POINT LIST page. Otherwise, scroll to incorrect field and enter correct data, paragraph 3-28g.

g. Perform the following steps to add a new point:

3-28. Data Management - Continued

(1) Press **F2**. POINT EDITOR page is displayed with cursor box on TYPE field. Function key line shows F1-USER, F2-WAY, F3-SCP and F9-EXIT.

```
┌────────────────────────────────────────────────────────────────────────┐
│ 🔲 IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)        _ □ X │
├────────────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC │4TH│M998│  TRAIN  │          │ 09/02/05   08:09:36      │
│                                                                          │
│  POINT EDITOR:      (UTM)              ┌─ CURRENT PLUMB BOB DATA ─┐      │
│                                          EAST:    556389.13 M           │
│    TYPE:         USERDEF                 NORTH: 3828850.38 M            │
│    PNT NAME:    │PNT000000000001│        ALTITUDE:    100.0  M         │
│    ELLIP:        WGS 84                  GRID ZONE:     14              │
│    DATUM:        WGS 84                   ELLIP:WGS 84                  │
│                                         DATUM:WGS 84                    │
│    EASTING:         000000.00 M          LEN OL:  0000.00  M           │
│    NORTHING:      00000000.00 M          RAD DIST: 0005.36  KM         │
│    ALTITUDE:         0000.0  M           TOT DIST: 0012.86  KM         │
│    GRID ZONE:          00                NXT ZUPT:  05:00 MM:SS        │
│    CREATION DATE: 00/00/00                HDNG:  6393.79 MILS          │
│    CREATION TIME: 00:00:00                                             │
│                                                                         │
│                                          RANGE:  0006.88  KM           │
│                                          WP AZ:  5766.99 MILS          │
│                                          STEER:  TURN LEFT             │
│    DESCRIPTION:                         ┌─ SYSTEM STATUS & MESSAGES ─┐ │
│  >                                          EMULATOR MODE              │
│  ┌ PRESS ENTER TO ACCEPT NAME OR TYPE NEW NAME ┐                       │
├────────────────────────────────────────────────────────────────────────┤
│F1-     │F2-USEALL│F3-   │F4-ZUPT│F5-   │F6-   │F7-   │F8-   │F9-EXIT │
└────────────────────────────────────────────────────────────────────────┘
```

(2) Press **F1** to store point data in the user defined list, **F2** for waypoint list, or **F3** for SCP list. Cursor box moves to PNT NAME field. Function key line shows F2-USE ALL and F9-EXIT.

(3) Press **ENTER** to accept pre-assigned name or press **FNC DEL** to clear PNT NAME field and enter the new name.

(4) Verify ellipsoid is correct for coordinates being entered. If ellipsoid is incorrect, scroll to ELLIP field, press **ENTER**, and enter new ellipsoid and datum, paragraph 3-11d.

(5) Verify datum is correct for coordinates being entered. If datum is incorrect, scroll to DATUM field, press **ENTER**, and enter new datum, paragraph 3-11d.

(6) Scroll to EASTING field and enter easting value in meters.

(7) Scroll to NORTHING field and enter northing value in meters.

(8) Scroll to ALTITUDE field and enter altitude value in meters.

(9) Scroll to GRID ZONE field and enter positive (+) UTM grid zone value for Northern Hemisphere, or negative (-) UTM grid zone value for Southern Hemisphere.

(10) Optional – scroll to DESCRIPTION and enter a point description.

(11) If data is correct, press **F2-USE ALL** to save data. If not, scroll to incorrect field and enter the correct data. Information line should show INFO: POINT WAS SUCCESSFULLY ADDED after pressing F2. If information line shows ERROR: NAME ALREADY IN USE after pressing F2, enter a point name that's not in the database and press **F2-USE ALL**. If data is incorrect after being saved, edit point or delete point to start over.

(12) Press **F9-EXIT** to return to POINTS LIST page.

3-29. FOS.

IPADS can communicate with a Forward Observer System (FOS). When connected to FOS, IPADS allows the operator to import and export data from and to the FOS.

NOTE

- Upon establishing communications, IPADS will synchronize its date/time to the FOS current date/time. At any time thereafter, the operator can synchronize the IPADS date and time to the FOS current date and time by sending a request from the IPADS CDU.

- FOS can request IPADS current position for transmission to AFATDS via vehicle combat net radio.

- From IPADS CDU the operator can send IPADS SCP data to the FOS for subsequent transmission to AFATDS.

- From FOS the operator can send a trig list of SCPs received from AFATDS to IPADS.

a. Connect IPADS to FOS using the W136 FOS cable assembly. Connect P1 to CDU J2 connector. If using Handheld Terminal Unit (HTU) as FOS, connect W136 P2 to HTU J7. If using Rugged Handheld Computer (RHC) as FOS, connect W136 P2 to RHC Com 1.

b. Connect FOS to power and initialize it per the FOS operator's manual, TB 11-7021-228-10-1 or -2 depending on the platform.

c. Verify that the FOS Status indicator (fifth field on the mode line) indicates FOS. If not, see paragraph 4-5, Field Troubleshooting.

d. Once communications are established, the IPADS clock is automatically synchronized to the FOS current date/time. If immediately after connecting IPADS and FOS IPADS time is not within one second of FOS time, see paragraph 4-5, Field Troubleshooting. To re-synchronize the IPADS date/time, perform the following procedure:

(1) Scroll down to DATE/TIME on the MENU, then press **ENTER**.

(2) DATE / TIME page is displayed with the function key legends: F2-USE ALL, F5-GET TIME, and F9-MENU.

(3) Press **F5** to synchronize time. DATE / TIME page is displayed with INFO: FOS TIME DATA RECEIVED on information line.

(4) Press **F9** to return to MENU.

IPADS current position can be imported into FOS once IPADS has been initialized with position, paragraph 3-12. To import IPADS current position, follow instructions in the FOS operator's manual, TB 11-7021-228-10-1 or –2, depending on the platform.

e. **To export SCPs from IPADS to FOS**, perform the following procedure:

(1) Press **F7** on the MENU, MAP, or NAVIGATION AID pages. POINT LIST page is displayed with function key line: F2-NEW, F4-FILTER, F5-DEL ALL, F6-SND PNT, F7-SND ALL, and F9-EXIT.

CAUTION

If **F5** (DEL ALL) is pressed, IPADS prompts PRESS Y TO DELETE DISPLAYED POINTS; OTHER KEY TO CANCEL. Pressing **Y** permanently deletes all points in displayed list.

3-29. FOS - Continued

NOTE

Only SCPs may be sent to FOS. MARK, USER DEF, and WAYPOINTS may
not be sent.

(2) Point filter sets the type of points shown on POINT LIST page. Point filter type is displayed in fourth
field of mode line and on POINT LIST page. Set point filter type by pressing **F4** until SCP point filter
type is displayed.

Filter Type	Mode Line	POINT LIST Page	Description
All Points	FL:ALL	ALL POINTS	All points in IPADS database.
Mission	FL:MISN	MISSION FILTER	All unadjusted IPADS points established during current mission.
SCP	FL:SCP	ALL SCP	Unadjusted IPADS SCP (OS) before closure; Adjusted IPADS SCP (OS) after closure adjustment.
Waypoint	FL:WAY	ALL WAY PTS	Navigation waypoints entered by operator.
Mark	FL:MARK	ALL MARKED PTS	Unadjusted IPADS mark points (EOL) before closure; Adjusted IPADS mark points (EOL) after closure adjustment.
User Defined	FL:USER	ALL USERDEF	Unadjusted IPADS SCP (OS) and mark points (EOL) after closure adjustment.

(3) To send a single point, scroll to the point and press **F6** (SND PNT). POINT LIST page is displayed
with INFO: *xxxx* SENT TO FOS on information line, where *xxxx* is the name of the point. Verify that
FOS received the point per instructions in the FOS operator's manual TB 7021-228-10-1 or –2,
depending on the platform.

(4) To send the full list of SCPs to FOS, press **F7** (SND ALL). POINT LIST page is displayed with
INFO: SEND ALL POINTS: *NN* SECONDS REMAINING: PRESS F9 TO CANCEL on information
line, and F9-CANCEL on function key legend, where *NN* is the number of seconds remaining for
transmission to complete.

   (a) Pressing F9 terminates the send operation. POINT LIST page is displayed with INFO: SEND
ALL POINTS TO FOS CANCELED on information line.

   (b) The POINT LIST page is displayed with INFO: *NN* SURVEY CONTROL POINTS SENT TO
FOS on information line upon completion of the send all operation, where *NN* is the number of
points sent to the FOS. Verify that FOS received the points per instructions in the FOS operator's
manual TB 7021-228-10-1 or 2, depending on the platform.

(5) Press **F9** to display previous page.

(6) To transmit a trig list to IPADS, follow instructions in the FOS operator's manual,
TB 11-7021-228-10-1 or 2, depending on the platform.

NOTE

The POINT LIST page will display INFO: FOS DATA RECEIVED on the
information line if the POINT LIST page is active. Otherwise INFO: FOS
DATA RECEIVED will be displayed the next time the POINT LIST page is
activated.

3-30. Map Display.

WARNING

To avoid the risk of driving accidents, the driver's attention must at all times be focused on safe driving. Prolonged diversion of driver's attention to the CDU screen while driving should be avoided.

NOTE

IPADS provides a digital map display capability to aid in navigation and provide a visual display of point locations. Map display is not required to conduct survey operations.

If a digital map of the local area is loaded in CDU memory, IPADS will display it after the IPADS has been initialized, paragraph 3-12f. A green cross identifies IPADS current position on the map. Icons identify locations of points on the map according to the point filter type. Operator may zoom in or out on map and change map position on the screen. Map operations are described in the following subparagraphs:

(1) Press **F6-MAP** on MENU or NAVIGATION AID page to display MAP page. If no map data are loaded covering the current IPADS location, MAP and INFO: MAP NOT OPEN; SURVEY FUNCTIONS FULLY AVAILABLE are displayed. If map data are available, a map will be displayed centered on current IPADS location. Function key line shows F1-MANUAL, F2-MARK, F3-UPDT, F4-ZUPT, F5-NAV or F5-NAV AID, F6-CENTER, F7-POINTS, F8-STATUS, and F9-MENU.

(2) Press **FNC –** (minus) to zoom out (reduce zoom). Press **FNC +** (plus) to zoom in (increase zoom). Third field on mode line will show zoom level for a few seconds and then reverts to vehicle type.
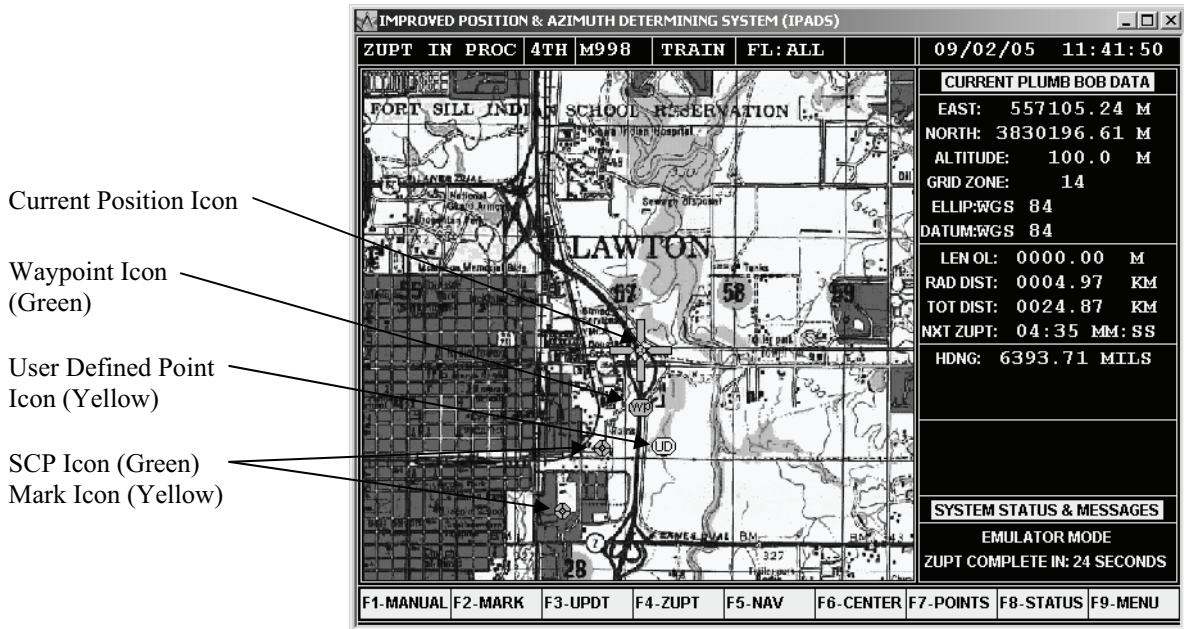
NOTE

When map is centered, IPADS current position remains centered and map moves in response to vehicle motion. When map is not centered, map remains stationary and current position icon moves in response to vehicle motion.

3-30. Map Display - Continued

(3) Press ← to move map westward, ↑ to move map northward, → to move map eastward, or ↓ to move map southward.

(4) Press **F6-CENTER** to center map and restore zoom to 1.000.

(5) Perform the following steps to change type(s) of points displayed on map:

(a) Press **F7-POINTS**. POINT LIST page is displayed. Function key line shows F2-NEW, F4-FILTER, F5-DEL ALL, and F9-EXIT.

(b) Press **F4** until desired point filter type is displayed in fourth field of mode line.

(c) Press **F9** to return to MAP page.

Filter Type	Mode Line	POINT LIST Page	Description
All Points	FL:ALL	ALL POINTS	All points in IPADS database.
Mission	FL:MISN	MISSION FILTER	All unadjusted IPADS points established during current mission.
SCP	FL:SCP	ALL SCP	Unadjusted IPADS SCP (OS), before closure; Adjusted IPADS SCP (OS) after closure adjustment.
Way point	FL:WAY	ALL WAY PTS	Navigation waypoints entered by operator.
Mark	FL:MARK	ALL MARKED PTS	Unadjusted IPADS mark points (EOL), before closure; Adjusted IPADS mark points (EOL) after closure adjustment.
User Defined	FL:USER	ALL USERDEF	Unadjusted IPADS SCP (OS) and mark points (EOL), after closure adjustment.

NOTE

- A gray background will be displayed outside the boundaries of the current map.

- IPADS Map Manager prepares adjacent maps, prepared in the same session, with overlapping boundaries to minimize display of blank (gray) background.

- If maps were prepared with overlapping boundaries, an adjacent map can be displayed by pressing **F6-CENTER** when the gray background is displayed anywhere on the screen.

- If maps were prepared without overlapping boundaries, pressing **F6-CENTER** won't display an adjacent map until the cursor is within the gray background.

- If an adjacent map hasn't been loaded into IPADS, the current display will be retained when **F6-CENTER** is pressed.

- Display of a black background, without text, indicates a map is being displayed but there is no map image data for that area. In this case, pressing **F6-CENTER** will not alter the display.

- It may take several seconds to display a new map when **F6-CENTER** is pressed.
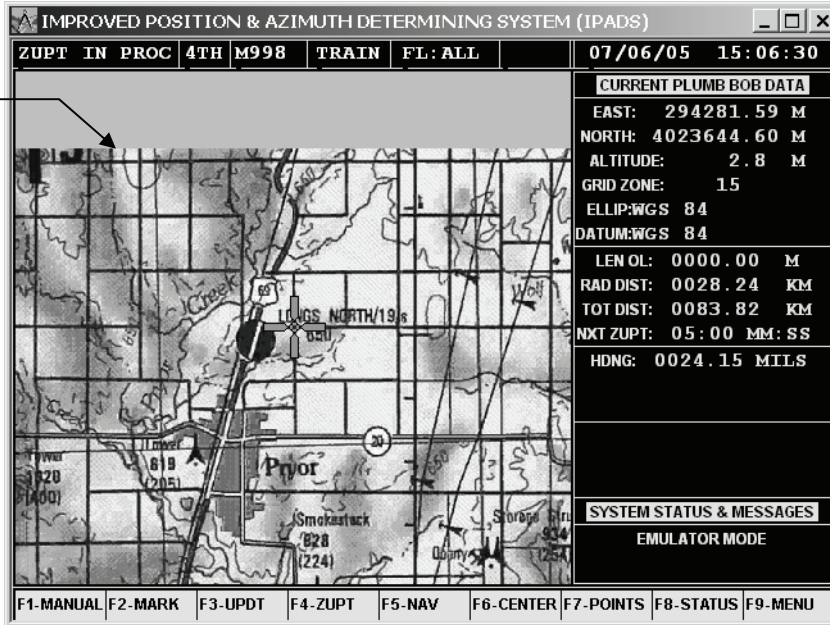
Map Boundary ——————————

(6) When a map boundary is displayed, press **F6-CENTER** to display the adjacent map. If an adjacent map is available, it will be displayed within a few seconds.
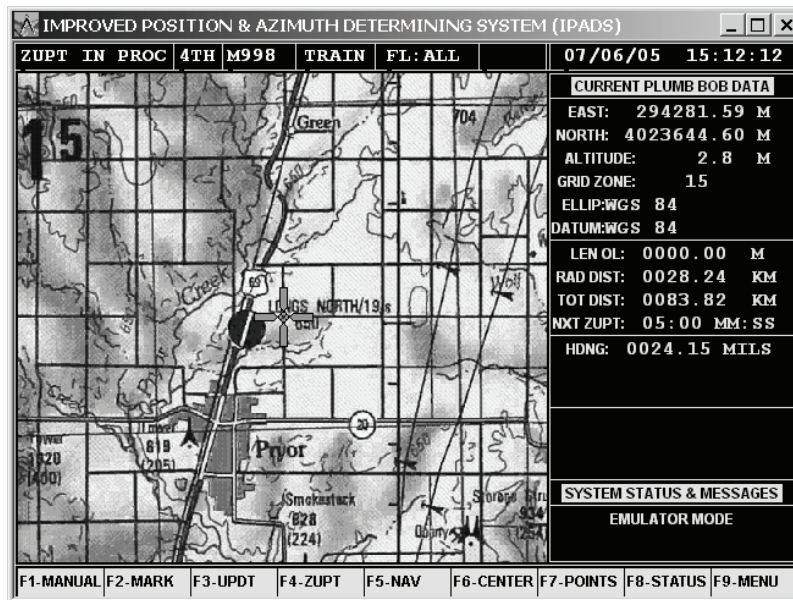
3-31. Waypoint Navigation.

a. Perform the following steps to use the waypoint navigation feature by selecting a point from IPADS database or entering coordinates for a new point.

WARNING

To avoid the risk of driving accidents, the driver's attention must at all times be focused on safe driving. Prolonged diversion of driver's attention to the CDU screen while driving should be avoided.

NOTE

- After position is initialized, IPADS provides data to assist in navigating to an operator-entered waypoint. Waypoint navigation is not required for IPADS to perform survey operations.

- IPADS provides two sources of navigation data after a waypoint is set. RANGE and waypoint azimuth (WP AZ) and steering instructions (e.g. STEER: TURN RIGHT) are available in the navigation data area on the right side of all pages. A graphical navigation aid is available on the NAVIGATION AID page and can be selected by pressing **F5-NAV AID** on the MENU or MAP pages.

- IPADS marked points can be used as waypoints to back track the survey route.

- After IPADS is initialized at a known SCP, the NAVIGATION AID can be useful in recovering other SCPs.

- Position data is in UTM format and angle format is in mils. Latitude/longitude and decimal degrees or degrees, minutes, seconds formats may also be used, paragraph 3-11e(3).

b. **Perform the following steps to set a waypoint and display navigation data**: If a waypoint was previously set and navigation data is displayed, press **F5-NAV AID** from MENU or MAP page to display NAVIGATION AID page. Press **F5-STOPNAV** to stop navigation. Navigation data is no longer displayed and F5 legend changes to F5-NAV.

CAUTION

If **F5-DEL ALL** is pressed, IPADS prompts PRESS **Y** TO DELETE DISPLAYED POINTS; OTHER KEY TO CANCEL. Pressing **Y** permanently deletes all points in displayed list.

(1) From MENU, MAP, or NAVIGATION AID page, press **F3-NAV**. POINT LIST page is displayed with function key legends F2-NEW, F3-SEL PT., F4-FILTER, F5-DEL ALL, and F9-EXIT.

```
┌────────────────────────────────────────────────────────────────────────┐
│ ⋀ IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)      _ □ X       │
├────────────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC │4TH│M998 │ TRAIN │ FL:ALL │      │ 09/02/05  08:05:36       │
├──────────────────────────────────────────┬──────────────────────────────┤
│ POINT LIST:    (UTM)                      │  CURRENT PLUMB BOB DATA       │
│   NAME              EAST M     NORTH M  GZ│ EAST:    556389.13 M          │
│  ──────────────   ─────────  ──────────  ─│ NORTH: 3828850.38 M           │
│                                           │ ALTITUDE:   100.0  M          │
│   FT BRAGG        670057.99  3892648.98  17│ GRID ZONE:    14             │
│   RABBIT          553000.00  3833000.00  14│ ELLIP:WGS 84                 │
│   UABBIT 2        562996.69  3834814.94  14│ DATUM:WGS 84                 │
│  ┌GEORGE          552390.19  3834434.61  14┐│                             │
│  └──────────────  ───────.──  ────────.── ─┘│ LEN OL:  0000.00   M        │
│   ──────────────  ───────.──  ────────.── ─│ RAD DIST: 0005.36  KM        │
│   ──────────────  ───────.──  ────────.── ─│ TOT DIST: 0012.86  KM        │
│   ──────────────  ───────.──  ────────.── ─│ NXT ZUPT:  05:00  MM:SS      │
│   ──────────────  ───────.──  ────────.── ─│ HDNG:  6393.79 MILS          │
│   ──────────────  ───────.──  ────────.── ─│                             │
│   ──────────────  ───────.──  ────────.── ─│                             │
│   ──────────────  ───────.──  ────────.── ─│ RANGE:  0006.88   KM         │
│   ──────────────  ───────.──  ────────.── ─│ WP AZ:  5766.99 MILS         │
│   ──────────────  ───────.──  ────────.── ─│ STEER:  TURN LEFT            │
│   ──────────────  ───────.──  ────────.── ─│ SYSTEM STATUS & MESSAGES     │
│ ALL POINTS : FROM 1 TO 4 OF 4             │      EMULATOR MODE            │
│ "001      " DELETED                       │                             │
├──────────────────────────────────────────┴──────────────────────────────┤
│ F1-    │F2-NEW  │F3-   │ F4-FILTER │F5-DEL ALL│F6-   │ F7- │ F8- │F9-EXIT │
└────────────────────────────────────────────────────────────────────────┘
```

(2) Perform the following steps to select an existing point from database list:

(a) Point filter sets the type of points shown on POINT LIST page. Point filter type is displayed in fourth field of mode line and on POINT LIST page. Set point filter type by pressing **F4** until desired point filter type is displayed.

Filter Type	Mode Line	POINT LIST Page	Description
All Points	FL:ALL	ALL POINTS	All points in IPADS database.
Mission	FL:MISN	MISSION FILTER	All unadjusted IPADS points established during current mission.
SCP	FL:SCP	ALL SCP	Unadjusted IPADS SCP (OS), before closure; Adjusted IPADS SCP (OS) after closure adjustment.
Way point	FL:WAY	ALL WAY PTS	Navigation waypoints entered by operator.
Mark	FL:MARK	ALL MARKED PTS	Unadjusted IPADS mark points (EOL), before closure; Adjusted IPADS mark points (EOL) after closure adjustment.
User Defined	FL:USER	ALL USERDEF	Unadjusted IPADS SCP (OS) and mark points (EOL), after closure adjustment.

(b) Scroll to desired navigation waypoint (e.g. RAILROAD CROSS) and press **F3**.

(3) Perform the following steps to enter coordinates for a new point:

(a) Press **F2**. POINT EDITOR page is displayed with cursor box on TYPE field and function key line F1-USER, F2-WAY, F3-SCP, and F9-EXIT.

(b) Press **F1** for user defined point type, **F2** for waypoint, or **F3** for SCP. Selected point type is displayed. Cursor box moves to PNT NAME field. Function key line shows F2-USE ALL and F9-EXIT.
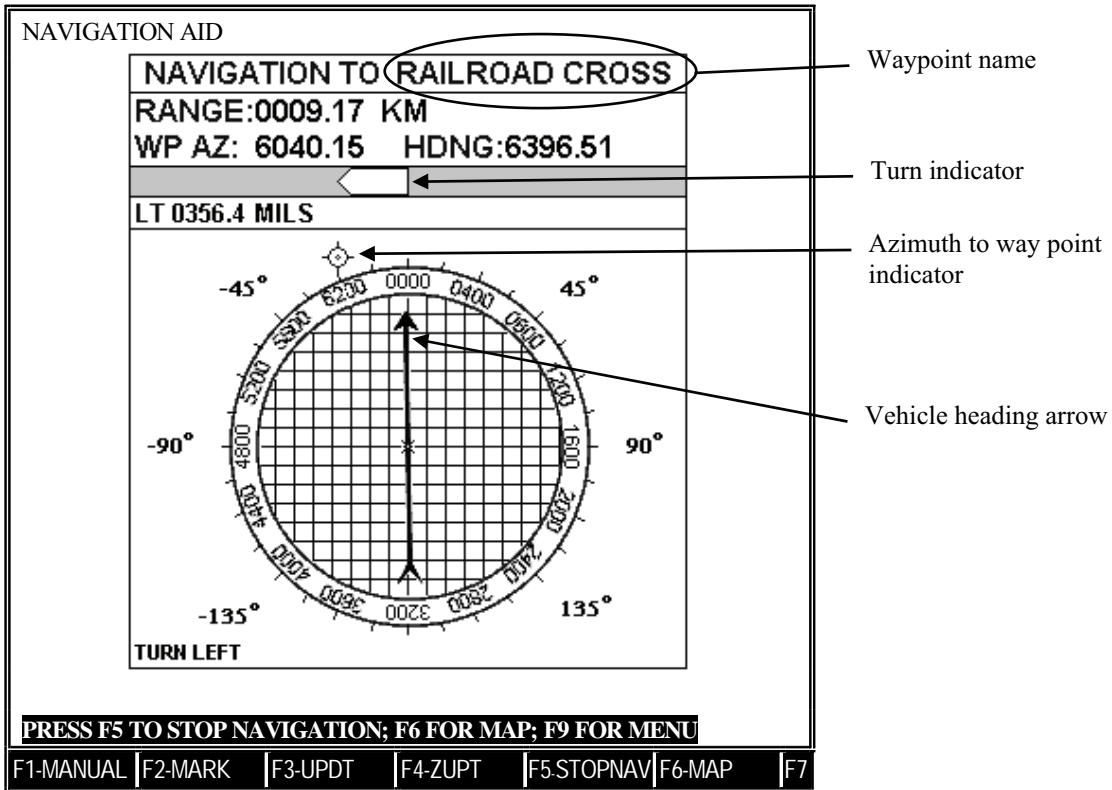
3-31. Waypoint Navigation - Continued

```
┌─────────────────────────────────────────────────────────────────────────┐
│ ⋀ IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)      _ □ ×       │
├─────────────────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC 4TH M998  TRAIN            09/02/05  08:09:36                │
│                                        ┌──────────────────────┐          │
│  POINT EDITOR:     (UTM)               │ CURRENT PLUMB BOB DATA│          │
│                                         EAST:   556389.13 M              │
│   TYPE:        USERDEF                  NORTH: 3828850.38 M              │
│   PNT NAME:   │PNT000000000001│         ALTITUDE:   100.0  M            │
│   ELLIP:       WGS 84                   GRID ZONE:    14                 │
│   DATUM:       WGS 84                   ELLIP:WGS 84                     │
│                                        DATUM:WGS 84                     │
│   EASTING:        000000.00 M           LEN OL:  0000.00   M            │
│   NORTHING:     00000000.00 M           RAD DIST: 0005.36  KM           │
│   ALTITUDE:         0000.0  M           TOT DIST: 0012.86  KM           │
│   GRID ZONE:           00               NXT ZUPT:  05:00 MM:SS          │
│   CREATION DATE: 00/00/00               HDNG:  6393.79 MILS             │
│   CREATION TIME: 00:00:00                                               │
│                                                                         │
│                                         RANGE:  0006.88   KM            │
│                                         WP AZ:  5766.99 MILS            │
│                                         STEER:  TURN LEFT               │
│   DESCRIPTION:                          ┌──────────────────────┐        │
│   >                                     │ SYSTEM STATUS & MESSAGES│      │
│   ┌──────────────────────────────────┐     EMULATOR MODE               │
│   │PRESS ENTER TO ACCEPT NAME OR TYPE NEW NAME│                         │
│   └──────────────────────────────────┘                                 │
├─────────────────────────────────────────────────────────────────────────┤
│ F1-   F2-USEALL F3-   F4-ZUPT F5-  F6-   F7-   F8-   F9-EXIT            │
└─────────────────────────────────────────────────────────────────────────┘
```

(c) Press **ENTER** to accept pre-assigned name or press **FNC DEL** to clear PNT NAME field and enter the new name.

(d) Verify ellipsoid is correct for coordinates being entered. If ellipsoid is incorrect, scroll to ELLIP field, press **ENTER**, and enter new ellipsoid and datum, paragraph 3-11d(1).

(e) Verify datum is correct for coordinates being entered. If datum is incorrect, scroll to DATUM field, press **ENTER**, and enter new datum, paragraph 3-11d(2).

(f) Scroll to EASTING field and enter easting value in meters.

(g) Scroll to NORTHING field and enter northing value in meters.

(h) Scroll to ALTITUDE field and enter altitude value in meters.

(i) Scroll to GRID ZONE field and enter positive (+) UTM grid zone value for Northern Hemisphere, or negative (-) UTM grid zone value for Southern Hemisphere.

(j) Optional – scroll to DESCRIPTION and enter a point description.

(k) Verify entered data. If it is correct, press **F2**. Otherwise, scroll to incorrect field and enter correct data.

(l) INFO: POINT WAS SUCCESSFULLY ADDED is displayed. Press **F9**-EXIT to return to POINT LIST page.

(m) Scroll to newly entered point and press **F3-SEL PT**.

(4) NAVIGATION AID page is displayed. Function key line shows F1-MANUAL, F2-MARK, F3-UPDT, F4-ZUPT, F5-STOPNAV, F6-MAP, F7-POINTS, F8-STATUS, and F9-MENU.

NAVIGATION AID

NAVIGATION TO RAILROAD CROSS — Waypoint name

RANGE:0009.17 KM
WP AZ: 6040.15   HDNG:6396.51

— Turn indicator

LT 0356.4 MILS

— Azimuth to way point indicator

-45°   0000   45°

-90°   90°

— Vehicle heading arrow

-135°   135°

TURN LEFT

PRESS F5 TO STOP NAVIGATION; F6 FOR MAP; F9 FOR MENU

| F1-MANUAL | F2-MARK | F3-UPDT | F4-ZUPT | F5-STOPNAV | F6-MAP | F7 |

(5) Press **F5** to stop navigation data display, **F6** to display MAP page, or **F9** to display MENU.

3-32. Transfer Between Land Vehicles.

NOTE

- Ensure BCU BATTERY GOOD and BATTERY TEMP indicators are illuminated prior to transferring an operating IPADS between vehicles.
- Transfer system to the second vehicle's power quickly to minimize discharge of batteries.
- Initiate a ZUPT whenever the system is stationary.

a. If the IPADS will be transferred to a vehicle that already has a full vehicle installation kit (base plate, CDU mount, plumb bob bracket or arm, and W116-1 power cable) installed, remove IPADS as follows:

(1) Position vehicles for easy transfer of IPADS and clear canvas and remove support and personal gear, as needed to provide uncluttered access.

(2) If connected, disconnect FOS data cable W136 P1 from CDU J2 and place caps on CDU and cable connectors.

(3) Place the CDU in the CDU carrier on the IPADS frame keeping the CDU switch in the ON position and the W114 cable connected.

(4) Keep both BCU power switches (DC INPUT and OUTPUT) in the ON position.

(5) If installed, remove two T-handles securing two clamping brackets to second (gaining) vehicle's floor plate.

(6) Remove two T-handles securing two clamping brackets to first vehicle's floor plate.

(7) Move IPADS frame assembly a few inches to disengage pins in alignment bracket assembly.

(8) When ready to transfer, turn the BCU INPUT power switch to OFF (IPADS should remain operational, running on internal IPADS batteries; all BCU LEDs will be extinguished).

(9) Disconnect W116-1 from the BCU.

(10) Using a four-man lift, remove the IPADS assembly from first vehicle and place it on the base plate in the second vehicle.

(11) Connect W116-1 to the BCU.

(12) Turn the BCU INPUT power switch to ON.

(13) Slide IPADS frame assembly to engage pins on alignment bracket assembly, Figure 2-8 (HMMWV) or Figure 2-43 (SUSV).

(14) Adjust alignment pins as necessary, paragraph 2-8.e.

(15) Secure IPADS frame to floor plate using two T-handles and two clamping brackets, Figure 2-10 (HMMWV) or Figure 2-44 (SUSV).

(16) Remove the CDU from the CDU carrier on the IPADS frame and attach it to bracket assembly by aligning two pins located on CDU plate with CDU and secure using two locking latches on CDU plate, Figures 2-20 and 2-21.

(17) If vehicle types are different, change vehicle type on the CDU, paragraph 3-11b.

(18) Reattach T-handles and clamping brackets to first vehicle's floor plate after IPADS has been moved.

b. If IPADS will be transported to a vehicle that does not have a base plate already installed, remove as follows:

(1) Since this procedure will take longer than the 15 minutes of back up battery power provided by the IPADS, you will need to shut down the IPADS system.

(2) If connected, disconnect FOS data cable W136 P1 from CDU J2 and place caps on CDU and cable connectors.

(3) Disconnect W114 cable from CDU and place the CDU back in the CDU carrier on the IPADS frame

(4) Disconnect W116-1 from the BCU.

(5) Using a four-man lift, remove the IPADS assembly from one vehicle and place it in a secure location.

(6) From the vehicle that will be losing the IPADS, remove the W116-1 from the vehicle battery.

(7) Remove the IPADS base plate from the floor of the vehicle.

(8) Install the IPADS in the next vehicle, paragraph 2-6.

(9) If vehicle types are different, change vehicle type on the CDU, paragraph 3-11b.
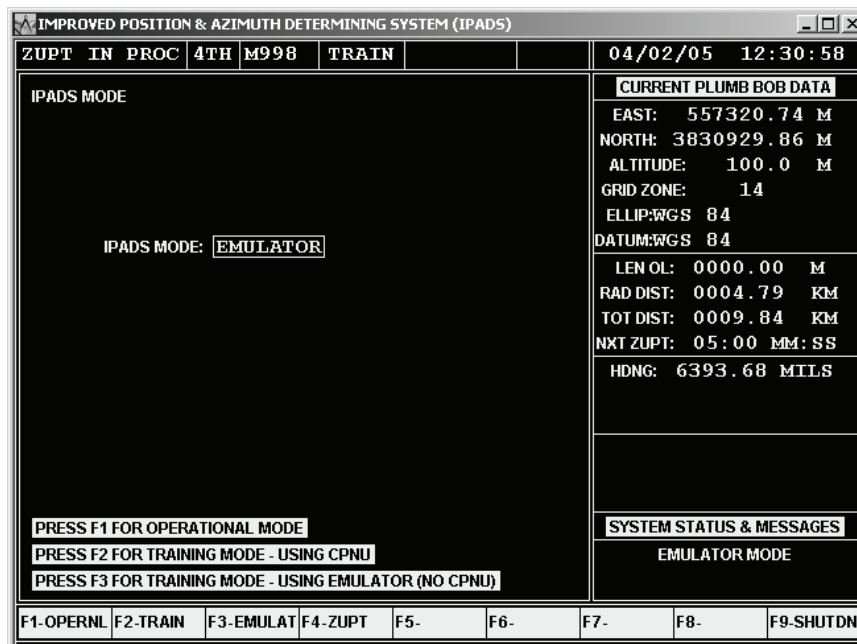
3-33. Operation in Emulator Mode.

The IPADS software can be operated in emulator mode for training purposes on an IPADS CDU, with or without a CPNU, or on a standard IBM Personal Computer (PC)-compatible machine. This paragraph describes operation without CPNU. In emulator mode the CDU does not communicate to, or use the CPNU. See paragraph 3-5 for operation in training mode with a complete IPADS.

NOTE

- IPADS indicates it is in one of the two training modes by displaying the word TRAIN on the top line as shown in Figure 3-4. In addition, the top line font will be white, when in a training mode. In normal operations, the top line font will be amber, and the word TRAIN will not be displayed.

- Points created using the training modes will not be available in normal operation mode, and vice versa. This is done to ensure that operational data is not corrupted with training data.

- Switching from normal operation mode to training modes requires operator confirmation. Upon confirmation, when using IPADS, the CDU will then be shut down. Recycle power using the BCU OUTPUT switch.

- When using a PC, the PC will not be shutdown, but the IPADS emulator will be exited. The operator must then re-start the emulator. All other operations described below operate the same on a PC or CDU.

- When changing from training modes to normal operation mode the time/date will not restore to the normal operation mode.

3-33. Operation in Emulator Mode – Continued

a. When starting IPADS, the IPADS MODE screen is displayed with function keys F1-OPERNL, F2-TRAIN, F3-EMULAT, and F4-ZUPT. If the IPADS MODE screen does not display when IPADS is turned on, refer to paragraph 4-5, Field Troubleshooting.

```
┌──────────────────────────────────────────────────────────────┐
│ ▓ IMPROVED POSITION & AZIMUTH DETERMINING SYSTEM (IPADS)  _ □ X │
├──────────────────────────────────────────────────────────────┤
│ ZUPT IN PROC 4TH M998   TRAIN           04/02/05  12:30:58     │
│                                                                │
│  IPADS MODE                              CURRENT PLUMB BOB DATA │
│                                          EAST:    557320.74  M │
│                                          NORTH: 3830929.86  M  │
│                                          ALTITUDE:    100.0  M │
│                                          GRID ZONE:     14     │
│                                           ELLIP:WGS 84         │
│                                          DATUM:WGS 84          │
│            IPADS MODE: EMULATOR            LEN OL:  0000.00  M │
│                                           RAD DIST: 0004.79 KM │
│                                           TOT DIST: 0009.84 KM │
│                                          NXT ZUPT: 05:00 MM:SS │
│                                            HDNG: 6393.68 MILS  │
│                                                                │
│                                                                │
│  PRESS F1 FOR OPERATIONAL MODE            SYSTEM STATUS & MESSAGES │
│  PRESS F2 FOR TRAINING MODE - USING CPNU       EMULATOR MODE   │
│  PRESS F3 FOR TRAINING MODE - USING EMULATOR (NO CPNU)         │
├──────────────────────────────────────────────────────────────┤
│ F1-OPERNL F2-TRAIN F3-EMULAT F4-ZUPT F5-  F6-  F7-  F8-  F9-SHUTDN │
└──────────────────────────────────────────────────────────────┘
```

b. To access the emulator press **F3** – "PRESS F3 FOR TRAINING MODE – USING EMULATOR (NO CPNU)."

c. IPADS requires shutdown to change modes. When prompted, press **Y** to confirm shutdown or press any other key to cancel.

NOTE

- Points created using the training modes will not be available in normal operation mode, and vice versa.
- Switching from normal operation mode to training modes requires operator confirmation. When using IPADS, the CDU will then be shut down. When using a PC, the PC will not be shutdown, but the IPADS emulator will be exited. The operator must then re-start the emulator. All other operations described below may not operate the same on a PC.
- When changing from training modes to normal operation mode the time/date will not restore to the normal operation mode.

d. Emulator mode capabilities. Verify IPADS is in the emulator mode as indicated by the white text and the word "TRAIN" at the top of the CDU display. While in the emulator mode the IPADS CDU will not communicate with the CPNU, and will not be capable of performing normal survey operations. However the operator can simulate:

(1) Position initialization simulation. See paragraph 3-13 for entering initial position in either UTM or geodetic form.

(2) Motion simulation. Once position is initialized, simulate movement by entering NAVAID or the MAP page (press **F5** or **F6** on the MENU) and using the A, W, D, and X keys to simulate motion in the westerly, northerly, easterly, and southerly directions. Prolonged depression of any of these will rapidly increase simulated vehicle speed. Use S to stop motion, R to simulate rotation to the right and L for rotation to the left. For example, when the IPADS is initiated between 65 and 75 degrees north and south latitude the IPADS will tell the operator to spin the vehicle around 180 degrees so the

IPADS can continue to align. This can be simulated in the emulator by using the R and L keys to simulate turning the vehicle 180 degrees.

(3) Marking simulation. Simulate marking operations as described in paragraph 3-21. To simulate 2-position azimuth marking when the CDU displays **OS (P1) MARKED; MOVE TO EOL (P2) POSITION**, paragraph 3-23, simulate movement to EOL as described above (motion simulation). The LEN OL indicator and TIME IN P1 – P2 OPERATION *xx:xx* will operate as normal.

(4) Update simulation. Once simulation of mission is complete (points were marked), an update can be simulated. Simulate motion from the last marked point to a few meters from the initial or another survey control point. Follow instructions in paragraph 3-15a to simulate the update using the initial or other SCP point data. The IPADS position will appear to be updated as described in paragraph 3-15c, and the marked points will be adjusted based on their simulated total distance traveled from the initialization point, and the error between the SCP used and the simulated IPADS closing position.

e.   Map display capability is available and operates as described in paragraph 3-29.

Waypoint navigation is available and operates as described in paragraph 3-30, except that vehicle heading remains pointing TRUE north.

To switch to normal operation follow instructions in paragraph 3-11a(1).

f.   To shut down, follow instructions in paragraph 3-6b.

SECTION III. OPERATION UNDER UNUSUAL CONDITIONS

3-34. Operation in Extremely Rough Terrain. Not applicable.

3-35. Operation at Temperature Extremes.

    a.   **Operation in Extreme Heat.**

       (1) Operation of IPADS in ambient temperatures above 115º F may cause the internal BCU battery temperature to approach or exceed 150º F.

CAUTION

IPADS batteries contain an internal thermal cutoff switch to protect them from extreme heat. If the internal battery temperature approaches 150º F, the BCU may not provide backup battery power for IPADS operation.

       (2) **Extended Mission.** IPADS can be operated for long periods of time on vehicle battery power. If it is necessary to extend a mission after operating IPADS at temperatures of 115º F or above, do not turn vehicle off or turn IPADS DC INPUT power off before performing a one-position mark. The Hot Start initialization procedure can be used to reinitialize IPADS if necessary.

       (3) **Transfer Between Vehicles.** If a vehicle-to-vehicle transfer is required for an IPADS that has been operated for long periods of time at temperatures of 115º F or above, perform a one-position mark before switching over to backup battery power. The marked point can be used to reinitialize IPADS if necessary.

    b.   **Operation in Extreme Cold.**

CAUTION

- Permanent damage to the IPADS CDU Active Matrix Liquid Crystal Display (AMLCD) screen may result from exposure to temperatures below -40º F.

- Permanent damage to the IPADS CDU hard disk drive (HDD) may result from operation at temperatures below –22º F.

- Degradation of instrument (CPNU) accuracy may occur at temperatures below –22º F.

       (1) **CDU Operation.** Ensure that vehicle temperature is raised above –22 º F using vehicle heater, prior to installing CDU in vehicle. When powering up the IPADS at temperatures below –4 º F, the CDU power indicator, will flash to indicate that the CDU is warming up. This could take up to 5 minutes. After the warm-up period, the CDU will operate as normal.

       (2) **CPNU Operation.** Ensure that temperature in cargo area of vehicle is raised above – 22 º F using vehicle heater or Arctic heater unit prior to commencement of survey operations.

       (3) If IPADS batteries have been stored for long periods of time at temperatures of –30 º F or below it may take at least one hour of operation for the batteries to warm up and the IPADS Battery Temperature indicator light to illuminate. The time required to allow the IPADS batteries to reach their normal rated operating temperature can be reduced by using vehicle heaters to heat the vehicle compartment while running IPADS on vehicle power.

       (4) **Transfer Between Vehicles.** If the BCU Battery Good and Battery Temperature indicators are not illuminated before performing a vehicle-to-vehicle transfer, perform a one-position mark before switching over to IPADS backup battery power. If IPADS shuts down during the transfer, reinitialize it over the last marked point.

3-36. Operation at Extreme Northern or Southern Latitudes.

The IPADS initialization procedure requires a two-step approach to assure that accuracies are met at latitudes greater than 65º. Normal and hot start initialization times increase to 20 and 10 minutes, respectively. Half way through initialization, the CDU will prompt the operator audibly and visually to turn the vehicle around, approximately 180º. The CDU also displays driver guidance instructions, for turning the vehicle, until the correct heading is reached. The IPADS will then continue to initialize and alert the operator when ready to start surveying.

IPADS horizontal position accuracy degrades at higher latitudes. When the operational situation permits, use the following techniques to plan survey missions and keep horizontal position errors within allowable limits:

NOTE

At high latitudes, azimuth misalignment is a major contributor to IPADS horizontal position error. Adjustment doesn't remove azimuth misalignment error when the survey is closed back at the starting point.

a.   Close the survey at a known SCP other than the starting SCP. Closing at a SCP near the far end of the survey removes most of the error caused by azimuth misalignment.

NOTE

Position error, resulting from azimuth misalignment, grows with distance from the starting point.

b.   If it's not possible to close at a SCP near the far end of the survey, restrict the maximum radial distance from the starting point to 50 Km.

NOTE

IPADS reduces azimuth misalignment as it surveys.

c.   Keep IPADS running between surveys, which also minimizes initialization time for subsequent surveys.

NOTE

IPADS reduces azimuth misalignment when the survey trajectory changes direction, especially near the start of the survey.

d.   Do not conduct surveys in a straight line. Changes in direction, especially near the beginning of a survey, improve accuracy.

Start/Close

"Poor" Survey Traject
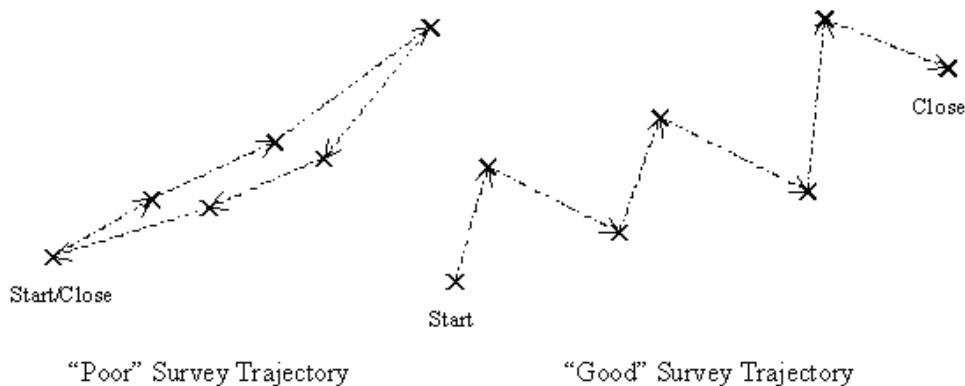
3-37. Operation in Sand Storms.

The IPADS will operate as normal in sand storms. While within the vehicle, minimize direct CDU exposure to the blowing sand. If transferring IPADS between vehicles in a sand storm, cover the CDU during the transfer to minimize direct screen exposure to the blowing sand.

CAUTION

While the IPADS CDU will operate in sand storms, direct exposure of the CDU
screen to blowing sand can permanently etch the screen, reducing readability.

3-38. Operation Under Emergency Conditions.

The IPADS CDU has the capability to perform an emergency zeroize to avoid compromising sensitive data.

DESTRUCTION OF ARMY MATERIAL TO PREVENT ENEMY USE. To render the IPADS unserviceable, thus denying its use by the enemy, perform the emergency zeroize procedure.

CAUTION

Improper use of the emergency zeroize procedure may cause the CDU to stop
functioning, requiring complete CDU reprogramming.

a.   To perform an emergency zeroize on the IPADS, press **FNC** and **ERS** simultaneously. The RHC Purge Dialog menu will be shown.
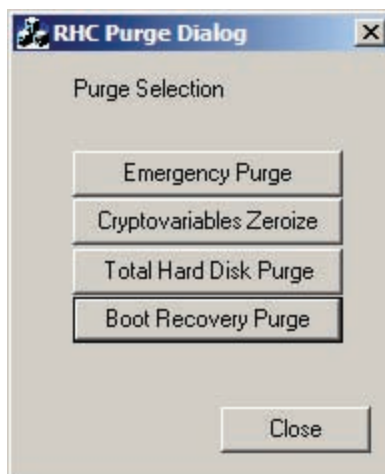
b.   Using the up or down arrows, select the Emergency Purge button and press **ENTER**.

CHAPTER 4

FIELD MAINTENANCE INSTRUCTIONS

SECTION I. TOOLS AND EQUIPMENT

4-1. General. Tools required for most field maintenance are contained in a kit located in the storage box on the IPADS frame and are listed in the Basic Issue Items List, Appendix B, Section III.

    a. Paint IPADS with CARC paint (app F, item 4) and a small brush (app F, item 5) for touchup painting only.

    b. Assistance in troubleshooting battery problems may be obtained from Sustainment Maintenance personnel.

SECTION II. LUBRICATING INSTRUCTIONS

4-2. General. There is no lubrication required for IPADS.

SECTION III. FIELD PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-3. General. Safe and efficient IPADS operation requires regular checks of equipment. When performing PMCS, the operator discovers equipment malfunctions or performs routine maintenance for upkeep of the IPADS. Malfunctions require corrective action to avoid equipment failure or injury to personnel. The necessary preventive maintenance checks and services to be performed are listed and described in Table 4-1. Item numbers in the tables indicate sequence of minimum inspection requirements. Note defects discovered during operation for correction after operation. Stop operation immediately if a deficiency is noted which would damage the equipment. When performing Table 4-1, observe the following:

    a. Always observe the WARNINGS and CAUTIONS appearing in your PMCS table. Warnings and cautions appear before applicable procedures. You must observe these WARNINGS to prevent serious injury to yourself and others and CAUTIONS to prevent your equipment from being damaged.

    b. If your equipment fails to operate, troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA Pam 738-750, The Army Maintenance Management System (TAMMS). Marine Corps users shall refer to TM 4700-15/1.

4-4. Explanation of Table Entries.

    a. Item Number column. Numbers in this column are for reference. When completing DA Form 2404 or DA Form 5988-E (Equipment Inspection and Maintenance Worksheet), include the item number for the check/service indicating a fault. Item numbers also appear in the order that you must do checks and services for the intervals listed.

    b. Interval column. This column tells you when you must do the procedure listed in the procedure column. BEFORE operation procedures must be done before you operate or use the equipment for its intended mission. AFTER operation procedures must be done immediately after you have operated or used your equipment.

    c. Item to be Inspected column. This column provides the item to be checked or serviced.

    d. Procedure column. This column gives the procedure you perform to check or service the item listed in the Item to be Inspected column so you know if the equipment is ready or available for its intended mission or for operation. You must do this procedure at the time stated in the Interval column.

    e. Equipment Not Ready/Available If column. Information in this column tells you what faults will keep your equipment from being capable of performing its primary mission. If you make check and service procedures that show fault listed in this column, do not operate the equipment until it is repaired or becomes fully operational. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.

    f. Other Table Entries. Be sure to observe all special information and notes that appear in your PMCS table.

4-4. Explanation of Table Entries - Continued

Table 4-1. Field Preventive Maintenance Checks and Services

NOTE Within designated interval, these checks are to be performed in the order listed		
B - Before	**A** - After	**M** - Monthly
D - During	**W** - Weekly	

Item No.	Interval					Item to be Inspected	Procedure	Equipment Not Ready/Available If
	B	**D**	**A**	**W**	**M**			
							CAUTION Cable connectors may be damaged by improper operation. Release connectors by turning locking ring counterclockwise. Never turn the backshell. Align keyways before mating connectors. Secure connectors by turning locking ring clockwise until it locks. **Pre-Turn On Checks and Services**	
1	●					Flashlight	Check operation of flashlight.	If flashlight does not turn on equipment not ready.
2	●					Porro-prism assembly	Inspect porro-prism assembly for damage or degraded reflectivity. Check leveling mechanism for smooth operation throughout its range and that level vial is not damaged. Check that porro-prism cover is securely latched.	
3	●					Alignment bracket assembly	Check all t-handle bolts on the alignment bracket assembly for hand tightness.	
4	●					IPADS frame	Check that IPADS frame is securely fastened. **Initialization Inspection** Perform immediately after turn-on for each mission.	
5			●			Power indicators	Check BCU indicator lights for presence of vehicle power.	Vehicle power not present.

Table 4-1. Field Preventive Maintenance Checks and Services

Item No.	Interval					Item to be Inspected	Procedure	Equipment Not Ready/Available If
	B	D	A	W	M			
6		•				Battery Good indicator	**CAUTION** IPADS may shut down if disconnected from vehicle power and the charge state indicator is not illuminated. Check that BCU Battery Good indicator is illuminated. New batteries require 24 hours to charge.	Battery Good indicator is NOT illuminated.
7		•				CDU status display	During CDU boot up, check status display for failure indications. Check that audible alarm is operational. With switch in STLTH position, check that screen dims and sound decreases. With switch in KBD, check that keyboard illuminates.	Any indicated failure.
8		•				Internal IPADS batteries	**Battery Test** **NOTE** This test provides a check of IPADS battery operation under load. A battery test will be performed at the end of a mission to minimize the impact of a defective battery and IPADS shutdown. a. While IPADS is operating, note that the BCU Battery Good indicator is illuminated. b. Disconnect vehicle power by setting BCU **DC INPUT** power switch to OFF. IPADS should remain operating with the input power indicator dark. c. After 3 minutes of battery operation, either set BCU **DC INPUT** power switch to ON to continue operation or turn IPADS off.	If IPADS shuts off before 3 minutes.
9			•			BCU batteries	Inspect BCU batteries for cracked case, leakage, or corrosion.	Case is cracked, or leakage or corrosion is present.
10			•			BCU connectors	Inspect connectors for bent or damaged pins and covers are present and attached.	Cable connector pins are damaged.

4-4. Explanation of Table Entries - Continued

Table 4-1. Field Preventive Maintenance Checks and Services

Item No.	Interval					Item to be Inspected	Procedure	Equipment Not Ready/Available If
	B	D	A	W	M			
11			●			Vehicle battery power cable connections	Check that connections to the vehicle batteries are tight. If NATO connector is used, insure connector plugs are secure.	
12					●	Porro-prism alignment	Check for loose screws and level vials not broken and not cloudy to the point that stadia scale is not readable.	
13			●		●	Porro-prism accuracy	**Porro-Prism Alignment Test** a. Turn on and initialize IPADS. b. Update IPADS over 4th order or higher SCP that has a known accurate azimuth. c. Maneuver vehicle, if required, to achieve auto reflection from porro-prism with prism leveled and with theodolite plumbed over SCP. d. With theodolite sighted on porro-prism and instrument initial circle reading set, measure and record horizontal angle to EOL. Measure and record distance and vertical angle. e. Plunge theodolite telescope and repeat step d. f. Mean the horizontal angles, distances, and vertical angles obtained in steps d. and e. g. Perform a theodolite mark using the mean horizontal angle, distance, and vertical angle calculated in step f. h. The IPADS determined azimuth must agree with the surveyed azimuth within .050 mils.	If IPADS and surveyed azimuths differ more than 0.050 mils porro prism is unserviceable. Repair of damaged or unserviceable item is achieved through replacement. Refer to paragraph 4-6 for further detail. If porro prism is unserviceable the entire IPADS needs to be sent to depot level maintenance.

SECTION IV. FIELD TROUBLESHOOTING

4-5. General. When an IPADS component fails, the failed area is readily identified through the internal fault isolation process. IPADS possesses a Built-In Test (BIT). This BIT allows the operator to identify the component or group of components with the fault. Fault identification is displayed in one of three ways. For the CPNU, a message will be sent via the CDU. The CDU contains its own internal BIT that will notify of a specific failure in the CDU. A BCU failure is displayed through the LEDs on the front and top of the BCU. On the CDU STATUS page the operational status of the CPNU can be checked. The software versions used on IPADS and the IPADS Elapsed Time Indicator (ETI) are also displayed on the STATUS page. This section describes troubleshooting to isolate faults to a specific LRU (BCU, CDU, or CPNU). Before performing troubleshooting tasks, carefully read the operating instructions and follow all notes, cautions, and warnings.

Malfunction

> **Test or Inspection**

> > **Corrective Action**

NOTE

If possible, troubleshoot by replacing with another known good Line Replaceable Unit (LRU). This will isolate the problem to the LRU or cable.

1. IPADS will not power up.

    Step 1. Inspect all cables to ensure they are not cut or pinched and are connected securely at the connectors.
    a. If all cables are in serviceable condition, take off and reconnect at each connector.
    b. Notify maintenance support (see paragraph 5-1).
    c. If any cable is not serviceable, turn in for repair, paragraph 4-6.
    d. If cables are serviceable, go to Step 2.

    Step 2. Check to ensure all power switches on the BCU and CDU are ON.
    a. Place switches to the ON position.
    b. If switches are already on go to Step 3.

    Step 3. If connected to vehicle, check to ensure the BCU DC Power Input LED is illuminated.
    a. If LED is not illuminated, check W116 cable, paragraph 5-1.
    b. If power cable is good, check vehicle battery.
    c. If vehicle battery is good, turn in BCU for repair, paragraph 4-6.

    Step 4. If connected to AC power, check to ensure the BCU AC LED is illuminated.
    a. If not illuminated, check the AC cable, paragraph 5-1.
    b. Notify maintenance support.
    c. If cable is not serviceable, turn in for repair.
    d. If AC cable is serviceable, replace BCU fuse, paragraph 4-10.
    e. If BCU fuse is good, turn in BCU for repair, paragraph 4-6.

4-5. General - Continued

Malfunction

    Test or Inspection

        Corrective Action

2. The CPNU will not power up.

    Step 1. Inspect wiring harness W114 cable connectors for looseness.
        a. If tight, go to Step 2.
        b. If loose, tighten and recycle power and try to power up IPADS.
        c. If the CPNU will not power up, go to Step 2.

    Step 2. Inspect wiring harness W114 to ensure it is not cut or pinched and there are no bent or damaged pins.
        a. If damaged, replace wiring harness by turning in, paragraph 4-6.
        b. Recycle power and try to power up IPADS.
        c. If CPNU will not power up, turn in entire IPADS for repair, paragraph 4-6.
        d. If cable appears serviceable, notify maintenance support.
        e. If maintenance support verifies wiring harness is serviceable, turn in entire IPADS for repair, paragraph 4-6.

3. The CPNU powers up and then shuts down during initialization.

    Step 1. Check the CDU Sys Status Screen for errors.
        a. If there are no errors, go to Step 2.

    Step 2. Check initialization grid coordinates for accuracy.
        a. If grid coordinates more than 100 meters off, enter correct grid and initialize.
        b. If CPNU shuts down or errors shown in the Sys Status, turn IPADS in for repair, paragraph 4-6.

4. The CDU will not power up.

    Step 1. Inspect wiring harness W114 cable connectors for looseness.
        a. If tight, go to Step 2.
        b. If loose, tighten and recycle power and try to power up IPADS.
        c. If CDU will not power up, go to Step 2.

    Step 2. Inspect wiring harness W114 to ensure it is not cut or pinched and there are no bent or damaged pins.
        a. If damaged, replace wiring harness by turning in, paragraph 4-6.
        b. Recycle power and try to power up IPADS.
        c. If CDU will not power up, turn in CDU for repair, paragraph 4-6.
        d. If cable appears serviceable, notify maintenance support.
        e. If maintenance support verifies wiring harness is serviceable, turn in CDU for repair, paragraph 4-6.

5. CDU fails BIT.

    Step 1. Recycle power as described in paragraph 3-6a.
        a. Observe CDU boot up for BIT.
        b. If BIT screen appears, CDU is good.
        c. If the CDU does not pass BIT, turn in CDU for repair, paragraph 4-6.

6. CPNU fails BIT.

    Step 1. Recycle power as described in paragraph 3-6a.
        a. If the CPNU does not pass BIT (CPNU COMM OK on IPADS SYSTEM STATUS AND MESSAGES indicator) turn IPADS in for repair, paragraph 4-6.

Malfunction

    Test or Inspection

        Corrective Action

7.   IPADS shuts down during transfer to another vehicle.

     Step 1. Check BCU Battery Good indicator to see if it is illuminated.
        a. If LED is not illuminated, charge backup battery for four hours.
        b. With IPADS running on vehicle power, turn **DC INPUT** switch off.
        c. If IPADS continues to run, backup battery is good.
        d. If IPADS shuts down, replace both backup batteries.

8.   BCU Battery Temp LED not illuminated.

NOTE

If IPADS is operating on AC power or battery backup power, the battery temperature light will not be illuminated.

     Step 1. Turn in BCU for repair, paragraph 4-6.

9.   IPADS CDU fails to communicate with FOS.

     Step 1. Inspect FOS cable W136 to ensure it is not cut or pinched, it is connected securely at the connectors and there are no bent or damaged pins.
        a. If cable is not serviceable, disconnect and turn in for repair, paragraph 4-6.
        b. Notify maintenance support (paragraph 5-1).

     Step 2. Check the System Status for error messages.
        a. If there is an error message, turn in CDU for repair, paragraph 4-6.
        b. If there is no error message, go to Step 3.

     Step 3. Replace FOS with serviceable FOS.
        a. Retry communication.
        b. If communication is good, repair is complete.
        c. If communication fails, turn in CDU for repair, paragraph 4-6.

10. SYSTEM STATUS & MESSAGES shows **CPNU COMM FAIL**.
     Step 1. Check wiring harness W114 cable connectors for looseness.
        a. If tight, go to Step 2.
        b. If loose, tighten, recycle power, and try to power up IPADS.
        c. If still no communications between CDU and CPNU, go to Step 2.

     Step 2. Check wiring harness W114 for continuity.
        a. Turn off IPADS.
        b. Notify maintenance.
        c. Perform continuity check on wiring harness W114.
        d. If W114 is unserviceable, turn it in for repair, paragraph 4-6.
        e. Reconnect W114 and turn on IPADS.
        f. If still no communications between CDU and CPNU, go to Step 3.

     Step 3. Check the System Status for error messages.
        a. If there is an error message, turn in CDU for repair, paragraph 4-6.
        b. If there is no error message, go to Step 4.

     Step 4. If available, replace CDU with known good CDU.
        a. If known good CDU works, turn bad CDU into depot level repair.

4-5. General - Continued

Malfunction

    Test or Inspection

        Corrective Action

11. IPADS WARNING: ERROR ACCESSING MAIN DATABASE CONNECTION, ATTEMPTING RESTORE OF BACKUP DATABASE.

    Step. 1 Press Enter.
        a. If CDU display comes up normally, press **F7-POINTS** and review stored data.
        b. Enter data for any points that were lost.
        c. Continue with mission.
        d. If IPADS WARNING: ERROR ACCESSING DATABASE, ATTEMPTING RESTORE OF BLANK DATABASE is displayed, go to Step 2.

    Step 2. Press Enter.
        a. If CDU display comes up normally, enter data for any points that were lost.
        b. Continue with mission.
        c. If IPADS FATAL ERROR: ERROR ESTABLISHING DATA BASE CONNECTION, PROGRAM TERMINATING is displayed, go to Step 3.

    Step 3. Press Enter.

    Step 4. Turn BCU OUTPUT switch OFF when IT IS NOW SAFE TO TURN OFF YOUR COMPUTER is displayed.

    Step 5. Reprogram CDU, paragraph 7-1.

    Step 6. Power IPADS ON and enter any required point data in the empty database.

12. IPADS FATAL ERROR: ERROR ACCESSING EGM DATABASE FILE, PROGRAM TERMINATING.

    Step 1. Press Enter.

    Step 2. Turn BCU OUTPUT switch OFF when IT IS NOW SAFE TO TURN OFF YOUR COMPUTER is displayed.

    Step 3. Reprogram CDU, paragraph 7-1.

    Step 4. Power IPADS ON and verify normal CDU display.

SECTION V. MAINTENANCE OF IPADS/GETTING IPADS REPAIRED

4-6. General. Sustainment level personnel are qualified to perform all required maintenance of the IPADS. Once identified, the component that has failed will be removed from the IPADS frame, IAW paragraphs 4-7 through 4-11. Call the inventory specialist at TACOM-RI, AMSTA-LC-GFSQ, DSN 793-3575 or COM (309) 782-3575 for shipping instructions. Marine Corps users shall call the Marine Corps IPADS item manager at DSN 567-8160, COM (229) 639-8160, or e-mail at elizabeth.bradshaw@usmc.mil. L-3 will repair the component and send it back to the owning unit.

a. **Maintainability.** The IPADS design is easy to troubleshoot, identify, and replace the failed component. Upon identification of the failed component and using the IPADS tool kit, Figure 1-3, removal and replacement can be accomplished within 10 minutes if PLL authorized. This allows the survey mission to continue with minimal delay when the replacement components are on-hand. The CDU and BCU are connected to the frame with clamshell type connectors allowing for easy removal and replacement. Operator maintenance consists of cleaning and spot painting, CDU and BCU replacement, cables, and mounting hardware replacement. The CPNU will not be removed from the IPADS frame.

b. **Each component of IPADS that is to be removed is easily removed.**

4-7. CPNU.

If the CPNU is not working it will not be removed from the IPADS frame. The entire IPADS is to be sent in for repair.

4-8. Replace BCU.

a. **Remove BCU.**

(1) Power down the IPADS and ensure all power switches are off on BCU.

(2) Disconnect DC power cable W116 or AC power cable W6 from the BCU.

(3) Disconnect wiring harness W114 from the BCU.

(4) Lift latches to release clamshell latches.

(5) Open clamshell latches and remove BCU.

(6) Place BCU into transit case for shipment to repair facility. Ensure that the BCU and the inside of the container, including the cushioning, are dry prior to placing the BCU into the container.

b. **Install BCU.** See Figure 4-3.

(1) On the IPADS frame, open clamshell latches and install BCU.

(2) Lock latches by hooking clamp on clamshell latch and pulling down to tighten clamshell latch.

(3) Connect wiring harness W114 to the BCU connector OUTPUT.

(4) Connect DC power cable W116 to BCU connector EXT DC or AC power cable W6 to BCU connector EXT AC.

(5) Power up IPADS to ensure proper operation of BCU, paragraph 3-6a.

NOTE

Prior to shipment ALL cable connector covers need to be installed.

4-9. Replace CDU

a. **Remove CDU.**

(1) Power down the IPADS, paragraph 3-6b, and ensure all power switches are off on BCU and CDU.

(2) Disconnect DC power cable W116 or AC power cable W6 from the BCU.

(3) Disconnect wiring harness W114 from the CDU connector J1 and install electrical covers.

(4) If connected, disconnect the FOS cable W143 from the CDU connector J2. Install electrical covers.

(5) If CDU is located on the CDU support arm, turn locking latches counter-clockwise to release CDU from mounting bracket, Figure 2-21, and remove.

(6) If the CDU is in the clamshell storage case on the IPADS frame, lift latches to release clamshells and remove CDU.

(7) Place CDU into transit case for shipment to repair facility. Ensure that the CDU and the inside of the container, including the cushioning, are dry prior to placing the CDU into the container.

b. **Install CDU.**

(1) Open clamshell latches on the IPADS frame and install the CDU.

(2) Secure latches by hooking clamp on clamshell latch and pulling down to tighten clamshell latch.

(3) Connect wiring harness W114 to CDU J1 connector.

(4) Connect DC power cable W116 or AC power cable W6 to the BCU.

(5) Remove CDU from clamshell storage case and install on CD support arm, paragraph 2-8j.

(6) Power up IPADS to ensure proper operation of the CDU, paragraph 3-6a.

4-10. Replace BCU Fuse.

CAUTION

Ensure that the BCU is not connected to AC power before opening the BCU cover.

CAUTION

- Use extreme care when opening the BCU cover to ensure interior wires are not pulled or stretched. The BCU cover will not lift off BCU. The cover will need to be rotated to the side of the BCU, see Figure 4-1.

- Use extreme care when closing the BCU cover to ensure interior wires are not pinched under the cover's edges.
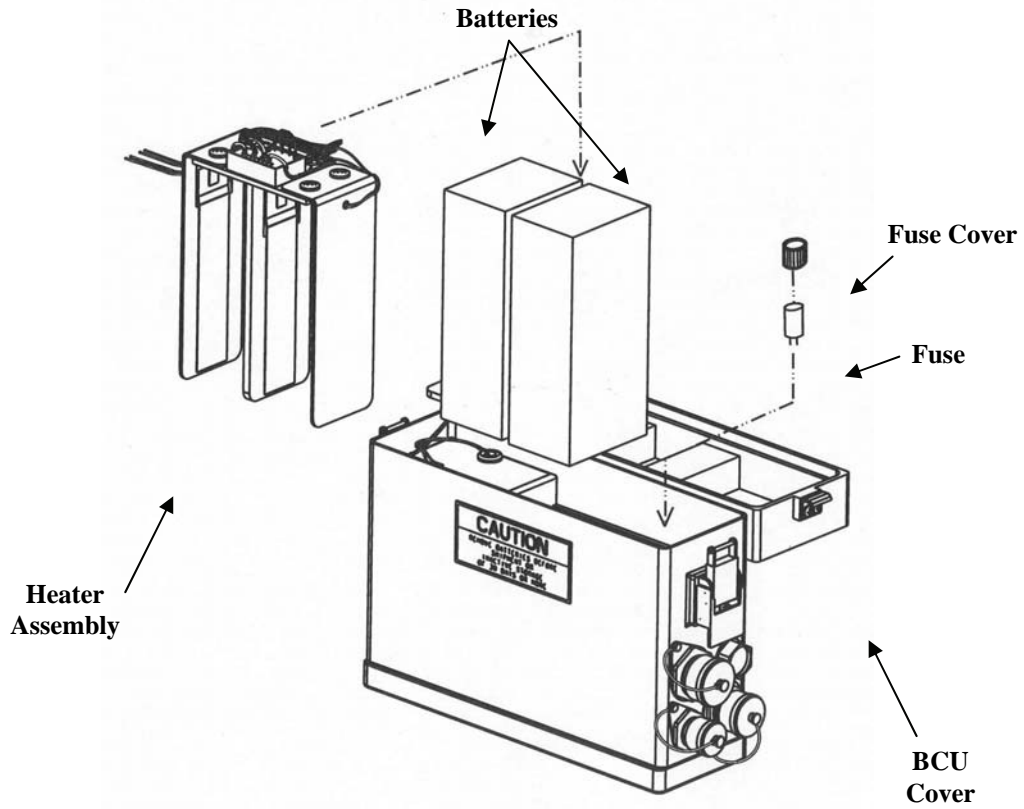
Figure 4-1 – BCU Fuse
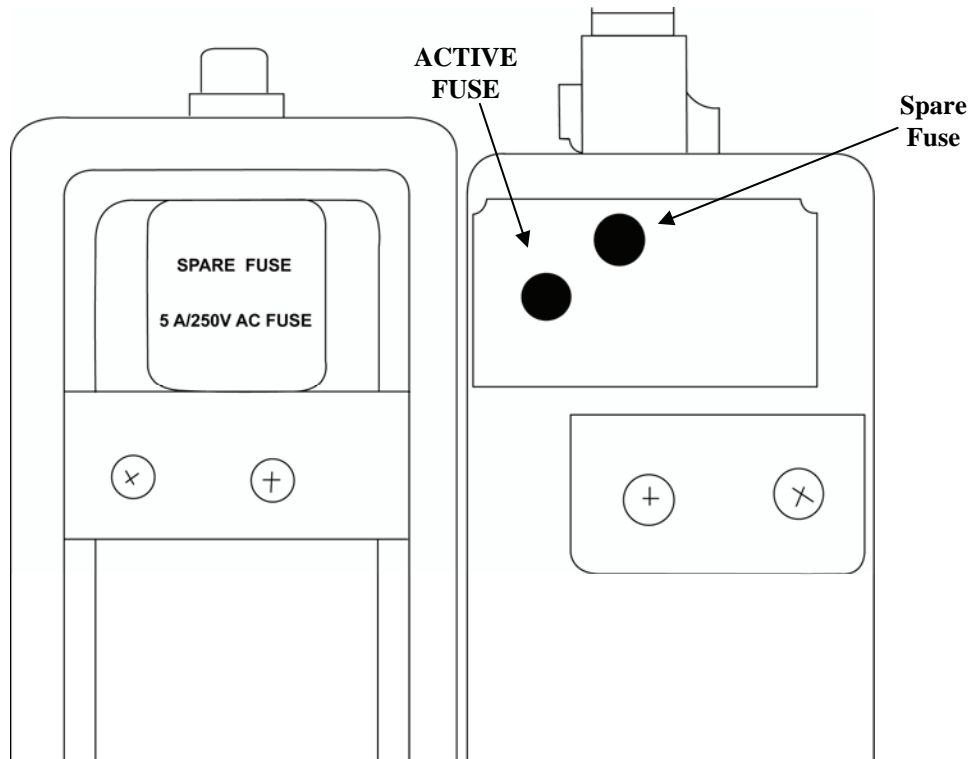
Figure 4-2 – BCU Active and Spare Fuse Location Detail

4-10. Replace BCU Fuse - Continued

a. **Remove BCU Fuse.**

(1) Remove BCU from IPADS frame, paragraph 4-8a.

(2) Open cover on BCU by lifting latches on ends.

(3) Lift cover and lean to side. Be careful not to pull the wires out.

NOTE

Needle nose pliers may be needed to unscrew fuse cover. The only time you will notice a failure with the fuse is when the IPADS is plugged into the wall using 110volt or 220volt power and the IPADS will not power up. These fuses have nothing to do with the IPADS when hooked up to a vehicle battery or the slave cable. **To repeat,** the fuse only protects the IPADS from AC power (outlet wall power).

(4) Looking down into the BCU you will notice there are two fuses. The first fuse, labeled "Active Fuse" (Figure 4-2) is the active fuse that the IPADS uses to send AC power to the IPADS. The second fuse labeled "Spare Fuse" is a back up fuse.

(5) Carefully reach in and remove **Active** Fuse (Figure 4-1) by pulling straight up on the fuse.

b. **Install BCU Fuse.**

CAUTION

The fuse cover is made of a very thin plastic. Care must be used as not to crush the fuse cover.

(1) Insert fuse into fuse holder inside BCU ensuring the two prong holes are lined up.

(2) Position fuse cover over fuse and turn clockwise to tighten.

(3) Close cover on BCU and secure latches to attach cover.

(4) Replace BCU in clamshell storage compartment on IPADS frame, paragraph 4-8b.

4-11. Replace BCU Backup Battery Pack. The BCU contains two backup batteries that allow the IPADS to continue to operate without external power being applied.

    a. **Remove BCU Backup Battery Packs.**

CAUTION

- Ensure that the BCU is not connected to AC power before opening the BCU cover.

- The backup batteries can be replaced while the IPADS is operational on DC power. This should only be attempted during extreme wartime situations. If not in combat, it is recommended that all power be shut off before battery replacement.

CAUTION

- Use extreme care when removing the BCU cover to ensure interior wires are not pulled or stretched.

- Use extreme care when closing the BCU cover to ensure interior wires are not pinched under the cover's edges.

(1) If the backup battery packs must be removed while IPADS is running, open clamshell latches securing BCU in frame and lean BCU outward to perform steps (3) through (9).

(2) If IPADS is turned off, remove BCU from frame, paragraph 4-8a. Cover will not be removable due to securing lanyard and attached wires.

(3) Open BCU cover by lifting latches on ends.

(4) Lift cover and lean to side. Be careful not to pull wires out.

(5) Disconnect Velcro strap securing battery receptacles and connectors inside front of BCU.

(6) Using a number 2 cross tip screwdriver, loosen, but do not remove, four screws on top of battery heater, Figure 2-3.

(7) Carefully lift battery heater straight up to remove, Figure 2-4.

(8) Disconnect each battery pack cable from receptacle by pressing the lock lever on the battery connector.

(9) Lift the two backup battery packs out of BCU, Figure 2-4.

    b. **Install Backup Battery Packs**

CAUTION

Replace both battery packs. Do not mix new and used battery packs.

(1) If the backup battery packs must be removed while IPADS is running, open clamshell latches securing BCU in frame and lean BCU outward to perform Steps (3) through (9).

(2) If IPADS is turned off, remove BCU from frame, paragraph 4-8a.

(3) With cover open and heater assembly removed, place two backup batteries into BCU, Figure 2-4.

(4) Carefully place battery heater down over the backup battery pack. Secure four screws on top of heater with a number 2 cross tip screwdriver while squeezing the outside heater panels against the batteries to ensure that battery to heater contact is made.

(5) For both battery packs, connect battery pack connectors to BCU battery receptacles and verify the connectors are securely locked to the receptacles.

(6) Wrap battery pack receptacles and connectors with Velcro strap to keep them together and out of the way.

(7) Replace BCU cover. Be careful not to pinch any wires in the edge.

(8) Secure latches on ends to secure cover.

4-11. Replace BCU Backup Battery Pack - Continued

(9) Install BCU in IPADS frame, paragraph 4-8b.

(10) Charge new battery packs for a minimum of 24 hours.

Figure 4-3 Component Replacement

4-12. Cleaning and Spot-Painting. Perform cleaning and spot-painting instructions as follows:

CAUTION

Do not paint over unpainted areas. These areas are EMI bonding surfaces that must remain unpainted for maximum conductance.

a. Spot painting is limited to touchup of scratched, scraped, or otherwise marred surfaces. Clean CDU screen and porro prism with lens paper to prevent scratching the surface. Wipe down cables and IPADS components with a soft lint free cloth. When using water to spray off IPADS, ensure all electrical connectors are securely connected or covered with their electrical cap.

WARNING

Denatured alcohol is flammable and gives off harmful vapors. Use only in well-ventilated areas away from open flames and sparks. Avoid prolonged or repeated inhalation of vapors.

b. The area to be painted must be thoroughly cleaned, dry, and free from oil or grease. Use steel wool or fine sand paper to clean rust from all steel surfaces. Do not sand any items that are aluminum or plastic. Use isopropyl alcohol as a cleaning solvent. Do not use soap and water because soap reacts with aluminum to produce a waxy film. Cover connectors and unpainted areas with masking tape before painting. The system probably will not work if connector contacts get painted. Make sure moving parts, such as clamping latches, are not immobilized by paint.

c. Carefully apply Chemical Agent Resistant Coating (CARC) paint with a small paintbrush. Brush out any runs or drips. Allow paint to air dry for at least 24 hours before subjecting it to wear.

4-13. Repair of Damaged or Unserviceable Items. Repair of damaged or unserviceable items are achieved through replacement.

CHAPTER 5

SUSTAINMENT MAINTENANCE INSTRUCTIONS

SECTION I. SUSTAINMENT TROUBLESHOOTING

5-1. General. When an IPADS LRU fails, Sustainment maintenance personnel are required to troubleshoot the associated cable to determine if it is serviceable. If so, the cable is returned to the field and the LRU is turned in for repair.

Malfunction
    Test or Inspection
        Corrective Action

1. Wiring harness W114 appears to be unserviceable.
    Step 1. Perform continuity check of wiring harness W114, Figure 5-1.
        a. If serviceable, return to operator.
        b. If unserviceable, turn in for repair, paragraph 4-6.

2. Power cable W116-1 or W116-3 appears to be unserviceable.
    Step 1. Perform continuity check of wiring harness W116, Figure 5-2.
        a. If serviceable, return to operator.
        b. If unserviceable, turn in for repair, paragraph 4-6.

3. AC power cable appears to be unserviceable.
    Step 1. Perform continuity check of AC power cable.
        a. If serviceable, return to operator.
        b. If unserviceable, turn in for repair, paragraph 4-6.

4. FOS cable appears to be unserviceable.
    Step 1. Perform continuity check of FOS cable, Figure 5-3.
        a. If serviceable, return to operator.
        b. If unserviceable, turn in for repair, paragraph 4-6.

5-1. General - Continued

P2 to CPNU J1

P3 to CPNU J9

P4 to BCU out
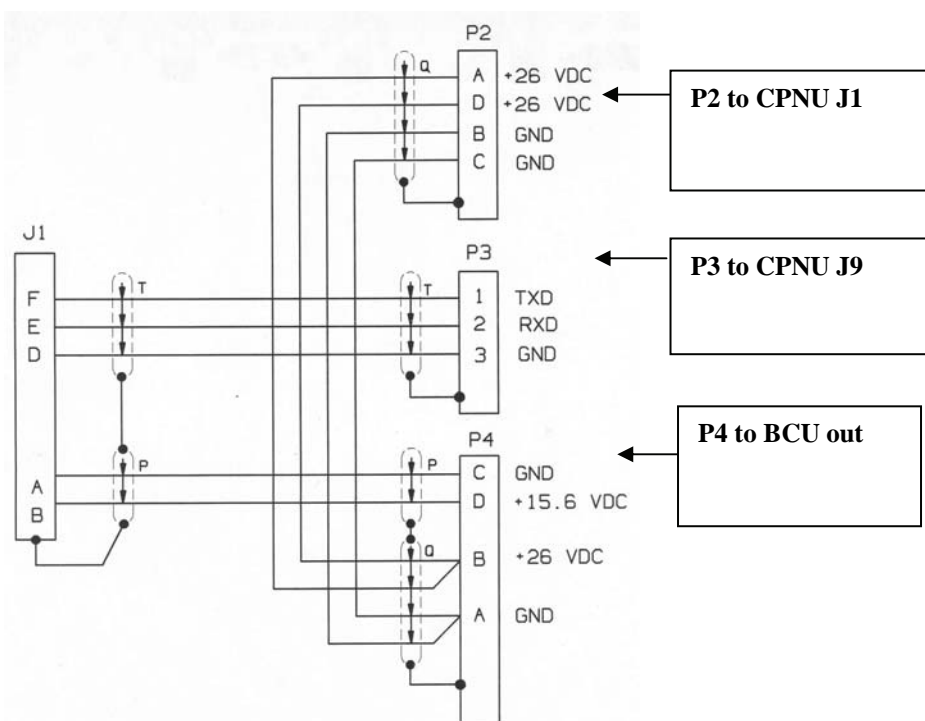
Figure 5-1 – Wiring Harness W114

Legend for Figure 5-1 – Wiring Harness W114

Wire	P-1 CDU J1	P-2 CPNU J1	P-3 CPNU J9	P-4 BCU AUX OUT	TEST
Ground		B, C		A	Check pin A on P-4 end and pins B and C on the P-2 end for continuity.
+26 volts DC		A, D		B	Check pins A and D on the P-2 end and pin B on the P-4 end for continuity.
Ground	A			C	Check pin C on BCU end and pin A on CDU end for continuity.
+15.6 volts DC	B			D	Check pin B on P-1 end and pin D on the P-4 end for continuity.
Transmit	F		1		Check pin F on P-1 end and pin 1 on P-3 end for continuity.
Receive	E		2		Check pin E on P-1 end and pin 2 on P-3 end for continuity.
Ground	D		3		Check pin D on P-1 end and pin 3 on P-3 end for continuity.
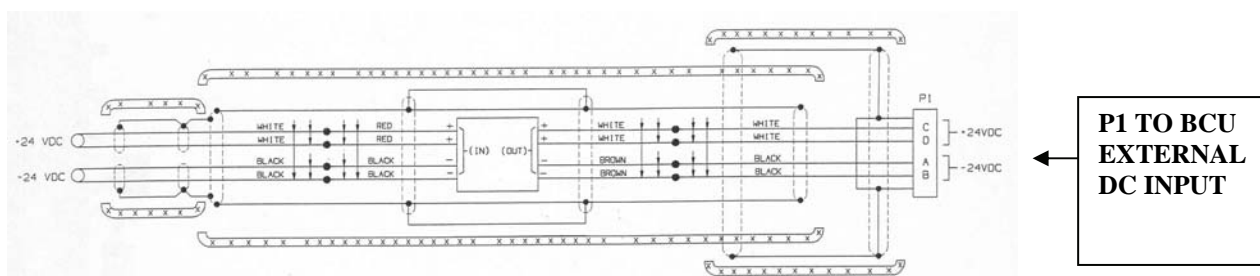
Figure 5-2 – Power Cable W116-1 and W116-3

Legend for Figure 5-2 – Power Cable W116-1 and W116-3

Wire	P-2 Vehicle Battery	P-1 BCU DC Power Input	Test
+24 volts DC	B	CD	Connect P-2 end to vehicle battery and check pin CD on the P-1 end to ensure +24 volts DC are being carried.
Ground	A	ABE	Connect P-2 end to vehicle battery and check pins A, B, and E on P-1 end to ensure Neg / Ground.

5-1. General - Continued
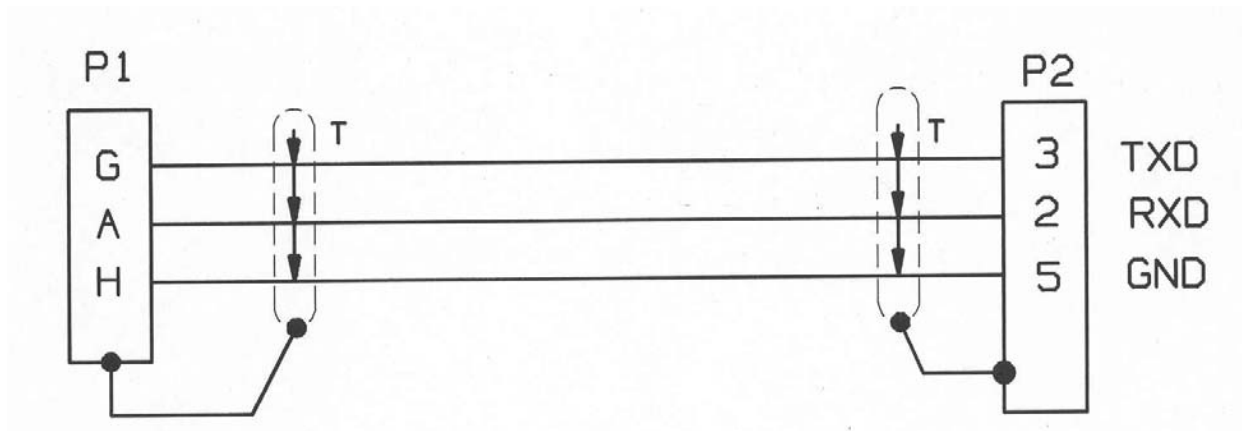
Figure 5-3 – FOS Cable W136

Legend for Figure 5-3 – FOS Cable W136

Wire	P-1 CDU J2	P-2 Miltope	Test
Transmit	G	3	Check pin G on P-1 end and pin 3 on P-2 end for continuity.
Receive	A	2	Check pin A on P-1 end and pin 2 on P-2 end for continuity.
Ground	H	5	Check pin H on P-1 end and pin 5 on the P-2 end for continuity.

CHAPTER 6

IPADS MAP MANAGER

SECTION I. INTRODUCTION

6-1. Scope. These instructions cover installation, removal, and operation of IPADS Map Manager to and from a laptop computer.

a. IPADS Map Manager allows the operator to:

   (1) Prepare digital map files in the special format required by IPADS from National Geospatial Intelligence Agency (NGA) CDs containing digital map data in the Compressed Arc Digitized Raster Graphic (CADRG) format.

   (2) Delete IPADS map files from the host PC IPADS Map Library, removable disk, IPADS or Emulator.

   (3) Copy IPADS map files from the IPADS Map Library on the host PC hard drive to an IPADS, IPADS Emulator, or a removable disk.

   (4) Copy IPADS map files from an IPADS Map Library on a removable disk to the IPADS Map Library on the host PC hard drive, an IPADS, IPADS Emulator, or a different removable disk.

b. IPADS Map Manager software can be installed from a CD or downloaded from the Army Electronic Product Support (AEPS) Website:

   (1) **CD**

      (a) Prepare digital map files in the special format required by IPADS from National Geospatial Intelligence Agency (NGA) CDs containing digital map data in the Compressed Arc Digitized Raster Graphic (CADRG) format.

      (b) Delete IPADS map files from the host PC IPADS Map Library, removable disk, IPADS or Emulator.

      (c) Copy IPADS map files from the IPADS Map Library on the host PC hard drive to an IPADS, IPADS Emulator, or a removable disk.

      (d) Copy IPADS map files from an IPADS Map Library on a removable disk to the IPADS Map Library on the host PC hard drive, an IPADS, IPADS Emulator, or a different removable disk.

   (2) **AEPS** (https://aeps.ria.army.mil)

      (a) If you have a username, log onto the AEPS site.

         a   Click on "New Services on AEPS" on the right hand of the screen.

         b   Click on "IPADS software download."

         c   Follow instructions for download and installation of software.

      (b) If you don't have a username, go to http://aeps.army.mil.

      (c) Click ACCEPT.

      (d) If you have a CAC card click on **ACCESS REQUEST FORM** on the left side of the screen.

      (e) If you do not have a CAC card click on **ACCESS REQUEST FOR NON-CAC USERS.**

      (f) Follow the on-screen instructions.

      (g) Your username and password will be e-mailed to you. You may then access AEPS.

6-2. Controls and Indicators. IPADS Map Manager has two major windows, IPADS Map Manager and IPADS Map Maker. Controls and indicators for IPADS Map Manager are shown in Figure 6-1. The "look" of IPADS Map Manager varies with the selected coordinate type. Controls and indicators for IPADS Map Maker are shown in Figures 6-2 through 6-4.

NOTE

Depending on the PC and Windows™ configuration, on-screen displays may vary slightly from the illustrations in these instructions.
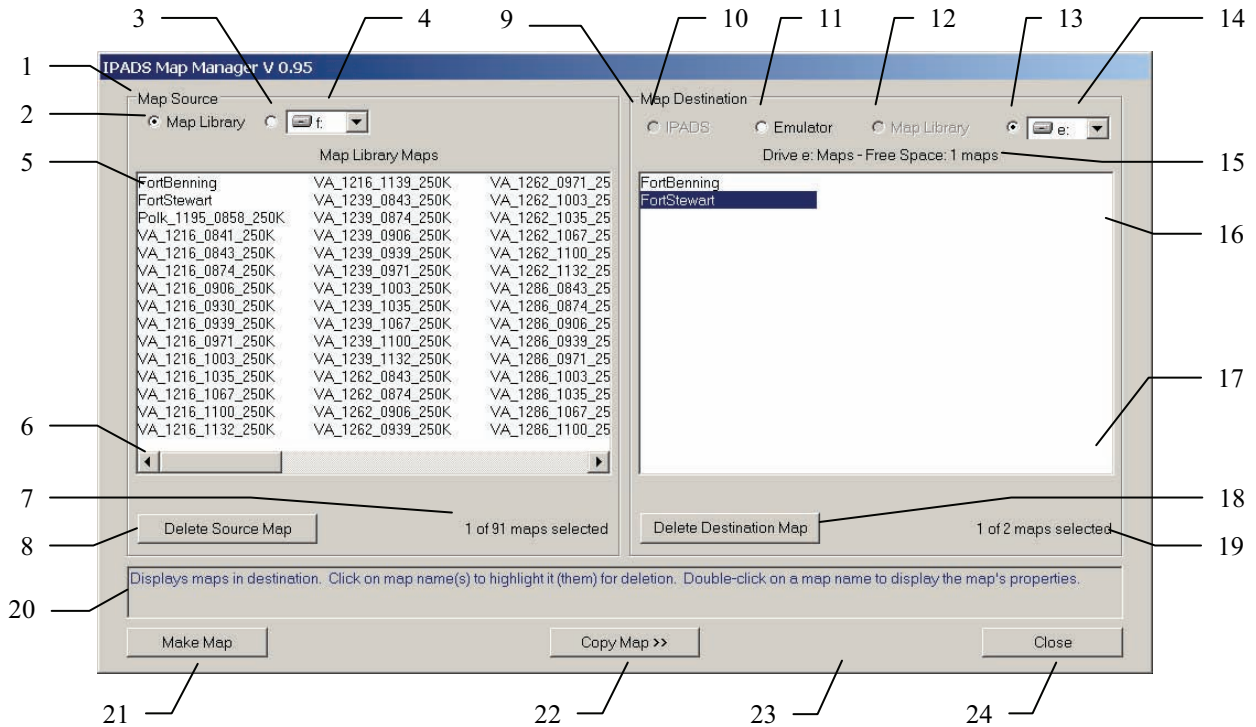
Figure 6-1 - IPADS Map Manager Window

Legend for Figure 6-1 – IPADS Map Manager Window

Find	Control/Indicator	Function
1	Map Source box	Control group for selecting map files for copying or deletion.
2	Map Library radio button	Selects PC Map Library as map file source.
3	Import Drive radio button	Selects displayed Import Drive as map file source. Enabled when selected Import Drive contains an IPADS Map Library.
4	Import Drive box	Shows available drives and selected Import Drive.
5	Source map list box	Displays list of IPADS map files available from the selected map source. Selected map files are highlighted.
6	Scroll Bar	Allows navigation of source map list. Displayed only when number of map files exceeds visible area of box.

Legend for Figure 6-1 – IPADS Map Manager Window

Find	Control/Indicator	Function
7	Source map status	Displays number of maps selected from the map source and the total number available.
8	Delete Source Map button	Initiates deletion of selected source maps. Enabled only when one or more maps is selected.
9	Map Destination box	Control group for selecting the destination for copying map files.
10	IPADS radio button	Selects IPADS as the destination for copying map files. Enabled when communications with IPADS has been established.
11	Emulator radio button	Selects IPADS Emulator as destination for copying map files. Enabled only when emulator software is installed on the PC.
12	Map Library radio button	Selects the IPADS Map Library as the destination for copying map files. Enabled only when the Import Drive is the map source.
13	Export Drive radio button	Selects the selected Export Drive as the destination for copying maps. Enabled only when the Export Drive is writable and not full.
14	Export Drive box	Shows available drives and selected Export Drive.
15	Free Space indicator	Displays the approximate number of additional maps the destination can hold.
16	Destination map list box	Displays list of IPADS map files available on the selected map destination. Selected map files are highlighted.
17	Scroll Bar (hidden)	Allows navigation of destination map list. Displayed only when number of map files exceeds visible area of box.
18	Delete Destination Map button	Initiates deletion of selected destination maps. Enabled only when one or more maps is selected.
19	Destination map status	Displays number of maps selected from the map destination and the total number available.
20	Message area	Displays context help and other messages.
21	Make Map button	Launches IPADS Map Maker window, which allows preparation of new IPADS format map files.
22	Copy Map >> button	Copies selected source map files to the selected destination. Enabled only when one or more source map files and a destination have been selected.
23	Progress bar (hidden)	"Gas gage" indicator of progress copying map files.
24	Close button	Closes IPADS Map Manager.

6-2. Controls and Indicators - Continued
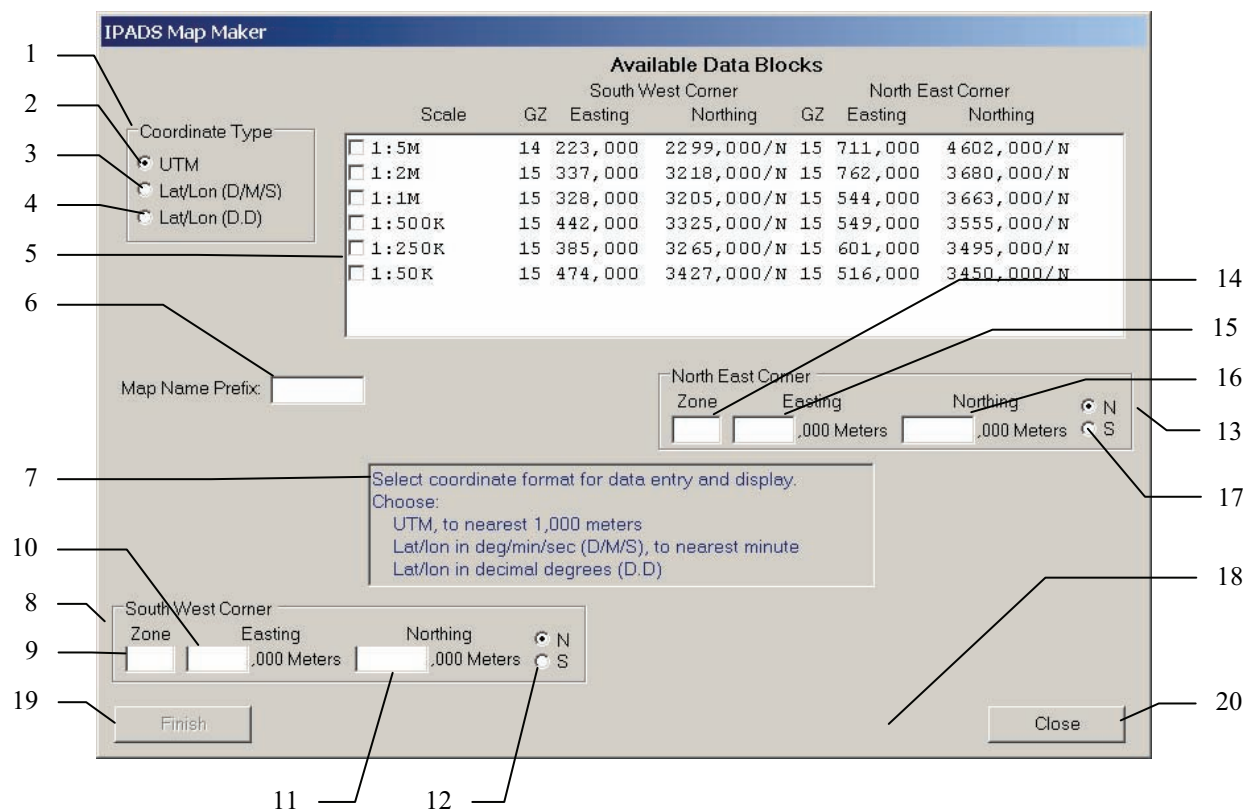
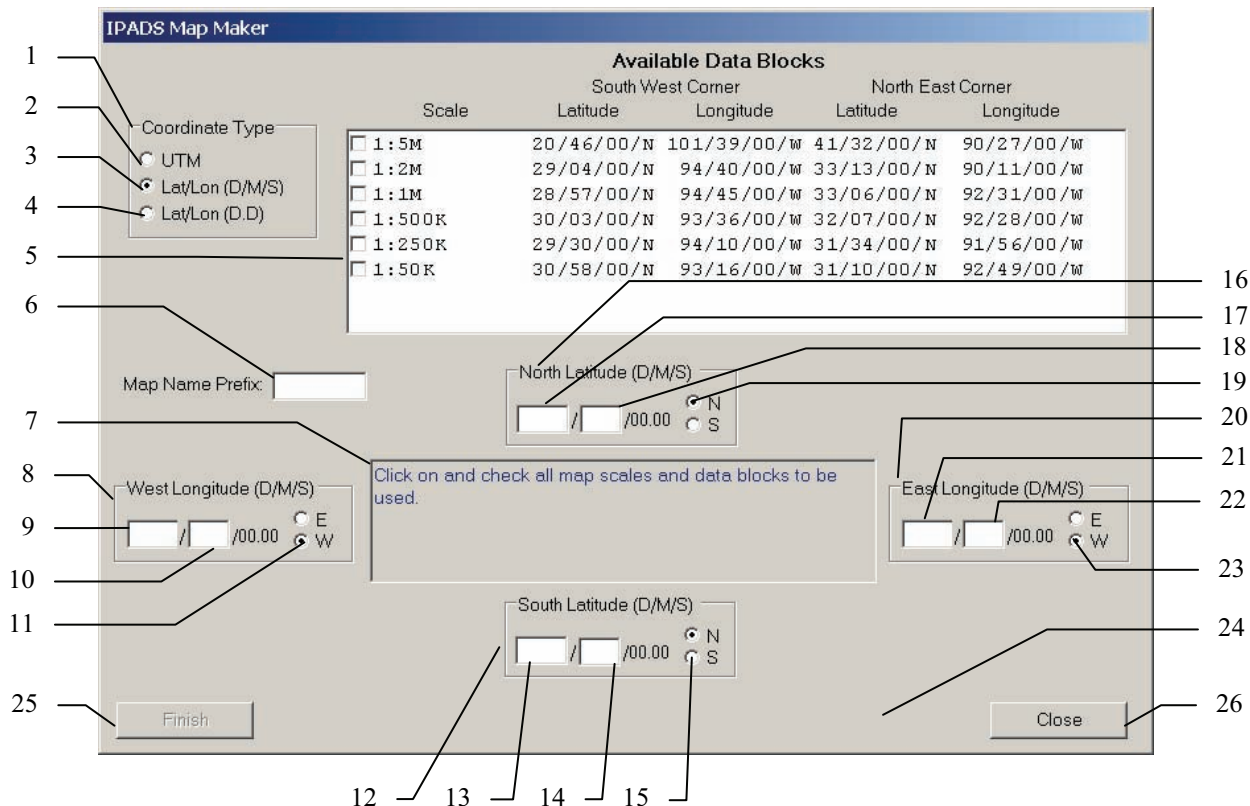**Figure 6-2 – IPADS Map Maker Window (UTM)**

Legend for Figure 6-2 – IPADS Map Maker Window (UTM)

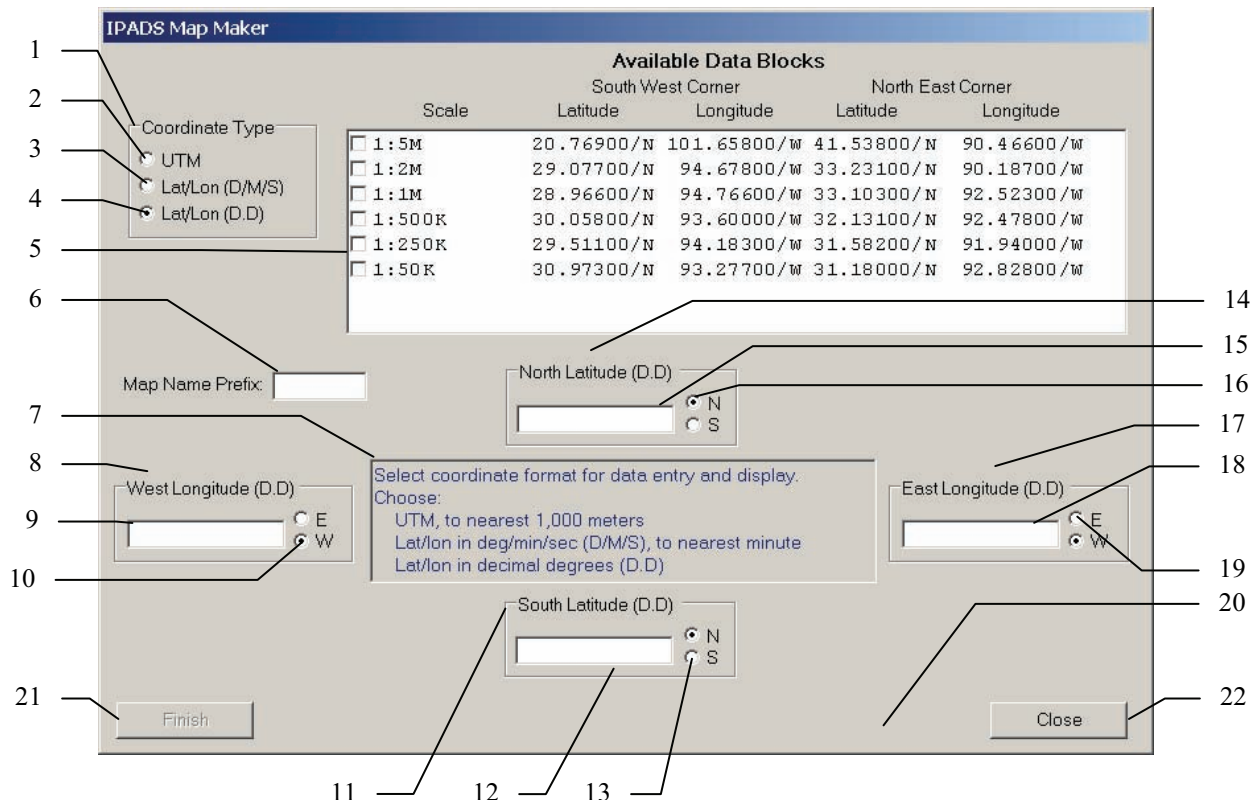| Find	Control/Indicator	Function
1	Coordinate Type box	Control group for selecting coordinate format for input and display.
2	UTM radio button	Selects UTM coordinates, when checked (default).
3	Lat/Lon (D/M/S) radio button	Selects Latitude and Longitude in degrees and minutes, when checked.
4	Lat/Lon (D.D) radio button	Selects Latitude and Longitude in decimal degrees, when checked.
5	Available Data Blocks box	Displays map scales and data blocks available on the map data CD. Operator clicks on data blocks to select them for processing.
6	Map Name Prefix field	Entry field for an optional map name prefix. Eight character limit. Allowable characters are lower and upper case alphabetic, numeric, space, dash (-), and underscore (_).
7	Message area	Displays context help and other messages.

8	Southwest Corner input fields	Entry fields for the UTM coordinates of the southwest corner of the map area. Coordinates must be within the UTM area (80°S - 84°N) and the extended grid zone boundaries.
9	Zone field	UTM grid zone number for the southwest corner, from 1 to 60.
10	Easting field	UTM easting for the southwest corner, to the nearest 1,000 meters.
11	Northing field	UTM northing for the southwest corner, to the nearest 1,000 meters.
12	Hemisphere radio buttons	Selects hemisphere of southwest corner. "N" for Northern Hemisphere, "S" for Southern Hemisphere. Default is "N".
13	Northeast Corner input fields	Entry fields for the UTM coordinates of the northeast corner of the map area. Coordinates must be within the UTM area (80°S - 84°N) and the extended grid zone boundaries.
14	Zone field	UTM grid zone number for the northeast corner, from 1 to 60.
15	Easting field	UTM easting for the northeast corner, to the nearest 1,000 meters.
16	Northing field	UTM northing for the northeast corner, to the nearest 1,000 meters.
17	Hemisphere radio buttons	Selects hemisphere of northeast corner. "N" for Northern Hemisphere, "S" for Southern Hemisphere. Default is "N".
18	Progress bar (hidden)	"Gas gage" indicator of progress making maps.
19	Finish button	Initiates creation of IPADS map files. Enabled when all required data fields have been filled.
20	Close button	Closes IPADS Map Maker and returns operation to IPADS Map Manager.

6-2. Controls and Indicators - Continued

Figure 6-3 – IPADS Map Maker Window (Lat/Lon D/M/S)

Legend for Figure 6-3 – IPADS Map Maker Window (Lat/Lon D/M/S)

| Find	Control/Indicator	Function
1	Coordinate Type box	Control group for selecting coordinate format for input and display.
2	UTM radio button	Selects UTM coordinates when checked (default.)
3	Lat/Lon (D/M/S) radio button	Selects Latitude and Longitude in degrees and minutes, when checked.
4	Lat/Lon (D.D) radio button	Selects Latitude and Longitude in decimal degrees, when checked.
5	Available Data Blocks box	Displays map scales and data blocks available on the map data CD. Operator clicks on data blocks to select them for processing.
6	Map Name Prefix field	Entry field for an optional map name prefix. Eight character limit. Allowable characters are lower and upper case alphabetic, numeric, space, dash (-), and underscore (_).
7	Message area	Displays context help and other messages.
8	West Longitude	Entry fields for the longitude of the west boundary of the map area.

Legend for Figure 6-3 – IPADS Map Maker Window (Lat/Lon D/M/S)

Find	Control/Indicator	Function
9	Degrees	Longitude integer degrees for the west boundary, from 0 to 180.
10	Minutes	Longitude integer minutes for the west boundary, from 0 to 59.
11	Hemisphere radio buttons	Selects hemisphere of the west boundary. "E" for Eastern Hemisphere, "W" for Western Hemisphere. Default is "W".
12	South Latitude	Entry fields for the latitude of the south boundary of the map area.
13	Degrees	Latitude integer degrees for the south boundary, from 0 to 84 in Northern Hemisphere and 0 to 80 in Southern Hemisphere.
14	Minutes	Latitude integer minutes for the south boundary, from 0 to 59.
15	Hemisphere radio buttons	Selects hemisphere of south boundary. "N" for Northern Hemisphere, "S" for Southern Hemisphere. Default is "N".
16	North Latitude	Entry fields for the latitude of the north boundary of the map area.
17	Degrees	Latitude integer degrees for the north boundary, from 0 to 84 in Northern Hemisphere and 0 to 80 in Southern Hemisphere.
18	Minutes	Latitude integer minutes for the north boundary, from 0 to 59.
19	Hemisphere radio buttons	Selects hemisphere of north boundary. "N" for Northern Hemisphere, "S" for Southern Hemisphere. Default is "N".
20	East Longitude	Entry fields for the longitude of the east boundary of the map area.
21	Degrees	Longitude integer degrees for the east boundary, from 0 to 180.
22	Minutes	Longitude integer minutes for the east boundary, from 0 to 59.
23	Hemisphere radio buttons	Selects hemisphere of the east boundary. "E" for Eastern Hemisphere, "W" for Western Hemisphere. Default is "W".
24	Progress bar (hidden)	"Gas gage" indicator of progress making maps.
25	Finish button	Initiates creation of IPADS map files. Enabled when all required data fields have been filled.
26	Close button	Closes IPADS Map Maker and returns operation to IPADS Map Manager.

6-2. Controls and Indicators - Continued

Figure 6-4 – IPADS Map Maker Window (Lat/Lon D.D)

Legend for Figure 6-4 – IPADS Map Maker Window (Lat/Lon D.D)

Find	Control/Indicator	Function
1	Coordinate Type box	Control group for selecting coordinate format for input and display.
2	UTM radio button	Selects UTM coordinates when checked (default.)
3	Lat/Lon (D/M/S) radio button	Selects Latitude and Longitude in degrees and minutes, when checked.
4	Lat/Lon (D.D) radio button	Selects Latitude and Longitude in decimal degrees, when checked.
5	Available Data Blocks box	Displays map scales and data blocks available on the map data CD. Operator clicks on data blocks to select them for processing.
6	Map Name Prefix field	Entry field for an optional map name prefix. Eight character limit. Allowable characters are lower and upper case alphabetic, numeric, space, dash (-), and underscore (_).
7	Message area	Displays context help and other messages.
8	West Longitude	Entry fields for the longitude of the west boundary of the map area.

Legend for Figure 6-4 – IPADS Map Maker Window (Lat/Lon D.D)

Find	Control/Indicator	Function
9	Degrees	Longitude of the west boundary, in decimal degrees, from 0 to 180.
10	Hemisphere radio buttons	Selects hemisphere of the west boundary. "E" for Eastern Hemisphere, "W" for Western Hemisphere. Default is "W".
11	South Latitude	Entry fields for the latitude of the south boundary of the map area.
12	Degrees	Latitude of the south boundary, in decimal degrees, from 0 to 84 in Northern Hemisphere and 0 to 80 in Southern Hemisphere.
13	Hemisphere radio buttons	Selects hemisphere of south boundary. "N" for Northern Hemisphere, "S" for Southern Hemisphere. Default is "N".
14	North Latitude	Entry fields for the latitude of the north boundary of the map area.
15	Degrees	Latitude of the north boundary, in decimal degrees, from 0 to 84 in Northern Hemisphere and 0 to 80 in Southern Hemisphere.
16	Hemisphere radio buttons	Selects hemisphere of north boundary. "N" for Northern Hemisphere, "S" for Southern Hemisphere. Default is "N".
17	East Longitude	Entry fields for the longitude of the east boundary of the map area.
18	Degrees	Longitude of the east boundary, in decimal degrees, from 0 to 180.
19	Hemisphere radio buttons	Selects hemisphere of the east boundary. "E" for Eastern Hemisphere, "W" for Western Hemisphere. Default is "W".
20	Progress bar (hidden)	"Gas gage" indicator of progress making maps.
21	Finish button	Initiates creation of IPADS map files. Enabled when all required data fields have been filled.
22	Close button	Closes IPADS Map Maker and returns operation to IPADS Map Manager.

6-3. Windows™ Navigation. There are conventions for operator interaction with Windows™ programs. Often there is more than one way to accomplish the same task. The following subparagraphs describe general Windows™ operations used with IPADS Map Manager.

a. **Clicking.** Clicking refers to placing the mouse cursor on the desired item and momentarily pressing the left mouse button to perform an operation. Operations include activating a button, selecting an item from a list, or selecting a field for data entry. Often, clicking with a mouse or trackball is the most convenient way to select items and perform operations. However, on some portable computers it may be more convenient to Tab to the desired item, paragraph 6-3b.

b. **Tabbing.** Pressing the Tab key will make buttons, data entry fields, and list boxes active in sequence. Pressing Tab while holding the shift key reverses the sequence. The active item in a Window is indicated by a box drawn around the text or a cursor in a data entry field. An additional action may be needed to actually make a selection or initiate an operation. These actions are described in following subparagraphs. Tabbing, followed by the additional action, if any, is equivalent to clicking. The equivalent Tabbing function may be used when the term "Click" is used in this document.

6-3. Windows™ Navigation - Continued

└ Disabled   └ Enabled   └ Active
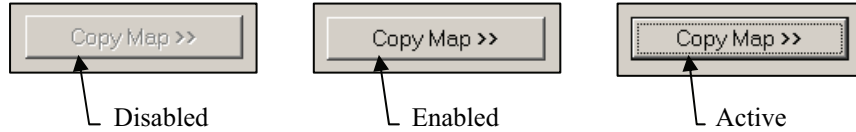
c. **Buttons.** Buttons are controls that initiate a process (e.g. deleting maps.) A button will be disabled or inactive until the minimum requirements for initiating the process have been met (e.g. all required input fields have been filled.) A button is disabled or inactive if the text is a "ghost" image of normal text. A button is enabled if the text appears normal. A button is active when a box surrounds the text. Active buttons also are enabled.

   (1) Click on an enabled or active button to initiate the process.

   (2) Alternately, press the Enter key to initiate the process for an active button.

   (3) No operation will result from clicking on a disabled button.

└ Disabled   └ Enabled   └ Selected   └ Active
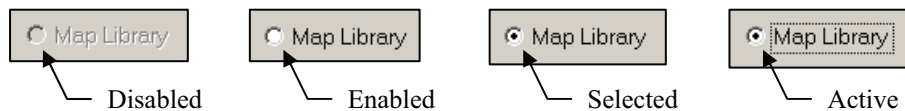
d. **Radio buttons.** Radio buttons are grouped and displayed as circles followed by a legend or pull-down box. Only one radio button in a group may be selected. A radio button is disabled or inactive if the color of the circle is the same as the background color and the text is a "ghost" image of normal text. A radio button is enabled, but not selected, if the circle color is white and text appears normal. A radio button is selected if the circle color is black. A radio button is active when a box surrounds the text. Active radio buttons also are selected.

   (1) Click on an enabled radio button to select it.

   (2) Alternately:

      (a) Press the Tab key until a radio button in the desired group becomes active.

      (b) Use the up, down, left, right arrow keys to change the selected radio button to a different one in the same group.

   (3) No operation will result from clicking on a disabled or already selected radio button.

e. **Drop-down boxes.** Drop-down boxes are used to pick Import and Export drives from a list. Perform the following steps to initialize or change the contents of a drop-down box.

   (1) Click on the arrow at the right side of the box. The list of available drives will drop down.

   (2) Click on the desired drive in the drop-down list. The list will close and the selected drive will be displayed and highlighted in the box.

f. **List boxes.** The names of maps in the source or destination are displayed in list boxes. The list boxes can display up to three columns of map names. If the number of names exceeds the viewable area, a scroll bar is displayed at the bottom of the list box to allow access to additional columns. Map names must be

selected from the list in the source or destination map list box before they can be copied or deleted. Perform the following to select maps:

(1) To select a single map, click on its name in the appropriate map list box. The name will be highlighted.

(2) An alternate method to select a single map is:

FortBenning
FortStewart
Polk_1195_0858_250K

(a) Press the Tab key until one of the map names in the list is surrounded by a box. The list box is now active.

(b) Use the Up, Down, Left, Right arrow keys to highlight the desired map name.

(c) Press the Tab key to exit the box. The selected map name will remain highlighted.

NOTE

The following procedure may be used to select all maps in a box list by selecting the first map in the list as the first map in the range and the last map in the list as the last map in the range.

FortBenning
FortStewart
Polk_1195_0858_250K
VA_1216_0841_250K
VA_1216_0843_250K
VA_1216_0874_250K
VA_1216_0906_250K
VA_1216_0930_250K
VA_1216_0939_250K
VA_1216_0971_250K
VA_1216_1003_250K
VA_1216_1035_250K
VA_1216_1067_250K
VA_1216_1100_250K
VA_1216_1132_250K

(3) To select a sequential series of map names:

(a) Click on the name of the first map in the series.

(b) While pressing the Shift key, click on the name of the last map in the series. All map names from the first to the last in the series will be highlighted.

(4) An alternate method to select a sequential range of map names is:

FortBenning
FortStewart
Polk_1195_0858_250K

(a) Press the Tab key until one of the map names in the list is surrounded by a box. The list box is now active.

(b) Use the Up, Down, Left, Right arrow keys to highlight the name of the first map in the series.

(c) While holding down the Shift key, use the Up, Down, Left, Right arrow keys to navigate to the name of the last map in the series. All map names in the selected range will be highlighted.

6-3. Windows™ Navigation - Continued

      (d) Release the Shift key.

      (e) Press the Tab key to exit the box. The selected map names will remain highlighted.
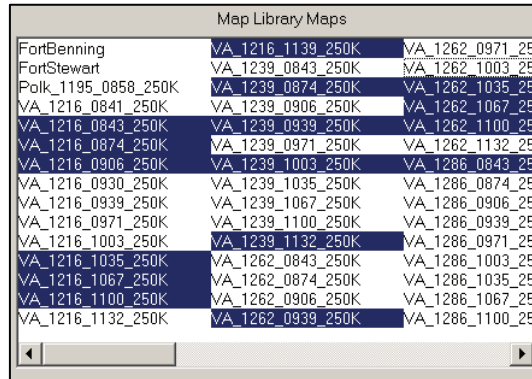
    (5) To select multiple map names that are not in sequence:

      (a) Click on the name of a map in the set.

      (b) While pressing the Ctrl key, click on the names of all additional maps to be selected. All selected map names will be highlighted.

    (6) There is no alternate method to select multiple map names that are not in sequence.

    (7) To deselect a highlighted map, click on its name while pressing the Ctrl key. The map name no longer will be highlighted.

SECTION II. OPERATION OF IPADS MAP MANAGER

6-4. Preparation for Installation of IPADS Map Manager.

NOTE

If previous versions of the IPADS Emulator, IPADS Map Manager, and/or
IPADS Downloader have NOT been installed on the computer, go to paragraph
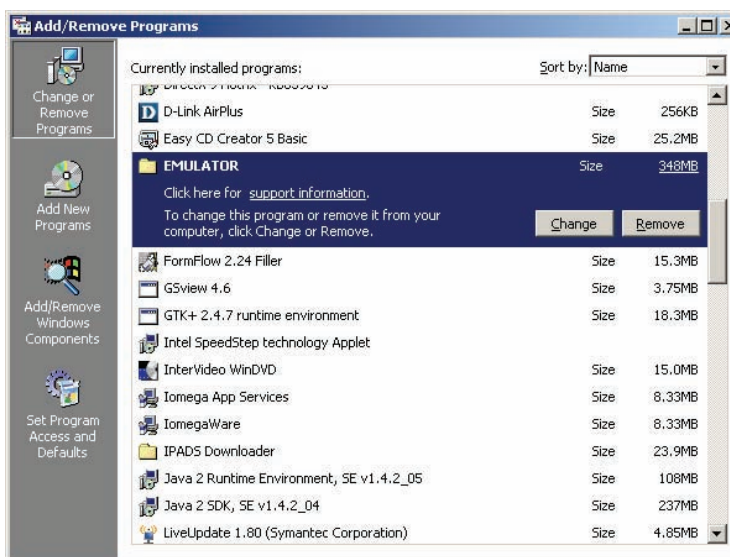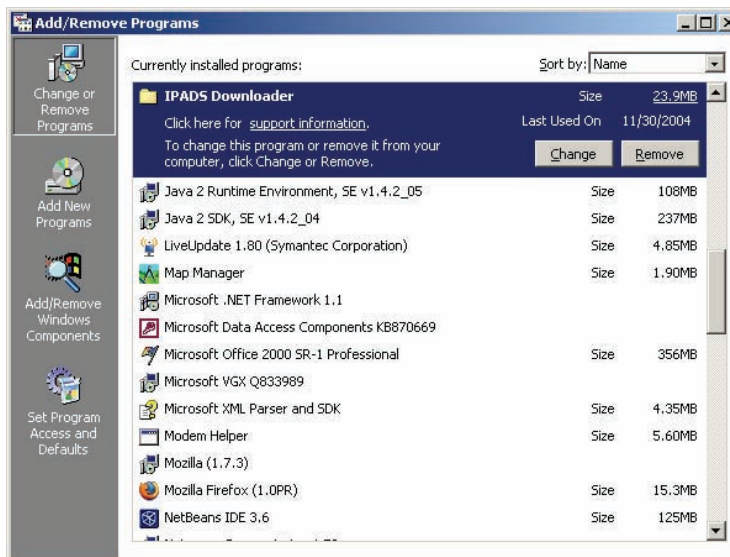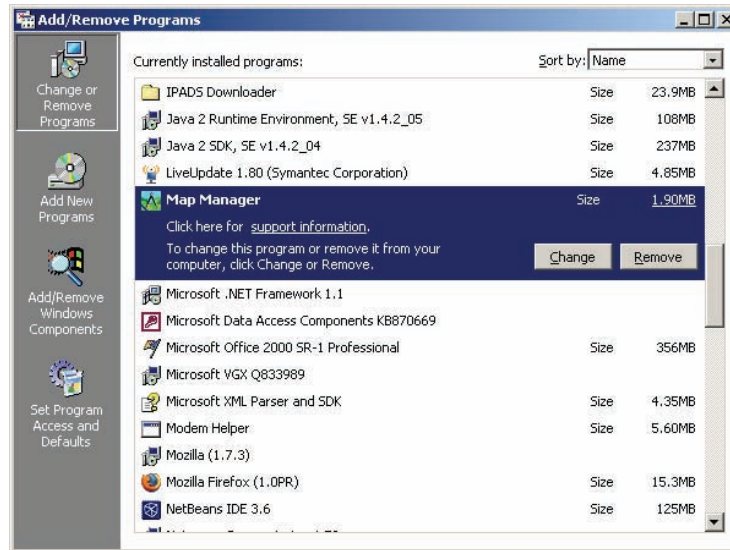6-5, Installing IPADS Map Manager.

a. **Remove previous versions of IPADS Emulator, IPADS Map Manager, and/or IPADS Downloader.**

(1) Open Add/Remove Programs from the Windows™ Control Panel (Start\Settings\Control Panel).
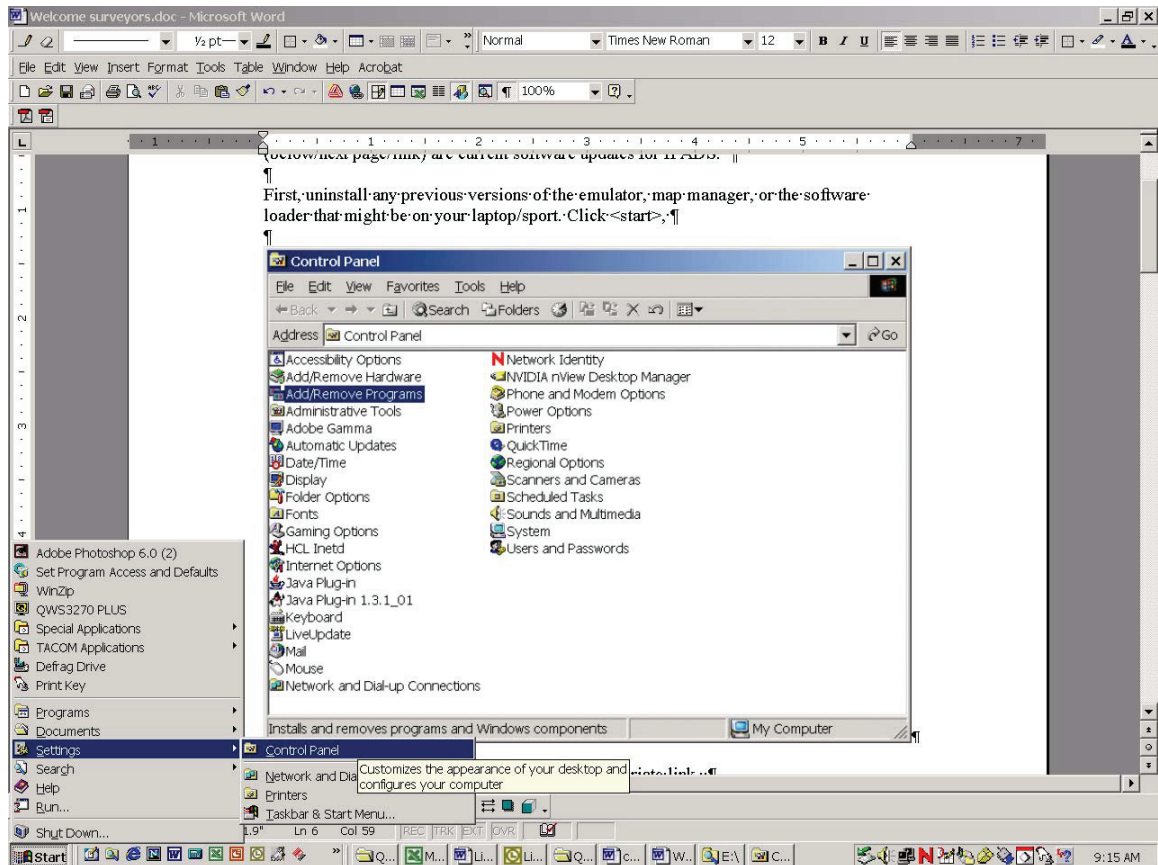
(2) Search the Add/Remove Programs list for Map Manager, Emulator, and/or IPADS Downloader.

6-4. Preparation for Installation of IPADS Map Manager – Continued

    (3) When prompted, click the Remove button to uninstall Map Manager, Emulator, and/or IPADS Downloader.

  b. Computer is now ready for installation of IPADS Map Manager.

6-5. Installing IPADS Map Manager.

Computer requirements:

    (1) Intel™ Pentium 4™ processor or equivalent.

    (2) Microsoft™ Windows™ 2000 or Windows™ XP operating system.

    (3) CD-ROM drive.

    (4) An Ethernet port to copy map files to an IPADS.

    (5) IPADS Software Downloader software must be installed to copy map files to an IPADS.

    (6) A writable drive to copy map files to a removable disk.

    (7) Roxio CD Creator™ or similar software must be installed to copy map files to a CD.

NOTE

- You must have administrator privileges to be able to install or remove IPADS Map Manager.

- If IPADS Map Manager already is installed on the host PC, it must be removed (uninstalled) before reinstalling or installing a new version of IPADS Map Manager. Go to paragraph 6-4 for removal of IPADS Map Manager.

6-6. Operation.

NOTE

- IPADS Map Manager can be started from the Windows™ desktop, the Windows™ Start Programs menu, or from IPADS Software Downloader. IPADS Map Manager must be started from IPADS Software Downloader to load maps into an IPADS. If the host PC will not be connected to an operating IPADS during the session, IPADS Map Manager must be started from the Windows™ desktop or Start Programs menu.

- Depending on firewall settings, the host PC may display a message saying IPADS Software Downloader or IPADS Map Manager is attempting to access a server. If software or maps will be downloaded to an IPADS, access must be allowed. If IPADS Map Manager will not be communicating with an IPADS, it is Ok to block access.

  a. **Starting IPADS Map Manager.**

    (1) To start IPADS Map Manager from the Windows™ desktop, double-click on the IPADS Map Manager icon.

    (2) To start IPADS Map Manager from the Windows™ Start Programs menu:

      (a) Click on Start button on Windows™ task bar.

      (b) Click on Programs.

6-6. Operation - Continued

       (c) Click on IPADS Map Manager in the list of programs. The IPADS Map Manager window will be displayed, Figure 6-1.

    (3) To start IPADS Map Manager from IPADS Software Downloader:

       (a) Start IPADS Software Downloader.

       (b) Click on the "Map Manager" button in the IPADS Software Downloader window.

       (c) Follow the on-screen instructions to connect to and power up the IPADS.

       (d) IPADS Map Manager will automatically start when the connection to IPADS has been established and verified.

  b. **Closing IPADS Map Manager.** Click on the Close button, at the bottom right, to close IPADS Map Manager. If IPADS Map Manager was started from IPADS Software Downloader, follow the on-screen instructions to shut down and disconnect the IPADS after IPADS Map Manager has closed.

c. **Help.** Context related help is displayed in the Message Area if a data input field is selected or the mouse cursor (pointer) is placed over an enabled control or data field. In addition, pop-up alert messages are displayed when an error is detected. These must be acknowledged by clicking on the OK button.

d. **Map properties.** To display the properties of a map file:
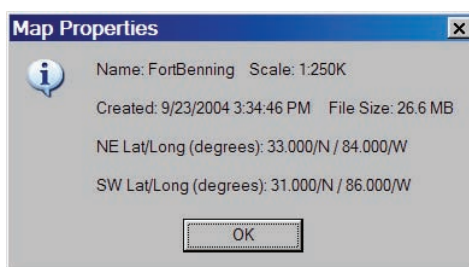
    (1) Double-click on the map name in the Source or Destination Map List box. A Map Properties window will pop up showing the map name, map scale, file creation date and time, file size, and the latitudes and longitudes of the northeast and southwest corners of the map.

    (2) Click on the OK button to close the Map Properties window.

e. **Preparing Maps for IPADS.**

    (1) Click on Make Map button. IPADS Map Manager will search for a CD containing CADRG map files. If map files are not found, you will be prompted to select the CD drive and a folder named RPF.
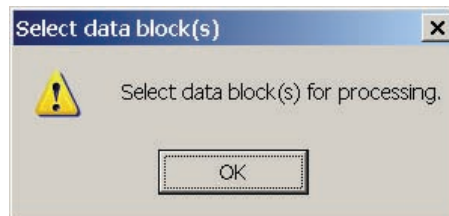
NOTE

IPADS Map Manager automatically searches for a folder named RPF, containing CADRG data. If a RPF folder isn't found, the Browse for Folder window is displayed, which allows selection of a folder from the directory tree. A RPF folder won't be automatically found if there is no CD in the drive; the CD doesn't have properly formatted map data; or the RPF folder is in another folder. The latter case can occur if the CD contains multiple map data formats. In which case, a folder containing CADRG data must be selected. If the CD does not have an RPF folder, it doesn't contain properly formatted map data.
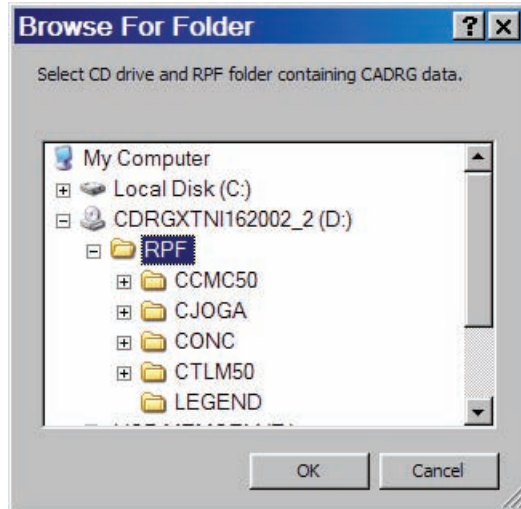
(2) If the Browse For Folder window is displayed:

  (a) Click on the plus (+) sign in front of the CD drive icon to expand the directory tree to show the folders on the drive.

  (b) If a RPF folder is not shown, click on the plus (+) sign in front of the desired folder to expand the directory tree.

  (c) You may have to expand one or more levels of folders to find an RPF folder.

  (d) When an RPF folder is located, click on it to select it. The selected folder will be highlighted.

  (e) Click on the OK button, to continue, or click on the Cancel button to return to IPADS Map Manager.

(3) If the CD contains more than one block of map data, you will be prompted to select the data blocks for processing.

(4) If the Select data block(s) prompt is displayed, click on the OK button.

6-6. Operation - Continued
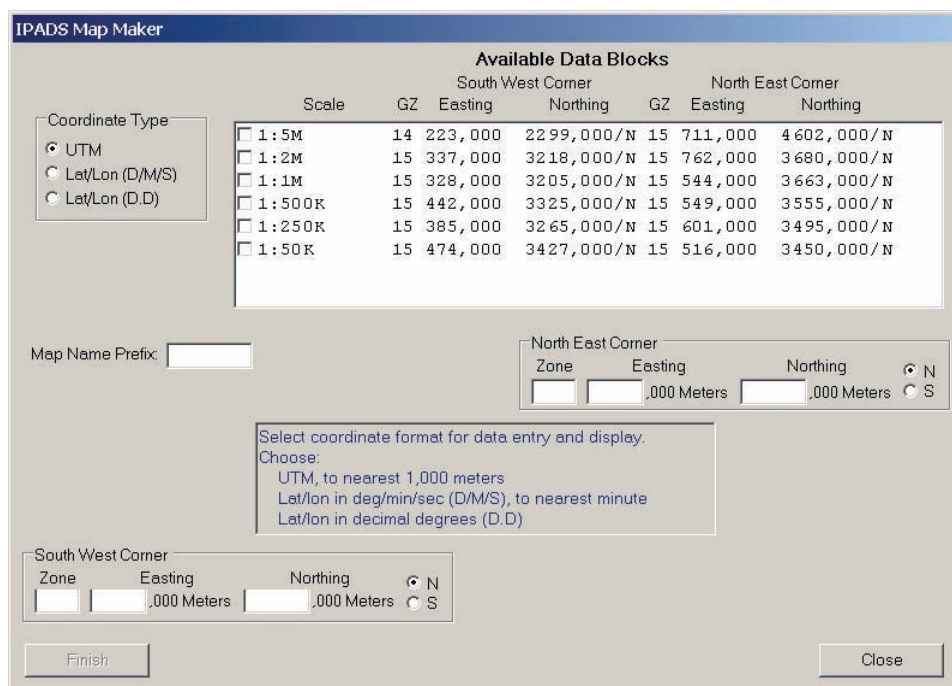
(5) IPADS Map Maker window will be displayed with the available data blocks and map scales listed.

NOTE

- The IPADS Map Maker window "look" and input data fields vary with the type of coordinates selected for display, Figures 6-2 through 6-4.

- UTM is the default coordinate type.

- Changing the coordinate type will clear data input fields and checked data blocks.

(6) Click on the UTM, Lat/Lon (D/M/S), or Lat/Lon (D.D) radio button to select the desired coordinate type.

NOTE

- A line containing a check box, map scale, coordinates of the southwest data block corner, and the coordinates of the northeast data block corner will be displayed for each data block available on the CD.

- Map scales are displayed as given on the CD. Map scales are expressed as ratios (e.g. 1:50K or 1:1M, where "K" means "thousand" and "M" means "million"). While seeming counter-intuitive, the larger the number on the right side of the colon (:) the smaller the map scale. e.g. 1:1M is smaller than 1:50K.

- The same map scale may be represented differently on the CD. e.g. 1:50K, 1:50k, and 1:50,000 are different representations of the same map scale. IPADS Map Manager handles these different representations.

- Larger scale maps have more detail than smaller scale maps. When there is a choice, choose the larger scale (e.g. 1:50K rather than 1:250K). Maps at scales smaller than 1:250K generally are inadequate for IPADS navigation.

- The most commonly available maps are 1:250K Joint Operations Graphics (JOG) and 1:50K Topographic Line Maps (TLM). Maps do not exist for all operational areas. Generally, JOG coverage is more extensive than TLM coverage. Larger scale maps (e.g. 1:24K) are available for some urban areas.

- IPADS automatically selects a map that encompasses its current position. If the current position falls within more than one map, the operator has no control over which map IPADS will display. If multiple map scales are available for a given area, select only one scale for preparing IPADS maps.

(7) Select (click on) all data blocks you want to process. Selected blocks are denoted by a ✓ in the box in front of the data block information. At least one data block must be selected before the Finish button is enabled and processing can be initiated.

NOTE

- The cursor automatically moves to the next field when a full field (e.g. two digit grid zone) is detected. The cursor must be manually moved to the next field, if a full field cannot be detected (e.g. single digit grid zone), by pressing the Tab key or clicking on the next field with the mouse. Shift Tab will return to the previous field.

- IPADS Map Manager automatically generates map names to insure maps will load into IPADS in proper order. For easier identification of maps, you may enter a map name prefix. For proper loading, all maps for the same operational area should have the same prefix.

(8) Enter a map name prefix for the operational area (optional). The prefix may be 0 to 8 characters long. Upper and lower-case alphabetic, numeric, space, dash (-), and underscore (_) characters are allowed.

NOTE

- To insure proper map display, boundaries for the entire operational area to be covered should be entered. IPADS Map Manager will prepare as many maps as are necessary to cover the area within the data available for the selected data blocks.

- The data fields for boundary coordinate entry vary with the selected coordinate type.

- Precise coordinates are not needed for map area boundaries. Therefore, input resolution is limited to the nearest 1,000 meters for UTM, and the nearest minute for latitude and longitude (D/M/S).

- IPADS Map Manager expects WGS 84 coordinates. Entry of coordinates referenced to another datum won't significantly impact map boundaries.

(9) UTM coordinate entry:

(a) Enter the grid zone number for the southwest corner of the map area. Allowable entries are 1 to 60.

(b) Enter the easting for the southwest corner of the map area, to the nearest 1,000 meters. Easting values must be within the extended grid zone boundaries, which vary by latitude.

(c) Enter the northing for the southwest corner of the map area, to the nearest 1,000 meters. Northing values must be within the boundaries of the UTM area (80°S to 84°N).

(d) Click on the hemisphere button for the southwest corner of the map area, "N" for northern hemisphere (default) or "S" for southern hemisphere.

(e) Enter the grid zone number for the northeast corner of the map area. Allowable entries are 1 to 60.

6-6. Operation - Continued

      (f) Enter the easting for the northeast corner of the map area, to the nearest 1,000 meters. Allowable entries are 100,000 to 900,000 meters.

      (g) Enter the northing for the northeast corner of the map area, to the nearest 1,000 meters. Allowable entries are 0,000 to 9330,000 meters in the northern hemisphere and 1110,000 to 10000,000 in the southern hemisphere.

      (h) Click on the hemisphere button for the northeast corner of the map area, "N" for northern hemisphere (default) or "S" for southern hemisphere.

  (10) Latitude and longitude entry in degrees, minutes and seconds:

      (a) Enter the degrees portion of the latitude of the north map area boundary to the nearest degree. Allowable entries are 0 to 84 degrees in the northern hemisphere and 0 to 80 degrees in the southern hemisphere.

      (b) Enter the minutes portion of the latitude of the north map area boundary to the nearest minute. Allowable entries are 0 to 59 minutes.

      (c) Click on the hemisphere button for the north map area boundary, "N" for northern hemisphere (default) or "S" for southern hemisphere.

      (d) Enter the degrees portion of the latitude of the south map area boundary to the nearest degree. Allowable entries are 0 to 84 degrees in the northern hemisphere and 0 to 80 degrees in the southern hemisphere.

      (e) Enter the minutes portion of the latitude of the south map area boundary to the nearest minute. Allowable entries are 0 to 59 minutes.

      (f) Click on the hemisphere button for the south map area boundary, "N" for northern hemisphere (default) or "S" for southern hemisphere.

      (g) Enter the degrees portion of the longitude of the west map area boundary to the nearest degree. Allowable entries are 0 to 180 degrees.

      (h) Enter the minutes portion of the longitude of the west map area boundary to the nearest minute. Allowable entries are 0 to 59 minutes.

      (i) Click on the hemisphere button for the west map area boundary, "E" for eastern hemisphere or "W" for western hemisphere (default).

      (j) Enter the degrees portion of the longitude of the east map area boundary to the nearest degree. Allowable entries are 0 to 180 degrees.

      (k) Enter the minutes portion of the longitude of the east map area boundary to the nearest minute. Allowable entries are 0 to 59 minutes.

      (l) Click on the hemisphere button for the east map area boundary, "E" for eastern hemisphere or "W" for western hemisphere (default).

  (11) Latitude and longitude entry in decimal degrees:

      (a) Enter the latitude of the north map area boundary in decimal degrees. Allowable entries are 0 to 84 degrees in the northern hemisphere and 0 to 80 degrees in the southern hemisphere.

      (b) Click on the hemisphere button for the north map area boundary, "N" for northern hemisphere (default) or "S" for southern hemisphere.

      (c) Enter the latitude of the south map area boundary in decimal degrees. Allowable entries are 0 to 84 degrees in the northern hemisphere and 0 to 80 degrees in the southern hemisphere.

      (d) Click on the hemisphere button for the south map area boundary, "N" for northern hemisphere (default) or "S" for southern hemisphere.

      (e) Enter the longitude of the west map area boundary in decimal degrees. Allowable entries are 0 to 180 degrees.

(f) Click on the hemisphere button for the west map area boundary, "E" for eastern hemisphere or "W" for western hemisphere (default).

(g) Enter the longitude of the east map area boundary in decimal degrees. Allowable entries are 0 to 180 degrees.

(h) Click on the hemisphere button for the east map area boundary, "E" for eastern hemisphere or "W" for western hemisphere (default).

NOTE

The Finish button will become enabled when all required fields have entries and at least one data block is checked.

(12) Verify that all entries are correct. Correct any incorrect entries.

(13) Click on the Finish button to initiate map preparation.

(14) A progress bar and messages will be displayed during map preparation.

(15) A message will be displayed in the Message Area when a map file has been successfully created.

(16) A pop-up message will be displayed if an error was encountered. Click on OK to acknowledge the message and take the appropriate corrective action.

(17) After map files have been created, you can create new maps by changing one or more of the other input parameters and then clicking on the Finish button.

(18) Click on the Close button to exit IPADS Map Maker and return to IPADS Map Manager.

f. **Map names.** The latitude and longitude of the southwest corner and the map scale are embedded in the map name. Map names generated by IPADS Map Manager have the form P_OLat_OLon_IS where:

P is the operator entered map name prefix.

OLat is the offset latitude of the southern map boundary.

OLon is the offset longitude of the western boundary.

IS is the inverse map scale.

(1) To decode the latitude of the southern map boundary:

(a) Divide the offset latitude by 10.

(b) Subtract 90. The result is the latitude in decimal degrees. Latitude is negative in the Southern Hemisphere.

(2) To decode the longitude of the western map boundary:

(a) Divide the offset longitude by 10.

(b) Subtract 180. The result is the longitude in decimal degrees. Longitude is negative in the Western Hemisphere.

(3) To decode the map scale, place "1:" before the inverse scale.

(4) For example, a map name of VA_1262_0939_250K translates to:

VA is the map name prefix assigned by the operator.

Latitude = 1262 / 10 – 90 = 36.2 degrees

Longitude = 0939 / 10 – 180 = -86.1 degrees

Map scale = 1:250K

6-6. Operation - Continued

    g. **Deleting source maps.** Perform the following steps to delete source maps:

NOTE

- The IPADS Map Library on the host PC is the default source for IPADS maps. IPADS maps are placed there when they are created. Maps can also be imported from removable media or drive (e.g. a CD or USB Flash Drive) containing an IPADS Map Library.

- External drives must be connected to the PC before launching IPADS Map Manager. Otherwise, they won't be recognized.

- Removable media must be inserted in the PC's drive before attempting to access the drive. Otherwise, the map library won't be found.

- The map source and destination cannot be the same. IPADS Map Manager prevents selection of the same source and destination

- Maps can't be deleted from a write protected or non-writable import drive.

(1) Use the Import Drive drop-down box and source radio buttons to select the source for maps to be deleted, paragraphs 6-3d and 6-3e.

(2) Select the map name(s) in the source map list box to be deleted, paragraph 6-3f.
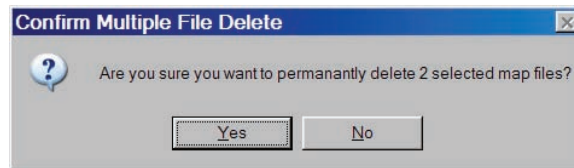
(3) Click on the Delete Source Map button. A Confirm File Delete request will pop up.

(4) Select the <u>Y</u>es button to complete deletion or <u>N</u>o button to cancel the deletion. Deletion progress will be displayed. The file name list will be refreshed when deletion is complete.

    h. **Deleting destination maps.** The delete destination map function allows maintenance of the maps in IPADS and the Emulator as well as on export drives. Perform the following steps to delete destination maps:

NOTE

- IPADS must be connected to the host PC using IPADS Software Downloader before launching IPADS Map Manager.

- IPADS Emulator must be installed on the same drive as IPADS Map Manager for it to be recognized.

- External drives must be connected to the PC before launching IPADS Map Manager. Otherwise, they won't be recognized.

- Removable media must be inserted in the PC's drive before attempting to access the drive.

- CDs must be preformatted using Roxio CD Creator before accessing the CD drive.

- The map source and destination cannot be the same. IPADS Map Manager prevents selection of the same source and destination. Map Library will be enabled as a destination only when an import drive is selected as the source.

(1) Use the Export Drive drop-down box and destination radio buttons to select the source for maps to be deleted, paragraphs 6-3d and 6-3e.

NOTE

Delete outdated maps from IPADS and the Emulator before loading new maps covering the same area. Otherwise, you can't be sure which map(s) IPADS or the Emulator will display.

(2) Select the map name(s) in the Destination Map List box to be deleted, paragraph 6-3f.
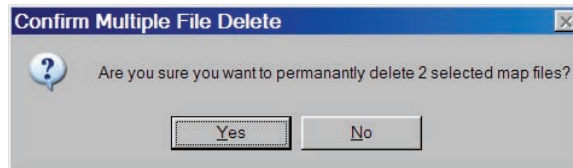
(3) Click on the Delete Destination Map button. A Confirm File Delete request will pop up.

(4) Select the Yes button to complete deletion or No button to cancel the deletion. Deletion progress will be displayed. The destination map name list will be refreshed when deletion is complete.

i. **Copying Maps to IPADS.** Before launching IPADS Map Manager:

(1) Start IPADS Software Downloader.

(2) Click on the Map Manager button.

(3) Follow the on-screen instructions to connect the PC to IPADS and power up IPADS.

(4) IPADS Map Manager will be started after IPADS Software Downloader has established and verified communications with IPADS. IPADS will be selected as the default map destination.

(5) If any maps are to be deleted from IPADS:

(a) Select the map name(s) in the Destination Map List box to be deleted, paragraph 6-3f.

(b) Click on the Delete Destination Map button. A Confirm File Delete request will pop up.

(c) Select the Yes button to complete deletion or No button to cancel the deletion. Deletion progress will be displayed. The destination map name list will be refreshed when deletion is complete.

(6) If the default Map Library is not the source for maps to be copied, use the Import Drive drop-down box and source radio buttons to select the source for maps to be copied, paragraphs 6-3d and 6-3e.

(7) Select the map name(s) in the source map list box to be copied, paragraph 6-3f.

(8) Click on Copy Map >> button to initiate copying of the selected maps to IPADS. Messages and a progress bar will indicate progress during copying. The destination map list will be refreshed and a message displayed when copying is complete.

(9) Repeat steps (6) through (8) to copy additional maps.

(10) Click on the Close button when map copying is finished. IPADS Map Manager will close.

(11) Follow the on-screen instructions to power down IPADS and disconnect it from the PC.

(12) Close IPADS Software Downloader.

NOTE

The Map Destination Emulator radio button will be enabled only when IPADS Emulator software is loaded on the PC.

6-6. Operation - Continued

j. **Copying Maps to IPADS Emulator.**

   (1)   If running, shut down IPADS Emulator.

   (2)   If not already running, start IPADS Map Manager.

   (3)   Click on the Emulator radio button.

   (4)   If any maps are to be deleted from the Emulator:

      (a) Select the map name(s) in the Destination Map List box to be deleted, paragraph 6-f.

      (b) Click on the Delete Destination Map button. A Confirm File Delete request will pop up.

      (c) Select the <u>Y</u>es button to complete deletion or <u>N</u>o button to cancel the deletion. Deletion progress will be displayed.   The destination map name list will be refreshed when deletion is complete.

   (5)   If the default Map Library is not the source for maps to be copied, use the Import Drive drop-down box and source radio buttons to select the source for maps to be copied, paragraphs 6-3d and 6-3e.

   (6)   Select the map name(s) in the source map list box to be copied, paragraph 6-3f.

   (7)   Click on Copy Map >> button to initiate copying of the selected maps to the Emulator. Messages and a progress bar will indicate progress during copying. The destination map list will be refreshed and a message displayed when copying is complete.

   (8)   Repeat steps 6-6j(6) through 6-6j(7) to copy additional maps.

NOTE

The Map Destination Map Library radio button is enabled only when an Import Drive is selected as the source.

k. **Copying Maps to IPADS Map Library.**

   (1)   If not already running, launch IPADS Map Manager.

   (2)   If not already selected, use the Import Drive drop-down box and radio button to select an import drive as the source for maps to be copied, paragraphs 6-3d and 6-3e.

   (3)   Select the map name(s) in the source map list box to be copied, paragraph 6-3f.

   (4)   Click on Copy Map >> button to initiate copying of the selected maps to the IPADS Map Library. Messages and a progress bar will indicate progress during copying. The destination map list will be refreshed and a message displayed when copying is complete.

   (5)   Repeat steps 6-6k(3) through 6-6k(4) to copy additional maps.

NOTE

- The Map Destination Export Drive radio button will be enabled only when a writable Drive is selected as the destination.

- The Import Drive and Export Drive cannot be the same drive.

- The Export Drive must have enough free space to hold the map files to be copied.

- If the Export Drive is a CD writer, the CD must be pre-formatted to accept files using a program such as directCD™ format utility.

l. **Copying Maps to an Export Drive.**

   (1)   If not already running, launch IPADS Map Manager.

   (2)   Use the Export Drive drop-down box and radio button to select an export drive as the destination for maps to be copied, paragraphs 6-3d and 6-3e.

(3)   If any maps are to be deleted from the Export Drive:

  (a)   Select the map name(s) in the Destination Map List box to be deleted, paragraph 6-3f.

  (b)   Click on the Delete Destination Map button. A Confirm File Delete request will pop up.

  (c)   Select the Yes button to complete deletion or No button to cancel the deletion. Deletion progress will be displayed. The destination map name list will be refreshed when deletion is complete.

(4) If the default Map Library is not the source for maps to be copied, use the Import Drive drop-down box and source radio buttons to select the source for maps to be copied, paragraphs 6-3d and 6-3e.

NOTE

IPADS Map Manager's estimate of free space (number of maps) is conservative. If free space remains after copying maps to a destination, you may copy additional maps to it.

(5)   Considering the free space available on the export drive, select the map name(s) in the source map list box to be copied, paragraph 6-3f.

(6)   Click on Copy Map >> button to initiate copying of the selected maps to the Export Drive. Messages and a progress bar will indicate progress during copying. The destination map list will be refreshed and a message displayed when copying is complete.

(7)   Repeat steps 6-6l(5) through 6-6l(6) to copy additional maps.

CHAPTER 7

REPROGRAMMING LRUS AND DOWNLOADING MAPS

SECTION I. INTRODUCTION

7-1. General. IPADS CDU and CPNU can be reprogrammed using the Maintenance Support Device (MSD) or equivalent, the reprogramming cable W143 (PN 7204143-9), IPADS Software Downloader software, and TB 9-6675-349-12-2 (CD). Maps can be downloaded to IPADS using the same hardware configuration running IPADS Map Manager and IPADS Software Downloader software. IPADS Map Manager and IPADS Software Downloader software can be installed on the MSD from TB 9-6675-349-12-1 (CD). TB 9-6675-349-12-1 (CD) also can install the IPADS Emulator on the MSD or other personal computer (PC). IPADS Map Manager also can be used to prepare maps for IPADS from NGA digital data.

SECTION II. COMPUTER REQUIREMENTS AND SOFTWARE INSTALLATION

7-2. Computer Requirements. Minimum PC requirements are:

a. Operating System: Windows NT™, Windows 2000 ™, or Windows XP™.
b. Available hard drive space: 30 Mbytes.
c. CD-ROM drive.
d. An Ethernet port to copy map files to an IPADS.
e. A writable drive to copy map files to a removable disk with IPADS Map Manager.
f. Adobe Acrobat Reader™ must be installed for the IPADS Emulator to display the Technical Manual.
g. Roxio CD Creator™ software must be installed to copy map files to a CD with IPADS Map Manager.

7-3. Software Installation. IPADS Map Manager and IPADS Software Downloader must be installed on a computer used to reprogram IPADS and download maps to IPADS. IPADS Emulator and IPADS Map Manager software must be installed on a PC used for IPADS and map management training.

NOTE

- You must have Administrator privileges to install software on your computer.

- Previous versions of IPADS Software Downloader, IPADS Emulator and IPADS Map Manager software must be removed (uninstalled) before installing a new version, paragraph 7-4.

- To quit installation, click on "Cancel" at any point in the process.

```
 C:\WINDOWS\system32\cmd.exe

M111 IPADS Accessory Software Installer
Automated Test Systems Division (ATSD)
U.S. Army, Picatinny Arsenal, NJ


Enter Y (Yes) to install or N (No) to skip:
  IPADS Software Downloader
  IPADS Emulator
  IPADS Map Manager
Enter Q (Quit) to exit Accessory Software Installation

Follow instructions for each setup


Install IPADS Software Downloader? [Y, N, or Q]:
```

7-3. Software Installation – Continued

a. Insert TB 9-6675-349-12-1 (CD) into CD drive of computer. A software installation selection screen will be displayed.
b. When each software package is listed on the screen, select it for installation (Y) or no installation (N) depending on the function of the computer.
c. Follow on-screen instructions to complete installation of each desired software package.
d. Completion of installation will be displayed on-screen.

7-4. Software Removal. Software packages must be removed (uninstalled) before installing an upgraded version. Software packages should be removed from a computer if the computer will no longer perform the function intended by the software.

NOTE

- You must have Administrator privileges to uninstall software on your computer.

- Windows™ can be set to compress programs that have not been run for a while. Programs that have been compressed may not uninstall. If you get a message to insert the distribution disk when trying to uninstall a program, cancel out of the uninstall and run the old version of the program you are trying to uninstall. Close the program. It should now uninstall properly.

a. From the Windows™ Task Bar select **Start** > **Settings** > **Control Panel**.
b. From **Control Panel** select **Add or Remove Programs**.
c. Select a program to be removed from the displayed list.
d. Click on **Remove** and follow any on-screen instruction.
e. When removal is complete, repeat steps c. and d. for any other programs to be removed.
f. When all desired programs are removed, close **Add or Remove Programs** and **Control Panel**..

SECTION III. REPROGRAMMING IPADS AND DOWNLOADING MAPS

7-5. Reprogramming the CPNU and CDU.

NOTE

- IPADS Software Downloader must have been previously installed on the MSD.

- TB 9-6675-349-12-2 (CD), containing the latest IPADS software, is needed to reprogram IPADS.

a. Start IPADS Software Downloader on the MSD.
b. Select **UPDATE Software** and follow on-screen instructions.
c. Load TB 9-6675-349-12-2 (CD) into the MSD when instructed.

7-6. Downloading Maps.

NOTE

IPADS Software Downloader and IPADS Map Manager must have been previously installed on the MSD.

a. Start IPADS Software Downloader on the MSD.
b. Select **Map Manager** and follow on-screen instructions.
c. When IPADS Map Manager is displayed, follow instructions in Chapter 6 to download maps to IPADS.

CHAPTER 8

MATERIEL USED IN CONJUNCTION WITH MAJOR ITEM

SECTION I. INTRODUCTION

8-1. General. This chapter lists auxiliary equipment items that are used by field to transfer position and azimuth in performing the IPADS mission as described in Chapter 3.

SECTION II. MATERIEL USED IN CONJUNCTION WITH MAJOR ITEM

8-2. General. Following is a list of materiel used in conjunction with major item.

 a. **Theodolite**: (with sight painted white to aid in auto reflection)

  (1) W07701 Theodolite Survey: direct 0.002 mil 30 ±5 power detach tribrach, or:

  (2) W07838 Theodolite Survey: direct 0.2 mil with tripod and carrying case.

 b. **Surveying Set**: Supplementary Equipment for Improved Position and Azimuth Determining System, NSN 6675-01-073-3832.

APPENDIX A

REFERENCES

A-1. Scope.

This appendix lists all forms, field manuals, technical bulletins, and technical manuals referenced in this manual.

A-2. Forms

NAVMC Form 10772	Recommended Changes to Technical Publications/Logistics-Maintenance Data Coding
DA Form 2028	Recommended Changes to Publications and Blank Forms
SF 361	Transportation Discrepancy Report
SF 364	Report of Discrepancy (ROD)
SF 368	Product Quality Deficiency Report

A-3. Shipment and Storage

MCO 4450.7	Marine Corps Warehousing Manual
TM 740-90-1	Administrative Storage of Equipment

A-4. Maintenance

DA PAM 738-750	Functional Users Guide for the Army Maintenance Management System (TAMMS)
TM 4700-15-1	Equipment Record Procedures
TM 9-2320-280-10	Operator's Manual for HMMWV
TM 9-2320-285-10	Operator's Manual for Carrier, Cargo: Tracked, 1-1/2 Ton, M973A (NSN 2350-01-281-6451) Carrier, Cargo: Tracked, 2-Ton, M1067 (2350-01-281-6450) Carrier, Command Post: Tracked, 1-1/2 Ton, M (2350-01-281-8324) Carrier, Ambulance: Tracked, 1-1/2 Ton M1066 (2350-01-283-6215)
TM 9-2320-285-20	Unit Maintenance Manual for Carrier, Cargo: Tracked, 1-1/2 Ton, M973A (NSN 2350-01-281-6451) Carrier, Cargo: Tracked, 2-Ton, M1067 (2350-01-281-6450) Carrier, Command Post: Tracked, 1-1/2 Ton, M (2350-01-281-8324) Carrier, Ambulance: Tracked, 1-1/2 Ton M1066 (2350-01-283-6215)
TM 9-2320-362-14&P	Operator, Unit, Direct Support, and General Support Maintenance Including Repair Parts and Special Tools List for Electrical Environmental System (EES) Kit Used on Truck Utility: S250 SHEL Carrier, 4X4, M1037 For Traffic Jam AN/TLQ-17A(V) 3 (HMMWV)

A-5. Demolition

TM 750-244-2	Procedures for Destruction of Electronics Material to Prevent Enemy Use (Electronics Command)

A-6. Miscellaneous

AR 750-10	Army Modification Program
CTA 50-970	Expendable/Durable Items (Except: Medical, Class V, Repair Parts, and Heraldic Items)
DA PAM 750-10	US Army Equipment Index of Modification Work Orders SL 1-2 1-3
FM 4-25.11	First Aid
MCO 4430.3	Report of Item and Packaging Discrepancies (ROD)
MCO 4855.10B	Quality Deficiency Report
MCO P4610.19C	Transportation and Travel Report of Transportation Discrepancies and Shipments
SB 700-20	Army Adapter/Other Items Selected for Authorization List of Portable Items
TB 9-6675-349-12-1/ TB 9-6675-349-12-2	
TB 11-7021-228-10-1 TB 11-7021-228-10-2	Forward Observer Systems (FOS) HTU (Digital Data Set AN/PSG-9) (NSN 7035-01-452-4306) LCU (Fire Control System AN/GYK-37) (NSN 1230-01-380-9228) and RHC (Digital Data Set AN/PSG-11) (NSN 7021-01-491-9157)

APPENDIX B

COMPONENTS OF END ITEM LIST
COMPONENTS OF END ITEM (COEI) AND BASIC ISSUE ITEMS (BII) LIST

SECTION I. INTRODUCTION

B-1. Scope.

This appendix lists components of the end item and basic issue items for the IPADS to help you inventory the items for safe and efficient operation of the equipment.

B-2. General.

The components of end item (COEI) and basic issue items (BII) lists are divided into the following sections:

a. **Section II. Components of End Item.**

This listing is for information purposes only and is not authority to requisition replacements. These items are part of the IPADS but they are to be removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to help you find and identify the items.

b. **Section III. Basic Issue Items.**

These essential items are required to place the IPADS in operation, operate it, and do emergency repairs. Although shipped separately packaged, BII must be with the IPADS during operation and when transferred between property accounts. Listing these items is your authority to requisition them for replacement based on authorization of the end item by the TOE/MTOE (Table of Organization and Equipment/Modified Table of Organization and Equipment). Illustrations are furnished to help you find and identify the items.

B-3. Explanation of columns

a. **Column 1 - Illustration Item Number.**

Indicates the callout number used to reference the item in the illustration.

b. **Column 2 - National Stock Number (NSN).**

Indicates the NSN assigned to the item that will be used for requisitioning.

c. **Column 3 - Description.**

Part Number, Description, and Usable On Code identify the federal item name followed by a minimum description when needed. The last line below the description is the CAGEC (Commercial and Government Entity Code) (in parentheses) and the part number.

d. **Column 4 - Unit of Issue (U/I).**

This column indicates how the item is issued for the national stock number shown in column 2.

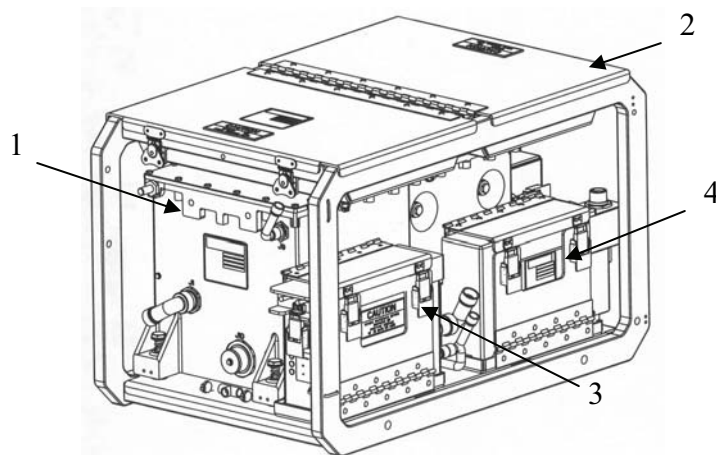e. **Column 5 - Quantity Required (Qty Req'd).**

This column lists the quantity of each item required for a complete major item.

SECTION II. COMPONENTS OF END ITEM (COEI)

ILLUSTRATION		NATIONAL STOCK NUMBER	DESCRIPTION PART NUMBER (CAGEC)	UNIT OF ISSUE	QUANTITY REQUIRED
FIG	**ITEM**				
1-3	1	6605-01-521-7884	Compact Position and Navigation Unit/Porro Prism Assembly (CPNU) (PPA) 7204153-9	EA	1
1-3	2	5975-01-522-4819	IPADS Frame 7204056-9	EA	1
1-3	3	6130-01-521-7883	Battery Charger Unit (BCU) 7204141-9	EA	1
1-3	4	7010-01-521-7883	Control and Display Unit (CDU) 7204142-9	EA	1
1-5		5340-01-522-1647	Installation Kit (HMMWV) 7204154-9	EA	1
1-6		5340-01-523-6532	Installation Kit (SUSV) 7204144-9	EA	AR
1-3	6	5995-01-522-5485	IPADS Harness Assembly W114 7204114-9	EA	1
1-3	9	5180-01-521-3695	IPADS TOOL Kit 7204146-9	EA	1

SECTION III. BASIC ISSUE ITEMS

ILLUSTRATION		NATIONAL STOCK NUMBER	DESCRIPTION PART NUMBER (CAGEC)	UNIT OF ISSUE	QUANTITY REQUIRED
FIG	ITEM				
1-5	1	5210-01-367-7283	Plumb bob, brass 8 oz. (63474) 108	EA	1
1-5	2	5120-01-522-5473	Plumb bob String 25yds (39428) 2178A8	Roll	1
1-5	3	6230-00-264-8261	Flashlight 90˚angle (1CSX9) MX-991/U	EA	1
1-5	4	5975-00-899-4606	Strap, Tiedown, Elect.(Nylon) (81343) MS3367-5-0	12 Pcs.	1
1-5	5	5120-01-523-4302	Strap, Cable W/Buckle(Velcro) (34054) 6912K54	EA	5
1-5	6	7920-00-205-1427	Brush, Dusting, Lens (80244) 7920-00-205-1427	EA	1
1-5	7	6135-00-835-7210	Wrench, Open End 5/8 inch (55719) OSH20B	EA	1
1-5	8	5120-01-335-1294	Handle, Ratchet Wrench 3/8 inch (55719) F936	EA	1
1-5	9	5120-01-429-3597	Socket Set, Socket (68D9G) 211SFY(12 Point) Set to include: • ¼ inch • 5/16 inch • 3/8 inch • 7/16 inch • ½ inch • 9/16 inch • 5/8 inch • 11/16 inch • ¾ inch • 13/16 inch • 7/8 inch	EA	1
1-5	10	5120-01-428-7830	Pliers, Needle Nose (55719) 196BCP	EA	1
1-5	11	5120-01-300-1152	Screwdriver, Cross Tip 3 & ¾ inch (55719) GSDDP22	EA	1
1-5	12	5120-01-290-8231	Screwdriver, Crosstip 8 &13/32 inch (55719) GSDDP42	EA	1
1-5	13	5120-01-335-1235	Wrench, Box and Open End 9/16 inch (55719) OEX18B	EA	1

BASIC ISSUE ITEMS – Continued

ILLUSTRATION		NATIONAL STOCK NUMBER	DESCRIPTION PART NUMBER (CAGEC)	UNIT OF ISSUE	QUANTITY REQUIRED
FIG	ITEM				
1-5	14	5120-01-367-3356	Wrench, Box and Open End ¾ inch (55719) OES24B	EA	1
1-5	15	5110-01-399-9317	Knife, Pocket, Electrician's (1CV05) 18535	EA	1
1-5	16	5140-01-528-1311	Roll, Tools & Accessories (39428) 6389A11	EA	1
1-5	17	5920-01-493-6642	Fuse, Cartridge (0JR59) 373150041	EA	5
1-5	18	5120-01-335-1233	Wrench, Box and Open 7/16 inch (55719) OEX14B	EA	1
1-5	19		Field and Sustainment Maintenance Manual for the IPADS TM 9-6675-349-13&P	EA	1
1-5	20	5935-00-567-0128	Connector Plug Electrical, NATO (61090) TGC2338	EA	1
1-5	21	5995-01-519-0653	Cable Assembly, Special, W136 (FOS) (1NZ85) 7204136-9	EA	1
1-5	22	5995-01-522-2631	Cable Assembly, Special, W143 (REPROGRAMMING) (1NZ85) 7204143-9	EA	1
1-5	23	5995-01-493-8358	Cable, Charging, BCU (1NZ85) ABP-ACC-TR-1	EA	1
1-5	24	5120-01-263-6436	Hex Key, 5/16" L Handle (3A054) 57185A17	EA	1

APPENDIX C

ADDITIONAL AUTHORIZATION LIST

SECTION I. INTRODUCTION

C-1. Scope.

This appendix lists additional items you are authorized for the support of the IPADS.

C-2. General.

This list identifies items that do not have to accompany the IPADS and do not have to be turned in with it. These items are authorized to you by CTA, MTOE, TDA, or JTA.

C-3. Explanation of Listing.

National stock number, description, and quantities are provided to help you identify and request the additional items you require to support this equipment.

SECTION II. ADDITIONAL AUTHORIZATION LIST

NATIONAL STOCK NUMBER	PART NUMBER (CAGEC)	DESCRIPTION	U/M	QUANTITY AUTHORIZED
6135-00-835-7210	BA 3030/U (81349)	Battery, Dry, 1.5 Volts	EA	12
2540-00-051-3839	8712420 (19207)	Kit, Winterization for Truck Utility, ¼-ton (NOTE: For operation below -30°C (-25°F)	EA	1
2405-01-269-2215	13222E2450 (97403)	Installation Kit, SUSV, Electronic Equipment, IPADS (NOTE: Used to install IPADS on small utility support vehicle M973 series).	EA	1
5120-01-288-2510	GSDD44 (55719)	Screwdriver, flat tip	EA	1
5120-01-439-0677	00858 (4D864)	Screwdriver, cross tip	EA	1
5120-00-264-3796	D712 (96508)	Wrench Adjustable 12 in long	EA	1
5120-01-335-1260	OEX28B (55719)	Combination wrench 7/8 inch	EA	1
5120-01-367-3352	OES16 (55719)	Combination wrench ½ inch	EA	1
6625-01-458-5183	179 (89536)	Multimeter	EA	1
8145-01-525-4317	7158019-5 (1NZ85)	Shipping and Storage, CDU (Figure 1-9)	EA	1

APPENDIX D

MAINTENANCE ALLOCATION CHART

SECTION I. INTRODUCTION

D-1. Scope.
The Maintenance Allocation Chart (MAC) provides an explanation of all maintenance and repair functions authorized at various maintenance levels under the Army maintenance system concept. The IPADS maintenance concept will be somewhat different due to the fact that there is only operator level maintenance and the depot level maintenance, which is L-3 Communications. The maintenance allocation chart in Appendix D Section II lists the actions and estimated times to conduct the maintenance required.

D-2. General.
a. The MAC designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component shall be consistent with the capacities and capabilities of the designated maintenance levels, which are shown on the MAC in column (4) as:

    Field – Includes two subcolumns (C [Operator/Crew] and O [Unit]) maintenance and Direct Support (F) maintenance.

    Sustainment – Includes two subcolumns, General Support (H) and Depot (D) maintenance.

b. The tools and test equipment requirements (Appendix E) list the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from the MAC.

c. The remarks contain supplemental instructions and explanatory notes for a particular maintenance function.

D-3. Maintenance Functions.
Maintenance functions are limited to and defined as follows:

a. **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel). This includes scheduled inspection and gagings and evaluation of cannon tubes.

b. **Test.** To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards on a scheduled basis, i.e., load testing of lift devices and hydrostatic testing of pressure hoses.

c. **Service.** Operations required periodically to keep an item in proper operating condition; e.g., to clean (includes, decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases. This includes scheduled exercising and purging of recoil mechanisms.

d. **Adjust.** To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.

e. **Align.** To adjust specified variable elements of an item to bring about optimum or desired performance.

f. **Calibrate.** To determine and cause corrections to be made or to be adjusted on instruments of test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

D-3. Maintenance Functions – Continued

g. **Remove/Install.** To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. **Replace.** To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and assigned maintenance level is shown as the third position code of the Source, Maintenance and Recoverability (SMR) code.

i. **Repair.** The application of maintenance services, including fault location/troubleshooting, removal/ installation, disassembly/assembly procedures, and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

NOTE

The following definitions are applicable to the "repair" maintenance function:

- Services—Inspect, test, service, adjust, align, calibrate, and/or replace.

- Fault location/troubleshooting—The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or Unit Under Test (UUT).

- Disassembly/assembly—The step-by-step breakdown (taking apart) of a spare/ functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).

- Actions—Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

j. **Overhaul.** That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. **Rebuild.** Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours/miles) considered in classifying Army equipment/ components.

D-4. Explanation of Columns in the MAC

a. **Column (1) – Group Number.** Column (1) lists FGC numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the Next Higher Assembly (NHA).

b. **Column (2) – Component/Assembly.** Column (2) contains the item names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. **Column (3) – Maintenance Function.** Column (3) lists the functions to be performed on the item listed in column (2). (For a detailed explanation of these functions refer to "Maintenance Functions" outlined above.)

d. **Column (4) – Maintenance Level.** Column (4) specifies each level of maintenance authorized to perform each function listed in column (3), by indicating work time required (expressed as manhours in whole hours or decimals) in the appropriate subcolumn. This work time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures are to be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

 Field:

  C – Operator or crew maintenance

  O – Unit maintenance

  F – Direct support maintenance

 Sustainment:

  L – Specialized repair activity (SRA)

  H – General support maintenance

  D – Depot maintenance

  K – Contractor facility

NOTE

The "L" maintenance level is not included in column (4) of the MAC. Functions to this level of maintenance are identified by a work time figure in the "H" column of column (4), and an associated reference code is used in the REMARKS column (6). This code is keyed to the remarks and the SRA complete repair application is explained there.

e. **Column (5) – Tools and Equipment Reference Code.** Column (5) specifies, by code, those common tool sets (not individual tools), common Test, Measurement and Diagnostic Equipment (TMDE), and special tools, special TMDE and special support equipment required to perform the designated function. Codes are keyed to the entries in the tools and test equipment table.

f. **Column (6) – Remarks Code.** When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks table entries.

D-5. Explanation of Columns in the Tools and Test Equipment Requirements

a. **Column (1) – Tool or Test Equipment Reference Code.** The tool or test equipment reference code correlates with a code used in column (5) of the MAC.

b. **Column (2) – Maintenance Level.** The lowest level of maintenance authorized to use the tool or test equipment.

c. **Column (3) – Nomenclature.** Name or identification of the tool or test equipment.

d. **Column (4) – National Stock Number (NSN).** The NSN of the tool or test equipment.

e. **Column (5) – Tool Number.** The manufacturer's part number, model number, or type number.

D-6. Explanation of Columns in the Remarks.

a. **Column (1) – Remarks Code**. The code recorded in column (6) of the MAC.

b. **Column (2) – Remarks.** This column lists information pertinent to the maintenance function being performed as indicated in the MAC.

SECTION II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			FIELD			SUSTAINMENT			
			UNIT		DIRECT SUPPORT	GENERAL SUPPORT	DEPOT		
			C	O	F	H	D		
00	IPADS ASSEMBLY 705004-9	Inspect	0.5	0.5			0.5		
		Repair		0.4			8.0	1,2,3	
		Replace		0.4			1.5		
01	Compact Position Navigation Unit/Porro Prism Assembly (CPNU/PPA) 11838924-1	Inspect	0.1				0.5		
		Test	1.0				0.5		
		Repair					4.5	1,2	
02	Battery Charger Unit (BCU) 11838924-2	Inspect	0.1	0.1			0.2		
		Test		0.2			0.5	1,2,3	
		Replace		0.2					
		Repair					2.0		
03	Display and Processor (CDU) 11838924-3	Inspect	0.1						
		Replace		0.3				1,2	
		Repair					2.5		
04	W-114 Wiring Harness 7204114-9	Inspect	0.1	0.1					
		Test		0.8					
		Replace		0.5				3	
05	Chassis, Weldment 7204056-9	Inspect	0.1				0.5		
		Replace					1.5	1,2	
		Repair					1.0		
06	Installation Kit HMMVV (vehicle) 7204154-9	Inspect		0.1			0.2		
		Replace		0.5				1,2	
		Repair					1.5		
08	Installation Kit SUSV 7204144-9	Inspect	0.2						
		Replace		3.5				1,2,4	
0801	Frame Assembly 7204193-9	Inspect	0.5	0.5					
		Replace		2.5				1,2,4	
		Repair					8.0		

(1)	(2)	(3)	(4) MAINTENANCE LEVEL					(5)	(6)
			FIELD			SUSTAINMENT			
			UNIT		DIRECT SUPPORT	GENERAL SUPPORT	DEPOT		
GROUP NUMBER	COMPONENT/ASSEMBLY	MAINTENANCE FUNCTION	C	O	F	H	D	TOOLS AND EQUIPMENT	REMARKS
0802	Plumb Bob Assembly 7204201-9	Inspect Replace Repair	0.5	0.5 1.0			1.5	1,2,4	
0803	Mount Assembly CDU 7204202-9	Inspect Replace Repair	0.5	0.5 1.0			8.0	1,2,4	
0804	Cord Assembly Electrical 7204116-3	Inspect Test Replace	0.5	0.5 1.0 1.5				3 1,2,4	
09	Cable Assembly, FOS W-136 7204136-9	Inspect Test Replace	0.5	0.5 1.0 1.0				3 1,2,4	
10	Cable Assembly Reprogramming, W-143 7204143-9	Inspect Test Replace	0.1	0.1 0.5 0.5				3 1,2	
11	Tool Kit 7204146-9	Inspect Replace	0.2	0.2 0.3				1,2	

SECTION III. TOOLS AND TEST EQUIPMENT REQUIREMENTS

ITEM NUMBER	MAINT-LVL	NOMENCLATURE	NSN	PART No.
1	CREW/ORG	IPADS Tool Kit	5180-01-521-3695	7204146-9
2	ORG	Mechanic's Tool Kit	5180-01-483-0249	5180-95-B47
3	ORG	Multimeter	6625-01-458-5183	(89536) 179
4	ORG	SUSV Operator's Tool Kit		SUSV Basic Issue Item

APPENDIX E

REPAIR PARTS AND SPECIAL TOOLS LIST

SECTION I. INTRODUCTION

E-1. Scope.

This RPSTL lists and authorizes spares and repair parts; special tools; special test, measurement, and diagnostic equipment TMDE; and other special support equipment required for performance of organizational, direct support, and general support maintenance of the Improved Position and Azimuth Determining System. It authorizes the requisitioning, issue and disposition of spares, repair parts, special tools as indicated by the source, maintenance, and recoverability (SMR) codes.

E-2. General.

In addition to this section (Introduction), this Repair parts and Special Tools List is divided into the following sections:

SECTION II. Repair Parts List. A list of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. This list also includes parts that must be groups in ascending alphanumeric sequence, with the parts in each group listed in ascending figure and item number sequence. Bulk materials are listed in the item name sequence. Repair parts kits are listed separately in their own functional group within Section II. Repair parts for repairable special tools are also listed in this section. Hems are shown in the associated illustration(s)/figure(s).
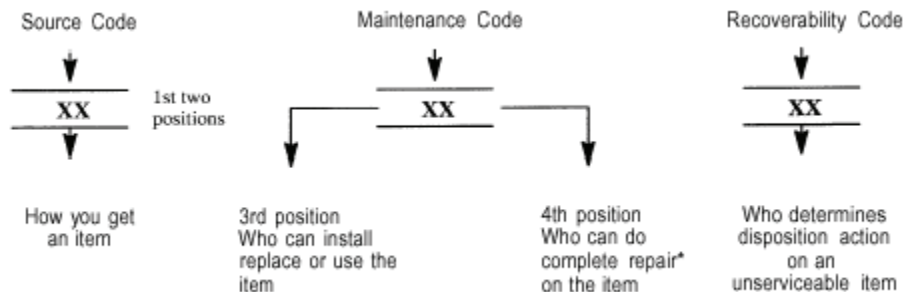
SECTION III. Special Tools List. A list of special tools, special TMDE, and other special support equipment authorized by this RPSTL (as indicated by Basis of Issue (BOI) information in DESCRIPTION AND USABLE ON CODE column) for the performance of maintenance.

SECTION IV. Cross-references Indexes. A list, in National Item Identification Number (NIIN) sequence, of all National stock numbered items appearing in the listing, followed by a list in alphanumeric sequence of all part numbers appearing in the listings. National stock numbers and part numbers are cross-referenced to each illustration figure and item number appearance. The figure and item number index lists figure and item number in alphanumeric sequence and cross-references NSN, CAGEC, and part number.

E-3. Explanation of Columns (SECTIONS II AND III).

Column (1) - ITEM NO. Indicates the number used to identify items called out in the illustration.

Column (2) - SMR Code. The Source, Maintenance, and Recoverability (SMR) code is a 5-position code containing supply/requisitioning information, maintenance category authorization criteria, and disposition instruction, as shown in the following breakout:

Source Code	Maintenance Code	Recoverability Code
XX 1st two positions	XX	XX
How you get an item	3rd position Who can install replace or use the item 4th position Who can do complete repair* on the item	Who determines disposition action on an unserviceable item

*Complete Repair: Maintenance capacity, capability, and authority to perform all corrective maintenance tasks of the "Repair" function in a use/user environment in order to restore serviceability to a failed item.

Source Code. The source code tells you how to get an item needed for maintenance, repair, or overhaul of an end item/equipment. Explanations of source code follows:

Code	Explanation
PA PB** PC** PD PE PF PG	Stocked items; use the applicable NSN to requested/requisition items with these source codes. They are authorized to the category indicated by the code entered in the 3rd position of the SMR code. NOTE: Items coded PC are subject to deterioration.
KD KF KB	Items with these codes are not to be requested/requisitioned individually. They are part of a kit which is authorized to the maintenance category indicated in the 3rd position of the SMR code. The complete kit must be requisitioned and applied.

MO - (Made at org/AVUM Level)
MP - (Made at DS/AVUM Level)
MH - (Made at GS Level)
ML - (Made at Specialized Repair Activity (SRA))
MD - (Made at Depot)

} Items with these codes are not to be requested/requisitioned individually. They must be made from bulk material which is identified by the part number in the DESCRIPTION and USABLE ON CODE (UOC) column and listed in the Bulk Material group of the repair parts list in this RPSTL. If the item is authorized to you by the 3rd position code of the SMR code, but the source code indicates it is made at a higher level, order the item from the higher level of maintenance.

AO - (Assembled by org/AVUM Level)
AF - (Assembled by DS/AVIM Level
AH - (Assembled by GS Category)
AL - (Assembled by SRA)
AD - (Assembled by Depot)

} Items with these codes are not to be requested/requisitioned individually. The parts that make up the assembled item must be requisitioned or fabricated and assembled at the level of maintenance indicated by the source code. If the 3rd position code of the SMR code authorizes you to replace the item, but the source code indicates the items are assembled at a higher level, order the item from the higher level of maintenance.

XA - Do not requisition "XA"-coded item. Order its next higher assembly. (Also, refer to the NOTE below.)

XB - If an "XB" item is not available from salvage, order it using the CAGEC and part number given.

XC - Installation drawing, diagram, instruction sheet, field service drawing, that is identified by Reciprocating Compressor manufacturer's part number.

XD - Item is not stocked. Order an "XD"-coded item through normal supply channels using the CAGEC and part number given if no NSN is available.

NOTE

Cannibalization or controlled exchange, when authorized, may be used as a source of supply for items with the above source codes, except for those source coded "XA" or those aircraft support items restricted by requirements of AR 750-1.

Maintenance Code. Maintenance codes tell you the level(s) of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the third and fourth positions of the SMR code as follows:

The maintenance code entered in the third position tells you the lowest maintenance level authorized to remove, replace, and use an item. The maintenance code entered in the third position will indicate authorization to one of the following levels of maintenance:

Code	Application/Explanation
C -	Crew or operator maintenance done with unit maintenance.
O -	Unit category can remove, replace, and use the item.
F -	Direct support can remove, replace, and use the item.
H -	General support level can remove, replace, and use the item.
L -	Specialized repair activity can remove, replace, and use the item.
D -	Depot level can remove, replace, and use the item.
K -	Reparable item removed or replaced at contractor's facility

The maintenance code entered in the fourth position tells whether the item is to be repaired and identifies the lowest maintenance level with the capability to do complete repair (i.e., perform all authorized repair functions.)

NOTE

Some limited repair may be done on an item at a lower level of maintenance, if authorized by the Maintenance Allocation Chart (MAC) and SMR codes. This position will contain one of the following maintenance codes.

Code	Application/Explanation
O -	Unit is the lowest level that can do complete repair of the item.
F -	Direct support is the lowest level that can do complete repair of the item.
H -	General Support is the lowest level that can do complete repair of the item.
L -	Specialized repair activity is the lowest level that can do complete repair of the item.
D -	Depot is the lowest level that can do complete repair of the item.
Z -	Non-repairable. No repair is authorized.
B -	No repair is authorized. (No parts or special tools are authorized for the maintenance of a "B" coded Item). However, the item may be reconditioned by adjusting, lubricating, etc., at the user level.
K -	Reparable support item. Complete repair capability exists at a designated contractor's facility.

Recoverability Code. Recoverability codes are assigned to items to indicate the disposition action on unserviceable items. The recoverability code is entered in the fifth position of the SMR code as follows:

Recoverability Codes	Application/Explanation
Z -	Non-reparable item. When unserviceable, condemn and dispose of the item at the level of maintenance shown in 3rd position of SMR Code.
O -	Reparable item. When not economically reparable, condemn and dispose of the item unit or aviation unit level
F -	Reparable item. When uneconomically reparable, condemn and dispose of the item at the direct support or aviation intermediate level
H -	Reparable item. When uneconomically reparable, condemn and dispose of the item at the general support level.
D -	Reparable item. When beyond lower level repair capability, return to depot. Condemnation and disposal of item not authorized below depot level.
L -	Reparable item. Condemnation and disposal not authorized below specialized repair activity (SRA).
A -	Item requires special handling or condemnation procedures because of specific reasons (e.g., precious metal content, high dollar value, critical material, or hazardous material). Refer to appropriate manuals/directives for specific instructions.
K -	Reparable item. Condemnation and disposal to be performed at contractor's facility.

Column (3) - CAGEC. The Commercial and Government Entity Code (CAGEC) is a 5-digit numeric code that is used to identify the manufacturer, distributor, or Government agency, etc. that supplies the item.

Column (4) - PART NUMBER. Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity) that controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

NOTE

When you use an NSN to requisition an item, the item you receive may have a different part number from the part ordered.

Column (5) - DESCRIPTION AND USABLE ON CODE (UOC). This column includes the following information:

a. The Federal item name and, when required, a minimum description to identify the item.

b. The physical security classification of the item is indicated by the parenthetical entry, e.g., PhySec C1 – Confidential, PhySec C1 (S) – Secret, PhySec C1 (T) – Top Secret.

c. Items that are included in kits and sets are listed below the name of the kit or set.

d. Spare/repair parts that make up an assembled item are listed immediately following the assembled item line entry.

e. Part numbers for bulk materials are referenced in this column in the line item entry for the item to be manufactured/fabricated.

f. When the item is not used with all serial numbers of the same model, the effective serial numbers are shown on the last line(s) of the description (before UOC).

g. The usable on code, when applicable (see paragraph 5, Special Information).

h. In the Special Tools List section, the basis of issue (BOI) appears as the last line(s) in the entry for each special tool, special TMDE, and other special support equipment. When density of equipments supported exceeds density spread indicated in the basis of issue, the total authorization is increased proportionately.

i. The statement "END OF FIGURE" appears just below the last item description in Column 5 for a given figure in both SECTION II and SECTION III.

j. The indenture, shown as dots appearing before the repair part, indicates that the item is a repair part of the next higher assembly.

Column (6) - QTY. The QTY (quantity per figure column) indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a functional group, sub-functional group, or an assembly. A "V" appearing in this column in lieu of a quantity indicates that the quantity is variable and may vary from application to application.

E-4. EXPLANATION OF COLUMNS (SECTION IV).

NATIONAL STOCK NUMBER (NSN) INDEX.

STOCK NUMBER column. This column lists the NSN by National item identification number (NIIN) sequence. The NIIN consists of the last nine digits of the NSN, i.e.

When using this column to locate an item, ignore the first 4 digits of the NSN. However, the complete NSN should be used when ordering items by stock number.

$$\underline{\text{NSN}}$$
$$5305\text{-}01\text{-}\underline{574\text{-}1467}$$
$$\text{NIIN}$$

FIG column. This column lists the number of the figure where the item is identified/located. The figures are in numerical order in SECTIONS II and III.

ITEM column. The item number identifies the item associated with the figure listed in the adjacent FIG. Column. This item is also identified by the NSN listed on the same line.

PART NUMBER INDEX. Part numbers in this index are listed by part number in ascending alphanumeric sequence (i.e., vertical arrangement of letter and number combination which places the first letter or digit of each group in order A through Z, followed by the numbers 0 through 9 and each following letter or digit in like order).

CAGEC column. The Commercial and Government Entity Code (CAGEC) is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

PART NUMBER column. Indicates the primary number used by the manufacturer (individual, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

STOCK NUMBER column. This column lists the NSN for the associated part number and manufacturer identified in the PART NUMBER and CAGEC columns to the left.

FIG column. This column lists the number of the figure where the item is identified/located in SECTIONS II and III.

ITEM column. The item number is that number assigned to the item as it appears in the figure referenced in adjacent figure number column.

FIGURE AND ITEM NUMBER INDEX.

FIG column. This column lists the number of the figure where the item is identified/located in SECTIONS II and III.

ITEM column. The item number is that number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

STOCK NUMBER column. This column lists the NSN for the item.

CAGEC column. The Commercial and Government Entity Code (CAGEC) is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

PART NUMBER column. Indicates the primary number used by the manufacturer (individual, firm, corporation, or Government activity) that controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

E-5. SPECIAL INFORMATION

USABLE ON CODE. The usable on code appears in the lower corner of the Description column heading. Usable on codes are shown as "UOC:…" in the Description Column justified left on the last line applicable item description/nomenclature. Uncoded items are applicable to all models.

ASSOCIATED PUBLICATIONS. There are no other publications pertaining to the Improved Position and Azimuth Determining System and its components.

E-6. HOW TO LOCATE REPAIR PARTS.

When National Stock Number or Part *is* known:

1. Using the Index of National Stock Numbers and Parts Numbers, find the pertinent National Stock Number or Part Number. The NSN index is in the National Item Identification Number (NIIN) sequence, paragraph E-4. The part numbers in the Part Number index are listed in ascending alphanumeric sequence, paragraph E-4. Both indexes cross-reference you to the illustration figure and item number of the item you are looking for.

2. After finding the figure and item number, verify that the item is the one you are looking for, locate the item number in the repair parts list for the figure.

When National Stock Number or Part Number is *NOT* known:

1. Using the table of contents, determine the assembly or subassembly group to which the item belongs. This is necessary since figures are prepared for assembly groups and subassembly groups, and listings are divided into the same groups.

2. Find the figure covering the assembly or subassembly group to which the item belongs.

3. Identify the item on the figure and note the item number.

4. Refer to the Repair Parts List for the figure to find the part number for the item number noted on the figure.

5. Refer to the Part Number Index to find the NSN, if assigned.

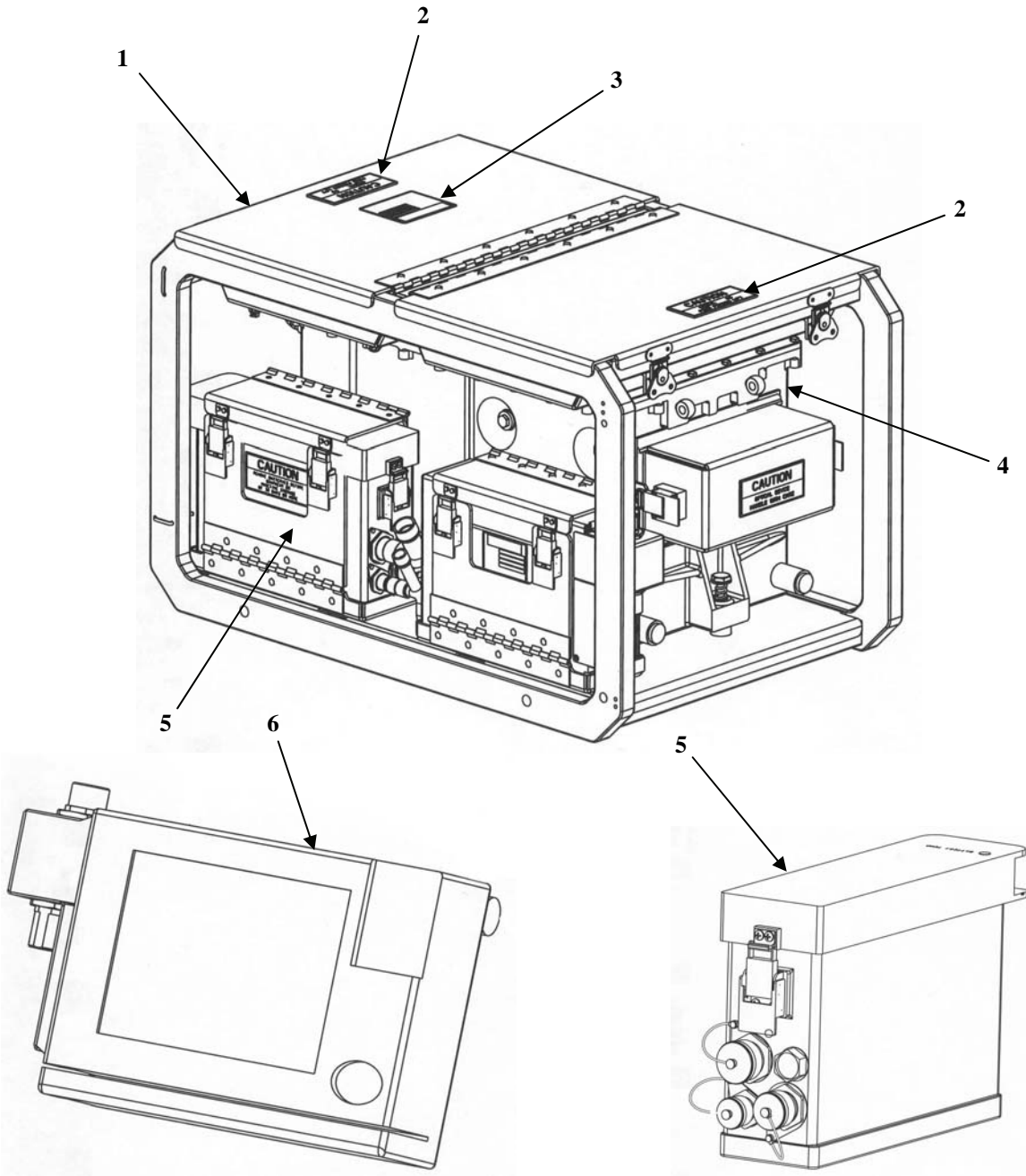## E-7. ABBREVIATIONS. Abbreviations used in this manual are listed in MIL-STD-12.
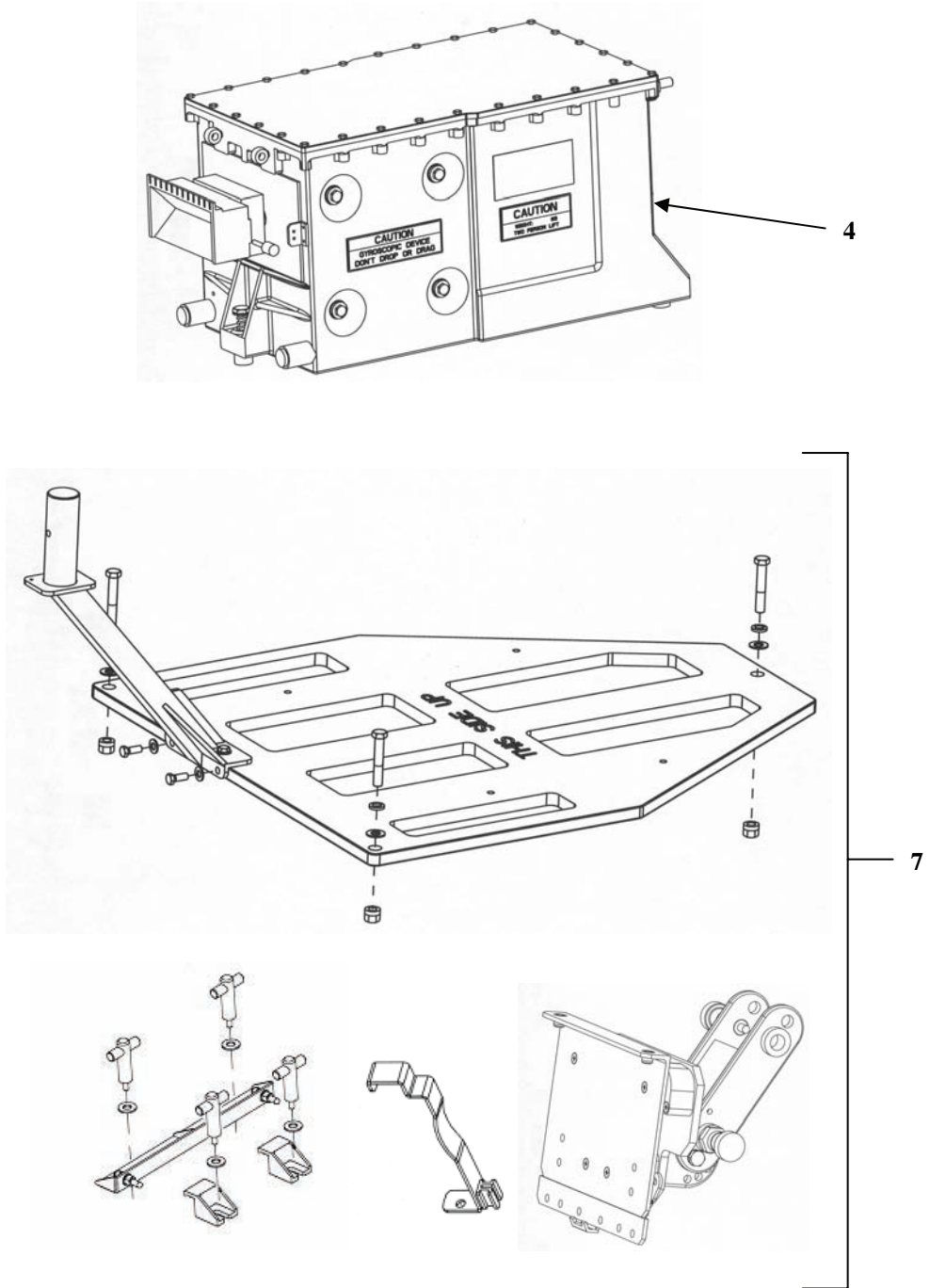
Figure E-1 – IPADS Assembly (1 of 4)

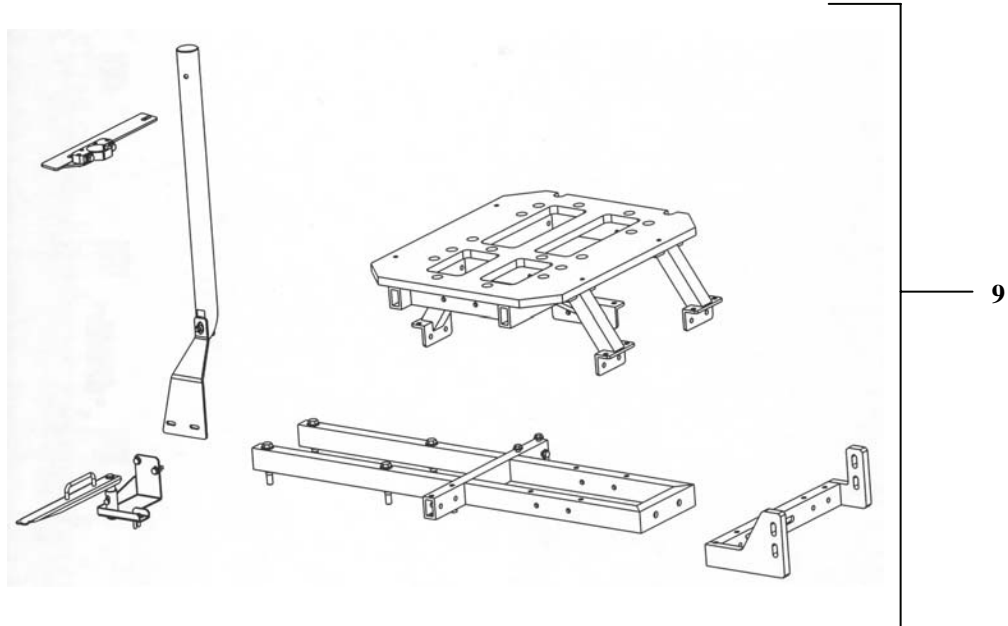**Figure E-1 – IPADS Assembly (2 of 4)**
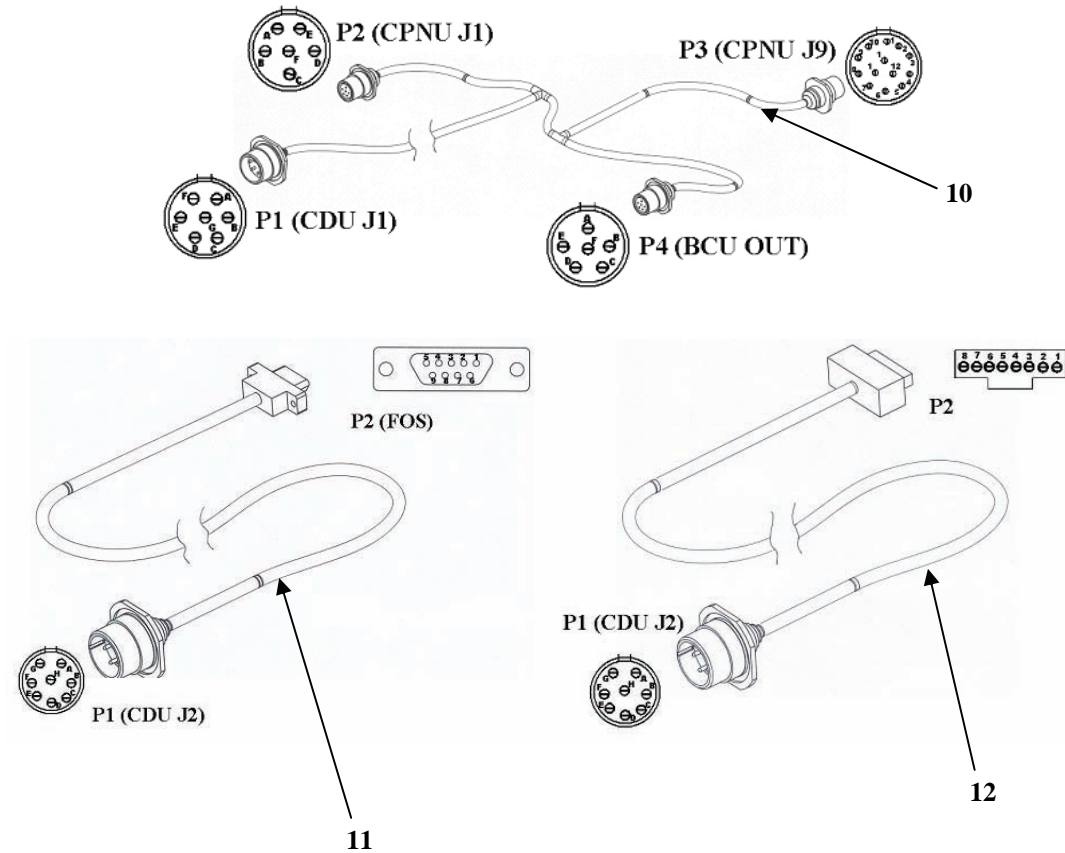
Figure E-1 – IPADS Assembly (3 of 4)

P2 (CPNU J1)

P3 (CPNU J9)

10

P1 (CDU J1)

P4 (BCU OUT)

P2 (FOS)

P2

P1 (CDU J2)

P1 (CDU J2)

12

11

FIGURE E-1 – IPADS ASSEMBLY (4 OF 4)

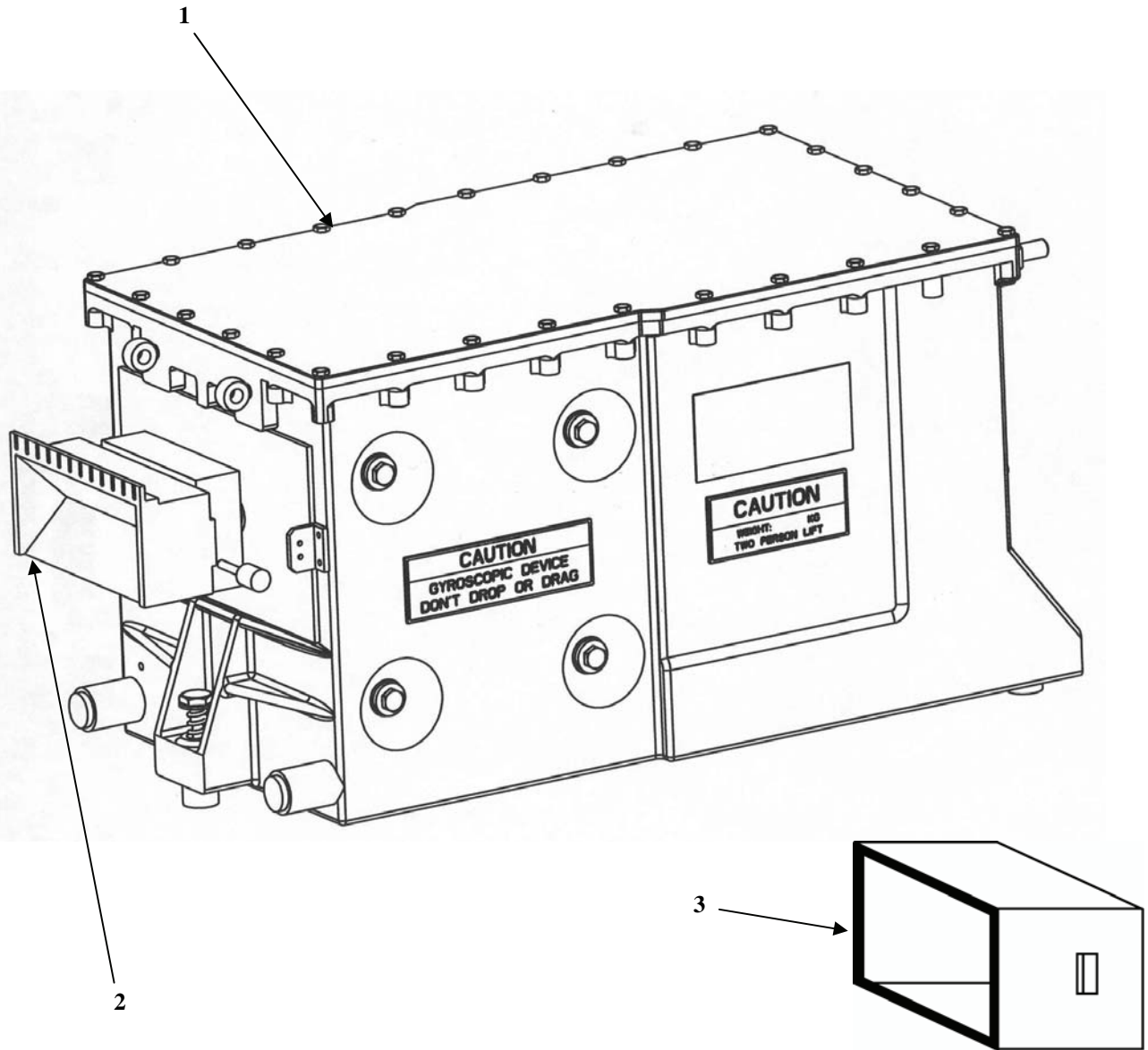| SECTION II			TM9667534912&P			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
ITEM NO	SMR CODE	NSN	CAGEC	PART NUMBER	DESCRIPTION AND USABLE ON CODES(UOC)	QTY
					GROUP 00 FIGURE E-1 IPADS ASSEMBLY 7050004-9	
1	PAKKK	5975015224819	1NZ85	7204056-9	BASE, CHASSIS........................	1
2	PGOZZ	7690015244226	1NZ85	7170172-2	DECAL...............................	2
3	PGOZZ	9905005512991	18876	10162862-17	PLATE, IDENTIFICATION...............	1
4	PAOKK	6605015217884	19200	11838924-1	INERTIAL REFERENCE (CPNU-WITH STORAGE, SHIPPING CONTAINER, AND.....	1
5	PAOKK	6130015216921	19200	11838924-2	CHARGER, BATTERY (BCU-WITH STORAGE AND SHIPPING CONTAINER)..............	1
6	PAOKK	7010015217883	19200	11838924-3	PROCESSOR, DISPLAY AND (CDU-WITH STORAGE AND SHIPPING CONTAINER)......	1
7	PAOOO	5340015221647	1NZ85	7204154-9	HARDWARE KIT, ELECTRONIC MOUNTING (HMMWV INSTALLATION KIT).............	1
9	PAOOO	5340015236532	1NZ85	7204144-9	HARDWARE KIT, ELECTRONIC MOUNTING (SUSV INSTALLATION KIT)..............	1
10	PAOKK	5995015225485	1NZ85	7204114-9	WIRING HARNESS, W-114................	1
11	PAOKK	5995015190653	1NZ85	7204136-9	CABLE ASSEMBLY, SPECIAL, W-136 (FOS)	1
12	PAOKK	5995015222631	1NZ85	7204143-9	CABLE ASSEMBLY, SPECIAL, W-143 (REPROGRAMMING)......................	1

END OF FIGURE

Figure E-2 – P/N 11838924-1 Compact Position Navigation Unit/Porro Prism Assembly (CPNU/PPA)

```
     SECTION II          TM9667534912&P
  (1)    (2)     (3)         (4)       (5)                    (6)                    (7)
 ITEM   SMR                           PART
  NO    CODE    NSN        CAGEC     NUMBER   DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                              GROUP 01
                                              FIGURE E-2
                                              COMPACT POSITION AND NAVIGATION
                                              UNIT/PORRO PRISM ASSEMBLY (CPNU/PPA)
                                              11838924-1

    1 XAOKK               1NZ85 7204153-9     POSITION & NAV UNIT (CPNU-WITH      1
                                              PORRO PRISM ASSEMBLY)...............
    2 PAOOO 1260015214556 1NZ85 7170155-9     COVER, FIRE CONTROL (PORRO PRISM    1
                                              COVER)..............................
    3 PCOZZ 5330015236754 1NZ85 7170174-2     GASKET, COVER, PORRO PRISM........... 1

                              END OF FIGURE
```
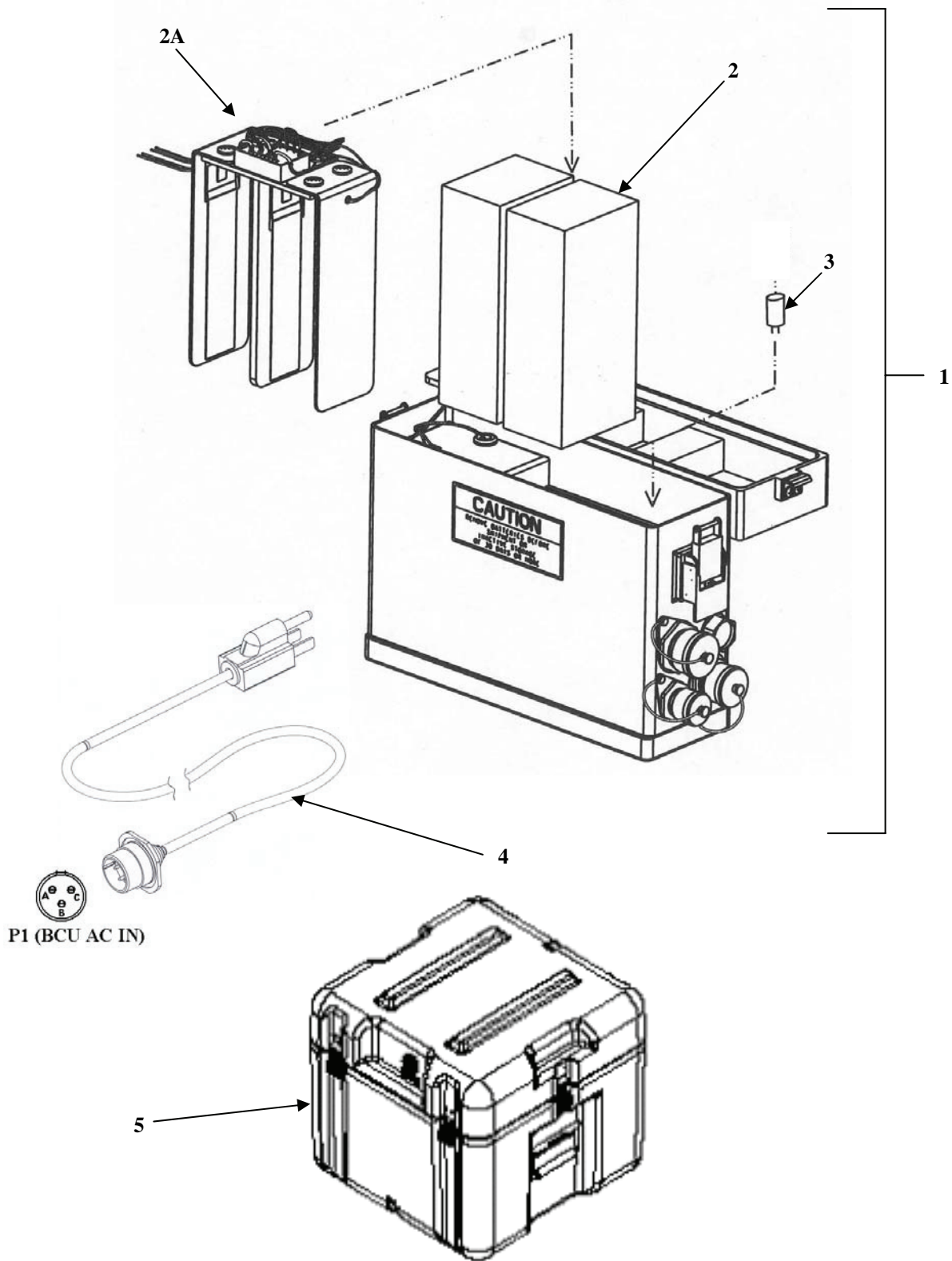
P1 (BCU AC IN)

Figure E-3 – P/N 11838924-2 Battery Charger Unit (BCU) with Shipping and Storage Case

```
   SECTION II          TM9667534912&P
  (1)    (2)     (3)        (4)      (5)                (6)                    (7)
 ITEM    SMR                         PART
 NO     CODE    NSN       CAGEC     NUMBER    DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                              GROUP 02
                                              FIGURE E-3
                                              BATTERY CHARGER UNIT (BCU)
                                              (WITH BATTERY HEATER ASSEMBLY AND
                                              SHIPPING CASE)
                                              11838924-2

   1 XAOKK               1NZ85 7204141-9      BAT & CHARGER UNIT................... 1
   2 PCOZZ 6140014938357 08TP4 ABP-BT-24V/1.9AH BATTERY, STORAGE.................... 2
                                           -1
  2A XDOZZ               08TP4 7204148-9      HEATER CONTROLLER................... 1
   3 PAOZZ 5920014936642 0JR59 373150041     FUSE, CARTRIDGE..................... 5
   4 PAOZZ 5995014938358 08TP4 ABP-ACC-TR-1  CABLE ASSEMBLY, SPECIAL, 115VAC(W-6). 1
   5 PAOZZ 8145015254325 1NZ85 7158019-4     SHIPPING AND STORAGE, BCU........... 1


                            END OF FIGURE
```
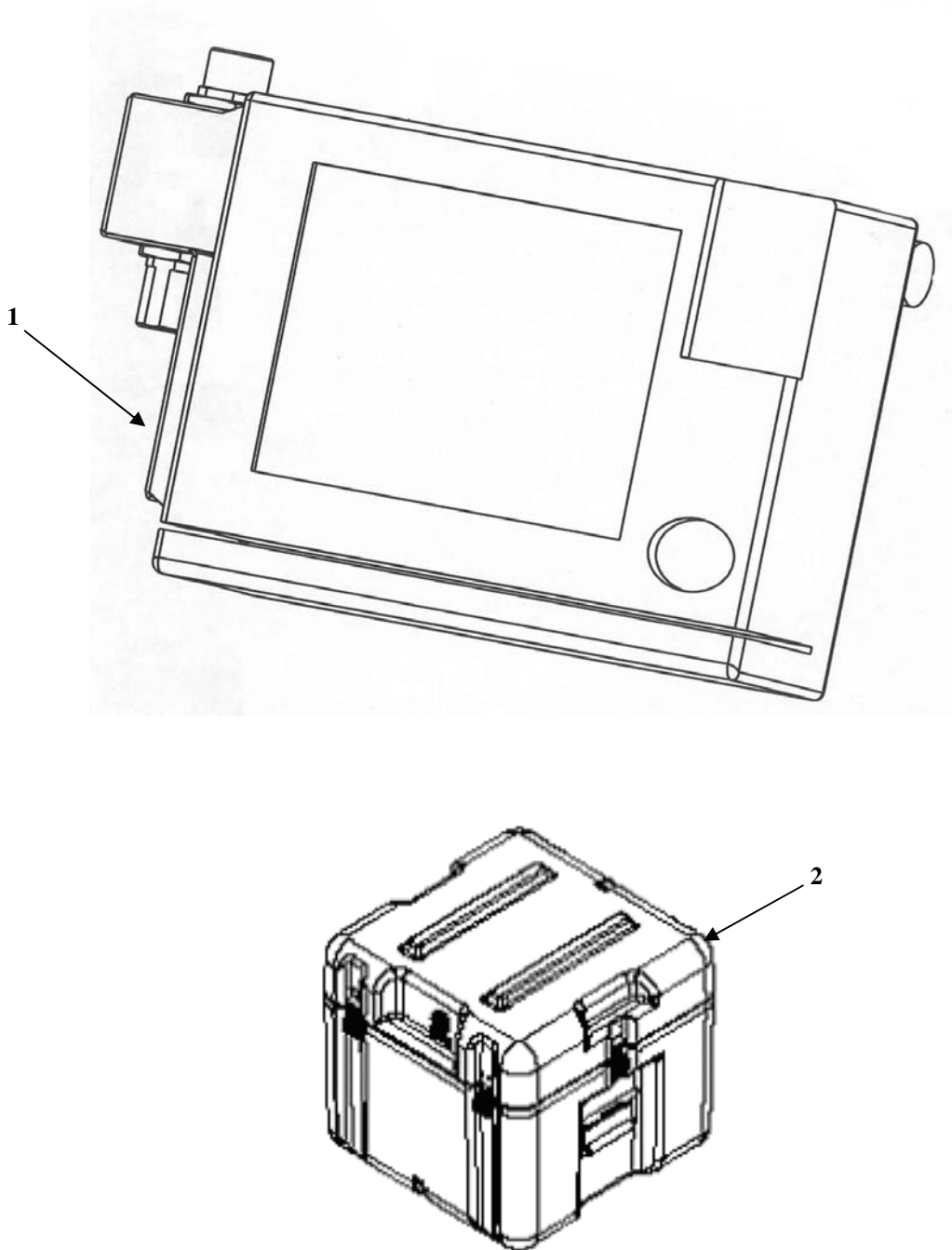
Figure E-4 – P/N 11838924-3 Display and Processor (CDU) with Shipping and Storage Case

```
   SECTION II        TM9667534912&P
 (1)    (2)     (3)         (4)      (5)                  (6)                    (7)
ITEM    SMR                          PART
 NO    CODE     NSN        CAGEC     NUMBER    DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                               GROUP 03
                                               FIGURE E-4
                                               DISPLAY AND PROCESSOR (CDU)
                                               11838924-3

   1 XAOKK                  1NZ85 7204142-9    CONT & DISPLAY UNIT (CDU)............ 1
   2 PAOZZ 8145015254317 1NZ85 7158019-5    SHIPPING AND STORAGE, CDU............ 1

                                END OF FIGURE
```
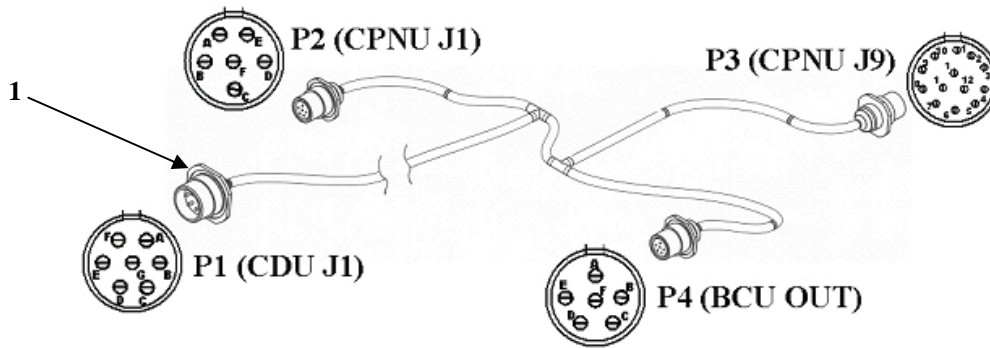
Figure E-5 – W114 Wiring Harness (P/N 7204114-9)

```
    SECTION II          TM9667534912&P
 (1)   (2)    (3)          (4)      (5)                 (6)                    (7)
ITEM   SMR                          PART
 NO    CODE   NSN         CAGEC    NUMBER    DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                             GROUP 04
                                             FIGURE E-5
                                             W114 WIRING HARNESS
                                             7204114-9

  1 PAOKK 5995015225485 1NZ85 7204114-9     WIRING HARNESS, W-114................ 1

                              END OF FIGURE
```
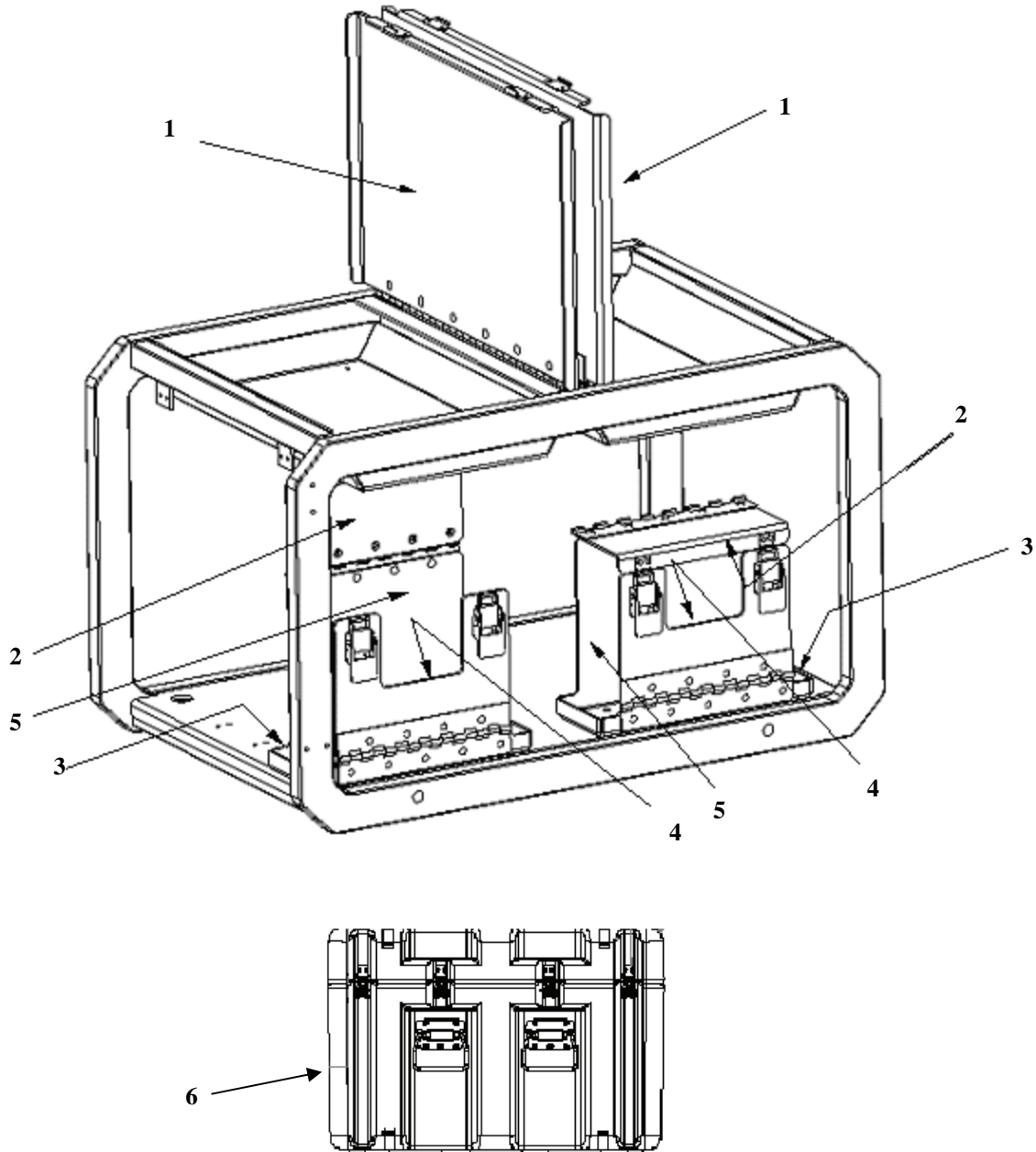
Figure E-6 – Weldment Chassis (P/N 7204056-9)

```
      SECTION II          TM9667534912&P
  (1)    (2)     (3)          (4)       (5)                    (6)                    (7)
  ITEM   SMR                            PART
  NO    CODE    NSN          CAGEC     NUMBER    DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                                 GROUP 05
                                                 FIGURE E-6
                                                 CHASSIS, WELDMENT
                                                 7204056-9

     1 PCOZZ 5330015236683 1NZ85 7170174-7      GASKET, STORAGE BIN.................. 2
     2 PCOZZ 5330015236689 1NZ85 7170174-3      GASKET, HOLDER TOP................... 2
     3 PCOZZ 5330015236850 1NZ85 7170174-5      GASKET, HOLDER BOTTOM............... 2
     4 PCOZZ 5330015237526 1NZ85 7170174-4      GASKET, HOLDER FRONT................ 2
     5 PCOZZ 5330015237025 1NZ85 7170174-6      GASKET, HOLDER, REAR................ 2
     6 PAOZZ 8145015254312 1NZ85 7158019-1      CASE, TRANSIT (IPADS ASSEMBLY)....... 1


                             END OF FIGURE
```
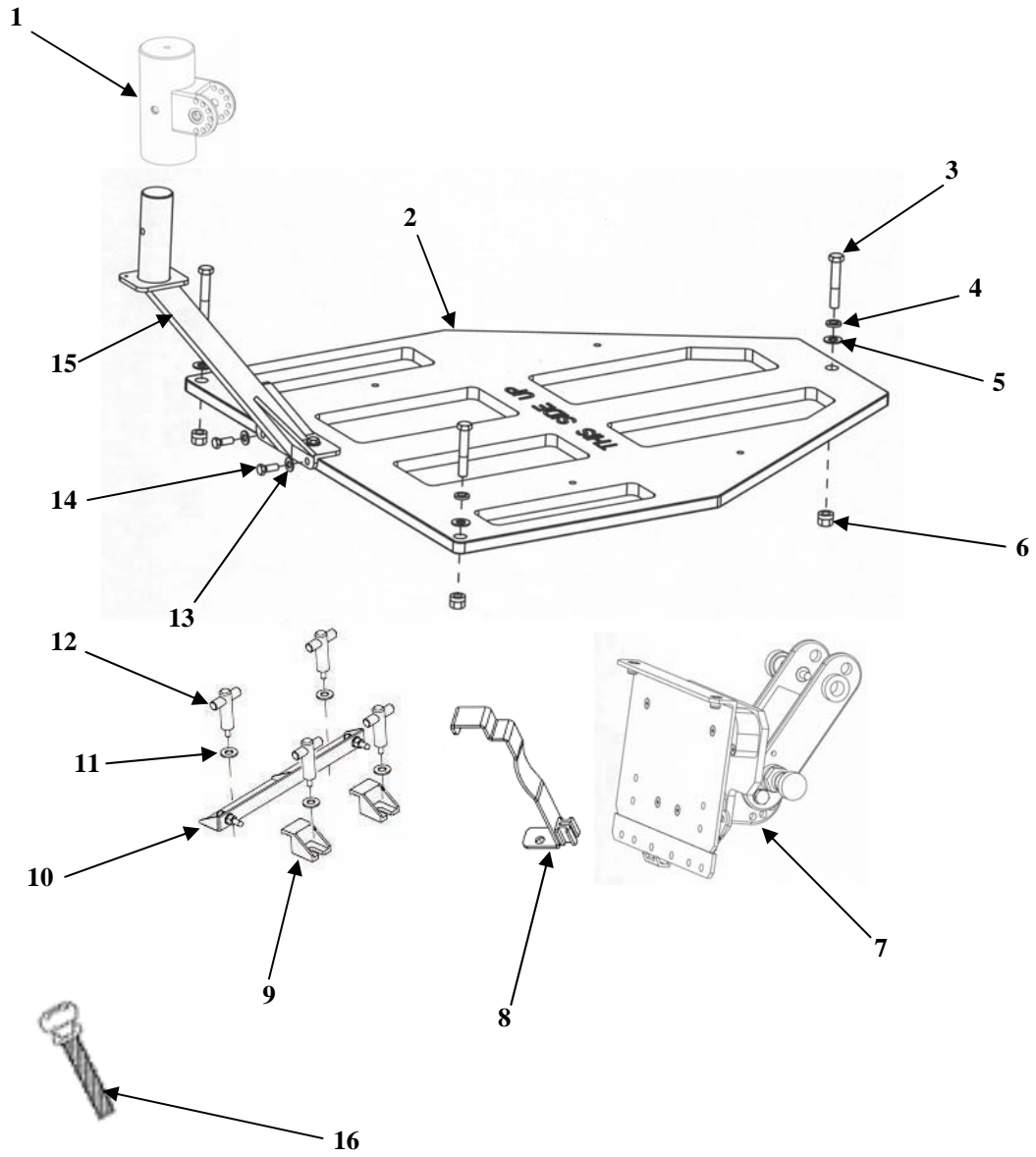
Figure E-7 – Electronic Hardware Kit (HMMWV Installation Kit) (P/N 7204154-9)

```
    SECTION II          TM9667534912&P
  (1)   (2)     (3)          (4)       (5)                 (6)                        (7)
 ITEM   SMR                            PART
  NO   CODE     NSN         CAGEC     NUMBER      DESCRIPTION AND USABLE ON CODES(UOC) QTY
```

```
                                                  GROUP 06
                                                  FIGURE E-7
                                                  HARDWARE KIT, ELECRONIC
                                                  (HMMWV INSTALLATION KIT)
                                                  7204154-9

   1 PAOOO 5985015176193 1NZ85 7204108-5      MAST SECTION (MAST, CDU INDEXER)....... 1
   2 PAOKK 5340015198010 1NZ85 7204108-1      PLATE, MOUNTING (FLOOR PLATE).......... 1
   3 PAOZZ 5305001032072 96906 MS35307-419    SCREW, CAP, HEXAGON HEAD............... 3
   4 PAOZZ 5310007679425 80205 MS15795-818    WASHER, FLAT........................... 3
   5 PAOZZ 5310009338778 80205 MS35338-143    WASHER, LOCK........................... 3
   6 PAOZZ 4730014939632 2V507 94758A033      NUT, TUBE COUPLING (FLANGE NUT)........ 3
   7 PAOOO 5340015210007 1NZ85 7204149-9      PLATE, MOUNTING (CDU MOUNTING          1
                                              ASSEMBLY)..............................
   8 PAOZZ 5340015237601 1NZ85 7204108-8      BRACKET, MOUNTING (PLUMB BOB           1
                                              BRACKET)...............................
   9 PAOZZ 5340015236743 1NZ85 7204108-4      CLAMP, SYNCHRO......................... 2
  10 XAOOO               1NZ85 7204151-9      BRACKET ASSY, ALIGN MENT............... 1
  11 PAOZZ 5310015236783 2V507 98370A035      WASHER, FLAT 5/8 LOAD DISTRIBUTING..... 4
  12 PAOZZ 5306015237270 1NZ85 7204108-3      BOLT, TEE HEAD......................... 4
  13 PAOZZ 5310007737618 80205 MS15795-814    WASHER, FLAT........................... 4
  14 PAOZZ 5305005765417 80205 MS35307-360    SCREW, CAP, HEXAGON HEAD............... 4
  15 PAOZZ 1290015244517 1NZ85 7204155-9      ARM ASSY, CDU SPRT..................... 1
  16 PAOZZ 5305015236810 2V507 91744A583      THUMBSCREW (5/16-18 X 1L)-EXTRA        1
                                              PLUMB BRACKET MOUNTING SCREW...........
```
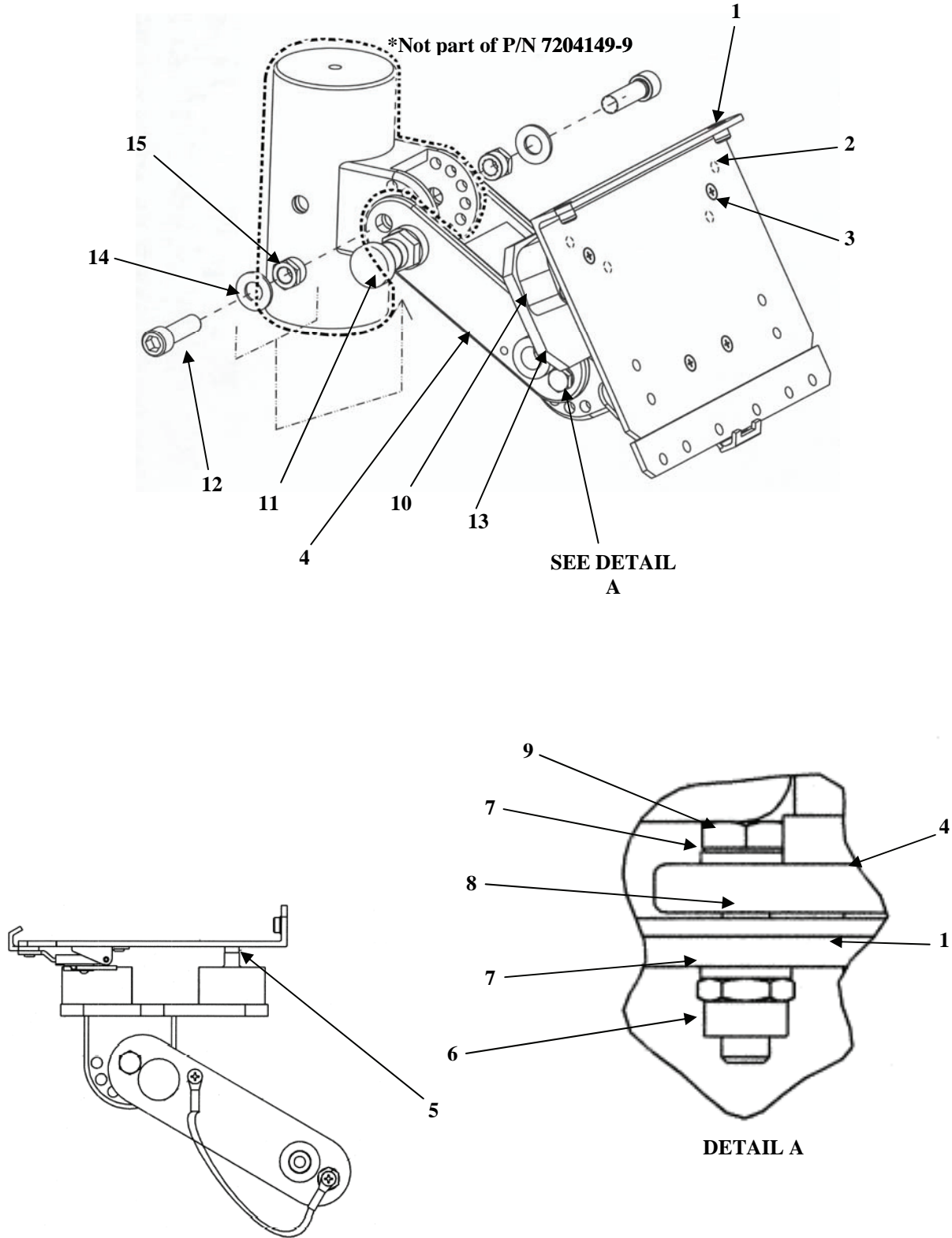
                              END OF FIGURE

*Not part of P/N 7204149-9

Figure E-7A – CDU Mounting Plate (P/N 7204149-9)

```
   SECTION II         TM9667534912&P
 (1)   (2)    (3)        (4)       (5)                    (6)                   (7)
 ITEM   SMR                                  PART
 NO    CODE   NSN        CAGEC    NUMBER    DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                            GROUP 0601
                                            FIGURE E-7A
                                            CDU MOUNTING PLATE
                                            7204149-9

   1 XAOZZ                1NZ85 7204168-9    HOLDER ASSEMBLY CDU.................. 1
   2 PAOZZ 5305007640075 96906 MS51959-49    SCREW, MACHINE (8-32 X 1.00 L)....... 8
   3 PAOZZ 5305000889666 80205 MS24693-C51   SCREW, MACHINE (8.32 X 5/8 L)........ 4
   4 XAOZZ                1NZ85 7204108-6    LINKAGE ASSEMBLY..................... 1
   5 PAOZZ 5365015286297 3A054 92320A213     SPACER, RING (SPACER CRES 5/16 OD    1
                                             NO.8 ID X 1/8L).....................
   6 PAOZZ 5310015283382 3A054 91831A120     NUT, SELF-LOCKING, CA STELLATED (1/4- 2
                                             28).................................
   7 PAOZZ 5310009520309 80205 NAS620C416    WASHER, FLAT (1/4 IN)............... 4
   8 PAOZZ 5310015297197 3A054 95630A475     WASHER, FLAT (PTFE)................. 2
   9 PAOZZ 5305007208245 80205 MS35308-309   SCREW, CAP, HEXAGON HEAD............. 2
  10 XAOZZ                1NZ85 7170190-9    ISOLATION PLATE CDU................. 1
  11 PAOZZ 5340015296873 0XY83 120FSN5/AK    PLUNGER, QUICK RELEA................ 2
  12 XDOZZ                80205 MS16996-41    SCREW, CAP, SOCKET HE............... 2
  13 PAOZO 5342007061716 76005 HT0-3         MOUNT, RESILIENT, WEAR (SHOCK MOUNT). 4
  14 PAOZZ 5310007737618 80205 MS15795-814   WASHER, FLAT........................ 2
  15 PAOZZ 5310014990431 2V507 91831A130     NUT, SELF LOCKING................... 2

                               END OF FIGURE
```
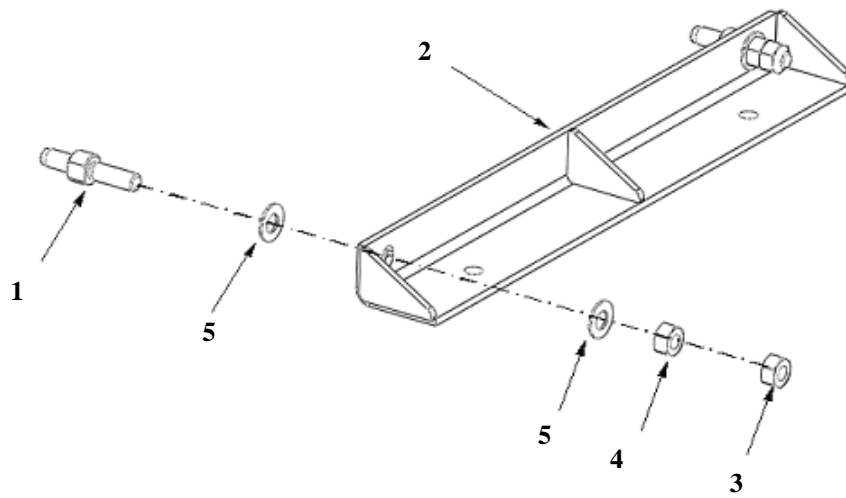
Figure E-7B – Alignment Bracket Assembly (P/N 7204151-9)

```
   SECTION II         TM9667534912&P
 (1)   (2)    (3)        (4)      (5)                 (6)                    (7)
ITEM   SMR                        PART
 NO   CODE    NSN       CAGEC    NUMBER   DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                          GROUP 0602
                                          FIGURE E-7B
                                          ALIGNMENT BRACKET ASSEMBLY
                                          7204151-9

  1  PAOZZ 5315015236856 1NZ85 7170176-1   PIN, SHOULDER, HEADLESS.............. 2
  2  PAOZZ 5340015237611 1NZ85 7204108-7   BRACKET, ALIGNMENT................... 1
  3  PAOZZ 5310015287530 3A054 91831A133   NUT, SELF-LOCKING, HEXAGON.......... 2
  4  PAOZZ 5310009651800 96906 MS51971-4   NUT, PLAIN, HEXAGON................. 2
  5  PAOZZ 5310001848628 80205 MS15795-816 WASHER, FLAT........................ 4

                                 END OF FIGURE
```
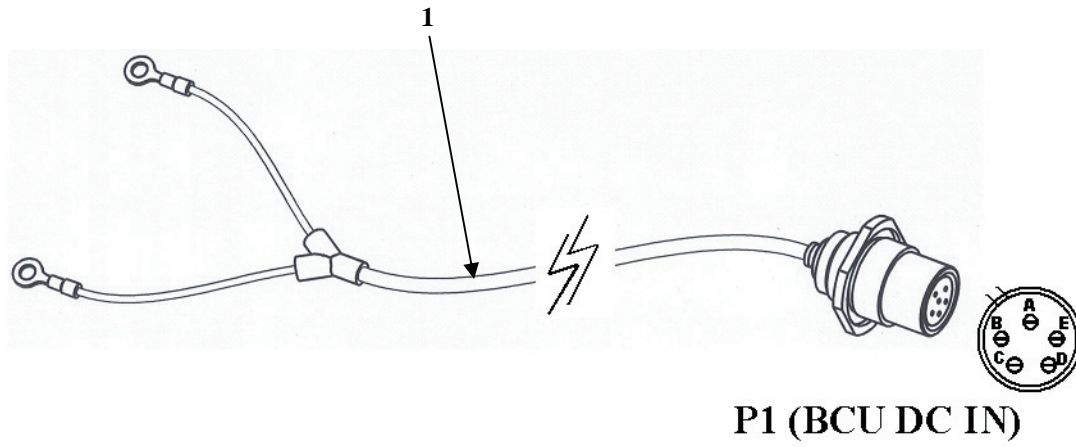
Figure E-7C – W116-1 Electrical Cord Assembly

```
    SECTION II        TM9667534912&P
 (1)   (2)    (3)         (4)     (5)                    (6)                 (7)
ITEM   SMR                        PART
 NO   CODE   NSN         CAGEC   NUMBER    DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                          GROUP 0603
                                          FIGURE E-7C
                                          W116-1 ELECTRICAL CORD ASSEMBLY
                                          7204116-1

  1 PAOKK 5995015253986 1NZ85 7204116-1     CORD ASSEMBLY, ELECTRICAL, W-116-1...  1

                                  END OF FIGURE
```
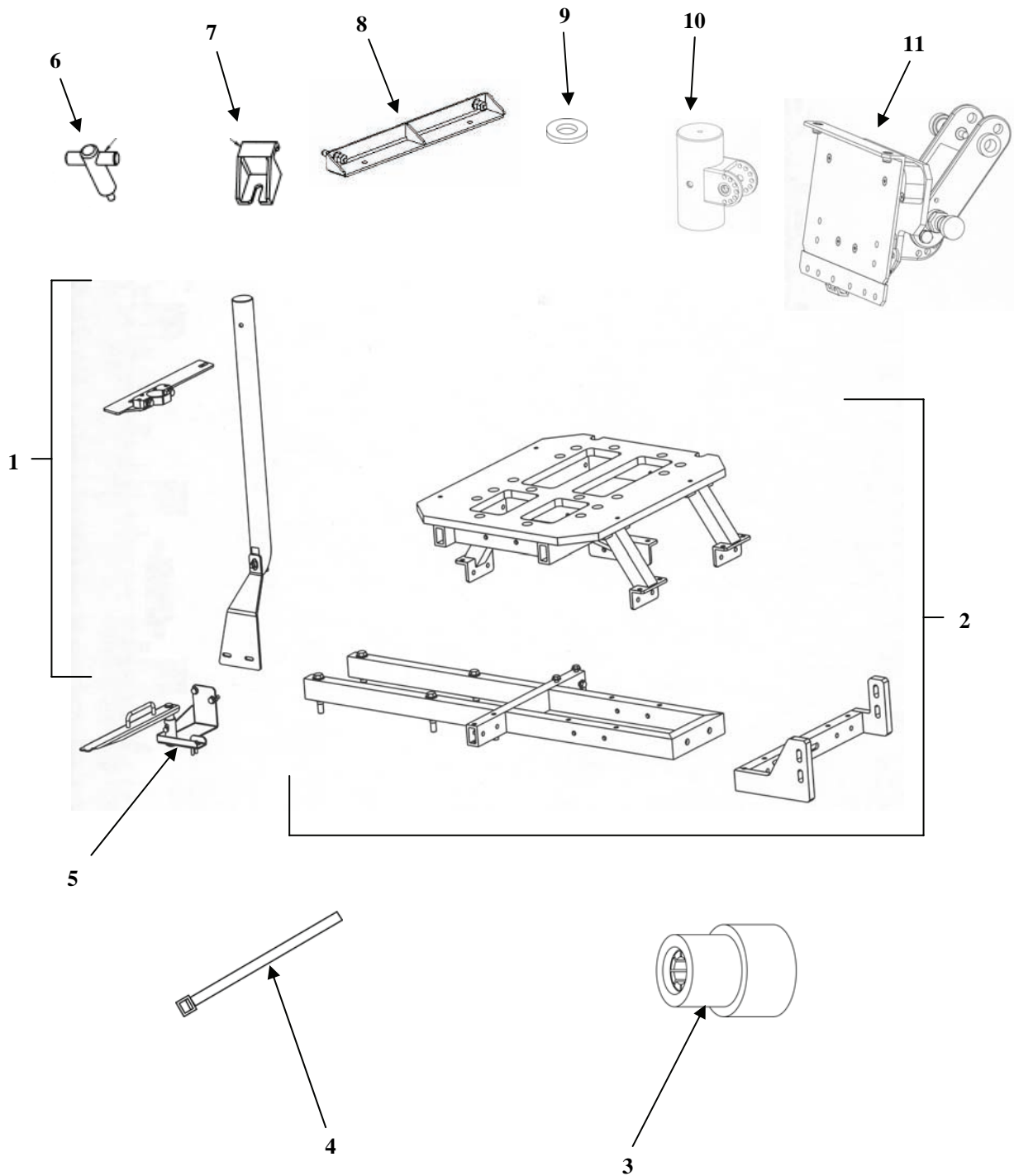
Figure E-9 – Electronic Hardware Kit (SUSV Installation Kit) (P/N 7204144-9)

```
   SECTION II        TM9667534912&P
  (1)  (2)   (3)        (4)     (5)                (6)                    (7)
 ITEM  SMR                              PART
  NO  CODE    NSN        CAGEC        NUMBER    DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                              GROUP 08
                                              FIGURE E-9
                                              HARDWARE KIT, ELECTRONIC
                                              (SUSV INSTALLATION KIT)
                                              7204144-9

    1 PAOOO 5340015251893 1NZ85 7204213-9     BRACKET, MOUNTING, CDU.............. 1
    2 PAOOO 5340015236531 1NZ85 7204193-9     HARDWARD KIT, ELECTRONIC ( CENTER   1
                                               FRAME ASSY).........................
    3 PAOZZ 5935003228959 19207 11677570      ADAPTER, CONNECTOR, POWER CABLE...... 1
    4 PAOZZ 5975001338687 81343 MS3367-5-0    STRAP, TIEDOWN, ELECTRICAL.......... 12
    5 PAOOO 5340015246141 1NZ85 7204201-9     BRACKET, MOUNTING, PLUMB BOB........ 1
    6 PAOZZ 5306015237270 1NZ85 7204108-3     BOLT, TEE HEAD...................... 1
    7 PAOZZ 5340015236743 1NZ85 7204108-4     CLAMP, SYNCHRO..................... 1
    8 PAOZZ               1NZ85 7204151-9     BRACKET ASSY, ALIGN................ 12
    9 PAOZZ 5310015236783 2V507 98370A035     WASHER, FLAT (5/8 INCH)............. 1
   10 PAOOO 5985015176193 1NZ85 7204105-5     MAST SECTION (MAST, CDU INDEXER)..... 1
   11 PAOOO 5340015210007 1NZ85 7204149-9     PLATE, MOUNTING (CDU MOUNTING       1
                                               ASSEMBLY)...........................
```

                        END OF FIGURE
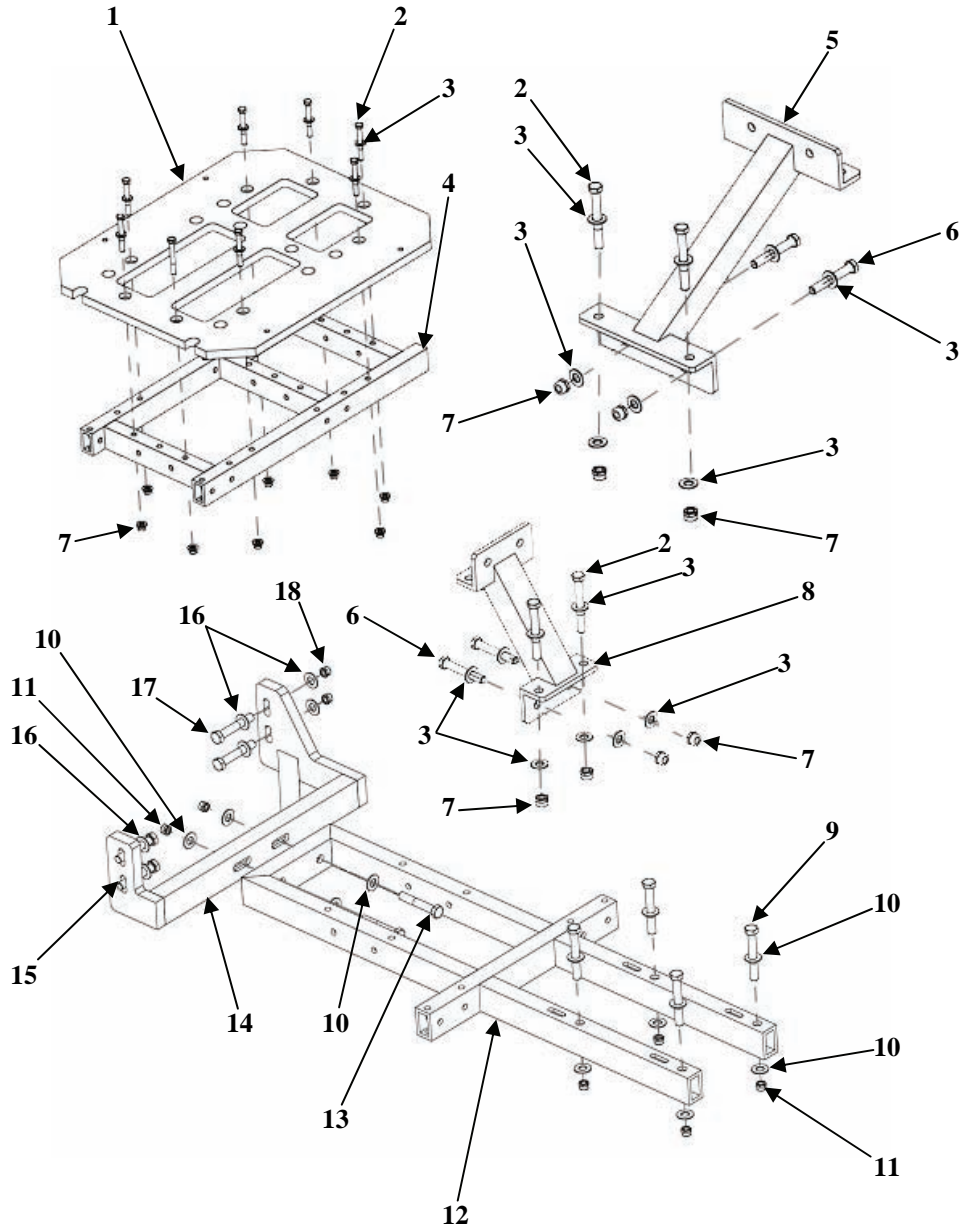
Figure E-9A – SUSV Electronic Hardware Kit (Center Frame Assembly) (P/N 7204193-9)

```
    SECTION II        TM9667534912&P
  (1)   (2)    (3)        (4)      (5)              (6)                      (7)
 ITEM   SMR                        PART
  NO   CODE    NSN       CAGEC    NUMBER   DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                           GROUP 0801
                                           FIGURE E-9A
                                           ELECTRONIC HARDWARE KIT, SUSV
                                           (CENTER FRAME ASSEMBLY)
                                           7204193-9

   1 PAOZZ 9520015288428 1NZ85 7170223     PLATE, FLOOR, METAL.................. 1
   2 PAOZZ 5305005434406 80205 MS35307-370 SCREW, CAP, HEXAGON HEAD............. 28
   3 PAOZZ 5310014650900 81349 MS15795-814 WASHER, FLAT (3/8)................... 96
   4 PAOZZ 5340015280922 1NZ85 7204196-9   BRACKET, MOUNTING (CENTER RAIL       1
                                           ASSEMBLY)...........................
   5 PAOZZ 5340015293832 1NZ85 7170225-9   FRAME SECTION, STRUCURAL (CROSS      1
                                           BRACE)..............................
   6 PAOZZ 5305008225853 96906 MS35307-368 SCREW, CAP, HEXAGON HEAD............. 20
   7 PAOZZ 5310013863517 39428 90099A031   NUT, SELF-LOCKING, HEXAGON........... 48
   8 PAOZZ 5340015296841 1NZ85 7170224-9   BRACKET, MOUNTING (SUPPORT BRACE).... 4
   9 PAOZZ 5305015280950 4J007 81838955    SCREW, CAP, HEXAGON HEAD............. 4
  10 PAOZZ 5310014650892 81349 MS15795-818 WASHER, FLAT (1/2)................... 8
  11 PAOZZ 5310015263438 3A054 91831A140   NUT, SELF-LOCKING, HEXAGON........... 4
  12 PAOZZ 5340015279895 1NZ85 7204194-9   SUPPORT (FRONT RAIL ASSEMBLY)........ 1
  13 PAOZZ 5305015284397 4J007 81838963    SCREW, CAP, HEXAGON HEAD............. 2
  14 PAOZZ 5340015258711 1NZ85 7204195-9   BRACKET, MOUNTING (REAR RAIL         1
                                           ASSEMBLY)...........................
  15 PAOZZ 5305015283658 4J007 81838658    SCREW, CAP, HEXAGON HEAD............. 2
  16 PAOZZ 5310006143506 80205 MS15795-817 WASHER, FLAT........................ 6
  17 PAOZZ 5305015282844 4J007 81838682    SCREW, CAP, HEXAGON HEAD............. 2
  18 PAOZZ 5310015281408 3A054 91831A135   NUT, SELF-LOCKING, HEXAGON........... 2

                              END OF FIGURE
```
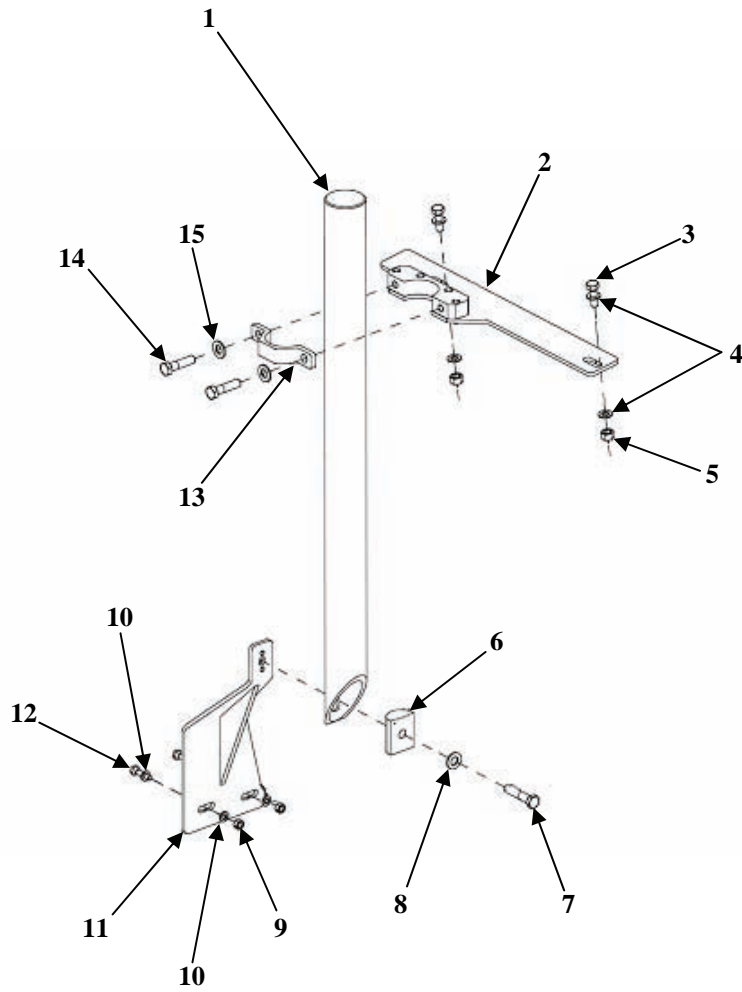
Figure E-9B – CDU Mount Bracket (SUSV) (P/N 7204213-9)

```
   SECTION II        TM9667534912&P
 (1)   (2)    (3)         (4)        (5)                  (6)                    (7)
ITEM   SMR                          PART
 NO   CODE    NSN        CAGEC     NUMBER   DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                            GROUP 0802
                                            FIGURE E-9B
                                            CDU MOUNTING BRACKET (SUSV)
                                            7204213-9

   1 PAOZZ 3040015280941 1NZ85 7170227-1       SHAFT ASSEMBLY, STRAIGHT............. 1
   2 PAOZZ 5975015285525 1NZ85 7204198-9       MOUNTING BASE, ELECTRONIC (CDU       1
                                               UPPER PLATE ASSEMBLY)................
   3 PAOZZ 5305015279566 15526 M8X25DIN933-A2  SCREW, CAP, HEXAGON HEAD............. 4
   4 PAOZZ 5310015284377 15526 8.4DIN125NRST   WASHER, FLAT......................... 4
   5 PAOZZ 5310015280345 15526 M8X1.25DIN985-A2 NUT, SELF-LOCKING, HEXAGON.......... 2
   6 PAOZZ 5310015283395 1NZ85 7170226         WASHER, CONVEX...................... 1
   7 PAOZZ 5305005311097 80205 MS35308-365     SCREW, CAP, HEXAGON HEAD (SS, 3/8-24 1
                                               X 1-3/4 L)..........................
   8 PAOZZ 5310014650900 81349 MS15795-814     WASHER, FLAT (SS, 3/8).............. 3
   9 PAOZZ 5310015284368 15526 M6X1DIN985-A2   NUT, SELF-LOCKING, HEXAGON (NYLON)... 2
  10 PAOZZ 5310015278567 15526 6.4DIN125NRST   WASHER, FLAT......................... 4
  11 PAOZZ 5975015284062 1NZ85 7204197-9       MOUNTING BASE, ELECTRONIC (CDU       1
                                               LOWER PLATE ASSEMBLY)...............
  12 PAOZZ 5305015280593 15526 M6X25DIN933A2   SCREW, CAP, HEXAGON HEAD............. 2
  13 PAOZZ 5340015267840 1NZ85 7170228         CLAMP, LOOP......................... 1
  14 PAOZZ 5305008015747 80205 MS35308-364     SCREW, CAP, HEXAGON HEAD (SS, 3/8-24 2
                                               X 1-1/2 L)..........................
  15 PAOZZ 5315013584821 39428 92384A081       PIN, STRAIGHT, HEADED (QUICK RELEASE, 1
                                               3/8 DIA X 3 L)......................

                             END OF FIGURE
```
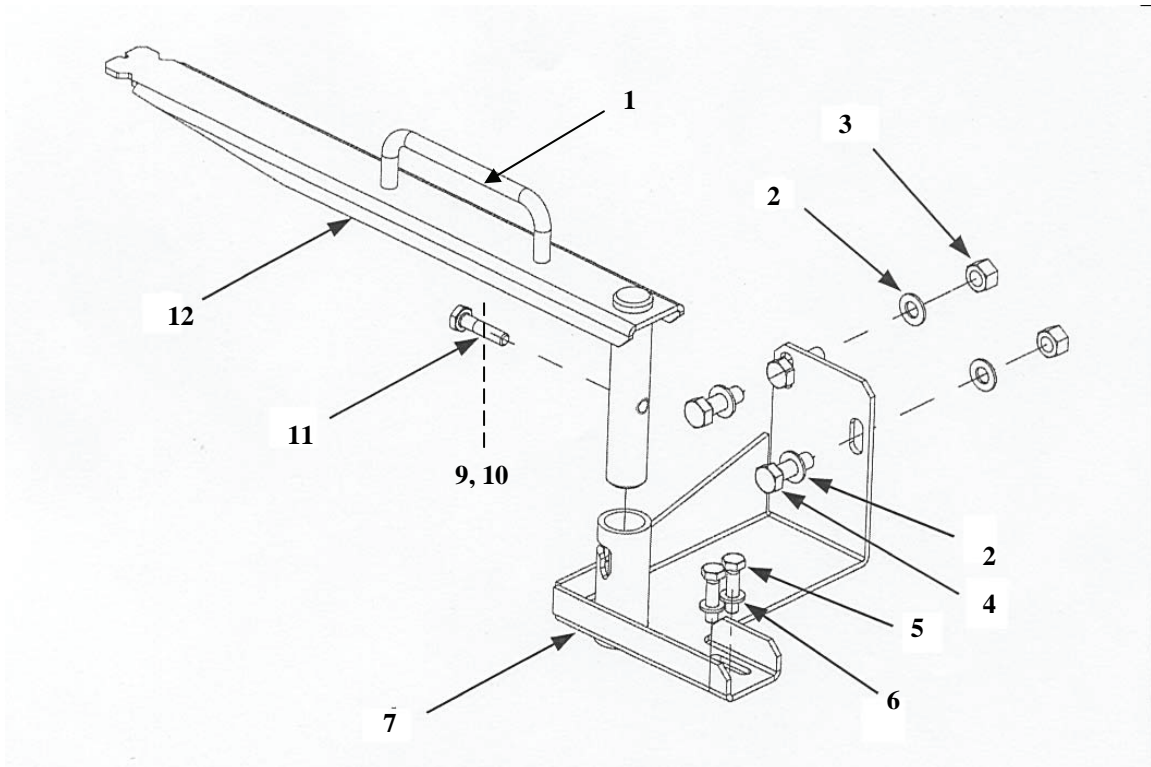
Figure E-9C – Plumb Bob Assembly (SUSV) (P/N 7204201-9)

```
   SECTION II          TM9667534912&P
 (1)   (2)    (3)        (4)      (5)                 (6)                    (7)
ITEM  SMR                                                                    
 NO   CODE   NSN        CAGEC    PART       DESCRIPTION AND USABLE ON CODES(UOC) QTY
                                 NUMBER

                                            GROUP O803
                                            FIGURE E-9C
                                            PLUMB BOB MOUNTING BRACKET (SUSV)
                                            7204201-9

   1 PAOZZ 5340015280953 3A054 1726A33          HANDLE, BAIL........................ 1
   2 PAOZZ 5310015284377 15526 8.4DIN125NRST    WASHER, FLAT........................ 2
   3 PAOZZ 5310015280345 15526 M8X1.25DIN985-A2 NUT, SELF-LOCKING, HEXAGON.......... 2
   4 PAOZZ 5305015279566 15526 M8X25DIN933-A2   SCREW, CAP, HEXAGON H............... 2
   5 PAOZZ 5305015280593 15526 M6X25DIN933-A2   SCREW, CAP, HEXAGON HEAD............ 2
   6 PAOZZ 5310015278567 15526 6.4DIN125NRST    WASHER, FLAT........................ 2
   7 PAOZZ 5340015272319 1NZ85 7204199-9        BRACKET, ANGLE (PLUMB BOB BRACKET    1
                                                ASSEMBLY)...........................
   9 PAOZZ 5310009338119 80205 MS35338-137      WASHER, LOCK........................ 2
  10 PAOZZ 5305009887603 80205 MS16995-27       SCREW, CAP, SOCKET HEAD (8-32)...... 2
  11 PAOZZ 5305007208245 80205 MS35308-309      SCREW, CAP, HEXAGON HEAD (SS, 1/4-28 1
                                                X 1-1/8 L)..........................
  12 PAOZZ 5340015280936 1NZ85 7204200-9        LEVER, MANUAL CONTROL (PLUMB BOB     1
                                                ARM ASSEMBLY).......................

                          END OF FIGURE
```
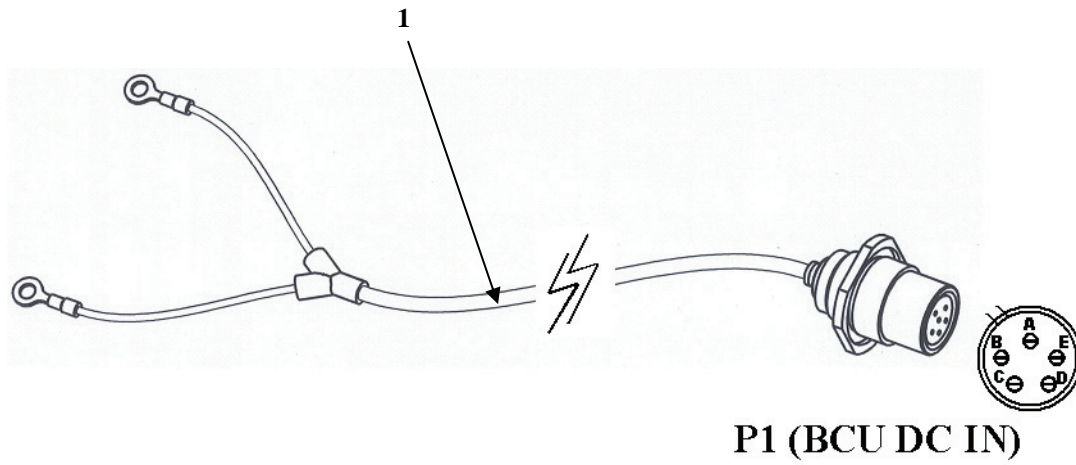
Figure E-9D – W116-3 SUSV Power Cable Assembly (P/N 7204116-3)

```
   SECTION II          TM9667534912&P
 (1)   (2)    (3)          (4)      (5)                  (6)                    (7)
ITEM   SMR                          PART
 NO    CODE    NSN         CAGEC    NUMBER      DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                              GROUP 0804
                                              FIGURE E-9D
                                              W116-3 POWER CABLE ASSEMBLY (SUSV)
                                              7204116-3

  1 PAOKK 6150015276847 1NZ85 7204116-3        CABLE ASSEMBLY, POWER, W-116-3....... 1

                                   END OF FIGURE
```

1
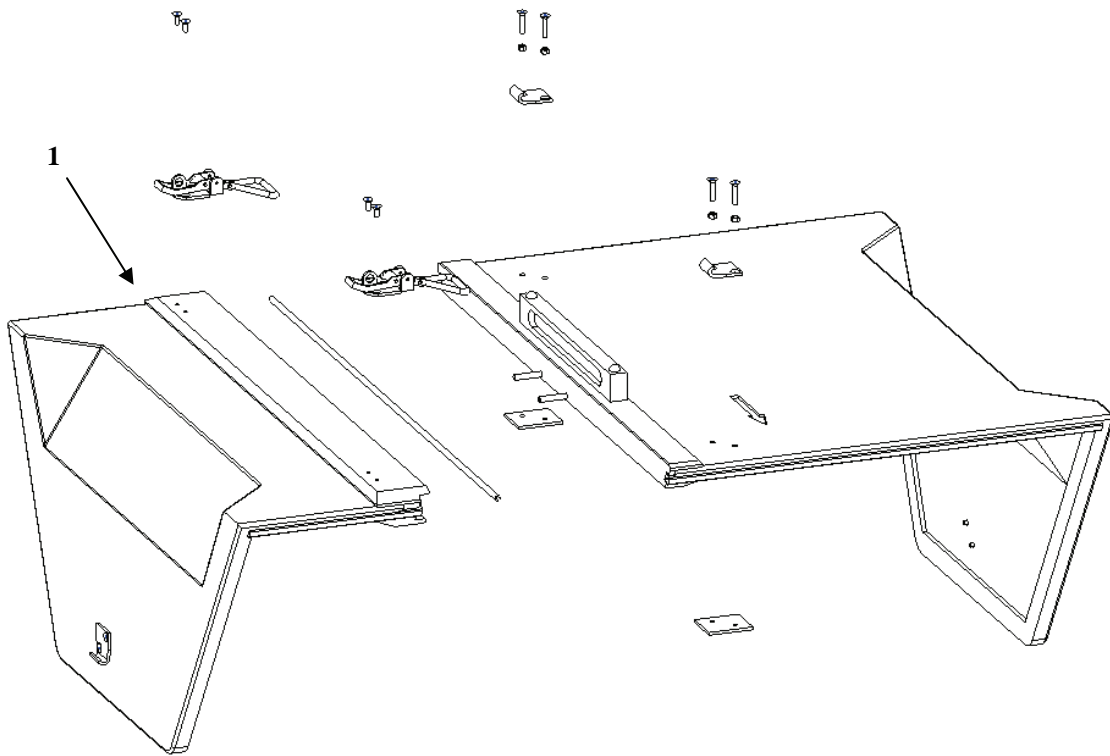
Figure E-9E – SUSV Modified Engine Cover Assembly (P/N 7204262-9)

```
   SECTION II        TM9667534912&P
 (1)   (2)    (3)        (4)      (5)                    (6)                      (7)
 ITEM   SMR                                                                       
 NO    CODE   NSN       CAGEC    PART      DESCRIPTION AND USABLE ON CODES(UOC) QTY
                                 NUMBER

                                           GROUP 0805
                                           FIGURE E-9E
                                           SUSV MODIFIED ENGINE COVER ASSEMBLY
                                           7204262-9

   1 PAOZZ 2510015413655 1NZ85 7204262-9   COVER, ENGINE, SUSV MODIFIED ENGINE   1
                                           COVER...............................
```

END OF FIGURE
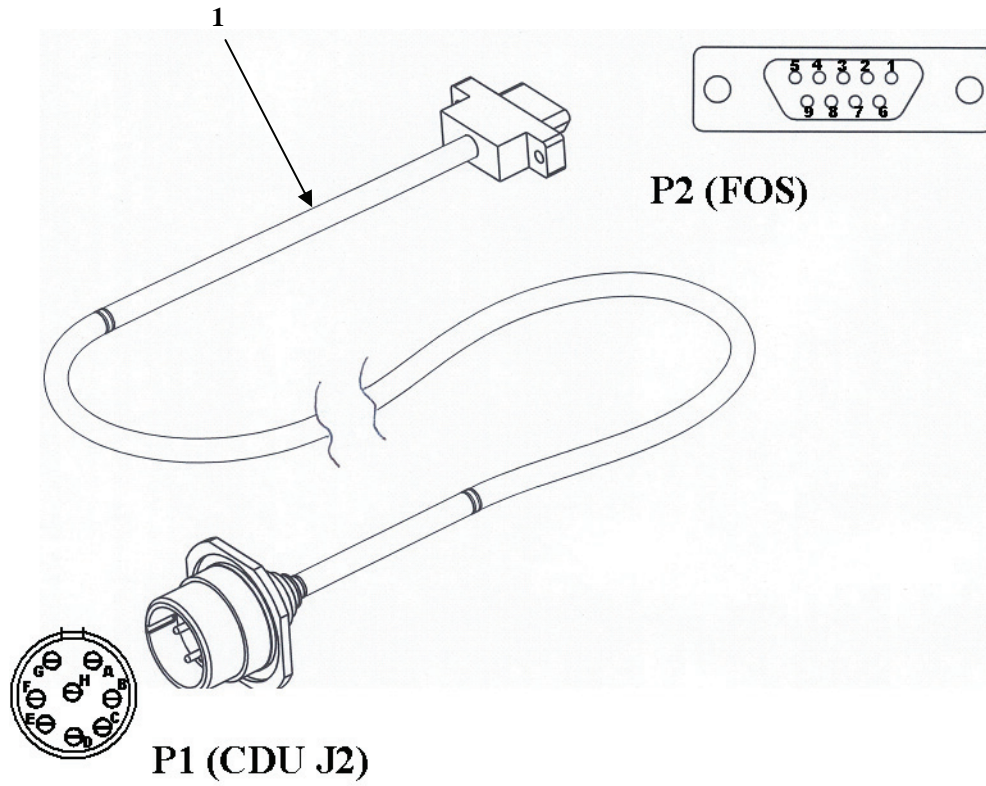
Figure E-10 – W136 FOS Cable Assembly (P/N 7204136-9)

```
   SECTION II          TM9667534912&P
 (1)   (2)    (3)         (4)      (5)                  (6)                      (7)
ITEM   SMR                         PART
 NO    CODE   NSN        CAGEC    NUMBER    DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                            GROUP 09
                                            FIGURE E-10
                                            W136 FOS CABLE ASSEMBLY
                                            7204136-9

   1 PAOKK 5995015190653 1NZ85 7204136-9      CABLE ASSEMBLY, SPECIAL, W-136 (FOS).. 1

                               END OF FIGURE
```

1

Figure E-11 – W143 Reprogramming Cable Assembly (P/N 7204143-9)

```
   SECTION II         TM9667534912&P
 (1)   (2)    (3)        (4)      (5)                  (6)                    (7)
ITEM   SMR                                                         
 NO    CODE   NSN       CAGEC    PART                                       
                                 NUMBER    DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                           GROUP 10
                                           FIGURE E-11
                                           W143 REPROGRAMMING CABLE ASSEMBLY
                                           7204143-9

   1 PAOKK 5995015222631 1NZ85 7204143-9   CABLE ASSEMBLY, SPECIAL, W-143       1
                                           (REPROGRAMMING)......................
```

                              END OF FIGURE
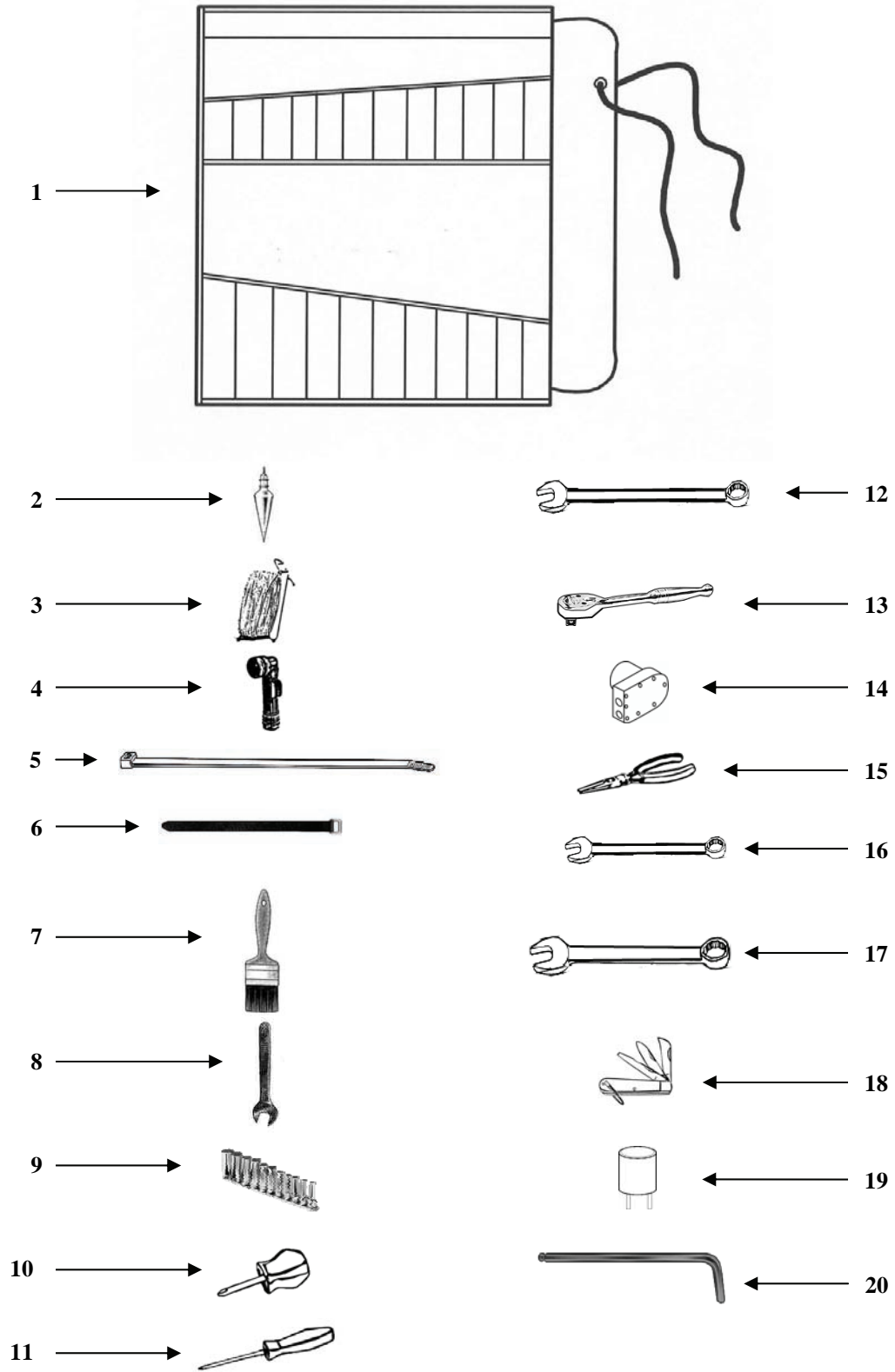
Figure E-12 – P/N 7204146-9 Electronic Tool Kit

```
   SECTION II          TM9667534912&P
  (1)   (2)    (3)          (4)       (5)                    (6)                        (7)
 ITEM   SMR                            PART
  NO    CODE   NSN          CAGEC    NUMBER     DESCRIPTION AND USABLE ON CODES(UOC) QTY

                                                GROUP 9500
                                                FIGURE E-12
                                                TOOL KIT
                                                7204146-9

    1 PAOZZ 5140015281311 39428 6389A11         ROLL, TOOLS AND ACCE................. 1
    2 PAOZZ 5210013677283 63474 108             PLUMB BOB *.......................... 1
    3 PAOZZ 4020015225473 39428 2178A8          CORD, FIBROUS........................ 1
    4 PAOZZ 6230002648261 28815 MX991/U         FLASHLIGHT........................... 1
    5 PAOZZ 5975008994606 81343 MS3367-2-0      STRAP, TIEDOWN, ELECT............... 5
    6 PAOZZ 5975015234302 3A054 6912K54         STRAP, TIEDOWN, ELECT............... 5
    7 PAOZZ 7920002051427 80244 7920-00-205-1427 BRUSH, DUSTING, LENS................ 1
    8 PAOZZ 5120013351294 55719 OSH20B          WRENCH, BOX AND OPEN (5/8 INCH)...... 1
    9 PAOZZ 5120014293597 68D9G 211SFY          SOCKET SET, SOCKET W................. 1
   10 PAOZA 5120013001152 55719 GSDDP22         SCREWDRIVER, CROSS TIP (3 3/4 INCH).. 1
   11 PAOZA 5120012908231 55719 GSDDP42         SCREWDRIVER, CROSS TIP (8 13/32 INCH) 1
   12 PAOZZ 5120013673356 55719 OES24B          WRENCH, BOX AND OPEN (3/4 INCH)...... 1
   13 PAOZZ 5120014745182 55719 F936            HANDLE, SOCKET WRENCH (3/8 INCH)..... 1
   14 PAOZZ 5935005670128 61090 TGC2338         CONNECTOR, PLUG, NATO............... 1
   15 PAOZZ 5120014287830 55719 196BCP          PLIERS............................... 1
   16 PAOZZ 5120013351235 55719 OEX18B          WRENCH, BOX AND OPEN (9/16 INCH)..... 1
   17 PAOZZ 5120013351233 55719 OEX14B          WRENCH, BOX AND OPEN (7/16 INCH)..... 1
   18 PAOZZ 5110013999317 1CV05 18535           KNIFE, POCKET........................ 1
   19 PAOZZ 5920014936642 0JR59 373150041       FUSE, CARTRIDGE...................... 5
   20 PADZZ 5120012636436 39428 7122A53         KEY, SOCKET HEAD SCR................. 1
```

END OF FIGURE

SECTION IV   TM9667534912&P

CROSS-REFERENCE INDEXES

NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
5305-00-088-9666	E-7A	3	5985-01-517-6193	E-7	1
5305-00-103-2072	E-7	3	5995-01-519-0653	E-1	11
5975-00-133-8687	E-9	4		E-10	1
5310-00-184-8628	E-7B	5	5340-01-519-8010	E-7	2
7920-00-205-1427	E-12	7	5340-01-521-0007	E-7	7
6230-00-264-8261	E-12	4	1260-01-521-4556	E-2	2
5935-00-322-8959	E-9	3	6130-01-521-6921	E-1	5
5305-00-531-1097	E-9B	7	7010-01-521-7883	E-1	6
5305-00-543-4406	E-9A	2	6605-01-521-7884	E-1	4
9905-00-551-2991	E-1	3	5340-01-522-1647	E-1	7
5935-00-567-0128	E-12	14	5995-01-522-2631	E-1	12
5305-00-576-5417	E-7	14		E-11	1
5310-00-614-3506	E-9A	16	5975-01-522-4819	E-1	1
5342-00-706-1716	E-7A	12	4020-01-522-5473	E-12	3
5305-00-720-8245	E-7A	9	5995-01-522-5485	E-1	10
	E-9C	11		E-5	1
5305-00-764-0075	E-7A	2	5975-01-523-4302	E-12	6
5310-00-767-9425	E-7	4	5340-01-523-6531	E-9	2
5310-00-773-7618	E-7	13	5330-01-523-6683	E-6	1
	E-7A	13	5330-01-523-6689	E-6	2
5305-00-801-5747	E-9B	14	5340-01-523-6743	E-7	9
5305-00-822-5853	E-9A	6	5330-01-523-6754	E-2	3
5975-00-899-4606	E-12	5	5310-01-523-6783	E-7	11
5310-00-933-8119	E-9C	9	5305-01-523-6810	E-7	16
5310-00-933-8778	E-7	5	5330-01-523-6850	E-6	3
5310-00-952-0309	E-7A	7	5315-01-523-6856	E-7B	1
5310-00-965-1800	E-7B	4	5330-01-523-7025	E-6	5
5305-00-988-7603	E-9C	10	5306-01-523-7270	E-7	12
5120-01-290-8231	E-12	11	5330-01-523-7526	E-6	4
5120-01-300-1152	E-12	10	5340-01-523-7601	E-7	8
5120-01-335-1233	E-12	17	5340-01-523-7611	E-7B	2
5120-01-335-1235	E-12	16	7690-01-524-4226	E-1	2
5120-01-335-1294	E-12	8	1290-01-524-4517	E-7	15
5315-01-358-4821	E-9B	15	5340-01-524-6141	E-9	5
5120-01-367-3356	E-12	12	5340-01-525-1893	E-9	1
5210-01-367-7283	E-12	2	5995-01-525-3986	E-7C	1
5310-01-386-3517	E-9A	7	8145-01-525-4312	E-6	6
5110-01-399-9317	E-12	18	8145-01-525-4317	E-3	5
5120-01-428-7830	E-12	15	8145-01-525-4325	E-4	2
5120-01-429-3597	E-12	9	5340-01-525-8711	E-9A	14
5310-01-465-0892	E-9A	10	5310-01-526-3438	E-9A	11
5310-01-465-0900	E-9A	3	5340-01-526-7840	E-9B	13
	E-9B	8	5340-01-527-2319	E-9C	7
5120-01-474-5182	E-12	13	6150-01-527-6847	E-9D	1
5920-01-493-6642	E-3	3	5310-01-527-8567	E-9B	10
	E-12	19		E-9C	6
6140-01-493-8357	E-3	2	5305-01-527-9566	E-9B	3
5995-01-493-8358	E-3	4		E-9C	4
4730-01-493-9632	E-7	6	5340-01-527-9895	E-9A	12
5310-01-499-0431	E-7A	14	5310-01-528-0345	E-9B	5

SECTION IV   TM9667534912&P

CROSS-REFERENCE INDEXES

NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
5310-01-528-0345	E-9C	3			
5305-01-528-0593	E-9B	12			
	E-9C	5			
5340-01-528-0922	E-9A	4			
5340-01-528-0936	E-9C	12			
3040-01-528-0941	E-9B	1			
5305-01-528-0950	E-9A	9			
5340-01-528-0953	E-9C	1			
5140-01-528-1311	E-12	1			
5310-01-528-1408	E-9A	18			
5305-01-528-2844	E-9A	17			
5310-01-528-3382	E-7A	6			
5310-01-528-3395	E-9B	6			
5305-01-528-3658	E-9A	15			
5975-01-528-4062	E-9B	11			
5310-01-528-4368	E-9B	9			
5310-01-528-4377	E-9B	4			
	E-9C	2			
5305-01-528-4397	E-9A	13			
5975-01-528-5525	E-9B	2			
5365-01-528-6297	E-7A	5			
5310-01-528-7530	E-7B	3			
9520-01-528-8428	E-9A	1			
5340-01-529-3832	E-9A	5			
5340-01-529-6841	E-9A	8			
5340-01-529-6873	E-7A	11			
5310-01-529-7197	E-7A	8			
2510-01-541-3655	E-9E	1			

I-2

SECTION IV   TM9667534912&P

CROSS-REFERENCE INDEXES

PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
08TP4	ABP-ACC-TR-1	5995-01-493-8358	E-3	4
08TP4	ABP-BT-24V/1.9AH-1	6140-01-493-8357	E-3	2
55719	F936	5120-01-474-5182	E-12	13
55719	GSDDP22	5120-01-300-1152	E-12	10
55719	GSDDP42	5120-01-290-8231	E-12	11
76005	HT0-3	5342-00-706-1716	E-7A	12
80205	MS15795-814	5310-00-773-7618	E-7	13
			E-7A	13
		5310-01-465-0900	E-9A	3
			E-9B	8
80205	MS15795-816	5310-00-184-8628	E-7B	5
80205	MS15795-817	5310-00-614-3506	E-9A	16
80205	MS15795-818	5310-00-767-9425	E-7	4
		5310-01-465-0892	E-9A	10
80205	MS16995-27	5305-00-988-7603	E-9C	10
80205	MS16996-41		E-7A	12
80205	MS24693-C51	5305-00-088-9666	E-7A	3
81343	MS3367-2-0	5975-00-899-4606	E-12	5
81343	MS3367-5-0	5975-00-133-8687	E-9	4
80205	MS35307-360	5305-00-576-5417	E-7	14
96906	MS35307-368	5305-00-822-5853	E-9A	6
80205	MS35307-370	5305-00-543-4406	E-9A	2
96906	MS35307-419	5305-00-103-2072	E-7	3
80205	MS35308-309	5305-00-720-8245	E-7A	9
			E-9C	11
80205	MS35308-364	5305-00-801-5747	E-9B	14
80205	MS35308-365	5305-00-531-1097	E-9B	7
80205	MS35338-137	5310-00-933-8119	E-9C	9
80205	MS35338-143	5310-00-933-8778	E-7	5
96906	MS51959-49	5305-00-764-0075	E-7A	2
96906	MS51971-4	5310-00-965-1800	E-7B	4
28815	MX991/U	6230-00-264-8261	E-12	4
15526	M6X1DIN985-A2	5310-01-528-4368	E-9B	9
15526	M6X25DIN933-A2	5305-01-528-0593	E-9C	5
15526	M6X25DIN933A2	5305-01-528-0593	E-9B	12
15526	M8X1.25DIN985-A2	5310-01-528-0345	E-9B	5
			E-9C	3
15526	M8X25DIN933-A2	5305-01-527-9566	E-9B	3
			E-9C	4
80205	NAS620C416	5310-00-952-0309	E-7A	7
55719	OES24B	5120-01-367-3356	E-12	12
55719	OEX14B	5120-01-335-1233	E-12	17
55719	OEX18B	5120-01-335-1235	E-12	16
55719	OSH20B	5120-01-335-1294	E-12	8
61090	TGC2338	5935-00-567-0128	E-12	14
18876	10162862-17	9905-00-551-2991	E-1	3
63474	108	5210-01-367-7283	E-12	2
19207	11677570	5935-00-322-8959	E-9	3
19200	11838924-1	6605-01-521-7884	E-1	4
19200	11838924-2	6130-01-521-6921	E-1	5

I-3

SECTION IV   TM9667534912&P

CROSS-REFERENCE INDEXES

PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
19200	11838924-3	7010-01-521-7883	E-1	6
3A054	11838924-4		E-1	8
0XY83	120FSN5/AK	5340-01-529-6873	E-7A	11
3A054	1726A33	5340-01-528-0953	E-9C	1
1CV05	18535	5110-01-399-9317	E-12	18
55719	196BCP	5120-01-428-7830	E-12	15
68D9G	211SFY	5120-01-429-3597	E-12	9
39428	2178A8	4020-01-522-5473	E-12	3
0JR59	373150041	5920-01-493-6642	E-3	3
			E-12	19
3A054	57185A17		E-12	20
15526	6.4DIN125NRST	5310-01-527-8567	E-9B	10
			E-9C	6
39428	6389A11	5140-01-528-1311	E-12	1
3A054	6912K54	5975-01-523-4302	E-12	6
1NZ85	7158019-1	8145-01-525-4312	E-6	6
1NZ85	7158019-4	8145-01-525-4325	E-4	2
1NZ85	7158019-5	8145-01-525-4317	E-3	5
1NZ85	7170155-9	1260-01-521-4556	E-2	2
1NZ85	7170172-2	7690-01-524-4226	E-1	2
1NZ85	7170174-2	5330-01-523-6754	E-2	3
1NZ85	7170174-3	5330-01-523-6689	E-6	2
1NZ85	7170174-4	5330-01-523-7526	E-6	4
1NZ85	7170174-5	5330-01-523-6850	E-6	3
1NZ85	7170174-6	5330-01-523-7025	E-6	5
1NZ85	7170174-7	5330-01-523-6683	E-6	1
1NZ85	7170176-1	5315-01-523-6856	E-7B	1
1NZ85	7170190-9		E-7A	10
1NZ85	7170223	9520-01-528-8428	E-9A	1
1NZ85	7170224-9	5340-01-529-6841	E-9A	8
1NZ85	7170225-9	5340-01-529-3832	E-9A	5
1NZ85	7170226	5310-01-528-3395	E-9B	6
1NZ85	7170227	3040-01-528-0941	E-9B	1
1NZ85	7170228	5340-01-526-7840	E-9B	13
1NZ85	7204056-9	5975-01-522-4819	E-1	1
1NZ85	7204108-1	5340-01-519-8010	E-7	2
1NZ85	7204108-3	5306-01-523-7270	E-7	12
1NZ85	7204108-4	5340-01-523-6743	E-7	9
1NZ85	7204108-5	5985-01-517-6193	E-7	1
1NZ85	7204108-6		E-7A	4
1NZ85	7204108-7	5340-01-523-7611	E-7B	2
1NZ85	7204108-8	5340-01-523-7601	E-7	8
1NZ85	7204114-9	5995-01-522-5485	E-1	10
			E-5	1
1NZ85	7204116-1	5995-01-525-3986	E-7C	1
1NZ85	7204116-3	6150-01-527-6847	E-9D	1
1NZ85	7204136-9	5995-01-519-0653	E-1	11
			E-10	1
3A054	7204141-19		E-3A	1
1NZ85	7204141-9		E-3	1
1NZ85	7204142-9		E-4	1

I-4

SECTION IV   TM9667534912&P

CROSS-REFERENCE INDEXES

PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
1NZ85	7204143-9	5995-01-522-2631	E-1	12
			E-11	1
08TP4	7204148-9		E-3	2A
1NZ85	7204149-9	5340-01-521-0007	E-7	7
1NZ85	7204151-9		E-7	10
1NZ85	7204153-9		E-2	1
1NZ85	7204154-9	5340-01-522-1647	E-1	7
1NZ85	7204155-9	1290-01-524-4517	E-7	15
1NZ85	7204168-9		E-7A	1
1NZ85	7204193-9	5340-01-523-6531	E-9	2
1NZ85	7204194-9	5340-01-527-9895	E-9A	12
1NZ85	7204195-9	5340-01-525-8711	E-9A	14
1NZ85	7204196-9	5340-01-528-0922	E-9A	4
1NZ85	7204197-9	5975-01-528-4062	E-9B	11
1NZ85	7204198-9	5975-01-528-5525	E-9B	2
1NZ85	7204199-9	5340-01-527-2319	E-9C	7
1NZ85	7204200-9	5340-01-528-0936	E-9C	12
1NZ85	7204201-9	5340-01-524-6141	E-9	5
1NZ85	7204213-9	5340-01-525-1893	E-9	1
1NZ85	7204262-9	2510-01-541-3655	E-9E	1
80244	7920-00-205-1427	7920-00-205-1427	E-12	7
15526	8.4DIN125NRST	5310-01-528-4377	E-9B	4
			E-9C	2
4J007	81838658	5305-01-528-3658	E-9A	15
4J007	81838682	5305-01-528-2844	E-9A	17
4J007	81838955	5305-01-528-0950	E-9A	9
4J007	81838963	5305-01-528-4397	E-9A	13
39428	90099A031	5310-01-386-3517	E-9A	7
2V507	91744A583	5305-01-523-6810	E-7	16
3A054	91831A120	5310-01-528-3382	E-7A	6
2V507	91831A130	5310-01-499-0431	E-7A	14
3A054	91831A133	5310-01-528-7530	E-7B	3
3A054	91831A135	5310-01-528-1408	E-9A	18
3A054	91831A140	5310-01-526-3438	E-9A	11
3A054	92320A213	5365-01-528-6297	E-7A	5
39428	92384A081	5315-01-358-4821	E-9B	15
2V507	94758A033	4730-01-493-9632	E-7	6
3A054	95630A475	5310-01-529-7197	E-7A	8
2V507	98370A035	5310-01-523-6783	E-7	11

I-5

APPENDIX F

EXPENDABLE SUPPLIES AND MATERIALS LIST

SECTION I: INTRODUCTION

F-1. Scope.

This appendix lists expendable supplies and materials required to operate and maintain the IPADS. These items are authorized by CTA50-970, Expendable Items (except medical, Class V, Repair Parts, and Heraldic Items).

F-2. Explanation of Columns.

a.   **Column 1 - Item Number.** This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., use cleaning compound, Item 5, App. F).

b.   **Column 2 - Level.** This column identifies the lowest level of maintenance that requires the listed item. (Enter as applicable):

c.   **Column 3 - National Stock Number.** This is the National Stock Number assigned to the item; use it to request or requisition the item.

d.   **Column 4 - Description.** Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

e.   **Column 5 - Unit of Measure (U/M).** Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two – character alphabetical abbreviation (eg., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

SECTION II. EXPENDABLE SUPPLIES AND MATERIALS LIST

ITEM NUMBER	LEVEL	NATIONAL STOCK NUMBER	DESCRIPTION	U/M
1	C	6810-00-201-0906	Alcohol, denatured (OMUS3) 27 CFR 21.35	BX
2	C	7910-00-044-9281	Cloth, Lint-free (51200) Miracle WipeL001	BX
3	C	6640-00-436-5000	Paper, Lens (81348) NNNP40, Type I, Class 1	PKG
4	O	8010-01-414-8422	Epoxy Coating Kit (81349) M22750-002Q-24410	KT
5	O	8020-00-285-1167	Brush Set, Artist's (80244) PD8020-00-285-8010	SE
6	O	8030-00-081-2337	Sealing Compound, Loctite (81349) 08721	BX
7	O	7510-00-290-2026	Tape, Pressure Sensitive, Masking (52152) 250 2IN	RO

APPENDIX G

CDU Function Keys

Legend	Description	Reference
F1-MANUAL	Displays IPADS Technical Manual.	
F1-2POS	Marks the first point, orienting station (OS), of a two-position mark, using vehicle plumb bob reference.	
F1-4TH	Sets survey order for fourth order (five-minute ZUPT interval).	
F1-GRID	Sets azimuth type to grid azimuth.	
F1-M998	Sets IPADS vehicle type for operation in M998 HMMWV.	
F1-MILS	Sets angle display format to mils.	
F1-MRK EOL	Marks the second point, end of orienting line (EOL), of a two-position mark, using vehicle plumb bob reference.	
F1-NORMAL	Selects normal grid zone. The normal grid zone will be displayed on either side of a grid zone crossing.	
F1-ON	Enables audible alarm.	
F1-OPERNL	Selects normal operational mode. Confirmation required to switch from one of the two training modes. IPADS will be shut down. Recycle power using BCU OUTPUT switch.	
F1-UPDT-PB	Initiates position update and adjusts previously established points using vehicle plumb bob reference point.	
F1-USER	Sets point type to user defined when creating a point in the point editor.	
F1-UTM	Sets position display format to UTM.	
F2-1POS	Initiates one position survey control point mark using vehicle plumb bob reference.	
F2-5TH	Sets survey order for fifth order (ten-minute ZUPT interval).	
F2-ALARM	Tests the audible alarm. Accessible from within the STATUS screen.	
F2-DMS	Sets display position format to latitude/longitude or angle format in degrees, minutes and seconds.	
F2-M1123	Sets IPADS vehicle type for operation in M1069 or M1123 HMMWV.	
F2-MARK	Initiates marking (establishing) a point.	
F2-NEW	Displays the point editor page to add a new point to the database.	
F2-OFF	Disables audible alarm.	
F2-TRAIN	Selects full-IPADS training mode. Confirmation required to switch from normal or emulator modes. IPADS will be shut down. Recycle power using BCU OUTPUT switch.	
F2-TRUE	Sets azimuth type to true (geodetic) azimuth.	
F2-UPDT-⊼	Initiates position update using an offset (theodolite) reference and adjusts previously established points. Must be confirmed to complete.	
F2-USE ALL	Apply the data that was entered on a page. IPADS will validate the data and display an appropriate response.	
F2-WAY	Sets point type to waypoint when creating a point in the point editor.	

Legend	Description	Reference
F2-WEST GZ	Selects extension of the west grid zone. The grid zone west of the grid zone boundary will be displayed while operating within 40km of the grid zone boundary.	
F3-⋀ AZ	Initiates offset (theodolite) position and azimuth mark.	
F3-D.D	Sets display position format to latitude/longitude or angle format in decimal degrees.	
F3-EAST GZ	Selects extension of the east grid zone. The grid zone east of the grid zone boundary will be displayed while operating within 40km of the grid zone boundary.	
F3-EMULAT	Selects emulator mode for training. Confirmation required to switch from normal mode or full-IPADS training mode. IPADS will be shut down. Recycle power using BCU OUTPUT switch.	
F3-FLAT	Selects display of inverse flattening during entry of user defined ellipsoid and datum.	
F3-M973	Sets IPADS vehicle type for operation in M973 SUSV.	
F3-SCP	Sets point type to SCP when creating a point in the point editor.	
F3-PT SEL.	Displays point list to select position update point or navigation way point.	
F3-UPDT	Initiates a position update and adjustment of previously established points.	
F3-YES	Enables usage of daylight savings in date / time screen.	
F4-⋀ SCP	Initiates offset (theodolite) position only mark.	
F4-FILTER	Toggles through the type of points to be displayed on map and point list.	
F4-MINOR	Selects display of semi-minor axis during entry of user defined ellipsoid and datum.	
F4-NO	Disables usage of daylight savings in date / time screen.	
F4-ZUPT	Initiates a ZUPT, which must be confirmed to complete.	
F5-DEL ALL	Initiates deletion of all points from the point list for the displayed filter type. Must be confirmed to complete deletion. Use the delete function (FNC and DEL keys) to delete a single selected point.	
F5-GETTIME	Synchronizes CDU date and time to FOS. Requires FOS to be connected to CDU J2 connector via the FOS data cable, and initialized.	
F5-NAV	Initiates input of navigation waypoint.	
F5-NAV AID	Displays navigation aid (compass rose).	
F5-OTHER	Sets IPADS vehicle type for operation in a user-defined vehicle.	
F5-STOPNAV	Discontinues waypoint navigation.	
F5-ZONE	Initiates setting normal or extended zone when zone boundary crossed.	
F6-CENTER	Centers map on current location, resets zoom to 1.00, and loads an adjacent map if current location moves off the previously loaded map.	
F6-MAP	Displays map.	
F6-SND PNT	Sends the selected point within the point list to the FOS. Requires FOS to be connected to CDU J2 connector via the FOS data cable, and initialized.	
F7-POINTS	Displays point list.	

Legend	Description	Reference
F7-SND ALL	Sends all SCPs stored on IPADS to the FOS. Requires FOS to be connected to CDU J2 connector via the FOS data cable, and initialized.	
F8-STATUS	Displays current IPADS status.	
F9-CANCEL	Cancels the operation in process.	
F9-EXIT	Returns display to previous page.	
F9-MENU	Returns display to the menu.	
F9-SHUTDN	Initiates shutdown of IPADS. Must be confirmed to complete.	

APPENDIX H

IPADS MAP MANAGER SOFTWARE PERFORMANCE SPECIFICATION

SECTION I. INTRODUCTION

H-1. Scope. This performance specification covers the requirements for IPADS Map Manager software. IPADS is an inertial surveying system that can display a digital map background as an aid for navigation. The map background is not required for IPADS to meet its performance requirements. IPADS Map Manager software has two primary functions: preparation of map data files in the format required by IPADS; and loading and managing of map files in IPADS.

a. **Threshold Requirements.** Threshold requirements are requirements that must be met. All requirements in this specification are threshold, unless identified.

b. **Objective Requirements.** Objective requirements are desired, but not required. Objective requirements may be met in whole or in part. Meeting objective requirements will not degrade satisfaction of threshold requirements.

SECTION II. APPLICABLE DOCUMENTS

H-2. General. The documents listed in this section are specified in H-3. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in H-3, whether or not they are listed.

H-3. Government Documents.

a. **Specifications, Standards, and Handbooks.** The following specifications, standards, and handbooks are referenced in this specification. In the event of a conflict between the following documents and the contents of this specification, this specification supercedes the following documents.

STANDARDS
MIL-STD-2411 Notices 1-3	Raster Product Format (RPF)
MIL-STD-1472	Human Engineering

SPECIFICATIONS
MIL-PRF-52955C	Improved Position and Azimuth Determining System (IPADS)
MIL-PRF-89038 Amendment 2, Notice 1	Compressed Arc Digitized Raster Graphics (CADRG)

(Unless otherwise noted, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Bldg. 4D, Philadelphia, PA 19111-5094. They also may be downloaded from ASSIST-QuickSearch.)

b. **Other Government Documents, Drawings, and Publications.** The following government documents, drawings, and publications are referenced in this document. Unless otherwise specified, the issues are those cited in the solicitation.

Improved Position and Azimuth Determining System (IPADS) Accessory Software Interface Control Document (ICD)

Copies or other publications required by suppliers in connection with specified procurement functions should be obtained from the contracting agency or as directed by the contracting offices.

H-4. Non-Government Documents. The following documents are referenced in this specification. In the event of a conflict between the following documents and the contents of this specification, this specification supercedes the following documents.

STANDARDS

    IEEEE 802.3-2002   Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

IEEE 802.3-2002 may be downloaded from http://standards.ieee.org/getieee802.

SECTION III. REQUIREMENTS

H-5. Computer Requirements. IPADS Map Manager operates as specified when installed on a host personal computer (PC) meeting the following requirements:

a. **Operating System:** Windows 2000™ or Windows XP™.

b. **Hard Drive:** Any read/write hard drive with at least 2GB free space.

c. **CD-ROM Drive:** Any operating CD-ROM drive.

d. **CD-RW Drive:** Any operating CD-RW drive with the assistance of Roxio CD Creator™ or equivalent.

    (1) Threshold: Enables IPADS Map Manager to copy IPADS map files to a preformatted CD

    (2) Objective: Enables IPADS Map Manager to copy IPADS map files to an unformatted CD

e. **Ethernet port:** 100/10 Base-T Ethernet port meeting the requirements of IEEE 802.3-2002.

(Enables IPADS Map Manager to copy files to an IPADS CDU, moving files between IPADS CDU folders, and deleting files from IPADS CDU.)

H-6. Installation: Any self-installation package that installs all software components needed for IPADS Map Manager to operate.

a. **Location:**

    (1) Threshold: Installs on any read/write hard drive with sufficient free space.

    (2) Objective: Installs in any folder on any read/write hard drive with sufficient free space with the default folder C:\Program Files\Map Manager\.

b. **Start Icons:** IPADS Map Manager puts a startup icon on the Windows™ Desktop and in the Windows™ Start/Programs Menu.

c. **Removal:** Removes using Windows™ Control Panel (Add or Remove Programs).

H-7. Startup. IPADS Map Manager launches when the operator "double clicks" on the desktop start icon; selects it from the Start/Programs menu; selects "Open" from the right-click pop-up menu for either icon; or runs via the Start\Run window.

a. **Component Checking:** IPADS Map Manager verifies all required components are available and gracefully adjusts functionality if a component is not available.

b. **Map Library:** IPADS Map Manager selects the IPADS Map Library folder for map files. If the IPADS Map Library folder does not exist IPADS Map Manager will create it.

c. **IPADS.** IPADS Map Manager determines if IPADS is connected to the host PC. If IPADS is not connected, IPADS Map Manager will not enable IPADS as a destination. If IPADS is connected, IPADS Map Manager will:

    (1) Enable IPADS as a destination.

    (2) Select IPADS as the default destination.

    (3) Automatically remove all map image and text files from the IPADS\IPADS CSCI\Data Files\Map Repository\ folder to the IPADS\IPADS UPDATE\CDU\Map Repository\ folder.

    (4) Automatically deletes any orphan map images or text files from the IPADS Map Repository (an orphan file is one that doesn't have a corresponding map or image file with the same name).

  d. **Emulator:** IPADS Map Manager determines if an IPADS Emulator is installed on the host PC. If installed, IPADS Map Manager will:

    (1) Enable the Emulator as a destination

    (2) Select the Emulator as the default destination if an IPADS is not connected.

    (3) Automatically moves all map images and text files form the Emulator\IPADS CSCI\Data Files\Map Repository\ folder to the Emulator\IPADS UPDATE\CDU\Map Repository\ folder.

    (4) Automatically deletes any orphan map images or text files from the Emulator Map Repository.

  e. **Window Size:** The IPADS Map Manager window will be displayed at normal size. The operator will not be able to minimize or maximize the IPADS Map Manager window.

H-8. Shutdown. The operator will be provided with a control to initiate graceful closure of IPADS Map Manager.

H-9. IPADS Map File Preparation. IPADS Map manager prepares IPADS map files from source digital map data.

  a. **Source Digital Map Data.**

    (1) Format.

        (a) Threshold – IPADS Map Manager accepts source digital map data in the CADRG format as specified in MIL-PRF-89038.

        (b) Objective – IPADS Map Manager accepts digital map data in all formats suitable for map background display.

    (2) Data Source.

        (a) Threshold – IPADS Map Manager automatically searches all drives on the host PC (except the root dive) for source digital map data. Source data is considered available if an A.TOC file is found in a RPF folder in the root directory of the drive.

        (b) Objective – IPADS Map Manager automatically identifies all sources of map data on all drives of the host PC.

        (c) In the event source data is not automatically found, IPADS Map Manager allows the operator to browse for it.

    (3) Available Data Display. When source data has been found, IPADS map Manager displays the map scale and boundary coordinates for each available data block.

    (4) Data Block Selection. IPADS Map Manager allows the operator to select the map scale(s) and data block(s) to be processed directly from the displayed data.

  b. **Output IPADS Map Files.** IPADS Map Manager prepares IPADS image and text files.

    (1) Formats. Output map image and text file formats are as specified in the IPADS Accessory Software Interface ICD.

H-9. IPADS Map File Preparation – Continued

    (2) File Size. IPADS map image files created by IPADS Map Manager will not exceed 64MB in size. If a single IPADS map image file covering the map preparation area exceeds 64MB, IPADS Map Manager automatically prepares multiple IPADS map files with overlapping boundaries as described in Appendix A of the IPADS Accessory Software Interface ICD.

    (3) File Names. IPADS Map Manager automatically assigns map names using the map name convention described in Appendix A of the IPADS Accessory Software Interface ICD. IPADS Map Manager allows the operator to enter an optional map name prefix (up to eight characters in length) for the map preparation area. Characters used in file names are limited to those specified in the IPADS Accessory Software Interface ICD. Map image file names are the map name with a .bmp file extension. Map text file names are the map name with a .txt file extension.

    (4) Output File Location. IPADS map files, prepared by MM, are placed in the \IPADS Map Library\ folder on the installation drive of the host PC.

  c. **Map Preparation Area.** IPADS Map Manager provides the capability for the operator to specify the boundaries of the map preparation area. Threshold – Boundary coordinates are numerical. Objective – Boundary coordinates are graphical.

    (1) Coverage Area. IPADS Map Manager allows entry of boundaries within 80º S to 80º N latitude and 180º W to 180º E longitude.

    (2) Coordinate Types. IPADS Map Manager allows the operator to select boundary coordinate entry as UTM grid coordinates, latitude and longitude in decimal degrees, and latitude and longitude in degrees, minutes, and seconds.

    (3) Coordinate Formats. Coordinate formats and hemisphere conventions will be consistent with those in MIL-PRF-52955C.

    (4) Coordinate Resolution. Coordinate entry resolution is to the nearest minute for latitude and longitude in degrees, minutes, and seconds, and to the nearest 1,000 meters for UTM.

    (5) Error Checking. IPADS Map Manager provides error messages, requiring operator acknowledgement, when:

      (a) Coordinates are outside the coverage area, H-9c(1).

      (b) The UTM grid zone number is outside the range of 1 through 60.

      (c) UTM coordinates are more than 45KM outside the normal grid zone boundaries. Normal grid zone boundaries are three degrees in longitude from the central meridian, worldwide.

      (d) Coordinates of the eastern boundary are equal to or west of those for the western boundary.

      (e) Coordinates of the southern boundary are equal to or north of those for the northern boundary.

  d. **Processing.**

    (1) Enablement. Map preparation will not be enabled until:

      (a) One or more source data blocks have been selected for processing, and coordinates for all four boundaries have been entered.

      (b) An input parameter has been changed and the conditions of H-9d(1)(a) have been satisfied after processing has been completed.

      (c) An input parameter has been changed and the conditions of H-9d(1)(a) have been satisfied after an error has been deleted.

    (2) Initiation. After map preparation is enabled, map preparation will be initiated by operator action.

    (3) Duplicate Files. If the \IPADS Map Library\ folder already contains map files with the same name as the files being created, IPADS Map Manager replaces the old files with the new ones without operator intervention.

(4) Zoom. Zoom is the ration of output pixels to input pixels, in one dimension, for raster source data. Threshold – For source data at a map scale of 1:50K, IPADS image files are prepared with a zoom of 0.7. A zoom of 1.0 will be used for all other map scales. IPADS image files are prepared with a zoom that minimizes file space while minimizing visual degradation of the image.

(5) Processing Status. Processing progress will be displayed after map preparation has been initiated.

(6) Completion Status. The number of maps successfully created will be displayed after processing has been completed.

(7) Error Reporting. IPADS Map Manager provides error messages, requiring operator acknowledgement, when processing errors are encountered.

(8) Processing Termination.

   (a) Threshold – IPADS Map Manager will not allow termination of map preparation while processing is ongoing.

   (b) Objective – IPADS Map Manager requires operator confirmation and gracefully exits processing when the operator initiates exit of map preparation while process is ongoing.

H-10. Map Management.

a. **Source Map Selection.**

(1) Source Map Library Selection. IPADS Map Manager allows the operator to select the source of IPADS map files from the IPADS Map Library and from all other drives (import drives) containing a \IPADS Map folder in the root directory.

(2) Source Enablement. A map source will be enabled only when it contains an \IPADS Map Library\ folder in the root directory.

(3) Import Drive Selection. IPADS Map Manager allows the operator to select an import drive from a list of available drives. The drive IPADS Map Manager is installed on will be excluded from the selection list. Drives with insufficient capacity to support an IPADS Map Library (e.g. floppy drives) may be excluded form the selection list. When a drive containing \IPADS Map Library\ in the root directory is selected from the list, it will be enabled and selected for display. It will remain enabled for selection when the host PC's IPADS Map Library is subsequently selected.

(4) Source Map List. When a map source is selected, IPADS Map Manger displays a list of map names available in the source \IPADS Map Library\ folder. Only a single map name for a map image file and map text file pair will be displayed. Map names will be displayed without file extension. It will be possible to access any map name in the list when the number of map names in the list exceeds the visible display area.

(5) Source Map Name Selection. IPADS Map Manager shows the number of maps selected and the total number of maps in the source map list using standard Windows™ operations.

(6) Selected Source Map Indication. IPADS Map Manager shows the number of maps selected and the total number of maps in the source map list.

b. **Destination Selection.** IPADS Map Manager allows the operator to select the destination for IPADS map files from IPADS, IPADS Emulator, IPADS Map Library, and from other (export) drives.

(1) Destination Folders. The destination folder for IPADS and IPADS Emulator will be \IPADS UPDATE\CDU\Map Repository\. The destination folder for the IPADS Map Library and export drives will be \IPADS Map Library\.

(2) Destination Enablement. A map destination will be enabled only when it meets the enablement criteria at startup (IPADS, IPADS Emulator, or IPADS Map Library) or it is an export drive containing writable storage media.

H-10. Map Management – Continued

      (3) Export Drive Selection. IPADS Map Manager allows the operator to select an export drive from a list of available drives. The drive IPADS Map Manager is installed on will be excluded from the selection list. Drives with insufficient capacity to support an IPADS Map Library (e.g. floppy drives) may be excluded from the selection list. When a drive containing a writable media is selected from the list, it will be enabled and selected for display. It will remain enabled for selection when a different destination is subsequently selected.

      (4) Map Library Folder. IPADS Map Manager automatically creates a \IPADS Map Library\ folder in the root directory of a selected export drive if it doesn't already exist.

      (5) Destination Map List. When a map destination is selected, IPADS Map Manager displays a list of map names available in the destination without file extensions. Only a single map name for a map image file and map text file pair will be displayed. A method will be provided to access any map name in the list when the number of map names in the list exceeds the visible display area.

      (6) Destination Map Name Selection. IPADS Map Manager allows the operator to select one or more map names on the destination map list using standard Windows™ operations.

      (7) Selected Destination Map Indication. IPADS Map Manager shows the number of maps selected and the total number of maps in the destination map list.

      (8) Destination Free space. IPADS Map Manager shows the available free space in the selected destination in terms of number of maps. An estimated map image file size of 64MB may be used to calculate the number of maps the free space can accommodate.

   c. **Copying.** IPADS Map Manager allows the operator to copy maps from a source to a destination.

      (1) Copy Enablement. Copying will not be enabled until one or more source maps have been selected and a destination has been selected. Copying will not be enabled if the map source and destination are the same.

      (2) Copy Initiation. When copying is enabled, IPADS Map Manager permits the operator to initiate copying (with one action) of the text and image files for all selected source maps to the selected destination.

      (3) File Extensions. Map text files will be copied to all destinations with the .txt file extension in the file name. Map image files will be copied to IPADS and the IPADS Emulator with no file extension in the file name (i.e. the map name only). Map image files will be copied to IPADS Map Libraries on the host PC or export drives with the .bmp file extension in the file name.

      (4) Copy Status. After the operation has initiated copying, IPADS Map Manager will display the status of copying maps.

      (5) Copy Completion. After completing map file copying, IPADS Map Manager indicates successful copying and updates the displayed list of destination maps and available destination free space.

      (6) Free Space. Before copying a map, PADS Map Manager determines whether the destination has sufficient free space to contain both the map image and text files. If there is insufficient free space, IPADS Map Manager displays an error message requiring operator acknowledgement and discontinues copying.

   d. **Deletion.** IPADS Map Manager allows the operator to delete map files from the source or destination.

      (1) Deletion Enablement. The delete function will not be enabled until one or more source or destination maps have been selected and the source or destination drive is write enabled.

      (2) Deletion Initiation. When deletion is enabled, IPADS Map Manager permits the operator to initiate deletion (with one action) of the text and image files for all selected source or destination maps. When deletion is initiated, MM displays a confirmation message requiring the operator to continue with or cancel the delete action. When continuation is selected, MM deletes both the image and text file associated with each selected map name. MM protects against deletion of destination maps when deletion of source maps is initiated and vice versa.

(3) Deletion Status. After the operator has initiated deletion, IPADS Map Manager displays the status of map deletion.

(4) Deletion Completion. After completing map file deletion, IPADS Map Manager indicates successful deletion and updates the displayed list of source or destination maps and the destination available free space.

e. Map Properties. IPADS Map Manager allows the operator to display the properties of any map in the source and destination map lists. Displayed map properties include: map name; image file size; image file creation date and time; map scale; and the coordinates of the north, south, east, and west map boundaries.

H-11. Human Factors Design. IPADS Map Manager complies with the human engineering design criteria, principles, and practices of MIL-STD-1472. Special design emphasis will be given to MIL-STD-1472, paragraphs 4 (General Requirements) AND 5.14 (Human-computer interface) as applicable.

a. **Help.**

(1) Threshold – IPADS Map Manager displays context related help messages for enabled controls and display areas.

(2) Objective – IPADS Map Manager provides full-featured help capability.

b. **Target Operator.** The target operator for IPADS Map Manager is MOS TBD, Field Artillery Surveyor.

APPENDIX I

Acronyms and Abbreviations

1/f	Inverse Flattening
AC	Alternating Current
AEPS	Army Electronic Product Support
ALT	Altitude
AZ	Azimuth
BCU	Battery and Charger Unit
BII	Basic Issue Item
BIT	Built In Test
BITE	Built In Test Equipment
C	Degrees Celsius
CADRG	Compressed ARC Digitized Raster Graphics
CAGEC	Commercial Activity Government Entity Code
CDU	Control and Display Unit
CEP	Circular Error Probable
CM	Configuration Management
COEI	Component of End Item
CPNU	Compact Position and Navigation Unit
CSCI	Computer Software Configuration Item
D.D	Decimal Degrees
D/M/S	Degrees/Minutes/Seconds
DA	Department of Army
DAPAM	Department of the Army Pamphlet
DC	Direct Current
DEL	Delete Key
DGR	Degraded Operations Indicator
DISREP	Discrepancy in Shipment Report
DMS	Degrees Minutes Seconds
EIR	Equipment Improvement Recommendation
EL	Elevation
ELLIP	Ellipsoid
EMI	Electromagnetic Interference
EOL	End of Orienting Line
ESC	Equipment Service Criteria
ETI	Elapsed Time Indicator
F	Degrees Fahrenheit
FI	Fault Isolation
FL	Filter
FNC	CDU FNC Key
FOS	Forward Observer System
GZ	UTM Grid Zone

Acronyms and Abbreviations

HDNG	Heading
hh:mm:ss	Hours:Minutes:Seconds
HMMWV	High Mobility Multi-Wheeled Vehicle
HORIZ	Horizontal
in	Inch
INIT	CPNU Initialization Mode
IPADS	Improved PADS
KBD	CDU Keyboard
kg	Kilograms
KM	Kilometers
km	Kilometers
LAN	Local Area Network
LAT	Latitude
lb	Pound
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LEN OL	Length of Orienting Line
LONG	Longitude
LRU	Line Replaceable Unit
m	Meters
MHz	Megahertz
MISN	Point Filter set to Current Mission
mm	Millimeters
mm:ss	Minutes:Seconds
MRK	Mark
MTBF	Mean Time Between Failure
MTOE	Modified TOE
MWO	Modification Work Order
N	Northern Hemisphere Indicator
NATO	North Atlantic Treaty Organization
NAV	Navigation Aid
NGA	National Geospatial- Intelligence Agency (formerly NIMA)
NIIN	National Item Identification Number
NIMA	National Imagery and Mapping Agency
NSN	National Stock Number
NXT ZPT	Next ZUPT (Time remaining till ZUPT is required)
OD	Outside Diameter
OL	Orienting Line
OS	Orienting Station
PADS	Position and Azimuth Determining System
PAE	Position Azimuth Elevation
PE	Probable Error
PERF	Performance

Acronyms and Abbreviations

PMCS	Preventative Maintenance
PN	Part Number
POS	Position
POS UPD REQ	Position Update Required Indicator
PPA	Porro-Prism Assembly
PT SEL	Point Select
RAD DIST	Radial Distance from Update Point
RAD ERR	Radial Error
ROD	Report of Discrepancy
S	Southern Hemisphere Indicator
SB	Supply Bulletin
SCP	Survey Control Point
SF	Standard Form
SHUTDN	Shut Down
SND PNT	Sent Point to FOS
SS	Stainless Steel
STLTH	CDU Stealth Mode
SUSPND	CDU Suspend Mode
SUSV	Small Utility Support Vehicle
SW VER	Software Version
TACOM	Tank-automotive and Armaments Command
TAMMS	The Army Maintenance Management System
TB	Technical Bulletin
TDA	Table of Distribution Allowances
TM	Technical Manual
TO&E	Table of Organization and Equipment
TOE	Table of Equipment
TOT DIST	Total Distance from Update Point
U/I	Unit of Issue
UPDT-PB	Update Plumb Bob
UPDT-T	Update Theodolite
USERDEF	User Defined Point Type
UTM	Universal Transverse Mercator
VDC	Volts Direct Current
VERT	Vertical
WAY	Waypoint
WGS	World Geodetic System
WP	Waypoint
X-SHIFT	X Datum transformation Parameter
Y-SHIFT	Y Datum transformation Parameter
Z-SHIFT	Z Datum transformation Parameter
ZUPT	Zero Velocity Update
ZUPT IN PROC	Zupt is in Process Indicator
$\overline{\wedge}$	Theodolite

APPENDIX J

WARRANTY

J-1. GENERAL.

a. This Warranty Agreement provides guidance for user activities in managing and complying with the manufacturer's warranty for the Improved Position & Azimuth Determining System (IPADS) procured under Contract DAAE20-03-D-0150 with L-3 Communications Corp.

b. Due to warranty claim(s) processing time, the warranty alone may not be an appropriate vehicle for maintaining readiness of the IPADS. The requisitioning of replacement components should be considered in addition to processing a warranty claim when the rapid restoration of IPADS operation is essential to maintain readiness.

c. The warranty provides that the IPADS components at the time of acceptance (or handoff to the user) will: 1) conform to design and manufacturing requirements; 2) be free from all defects in materials and workmanship; and 3) conform to all performance requirements delineated in the applicable specifications of the contract. The warranty period for the IPADS Line Replaceable Units (LRUs) will be based on the warranty period of the IPADS end item in which they are installed. Therefore, the warranty period of the IPADS will be tracked by the serial number of each end item. Table J-1 identifies the LRUs in the IPADS system that will be covered by the contractor warranty. The warranty will include furnishing of new or repaired items (without cost to the government) to replace any items that prove to be nonconforming and/or defective within the warranty period.

d. When repair or replacement requires transportation of the nonconforming or defective items, transportation will be funded by the contractor assuming that proper return procedures are followed. Refer to paragraphs J-6 and J-7.

e. Appendix J provides information on manufacturer's warranties for IPADS components. The warranty period will be for 5 years from time of handoff or within 60 days after delivery to the government.

J-2. EXPLANATION OF TERMS.

a. Abuse. The improper use, repair, or handling of warranted items such that the warranty may become void.

b. Alterations/Modifications. Any alteration after production such as retrofit, conversion, remanufacture, design change, engineering change and the like.

c. Contractor Support. Those services that are to be performed and those responsibilities that are placed upon the contractor by the government as specified in the warranty/provisions. This support, which may include such things as labor, parts, tools, training, technical packages, etc., will be used in support of the warranted equipment during the specified warranty period.

d. Defect. Any condition or characteristic in any supplies or services furnished by the contractor under the contract that is not in compliance with the requirements of the contract.

e. Failed Item. A part, component, or end item that fails to perform its intended use.

f. No Evidence of Failure (NEOF). The return of suspected defective warranty items to the manufacturer that are eventually determined to be serviceable.

g. Improper Use. The improper use, repair, or handling of items such that the warranty may become void.

J-2. EXPLANATION OF TERMS – Continued

h.   Repair. To restore an item to serviceable condition without affecting the warranty.

i.   Reparable. An item that may be reconditioned or economically repaired for reuse when it becomes unserviceable.

j.   Serviceable. The condition of an item which may be new or used that meets all the requirements and performs the functions for which was originally intended.

k.   Warranty. A promise or statement of fact from a seller to a purchaser on the nature, usefulness, or condition of the supplies or performance of services to be furnished. The main purposes of a warranty in a government contract are to outline the rights and obligations of the contractor and the government for defective items and services. It also serves to foster quality performance by the contractor, but it is not a substitute for an adequate quality assurance program.

l.   Warranty Claim. Action started by the equipment user for authorized warranty repair or replacement.

m.   Warranty Period. Time during which the warranty is in effect. Normally measured as the maximum number of years, months, and days used.

n.   Warranty Start/End Date. The date the warranty is in effect and date the warranty lapses.

J-3.   COVERAGE - SPECIFIC. The following listing identifies the IPADS components covered under this warranty:

Table J-1 - Warranted Components

Nomenclature	NSN	Part No.	CAGEC
CPNU	6605-01-521-7884	11838924-1	19200
BCU w/container	6130-01-521-6921	11838924-2	19200
CDU w/container	7010-01-521-7883	11838924-3	19200
W114 Cable	5995-01-522-5485	7204114-9	1NZ85
W116-1 HMMWV Cable	5995-01-525-3986	7204116-1	1NZ85
W116-3 SUSV Cable	6150-01-527-6847	7204116-3	1NZ85
W136 FOS Cable	5995-01-519-0653	7204136-9	1NZ85
AC Power Cable	5995-01-493-8358	ABP-ACC-TR-1	08TP4
Reprogramming Cable	5995-01-522-2631	7204143-9	1NZ85

CPNU - Compact Position & Navigation Unit, PN 7204153-9 (1NZ85)

BCU - Battery & Charger Unit, PN 7204141-9 (1NZ85)

CDU - Control & Display Unit, PN 7204142-9 (1NZ85)

NOTE

Failure of the CPNU requires return of the entire IPADS system in its transit case.

J-4. CONTRACTOR RESPONSIBILITIES.

a. The items determined to be defective, as covered under terms of the warranty, will be replaced with a new or repaired item and returned to the government at no cost to the government. (The warranty does not cover field level costs associated with the removal and installation of defective or failed warranty items.)

b. Determine with DCMC if the failure or item is covered under warranty.

c. Repair or replace the returned item.

d. Maintain a real time database that contains serial numbers and/or part numbers (for cables) of warranted items, warranty information, and status of maintenance actions including expected return date identified by component serial number. This database will be accessible to the Government to track status of maintenance and warranty information.

e. Ship a repaired or replacement end item/LRU per instructions from TACOM item manager.

f. Provide a prepaid shipping label for return shipments.

g. Maintain a telephone number for the purpose of obtaining warranty service support.

J-5. GOVERNMENT RESPONSIBILITIES.

a. User responsibilities. The owning unit will ensure that troubleshooting was done and that there is no evidence of abuse. All information will be documented at the time of the warranty service request.

b. Nullification. In addition to battle damage, the following actions taken by the government may nullify the warranty:

    (1) Improper installation.

    (2) Improper use.

    (3) Abuse.

    (4) Performing maintenance not authorized in TM 9-6675-349-13&P, including alterations and modifications.

    (5) Improper packaging causing damage during shipment.

c. The warranty does not cover field level costs associated with the removal and installation of defective or failed warranty items.

J-6. CLAIM PROCEDURES. The following procedures identify the claim procedure:

a. Identification of Failed Items. IPADS components that experience a warranty failure shall be tagged/identified to prevent improper repair or use.

J-6. CLAIM PROCEDURES – Continued

b. Warranty Service. To obtain warranty service, contact the TACOM Target Acquisition Team Item Manager at (309) 782-3575 (DSN 793-3575). Complete a DA Form 2407, Maintenance Request. Refer to the following table and DA PAM 738-750 as a guide in completing DA Form 2407. The Item Manager will provide a number for which to FAX the DA Form 2407.

Table J-2 - DA Form 2407, Maintenance Request Data

Block No.	Data Element	Data Input
1a*	UIC Customer	Self-Explanatory
1b*	Customer Unit Name	Self-Explanatory
1c*	Phone No.	Commercial & DSN
5*	Type MNT Req Code	As appropriate
6*	ID	As appropriate
7*	NSN	From Table J-1
9	Noun	From Table J-1
10a*	Org WON/Doc No.	As appropriate
10b*	EIC	As appropriate
11*	Serial Number	Serial number of IPADS end item
12*	QTY	1
13*	PD (Priority Designator)	As appropriate
24*	Describe Deficiencies or Symptoms	Date of failure and symptoms identified
25*	Remarks	DODAAC and shipping address

* Indicates mandatory information

NOTE

Neither the government nor the contractor will track other than the IPADS end item serial number.

b. Disposition. The TACOM Target Acquisition Team will provide shipping instructions based on the following scenarios:

(1) Unit within OCONUS. A funded requisition must be provided at the time of the warranty request. Upon determination by the contractor that the failed LRU is covered under terms of the warranty, the funded requisition will be cancelled back to the user. The user will be billed for the cost of a replacement LRU if the failed LRU is not received. This ensures that the unserviceable item will be returned by the using unit.

(2) Unit within CONUS. The failed LRU will be sent to the contractor. The contractor has 72 hours from the time of receipt to repair or replace the LRU and ship the repaired or replacement LRU back to the user.

NOTE

When items returned to the contractor for repair are found to be serviceable, the submitting unit may be billed for the cost of testing and shipping.

c. Assistance. If you need assistance with the warranty process, contact your local TACOM Logistics Assistance Representative (LAR) (Go to http://aeps.army.mil, and click on 'AMC LAO Offices'), or the TACOM Target Acquisition Team.

d. Claim denial or dispute. If a warranty claim is denied or disputed, the contractor will contact the TACOM Target Acquisition Team and inform it that the item will not be covered under warranty and will provide an estimated repair cost.

J-7. STORAGE/SHIPPING/HANDLING. The following listing identifies the shipping containers for each LRU covered under this Warranty Technical Bulletin. Use the reusable shipping containers for the IPADS end item and LRUs as described in TM 9-6675-349-13&P. The contractor will provide a prepaid shipping label for return shipments.

Table J-3 - Shipping Containers

Nomenclature	NSN	Part No.	CAGEC
IPADS container	8145015254312	7158019-1	1NZ85
BCU container	8145015254317	7158019-4	1NZ85
CDU container	8145015254325	7158019-5	1NZ85

INDEX

C – Continued

D

E

F

G

H

I

M – Continued

S

T

U

V

W

Z

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS

For use of this form, see AR 25-30; the proponent agency is ODISC4.

Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).

DATE

Date you filled out this form

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*
AMSTA-LC-LMIT / TECH PUBS, TACOM-RI
1 Rock Island Arsenal
Rock Island, IL 61299-7630

FROM: *(Activity and location) (Include ZIP Code)*

Your mailing address

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER
ARMY TM 9-6675-349-13&P
MARINE CORPS TM 11039A-OR/1

DATE

TITLE
OPERATOR AND FIELD MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR SURVEYING INSTRUMENT AZIMUTH: IMPROVED POSITION AND AZIMUTH DETERMINING SYSTEM (IPADS) M111

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON *(Provide exact wording of recommended changes, if possible).*
	1-14	1-12		1-6		Illustration shows wrong design for T-bolt.

*Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE

Your Name

TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION

SIGNATURE

Your Signature

DA FORM 2028, FEB 74   REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED.   USAPPC V3.00

TO: (Forward direct to addressee listed in publication) AMSTA-LC-LMIT / TECH PUBS, TACOM-RI 1 Rock Island Arsenal Rock Island, IL 61299-7630	FROM: (Activity and location) (Include ZIP Code) Your address	DATE Date you filled out this form

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER ARMY TM 9-6675-349-13&P MARINE CORPS TM 11039A-OR/1	DATE	TITLE OPERATOR AND FIELD MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR SURVEYING INSTRUMENT AZIMUTH: IMPROVED POSITION AND AZIMUTH DETERMINING SYSTEM (IPADS) M111

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS (*Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.*)

TYPED NAME, GRADE OR TITLE Your Name	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE Your Signature

UASPPC V3.00

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER				DATE		TITLE

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

* Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

DA FORM 2028, FEB 74 REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED. USAPA V3.01

TO: *(Forward direct to addressee listed in publication)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER				DATE				TITLE	

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

USAPA V3.01

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
For use of this form, see AR 25-30; the proponent agency is OAASA		

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	FROM: *(Activity and location) (Include ZIP Code)*

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER				DATE		TITLE

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

* Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

DA FORM 2028, FEB 74   REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED.   USAPA V3.01

TO: *(Forward direct to addressee listed in publication)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER				DATE				TITLE	
PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION	

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the Secretary of the Army

0722111

By Order of the Commandant of the Marine Corps:

JAMES M. RIPLEY

Program Manager, Fire Control Support Systems
Marine Corps Systems Command

THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meter = 0.3937 Inch
1 Decimeter = 10 Centimeters = 3.94 Inches
1 Meter =10 Decimeters = 100 Centimeters
    = 1000 Millimeters = 39.37 Inches.
1 Dekameter = 10 Meters = 32.8 Feet
1 Hectometer =10 Dekameters = 328.08 Feet
1 Kilometer =10 Hectometers = 1000 Meters
    = 0.621 Mile = 3,280.8 Feet
Millimeters = Inches times 25.4
Inches = Millimeters divided by 25.4

WEIGHTS

1 Centigram = 10 Milligrams = 0.154 Grain
1 Decigram = 10 Centigrams = 1.543 Grains
1 Gram = 0.001 Kilogram = 10 Decigrams
    =1000 Milligrams = 0.035 Ounce
1 Dekagram = 10 Grams = 0.353 Ounce
1 Hectogram = 10 Dekagrams = 3.527 Ounces
1 Kilogram = 10 Hectograms = 1000 Grams = 2.205 Pounds
1 Quintal = 100 Kilograms = 220.46 Pounds
1 Metric Ton = 10 Quintals = 1000 Kilograms
    = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liter = 0.034 Fluid Ounce
1 Centiliter = 10 Milliliters = 0.34 Fluid Ounce
1 Deciliter = 10 Centiliters = 3.38 Fluid Ounces
1 Liter = 10 Deciliters = 1000 Millileters
    = 33.82 Fluid Ounces
1 Dekaliter = 10 Liters = 2.64 Gallons
1 Hectoliter = 10 Dekaliters = 26.42 Gallons
1 Kiloliter = 10 Hectoliters = 264.18 Gallons

SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inch
1 Sq Decimeter = 100 Sq Centimeters = 15.5 Sq Inches
1 Sq Meter (Centare) = 10 Sq Decimeters
    = 10,000 Sq Centimeters = 10.764 Sq Feet
1 Sq Dekameter (Are) = 100 Sq Meters = 1,076.4 Sq Feet
1 Sq Hectometer (Hectare) = 100 Sq Dekameters
    = 2.471 Acres
1 Sq Kilometer = 100 Sq Hectometers
    = 1,000,000 Sq Meters = 0.386 Sq Mile

CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.061 Cu Inch
1 Cu Decimeter = 1000 Cu Centimeters = 61.02 Cu Inches
1 Cu Meter = 1000 Cu Decimeters
    = 1,000,000 Cu Centimeters= 35.31 Cu Feet

TEMPERATURE

$5/9 \ (°F - 32°) = °C$
$9/5 \ (°C+ 32°) = °F$
-35° Fahrenheit is equivalent to -37° Celsius
0° Fahrenheit is equivalent to -18° Celsius
32° Fahrenheit is equivalent to 0° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
100° Fahrenheit is equivalent to 38° Celsius
212° Fahrenheit is equivalent to 100° Celsius

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds-Inches	Newton-Meters	0.11375
Pounds per Square Inch	Kilopascals	6.895
Ounce-Inches	Newton-Meters	0.007062
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621
°Fahrenheit	°Celsius	$°C = (°F-32)×5/9$
°Celsius	°Fahrenheit	$°F = (9/5×°C)+32$