

TRW-130 (AN/UYK-1) SALES APPLICATION RECORD (1)

Small Ships Combat Data System

The first TRW-130 (AN/UYK-1) Computer was delivered to the Naval Electronic Laboratory at San Diego. The first computer (service test model) is being programmed primarily for the SPADE Program. The SPADE Program is the sonar portion of the SSCDS, Small Ships Combat Direction System. The computer is used to calculate the positions of various targets. The positions will be displayed on a Westinghouse sonar display. The system will include other NTDS equipment, and the input data will come from various sources. In this application, the TRW-130 serves as a peripheral processor to the large NTDS main frame computer.

TRW-130 (AN/UYK-1) SALES APPLICATION RECORD (2)

ADVENT Shipboard Communication Terminal

Bendix Systems Division has been provided, GFE from BuShips, a TRW-130 Data Processing System for use in the ADVENT and follow-on Communications Satellite programs.

The TRW-130 Computer acts as a tracking director in that it accepts orbital parameters from the Satellite Test Center (STC), roll, pitch, and yaw information from a Mark 19 Gyro Compass, and azimuth and elevation angle data from a shipboard radar. The Computer performs polar to cartesian coordinate transformation on the gyro and radar data. This information is processed along with the orbital parameters and converted into azimuth and elevation acquisition angles for the radar. The mentioned inputs, outputs and acquisition calculations are performed in real-time. The azimuth and elevation data from the radar set are used to inform the computer as to the exact instantaneous position of the radar antenna. The complete system comprises a real-time feedback control system.

The TRW-130 Computer also acts as the central system check-out and control unit, exercising the complete system prior to passage of a satellite, and controls the system prior to and during the satellite pass.

TRW-130 (AN/UYK-1) SALES APPLICATION RECORD (3)

Satellite Injection Stations

One computer has been purchased by BuShips for installation at PMR, and another by the Applied Physics Laboratory of Johns Hopkins University.

Both computers perform timing control and message format translation for messages transmitted to the TRANSIT satellite. The computers also verify that the messages transmitted by the satellite are identical to the message transmitted to the satellite from the injection station.

The data transmitted by a navigation satellite and the doppler generated by orbital motion permit a ship or submarine to precisely calculate its position on the open seas. Because each orbit is slightly different from the previous orbit and from the predicted current orbit, it is necessary that the satellite be given updated orbital parameters for retransmission. The TRW-130 Computer serves as a link between a large data processing computer, which is continuously performing orbital computations, and the telemetry transceiver which sends (injects) and receives data from the navigation satellite. The TRW-130 performs format conversion and coding, adds the "key" to authorize the satellite to accept the new data, and clocks out the data in an acceptable format. The computer stores the transmitted data and matches this with the received data to verify that the satellite is transmitting the correct message.

TRW-130 (AN/UYK-1) SALES APPLICATION RECORD (4)

Satellite Navigation Using Computers

Under subcontract with the Applied Physics Laboratory of Johns Hopkins University, RW has developed for the U. S. Navy a Transit Data Processing System to be used aboard FBM Submarines for navigating on Transit satellites. The system allows the submarines to make the necessary refinements on ship-position information to provide accurate launch parameters for Polaris missiles.

The TRANSIT satellite transmits position information in the form of orbital parameters. The receiver detects both this orbital message and a doppler frequency derived from satellite radio transmissions. Together, the orbital message and the doppler frequency supply the information required to compute position. To aid in the computation, an estimate of the ship's location at particular times is received from the NAVDAC Computer which uses data from the Ship's Inertial Navigation System (SINS). The AN/UYK-1 Computer calculates acquisition and tracking aids for the receiver and, at the end of the satellite pass, computes the ship's location for transmission to the NAVDAC Computer. Signals from the data processor illuminate indicators on the navigation control console to display system status to the operator. The data processor supplies the interface between the AN/UYK-1; the receiver, and the NAVDAC Computer.

The equipment being built by the RW Division for this project includes a Transit Data Processor, an AN/UYK-1 Stored Logic Digital Computer, and a number of input-output devices. The Data Processor connects to the doppler receiver, to the ship's conventional navigation system, and to the AN/UYK-1 Computer. It contains the digital-to-analog and analog-to-digital conversion circuits necessary for allowing the AN/UYK-1 to send tracking data to the doppler receiver that assists it in locking onto the satellite, and allowing the AN/UYK-1 to accept the orbital and doppler data from the receiver.

When the AN/UYK-1 is used on a ship which does not have a NAVDAC system, the NAVDAC inputs are replaced by switches for entering the best estimate of dead reckoned position; which is always available on any vessel. The only requirement being that the best estimate be accurate to  $\pm 50$  mi. The computer then can compute a fix and displays either the error in latitude or longitude on an output display, or if so programmed, displays latitude or longitude directly.

## TRW-130 (AN/UYK-1) SALES APPLICATION RECORD (5)

### AMR Computer Aided Radar Tracking System

The ARCAS (Automatic Radar Chain Acquisition System) installations will update present AMR tracking radars with more precise acquisition information for continuous and uninterrupted target tracking.

The tracking system is composed of six range tracking and computing centers located at Cape Canaveral, Patrick AFB, Grand Bahama Island, San Salvador, Puerto Rico and Antigua, plus a central computer site at the Cape. Each ARCAS radar/computer site has an AN/FPQ-6 tracking radar, AN/UYK-1 Computer System and related data translation equipment.

Designate data is used to compute target range, azimuth and elevation for pointing of the site's radar antenna. When the target is acquired, the high-resolution radar data is used by the AN/UYK-1 to generate updated information which is available for use by any other site.

In addition, the AN/UYK-1 performs site diagnostic and self-slew tests to relieve the central computer during pre-launch checks. During overall system checks, the AN/UYK-1 responds to designate data from the IBM 7090 Central Computer and calculates the range, azimuth and elevation designations for its particular site.

The addition of the TRW-130 Computers has enhanced the mission capability of the range instrumentation because of the free exchange of accurate positional data, thus assuring that each tracking site will be on target each shoot. Real time plotting of target position is now provided. Simultaneous operations are now feasible.

Digital computer automation of the acquisition and target position designation for the tracking radars along the first 1300 miles of AMR has resulted in enhanced performance through:

- 1) Finer data granularity
- 2) Increased probability of acquisition
- 3) Instantaneous re-acquisition information
- 4) Compensation for local anomalies
- 5) Automation of operator functions
- 6) More meaningful data, is quantity

TRW-130 (AN/UYK-1) SALES APPLICATION RECORD (6)

Navigation Test Programs

BuWeps has purchased a computer to be used aboard the USS Compass Island for scientific and general purpose calculations. The scientific calculations would be performed in conjunction with the ship's navigation equipment and other special purpose devices. The general purpose calculations will include inventory control of spare parts, calculation of logistic data, etc.

TRW-130 (AN/UYK-1) SALES APPLICATION RECORD (7)

Fire Control Trainer and Simulator

Minneapolis Honeywell has purchased a TRW-130 Computer for use in a fire control trainer and simulator which is being designed and built for the Navy Training Devices Center of the U. S. Navy.

The computer is used in a closed-loop system which utilizes a large number of analog inputs and outputs in order to simulate actual operation of the fire control equipment. Various operational situations are programmed for the computer so that trainees may operate the simulator under realistic conditions.

The operational requirements of the computer include:

1. Radar simulation
2. NTDS input simulation
3. Read data from operators console
4. Switch modes of operation
5. Calculate ship's heading and clearance words for display
6. Calculate channel position, target speed, etc.
7. Display tactical data
8. Simulate count down and missile firings

TRW-130 (AN/UYK-1) SALES APPLICATION RECORD (8)

Air Defense Display System

Hughes Aircraft has a computer for use in a new Air Defense Display System. The computer accepts real-time target data and compares this data with that previously stored. If the data has not changed, the computer will restore the previous data. If the data has changed, the computer will perform new computations. Targets are compared by target position and velocity. The comparison is performed by a branch-if-not-equal type of logand, which is one of the many special, powerful data processing instructions.

Each system will locate and track 24 targets. Three displays, capable of handling 8 targets each, will be driven by the computer. The TRW-130 Computer will initially determine the target symbol (friendly, foe; surface vessel, aircraft; etc.) and target position and vector velocity. Any computations for target changes in position and velocity will be performed in real time.



TRW-130 (AN/UYK-1) SALES APPLICATION RECORD

(9) Format Conversion

A computer is being used by the Naval Research Lab to perform format and code conversion between large scale data processors. Details classified.

(10) Sonar Real Time Data Reduction

A computer is on order from USN USL for processing sonar data. Details classified.

(11) Typhon Fire Control System

Three computers have been purchased by BuShips for GFE delivery to Westinghouse. The TRW-130 (AN/UYK-1) Computers will receive data from AN/USQ-20's. The AN/UYK-1's will compute coordinates and perform other navigation computations. Details classified.

(12) AGMR Communication Ship Display System

A computer is on order from BuShips for a ship display system. Details classified.

(13) Tracking Director

A computer is being used by General Electric, Syracuse, for a radar tracking director. Details classified.

TRW-130 (AN/UYK-1) SALES APPLICATION RECORD (14)

Range Instrumentation System

BuWeps has purchased for the Pacific Missile Range a computer to be used as a part of a six site range tracking system. The primary function of this computer will be the processing of range data. The system will accept 24-bit words at the rate of 100 words per second. The computer will perform positional computations and pass along data to other TRW-130 computer sites, thus forming a complete instrumentation data transmission system. The computer will also perform range safety computation. The computer will convert formats, multiplex data, and send and receive data in NTDS style.

TRW-130 (AN/UYK-1) SALES APPLICATION RECORD (15)

Processing Telemetered Data in the Mercury Space Program

The National Aeronautics and Space Administration selected the TRW-130 (AN/UYK-1) Digital Computer, with peripheral equipment, for use in processing telemetered data in the Mercury Space program. The TRW-130 is currently on site at the Goddard Space Flight Center at Beltsville, Md., where it is being programmed by NASA and RW personnel. The TRW-130 is presently being used as a part of a feasibility study of computer handling of telemetered data. Later the computer, which was designed for exceptionally reliable operation in rugged environments, may be installed at a NASA tracking station, to aid ground personnel in monitoring the condition of space capsules and astronauts in flight.

A normal complement of ground station personnel consists of three men--a capsule monitor, a flight controller, and an aeromedical observer, monitoring three consoles. These men watch a total of about 40 meters that supply information telemetered through some 90 channels. During space flights without computer monitoring, ground personnel constantly take readings and then enter significant information derived from them onto standard forms for transmittal to the control site by teletype operators.

With the aid of the TRW-130 computer, the process can become considerably more comprehensive and efficient. For each of the 90 channels, the computer can take a sample reading every 0.88 seconds, compute averages for the readings at two-minute intervals (based on about 135 sample readings per channel), convert these values into engineering units, and forward the results directly to the control site via teletype.

TRW-130 (AN/UYK-1) SALES APPLICATION RECORD (16)

Oceanographic Survey System

General Instruments has purchased computers for a shipboard Oceanographic Survey System for BuWeps. The computers will perform real time data processing of oceanographic data.

The major role of the computers will be the solving of equations to correct for ray bending of sonar beams. Also taken into consideration will be the ship's speed, roll, pitch, and yaw; any of which, unless compensated for, can result in considerable errors and misleading contour plots.

The mapping of the ocean floor must be correlated with an accurate positional fix. The computers have sufficient storage capability and computation speed to perform navigation calculations. The system outputs are a plotting board and a magnetic tape unit.

## TRW-130 (AN/UYK-1) SALE APPLICATION RECORD (17)

### AN/FYQ-9 Data Processors for the Alaskan Air Command

The AN/FYQ-9 Data Processing and Display System is being implemented to modernize the reporting, processing and display of air defense data for the NORAD Control Centers in the Alaskan Air Command Complex. Under subcontract to Philco Corporation, Communications Division, Fort Washington, Pennsylvania -- the prime contractor -- five AN/UYK-1 computers are being provided to serve as the data processors for the AN/FYQ-9 system. One AN/UYK-1 computer will be installed at each of four NORAD Control Centers (NCC's) and the fifth at the Alaskan NORAD Regional Control Center (ANRCC).

The AN/UYK-1 computer at the NCC installations acquires target track data in the form of teletype messages generated by surveillance radars. Messages are received from radars reporting directly to the NCC site and from the other radars via cross-telling circuits from the other three NCC's. The messages are of a designated format called Surveillance Tactical or SUR/TAC Messages.

The AN/UYK-1 computer checks the format and contents of all messages, performs format conversions, and stores the messages. From the stored message contents, track data on up to 100 targets are generated and presented on an associated data display system. The latter consists of a large screen display for composite target track data and tabular read-out displays for display of selected messages.

To complete the air situation picture, V-3 Weapons Status Messages are voice told from weapons bases to NCC installations where they are manually inserted into the data processor for storage and display.

The AN/UYK-1 computer at the ANRCC performs similar functions on SUR/TAC messages received from all four NCC's. In addition Numerical Summation (NUSUM) Reports are generated for transmission to NORAD COC at Colorado Springs.

The AN/UYK-1 serves the important function in the AN/FYQ-9 System of the central data processor at the NCC and ANRCC sites. Input data is in the form of teletype messages - from associated radars and other NCC's. Principal outputs are for large screen displays and tabular readout displays. Output in teletype format is also required of selected messages for local print-out and transmission to other locations.

The general purpose of the AN/FYQ-9 System is to provide a complete picture for NORAD of the Alaskan regional air situation. It serves principally as a command information system rather than any control of intercept function.

Procurement of equipment for the AN/FYQ-9 System placed much importance on a high level of reliability due to the nature of the function performed and the remote operational environment.

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(18) Off-Line Simulation

A TRW-130 (AN/UYK-1) has been purchased by ISC, England, (International System Control, Ltd.) for off-line systems simulation. Details classified.

(19) Image Interpretation Cell

A TRW-130 (AN/UYK-1) is being used in an Image Interpretation Cell application. Details classified.

TRW-130 (AN/UYK-1) SALES APPLICATION RECORD (20)

Oceanographic Study

A TRW-130 (AN/UYK-1) computer is being used in the ASWEPS\* Shipboard System, it will be possible for a variety of vessels to systematically and accurately collect the large volume of data necessary to establish a synoptic picture of the underwater environment. This integrated system is now under development for the Naval Oceanographic Office by the Bissett-Berman Corp. of Santa Monica.

The shipboard system itself incorporates a number of advances in the state-of-the-art in sensor technology deck equipment and data handling techniques.

Thus the TRW-130 computer helps to serve the function of contributing to environmental prediction, but also represents a significant advance in the field of instrumentation in the oceanographic community.

\*Anti-Submarine Warfare Environmental Prediction System

TRW-130 (AN/UYK-1) SALES APPLICATION RECORD

(21) Ground Checkout System

The Space Technology Laboratories Support Systems group of the Ground Support Equipment Laboratory is using a TRW-130 (AN/UYK-1) computer as an experimental tool in the development of a ground checkout system.

(22) A computer is being used by CAE (Compagnie Europeene d'Automatisme Electronique) for automatic ground checkout for the French Government.



TRW-130 (AN/UYK-1) SALES APPLICATION RECORD (23)

Computer Aided Satellite Tracking

Deco Electronics is an RF R&D organization in Leesburg, Virginia with a background in high power antenna design. They have a contract with BuShips to develop a prototype Satellite Relay Communication System for such programs as Echo, Moon Communication System, and active and passive repeaters.

The TRW-130 (AN/UYK-1) uses linear interpolation to calculate azimuth and elevation using hour angle, declination, and time of day as inputs. The computer controls a mount holding a 12-foot antenna and transmitter for communication by signal bounce off passive satellites. The antenna pedestal is a modified gun mount with optical encoders mounted on the azimuth and elevation shafts. The computer samples the encoders, performs gray-to-binary conversion and generates an error signal at least once per second to correct the position of the mount. Later phases of operations will entail the use of active relay satellites.