

Safety
SAFETY INVESTIGATION
SAFETY INVESTIGATION WORKBOOK

Volume III provides a methodical initial system for safety board members to compile and analyze data, and provides the flight surgeon with a vehicle to thoroughly analyze human factors aspects of the mishap. It is designed to be used with volumes I and II. It applies to all personnel involved in the investigation of US Air Force, US Air Force Reserve, and Air National Guard mishaps.

	Page
PART ONE—ENVIRONMENTAL CONCERNS	
Chapter 1—Board President	
1-1. Using This Workbook	1-1
1-2. Overall Board Member Responsibilities	1-1
1-3. Board President's Contribution	1-1
1-4. Role of the Flight Surgeon	1-1
1-5. Board Consultations	1-2
1-6. Human Factors Glossary	1-2
Chapter 2—Investigating Officer	
2-1. Using This Workbook	2-1
2-2. General Considerations	2-1
Chapter 3—Pilot Member	
3-1. Using This Workbook	3-1
3-2. General Considerations	3-1
Chapter 4—Maintenance Officer	
4-1. Using This Workbook	4-1
4-2. General Considerations	4-1
Chapter 5—Life Support Officer	
5-1. Using This Workbook	5-1
5-2. General Considerations	5-1
PART TWO—HUMAN PERFORMANCE CONCERNS	
Chapter 6—Medical Member	
6-1. Using This Workbook	6-1
6-2. Actions on Notification	6-1



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	Page
6-3. Response To Survivors	6-2
6-4. Initial Investigation	6-2
6-5. On-Scene Identification Concerns	6-2
6-6. On-Scene Notes	6-3
6-7. Required Specimens	6-4
6-8. Required Paperwork	6-5
6-9. Specimen Handling	6-5
6-10. Post Mortem Considerations	6-6
6-11. Initial Personal History	6-8
 Chapter 7—Data Consolidation	
7-1. Day 3 to Day 10	7-1
7-2. Human Characteristics	7-1
7-3. Last Minute Reminders	7-5
7-4. Psychological Performance	7-5
 Chapter 8—Team Analysis	
8-1. Day 11 to Day 21	8-1
8-2. Board Expertise	8-1
 Chapter 9—Reporting Guidelines	
9-1. Day 22 to Day 30	9-1
9-2. Evidence Disposition	9-1
 Figures	
6-1. Activity Chart	6-9
6-2. Activity Pattern	6-11
8-1. Summary Sheet—Factor Contribution Scales	8-3
 Attachments	
1. Glossary of Terms	A1-1
2. Unit Member Survey	A2-1
3. Injury Worksheet	A3-1
4. Spouse or Friend Interview Guide	A4-1
5. Flight Surgeon Evaluation	A5-1

PART ONE**ENVIRONMENTAL CONCERNS****Chapter 1****BOARD PRESIDENT**

1-1. Using This Workbook. This is a guide for field use by safety investigation boards. Together with AFP 127-1, volumes I and II, this workbook will improve the quality of board investigations and data available for pattern and trend analysis. It is divided into two major parts: environmental and human performance concerns. Environmental concerns include factors such as: mission planning, procedures, life support, logistics, personnel management, egress, and survival. Human performance concerns include such factors as: medical clearances, supervision, training, fatigue, communications, and injury patterns. Overlap between these two major concerns will occur, as mishaps are often complex.

1-2. Overall Board Member Responsibilities. A successful board investigation depends on the coordinated effort of all board members as they apply their own considerable knowledge and experience. Think-tank sessions between board members on factors outside their assigned area of concern or on relationships between factors are invaluable in assessing or ruling out some "casual" states and their degree of contribution to the sequence of events in a mishap.

a. This workbook addresses a thumbnail sketch of areas to be evaluated to ensure investigation across the wider spectrum of concerns important to the entire board. This is important to effective reporting and subsequent trend analysis of mishaps. It is impossible to provide the board with all the questions which, when answered, would provide a "causal" solution to each mishap. This workbook does provide a point of departure to assist in getting started. The questions herein have proven themselves common in mishaps and essential to a complete investigation.

b. Each board member should review their

respective chapters with the flight surgeon.

c. Once the workbook is filled in, and the board has completed its investigation, this document must be sent directly to HQ AFISC/SER, Norton AFB CA 92409-7001.

d. Although the primary interest area of this workbook is aircraft mishaps, this can also be used in space, ground or missile, or other types of mishap investigations.

1-3. Board President's Contribution. This workbook provides a thumbnail sketch of concerns for the senior board member. Your wealth of knowledge, experience, and leadership is invaluable in determining why a mishap occurred and recommendations to prevent future mishaps. Review of each subsection in the guide will increase your overall awareness of the investigation process and where your mediation will be most constructive during the board's deliberations. Most importantly, your assistance to the flight surgeon will play a crucial role in the flight surgeon's final human performance analysis. Topics the board president may investigate and discuss with the flight surgeon may include supervisory and institutional concerns. Supervisory problem areas include command and control, discipline enforcement, behavior modeled by supervisors, and pressure or tasking on the aircrew. Institutional concerns address selection, evaluation, promotion, workload (including "additional duties"), conditions of the local or military lifestyle, and internalization of unit or organizational values. Consider factor presence, degree of contribution, and temporal role as you review the issues.

1-4. Role of the Flight Surgeon. The flight surgeon responsibility in aircraft mishap investigation is to assist the board in evaluating the contribution of human performance to the

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mishap through remains analysis, medical and psychological or psychosocial history gathering, and assessing human capability compared to the demands placed on the aircrew. Since human performance concerns (part two) are much more similar across weapons systems, far more detail is provided to describe the phased process of human performance analysis. This is a process, however, which overlaps at every stage with the complex and diverse environmental concerns. While the flight surgeon is tasked with performing the human performance analysis, he or she will need to draw heavily on each board

member's expertise to complete the broader human factors analysis.

1-5. Board Consultations. During the investigation, if human performance (human factors) appears to become a major player in the mishap, the board flight surgeon will be contacting the Human Performance Branch (AUTOVON 876-2432) at HQ AFISC for early consultation.

1-6. Human Factors Glossary. In this workbook the symbol (D) after a term means to refer to attachment 1, if a definition is desired.

Chapter 2
INVESTIGATING OFFICER

2-1. Using This Workbook. This workbook provides a thumbnail sketch of concerns you should consider. Topic areas such as the sequence of events, personal background and training, supervisory issues, communication problems, peer influences, and access to adequate facilities and services should be investigated and reviewed with the flight surgeon. Supervisory issues include discipline enforcement, command and control, supervisory role model behavior, and over-tasking. Communication problems include those within the cockpit, outside the cockpit, between personalities, and equipment failure. Peer influences include verbal comments, commonly held beliefs based on unspoken or unwritten learning, and perceptions of equipment concerns. Adequacy of access to quarters, adequate nutrition, exercise, recreation and health care must be examined. More directly, however, facilities of an airfield or air traffic control services may have an impact. The flight surgeon will integrate these inputs into an overall human factors analysis. Consider your confidence not only in the presence of a factor, but also your confidence it contributed, the degree of contribution, and the time sequence involved. You may wish to review questions considered by other board members. MAJCOM supplements for hardware or weapons system-specific issues may exist.

2-2. General Considerations. As the key coordinator of the investigation, your opinion on these areas is a necessary part of the investigation. A glossary of terms is available. Terms marked (D) are included in the glossary, attachment 1.

a. Airfield Facilities. For the following, describe any problems which increased workload or stress, or otherwise hindered the pilot. Name the item of equipment involved:

- (1) Inflight lunch: _____
- (2) Runway environment: _____
- (3) Approach environment: _____
- (4) Radar facilities: _____
- (5) Weather assessment equipment: _____
- (6) Maintenance equipment: _____
- (7) Airfield equipment: _____
- (8) Navigation aids: _____
- (9) Flight planning facilities: _____
- (10) Crew rest facilities: _____
- (11) Dining facilities: _____
- (12) Transient maintenance: _____
- (13) Ground transportation: _____

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(14) Emergency equipment: _____

(15) Training equipment: _____

(16) Training facilities: _____

(17) Alert facilities: _____

(18) Other (specify): _____

b. Support Agencies. For the following agents or categories of support agencies, name and comment on how each contributed to or sustained mishap sequence of events:

(1) Other crew or flight members: _____

(2) Maintenance personnel: _____

(3) Weather services (to include windshear reporting): _____

(4) Air route traffic control: _____

(5) Approach and departure control: _____

(6) Tower and ground control: _____

(7) Command post: _____

(8) Supervisor of flying: _____

(9) RSU: _____

(10) Airfield maintenance: _____

(11) GCI site: _____

(12) Range officer and control: _____

(13) Medical support: _____

(14) Supply: _____

(15) Another aircraft: _____

(16) Other (explain): _____

c. Job Performance Aids. For the following categories of job performance aids, name the specific item involved for each and describe any problems of completeness, clarity, availability, and currency as they relate to the mishap flight:

(1) Technical orders: _____

(2) Checklists and FLIPs: _____

- (3) US Air Force regulations: _____
- (4) MAJCOM regulations: _____
- (5) Subordinate command regulations: _____
- (6) Aircraft operating instructions: _____
- (7) Other operating instructions: _____
- (8) Flight crew information file (FCIF): _____
- (9) Standard instrument departure (SID) plates: _____
- (10) Approach plates: _____
- (11) Charts and maps: _____
- (12) Rules of engagement (ROE): _____

d. Communication and Coordination Problems:

(1) Name and describe any problems in communication or cockpit resource management between the pilot and other crewmembers, or the pilot and outside agencies: _____

(2) Describe any abnormalities in crew and flight coordination as they relate to the mishap sequence of events: _____

(3) Did the pilot, any crewmember, or outside agency exhibit the copilot syndrome (D)? No ____
If yes, name and explain: _____

(4) Was there a failure in communication equipment? No ____ If yes, describe: _____

e. Crew Rule Violations:

(1) Were rules violated by the pilot or others? _____

(2) What was the rationale for those violations? _____

f. Rule Waivers. For the following types of rules, name and explain any waivers and the source of their authorization:

(1) Operational rules: _____

(2) Training rules: _____

(3) Maintenance rules: _____

(4) Other rules: _____

g. Operating Area:

(1) Describe the mishap mission operating area:_____

(2) Was the pilot familiar with the operating area? Yes____ If no, explain:_____

(3) Was the pilot on a deployment? No____ If yes, describe the deployment purpose and situation:_____

(4) If deployed, how long had it been since departing home base and how long before the planned return?_____

(5) Enter any other data relating to the pilot's environment not covered above which you consider necessary to fully describe their contribution to or involvement in the mishap event sequence:

h. Physical Coordination and Motor Skills. Describe the pilot's general motor skills and any related problems:_____

i. Supervisor Assessment. How did the pilot's supervisors rate him or her as a pilot?_____

j. Rules Conformance:

(1) Was the pilot one to bend the rules? No____ If yes, what would be his or her rationale? (Motivation?)_____

(2) Were there any known violations of rules, OIs, regulations or established procedures in the past? No ____If yes, explain:_____

(3) Were there any violations of rules, OIs, regulations or established procedures on this mishap? No____ If yes, explain:_____

k. Crew Relations:

(1) Were there any noticeable conflicts between the pilot and other crew or flight members related to the mishap flight? No____ If yes, explain:_____

(2) What characterized the usual attitude of the pilot toward other crew members?_____

(3) Did the attitude of the pilot toward other aircrew influence their behavior during the mishap flight? No____ If yes, how?_____

(4) Did the pilot appear to have effectively used other crew or flight members during the mishap flight? Yes_____ If not, why_____

l. Unit Morale. Comment on the level of unit morale:_____

m. Personal Motivation:

(1) Why did the pilot want to fly?_____

(2) What was likely his or her attitude toward this flight?_____

n. Satisfaction:

(1) Indicate the pilot's level of satisfaction in the following areas by circling the appropriate number:

	<i>Extremely Satisfied</i>		<i>Neither Satisfied Nor Dissatisfied</i>			<i>Extremely Dissatisfied</i>	
	1	2	3	4	5	6	7
Career choice	1	2	3	4	5	6	7
Duty location	1	2	3	4	5	6	7
Type aircraft assignment	1	2	3	4	5	6	7
Ground duties:	1	2	3	4	5	6	7

(2) General. Were any of the following factors related to the mishap?

(a) Selection policy:_____

(b) Promotion evaluation policy:_____

(c) Additional duties:_____

(d) Adaptation to military lifestyle:_____

(e) Identification with the US Air Force's mission:_____

o. Decision Responsibility:

(1) Was the person responsible for making decisions relevant to the mishap flight clearly defined and accessible? Yes_____ If no explain,_____

(2) Was the person responsible for making decisions the same as the person with the authority to make decisions? Yes_____ If no, explain:_____

p. Supervisory Activity:

(1) Who was the significant supervisor?_____

(2) Was the supervisor qualified according to current regulation? _____

(3) Was supervisory guidance a factor in the mishap sequence of events? No ____ If yes, explain: __

(4) What was the quality of first level of supervision? _____

(5) What command, leadership, or management training did the supervisor have? _____

(6) Did this training (or lack) impact the aircrew environment? No ____ If yes, explain: _____

q. Rule Perceptions and Supervisory Example:

(1) Was the supervision in the unit consistent with the mission and configuration of the unit? Yes
If no, explain: _____

(2) Was the example set by supervisors supportive of the rules, or of "mature" behavior? Yes ____
If no, explain: _____

(3) What is your assessment of the perceptions of unit members concerning whether, how often
and why rules were violated? (Unit Member Survey, attachment 2, may be used.) _____

Chapter 3
PILOT MEMBER

3-1. Using This Workbook. This workbook provides a thumbnail sketch of the data you need and issues you should consider. Primary information that should be investigated includes topic areas such as the range of flight or mission-specific concerns, communication, peer influences, cockpit design, proficiency, and training. Obviously, the details of planning, briefing, and special stresses of flight pertinent to the mishap aircraft mission should be reviewed. Night, weather, emergency sequences and procedures, technical data and basic or upgrade training that may be pertinent to the sequence are part of this analysis. You are best qualified to evaluate problems with the particular aircraft. No other board member could better comment on seat position, visibility, instrumentation, automation, switch or control location, and possible physical task saturation. The flight surgeon will integrate these inputs into a total human factors analysis. This will require your evaluation of confidence in presence, in contribution, degree of contribution, and the time sequence involved. MAJCOM supplements on hardware or mission-specific concerns may be available.

3-2. General Considerations. As the weapons system expert in the investigation, your opinion on these areas is a necessary part of the investigation. A glossary of terms is available. Terms marked (D) are included in the glossary, attachment 1.

a. Configuration at Mishap. Indicate the relationship of the following components and their respective configurations to the mishap if applicable:

- (1) Gear: _____
- (2) Flaps: _____
- (3) Spoilers or speed brakes: _____
- (4) Trim (degrees): _____
- (5) Engines: _____
- (6) Fuel on board (pounds): _____
- (7) Cargo on board (pounds): _____
- (8) Passengers on board: _____
- (9) Armament or ordnance on board (pounds): _____
- (10) Center of gravity position: % MAC _____, + _____
- (11) Other (specify): _____

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b. Aircraft Attitude at Mishap:

(1) Describe the maneuver or attitude of the aircraft at the beginning of the mishap sequence of events:

(2) If at all possible, describe the aircraft attitude change onset rates during the mishap sequence of events:

(a) Pitch rate (degrees per second and extreme values): _____

(b) Roll rate (degrees per second and extreme values): _____

(c) Yaw rate (degrees per second and extreme values): _____

(d) Angle of attack rate (units per second and extreme values): _____

(3) Describe the influence of the above changes on aircrew actions: _____

c. Altitude and Airspeed at Mishap:

(1) Indicate the altitude and airspeed of the aircraft at the beginning of the mishap sequence of events:

(a) Altitude (feet m.s.l.): _____

(b) Altitude (feet a.g.l): _____

(c) MACH: _____

(d) Airspeed (KIAS): _____

(2) Describe the aircraft altitude and airspeed change rates during the mishap sequence of events:

(3) Describe the processes of aircraft altitude and airspeed change during the mishap sequence of events: _____

(4) Describe the flight path of the aircraft and any aircraft or flight envelope anomalies that occurred during the mishap event sequence: _____

d. Acceleration Forces at Mishap:

(1) What were the acceleration forces on the pilot at the beginning of the mishap sequence of events?

(a) Onset rate (G per second if estimated): _____

(b) Direction: _____

(c) Magnitude (G if estimated): _____

(2) If pertinent, describe the acceleration force changes and change rates during the mishap sequence of events: _____

(3) Describe the processes which changed the acceleration forces during the mishap event sequence: _____

(4) Describe any consequences of "G" effect on control operation: _____

e. Other Failures or Unusual Occurrences:

(1) Describe any other system failures or flight integrity anomalies demonstrated after the beginning of the mishap sequence of events: _____

(2) Name and describe how any aircraft components (e.g., drag chute) were incorrectly used by the pilot during the mishap event sequence:

(a) Item: _____

(b) Description of error: _____

f. Switch Characteristics. Name and describe any characteristics of the switches (size, shape, color, location, motion, etc.) in the cockpit that may have contributed to errors of substitution (D), unintentional activation (D), reversal (D), forgetting, or adjustment (D):

Switch	Characteristics	Error
_____	_____	_____
_____	_____	_____
_____	_____	_____

g. Control Characteristics. Name and describe any characteristics of the controls (size, shape, color, location, etc.) in the cockpit that may have contributed to errors of substitution (D), unintentional activation (D), reversal (D), forgetting, or adjustment (D):

Control	Characteristic	Error
_____	_____	_____
_____	_____	_____
_____	_____	_____

h. Cockpit Display Characteristics. Name and describe any cockpit display characteristics (size, shape, symbology, location, glare, motion, etc.) which may have contributed to errors on the part of the pilot. Indicate which display was involved, such as warning lights, horns, or instruments, such as the HUD or attitude indicator:

Display	Characteristics	Error
_____	_____	_____
_____	_____	_____
_____	_____	_____

i. Cockpit Area Characteristics. Name and describe any characteristics of the cockpit area which may have reduced performance by increasing stress, fatigue, or levels of distraction. These may include such things as climate control, restricted movement, illumination, visibility, noise, comfort, etc.:

Item	Characteristics	Error
_____	_____	_____
_____	_____	_____
_____	_____	_____

j. Cockpit Layout Configuration Differences:

(1) Were there differences in cockpit layout between the mishap aircraft and other models or other aircraft with modifications that the operator flew? No _____. If yes, explain: _____

(2) Were there significant aerodynamic differences between the mishap aircraft and other models or other modified versions of the aircraft that the pilot flew? No _____. If yes, describe: _____

k. Simulators:

(1) Was a simulator available? No _____. If yes, was it used? _____

(2) Was the simulator cockpit configuration different from the mishap aircraft? No. _____. If yes, explain: _____

l. Component Failure Indications:

(1) Describe the indications to the pilot of component(s) failure, malfunction, or inoperability: _____

(2) Describe the pilot's actions in response to perceived indications of components inoperability, failure, or malfunction: _____

m. Procedural Anomalies at Mishap:

(1) Name the operating procedures and describe any unwarranted, wrong, or inappropriate application of normal operating procedures demonstrated by the pilot during the mishap event sequence:

(a) Name of procedure: _____

(b) Description: _____

(2) Describe what the pilot was attempting to do prior to and during the mishap sequence of events:

(3) Name the emergency procedure and describe any unwarranted, wrong, or inappropriate application of emergency procedures demonstrated by the pilot during the mishap sequence of events:

(a) Name of procedure: _____

(b) Description: _____

(4) Under the circumstances, could alternative procedures have reasonably been used? Yes _____.
 No _____.
 Describe:

(a) If yes, were these alternatives practiced? Yes _____. No _____.

(b) If no, would decision times have been extended due to the number of alternatives and the lack of practice? Yes _____. No _____.

n. Cockpit Environment Factors:

(1) Were any factors such as smoke, fumes, or unusual odors encountered by the pilot?

Types	Source	Effects
_____	_____	_____
_____	_____	_____
_____	_____	_____

(2) Were there design problems in the cockpit that complicated management of cockpit resources?
 No _____. If yes, what were they? _____

o. Mission Planning:

(1) How long did mission planning take? _____

(2) Explain any unusual aspects of mission planning: _____

(3) Did all relevant persons participate in mission planning? Yes _____. If no, explain: _____

(4) Evaluate and comment on the mission planning as follows:

(a) Completeness: _____

(b) Adequacy: _____

(c) Adherence: _____

p. Mission Briefing:

(1) How long did the mission briefing take? _____

(2) Were there any unusual aspects of the mission briefing? No _____. If yes, explain: _____

(3) Did all relevant persons participate in mission briefing? Yes _____. If no, explain: _____

(4) Evaluate and comment on the mission briefing as follows:

(a) Completeness: _____

(b) Adequacy: _____

(c) Adherence: _____

q. Mission Type. What type of missions were briefed?

(1) Primary: _____

(2) Secondary: _____

(3) Tertiary: _____

(4) Other: _____

r. Sortie Characteristics. Was the mishap sortie perceived as a special sortie (D)? No _____. If yes, explain: _____

(1) Sortie type: _____

(2) Sortie urgency: _____

s. Phase of Flight. In what phase(s) of flight (D) did the mishap occur? _____

t. Tactics:

(1) What tactic was used or attempted? _____

(2) Were the tactics used familiar to the pilot? Yes _____. If no, explain: _____

u. Time Constraints. Was the pilot rushed or constrained by time in any way? No _____. If yes, explain: _____

(Consider the mental state of the mishap pilot in light of fatigue or stress of other types.)

v. Physical Task Saturation. Given stressors such as fatigue, external distraction, etc., was the pilot physically task saturated (D) at the beginning of the mishap sequence of events? No _____. If yes, why? _____

w. Mission Maneuver:

(1) Mission type: _____

(2) Maneuver (D) type: _____

(3) Familiarity with type of mission and maneuver: _____

(4) Was the pilot current in the maneuver being attempted? _____

(5) Mishap task (D): _____

(6) How long ago, if ever, had it been since the pilot performed the maneuver which ended in the mishap? _____

(7) List any differences in the conditions or circumstances about the last time the maneuver was performed and the one that ended in mishap (e.g., day vs. night, cloudy vs. clear, solo vs. dual, different ordnance, different flight composition, etc.): _____

(8) Did anything occur on recent sorties (within 2 weeks) which may have influenced the pilot's behavior during the mishap sortie? No _____. If yes, explain: _____

(9) Did anything occur on other training (e.g., simulator, procedural, ground) which influenced the pilot's behavior during the mishap sortie? No _____. If yes, explain: _____

(10) What other factors related to experience may have made the mission or missions more difficult for the pilot? Explain: _____

x. Mishap Task Intentions:

(1) Describe the mishap task (D): _____

(2) What was the pilot attempting to do? _____

y. Mishap Activity:

(1) What was the planned duration of the mishap flight? _____

(2) What was the actual duration of the mishap flight? _____

z. Crew Relations (Cockpit Resource Management):

(1) Were there any noticeable conflicts between the pilot and other crew or flight members before or during the mishap flight. No _____. If yes, explain: _____

(2) What characterized the usual attitude of the pilot toward other crewmembers? _____

(3) Did the attitude of the pilot toward other crew or flight members influence their behavior during the mishap flight? No _____. If yes, how?

(4) Did the pilot appear to effectively use other crew or flight members? Yes _____. If not, why?

aa. Anthropometric Problems. Name and describe any problems related to functional reach, sitting height, leg length, shoulder width, etc., in the mishap type aircraft. Work with the flight surgeon to evaluate these factors:

ab. Physical Operating Conditions:

(1) Cloud cover (height and amount): _____

(2) Precipitation (type and amount): _____

(3) Icing (type and amount): _____

(4) Freezing level: _____

(5) Surface winds (direction, velocity, gusts): _____

(6) Winds aloft (direction and velocity): _____

(7) Ambient temperature (°F or °C): _____

(8) Pressure altitude: _____

(9) Visibility (distance and restrictions): _____

(10) Noise (type, level and source): _____

(11) Vibration (type, frequency, intensity, and source): _____

(12) Turbulence (type, intensity, and source): _____

(13) Natural illumination (sun angle, glare, etc.): _____

(14) Artificial illumination (cockpit lights, runway lights, etc.): _____

(15) Heavy weather phenomena: _____

ac. Total Flying Hours (Mishap Aircrew):

(1) Total rated flying hours: _____

(2) Total civilian flying hours: _____

(3) Total nonpilot hours (Nav, WSO, etc.): _____

(4) Total mission hours: _____

(5) Total student pilot hours: _____

(6) Total FP and IP hours: _____

(7) Total hours in mishap-type aircraft: _____

(8) FP and IP hours in all aircraft and mishap-type aircraft for the following time periods:

- (a) Total: _____
- (b) 30 days: _____
- (c) 60 days: _____
- (d) 90 days: _____

ad. Recent Flying Hours (Night and Weather if Pertinent):

	Total	Night	Weather
(1) Hours for the last 7 days:	_____	_____	_____
(2) Hours for the last 30 days:	_____	_____	_____
(3) Hours for the last 60 days:	_____	_____	_____
(4) Hours for the last 90 days:	_____	_____	_____

ae. Recent Sortie History:

- (1) Sorties flown in the last 7 days: _____
- (2) Sorties flown in the last 30 days: _____
- (3) Sorties flown in the last 60 days: _____
- (4) Sorties flown in the last 90 days: _____

af. Sortie Types:

- (1) Type and number of sorties planned in the last 7 days: _____

- (2) Type and number of sorties briefed in the last 7 days: _____

- (3) Type and number of sorties flown in the last 7 days: _____

ag. Currency. Other than mishap aircraft, type of other aircraft the pilot was current in at time of mishap:

ah. Reportable Mishaps. Had the pilot had a reportable mishap before? No____. If yes, how many, type of most recent, and how long ago? (Indicate source and availability of data.) _____

ai. Training Status Data. For the following items, give the response and explain how each related to the mishap sequence of events:

- (1) What was the pilot's current phase of training (UPT, upgrade, continuation, etc.)? _____
- (2) Were there any problems in previous or current phase of training related to the mishap flight?

No _____. If yes, explain: _____

(3) Describe any recent time lags between training and operational assignment: _____

(4) What is the quality or state of wing or squadron training in the area pertaining to the mishap?

aj. UPT History Data (for UPT Students Only):

(1) How many instructors did the pilot have? _____

(2) How many other students did the pilot share with his or her instructor? _____

(3) How many rides were graded less than satisfactory? _____

(4) Where was the pilot ranked in his or her class? _____

Chapter 4
MAINTENANCE OFFICER

4-1. Using This Workbook. This workbook provides a thumbnail sketch of investigation areas concerning equipment. The maintenance member evaluates the status of the aircraft involved in the mishap. Quality assurance, and working conditions at the local level may contribute. These areas should be investigated and discussed with the board. The maintenance member may also be called on to comment on depot quality assurance, design deficiency, depot management, and overhaul, acquisition, or modification philosophies. Topics to be considered may (in conjunction with the flight surgeon) extend to include psychological, psychosocial, or anthropometric problems for maintenance personnel. Psychological concerns include maintenance training or skill and knowledge. Issues of training, perception, attention, perceived stresses, fatigue, possible drug use, and life styles may warrant investigation. Psychosocial concerns include supervisory issues, communication, peer influences, and various personal and community factors. Even ergonomic concerns may become evident. Inadequate strength or inappropriate tool design to properly accomplish a task are examples. These are the kinds of issues that will come to light in the course of unfolding events. The flight surgeon will integrate these inputs into a total human factors analysis. You should ensure the flight surgeon evaluates those people playing key roles early in the investigation.

4-2. General Considerations. As a key expert in the investigation, your evaluation of these areas is a necessary part of the investigation. Discuss potential problems in any of these areas with the appropriate board members. Attachment 1 is a glossary of terms.

a. Component Failure:

(1) Describe any component(s) of the aircraft that failed or malfunctioned during the course of the mishap: _____

(2) What was the reason for the failure or malfunction? _____

(3) Name and describe any component(s) of the aircraft that was or were inoperative before the mission: _____

b. Aircraft Structural Failure:

(1) Describe any aircraft wing, fuselage, tail, appendage, or other structural failure that occurred during the course of the mishap: _____

(2) What was the reason for the structural failure? _____

c. Support Equipment. For the following items of support equipment, describe any problems which may have increased workload, caused delays, or otherwise did not provide timely or adequate support. Briefly explain each answer:

(1) Electrical power cart: _____

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- (2) Towing equipment: _____
- (3) Weapons: _____
 - (a) Loading procedures: _____
 - (b) Loading equipment: _____
- (4) Refueling equipment: _____
- (5) Oxygen-servicing equipment: _____
- (6) Communications equipment: _____
- (7) Other maintenance equipment: _____

d. Servicing Resources (Field Working Conditions). For the following resources, name the specific type of resource and describe their availability, quality, quantity, or any other attribute that may have affected the mishap sequence of events. Indicate the problem induced, such as causing delays, frustrations, or malfunctions:

- (1) Fuel: _____
- (2) Engine oil: _____
- (3) Hydraulic fluid: _____
- (4) Aircraft availability: _____
- (5) Parts availability: _____
- (6) Ordnance: _____
 - (a) Release equipment: _____
 - (b) Suspension equipment: _____
- (7) Manning levels: _____
- (8) Personnel: _____

(Any problem individuals should be immediately identified to the flight surgeon for 72-hour histories and appropriate testing.)

- (9) Personnel training: _____
 - (a) Type (Tech School, OJT, etc.): _____
 - (b) Were trainers and instructors qualified? _____
 - (c) Was the management system for training adequate? _____
- (10) Quality assurance procedures: _____
- (11) Supervision: _____

(12) Technical data:_____

(a) Reliable?_____

(b) Well presented or useful?_____

(c) Who developed it?_____

(13) Tools:_____

(14) Oxygen:_____

(15) Pressurized air:_____

(16) Other:_____

e. Logistics Considerations:

(1) Depot quality assurance:_____

(2) Design deficiency (noncockpit):_____

(3) Depot management:_____

(4) Overhaul philosophy:_____

(5) Acquisition philosophy:_____

(6) Modification philosophy:_____

Chapter 5
LIFE SUPPORT OFFICER

5-1. Using This Workbook. The life support officer (LSO) is the expert on and responsible for investigating personal equipment, egress, survival, and rescue issues. This includes certain training data regarding physiological issues, equipment use, survival, and rescue. Being a consultant to the flight surgeon, the LSO's inputs are invaluable in the final human performance (human factors) analysis. When malfunctions in egress, survival, or rescue equipment are found and warrant corrective action, consult with HQ AFISC/SEL, AUTOVON 876-3458. Such actions (such as materiel deficiency reports) are not limited to the time constraints or review procedures characteristic of the overall mishap report.

5-2. General Considerations. A thumbnail sketch of areas of concern follows.

CAUTION: Do not reassemble fractured metal surfaces, as this may make subsequent metallurgical analysis difficult.

a. Oxygen: (If high altitude flight was involved, investigate the system.)

(1) Were oxygen hoses connected? _____

(a) Hose condition? _____

(b) Type regulator and setting? _____

(Mark switch position. Oxygen delivery may be checked in some cases.)

(2) What types of masks were worn? _____

(3) What was the charge in oxygen or LOX system? _____

(4) Were contaminants found in the oxygen system? _____

b. Other:

(1) Did a mechanical or structural failure occur in the pressurization control equipment? _____

(2) Were the connections and function of the anti-G suit appropriate? _____ Were fitting procedures appropriate? _____

(3) Was protection from smoke and fumes available and adequate? _____

c. Egress. The egress phase begins at the point of the mishap (the point where nothing an aircrew can do would prevent the mishap). The survival phase begins when the aircrew reaches land or water.

(1) Ejection-capable aircraft:

(a) Was there canopy hinge or latch failure? _____

(b) Was an attempt made to jettison the canopy? _____

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WARNING: Ensure all ejection seat explosive or propulsion devices have been inactivated before examining the seat!

(Assume an ejection attempt was made until proof to the contrary is generated.)

(c) Were ejection handles pulled? _____ Partly? _____ Fully? _____

(d) Was emergency harness release handle pulled? _____

(e) Were primary and secondary firing mechanisms, drogue gun, or main charges fired? Properly installed? _____ Pins out? _____

(f) Did time release mechanisms, barostat, G controller, inertial reel, and leg restraints function properly? _____

(g) Were shoulder harness and various restraints (gold key, etc.) attached, or was there evidence of failure? _____

(h) How was the parachute deployed? _____

(i) Was the parachute damaged, and when (deployment, descent, or landing phase)? _____

(j) Was there a 4-line jettison? _____

(k) Was there any problem with the seat-chute or man-seat separation, and based on what evidence (paint, line, or canopy damage)? _____

(l) What personal equipment was lost at egress? _____

(m) What personal equipment (helmet and clothing) damage occurred and how? _____

(n) Were there problems with equipment inventory? _____

(Consider US Air Force or other authorization, availability in the mishap aircraft, and the phase of the mishap in which the item was used, needed, lost, discarded, or failed.)

(o) What were the personal equipment malfunctions? _____

(This may need to be reported immediately on discovery so corrective measures can be expedited.)

(2) Nonejection-capable aircraft:

(a) Were escape hatches adequate in:

Number? _____

Location? _____

Function? _____

Ease of operation? _____

(Correlate with seating position.)

(b) Were seats and restraints adequate in view of impact forces? _____

(c) Were chutes available and used? _____

(d) Was inflight fire, toxic exposure, or preimpact injury a factor in survival? _____

(e) What personal equipment problems were noted? _____

(f) What survival equipment problems were noted? _____

d. Survival and Rescue:

(1) Notification time of rescue unit(s): _____

(2) Arrival time of rescue unit(s) on scene: _____

(3) Completion time of rescue operations: _____

(4) Distance between rescue unit's base and mishap scene: _____

(5) Environmental conditions (weather, terrain, water, etc.) at rescue site: _____

(6) Rescuers:

(a) Equipment used to notify rescue: _____

(b) Rescue equipment used to locate survivors (mishap scene): _____

(c) Communication effectiveness and coordination at rescue area: _____

(d) Rescue vehicles or equipment used: _____

(e) Rescue techniques (include search methods and adequacy of methods): _____

(f) Rescue personnel used (pararescue, 902XO's, firemen, etc.): _____

(g) Did a physician participate? Include physician's actions: _____

(h) Medical support to survivors (include on-scene and followup medical care at medical treatment facility): _____

(i) Describe any problems encountered by rescue forces: _____

(7) Rescuees:

(a) Survival equipment used (include automatic beacon, radio, flotation devices, etc.): _____

(b) Adequacy of equipment (positive or negative): _____

(c) Adequacy of rescuees' actions: _____

e. Firefighting Requirements:

(1) Were firefighting vehicles adequate? _____ If not, number and type? _____

(2) Were unusual fire control measures required? _____

(3) Time at which fire was under control or extinguished? _____

f. Evacuation (Transport or Helicopter Mishaps):

(1) Time required to accomplish egress? _____

(2) Emergency exits and design? _____

(3) Number of people using each exit? _____
(Correlate with seating position.)

(4) Emergency equipment used on board? _____

(5) Would additional equipment have been helpful? _____

How? _____

g. Training:

(1) Were passengers and ACMs appropriately briefed? _____

(2) Were there problems with training in the use and maintenance of:

(a) Life support equipment? _____

(b) Personal equipment? _____

(c) Egress equipment? _____

(d) On-board emergency equipment? _____

(e) Survival equipment? _____

h. Physiological Training:

(1) Type: _____ Location: _____ Date: _____

(2) What were dates of survival training? _____

(3) "Helo dunk" training? _____

(4) Egress training? _____

(5) G training? _____

- (6) Vertifuge training? _____
- (7) Other pertinent training? _____
- (8) Simulator ride within 24 hours? Yes/No (circle)

PART TWO

HUMAN PERFORMANCE CONCERNS

Chapter 6

MEDICAL MEMBER

6-1. Using This Workbook. "Human factors" is understood by some to be a synonym for "human error" or by others "human engineering." The term used here is as broad as the human side of the term "safety" itself, since it addresses every level of the human in the operational environment and includes concerns of each board member. The focus is on human performance for the medical board member, but adequate analysis requires broader consideration of the overlapping factors in part one, Environmental Concerns. During the investigation, if human performance appears to be a major player in the mishap, you should contact the Human Performance Branch (AUTOVON 876-2432, Commercial 714-382-2432) at the AFISC for consultation. Discuss your intent for consultation with the board members and also the board president before calling the Safety Center. Chapter 5 discusses how to obtain board assistance.

a. Because of training and exposure, the flight surgeon is the best board member to prepare a comprehensive and coherent "human factors" report. He or she must use fellow board member consultants to do this effectively. The narrative compiled using this workbook is described in AFP 127-1, volume I, chapter 10, and will fulfill the AFR 127-4 narrative requirements. All items in this workbook must be reviewed for each mishap (although many may not apply in a given mishap). Remember that human factors may be positive, negative, or neutral and may not be fully understood until the entire investigation is complete.

b. This workbook provides general guidance for the flight surgeon as he or she progresses through the learning process of safety investigation with the help of fellow board member consultants. The consultant process is familiar to every physician as a natural part of managing complex and difficult cases. Text terms followed by (D) are defined in attachment 1. At your earliest convenience, review AFP 127-1, volume I, chapter 10, which provides a thumbnail sketch of key areas of concern. Your first responsibility is to address questions in the context of the board. However, comprehensive and adequate reporting is vital to the effectiveness of subsequent reviews.

6-2. Actions on Notification:

- a. Note the time.
- b. Establish coordinates.
- c. Identify aircraft type.
- d. Count souls on board.
- e. Establish survivor status (if known) and ground casualties (if any).
- f. If any channel exists to pass information to the civil authorities involved, **assert the need not to disturb human remains. If remains have been moved, advise them not to remove or deal with clothing or personal items beyond basic identification, and to refrigerate but not embalm remains.**

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g. If available, record names of those involved, review and impound the medical records.

h. If there are suspected fatalities, placing a preliminary call to AFIP (AUTOVON 291-3232) will facilitate their response.

6-3. Response To Survivors. Response to the entry control point (if in the immediate base vicinity) should be immediate and in compliance with base disaster response plans. **Care of survivors is first priority**, and once that is underway:

a. Draw aircrew laboratory studies as early as possible (usually at the medical facility).

b. Accomplish the aircrew physical examinations, or see that another flight surgeon does.

c. Accomplish a 72-hour history on the surviving aircrew, or see that a flight surgeon does.

d. Release aircrew only when this has been completed.

e. Accomplish examinations on other survivors who were abroad. Correlate all with seating arrangements.

f. Beyond ambulance response range, you will need to identify either the helicopter departure or the convoy assembly point and report to it ready for both survivor care and investigation.

6-4. Initial Investigation:

a. The on-scene commander (OSC) is responsible for perimeter security. Area safety should be ensured before entry of medical personnel. Someone will be appointed by the OSC to record names and addresses of witnesses.

b. Report to the on-scene commander and, if appropriate, ensure the local coroner is notified. (If not on government property, the Mortuary Affairs Office may have an agreement with civil authorities.)

c. Priority should be given to site diagramming coordinated with chosen photographs.

WARNING: Ensure the Ejection Seat Is Safed or Pinned Before Approaching It.

(1) Stake and photograph (human remains first before moving them, and label with DD Form 1380) by location stake.

(2) Coordinate with Mortuary Affairs on an area search to identify any other remains as early as practical. Brief all search parties to prevent loss of fragile evidence (AFP 127-1, volume I, chapter 10).

(3) Photograph and examine life-support equipment attached to or lying with remains before moving remains. (EXPEDITE REMAINS REMOVAL.)

(4) Release the photographer to other board members only after the available remains have been photographed at the mishap site.

(5) Move on to life-support equipment and other issues as time permits, being careful to look for blood or tissue that may later prove a critical point. Do not tamper with fractured metal surfaces, as this may destroy clues.

d. Release no information at the scene except through the on-scene commander or public affairs designate. Protect classified, and do not speculate on any cause, equipment failure, or liability.

6-5. On-Scene Identification Concerns. Call for help early when you believe it is needed.

- a. Aid in identifying personnel by recording:
 - (1) Position in aircraft.
 - (2) Personal equipment.
 - (3) Scars, body marks, blood type, hair and personal effects.

(See AFP 127-1, volume I, chapter 10 for more information.)

b. Label body and body parts with DD Form 1380. (Do not remove personal equipment from the body or gather specimens in the field.)

c. Work closely with Mortuary Affairs. (Detailed guidance is in AFP 127-1, volume I.)

d. Ensure map includes body position, clothing, and life-support equipment with relative positions and relation to aircraft.

e. Stake out and label places where personal items were recovered.

f. If time of death is a concern, request consultant assistance.

6-6. On-Scene Notes. Before departing for autopsy:

a. Chronology (for all mishaps):

- (1) Year, month, and day of mishap (D) sortie: _____
- (2) Takeoff time—local (hours and tenths): _____
- (3) Time of occurrence—local (hours and tenths): _____
- (4) Time of occurrence—zulu (hours and tenths): _____
- (5) Time of day (circle one): DAWN DAY DUSK NIGHT MOON
- (6) Day of week (circle one): SUN MON TUES WED THURS FRI SAT HOLIDAY

b. Terrain or Surface Background. What was the terrain or water over which the mishap took place? (Consider how it may have contributed to the mishap.)

- (1) Terrain type: _____
- (2) Terrain conformation: _____
- (3) Terrain features or texture: _____
- (4) Water state: _____
- (5) Vegetation: _____
- (6) Flight path obstacles: _____

c. Visual Cue Data. What observations can you make concerning the following?

- (1) Visual cue availability: _____

(2) Visual cue texture or detail:_____

(3) Presence of objects of known size:_____

(4) Presence of objects of deceptive size:_____

(5) Presence of objects of known location:_____

(6) Terrain gradient or slope:_____

(7) Shadows and sun angle:_____

(8) Landmarks:_____

(9) Presence of man-made obstructions:_____

(10) Life-support equipment notes (if time permits, review pages 4-10, AF Form 711gA, Life Sciences Report of an Individual Involved in an Air Force Accident/Incident, Section A, Aircraft Accident/Incident):

6-7. Required Specimens. Take blood and urine only on survivors. Specimens on fatalities may be gathered at autopsy. Duplicate specimens may be refrigerated until receipt by AFIP is confirmed. A chain of custody for specimens must be maintained.

a. Blood—60 cc Total: (Send to AFIP using wide-mouthed plastic specimen cups with screw on tops.)

(1) 30 cc red top tubes. Test for drugs.

(2) 30 cc gray top tubes. (Use no alcohol swabs.) Test for HGB, Hct, glucose, ETOH, lactic acid, CO, or others at your discretion.

b. Urine—100-500 cc:

(1) Test for drug screen.

(2) Routine UA.

c. X-Rays:

(1) As needed on survivors.

(2) Spine films on all ejectees.

(3) All remains on fatalities, for injuries and identification (including AP and lateral of hands, feet, and spine).

d. AFIP Toxicology (Frozen) Tissue:

(1) 200 g brain.

(2) 500 g liver.

- (3) 200 g lung.
- (4) 200 g kidney.
- (5) 200 g skeletal muscle.
- (6) 200 g fat.
- (7) 200 g bone marrow (if others are unavailable).

e. Additional AFIP Toxicology (Frozen Fluids, but not in Glass):

- (1) Bile (as much as possible).
- (2) Stomach contents (50+ cc).
- (3) Other body fluids (vitreous humor may be a substitute for blood or urine if nothing else is available).

6-8. Required Paperwork:

- a. DD 1323, Toxicological Examination—Request and Report, for each individual on whom specimens are submitted.
- b. SF 523, Clinical Record—Authorization for Autopsy, for autopsy authorization.

6-9. Specimen Handling:

a. AFIP Toxicological Specimens. See AFP 127-1, volume I, chapter 10 for details on all types of specimens.

- (1) Keep the specimens in a freezer until dry ice arrives.
- (2) Ship frozen in dry ice in an appropriate container.
- (3) Ensure that all specimen containers are leak proof.
- (4) Support all specimen containers to ensure rattle proof package.
- (5) Place the above paperwork inside the package, including an address for the board and for the authorizing commander.
- (6) Seal the package with masking tape so that dry ice will last longer. This permits a transit time of 24 to 72 hours.
- (7) Label packages for mailing (patient's name, SSN, autopsy number, type specimen, hospital where taken, your name, and that of pathologist). Fragile, Rush, Frozen Specimen for Toxicological Examination (Aircraft Mishap).

b. AFIP Notification. Notify AFIP of the following by message or phone (AUTOVON 291-2800, Commercial 202-576-2800) before mailing:

Aircraft mishap toxicology material: _____
 Patient's name, rank, service number: _____
 Method of shipment (air express or air freight): _____

Name of Washington DC airport to receive shipment: _____
 Name of airline: _____
 Flight number: _____
 GBL or airbill number: _____
 Contributor's name: _____
 Departure time and date: _____
 Arrival time and date: _____

c. AFIP Address: Director, Armed Forces Institute of Pathology, Attn: AFIP-RRR, Washington DC 20306-6000. AUTOVON 291-2910, Commercial 202-576-2910. (AFIP street address: AFIP, Attn: CPL-A, Bldg 54, 14th & Alaska Aves, Washington DC 20306-6000) Authorization: AFR 160-55, AFM 160-28.

**Specimens are to be forwarded by the quickest means available.
 (Avoid military air, use overnight air freight.)**

6-10. Post Mortem Considerations. If AFIP is expected to arrive, you can help by preparing to manage the specimens, by getting whole body x-rays (including A/P and lateral of hands, feet, and spine), by clearing the autopsy (via JAG, SF 523, Clinical Record—Authorization for Autopsy), and accomplishing identification if possible. (It may be of value to review a cockpit or bring cockpit documentation such as diagrams and photos.) Autopsy objectives are to determine who died, "cause of death," "manner of death" (accident, suicide, etc.), and what the specific interactions between victim and aircraft components were that may have constituted a fatal injury, or that may reflect on the sequence of events. Attachment 3 is an injury worksheet. An AFIP procedural outline follows:

a. Photographic:

- (1) Clothing, external trauma first. (Correlate with personal equipment, pocket items or cockpit structure).
- (2) Internal trauma. (Correlate similarly where possible.)
- (3) Preexistent disease.

b. Preexistent Disease as a Contributor. This may be discovered from autopsy or medical record review. The medical record may disclose problems not easily identified at autopsy. Pathology pertinent to any waiver is of interest in order to help guide waiver policy.

- (1) Primary systems of concern:
 - (a) Cardiovascular.
 - (b) Central nervous.
 - (c) Respiratory (including signs of smoke inhalation).
 - (d) GI (rupture with decompression, gastroenteritis, gallstones, etc.).
 - (e) GU (renal lithiasis or occult problems).
- (2) Look for any disease which may cause sudden incapacitation.

c. Survivability Considerations (See AFP 127-1, volume I, chapter 10, and volume II):

- (1) Tolerable decelerative and impact forces.
- (2) Occupiable space, helmet function.

- (3) Post crash environment, clothing effectiveness.
- (4) Egress systems effectiveness, man-seat or man-chute interaction.

d. Injury Analysis. A coding worksheet follows:

- (1) Types of injury:
 - (a) Impact or decelerative.
 - (b) Intrusive.
 - (c) Thermal.
 - (d) Other blunt trauma.
- (2) Decelerative injuries, the approximate G forces involved:
 - (a) Transect aorta (horizontal at the ligamentum arteriosum)—80/100 G.
 - (b) Tears of aortic media—50 G.
 - (c) Transect vertebra (horizontal)—200/300 G.
 - (d) Compression fractures (less force may be needed in the thoracic region or with poor body position)—20/30 G.
 - (e) Fractured pelvis—100/200 G.
 - (f) Rupture of atlanto-axial (atlanto-occipital) membrane (fracture-disarticulation, subluxation, or a combination of both)—20/40 G.
- (3) Injury Analysis:
 - (a) Injuries due to man-machine interaction should be identified by careful cockpit reference.
 - 1. Blunt force trauma (imprints, fracture patterns, especially hands and feet).
 - 2. Lacerations, abrasions (correlate with clothing, personal equipment).
 - 3. Tissue from cockpit surfaces and type (may require repeat searches of wreckage).
 - (b) Flail-like injuries. Injuries resulting from violent extremity movement in high-speed ejection (Q forces). May be seen on occasion in nonejection mishaps.
 - (c) Injury correlation. Analyze individual or groups of injuries in relation to the overall mishap scenario, i.e., how did one injury result in or cause other injuries; how do occupant injuries relate to aircraft deformation—that is, crushing of occupiable space or cabin elasticity during impact; and how did ejection, PLF injuries occur (mechanism).
 - (d) Direction of forces.
- (4) Penetration injury:
 - (a) Rotor or propeller blade.

- (b) Trees, wires, etc.
 - (c) Bird strike.
 - (d) Aircraft strike.
- (5) Thermal injury:
- (a) Pugilistic attitude (a result of extreme heat).
 - (b) Fractures and amputations.
 - (c) Inhalation of soot, fumes.

e. Remains Identification. (1, 2, and 3 are usual legal means. Although some aids are discussed in AFP 127-1, volume I, chapter 10, this is primarily a Mortuary Affairs concern.)

- (1) Visual (often unreliable).
- (2) Finger and foot prints.
- (3) Dental records and x-rays.
- (4) Personal effects.
- (5) Association or exclusion.

(6) For technical assistance in identification, contact Mortuary Affairs at HQ AFESC/DEHM, Tyndall AFB FL, AUTOVON 970-6757 or Commercial 904-283-6757.

6-11. Initial Personal History. This may need to be done on more than one crewmember if uncertainty exists as to who was at the controls. An additional flight surgeon (or perhaps another qualified assistant) may need to gather this information if autopsy or remains identification workload ties you up. This can be done in two steps, getting immediate information (details that may be forgotten as listed below) at the first interview and getting other details later. At the time of the first interview, establish empathy and caring support. Followup by asking for a future meeting. The Spouse or Friend Interview Guide (attachment 4) may be useful. (If she or he departs, you may ask her or him to actually write out responses.) Do not think just in terms of 72 hours, but rather in terms of patterns over perhaps weeks. A number of points can be made concerning a more effective interview.

- a. Review the interview guide before the interview. Avoid "square filling" behavior using the guide in hand.
- b. Allow the subject (interviewee) to respond ad lib. Do not interfere with responses.
- c. Allow the subject to make associations to some factor other than the one you originally questioned, and come back later for completion (make a note to do so, then don't worry about it).
- d. Pay attention to the person you are interviewing, look at them, encourage complete openness.
- e. Advise the subject to make a note of any stray thought they might like to comment on later.
- f. Before letting the subject go, look over your material and cover points overlooked or intentionally missed to allow the subject his or her lead.
- g. Use a tape recorder. Our experience is that the flight surgeon interviewer is more uncomfortable than the subject. Most are very willing to be taped. Always given them the choice. Be sure the sound quality is good, and the microphone location adequate.

(A fill in activity chart is provided in figure 6-1). The 72-hour history is a minimum. For purposes of charting, a snack is less than 500 calories, while a meal is over that. You may wish to chart alcohol intake as well.

1. Food and Fluid Intake:

a. Describe the food intake of the pilot for the 72 (especially 24) hours before the mishap flight:_____

b. Was this diet characteristic of eating habits in the prior 2 weeks or so?_____

c. Indicate the number of hours between last full meal and sortie:_____

d. Was the operator on a diet? No____ If yes, what type?_____

e. What was the fluid intake of the pilot for the 24 hours before the mishap?_____

2. Circadian Rhythm. Where had the pilot traveled within the past 7 (or more) days?_____

3. Diurnal Cycle and Sleep:

a. How many hours was the usual sleep period?_____

b. Estimate the number of hours slept:

(1) In the 7 days before the sortie:_____

(2) In the 72 hours before the mishap sortie:_____

(3) In the 24 hours before the mishap sortie:_____

c. What was the number of hours since last sleep period (excluding naps) before the mishap sortie?_____

d. Did the mishap flight represent a change in the pupil's usual sleepwake cycle? No____ If yes, explain:_____

4. Activity Levels. What were the types and levels of physical (D) and mental (D) activity of the pilot between the last regular sleep period and the mishap?

a. Physical activity:_____

b. Mental activity:_____

5. Tobacco Habits:

a. What type of tobacco did the pilot use?_____

b. How much daily?_____

c. How long had the pilot used tobacco?_____

d. Had the pilot's tobacco use habits changed recently?_____

Figure 6-1. Activity Chart.

6. Alcohol Consumption:

- a. What were the pilot's normal drinking habits? _____
- b. How many drinks did the pilot consume within 24 hours of the mishap flight? _____
- c. Had the pilot's drinking habits changed recently? No _____ If yes, how? _____

- d. What was the time lapse between the pilot's last drink and his or her takeoff time? _____

7. Drug Use. Was the pilot taking any prescription or nonprescription medication before or during the mishap flight? What were the drug(s) and the purpose and source for each?

- a. Drug(s):
- b. Purpose:
- c. Source:

Figure 6-1. Continued.

ACTIVITY PATTERN CHART

TIME OF DAY (Hours based on home station time)

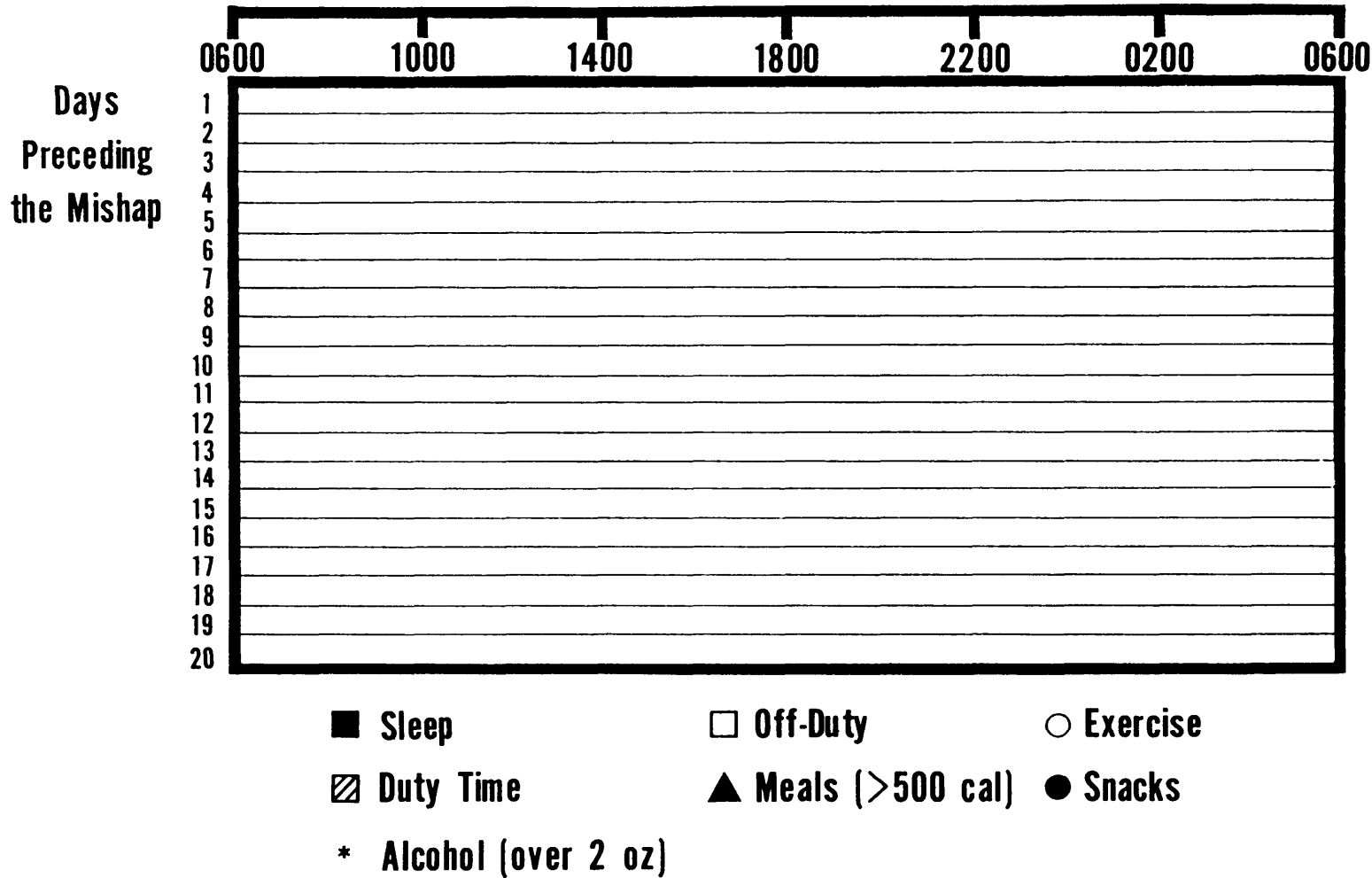


Figure 6-2. Activity Pattern.

Chapter 7

DATA CONSOLIDATION

7-1. Day 3 to Day 10. This section addresses questions you need to consider in the early days following disposition of remains and gathering of initial background 72-hour history. Here you will address more general considerations extending weeks or longer into the pilot's past, and you will work with the life-support officer to evaluate egress and survival concerns. At this point, review the glossary (attachment 1) and AFP 127-1, volume I, chapter 10, if you have not yet found the time.

a. The Unit Member Survey (attachment 2) may be used here either by you or by a consultant assisting you. The Spouse or Friend Interview Guide (attachment 4) should be used to guide more detailed interviewing during this period, especially if the spouse plans to depart the area. Remember, the term "pilot" means the aircraft operator at the time of the mishap. On rare occasions it may be necessary to do this for two aircrew if you have not yet made that distinction or if another individual played some key role. In preparation for your review of the issues with each board member, reread part one of this workbook.

b. If you do not have a life-support officer on the board, you will need to seek local help in gathering data to assess egress and survival concerns. A life-support officer workbook section (chapter 5) has been developed, but the questions to be addressed should be selected so that they are specific to the mishap aircraft, its mission and equipment.

c. You will address the questions listed under psychological performance to elucidate problem areas or clarify any need for board assistance in the area.

7-2. Human Characteristics:

a. Anthropometric Data. What were problems related to functional reach, sitting height, leg length, shoulder width, etc.? _____

b. Physical Condition:

(1) Describe the pilot's physical condition (D): (circle one)

Athletic (D) Active (D) Inactive (D) Sedentary (D) Unknown

(2) What was the pilot's general life style, and were there problems related to this lifestyle? _____

(3) What describes the pilot's physical strength, and were there any problems related to physical strength? (circle one)

Very strong Strong Average Below average Weak Unknown

(4) Was the pilot on medical waiver (e.g., weight, hearing, vision) at the time of mishap? No _____
If yes, explain: _____

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c. Physical Coordination and Motor Skills:

(1) What describes the pilot's coordination level, and were any problems related to physical coordination? (circle one)

Deft Above average Average Below average Awkward

(3) Describe the pilot's level of general motor skills and any related problems: _____

d. Physical Fatigue. Was the pilot's physical strength diminished or exhausted during the mishap flight? No _____. If yes, what caused this fatigue? _____

e. Physical Task Saturation. Was the pilot physically task-saturated (D) at the beginning of the mishap sequence of events? No _____. If yes, why? (Recall influence of fatigue, stressors.) _____

f. Duty Day:

(1) Flying hours by aircraft type in the past 48 hours as an aircrew member, including this sortie. Indicate types and hours for each:

(2) Flying hours during duty day, including this sortie: _____

(3) Number of sorties flown during duty day, including this sortie: _____

(4) Estimated hours spent in the squadron in the last 7 days: _____

(5) Number of duty hours worked 72 hours before mishap sortie: _____

(6) Amount of duty day elapsed at conclusion of mishap: _____

(7) Length of planned duty day: _____

(8) Enrollment in Masters Degree, SOS, ACSC, AWC? (circle)

(9) Completed Masters Degree, SOS, ACSC, AWC? (circle)

g. Visual Illusion. Did any of the following visual illusion(s) occur? What was supportive evidence?

(1) Autokinesis (D): _____

(2) Horizon surface (D): _____

(3) Vection (D): _____

(4) Geometric perspective (D): _____

h. Vestibular Illusion. Did any of the following vestibular illusions occur? What was supportive evidence?

(1) Somatogyral (D): _____

(2) Leans (D):_____

(3) Coriolis (D):_____

(4) Elevator (D):_____

i. Kinesthetic Illusions. Did any of the following kinesthetic illusions occur? What was supportive evidence?

(1) G-adaptation (D):_____

(2) G-differential (D):_____

j. Myopia. Was empty field myopia (D) a problem? No_____. If yes, explain:_____

k. Foreground Loss Effect (D). Did foreground loss effect occur? What was supportive evidence?_____

l. Spatial Disorientation. Did the pilot have any of the following spatial orientation problems? What was associated evidence to that effect?

(1) Type I (unrecognized):_____

(2) Type II (recognized):_____

(3) Type III (D):_____

(4) Geographic disorientation (lost) (D):_____

m. Vision Aids:

(1) Was the pilot wearing any aids for vision?_____

(2) Did the pilot have a prescription for glasses or contacts?_____

(3) Was the pilot required to wear glasses or contact lens? No_____. If yes, explain:_____

Remember that accommodation time (focus, refocus) increases with age and may be a factor even when "acuity" per se is not.

(4) Did the pilot have his or her glasses on during the mishap flight? Yes_____. If no, why?_____

n. Visual Acuity:

(1) Were there any problems in the mishap sequence of events (D) with visual acuity?_____

(2) Were there any problems as a result of focus time?_____ Remember with aging, focus time is extended up to 15 seconds.

(3) Were there any problems related to light adaptation?_____

(4) What was the pilot's bogie-spotting or lookout reputation?_____

o. Visual Perceptions:

(1) Were there any known previous problems with speed perception (D) or ground rush conditioning? That is, was the pilot known to either comfortably fly too close to the edge of disaster or fly in fear of low altitude?

(2) Were there any previous or existing problems with depth or height perception (D)?_____

p. Sensory Information Processing. Can you identify any problem the pilot had with detecting, processing, or acting on sensory information?_____

q. Ear Protection:

(1) Was ear protection required?_____

(2) What type of ear protection was the pilot wearing?_____

r. Acceleration Effects. What were acceleration effects (D) that the pilot experienced during the mishap flight (e.g., grey out, black out, red out, G-induced loss of situational awareness, loss of consciousness, restricted movement, etc.)?_____

s. Barometric Pressure Effects:

(1) Did the pilot experience any symptoms of evolved gas disorders (D) before or during the mishap flight?_____

(2) Did the pilot experience trapped gas effects (D) before or during the mishap flight?_____

t. Duty Assignments:

(1) What were the primary and additional duties of the pilot?

(a) Primary:_____

(b) Additional:_____

(2) What "non-official" tasks may have kept him or her at the desk or at work?_____

u. Parent's History and Involvement. Did the pilot's natural parents have a history of heart disease, stroke, seizures, or diabetes? No_____. If yes, which parent and problem?_____

v. Other Notes. What other information relating to the pilot's medical characteristics not covered above do you consider necessary to fully describe their potential involvement in the mishap event procedure? (Consider any evidence of clues to illness or, in women, menstrual cycles or other gender-specific potential problems.)_____

w. Other Notes on Environment (Heat or Cold Stress, Cabin Pressure, etc.): _____

7-3. Last Minute Reminders:

a. What is the status of toxicology or histology specimens submitted for analysis? _____

b. Remember, if there are any uncertainties in medical, psychological, or life-support or egress equipment analysis, call now to discuss it. (Call HQ AFISC/SER, AUTOVON 876-2432, Commercial (714) 382-2432.)

c. Hazardous Substances. Check with bioenvironmental engineering concerning any possible residual radioactive sources (such as in night systems) or hazardous chemicals (such as hydrazine) to ensure proper disposal. (See chapter 5, Life-Support Officer (part one) now if you have no life-support officer on the board.)

7-4. Psychological Performance. These questions are addressed by the flight surgeon. However, a number of psychologists and physiological training officers have aviation experience and a history of interaction with operational units. In some cases, he or she may be a trained US Air Force consultant. With board president and MAJCOM consent, a qualified individual may be asked to supplement the board. Every effort must be made to structure the questions so that they may be compared with available data on aircrew and so that the information gained is valid. For comments on augmentation in this area, consult AFP 127-1, volume I, chapter 10. If survey instruments are used, first call HQ AFISC/SEL (AUTOVON 876-3458).

a. Supervisory Activity:

(1) Who was the primary supervisor? (level, position, rank): _____

(2) Was supervisory guidance a factor in the mishap? No _____. If yes, explain: _____

(3) What was the quality of first level of supervision? _____

b. Rule Perceptions and Supervisory Example:

(1) Was the example set by supervisors supportive of the rules? Yes _____. If no, explain: _____

(2) Was the supervision in the unit consistent with the mission of the unit? Yes _____. If no, explain: _____

(3) Was the supervision in the unit consistent with the configuration of the unit? Yes _____. If no, explain: _____

(4) What is your assessment of the perceptions of unit members concerning how often and why rules were violated? (Unit Member Survey may be used.) _____

(5) Were there any problems with crew or flight coordination as they relate to the mishap sequence of events? _____

(6) Did the pilot, or any crewmember exhibit the copilot syndrome (D)? No____. If yes, who and how?_____

c. Sensory Information Processing? How would you account for any problem the pilot had with processing, or acting on sensory information?

- (1) Orientation:_____
- (2) Hearing:_____
- (3) Eyesight:_____
- (4) Smell:_____
- (5) Touch:_____
- (6) Proprioception:_____

d. Learning and Memory. Describe the pilot for each of the following: (If Spouse or Friend Survey (attachment 4) is used, report average and number of respondents.)

- (1) Learning ability (D):_____
- (2) Learning transfer (D):_____
- (3) Procedural knowledge (D):_____
- (4) Cognitive or mental flexibility (D):_____
- (5) How did the pilot's capabilities change under fatigue or stress?

e. Information Processing. Were there any problems noted with information processing (D) on the part of the pilot before or during the mishap flight?_____

f. Awareness Factors. Did the level of awareness (D) at which the pilot was functioning play a role in the mishap sequence of events? How?_____

g. Level of Attention. Was the level of attention (D) a factor? No____. If yes, describe how attention was managed:_____

h. Anomalies of Attention. For each of the following aspects of attention, indicate if and how they played a role in the mishap sequence of events:

- (1) General inattention (D) (complacency, boredom):_____
- (2) Selective inattention (D):_____

(3) Channelized attention (D): _____

(4) Fascination (D): _____

(5) Distraction (D): _____

(6) Habit pattern interference (D) (perceptual or response set): _____

(7) Confusion (D): _____

(8) Cognitive saturation (D): _____

i. Coping Style:

(1) Have there been any perceived personality changes in the pilot since his or her arrival with the unit? No _____. If yes, describe: _____

(2) Did the pilot tend to change personalities when flying or driving? No _____. If so, how? _____

(3) Was there any personality (D) factor that influenced the mishap sequence of events, including before the mishap flight? _____

(4) How would you evaluate the pilot's ability to function under stress (D) and ability to maintain presence of mind? _____

(5) Could the pilot set priorities (D) effectively? Yes _____. If no, explain: _____

(6) Were there aircraft design features which detracted from his or her ability to set priorities? _____

j. Previous Experience. What was the pilot's history of involvement in pursuits which require good vision and the establishment and maintenance of situational awareness (D)? _____

k. Social Companions. What were the pilot's most common social activities? (Divide 100 points among the following:)

- Family: _____
- Friends: _____
- Peers: _____
- Church: _____
- Social groups: _____
- Cultural groups: _____
- Recreational groups: _____

l. Career Progression:

(1) Was career progression normal compared to peers? Yes _____. If no, explain: _____

(2) How did the individual feel about his or her career progression?

m. Peer Assessment. (From Unit Member Survey, attachment 2.)

(1) What were the fellow pilot estimates of his or her general leadership qualities relative to peers?

EXTREMELY LOW 1 2 3 4 5 6 7 EXTREMELY HIGH

(2) What was the peer assessment of the pilot's susceptibility to peer influence or pressure?

EXTREMELY HIGH 7 6 5 4 3 2 1 EXTREMELY LOW

(3) How did the pilot's peers rate him or her as an officer?

EXTREMELY LOW 1 2 3 4 5 6 7 EXTREMELY HIGH

(4) How did pilot's peers rate him or her as a pilot?

EXTREMELY HIGH 7 6 5 4 3 2 1 EXTREMELY LOW

(5) What was the pilot's peers estimate of his or her flying skills relative to peers?

EXTREMELY LOW 1 2 3 4 5 6 7 EXTREMELY HIGH

n. Rules Conformance:

(1) Did the pilot tend to bend the rules? No____. If yes, what would be his or her rationale? (Motivation?)_____

(2) Were there any violations of rules, OIs, regulations, or established procedures in the past? No. If yes, how?_____

(3) Were there any violations of rules, OIs, regulations, or established procedures on this mishap? No____. If yes, how?_____

(4) What other factors may have been involved in bending the rules (supervision, fatigue, expectations, etc.)?_____

o. Crew Relations (Cockpit Resource Management):

(1) Were there any noticeable conflicts between the pilot and other crew or flight members before or during the mishap flight. No____. If yes, explain:_____

(2) What characterized the usual attitude of the pilot toward other crewmembers?_____

(3) Did the attitude of the pilot toward other crew or flight members influence their behavior during the mishap flight? No____. If yes, how?_____

(4) Did the pilot appear to have effectively used other crew or flight members during the mishap flight? Yes____. If not, why?_____

p. **Unit Morale.** Comment on the level of unit morale: _____

q. Personal Relations:

(1) Were there any problems or conflicts the pilot was having with close personal relationships? _____

(2) Did any deaths, injuries, or illnesses in the family or friends affect the operator? No _____. If yes, describe the effect: _____

r. Personal Problems. Indicate the presence of and describe any personal problems related to changes or anticipated changes in any of the following:

(1) Financial status: _____

(2) Legal problems: _____

(3) Job status: _____

(4) Religious problems: _____

(5) Marital problems or status: _____

s. Personal Motivation:

(1) Why did the pilot want to fly? _____

(2) What was the pilot's source of motivation (D) regarding the mishap flight? _____

(3) What was the pilot's source of professional or career motivation? _____

t. Satisfaction. Indicate the pilot's level of satisfaction in the following areas by circling the appropriate number:

	<i>Extremely Satisfied</i>	<i>Neither Satisfied nor Dissatisfied</i>				<i>Extremely Dissatisfied</i>	
Career choice	1	2	3	4	5	6	7
Duty location	1	2	3	4	5	6	7
Type aircraft assignment	1	2	3	4	5	6	7
Ground duties	1	2	3	4	5	6	7

u. Emotions and Moods:

(1) Did the pilot experience any intense emotion (D) before or during the mishap flight? No _____. If yes, describe:

(a) Before: _____

(b) During: _____

(2) Describe the mood (D) of the pilot before and during the mishap flight:

(a) Before: _____

(b) During: _____

(3) Describe any emotional displays on the part of the pilot before or during the mishap or mission flight:

(a) Before: _____

(b) During: _____

(4) Did the pilot have a recent history of significant changes in moods or emotions? No _____. If yes, explain: _____

v. Behavioral Factors:

(1) Did the pilot seem depressed recently? No _____. If yes, why? _____

(2) Did the pilot seem anxious recently? No _____. If yes, why? _____

(3) Was the pilot's behavior noted to be unusual before or during the mishap flight? No _____. If yes, explain: _____

w. Unit Member's Perceptions (if Accomplished). For the following areas, describe the representative unit member's perceptions (perhaps from questionnaire aids or modifications thereof). If used, report average rating and number of respondents:

(1) Reliability of aircraft: _____

(2) Adequacy of aircraft systems and subsystems: _____

(3) Reliability of egress systems: _____

(4) Adequacy of training: _____

(5) Adequacy of flying time: _____

(6) Adequacy of scheduling: _____

(7) Adequacy of unit leadership: _____

(8) TDY frequency: _____

(9) TDY duration: _____

(10) Additional duties: _____

(11) Promotion system: _____

- (12) Multiple-mission roles: _____
- (13) General job satisfaction (D): _____
- (14) Unit dynamics (competitive, cliquish, etc.): _____
- (15) Unit professional standards: _____
- (16) Career progression potential: _____

Chapter 8

TEAM ANALYSIS

8-1. Day 11 to Day 21. During this portion of the investigation, consultation with various board members will facilitate a comprehensive, integrated investigation. Review of part one will facilitate your interaction with board members. The preferred format would be to simply interview each individual and discuss the items. A copy of the glossary (attachment 1) should be used to guide common terminology. Some items may not be applicable to a particular investigation or weapons system. MAJCOM supplements may be developed. The summary sheet (figure 8-1) is composed of factor evaluation scales and is intended as an aid to systematic consideration of the factors (confidence in presence and contribution, degree of contribution, and temporal role) as well as to enhance recall during report composition. You should reproduce copies for your use in recording and reviewing pertinent factors with board members.

8-2. Board Expertise. Before reviewing the questions, update each board member on your findings as to performance decrements you suspect are likely based on your investigation to date. The following chapters are provided in part one:

a. Board President (Chapter 1). Comments from each section may be reviewed by this person, who is of broad military exposure.

b. Investigating Officer (Chapter 2). As the overall investigative officer, this input may be pertinent to a broad range of human factors concerns.

c. Pilot Member (Chapter 3). As the weapons system expert, his or her help will be needed to discriminate among factors pertinent to the particular aircraft and mission.

d. Maintenance Officer (Chapter 4). As the equipment expert, his or her responsibility includes maintenance person human factors which may include logistics or depot level considerations. This examination should go beyond why a failure occurred to explain who was involved and how.

e. Life Support Officer (Chapter 5). This responsibility includes life support, egress, survival and rescue equipment, and training concerns pertinent to its use.

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FIG 8-1. INTENDED FOR REPRODUCTION AND USE AS A DECISION AID TO FACILITATE REVIEWS OF FACTORS INVESTIGATED

Figure 8-1. Summary Sheet—Factor Contribution Scales.

Chapter 9
REPORTING GUIDELINES

9-1. Day 22 to Day 30. The AF Form 711gA will continue to be a basic reporting form. This workbook serves only to assist in a comprehensive investigation. AFP 127-1, volume I, chapter 10 provides a prescribed detailed reporting narrative format and writing tips.

9-2. Evidence Disposition. After board release, any remaining evidence (such as photos and x-rays) should be treated as sensitive and disposed of according to AFP 127-1, volume I, chapter 10. Attachment 5 is an optional flight surgeon critique of these materials.

BY ORDER OF THE SECRETARY OF THE AIR FORCE

OFFICIAL

LARRY D. WELCH, General, USAF
Chief of Staff

FREDERICK P. HALLSWORTH, Colonel, USAF
Director of Information Management
and Administration

SUMMARY OF CHANGES

This revision, in conjunction with volumes I and II, updates and greatly expands the guidance to the field on how to prepare for and conduct the Air Force safety investigation. Volume III is completely new and should be used as the mishap circumstances dictate.

WARNING: When filled out, this document is For Official Use Only (becomes a limited use report not releasable in whole or in part to persons or agencies outside the Air Force without the express approval of the disclosure authorities specified in AFR 127-4).

GLOSSARY OF TERMS

The number and letter sequence following major glossary entries denote the location within the standard reporting outline found in AFP 127-1, volume I, chapter 10.

Abort—To terminate a planned maneuver; e.g., an aborted takeoff.

Accelerated Stall—A stall occurring under acceleration, as in a pullout. Such a stall usually produces more violent motions of the airplane than does a stall occurring in unaccelerated flight.

Acceleration Effects—Influence on performance capability due to the effects of acceleration on diverse body systems.

Acceleration Cardiovascular Effects (ACE) (2a(1)(a))—Reduction in performance capability due to grey out (loss of peripheral vision due to positive “G”), black out (loss of all vision due to positive “G”), or loss of consciousness due to positive “G.” Analogous negative “G” effects also exist.

ACE-Lateral—Gy forces. This is associated with canard flight control surfaces which has caused up to 2.5 Gy (without cardiovascular difficulty).

ACE-Negative—When red out occurs, it is associated with substantial negative (2.5-3) G for 3 to 5 seconds.

ACE-Rapid Onset—Usually associated with loss of consciousness as a result of transition from normal to high (over 7) G in a period less than 3 seconds and a warning “grey out” is thus not seen.

Acceleration Displacement Effects (3b(2)(b))—Reduction in performance capability due to the physical displacement or restriction in movement of the operator as a result of \pm Gz (head to toe, or toe to head), \pm Gy (side to side), or \pm Gx (front to back, or back to front).

Acceleration Orientation Effects (2a(2)(b)1).—Influence on performance capability due to the effects of acceleration on the proprioceptive tactile, or vestibular apparatus. (See ambient orientation.)

Acceleration Tolerance (2a(1)(e))—The ability of an individual to preserve performance capability in the face of the various effects of acceleration. (See physical condition.)

Actual Special Sortie—See special sortie.

Acute or Transient Fatigue—See fatigue.

Adjustment Error—See error.

Advancing Blade—Any rotor blade or wing on a rotary-wing aircraft in horizontal motion, moving into the relative wind.

Advection Fog—Fog resulting from the movement of warm, humid air over a cold surface, especially a cold ocean surface. Also, sometimes, steam fog, which results from the transport of cold air over relatively warm water.

Adverse Yaw—Yaw in the opposite sense to that of the roll of an aircraft, e.g., a yaw to the left with the aircraft rolling to the right.

Advisory—Advice and information provided to assist pilots in the safe conduct of flight and aircraft movement.

Aerobic Confidence Maneuvers (3b(2)(a))—Aerobatics intended to increase pilot skill.

Aerobic Demonstration (3b(2)(a))—Aerobatics intended to demonstrate pilot skill and aircraft capabilities.

Aerobatics—Preplanned, precisely executed flight maneuvers in which the aircraft exceeds either 60 degrees of bank or 30 degrees of pitch.

Aeronautical Beacon—A visual NAVAID displaying flashes of white or colored light to indicate the location of an airport, a heliport, a landmark, a certain point of a Federal airway in mountainous terrain, or an obstruction.

Aerospace Medicine—A medical specialty dealing with prevention, especially dealing with the environments related to flight and individual capabilities in meeting those demands. Flight

surgeons receive at least a basic course reviewing these concerns in addition to whatever physician training they hold.

Affective States (2b(5)(c))—Subjective feelings of different types of pleasantness or unpleasantness that a person has about aspects of his or her environment, other people, or himself or herself. Affective states are subdivided into moods and emotions depending on their duration and intensity.

Emotion—An excited affective state which tends to be disruptive of mental, physiological, or behavioral process. Emotions are relatively brief in duration but strong in intensity (may be influenced by fatigue or various stressors).

Mood—An affective state of relatively low intensity but long in duration. A mood can facilitate a perceptual or response set.

Aircraft—Any machine that can be supported for flight in the air by buoyancy or the effects of the air against its surfaces.

Aircraft Subsystems—Lesser systems which are components of major aircraft systems. For example, subsystems of the hydraulic system include landing gear, brakes, wing flaps, nosewheel steering and speed brakes. NOTE: The terms "system" and "subsystem" are often used synonymously.

Aircraft Systems—Major components of the aircraft which operate from a common source of power, provide a common power source to similarly powered components, or perform a major function encompassing lesser functions or components. (Examples include hydraulics, electric, flight control, avionics, engine power, fuel, and all-weather systems.)

Airfoil—An aerodynamic surface designed to obtain a reaction from the air through which it moves; e.g., aileron, wing, rotor blade, rudder, or similar device.

Airframe—The fuselage, booms, nacelles, cowlings, fairings, airfoil surfaces (including rotors, but excluding propellers and rotating airfoils of engines), and landing gear of an aircraft, and their associated accessories and controls.

Airplane—An engine-driven fixed-wing heavier-than-air aircraft that is supported in flight by the dynamic reaction of the air against its wings.

Airport Advisory Area—The area within 10 miles of an airport that does not have a control tower or where there is a tower which is not in operation and on which a flight service station (FSS) is located. In such cases the FSS provides advisory service to arriving and departing aircraft.

Airport Marking Aids—Markings used on runway and taxiway surfaces to identify a specific runway, a runway threshold, a centerline, a hold line, or other designated area. A runway should be marked in accordance with its present usage such as: (1) visual, (2) nonprecision instrument, and (3) precision instrument.

Airport Surveillance Radar (ASR)—Approach control radar used to detect and display an aircraft's position in the terminal control area.

Airport Traffic Area—Unless otherwise specifically designated in FAR Part 93, that airspace within a horizontal radius of five statute miles from the geographical center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of the airport.

Ambient Orientation (2a(2))—A means of maintaining gross orientation without "thinking" about it. It is the result of the preconscious level of awareness keeping track of various sensory inputs (including peripheral visual, tactile, kinesthetic, vestibular, and auditory) to keep us oriented with respect to the various inputs. Discontinuity between such inputs is thought to predispose to motion sickness. In vision this involves peripheral vision.

Angle of Attack—The acute angle between the wing chord plane and the relative wind; also referred to as Geometric Angle of Attack.

Angle of Attack Indicator—An instrument which indicates the angle between the wing chord plane and the relative wind.

Antecedent Events, Mishap—See mishap.

Anthropometrics (2d(2))—Measurement of the physical height, weight, build, and dimensions of a person. (Used in solving biomechanical issues in equipment design.)

Approach Phase—See mishap, phase of flight.

Athletic—See fitness.

Attention (2b(2))—The use of some level of conscious mental or cognitive resources in processing information. (See vigilance.)

Attention, Anomalies of (2b(2))—Misallocation or untimely interruption of attention to a task (all may be influenced by fatigue or various stressors).

Channelized Attention—The focusing of conscious attention on a limited number of environmental cues to the exclusion of others of subjectively equal, higher, or more immediate priority. Channelized attention is an active anomaly of attention sometimes referred to as fixation. (Focus of attention = span of attention).

Cognitive Saturation—An attention anomaly in which the quantity of information to process exceeds a person's cognitive or mental resources, resulting in loss of situational awareness.

Distraction—The interruption and redirection of the focus of attention by an environmental cue or mental process.

External Distraction—Interruption of attention by a nontask-related environmental cue.

Internal Distraction—Interruption of attention by a nontask-related mental process or emotion.

Fascination—An anomaly of attention in which a person observes the environmental cues around him or her but fails to respond to them (as if he or she were viewing them from the outside). Fascination is usually associated with a high-stress or crisis situation.

Habit Pattern Interference or Substitution—See response set and perceptual set.

Inattention—A state of reduced conscious attention due to a sense of security, self-confidence, or a perceived absence of threat from the environment. This may often be a result of highly repetitive tasks.

General Inattention—Nonselective inattention due typically to boredom or complacency.

Boredom—A state of reduced conscious attention due to a perceived (or actual) uninteresting and undemanding environment. Repetitive task induced boredom makes vigilance very difficult.

Complacency—A state of reduced conscious attention due to an attitude of overconfidence or undermotivation.

“Mission Accomplished” Complacency—A relaxation of vigilance often seen as a result of a “mission complete” sensation.

Selective Inattention—Insufficient attention to relevant environmental cues due to lack of knowledge or an inappropriate perceptual or response set.

Attention, Level of (2b(2)(a))—The relative proportions of the span, focus, and margin of attention afforded to information processing. (See channelized attention and vigilance.)

Focus of Attention—The part of the span of attention directed toward conscious information processing.

Margin of Attention—The span of attention minus the focus of attention, or a person's remaining capacity to focus conscious attention.

Span of Attention—The total individual cognitive or attentional resources, both in quantity and duration, to process information at the conscious level.

Attitude, Aircraft—The orientation of the three major axes of an aircraft (longitudinal, lateral, and vertical) with respect to a fixed reference such as the horizon, the relative wind, or direction of flight.

Attitude, Personal—An enduring, learned predisposition to behave in a consistent way toward a given circumstance; a persistent mental state

of readiness to react to a certain circumstance, not as they are but as they are conceived to be.

Attitudinal Set—A predisposition, rooted in attitude(s), which may cause the individual to respond in a particular manner to a set of stimuli.

Autokinesis—See illusion.

Automated Radar Terminal System (ARTS)—A highly automatic radar system that displays, for terminal aircraft controllers, information about aircraft that they are controlling. ARTS gives identification, flight plan data, and other flight-associated information (e.g., altitude and speed).

Automatic Terminal Information Service (ATIS)—The continuous broadcast of recorded noncontrol information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve radio frequency congestion by automating the repetitive transmission of essential but routine information.

Autorotation—A rotorcraft flight condition in which the lifting rotor is driven entirely by action of the air when the rotorcraft is in motion.

Auto Throttle(s)—A control system that positions and adjusts the throttle(s) of an aircraft to maintain a constant airspeed, which is set (and can be changed) by the pilot.

Avionics—Electrical and electronic equipment used in aviation, principally for navigation and communication.

Awareness, Level of (2b(2))—The theoretical level of cognitive or mental function resulting in our behavior.

Conscious Level—A level of mental awareness at which active information processing or “thinking” takes place. Only one operation at a time can take place at the conscious level.

Preconscious Level—A theoretical level of automatic information processing which is the repository of short-term and long-term memory and over-learned response modes and habit patterns. This processing capability

allows us to do more than one thing at a time.

Subconscious Level—The theoretical repository of information and response modes not usually available at the conscious level. Reflexes and psychological defense mechanisms operate at the subconscious level.

Below Minimums—Weather conditions below the minimums prescribed by regulation for the particular action involved (e.g., landing minimums and takeoff minimums).

Bends—See evolved gas disorders.

Boredom—See attention, anomalies of.

Briefing Inadequacy (3b(1))—When a mission element that should have been briefed was not or was inadvertently briefed, briefing is considered a factor. Normal tasks, such as lowering the gear for landing, are not considered mandatory briefing items, and briefings are not considered inadequate when such tasks are not covered.

Busting (2c(2)(d))—Failure to perform to a standard (as in “busting” a maneuver or sortie).

Calibrated Airspeed (CAS)—The indicated airspeed of an aircraft corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.

Channelized Attention—See attention, anomalies of.

Chokes—See evolved gas disorders.

Circadian Desynchronization—That state in which the body’s “normal” 24-hour rhythmic biological cycle (circadian rhythm) is disturbed; typically caused by movement across several time zones and generally having an adverse effect upon pilot performance. Colloquially referred to as “Jet Lag.”

Circadian Rhythm (2b(3)(d))—The tendency for some biological process to recur at regular intervals within sequential 24-hour periods.

Circularvection—See illusion.

Clearance—Authorization by a traffic control facility for an aircraft to proceed within controlled airspace.

Climbout Phase—See mishap, phase of flight.

Closed Traffic—Successive operations involving takeoffs and landings or low approaches where the aircraft does not depart from the traffic pattern.

Cloud Base—The lower surface of a cloud.

Cloud Deck—The upper surface of a cloud.

Cockpit Resource Management (2c(4))—The aircrew's prioritized, coordinated, and timely use of available resources, to include use of automation, delegation of tasks to other crewmembers, effective communication and interface with control agencies. (Indicates enforcement of crew coordination.)

Cognitive Engineering—The application of knowledge from cognitive psychology (psychology of information processing) to the engineering design of systems.

Cognitive (Mental) Flexibility (2b(1)(a))—An individual's ability to shift from one mental task to another or to effectively time-share between several tasks while maintaining situational awareness.

Cognitive (Mental) Saturation (2b(2)(b))—See attention, anomalies of.

Cognitive Psychology—The study of the acquisition, storage, and retrieval of information; the processing of that information; and the consequent decision making processes.

Command and Control (2c(2)(a))—The orderly distribution of authority and responsibility designed to systematically accomplish a mission; and the continuous-feedback-loop communications network connecting all levels of command so that decisions can be made, efforts coordinated, and discipline maintained. Command and control are considered factors when supervision is inadequate or when procedures over which the MAJCOM has control are inadequate, nonexistent, or characterized by inadequate supervision at unit or wing level, or inadequate mission planning or scheduling. Failure to monitor the

conduct of operations or failure to provide close inflight supervision where training and proficiency are suspect are also indicators of command and control deficiencies.

Communication Problems (2c(4))—Information transfer ineffectiveness (5 types).

Equipment Failure.

Message Content—Garbled, inaccurate, or ambiguous.

Message Generation—Message not originated.

Message Reception—Receiving party did not receive or understand.

Message Timing—Message correct, but not timely.

Compass Locator—A low-power, low- or medium-frequency (L/MF) radio beacon installed at the site of the outer or middle marker of an instrument landing system (ILS). It can be used for navigation at distances of approximately 15 miles or as otherwise authorized in the approach procedure.

Complacency—See attention, anomalies of; inattention.

Composite Flight Plan—A flight plan which specified VFR operation for one portion of flight and IFR for another position.

Compulsory Reporting Points—Reporting points, designated on aeronautical charts by solid triangles or filed in a flight plan as fixes selected to define direct routes, which must be reported to ATC as each is reached.

Cone of Ambiguity—An inverted cone extending upward from the site of a VOR/TACAN facility in which navigational signals tend to be unreliable.

Confidence (2b(5)(d))—An attitude in which a person is predisposed to think that he or she can perform a task.

Overconfidence—An attitude in which a person assumes that he or she can perform a task even though this may not be true because he or she has not successfully performed it in the

past, has performed it in the past but under different circumstances, or because it is unrealistic to attempt it at all.

Underconfidence—An attitude in which a person assumes that he or she cannot perform a task, even though he or she has the demonstrated capabilities necessary.

Conflict Situation—A state of affairs that exists when aircraft come within certain vertical, lateral, or longitudinal distances from each other. These distances may vary depending on the density of the airspace and the type of aircraft.

Confusion (2b(2))—Loss of situational awareness that is recognized by the individual concerned. A state characterized by bewilderment, emotional disturbance, lack of clear thinking, and (sometimes) perceptual disorientation.

Conscious Level—See awareness, level of.

Contingency (2b(5)(a))—One or more contributing factors which influence a situation, but may not be inherently hazardous (e.g., unforecast bad weather, ATC delays, supervisor comments, unspoken or written rules, etc.).

Contingency Discrimination (2b(5)(a))—The process of effectively rank ordering environmental considerations by importance in terms of real and near term consequences as perceived by the individual. (See prioritized events and conditions.)

Control Feel—The “feel,” or reaction, that a pilot perceives through the cockpit controls, either from the aerodynamic forces acting on the control surfaces, or from artificial input simulating these aerodynamic forces.

Controlled Airspace—Airspace designated as a continental control area, control area, control zone, terminal control area, transition area, or positive control area within which some or all aircraft may be subject to air traffic control.

Continental Control Area—The airspace of the 48 contiguous states, the District of Columbia and Alaska (excluding the Alaska peninsula west of longitude 160W) at and above 14,500 feet MSL, but not including the

airspace less than 1,500 feet above the surface of the earth.

Control Area—Airspace designated as Colored Federal Airways, VOR Federal Airways, control areas associated with jet routes outside the continental control area, additional control areas, control area extensions, and area low routes.

Control Zone—Controlled airspace which extends upward from the surface and terminates at the base of the continental control area.

Positive Control Area (PCA)—Airspace, designated in FAR Part 71, within which there is positive control of aircraft.

Terminal Control Area (TCA)—Controlled airspace extending upward from the surface or higher to specified altitudes, within which all aircraft are subject to operating rules and pilot and equipment requirements.

Transition Area—Controlled airspace extending upward from 700 feet or more above the surface of the earth when designated in conjunction with an airport for which an approved instrument approach procedure has been prescribed, or from 1,200 feet or more above the surface of the earth when designated in conjunction with airway route structures or segments.

Copilot—A pilot serving in any piloting capacity other than as pilot-in-command, but excluding a pilot who is on board the aircraft for the sole purpose of receiving flight instruction.

Copilot Syndrome (2c(4))—An attitude resulting in ineffective crew coordination based on the comforting premise that one or more other crewmembers have the situation under control and are looking out for your best interest. Implicit in the term “other crewmembers” are other nonflight members, such as ATC, the command post, RAPCON, etc. Rank may at times play a role.

Coping Style (2b(5)(b))—Individual techniques for responding to environmental challenge (may be personality dependent).

Coriolis Illusion—See illusion, vestibular.

Crew Coordination (2c(4), 2c(2)(a))—The systematic division of subtasks between crew or flight members so as to accomplish a larger task more efficiently. Crew coordination is the most basic level of command and control. (See cockpit resource management.)

Crew Systems—Those portions of aircraft systems/subsystems that are affected by the aircrew, such as the flight control system, flight display system, radar systems, and environmental control systems.

Critical Angle of Attack—The minimum angle of attack of a given airfoil or airfoil section at which extensive flow separation occurs, with consequent loss of lift and increase of drag; generally results in stalling of the airfoil.

Cruise Phase—See mishap, phase of flight.

Cumulative or Chronic Fatigue—See fatigue.

Decision (2b(5)(a))—The perception of information and selection of a response designed to achieve a desired goal after having made a judgment as to significance and priority. There are four main types: (1) information processed, correct decision, (2) information processed, incorrect decision, (3) information not adequately processed, incorrect decision, and (4) information not adequately processed, correct decision. (See judgment, response.)

Decision Delay—Failure to select a response in a timely manner due to an anomaly of attention or motivation.

Indecision—Wavering between two or more responses resulting in failure to select a response in a timely manner.

Poor Decision—Selection of an inappropriate response assuming adequate information and time to decide. (May be a result of diminished personal capacity due to stressors or fatigue.)

Decision Height (DH)—The height at which a decision must be made during an ILS or PAR instrument approach either to continue the approach or to execute a missed approach.

Decompression Sickness—See evolved gas disorders.

Deep Stall—A stabilized high angle of attack assumed by an aircraft after it reaches the stall angle.

Delayed Perception—See perception.

Delayed Response—See response.

Department of Defense Flight Information Publications (DOD FLIPs)—Publications used for flight planning, en route, and terminal operations. FLIPs are produced by the Defense Mapping Agency for worldwide use. En route charts and instrument approach procedure charts are incorporated in DOD FLIPs for use in the National Airspace System (NAS).

Descent Phase—See mishap, phase of flight.

Discipline (Personal) (2b(5)(b)1.)—Discipline is evident when an individual willfully adheres to known and understood directives or restrictions. (See motivation.)

Discipline Enforcement (2c(2)(b))—Discipline enforcement is the process of supervisory support of known principles, rules or directives.

Displaced Threshold—A threshold that is located somewhere other than at the designated beginning of the runway.

Distance Measuring Equipment (DME)—Equipment (airborne and ground) used to measure, in nautical miles, the slant-range distance of an aircraft from its position at altitude to the DME navigational aid on the ground.

Distraction—See attention, anomalies of.

Distress (2b(5)(c))—An affective state of feeling pressure or threat, usually at the limit of coping skills and associated with physiological changes and perhaps symptoms (see general adaptation syndrome). Behavior under a condition of distress will tend to be a behavior that was learned earlier than the appropriate one or one that was overlearned.

Double Standard (2c(2)(c))—The stated or implied condoning of violations of established rules or a perception that the rules do not apply to everyone.

Drugs (2a(4)(b))—Any chemical compound taken for purposes of prevention of disease, treatment of disease, weight management, mood alteration, birth control, or sleep management. The effects may be direct or residual, and may reduce performance capability.

Ear Blocks—See trapped gas effects.

Easily Interpretable—Values and information displayed that can be perceived and understood with a high degree of accuracy by users without additional measuring devices or scales.

Elevator Illusion—See illusion, vestibular.

Emergency (3b(3))—An unplanned occurrence which jeopardizes the safe completion of a task and requires specific and timely action to avoid damage or injury.

Emotion—See affective states.

Empty Field Myopia—See illusion, visual.

Engineering Psychology—The study of human behavior in using tools and machines and of machine design in relation to the human's behavioral capacities, abilities, and motivations.

Envelope (Personal) (2b(5)(e))—The real range of physical and mental capacity of an individual which varies in time. (see insight.)

Ergonomics (2d)—Human factors engineering which deals with machine design and workspace environment to make them compatible with human capacities and limitations.

Error, Technical (2b(5)(a))—An objectively inappropriate individual discreet action (error of execution). Examples are missing a radio call, being off altitude or airspeed, or improper switch or control operation. (May be influenced by a perceptual set, response set, or misleading environmental cues.) (See judgment.)

Adjustment Error—Operating a control too slowly or too rapidly, moving a control or switch to the wrong position, or following the wrong sequence in operating several controls or switches.

Forgetting Error—Failing to check, set, or use a control or switch at the proper time.

Reversal Error—Moving a control or switch in a direction opposite to that necessary to produce the desired result.

Substitution Error—Confusing one control or switch with another or failing to identify a control or switch when it was needed.

Unintentional Activation—Accidentally operating a control or switch.

Equipment Malfunction (3e)—This factor is used to refer to the occasions when an aircraft failure or malfunction, rather than a mission element, caused the pilot to be distracted or otherwise fail to accomplish the task at hand.

Event Proficiency (2b(1)(b))—Event proficiency (lack of) is considered a factor when the pilot attempting the mission element has (1) never done it before, (2) done it before but not recently, or (3) done it recently but for the first time. "Proficiency" and "currency" as defined by MAJCOM criteria are not necessarily synonymous, as the pilot's demonstrated ability to perform the task is the governing factor. (See learning, memory, training, skill, knowledge.)

Evolved Gas Disorders (Decompression Sickness) (2a(3)(b))—Effects produced by evolution of gas (usually nitrogen) from tissues and fluids in the body due to changes in barometric pressure (symptoms may also result from air embolism).

Bends—Manifestations of mild to severe pain, usually in the larger joints, due to nitrogen evolving from the blood.

Chokes—Deep and sharp pain centrally located under the sternum most often due to nitrogen evolving from the blood and locating in the smaller blood vessels of the lungs and producing a dry, nonproductive cough.

Neurological Manifestations—The effects of nitrogen evolving from the blood and locating in the brain or spinal cord. Symptoms may include blurred vision, blind spots, flickering lights, headaches, or unilateral numbness or tingling.

Skin Manifestations—The effects of nitrogen evolving from the blood and locating in subcutaneous tissue. Symptoms may include

itching, hot or cold sensations, tingling, or the appearance of a mottled rash.

Excessive Motivation—See motivation, anomalies of.

Exercise (Operational) (3b(2)(d))—A period of enhanced operational activity to demonstrate readiness.

Expectation (2b(5)(a))—A mental set in which environmental conditions are anticipated before their occurrence. This may lead to a perceptual or response set.

Expedite—A command used by ATC when prompt compliance is required to avoid the development of a dangerous situation.

Experience Lack (2b(1)(d))—Lack of experience is a factor when the events during a mishap were caused by a pilot's lack of background in the type aircraft being flown (fighter, bomber, cargo, etc.), the type mission being attempted (air-to-ground, air-to-air, low level, etc.), or the role being performed (flight lead, IP, etc.). Whether or not the aircrew was "experienced" according to MAJCOM definitions, if his or her inexperience in the aircraft, mission, or role led to the mishap, this factor is assigned.

Explosive Decompression—Rapid reduction of air pressure inside an aircraft, coming to a new static condition of balance with the external pressure. A change in cabin pressure faster than the lungs can decompress. Generally, any decompression which occurs in less than 0.5 seconds.

External Distraction—See attention, anomalies of.

Face Curtain—A sheet of heavy fabric designed to be pulled in front of the face for protection against wind blast during ejection from an aircraft.

Face Time (2b(5)(b)5.)—Time invested in increasing supervisory awareness of the individual (may be positive or negative.)

Fail Safe—A design feature of a system that permits malfunction or failure of the component(s) most at risk without resulting in a dangerous or catastrophic outcome.

Fascination—See attention, anomalies of.

Fatal Injury—Any injury which results in death within 30 days of occurrence.

Fatigue (2b(3))—The progressive decrement in ability due to prolonged or extreme mental or physical activity. Sleep deprivation, disrupted diurnal cycles, or life event stress may all play a role in producing a retrospectively unmeasurable but significant performance decrement. (See general adaptation syndrome.)

Acute or Transient Performance Decrement—The type of exhaustion associated with physical or mental activity between two regular sleep periods. Acute or transient performance decrement is eliminated after a regular sleep period.

Cumulative or Chronic Performance Decrement—The type of exhaustion resulting from an inadequate recovery from successive periods of acute or transient fatigue. One regular sleep period will not eliminate cumulative fatigue; however, several sleep periods and reduced interim activity will eliminate it.

Motivational Exhaustion—The type of exhaustion associated with the wearing effects of such psychosocial problems as unresolved conflicts, prolonged frustration, or constant worrying. It is not eliminated by any number of sleep periods without first resolving the conflict or removing the frustrations. (Also called subjective fatigue or burnout.)

Physical Fatigue—The effects of prolonged physical activity, or the effects of brief but extreme physical activity, either of which taxes a person's physical strength to the level of exhaustion.

Fight or Flight Response (2b(5)(f))—The heightened physiological state, automatically assumed by the body when faced with a crisis, to prepare for "fight or flight." This heightened physiological state may detract from rational processes and cause a person to overreact, overcontrol, or overlook significant cues. (See general adaptation syndrome.)

Fitness (2a(4)(c))—The relative physical state of a person in terms of the extent of a regular rigorous exercise program or a physically active lifestyle.

Active—At least 2 hours of rigorous exercise (e.g., sports, yardwork, etc.) per week or a very active physical life.

Athletic—At least 6 hours of rigorous exercise per week and a physically active lifestyle.

Inactive—Less than 1 hour of rigorous exercise per week or an intermittently physically active lifestyle.

Sedentary—No rigorous exercise and not physically active.

Fix—A geographical position determined by visual reference to the surface, by reference to one or more radio NAVAIDs, by celestial plotting, or by another navigational device.

Flameout—Unintended loss of combustion in turbine engines resulting in the loss of engine power.

Flare—The increase in pitch angle of an aircraft just before touchdown. This change in pitch attitude on final approach to touchdown allows the airspeed to dissipate and the aircraft to settle down to the runway in the proper attitude.

Flat Spin—A spin in which the longitudinal axis of the aircraft inclines downward at an angle less than 45 degrees.

Flicker Vertigo—See illusion, visual.

Flight Clothing (3c(5))—Items of clothing designed for inflight needs for protection and utility.

Flight Level—A level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury. It is stated in digits representing hundreds of feet. For example, flight level 250 represents a barometric altimeter indication of 25,000 feet; flight level 255 indicates 25,500 feet.

Flight Path—A line, course, or track along which an aircraft is flying or intended to be flown.

Flight Path Angle—The angle between the flight path of the aircraft and the horizontal.

Flight Plan—Specified information relating to the intended flight of an aircraft that is filed orally or in writing with a Flight Service Station (FSS) or an Air Traffic Control (ATC) facility.

Flying Proficiency (2b(1)(b))—As opposed to event proficiency, this factor is assigned if limited recent flying time or sorties were considered to be a factor in the mishap.

Focus of Attention—See attention, level of.

Foreground Loss Illusion—See illusion, visual.

Forgetting Error—See error.

Forward Slip—A slip in which the airplane's direction of motion continues the same as before the slip was begun. The primary purpose of the forward slip is to dissipate altitude without increasing the airplane's airspeed, particularly in airplanes not equipped with flaps.

Foveal Visual Cues (2a(2)(a))—Visual stimuli falling within an approximately six degree cone from a person's normal sight line. Visual cues in this region are typically detected photopically (with cones). Foveal vision is mostly used for discerning fine detail, depth, and distance estimation, and differentiating colors. Acuity falls to 0.25 (20/80) at 5 degrees off foveal axis. Visual information more peripheral to this is thought to function heavily as a contributor to ambient orientation. (See peripheral visual cues.)

G-Adaptation Illusion—See illusion, kinesthetic.

G-Differential Illusion—See illusion, kinesthetic.

Gamesmanship (2b(5)(b)(5))—(Also called careerism.) A form of manipulation of "the system" or its rules exerted by an individual for the sake of convenience or personal interest, often to the detriment of the intent of rules or guidance.

Gastrointestinal Gas Expansion—See trapped gas effects.

General Adaptation Syndrome (2b(5)(f))—The entire syndrome of psychological adaptive response in 3 stages (Selye):

1. Fight or flight response or alarm reaction—See fight or flight response.

2. Stage of resistance—stage of full adaptation to the stresses with consequent disappearance of symptoms (but with decreased coping reserve).

3. Stage of exhaustion—under severe or prolonged stress, finite coping ability is exceeded, resulting in reappearance of symptoms (burn-out).

General Inattention—See attention, anomalies of; inattention.

Geographic Misorientation (3b(2)(c))—The type of misorientation in which a person is correctly oriented with reference to the pitch, roll, and yaw axis (position in space) but not oriented in relation to known ground references or navigational fixes. (Lost, not spatially disoriented.)

Geometric-Perspective Illusion—See illusion, visual.

Giant-Hand Illusion—See illusion, vestibular.

Glide Slope (GS)—That which provides vertical guidance for aircraft during approach and landing. The glide slope consists of the following:

1. Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS, or
2. Visual ground aids, such as VASI, which provide vertical guidance for VFR approach or for the visual portion of an instrument approach and landing.

GMT—Greenwich Mean Time—The mean solar time of the meridian of Greenwich, England used as the prime basis of standard time throughout the world. Expressed in hours GMT or hours Z (zulu phonetically).

Graveyard Spin—A sequence of repeated spins occurring because, in the proper recovery from a spin, the pilot's motion-sensing system tends to create an illusion of spinning in the opposite direction. Responding to this somatogyral illusion, the pilot returns the plane to its original spin.

Graveyard Spiral—A progressively steepening spiral resulting from the somatological illusion during a coordinated constant rate turn that has ceased to stimulate the motion sensing system of the pilot. When, in this situation, the pilot observes a loss of altitude, the tendency is to pull back on the controls, thus tightening the spiral and increasing the loss of altitude.

Ground Effect—The apparent increase in aerodynamic lift experienced by an aircraft when flying near the ground and observed up to a distance above the ground approximately equal to the wingspan of the aircraft.

Ground Speed—The speed of an aircraft relative to the surface of the earth, typically expressed in knots or statute miles per hours.

Gust—A sudden brief increase in the wind; according to United States Weather Bureau practice, gusts are reported when the variation in wind speed between peaks and lulls is at least 10 knots.

Habit Pattern Interference or Substitution—See response set and perceptual set.

Habituation—See attention, anomalies of.

Hangover (2a(4)(d))—A popular term for the state of diminished mental and physiological capacity associated with a period following heavy alcohol intake (usually less than 24 hours).

Histotoxic Hypoxia—See hypoxia.

Horizon Misplacement—See illusion, visual.

Human Factors—The study of the human side of safety, in other words the capacities and limitations of the human meeting environmental demands. (There is also HF engineering, referred to here under biomechanical, ergonomic and cockpit design topic headings.)

Humor (3f(6))—An affective response to an event where expectations differed grossly from actuality. It may be positive or negative depending on whether expectations were exceeded or not met. (See also morale.)

Hypemic Hypoxia—See hypoxia.

Hyperventilation (2a(1)(b))—Abnormally fast or deep respiration which results in sufficient change in blood pH to cause symptoms in an individual.

Hypoxia (2a(3)(a))—Insufficient oxygen delivered to tissue, of which the brain is most sensitive.

Histotoxic Hypoxia—Inability of tissues to transfer oxygen.

Hypemic Hypoxia—Inability of the blood to carry sufficient oxygen.

Hypoxic Hypoxia—Insufficient inspired oxygen.

Stagnant Hypoxia—Insufficient circulation of oxygenated blood to a tissue.

Hypoxic Hypoxia—See hypoxia.

Illusion—An erroneous interpretation of reality due to limitations of sensory receptors or the manner in which sensory information is presented or interpreted.

Illusion, Kinesthetic (2a(2)(c))—An erroneous perception of somatosensory stimuli to the ligaments, muscles, or joints of the body (proprioceptive).

G-Adaptation Illusion—An erroneous perception that motion has ceased after exposure to a sustained velocity. For example, movement in an elevator is only perceived at the beginning and end of the ascent or descent.

G-Differential Illusion—An erroneous perception of aircraft attitude based on “seat of the pants” sensations. Without other sensory inputs, a 30 degree bank level turn feels the same as a 60 degree bank descending turn.

Illusions, Vection (2a(2)(a)1.)—Visual illusions of motion, erroneously detected peripherally, in which a person perceives that he or she is moving when in fact an external object is moving.

Circularvection—An erroneous sensation of rotation due to movement detected in the visual field, especially peripherally.

Linearvection—An erroneous perception of linear movement due to motion detected in the visual field, especially peripherally.

Illusion, Vestibular (2a(2)(b)1.)—An erroneous perception of orienting stimuli to the semicircular ducts or otolith organs of the vestibular apparatus.

Coriolis Illusion—An erroneous sensation of rotation due to the movement of the head into a plane of angular or linear acceleration which induces fluid movement in the semicircular ducts.

Elevator Illusion—An erroneous sensation of pitch-up after level off from a steep descent, or pitch-down after level off from a steep climb, or when in turbulence.

Leans—An illusion of angular displacement (bank) due to an undetected subthreshold angular acceleration followed by a detected, transtreshold angular acceleration.

Giant-Hand Illusion—The erroneous sensation that controls will not respond to inputs, even with seemingly great effort, when the source of resistance is in fact the operator himself or herself attempting to respond to conflicting sensory cues.

Oculo-Vestibular—An illusion of spinning induced by a viewing of what appears to be a spinning environment (rotating beacon).

Somatogravic Illusion—An erroneous sensation of tilt in the vertical plane due to linear acceleration. This illusion is most common during rapid acceleration or deceleration.

Somatogyral Illusion—An erroneous perception that rotation has ceased because the semicircular canal fluid has stabilized after angular acceleration. The graveyard spin and graveyard spiral are results of the somatogyral illusion.

Illusion, Visual (2a(2)(a)1.)—An erroneous perception of stimuli to the visual system. (See illusion, vection.)

Autokinesis—an erroneous perception of movement of a light when stared at for a length of time in a dark visual field.

Empty Field Myopia—The tendency for the eyes to focus at a distance of about one meter when viewing a visually nonstimulating field such as solid black or white. This may be worsened by near (canopy) reflection or glare.

False Horizon—A visual illusion which occurs when ground lights are mistaken for stars or vice versa, or when sloping terrain or clouds are mistaken for level horizon. A variant of this can occur at night on a range when the receding margins of an area lit by a falling flare create a false horizon effect.

Flicker Vertigo—The disruptive psychological effects of cyclic visual stimulation of about 10-15 cycles per second.

Foreground Loss Illusion—The blending or blurring into the foreground of nearby objects when focusing on a distant object.

Geometric-Perspective Illusion—An erroneous perception of distance from an object due to equating retinal image size to distance or angular displacement from familiar objects. (Examples: An 8,000 feet runway viewed from 1,000 feet above it may appear the same size as a 10,000 feet runway viewed from 1,500 feet, or the tendency to flare high on a wider than usual runway.)

Vestibulo-Ocular—An erroneous and pathological vestibularly generated sensation of spinning that will affect visual interpretation of the environment (possibly inducing nystagmus).

Inactive—See physical condition.

Inattention—See attention, anomalies of.

Incident—An occurrence other than an aircraft mishap, associated with the operation of an aircraft, which adversely affects or could affect the safety of operations.

Information Processing (2b(5)(a))—The mental process of receiving incoming information from the environment, assessing its meaning, and deciding on an appropriate response. (See decision making.)

Insight (2b(5)(e))—Awareness of one's own capabilities and relationship to various environmental circumstances. (See envelope and self preflight.)

Internal Distraction—See attention, anomalies of.

Internalized Unit Values (3f(6))—A value system in which a person has taken the values, motives, and prioritized goals of the unit as his or her own. Such a person is referred to, colloquially, as a "team player." (see motivation.)

Intuitively Obvious—Term applied to that which can be described or operated correctly without training or explanation.

Inverted Spin—A spin throughout which the airplane is upside-down.

Job Satisfaction (3f(6))—A person's subjective evaluation of the extent to which he or she is performing and progressing satisfactorily in the occupation of his or her choice and which meets his or her "professional needs." (See morale.)

Judgment (2b(5)(a))—Assessing the significance and priority of information from the environment in terms of how they relate to the overall task at hand. The exercise of this process forms the basis on which subsequent technical decisions are made. (See decision.)

Judgment Delay—Failure, due to an anomaly of attention or motivation, to assess the significance and priority of information from the environment in a timely manner, assuming adequate quality and quantity of information.

Judgment Error—An objectively inappropriate selection of a course of action constituted by a number of subsequent subtasks. (Error of intention.) Examples are electing to shoot an approach below minimums, or accepting an aircraft or personal condition inappropriate to anticipated mission demands. (See error, technical.)

Judgment, Poor—Failure to realistically assess the significance and priority of information from the environment, assuming adequate quality and quantity of information, due to anomaly of attention or an anomaly of motivation.

Kinesthetic Illusion—See illusion.

Knowledge Lack (2b(1)(d))—When a pilot was adequately exposed to the information needed to

perform the mission element but did not absorb it, lack of knowledge is considered a factor. Lack of knowledge implies no deficiency in the training program, but rather the failure of the pilot to absorb or retain the information. (Exposure to information at a point in the past does not imply "knowledge" of it; see learning, memory, skill.)

Landing Hot—Landing an aircraft at a speed substantially greater than its stalling speed.

Landing Phase—See mishap, phase of flight.

Law of Exception—In the investigation of aircraft mishaps, the principle according to which, if all concrete or provable causes have been ruled out, it is concluded that the operative cause was one based on history of the particular aircraft or perhaps a typical or logical operator input.

Leans—See illusion, vestibular.

Learning (2b(1)(a))—Adjustments to a person's behavior or thinking as a result of internalization of information. It is observed through either manual skill or vocabulary. This process is less efficient under the extremes of stress, whether too little or too great. (See memory, skill, knowledge, and training.)

Learning Ability—The innate capacity to acquire new skills or knowledge and apply them practically.

Learning Rate—The relative efficiency with which new information is acquired and relatively permanent adjustments made in one's behavior or thinking.

Learning Reinforcement—The activity of recalling and reviewing information or experiences to retain them for use in applied situations.

Learning Transfer—The ability of a person to apply, in present or future situations, the related experience (or less significantly, knowledge) acquired in past situations.

Linearvection—See illusion, visual.

Locus of Control (2b(5)(b))—An attitudinal set in which a person believes he or she is in control

of his or her destiny (internal locus of control) or that outside influences control his or her destiny (external locus of control).

Long-Term Memory—See memory.

Major Injury—Any injury which: (1) requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received; (2) results in a fracture of any bone (except simple fractures of fingers, toes, or nose); (3) causes severe hemorrhages, or severe nerve, muscle, or tendon damage; (4) involves any internal organ; or (5) involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface.

Margin of Attention—See attention, level of.

Mean Time Between Failure (MTBF)—Total system operating time divided by the number of system failures that have occurred during that period; the average time one could expect a given system to operate before experiencing a system failure.

Memory (2b(1)(d))—The mental activity of recalling past experience. Experience includes any information a person receives through any means, any cognitive functions he or she performed on that information, and any response he or she made as a result of it. (See learning.)

Long-Term Memory—The recall or recognition of experience or information days, months, or years after its occurrence.

Short-Term Memory—The recall or recognition of experience or information within a few hours of occurrence. (Usually more strongly diminished by stress or fatigue.)

Working-Memory—That experience or knowledge which is immediately available. It is usually sensory rather than verbal.

Microburst—A localized but very severe weather phenomenon resulting in dramatic and abrupt changes in wind direction and velocity.

Mind Set—See perceptual set and response set.

Mishap—An unplanned, unintended event that results in damage to equipment or injury to personnel.

Mishap, Antecedent Events—Those events or conditions which occurred before the demonstration of intent for flight but which relate to the conditions making the mishap more likely (e.g., fatigue, get-home-itis, etc.).

Mishap, Maneuver—A subelement of the mishap phase of flight described by the sequence of tasks required to perform the event (e.g., turn out of traffic, formation crossover, egress from a weapons delivery pass, etc.).

Mishap, Phase of Flight—The phase of flight being performed at the point of the mishap.

Approach Phase—Final approach fix to missed approach point for an instrument approach; from reaching traffic pattern altitude until crossing the runway threshold for a visual approach. A go-around is considered part of the approach phase if it occurs before the missed approach point for an instrument approach or before crossing the runway threshold for a visual approach.

Climbout Phase—From the time of configuring for climbout to reaching cruise altitude.

Cruise Phase—From reaching cruise altitude to arrival at the area of range activity; or from leaving the range activity to beginning descent into the base of intended landing.

Descent Phase—From the initial approach fix to the final approach fix for an instrument descent; from beginning descent from cruise altitude to the final approach fix for an en route descent to an instrument approach; from beginning descent from cruise altitude until reaching traffic pattern altitude for an en route descent to a visual approach. Holding is considered part of the descent phase of flight.

Landing Phase—From the missed approach point until touchdown for an instrument approach; from crossing the runway threshold until touchdown for a visual approach. A go-around is considered part of the

landing phase if it occurs after the missed approach point for an instrument approach or after crossing the runway threshold for a visual approach. After touchdown, a touch-and-go is considered a take-off.

Range Phase—The time when the aircraft enters the area designated for practicing or conducting mission activities until departure. This may be in a low level route, military operating area, gunnery range, warning area, refueling track, etc.

Takeoff Phase—Runway hold line to airborne and past the field boundaries (until configuring for climbout).

Taxi Phase—From engine start to runway hold line, and from clearing the active runway to having parked the aircraft.

Mishap, Point of—That point in the mishap sequence of events at which no preventive or evasive action by the operator would have avoided the mishap. (Not always the point of impact.)

Mishap, Predisposing Events—Those events or conditions more general in nature or more longstanding than mishap antecedent events but which are predisposing to mishap occurrence (e.g., risk-taking tendencies, lax supervision, etc.).

Mishap, Sequence of Events—Those events or conditions related to the mishap which begin with demonstration of intent for flight as defined in AFR 127-4, and end when damage or injury has ceased.

Mishap, Task (3b(2))—A subelement of the mishap maneuver which describes each specific action required of the operator to accomplish that maneuver (e.g., switchology, target tracking, aircraft positioning, etc.).

Mishap "Factors"—Are an attempt to explain and catalog at HQ AFISC why "primary causes" occurred. The factors defined are not mutually exclusive but rather are often interrelated and, in some cases, influence one another. As a result, most mishaps involve multiple mishap factors.

Mishap Type Categories (3b)—The type mishap is a mishap category assigned by the Reports

and Analysis Division at AFISC. Type mishap does not necessarily imply "cause," but rather 1 of the natural mishap groupings that emerged from a comprehensive study of 3,400 mishaps done in 1975.

Cargo Delivery—Mishaps directly involving cargo delivery problems (LAPES, etc.) comprise this category.

Collision With the Ground—This mishap category is assigned when a pilot flies the aircraft into the ground without being forced to by a materiel failure. A materiel failure may exist, but if adequate control and power were available to avoid the terrain, this category is assigned.

Control Loss—Control loss is a mishap category assigned when a pilot stalls, spins, departs, or otherwise exceeds the aircraft's flyable angle of attack. Mishaps where the pilot fails to cope with the aerodynamic characteristics of the aircraft (such as putting it in a position from which recovery is impossible) are included in this category, but flight control or autopilot malfunctions are not.

Flameout (Pilot)—This mishap category involves pilot-induced flameouts for any reason. Inadvertent or intentional shutdown, fuel mismanagement, and flying out of the engine's tolerable envelope are examples of this type mishap.

Flight Controls, Landing Gear, Engine, Fuel System, Etc.—Mishaps that involve failure of aircraft systems are categorized by the system that failed. The rationale for this is twofold. First, our materiel failure prevention efforts are better served by isolating those mishaps where an aircraft system failure precipitated an aircrew error from those involving aircrew error only. Second, we believe that given enough system failures, the potential for an aircrew error increases, an error the pilot would not have made had the system not failed to begin with. Mishaps involving aircrew error preceded by an unrelated system failure are categorized by the type of error made.

Midair Collision—Mishaps that involve aircraft hitting each other during flight (starting

takeoff roll to end of landing roll) are categorized as midair collisions, regardless of whether the pilot or a flight-control failure was the cause.

Ops Other—Mishaps that involve the aircrew but do not fit any of the major operations types are classified by HQ AFISC as "ops other." Examples are a pilot who perceives a problem that does not really exist and ejects from a perfectly good airplane, or a pilot who has a taxi mishap because he or she did not notice brake hydraulic systems were turned off.

Range—This mishap category is assigned when a pilot fails to recover from an air-to-ground ordnance delivery pass, or if a pilot loses control while engaged in the activity of delivering ordnance. Again, the activity is the governing factor rather than the location, and mishaps that occur during actual or simulated ordnance delivery are categorized as range mishaps whether or not the aircraft crashed on range property.

Takeoff or Landing—Mishaps that occur during takeoff or landing and that do not involve any materiel failure are categorized as takeoff or landing mishaps. These mishaps must occur on takeoff before configuring for climb, or during landing after the pilot begins to flare or align the aircraft with the runway.

Tests—This mishap category primarily applies to mishaps involving weapons testing; e.g., A-10 gun gas ingestion.

Misperception—See perception.

Misplaced Motivation—See motivation, anomalies of.

Mission Demands (3b(2))—The relative degree of workload requirements inherent in different types of missions as a function of the number or difficulty of mission events.

Modeling (2c(2)(c))—Behavior exhibited by peers and supervisors in the context of its influence on learning in an individual observing them. (See learning, memory.)

Mood—See affective states.

Morale (3f(6))—A mindset consisting of a set of subjective assessments of well being relative to factors an individual perceives as important (which may be characterized by confidence and optimism or by bitterness and pessimism). Morale suffers when unnecessarily high or vague expectations are created because subsequent actual experience cannot measure up to them.

Motivation—A person's underlying or internalized drive consisting of a prioritized value system which influences his or her behavior and thought.

Motivation, Anomalies of (2b(5)(b)2.)—Characteristics of a person's value system which may result in unsafe acts.

Motivation, Excessive—Attributing a higher value to successfully performing the mission than actually warranted by the importance of the mission. Past failures often create this higher than desirable will to succeed, especially if the failures resulted in criticism. Overmotivation has also resulted from overemphasis on competition, with the attendant underemphasis on training.

Motivation, Misplaced—A situation in which the factors that influenced a person's selection of a course of action were superficially or not at all related to the objective requirements of the mission.

Motivation, Under—Attributing a lower value to successfully performing the mission than actually warranted by the importance of the mission.

Neurological Manifestations—See decompression sickness.

Nonperception—See perception.

Operator—The person in control of the aircraft at the point of the mishap. Other personnel involved in the mishap sequence of events are considered part of the operator's equipment or support.

Overcommitment (2b(5)(b)4.)—A response set in which a person commits to a task for which he or she is knowingly ill-prepared and which

presses pilots and their aircraft beyond reasonable limits ("taking a chance" or "pressing"). (See motivation.)

Overconfidence—See confidence.

Overtasking (2c(2)(d))—When a pilot is tasked to perform a mission element he or she is not capable of performing or put in a situation where success requires that person to exceed his or her capabilities, the pilot is considered to be "overtasked." Overtasking normally involves supervisors, schedulers, or flight leaders and implies some need for supervisory awareness of the variable capacities of those being tasked.

Peer Pressure (2c(1)(c)2.)—A motivating factor stemming from a person's perceived need to meet peer expectations. Peers may or may not express those expectations.

Perceived Special Sortie—See special sortie.

Perception, Sensory (2a(2))—The detection of transthreshold cues from the environment by one or more of the senses.

Perception, Delayed (2b(2))—Failure to detect cues in a timely manner due to an anomaly of attention or motivation.

Perception, Mis (2b(2))—Failure to detect or correctly interpret cues due to an inappropriate perceptual set.

Perception, Non—Inability to detect cues from the environment because of sensory limitations or the manner in which the cues are presented. (Possibly a cockpit design concern.)

Perception, Intellectual (3f(6))—The individual's general interpretation of surroundings, events, or conditions. This is influenced by such factors as the personality, motivation, and the expectations of the person. (See motivation, morale.)

Perceptual Set (2b(2)(h))—A cognitive or attitudinal framework in which a person expects to perceive certain environmental cues and tends selectively to search for those cues more actively than others. One extreme of this anomaly is when the expectancy is so strong that he or she perceives cues that in fact are not there; the other extreme is when he or she does not expect

cues to the extent that he or she does not detect cues that are there. Perceptual distortions in the form of illusions may also result. (See attention, anomalies of; inattention.)

Peripheral Visual Cues (2a(2)(a))—Visual stimuli falling outside of an approximately 6 degree cone from a person's normal sight line. Visual cues in this region are typically detected scotopically (with rods). Peripheral vision detects gross movement and even if not consciously recognized, contributes to ambient orientation. (See foveal visual cues.)

Personality Variables (2b(5)(b))—Those traits of a person which characterize his or her behavior, may predispose him or her to certain response patterns, and allow for some generalized predictions as to how a certain type individual is likely to respond in different situations.

Phase of Flight, Mishap—See mishap.

Physical Fatigue—See fatigue.

Physical Strength (2a(4)(c))—In the absence of objective measurement, this may be a subjective judgment of peers as to the relative physical strength of a person.

Physical Task Saturation (2b(4)(a))—A situation in which the number or difficulty of manual tasks to perform in a compressed time period exceeds a person's capacity to perform all of them (may be a result of poor crew coordination).

Point of Mishap—See mishap.

Preconscious Level—See awareness, level of.

Predisposing Events, Mishap—See mishap.

Pressing—See overcommitment.

Prioritized Significant Events and conditions (2b(5)(a))—A dynamic, cognitive hierarchy of perceived environmental factors which serves to organize what tasks need to be performed, and in which order, to manage the immediate situation. (See contingency discrimination.)

Procedural Knowledge (2b(1)(d))—Knowledge of the capabilities and limitations of the weapon system, and the tactics used to employ it in

various environmental conditions that has been acquired through formal training.

Procedures Inadequacy (3b(3))—When the procedures for accomplishing a task are clearly inadequate, this factor is assigned. For example, procedures for determining the adequacy of a strafe pit were lacking, and the resulting increased ricochet density caused a destroyed aircraft due to 22 mm engine FOD.

Professional (3f(6))—A term applied to a vocation which implies autonomy, group identity, altruism, extraordinary skill, and exercise of judgment.

Poor Decision—See decision.

Poor Response—See response.

Radar Service—A term which encompasses one or more of the following services based on the use of radar which can be provided by a controller to a pilot of a radar identified aircraft:

Radar Monitoring—The radar flight following an aircraft (whose primary navigation is being performed by the pilot) to observe and note deviations from its authorized flight path, airway, or route. Radar monitoring may include the monitoring of instrument approaches as well as en route radar flight following.

Radar Navigational Guidance—Radar vectoring of aircraft to provide course guidance.

Radar Separation—The use of radar to maintain spacing between aircraft in accordance with established minimums.

Rain Check (2b(5)(e))—The decision not to carry out a given act after appropriate risk analysis.

Range Phase—See mishap, phase of flight.

RAPCON Facility—A terminal ATC facility that uses radar and nonradar capabilities to provide approach control services to aircraft arriving, departing, or transiting airspace controlled by the facility.

Reaction Time (2b(2), 2b(4))—An inherent human limitation which requires an individual a

task-specific amount of time for information processing before action is taken. It includes the elements of perception, interpretation, judgment, decision, and response. Execution time required at any step may depend on experience, attention focus, fatigue, etc.

Redundant Design—A technique of incorporating into a system two or more components that perform the same function(s) so that if one fails or malfunctions the other(s) will perform the necessary functions to enable the system to continue to operate safely.

Regular Sleep Period (2b(3)(c))—The period of a 24-hour day that a person usually spends in continuous sleep. This must be on home time.

Response (2b(5)(a))—The execution of a selected course of action. This may include taking no action if that was the decision made. (See decision.)

Response, Delayed—The execution of a selected course of action so long after the decision was made that the selected course of action is no longer either appropriate or effective.

Response, Poor—Ineffective execution of a selected course of action due to cognitive or physical task saturation, an anomaly of attention, an anomaly of motivation, or lack of sufficient procedural knowledge.

Response Set (2b(1)(c))—A cognitive or mental framework of expectations which predispose a person to a certain course of action regardless of the environmental cues. (See inattention under attention, anomalies of.)

Habit Pattern Interference—Reverting to previously learned response modes which are objectively inappropriate to the task at hand. Habit pattern interference usually occurs at the preconscious level of awareness.

Habit Pattern Substitution—Reverting to previously learned and objectively inappropriate response modes when the appropriate response is unavailable due to a lack of procedural knowledge. Habit pattern substitution usually occurs at the conscious level of awareness.

Retrofit—Acronym for retroactive fit; a modification of an aircraft, aircraft component, or other object that duplicates a change or modification made in later models of the same type.

Reversal Error—See error.

Rotorcraft—An aircraft which in all of its usual flight attitudes is supported in the air wholly or in part by a rotor or rotors; i.e., by airfoils rotating or revolving about an axis. The term rotorcraft is commonly applied to a helicopter, autogyro, or the like, in which the sustaining airfoils rotate about a substantially vertical axis.

Scenario—An outline of a mission flight plan giving the particulars of each mission phase.

Sedentary—See physical condition.

See and Avoid—A visual procedure wherein pilots of aircraft flying in visual meteorological conditions (VMC), regardless of type of flight plan, are charged with the responsibility to observe the presence of other aircraft and to maneuver their aircraft as required to avoid collisions.

Selective Inattention—See attention, anomalies of.

Self-Image (2b(5)(b)3.)—This factor has been assigned by HQ AFISC in mishap reviews where the pilots involved persistently appeared to perceive themselves as far better, smarter, or more capable than they were. (See insight, motivation, and overconfidence, a task-oriented term.)

Self Preflight (2b(5)(e))—Personal self assessment that includes physiological and mental readiness in light of specific planned mission objectives.

Sequence of Events, Mishap—See mishap.

Service Ceiling—The height above sea level, under standard atmospheric conditions, at which a given airplane is unable to climb faster than 100 feet per minute.

Short Range Clearance—A clearance issued to a departing IFR flight which authorizes IFR flight to a specific fix short of the destination while

air traffic control facilities are coordinating and obtaining the complete clearance.

Short-Term Memory—See memory.

Shroud Line—In a parachute, any one of a number of lines that attach the harness or load to the canopy. Also called a shroud, or a suspension line.

Sideslip—A slip in which the airplane's longitudinal axis remains parallel to the original flight path, but in which the actual flight path changes direction according to the steepness of the bank. A sideslip is used to make the airplane move sideways through the air to counteract the drift which results from a crosswind.

Simulator—A device or facility that provides a representation of some essential elements of a system out of their normal setting in such a manner that the representation is a valid analog of the system to be used in the training and maintenance of pilots' skills. These are of limited value in mishap reconstruction and such results must be guardedly interpreted.

Sinus Block—See trapped gas effects.

Situational Awareness (2b(2))—Keeping track of the prioritized significant events and conditions in one's environment. Confusion here may affect the sequence or priority of tasks to be performed. ("Getting behind the power curve.") (See attention, vigilance.)

Skill or Technique Lack (2b(1)(d))—Skill or technique deficiencies are considered a factor when a pilot either lacks the required motor skills or uses an improper technique to perform the task attempted. (See learning.)

Skin Manifestations—See decompression sickness.

Slant-Range Distance—The distance from an aircraft directly to an airfield, a navigational fix, or another aircraft which is at a different elevation. The slant-range distance between two objects when they are at different elevations is greater than the horizontal distance.

Snap Roll—A maneuver in which an airplane is made, by a quick movement of the controls, to

complete a full rotation about its longitudinal axis while maintaining an approximately level line of flight.

Soar—To fly without propulsive power, as in a glider. It is called dynamic soaring unless it is done on ascending air currents; then it is called up-current soaring.

Somatogravic Illusion—See illusion, vestibular.

Somatogyral Illusion—See illusion, vestibular.

Spatial Disorientation, Unrecognized (Type I) (2a(2)(b)1.)—Unrecognized incorrect orientation in space. It may result from an illusion, an anomaly of attention, or an anomaly of motivation, but it is not accompanied by discomfort or confusion because it is not noticed. This is also referred to as spatial misorientation.

Spatial Disorientation, Recognized (Type II) (2a(2)(b)1.)—Recognized incorrect orientation in space typified by a discrepancy between sensory information and cognitive expectancy. The illusory sensory source may be visual, kinesthetic, or vestibular, and the effect of the cognitive conflict may range from mild discomfort or confusion to incapacitation.

Spatial Disorientation (Type III) (2a(2)(b)1.)—Lack of knowledge as to orientation in space due to the inability to detect orienting cues, as in a rapidly spinning or tumbling aircraft. In this situation the lack of orientation is recognized, but there are neither useable cues nor a cognitive expectation of true orientation. (Also called vestibulo-ocular disorganization.)

Special Sortie—A sortie which is singularly urgent or a measure of capability.

Actual Special Sortie (3b(2))—A sortie which is objectively urgent or a measure of capability such as combat, medical evacuation, weather evacuation, or search and rescue.

Perceived Special Sortie (2b(5)(g))—A sortie which is subjectively perceived to be urgent or a measure of capability, such as a checkride, an ORI, a higher headquarters exercise, or Red Flag. (See perception, intellectual.)

Special Use Airspace—Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and wherein limitations may be imposed upon aircraft operations that are not part of those activities. Special use airspace includes such areas as military operating areas, prohibited areas, and restricted areas.

Special VFR Conditions—Weather conditions in a control zone which are less than basic VFR but in which some aircraft are permitted flight under Visual Flight Rules.

Specification—A detailed, precise description of a weapon system, its hardware, software, geometry, or other design parameter.

Spin—A maneuver, either deliberate or inadvertent, of a stalled airplane in which the airplane descends in a helical path at an angle of attack greater than the angle of maximum lift. The nose of the aircraft in a spin is usually, though not necessarily, pointed sharply downwards. In a normal spin the longitudinal axis of the aircraft inclines downward at an angle greater than forty-five degrees.

Spiral—A maneuver or performance, especially of an airplane, in which the craft ascends or descends in a helical (corkscrew) path, distinguished from a spin in that the angle of attack is within the normal range of flight angles; also, the flight path of an aircraft so ascending or descending.

Split S—A flight maneuver consisting of a half snap roll followed by a pullout and accomplishing a 180 degree change in direction accompanied by a loss of altitude.

Stability, Aerodynamic—The inherent flight characteristic of an aircraft tending to restore it to its original condition when disturbed by an unbalancing force or moment.

Directional Stability—The stability of a vehicle about its yaw axis.

Dynamic Stability—That characteristic of an aircraft that determines the nature of its subsequent motion when displaced from its normal flight attitude(s) by an external force or by movement of the control surfaces.

Negative Dynamic Stability—The characteristic of an aircraft that causes the amplitude of an oscillatory motion to increase with time.

Positive Dynamic Stability—The characteristic of an aircraft that causes the amplitude of an oscillatory motion to decrease with time.

Inherent Stability—Stability of an aircraft due solely to the disposition and arrangement of its fixed parts; i.e., that characteristic which causes it, when displaced, to return to its normal attitude of flight without the use of controls or the interposition of any mechanical devices.

Lateral Stability—The characteristic of an aircraft that causes it to remain stable or regain stability when caused to roll or sideslip.

Longitudinal Stability—The characteristic of an aircraft that causes it to right itself or retain stability with respect to vertical displacement of the nose and tail of the aircraft about the center of lift (i.e., pitching motion).

Static Stability—The initial tendency that an aircraft displays after its equilibrium has been disturbed.

Static Stability, Negative—The characteristic of an aircraft which causes it, when disturbed from equilibrium, to continue to change attitude in the direction of disturbance (also called static instability).

Static Stability, Neutral—The characteristic of an aircraft that, when disturbed from equilibrium, neither causes it to continue in the direction of displacement nor causes it to return to its original attitude. A neutrally stable airplane is one which, if once disturbed from a state of steady flight, will not return to its original flight attitude but may seek any new flight attitude and state of steady flight. Dynamically, such an airplane is neither stable nor unstable.

Static Stability, Positive—The characteristic of an aircraft which causes it, when disturbed, to return to its previous attitude of equilibrium.

Stagnant Hypoxia—See hypoxia.

Stall—A condition wherein the airflow separates from the airfoil surface, or the airflow around the airfoil becomes turbulent. The result of a stall is that the force or lift effect of the airfoil is lost or severely reduced.

Stall Speed—Speed at which an aircraft will stall under given flight conditions.

Standard Rate Turn—A turn of three degrees per second.

Standard Sortie (3b(1))—One of a set of preplanned, commonly flown flight itineraries in use by a squadron.

State-Dependent Memory (2b(1)(d))—A learning anomaly in which a learned task is best remembered when the conditions exist that were present at the time of learning. Thus, procedural “knowledge” gained in a classroom setting may not be recalled in an operational setting.

Stress—Mental or physical demand presented or perceived as such to an individual necessitating some action or adjustment. (See also distress.) Also, in physics; the force per unit area over a body that tends to produce deformation.

Mission Stress (3b(2))—If the conditions surrounding a mission generate excessive stress, this is considered a factor. These conditions are often present during deployments, checkrides, exercises, and other high-visibility missions. (See special sortie.)

Personal Stress (2c(1))—Personal stress may be a factor if a pilot has unusual or severe personal problems. Although difficult to assess the extent to which these problems might influence his or her performance, personal stress may be considered a factor if severe problems exist.

Subconscious Level—See awareness, level of.

Subjective Fatigue—See fatigue.

Substitution Error—See error.

Subthreshold—See threshold.

Supervisory Pressure (2b(5)(g))—A motivating factor stemming from a person’s need to meet perceived supervisory expectations, whether or not those expectations are overtly expressed.

Suprathreshold—See threshold.

Symbology—The use of one or more symbols which make up a format to portray or define information

Takeoff Phase—See mishap, phase of flight.

Taxi Phase—See mishap, phase of flight.

Tech Data Inadquacy (3e(5))—Mishaps involving maintenance or design technical data which are clearly deficient are assigned this factor. A lack of description of generally known procedures (such as buttoning up panels when through or using left rudder if the aircraft drifts right on landing) is not considered an inadequacy.

Temporal Distortion (2b(2)(g))—A transient subjective experience of space or time compression or expansion relative to reality usually associated with a “fight or flight” response.

Terrain (2a(2)(a))—Conformation, texture, and type of earth surface beneath the plane of flight.

Threshold, Sensory (2a(2))—An inherent perceptual limitation which requires that stimuli be presented within a certain range of intensity and duration to insure perception by the individual.

Subthreshold—Stimuli that are presented below a detectable range or duration and thus are not perceived.

Suprathreshold—Stimuli that are presented above a detectable range or duration and thus are not perceived.

Transthreshold—Stimuli that are presented within a detectable range and duration and thus are perceived.

Tooth Pain—See trapped gas effects.

Training Program Inadequacy (3f(1))—Training program deficiencies are considered to be a factor when a pilot was not trained or was judged inadequately trained to perform the mission element being attempted.

Transthreshold—See threshold.

Trapped Gas Effects (2a(3)(c))—The physiological effects of the expansion of trapped gases in the body due to changes in barometric pressure.

Ear Block—Unequalized pressure of the gases between the middle ear and the atmosphere.

Gastrointestinal Gas Expansion—Unrelieved expansion of gases in the stomach or intestines.

Sinus Block—Unequalized pressure of the gases between the sinus cavities and the atmosphere.

Tooth Pain—Unrelieved expansion of gases beneath fillings and in periapical abscesses in the teeth.

Uncontrolled Airspace—That portion of the airspace that has not been designated as continental control area, control area, control zone, terminal control area, or transition area, and within which ATC has neither the authority nor the responsibility for exercising control over air traffic.

Underconfidence—See confidence.

Undermotivation—See motivation, anomalies of.

Unintentional Activation—See error.

Vection Illusions—See illusion.

Vestibular Illusions—See illusion.

Vicarious Learning (2c(3)(d))—Learning by observation in the absence of any structured effort to impart the knowledge gained or “reading between the lines.” (See also modeling.)

Vigilance (2b(5)(a))—The active, assertive management of attentional resources in information seeking and making decisions. (See level of attention.)

Visual Illusion—See illusion.

Visual Separation—A means employed by ATC to separate aircraft in terminal areas. There are two ways to effect this separation:

1. The tower controller may see the aircraft involved and issue instructions, as necessary, to ensure that the aircraft avoid each other.
2. A pilot may see the other aircraft involved and upon instructions from the controller provide his or her own separation by maneuvering the aircraft, as necessary, to avoid it.

Wake Turbulence—Phenomena resulting from the passage of an aircraft through the atmosphere. The term includes vortices, thrust stream turbulence, jet blast, jet wash, propeller wash, and rotor wash both on the ground and in the air.

Wind Shear—A change in the wind speed or wind direction in a very short distance resulting in a tearing or shearing effect. It can exist in a horizontal or vertical direction and occasionally in both.

Wingover—A flight maneuver or stunt in which the plane is put into a steep climbing turn until almost stalled after which the nose is allowed to drop while the turn is continued until normal flight is attained in a direction opposite to the original heading.

Workload—The total of the combined physical and mental demands upon a person.

UNIT MEMBER SURVEY

(Sample, Subject to Local Adaptation)

An effort to evaluate human factors in this mishap requires the mishap board to have valid peer opinions from aircrew. This information will be anonymous and for safety investigation board use only.

What are your opinions of the following in this unit? (circle one)

	Unfavorable				Favorable		
Reliability of aircraft	1	2	3	4	5	6	7
Adequacy of aircraft systems or subsystems	1	2	3	4	5	6	7
Reliability of egress systems	1	2	3	4	5	6	7
Adequacy of training	1	2	3	4	5	6	7
Adequacy of flying time	1	2	3	4	5	6	7
Adequacy of aircraft pubs	1	2	3	4	5	6	7
Adequacy of scheduling	1	2	3	4	5	6	7
Adequacy of unit leadership	1	2	3	4	5	6	7
TDY frequency	1	2	3	4	5	6	7
TDY duration	1	2	3	4	5	6	7
Additional duties	1	2	3	4	5	6	7
Promotion system	1	2	3	4	5	6	7
Multiple-mission roles	1	2	3	4	5	6	7
Frequency of rules violations	1	2	3	4	5	6	7
General job satisfaction	1	2	3	4	5	6	7
Unit atmosphere	1	2	3	4	5	6	7
Unit professional standards	1	2	3	4	5	6	7
Career progression potential	1	2	3	4	5	6	7

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Peer Assessment: (Complete only if you feel you knew the mishap pilot.)

What is your estimate of the pilot's general leadership qualities relative to peers?

EXTREMELY LOW 1 2 3 4 5 6 7 EXTREMELY HIGH

What is your assessment of the pilot's susceptibility to peer influence or pressure?

EXTREMELY HIGH 7 6 5 4 3 2 1 EXTREMELY LOW

How would you rate the pilot as an officer?

EXTREMELY LOW 1 2 3 4 5 6 7 EXTREMELY HIGH

How would you rate him or her as a pilot?

EXTREMELY HIGH 7 6 5 4 3 2 1 EXTREMELY LOW

How would you rate the pilot's flying skills relative to peers?

EXTREMELY LOW 1 2 3 4 5 6 7 EXTREMELY HIGH

How would you rate the pilot's bogie-spotting reputation relative to peers?

EXTREMELY LOW 1 2 3 4 5 6 7 EXTREMELY HIGH

Was he or she a team player?_____

What would be your impression of pressures on the pilots or the squadron not warranted by mission accomplishment?

What extra work or projects are you aware he or she may have been involved in?_____

COMMENTS:

INJURY WORKSHEET

INJURY WORKSHEET (One per aircrew who was: 1. an injured survivor or a fatality who ejected or 2. thought to have been exposed to G forces in or below the survivable (40-60) range)

<p>GENERAL INFORMATION:</p> <p>NAME: _____</p> <p>AGE: _____ SEX: _____ RACE: _____ SERVICE: _____ GRADE: _____</p> <p>SSAN: _____</p> <p>CREW POSITION: _____</p> <p>DATE/TIME OF DEATH: _____</p> <p>CAUSE OF DEATH: _____</p> <p>AIRCRAFT/DATE OF MISHAP: _____</p>	<p>Physical Characteristics. (If pertinent to injuries)</p> <p>Height in inches _____ Weight in pounds _____</p> <p>Record any pertinent anthropometric data available.</p> <p>Describe operator's build. _____</p> <p>Was the operator on an anthropometric (D) waiver? No _____.</p> <p>If yes, explain.</p>																																																																																																																																																																																																																		
<p>SURVIVOR INJURY COSTS</p> <p>Disability - Estimated total hospital days _____</p> <p>IF TEMPORARY - Estimated lost days of primary duty _____</p> <p>IF PERMANENT - Estimate total extent of anticipated functional impairment and describe briefly:</p>	<p>FOR OFFICIAL USE ONLY</p> <p>This is a limited use report not releasable in whole or in part to persons or agencies outside the Air Force without the express approval of the disclosure authorities specified in AFR 127-4.</p>																																																																																																																																																																																																																		
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SPOUSE OR FRIEND INTERVIEW GUIDE

An effort to evaluate human factors in this mishap requires the flight surgeon to have opinions from these who knew the pilot best. (See paragraph 6-11 for tips on interview technique before using.)

1. Physical Condition:

Can you describe the pilot's physical condition (D)? (circle one)

Athletic (D) Active (D) Inactive (D) Sedentary (D) Unknown

How would you describe the pilot's general lifestyle? _____

Can you describe the pilot's physical strength (D)? (circle one)

Very Strong Strong Average Below average Weak Unknown

2. Physical Coordination and Motor Skills:

Can you describe the pilot's coordination level? (circle one)

Deft Above average Average Below average Awkward

What were the pilot's general sports activities, etc.? _____

3. Physical Fatigue:

Was the pilot physically fatigued (D) during the day of mishap flight? No _____. If yes, what caused this fatigue? _____

4. Duty Day:

Can you estimate:

How many hours the pilot spent in the squadron in the last 7 days? _____

How many duty hours the pilot worked in the 72 hours before mishap? _____

How many hours the pilot had planned to work the day of the mishap? _____

Were there extra jobs or projects (on or off duty) which generated extra work? _____

5. Sensory Information Processing:

Can you describe any problem the pilot had with balance, hearing, vision, taste or smell, touch, or body position sense? _____

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6. Food and Fluid Intake:

Can you describe the food intake of the pilot for the 24 hours before the mishap flight? _____

Was this characteristic of the prior 2 weeks or so? _____

Was the pilot on a diet? No _____. If yes, what type? _____

Can you describe the fluid intake of the pilot for the 24 hours before the mishap? _____

7. Circadian Rhythm:

Where had the pilot traveled within 7 days of the mishap flight? _____

8. Diurnal Cycle and Sleep:

How many hours did the pilot usually sleep? _____

Can you estimate the number of hours slept:

In the 7 days before the mishap? _____

In the 72 hours before the mishap? _____

In the 24 hours before the mishap? _____

Did the mishap flight or preparation for it interrupt the pilot's usual sleep routine? _____

Did the pilot complain of sleepiness or fatigue? _____

9. Activity Levels:

What do you know about the types and levels of physical and mental activity of the pilot between the last regular sleep period and the mishap?

Physical activity: _____

Mental activity: _____

10. Leave:

How long had it been (in weeks) since the pilot's last leave and how long was the leave? _____

What was the nature of the pilot's last leave? _____

Was it conducive to rest and relaxation? _____

Leave companions: _____

Leave activities: _____

11. Tobacco Habits:

What type of tobacco did the pilot use? _____

How much tobacco did the pilot use daily? _____

How long had the pilot used tobacco? _____

Had the pilot's tobacco use habits changed recently? _____

12. Alcohol Consumption:

What were the pilot's normal drinking habits? _____

How many drinks did the pilot consume within 24 hours of the mishap flight and how long prior? _____

Had the pilot's drinking habits changed recently? _____

13. Drug Use:

Are you aware whether the pilot was taking any prescription or nonprescription medication before or during the mishap flight? What were the drug(s) and the purpose and source for each?

Drug(s): _____

Purpose: _____

Source: _____

14. Habit Pattern Changes:

If any of the following habit patterns of the pilot had changed recently, how?

Eating: _____

Physical activity: _____

Sleeping: _____

Socializing: _____

Work: _____

Other (specify): _____

15. Pathological Factors:

Are you aware of any disease or defect the pilot may have been experiencing at the time of mishap?

Had the pilot recently experienced, or had a history of, fainting spells? _____

Had the pilot recently experienced, or had a history of, motion sickness? _____

16. Learning and Memory:

How would you describe the pilot for each of the following? (circle one)

	<i>Poor</i>		<i>Average</i>			<i>Excellent</i>	
Learning ability	1	2	3	4	5	6	7
Motivation to learn	1	2	3	4	5	6	7
Learning transfer	1	2	3	4	5	6	7
Mental flexibility	1	2	3	4	5	6	7

17. Parent's History and Involvement:

Did the pilot's natural parents have a history of heart disease, stroke, seizures, or diabetes? _____

What do you believe was the pilot's relationship with his or her parents? _____

Can you describe the kind and level of parental interest in the pilot's career, their motivation on his or her behalf, and any childhood dreams? _____

18. Personality Factors:

Have you noticed any personality changes in the pilot since his or her arrival with the unit? No _____. If yes, how? _____

Did the pilot tend to "change personalities" when flying or driving? No _____. If yes, how? _____

19. Previous Experience. Please describe the pilot's history of involvement in pursuits which require good vision and the establishment and maintenance of situational awareness (sports, games, hobbies): _____

20. Social Companions. With whom did the pilot most often socialize? (Divide 100 points among the following:)

- Family: _____
- Friends: _____
- Peers: _____
- Church: _____
- Social groups: _____
- Cultural groups: _____
- Recreational groups: _____

21. Rules Conformance:

Did the pilot tend to bend the rules? No _____. If yes, what would be his or her rationale? _____

Were there pressures on the pilot to bend the rules to get the job done regardless of cost? _____

22. Family Relations:

Are you aware of any problems or conflicts the pilot was having with any of those close to him or her (friends, family)? _____

Are you aware of any deaths, injuries, or illnesses in those close to the pilot that affected him or her? _____

Are you aware of any personal problems related to changes or anticipated changes in any of the following:

Financial status: _____

Legal problems: _____

Job status: _____

Religious problems: _____

Marital problems or status: _____

23. Personal Motivation:

Why do you believe the individual wanted to be a pilot? _____

24. Satisfaction:

What do you believe was the pilot's level of satisfaction in the following areas? (circle one)

Career choice	High	Average	Low
Duty location	High	Average	Low
Type aircraft assignment	High	Average	Low
Ground duties	High	Average	Low

25. Emotions and Moods:

Did the pilot experience any intense emotion before the mishap flight? No _____. If yes, how? _____

Are you aware of the mood of the operator before the mishap flight? _____

Did the pilot have a recent history of significant changes in moods or emotions? No _____. If yes, how? _____

26. Behavioral Factors:

Did the pilot seem depressed recently? No _____. If yes, why? _____

Did the pilot seem anxious recently? No _____. If yes, why? _____

Was the pilot's behavior notably unusual before the mishap flight? No _____. If yes, explain: _____

27. Other Notes:

What other thoughts relating to the pilot's human characteristics do you consider pertinent? _____

FLIGHT SURGEON EVALUATION

A. Background Information:

Your rank:_____ Title of your position:_____

Name & phone (optional):_____

Number of years aerospace medicine experience:_____

Number of Safety Investigation Boards:_____

B. Workbook Evaluation. Please critique the workbook after use. As you will notice, it has several chapters, each aimed at different kinds and sources of information. As a result, it is not particularly useful to gather only general impressions. For that reason, we ask that you consider the various chapters and also the workbook as a whole. There are two dimensions we are interested in: clarity, and amount of detail. Please circle the number or letter corresponding to your rating:

	Detail			Clarity	
	Too Much	OK	Too Little	Clear	Unclear
Workbook Part One:					
1. President	1	2	3	a	b
2. Safety Officer	1	2	3	a	b
3. Pilot Member	1	2	3	a	b
4. Maintenance Officer	1	2	3	a	b
5. Life Support Officer	1	2	3	a	b
Workbook Part Two:					
6. Medical Member	1	2	3	a	b
7. Data Consolidation	1	2	3	a	b
8. Team Analysis	1	2	3	a	b
9. Reporting Guidelines	1	2	3	a	b
Glossary	1	2	3	a	b
Unit Member Survey	1	2	3	a	b
Spouse or Friend Interview	1	2	3	a	b
Overall	1	2	3	a	b

How would you modify the workbook for your personal use?_____

How do you feel about the quality of the data that would be collected using the workbook?_____

What questions would you recommend adding to or deleting from the workbook?_____

Thank you for your help. Please mail this evaluation to:

HQ AFISC/SERH, Norton AFB CA 92409-7001

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FIG 8-1. INTENDED FOR REPRODUCTION AND USE AS A DECISION AID TO FACILITATE REVIEWS OF FACTORS INVESTIGATED

Figure 8-1. Continued.