BY ORDER OF THE COMMANDER
AIR FORCE TEST CENTER

AIR FORCE TEST CENTER
INSTRUCTION 91-202

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Safety

AIR FORCE TEST CENTER TEST SAFETY REVIEW POLICY

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This publication implements Air Force Instruction (AFI) 91-202 Air Force Materiel Command (AFMC) Supplement, *The US Air Force Mishap prevention Program.* This publication provides further policy and guidance to Chapter 13. It directs the application of system safety principles to the planning and conduct of all Air Force Test Center (AFTC) and other designated AFMC test projects (reference paragraph 1.5) regardless of the agency conducting the tests. It also provides guidance for the application of system safety principles to AFTC training programs, logistics testing, and publications. Organizations within AFTC will supplement this instruction to provide a detailed local test safety review process. All direct Supplements must be routed to the OPR of this publication for coordination prior to certification and approval by the 412 and 96 Test Wings (TW) or Arnold Engineering Development Complex (AEDC) Commander. Attachment 1 lists abbreviations and acronyms used in this instruction. Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using the AF Form 847, *Recommendation for Change of Publication*; route AF Forms 847 from the field through the appropriate functional chain of command. The authority to waive wing/unit level requirements in this publication is Tier 3. See AFI 33-360, *Publications and Forms Management*, Table 1.1 for a description of the authorities associated with the Tier numbers. Submit requests for waivers through the chain of command to the appropriate Tier waiver approval authority, or alternately, to the Publication OPR for non-tiered compliance items. Ensure that all records created as a result of processes prescribed in this publication are maintained in accordance with (IAW) Air Force Manual (AFMAN) 33-363, Management of Records, and disposed of IAW Air Force Records Disposition Schedule (RDS) located in the Air Force Records Information Management System (AFRIMS). The use of the name or mark of any

specific manufacturer, commercial product, commodity, or service in this publication does not imply endorsement by the Air Force.

The major changes to this instruction include: Clarification of test safety officer and subject matter expertise requirements; clarification of negligible risk; mandatory requirement for Closure Amendments and Lessons Learned documentation; and training requirements for independent reviewers have been defined. The publication number has been changed to follow in-sequence with the implementing instruction.

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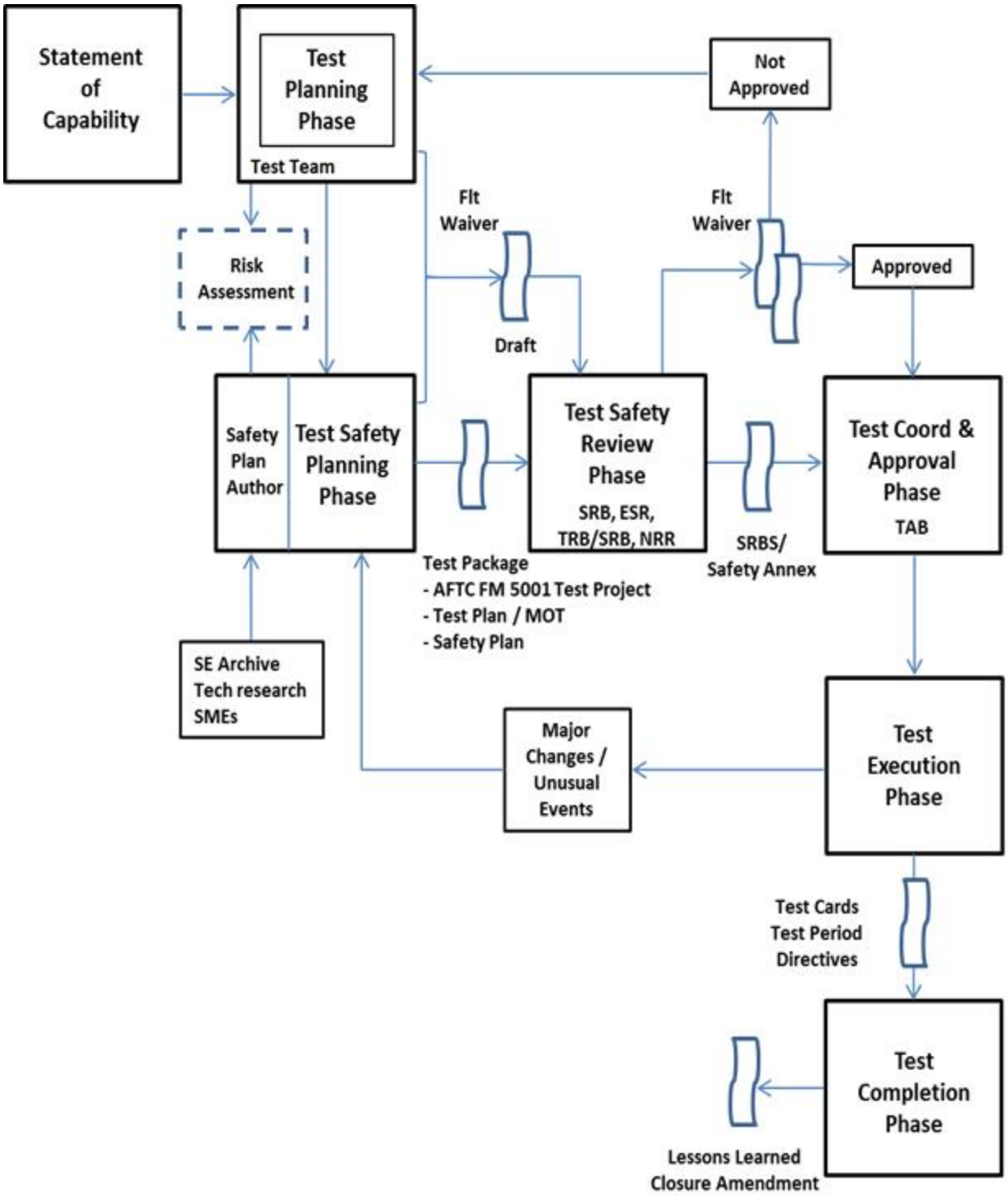
Chapter 1

INTRODUCTION

1.1. General. This instruction establishes a framework and basic requirements for AFTC test safety programs. This instruction further establishes basic vocabulary and definitions to be used universally throughout AFTC. Within the framework of this instruction, wings or their equivalent are expected to develop processes to fulfill the requirements of this instruction.

1.2. Test Safety Review Process. A Test Safety Review Process typically comprises the following functions or phases: Planning (Chapter 3), Risk Assessment (Chapter 4), Review (Chapter 5), Coordination and Approval (Chapter 6), Execution (Chapter 7), Revisions (Chapter 8), Feedback, and Test Completion and Termination. This instruction provides overall policy and guidance for test safety activity to ensure standardization of AFTC organizations while adhering to Air Force Instructions and Air Force Materiel Command Supplements. Organizations within AFTC will supplement this instruction to provide further test safety process details that uniquely apply to their specific test safety requirements. Figure 1.1. AFTCI 91-202 Process Flow shows the phases and the typical products from each phase.

Figure 1.1. AFTCI 91-202 Process Flow.



1.2.1. As part of the review process, the units will ensure that the appropriate safety plan writers, reviewers and approvers have signed the safety planning documents during the safety review process. This can be done via a locally generated form, workflow process or other electronic review. For the Test Safety Planning Phase these include the safety plan author,

Test Safety Officer (TSO), project pilot or project test engineer, unit chief engineer (if required) and a senior squadron level leader.

1.2.2. Additionally, during the Test Safety Review Phase the locally developed process will include a method for capturing the SRB members' signatures, to include the SRB chair, independent operations reviewer, technical experts and any additional safety reviewers (see paragraph 2.3). These signatures are required before the coordination and approval phase is accomplished. As the final step in the test safety process, approval and information signatures must be captured. These must include the Test Execution Authority (TEA), but can also include the Wing/Complex Test Safety chief, Wing/Complex Chief of Safety, Wing/Complex technical director, Group Commander or equivalent, Wing/Complex Commander, AFTC Test Safety Office and AFTC Commander. Approval level is specified in Table 6.1.

1.3. Safety Review Process Goals. The goal of any test safety review process is to prevent mishaps during test activities. This process should identify test hazards and establish both procedures and corrective actions to eliminate or control the hazards. The process will allow independent reviewers to evaluate test unique hazards identified by the test team, assess proposed mitigations and corrective actions, and affirm or modify the test team's proposed overall risk level. Once the independent review board has agreed upon and proposed an overall risk level, the safety plan is reviewed and approved by leadership at a level appropriate for the assessed risk. Risk management must be integrated and documented into all stages of Test and Evaluation (T&E) activities to identify test hazards, control measures and acceptance/rejection of the residual risk by an appropriate TEA. The safety plan records due diligence in risk management, acceptance and communicates (provides a written copy of) hazards and mitigating measures to test personnel.

1.4. Risk Management

1.4.1. Risk Management (RM) is the systematic application of management, engineering principles, criteria and tools to optimize all aspects of safety within the constraints of mission/activity effectiveness, time, and cost throughout all mission/activity phases. RM is the main tool used to prevent mishaps and is the essence of any test safety review process within AFTC. While each test may be unique, the test safety review process for each test will follow a predictable, consistent process. The policy outlined in this instruction and the processes defined in local supplements are tailored to manage risk unique to test activity. Detailed processes for risk management can be found in AFPAM 90-803, *Risk Management (RM) Guidelines and Tools.*

1.4.2. At the discretion of subordinate units, the policy defined in this instruction and local supplement may be used to complete and approve an RM review of non-test activities.

1.5. Safety Mindset. While test safety processes should be intentionally thorough, no process is perfect. Everyone involved in test must maintain a safety mindset. A safety mindset does not assume that a test is safe simply because the test has been reviewed and approved; rather, it is continually on the lookout for previously unrecognized hazards during test planning and execution. Once recognized, appropriate actions must be taken to prevent those hazards from becoming mishaps.

1.6. Scope. This instruction applies to:

1.6.1. Any ground or flight test activity utilizing AFTC assets. AFTC assets include:

1.6.1.1. Resources owned or possessed by AFTC (personnel, aircraft, equipment, facilities, etc.).

1.6.1.2. Ranges or airspace owned or restricted for use by AFTC units.

1.6.2. Any activity where the AFTC/CC or subordinate commander has responsibility for the safety of the general public such as the Major Range and Test Facility Base Commander IAW DoD 3200.11.

1.6.3. Any activity utilizing AFTC assets that presents unique hazards not covered by published procedures or management directives.

1.6.4. AFMC assets when AFTC units are assigned as Lead Developmental Test Organization (LDTO).

1.6.5. Any AFTC unit assigned or acting in the capacity of a Test Executing Organization (TEO) that is responsible for the safe conduct of test, even when AFTC assets are not at risk.

1.6.6. Any activities specified by the subordinate unit Test/System Safety Office.

1.7. Waivers to This Instruction. The AFTC Commander is the waiver authority for this instruction. Guidance in AFI 91-202, AFMC Sup Chapter 13 would still apply unless waived separately. The AFTC Chief of Safety (AFTC/SE) may approve minor variations from this instruction provided that the intent of the test safety process and this instruction are adequately met. Any variations or waivers to this instruction that have been approved by AFTC will be on file with the Wing/Complex Test Safety Office. Waiver requests must be coordinated through the appropriate wing safety office prior to submission to AFTC/SE. For minor variations, AFTC/SE will reply with an email with concur or non-concur and a tracking number. Waivers to local supplements will be handled in accordance with the established instructions in the supplement.

1.8. Authority. Compliance with AFTC Test Safety Review Policy does not provide authority to violate Air Force, AFMC, or AFTC instructions or directives or flight manual guidance.

1.8.1. When a test activity must deviate from an AFI or other command directive, units will comply with the applicable waivers/deviations process outlined in the applicable document. A copy of the waiver will be filed with the safety office and/or test unit. If the waiver authority is within the local Wing/Complex chain of command, the waiver may be obtained during the approval cycle and documented as a coordination comment within the Safety Annex.

1.8.2. When a test activity must deviate from a technical order or flight manual, units will follow current command guidance (AFI 11-215, *USAF Flight Manuals Program (FMP)* and AFI 11-215_AFMCSUP1, *USAF Flight Manuals Program [FMP])* or program office guidance for uninstalled test items. If a waiver is required, a copy of the approved waiver will be included in the Safety Annex. Test teams will note the deviation in the test plan and incorporate safety planning as required during the risk assessment process.

Chapter 2

SAFETY RESPONSIBILITIES

2.1. Test Safety Approval and Coordination Responsibilities

2.1.1. Responsibilities of personnel/organizations involved in the test safety approval and coordination phase are as follows:

2.1.2. The AFTC/CC will:

2.1.2.1. Be the approval authority for this instruction.

2.1.2.2. Be the waiver authority for this instruction.

2.1.3. AFTC/SE will:

2.1.3.1. Establish test safety review policy for all AFTC organizations.

2.1.3.2. Review local supplements to this instruction.

2.1.3.3. Approve minor variations from this instruction that meet the intent of the test safety process and this instruction.

2.1.4. AFTC Test Safety Office will:

2.1.4.1. Organize an annual test safety process meeting with all AFTC organizations to review local test safety process best practices.

2.1.4.2. Assess compliance of AFTC organizations with this instruction during site visits, staff assisted visits (SAV) and virtually through MICT.

2.1.4.3. Approve locally developed training in support of Test/System.

2.1.4.4. Notify HQ AFMC/SE/A3 and asset owner of high risk tests, IAW AFI 91-202_AFMCSUP.

2.1.5. Wing/Complex Commander will: Approve local supplements to this instruction.

2.1.6. Wing/Complex Safety Office will: Approve minor variations from the supplements to this instruction, provided that the intent of the test safety process and this instruction are adequately met.

2.1.7. Wing/Complex Test Safety Office (or SE delegate if none exists) will:

2.1.7.1. Develop a local test safety review process as a supplement to this instruction.

2.1.7.2. Maintain the integrity of locally developed test safety review process to ensure independent government review of safety planning documentation is being accomplished for leadership approval decisions.

2.1.7.3. Develop and maintain test safety training programs. Provide initial test safety review process training for Wing/Complex/Unit personnel (including contractor personnel as appropriate) who are involved in test safety planning, review, coordination and/or approval, to include independent safety reviewers/subject matter experts as described in Section 2.3. Annual training will be provided for safety plan authors.

Training products will be updated when this instruction, or supplements to this instruction, is revised.

2.1.7.4. Incorporate lessons learned and best practices into appropriate training programs and provide for discussion during AFTC's annual test safety process meeting.

2.1.7.5. Provide guidance and assistance to safety plan authors on test safety planning.

2.1.7.6. Designate or act as the Safety Review Board (SRB) chairperson (if an SRB is required).

2.1.7.7. Ensure an archive of approved test packages and associated documentation is current, maintained in a searchable archive or electronic folder and available to test teams across the enterprise.

2.1.7.8. IAW AFI 91-202, AFMCSUP, paragraph 13.10, lessons learned, effectiveness of hazard controls or minimizing procedures, unexpected hazards, value added from the safety review process, and suggestions for improving the safety review process will be captured in a lessons learned archive and available across the enterprise in a searchable format. This can be done at the completion of the program or at program reviews as a joint effort between the test team and the test safety office.

2.1.7.9. Develop and maintain a cadre of test safety officers to support the test safety process. The test safety officers may be part of the test unit or in the test safety office and will be identified in the Wing/Complex supplement to this document.

2.1.7.10. Review, approve, and sign AFTC Form 6239, *T-2 Modification Airworthiness Compliance*, for aircraft modifications that have an airworthiness assessment of *Impact, Non-Reportable.* Signature level is based on the risk assessment *(Overall Airworthiness Hazard Index (*AWHI) from the AFTC Form 6239) and Table 6.1 of this instruction. (See AFTCI 62-602, *Airworthiness*, paragraph 3.5.2.). Attendance at the Design Review Board (DRB)/Configuration Control Board (CCB) is highly desirable for upfront and early insight into the modifications and airworthiness assessments.

2.1.7.11. Test Safety Officers will:

2.1.7.11.1. Assist test teams with identification of test hazards and appropriate mitigation measure and preparation of all safety-related documentation, including amendments from safety planning through the approval phases.

2.1.7.11.2. Sign the AFTC Form 5001, or equivalent, which shows that the safety-related documentation complies with content and format standards contained in this instruction and supplements to this instruction prior to requesting an SRB.

2.1.7.11.3. Complete the appropriate Wing/Complex test safety training course.

2.1.7.11.4. Advise test team and safety plan author on appropriate independent reviewers and subject matter experts available for test and safety plan development.

2.2. Test Unit Safety Planning Responsibilities

2.2.1. Responsibilities of personnel within a test unit during the test safety planning and review phase are as follows:

2.2.2. Squadron Commanders (Test Unit Commander, Director or equivalent) will:

2.2.2.1. Review and provide coordination for all test and safety plans within their organization where they are not the TEO.

2.2.2.2. Approve Low Risk test activities as delegated by Group CC (or equivalent).

2.2.2.3. Approve Negligible Risk test activities if applicable per local supplement to this Instruction, as delegated by the Group CC (or equivalent).

2.2.2.4. Ensure all unit personnel involved in safety planning or execution are familiar and comply with this instruction and local supplements and receive test safety training.

2.2.2.5. Support the AFTC test safety process, which may include operations and/or technical personnel assigned to their test unit participating in independent review of other test projects or activities.

2.2.2.6. Provide Test Safety Officers (TSOs), as applicable per Wing/Complex test safety policy.

2.2.2.7. Maintain a list of test safety officers with training and experience applicable for test unit projects.

2.2.3. Safety plan authors will:

2.2.3.1. Complete a locally developed Test/System Safety training course offered by the Wing/Complex Test Safety Office and approved by AFTC/SET.

2.2.3.2. Maintain currency by completing continuation training annually.

2.2.3.3. Develop safety plans in accordance with **Chapter 3** of this Instruction and local supplements.

2.2.3.4. Ensure safety plans clearly and adequately provide enough information to support an approval decision.

2.2.3.5. Identify a proposed project risk and include the rationale for the proposed risk level to the safety review board members or to the independent reviewers in support of the safety reviews described in section 5.2.

2.2.3.6. Ensure safety plans include a summary of lessons learned and THAs from similar and/or applicable tests to indicate if there are any applicable hazards to consider in approval of the Safety Plan.

2.2.3.7. Nominate the team of independent safety reviewers to the Wing/Complex Safety Office for approval. The SRB chair can also nominate independent safety reviewers.

2.2.4. Test Team will:

2.2.4.1. Determine if test methods, conditions, and resources in test methodology balance safety and data needs.

2.2.4.2. Ensure all appropriate test techniques were considered. Choose the lowest risk technique which efficiently meets test/data objectives.

2.2.4.3. Ensure appropriate test unique hazards related to test methods and system(s) operation are identified and sufficiently controlled (eliminated, mitigated, or residual risk determined to be acceptable).

2.2.4.4. Ensure tests are being conducted per published technical orders and Air Force Instruction guidance.

2.2.4.5. Ensure flight manual waivers are submitted and approved per AFI 11-215, or per program office guidance for uninstalled test items.

2.2.4.6. Report changes to the Test Directive/Method of Test (MOT)/Test Plan to the Wing/Complex test safety office per local guidance.

2.2.4.7. Perform a review of the safety plans for their test programs every three years IAW paragraph 8.4.

2.3. Independent Safety Reviewer Responsibilities

2.3.1. Independent Safety Reviewers (ISRs) include the technical experts, operations reviewers and the SRB chair. The ISRs must be independent of the test project and should not have been involved (or had limited involvement) in preparing the test plan (MOT) or safety plan. The ISRs should have appropriate qualifications. They should be senior in test experience or have formal Test Pilot School training, have applicable knowledge and sufficient expertise in the test activity to be reviewed. To the maximum extent possible, independent safety reviewers should be the same individuals that served as independent reviewers for the technical review (if applicable). Independent reviewers will be approved by the Wing/Complex Test Safety Office in accordance with qualification guidelines set forth in local supplements to this instruction. All independent reviewers must have accomplished the initial test safety review process training. Independent reviewers will review and approve all THAs, BHAs and General Minimizing Procedures (GMPs) as part of the SRB process. Individual reviewer responsibilities are as follows:

2.3.2. SRB Chair will:

2.3.2.1. Ensure appropriate test unique hazards and routine hazards that can be exacerbated by the test conditions are identified and sufficiently controlled (eliminated, mitigated, or residual risk determined to be acceptable).

2.3.2.2. Ensure general and special mitigation measures are clear and unambiguous.

2.3.2.3. Ensure the safety assessment is clearly and concisely articulated to approval authorities.

2.3.2.4. Ensure operations, facilities, maintenance, etc., reviewers have appropriate expertise relevant to the type of testing being reviewed.

2.3.2.5. Be independent of the test team.

2.3.2.6. Be a government employee.

2.3.3. Technical Reviewer will:

2.3.3.1. Ensure safety hazards are identified and appropriately controlled (eliminated, mitigated, or residual risk determined to be acceptable).

2.3.3.2. Have applicable knowledge and sufficient expertise in the test activity to be reviewed.

2.3.4. Operations Reviewer will:

2.3.4.1. Be experienced in the type of system under test such as aircraft (i.e., fighter, bomber, cargo), ground test facility (i.e., wind tunnel, sled track, propulsion stand, climatic lab), and the types of tests being conducted. Exceptions can be approved by the Wing/Complex Chief of Test Safety.

2.3.4.2. Ensure tests are executable, all test techniques were considered, and lowest risk technique which efficiently meets test/data objectives was selected.

2.3.4.3. Ensure hazards related to operating the system are identified and appropriately controlled (eliminated, mitigated, or residual risk determined to be acceptable).

2.3.4.4. Be independent of the test team.

2.3.5. Facility Reviewer (if required) will: Ensure hazards related to operating ground test facilities are identified and appropriately controlled.

2.3.6. Maintenance Reviewer (if required) will: Ensure test conduct and execution does not deviate from system under test maintenance procedures or technical manuals.

2.3.7. Range Safety/Range Operations Engineer (if required) will: Analyze proposed test plans and attend SRBs relating to range activities as deemed necessary by the SRB chair.

2.3.8. Flight Safety representative (if required) will: Establish procedures to coordinate on all planned or contractual flight tests.

2.3.9. Weapons Safety representative (if required) will: Review weapon safety analyses, operating instructions, and attend SRBs relating to aircraft store/weapons system and range activities where new or modified weapon testing or explosives is involved.

2.3.10. In any SRB, additional expertise from other sources may and should be called upon when required. Optional Reviewers, as deemed necessary by the SRB chair, may include, but are not limited to:

2.3.10.1. Test Engineer

2.3.10.2. System Safety Engineer

2.3.10.3. Ground Safety Representative

2.3.10.4. Explosive Ordinance Disposal Representative

2.3.10.5. Test Requestor / Item Contractor

2.3.10.6. Airspace Representative

2.3.10.7. Logistics Representative

2.3.10.8. Munitions Representative

2.3.10.9. Fire Department Representative

2.3.10.10. Bioenvironmental Engineer

2.3.10.11. Medical Representative

2.3.10.12. Environmental Management Office Representative

2.3.10.13. Range O&M Representative

2.3.10.14. Laser or Directed Energy Safety Representative

2.3.10.15. Flight Termination System Analyst

Chapter 3

TEST SAFETY PLANNING PHASE

3.1. Test and Safety Planning. Safety planning and test planning are integral and iterative processes, and as such, both should be interwoven to ensure the test methods incorporate safety controls where possible. Well planned tests that consider and incorporate risk control measures to eliminate or mitigate test hazards are inherently safer than test plans without this safety emphasis. This chapter covers considerations and guidance during the test safety planning and review phases.

3.2. Safety Considerations during Test Planning.

3.2.1. Test Approach or Build-up. During test plan development, the test team will carefully consider the test approach or build-up. The way the test approaches a hazardous or unknown condition must be clearly defined. If predictive analysis does not exist, or has questionable validity, the test methodology may require a more refined buildup approach to offset the risk. Criteria to continue, or more importantly when to stop, can provide good risk control by providing a clearly defined roadmap into the test team's decision making. This decision-making process is extremely important and should be documented.

3.2.2. Test Plan Size and Complexity. The test team must consider the size and complexity of the test plan and assess whether a review of a large, complex safety plan is more or less advantageous than several smaller reviews. If feasible, teams may conduct test safety planning for large, complex test plans in smaller, less complex safety plans matched to progressive phases of the test project.

3.2.3. Integration. If the planned testing utilizes more than one test plan, method of test (MOT), test information sheet (TIS), or procedure, it is incumbent upon the team to provide a clear test progression description. Without a clear path, the ability to identify hazards appropriately and develop a sensible risk assessment is difficult. The test team should be aware of this basic issue to avoid significant and unplanned schedule delays caused by action items or cancelled safety review boards.

3.3. Safety Planning Objectives. The objective of the safety planning phase is to identify and assess hazards and develop controls or mitigation measures to reduce the risk to an acceptable level.

3.3.1. Hazard Identification. The first step in safety planning is identification and evaluation of existing and potential hazards. Some hazards will be inherent in operating the system and other will be induced by the test itself. For test safety planning, the goal is to identify and mitigate test unique hazards. If the nature of the test increases the probability or severity of non-unique hazards they should be addressed, mitigated, and documented.

3.3.1.1. Identify Test Unique Hazards. The team will identify unique hazards associated with each type of test or activity. In some cases test activities may elevate the risk associated with routine operational hazards, thus requiring additional safety planning. In the safety documentation, hazards should adequately describe the risk situation including the unsafe act or condition and its effects. It is often helpful to assess the risk (probability

and severity, see Chapter 4) prior to applying mitigations as well as after mitigations are in place. Sources for identifying test unique hazards include:

3.3.1.1.1. Archived test and safety planning, to include lessons learned and THAs, across the enterprise for consideration of similar tests.

3.3.1.1.2. Contact personnel or test teams with experience in similar test activities or testing.

3.3.1.1.3. Research technical aspects via technical libraries, internet, etc.

3.3.2. Eliminate or Control Hazards. Once the causes of each hazard have been identified, minimizing procedures or controls are used to reduce risk by reducing severity or probability or both. The following order of precedence should be applied to eliminate or control any hazards identified during the safety planning.

3.3.2.1. Design the test to eliminate the probability of the hazard occurring. This could include a decision to not perform the test if the risk is deemed to be unacceptably high. A redesign of the system to eliminate the hazard is another option.

3.3.2.2. Change the test methodology to reduce the probability, severity, or exposure to the hazard (building up to the test condition can be a strong control method).

3.3.2.3. Incorporate safety devices (e.g., spin chute or additional power sources).

3.3.2.4. Provide caution and warning devices to detect an unsafe condition or trend or install instrumentation and data displays with active monitoring.

3.3.2.5. Develop procedures and training when it is impractical to change the design or test methodology.

3.4. Test Package Documentation

3.4.1. The "test package" shall be an all-encompassing package of documents consisting of a test plan, safety planning, and any other appendices or documentation that support the test planning. All safety planning will be documented in the safety plan/annex including minimizing procedures, THAs, and safety buildup that may also be included in the test planning documents. Additional guidance on the test planning process and documentation can be found in local Wing/Complex test planning instructions.

3.4.2. The safety plan should follow documentation guidance from **Chapter 13**, paragraph 13.5.4, of AFI 91-202, *The US Air Force Mishap Prevention Program* as supplemented by AFMC. The safety plan shall also include documentation of GMPs, THAs, BHAs, and a Baseline Safety Review (BSR) (if applicable). THAs will be documented on a *Test Hazard Analysis* document that captures the information required in AFI 91-202, AFMC supplement. BHAs will be documented in accordance with local supplements. Format and structure of the safety plan may be further defined in local supplements to this instruction. In the event testing requires the preplanned damage/destruction of test assets, AFI91-202, AFMC Supplement paragraph 13.13 should be followed.

3.4.2.1. THAs are used to document and identify test hazards and the actions necessary to minimize or control them. Each Test Hazard Analysis (THA) captures a test unique hazard. A hazard is any condition that has the potential of causing a mishap. Confirm that the hazard is not a hazard associated with the basic operation of the aircraft, vehicle,

system under test, or facility. If the hazard is not unique to the series of tests, no THA is required. For example, midair collision with non-participating aircraft and bird strikes are not generally considered test unique hazards. However, should the very nature of the test increase the probability of these hazards above that of normal operations, they should be addressed as test unique hazards. The information in the THAs will be reviewed and approved as part of the Safety Annex as either a standalone document or by capturing the information in the safety planning documents. The THA will include the following:

3.4.2.1.1. Mishap severity and probability of the Hazard as discussed in detail in **Chapter 4**.

3.4.2.1.2. Causes are anything that could lead to the presence of the hazard. The causes can include inherent hazardous characteristics, design inadequacies, hardware failures, environmental effects, software deficiencies or operator errors. This is the cause of the hazard, not the mishap. There may be more than one cause for each hazard.

3.4.2.1.3. Effect is the outcome if the hazard is not controlled. The effect is what the THA is trying to prevent and is directly related to the mishap severity level. Effects are often descriptors that tie into the mishap severity, such as loss of life/aircraft/facility, severe injury/damage, minor injury/damage, superficial injury or less than minor damage.

3.4.2.1.4. Controls or Minimizing Procedures should be an action or procedure and tied to a specific cause, causes, or effect it is trying to control. These controls or minimizing procedures attempt to break the chain of events linking the causes to the hazard.

3.4.2.1.5. Corrective Actions or Emergency Procedures are the list of actions taken to prevent or mitigate a mishap (the effect) if the hazard occurs. Actions may be taken by the control room, ground personnel, flight crew, test facility operators, and anyone else participating in the test. Test unique and hazard specific emergency procedures would be listed here. If not test unique, corrective actions may state that operation manual procedures will be followed. These corrective actions attempt to break the chain of events linking the hazard to the mishap.

3.4.2.1.6. Comments are optional information that helps support the THA risk analysis but are not directive in nature and do not contribute to breaking the mishap chain.

3.4.2.1.7. While hazard identification should have been accomplished leading up to the SRB, emphasis should be placed on identifying items of special interest for THA/SRB consideration including, but not limited to:

3.4.2.1.7.1. New systems or system variants: aircraft, stores, instrumentation, test equipment.

3.4.2.1.7.2. Unique and/or unprecedented systems not previously used in the test environment: aircraft, stores, instrumentation, test equipment

3.4.2.2. GMPs are stand-alone phrases/statements and are used to address system under test restrictions, test build-up, critical parameter monitoring, go/no-go criteria, weather or

environmental criteria, and flight test chase requirements among other items of test safety concern.

3.4.2.3. Baseline Hazard Analysis (BHA): An analysis used to document known hazards concerned with the normal day-to-day operation of an aircraft, system, subsystem or facility. Examples of test equipment or test facilities which may be a good candidate for BHAs are: Wind tunnels, high-speed sled track, centrifuge, anechoic chamber, or climatic laboratory. BHAs shall include supporting documentation in order to assist reviewers of the analysis. BHAs can also be used to document hazards associated with instrumentation packages.

3.4.2.4. Baseline Safety Report (BSR): A compilation of the entire baseline hazard analyses. The BSR allows the individual hazard analyses that make up the baseline to be evaluated in a comprehensive package and thus shows the interaction of the systems and interfaces.

3.4.2.5. In addition to severity, probability, cause, effect, mitigation measures, and corrective actions or emergency procedures, the following shall be included on all baseline hazard analyses:

3.4.2.5.1. Hazard analysis title. The title should be easily searchable and shall describe the system or process analyzed. The title shall include the configuration item for baseline hazard analyses.

3.4.2.5.2. Description. The description shall include the system, test, or process being evaluated, the purpose, major system components, energy sources, interfaces (system and human), operating location and environment. Assumptions shall be clearly stated. Revisions to an approved document shall include a summary of the revision.

3.4.3. Statement of Capability (SOC). The following wording must be included in any SOC that is transmitted to a customer when the safety review process is required:

3.4.3.1. "AFTC Safety Review: The proposed test/activity must be reviewed using the procedures contained in AFTCI 91-202, *AFTC Test Safety Review Policy* and any local supplements to this instruction. To support this review, safety planning must begin early in the program."

3.4.4. Safety Considerations. Safety considerations to be documented will include the identified hazards, minimizing procedures, and risk assessments consolidated from the test safety review process. All safety documentation will be included in the approved and archived test documentation. As a minimum, safety documentation will contain the following information:

3.4.4.1. Test or project identifier.

3.4.4.2. Test Unique Hazards and Specific minimizing procedures (GMPs, THAs), controls, restrictions.

3.4.4.3. Special considerations (i.e., flight manual waivers, flight restrictions, etc.).

3.4.4.4. Mishap Accountability and reporting responsibility.

3.4.4.5. References to include review of previous similar test projects and lessons learned.

3.4.4.6. Supporting Documentation: flight manual waivers, SRB briefing slides (if applicable).

3.4.4.7. The safety plan may also contain other essential range safety criteria such as approved test areas, test items, danger areas, safety instrumentation requirements, safety footprint development methodology, etc.

3.4.4.8. Mishap Accountability. Detailed information on mishap accountability and investigating responsibility must be provided by the test team in the safety plan when deviating from AFI 91-204, or if non-Air Force assets are involved, to include pre-mishap planning. A memorandum of agreement is the preferred method when multiple agencies are involved. For tests that include non-AFTC resources, the AFTC assets that are at risk for the test should be explicitly identified.

3.4.4.9. Safety Review Board Summary (SRBS). The SRBS documents the results of the SRB meeting, any open action items that require closure prior to the final approval of the Safety Annex and the risk assessment. Final approval of the SRBS resides with the SRB chair. As a minimum, the SRBS will contain:

3.4.4.9.1. Date of SRB

3.4.4.9.2. SRB attendees

3.4.4.9.3. SRB Action Items and Responses and coordination comments and responses

3.4.4.9.4. Overall risk assessment with justification if lines of subjectivity were used in the assessment

3.4.4.9.5. Any test/training activity contingent on any waivers (i.e. Chase waiver, deviations from AFTCI 91-202 and/or local supplements) or flight manual waivers per AFI 11-215 requires discussion at the SRB and will be included in any hazard risk assessment and documented in the SRBS. Any waiver not approved by the Test Execution Authority (TEA), or appropriate approval authority, after the SRB will require a reassessment by the SRB. The SRBS will identify how the hazard risk assessments apply to the proposed test points for tests which contain identifiable test points, test sets or test matrices.

Chapter 4

RISK ASSESSMENT

4.1. General. Risk is defined as a combination of mishap severity and mishap probability. The overall risk level is the degree of risk assumed by leadership in allowing the proposed test to be accomplished in the manner described and under the conditions specified. Test teams will propose a risk assessment; independent reviewers will evaluate test unique hazards identified by the test team, assess proposed mitigations and corrective actions, and affirm or modify the test team's proposed overall risk level. Once the independent reviewers have agreed upon a risk level, they will document the overall risk level and make a recommendation to the Test Execution Authority (TEA) on whether or not to execute the test based on the SRB results, as outlined in **Chapter 6.** Test teams use system safety techniques, prior experience, legacy system research, lessons learned and overall engineering judgment to identify test hazards and assess risk by evaluating the credible outcome (mishap severity) of each hazard together with the associated probability of occurrence. The mishap severity and probability is then plotted on a Risk Assessment Matrix to determine the hazard's overall risk level. Although the goal is to minimize risk through good test and safety planning/review processes, the test may result in residual risk that must be directly accepted by the TEA in accordance with **Section 6.1**.

4.2. Determine Mishap Severity. Controls or minimizing procedures can be used to reduce the severity or probability of the hazard (Chapter 3). The mishap severity category is a qualitative assessment of the most reasonable credible mishap consequence that could occur with all mitigations in place. For activities at AFTC organizations, the mishap severity categories are shown in **Table 4.1**. The assessment should incorporate engineering judgment and/or past experience with similar tests or systems and is often assessed with no mitigations and then reassessed with all minimizing procedures and corrective actions in place. The severity is assigned based on the system level consequence of total direct cost and severity of injury/occupational illness or equipment loss or damage. Descriptive definitions should be used as the primary criteria for assessing mishap severity. However, quantitative values may be used for higher cost system under test. Quantitative values for mishap severity listed in **Table 4.1** may be adjusted to match current guidance specified in AFI91-204, *Safety Investigations and Reports*.

Table 4.1. Mishap Severity Definitions.

MISHAP SEVERITY	Level	Descriptive	Quantitative	Mishap Class
Catastrophic	**1**	**Loss of life, aircraft, facility, or expensive system.**	**> $2M**	**A**
Critical	**2**	**Severe injury, lengthy hospital stay, or permanent injury. Severe aircraft, equipment or property damage.**	**$500K - $2M**	**B**
Marginal	**3**	**Minor injury, requiring medical lost work days, but no permanent injury. Minor damage.**	**$50K - $500K**	**C**
Negligible	**4**	**Superficial injury, little or no first aid required. Incidental, less than minor damage.**	**< $50K**	**D/E**

NOTES:
1. Use values listed in AFI91-204 for definitive guidance.
2. Environmental impact is assessed independent of the test risk and is documented on an AF Form 813 per AFI 32-7061 or 32 CFR Part 989.3 (d).

4.3. Determine Mishap Probability. After hazards have been identified and mitigation measures have been assessed and documented, the safety reviewers will subjectively assess the mishap probability. The mishap probability level should qualitatively and/or quantitatively measure the likelihood of the mishap occurring due to personnel error, environmental conditions, design inadequacies, procedural deficiencies, or system/subsystem component failure or malfunction. The assessment should incorporate engineering judgment and past experience with similar tests or systems with all minimizing procedures and corrective actions in place. If available, the test team and safety reviewers should consider the system safety analysis results from the contractor or system program office in order to understand areas of known concern. For operations where there is a well-developed database or sophisticated modeling/simulation, probabilities may be expressed quantitatively as 1×10^{-4}, 3.8×10^{-6}, etc. However, for developmental testing, the ability to compute numeric failure probability values with confidence is difficult because these activities involve new, complex, and often unproven systems. Therefore, **Table 4.2** also contains descriptive probability definitions (along with some example descriptive statements) that should be used as a standard to consistently assess mishap probability for all AFTC test activities.

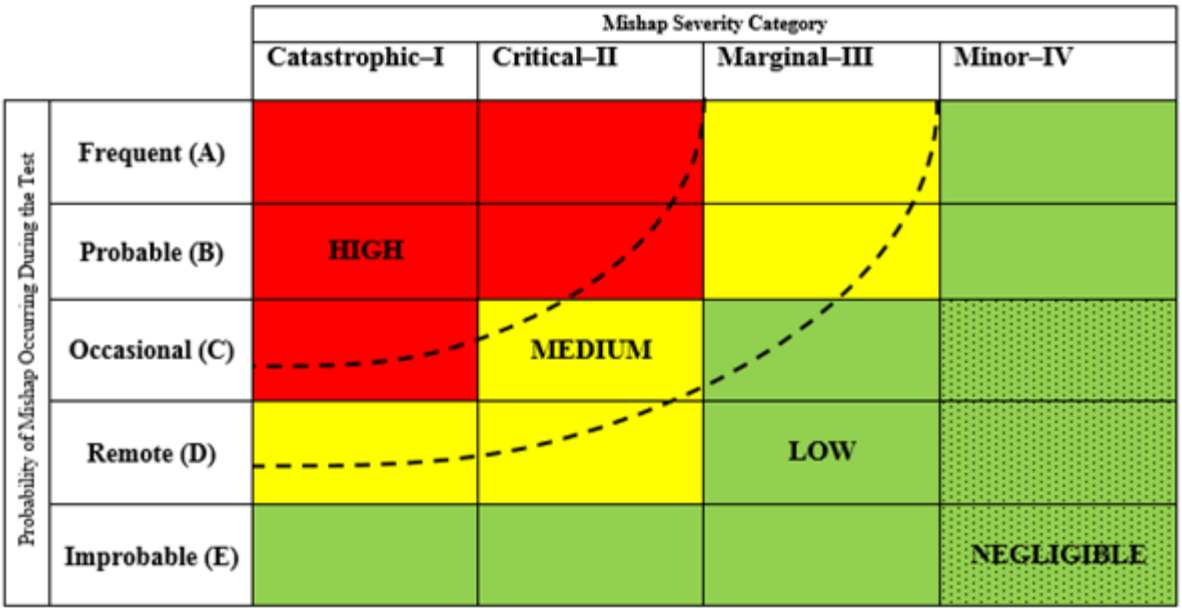
Table 4.2. Mishap Probability Definitions.

Probability	Level	Descriptive	Quantitative (Probability of occurrence per event[1])
Frequent	**A**	**Very likely to occur (e.g., test exceeds design limits or mishap occurred during similar testing, etc.)**	**$> 10^{-1}$**
Probable	**B**	**Likely to occur (e.g., test at design limits or mishap almost occurred during similar testing)**	**$< 10^{-1}$ but $> 10^{-2}$**
Occasional	**C**	**Some likelihood to occur, but not expected**	**$< 10^{-2}$ but $> 10^{-3}$**
Remote	**D**	**Unlikely to occur (e.g., test activity within design limits and done before w/no problems encountered)**	**$< 10^{-3}$ but $> 10^{-6}$**
Improbable	**E**	**Highly unlikely to occur**	**$< 10^{-6}$**

1 - Event may be defined in local supplements to this instruction.

4.4. Risk Assessment Matrix. The risk assessment matrix, shown in **Figure 4.1**, is a tool for assessing mishap risk of test hazards as documented in safety planning documents. The risk categories are discretely divided into four shaded regions to distinguish between NEGLIGIBLE (green dotted), LOW (green), MEDIUM (yellow), and HIGH (high) risk levels. The correlation of approval authorities with the assigned overall risk level is discussed in **Chapter 6.** Despite the discrete distinction between each risk level, safety reviewers are reminded of the subjective nature of their assessment. This subjectivity is illustrated within the Risk Matrix using two dotted subjectivity lines. The region between the subjectivity lines denotes a subjective MEDIUM risk level. Any block bisected by a subjectivity line becomes a "block of subjectivity" and can be designated using the original associated risk or can be adjusted up or down a risk level based upon the risk determination factors discussed in section 4.6. Use of subjectivity lines is optional for final risk determination. The lines are not intended to permit a significant deviation in risk (i.e., from HIGH to LOW). A subjective assessment differing from the discrete risk level blocks must be documented in the Safety Annex with the rationale for assigning the adjusted risk level. The use of the matrix defined in **Figure 4.1** and locally developed Test Safety Review Processes defined in supplements to this instruction are in accordance with AFI 91-202, *The US Air Force Mishap Prevention Program*, AFMC Sup, Chapter 13.

Figure 4.1. Risk Assessment Matrix.



4.5. NEGLIGIBLE Risk. The negligible risk assessment reflects a subset of "low" risk applicable to activities that are normal or routine operations. The Negligible Risk category is defined as hazards where the severity and probability assessments fall in the Negligible Severity column and Occasional, Remote, or Improbable Probability rows on the Risk Assessment Matrix. Due to the subjective nature of any risk assessment, an overall assessment greater than negligible for these blocks could still be appropriate.

4.5.1. For the severity category to be NEGLIGIBLE, the consequences of a mishap attributable to test activities must be less than minor injury or system damage. For personnel, the impact of the injury or illness equates to no work days lost. For equipment or facilities, less than minor damage equates to losses less than $50,000 (or current Class D definition). Applicable mishap probabilities for NEGLIGIBLE risk are limited to "occasional, "remote", or "improbable" levels. If the test team or reviewers identify test unique hazards that warrant a Test Hazard Analysis document, then an overall risk category of NEGLIGIBLE is not appropriate.

4.5.2. Examples include: ride-along data collection points, special instrumentation checkouts, form-fit-function checkouts of non-critical hardware/software, sensor or system tests, or logistics testing activities that do not directly affect the airworthiness of an aircraft or performance of a test facility nor are they required for hazard avoidance.

4.6. Determine Overall Risk Assessment. An overall risk level assessment is accomplished after all hazards to the test have been identified and mitigations are clearly defined and documented in accordance with **Section 3.4**. Hazards that are unique to the test will be documented on a *Test Hazard Analysis* Form (AFTC Form 5000), or in a locally developed format that captures the information required in AFI 91-202, AFMC supplement. Hazards associated with normal operation and maintenance may be documented in a locally produced Baseline BHA form. Plot the combination of mishap severity and probability on the Risk Assessment Matrix for each hazard. Once all the individual hazards are plotted, the test team

will discuss the safety aspects of the plan and propose an overall project risk level. Project risk will be no lower than the highest assessed risk from the THAs. A detailed explanation of THAs and BHAs is discussed in **Section 3.4 Test Package Documentation**.

4.6.1. Subjective Assessments. As discussed in previous sections, both the THA and overall risk assessment can be highly subjective as each test team member and safety reviewer incorporates engineering judgment and/or past experience with similar tests or systems into their risk level assessment. Because of this subjectivity, a test team or safety reviewer may conclude that risk levels that fall within "blocks of subjectivity" (see Figure 4.1) and may be higher or lower than depicted by the discreet risk level regions. For this reason, the members of the safety review board may utilize the subjectivity lines to fine tune their risk assessment if THA or overall risk assessment falls within a block crossed by a subjectivity line. The region between the dotted subjectivity lines denotes a potential MEDIUM risk level based on risk assessment and mitigations. Therefore, subjective risk assessments may only be adjusted one risk level higher or lower than the discrete risk assessment. The use of subjectivity lines is at the discretion of each Wing/Complex per supplements to this instruction. The expectation for safety review analysis is to use discrete risk level assessments for each identified hazard. The use of the subjectivity lines will be determined on a case-by-case basis dependent on the hazard discussion during the safety review process and at the discretion of the safety review official. If use of a subjectivity line resulted in an overall test risk level on the lower side of the line, the discussions which resulted in this decision will be captured in the Safety Annex.

4.6.2. THA Risk Assessment. The test team may assess the pre- and post-mitigation mishap severity category and probability level by plotting both on the Risk Assessment Matrix (**Figure 4.1**). This provides a comparison between initial and residual risk levels to evaluate the adequacy of safety measures and best available solution. Test teams and safety reviewers should note that although risk mitigation in the safety plan may not change the assessed "severity", "probability" it will still reduce the actual risk. The residual risk level determined by the test team for each THA acts as a proposal for the independent safety reviewers to affirm or adjust as necessary.

4.6.3. Overall Risk Assessment. The test team will propose an overall risk level for the test as determined by procedures discussed in this section. During the safety review phase (outlined in **Chapter 5**), the independent safety reviewers will have a general discussion of the test, identified hazards, and associated mitigations to generate opinions on the residual risk. The discussions should be candid and result in a general agreement by the board/independent review, although disagreements may occur. Safety reviewers will weigh the control measures in place (mitigation steps), their experience with the types of tests, and the system under test (SUT) to assess the overall residual risk. The cumulative risk may (and frequently does) exceed the assessed risks for all THAs individually. However, the overall risk cannot be lower than the risk associated with any individual THA unless lines of subjectivity are used (see paragraph 3.4). The safety reviewers must also consider the complexity of the test, the potential for safety-related "unknown unknowns", and their own experience with similar test activities. By using the Risk Assessment Matrix (**Figure 4.1**) and referencing the overall risk level descriptions, shown in **Table 4.3**, each safety reviewer should assess overall risk and provide justification for their assessment. This justification is

especially important if subjective assessments are incorporated as outlined in **Paragraph 4.6.1.** The overall risk assessment must be documented in the Safety Annex.

Table 4.3. Overall Risk Level Assessments.

Assessment	Description and Implication
HIGH RISK	Tests or activities that present a significant risk to personnel, equipment, and/or property after all precautionary measures have been taken.
MEDIUM RISK	Tests or activities that present a greater risk to personnel, equipment, and/or property than normal after all precautionary measures have been taken.
LOW RISK	Test or activities that present a little/no greater risk than normal operations (such as operating the system using approved procedures) after all precautionary measures have been taken. Routine supervision is appropriate.
NEGLIGIBLE RISK	Activities that are normal, routine, or operationally representative

4.6.3.1. In some situations, sufficient information may not be available to complete a risk assessment. The Test Safety Office of each AFTC organization will determine a course of action to develop resolution and may reconvene the safety reviewers to perform the assessment at a later date.

4.6.3.2. If appropriate, the risk may be assessed separately for AFTC and non-AFTC assets, for different phases of the test projects, or for individual test events. The overall risk for the test program is still based on the highest level of risk assessed on any of the tests, but the program can have split risk assessments. For example, an overall HIGH risk may be assigned for a test program which includes flight envelope expansion, but a subset of that testing may be assessed as MEDIUM or even LOW. If this is the case, the test points in each risk category will be clearly identified in the safety planning.

4.7. Elevated Risk Activities. Certain tests conducted at AFTC organizations have demonstrated a higher than normal risk due to the inherent hazards involved. However, if the analysis of test activities clearly indicates that the predicted performance (flying qualities, pilot induced oscillation susceptibility, flutter margin, loads margin, etc.) is well within acceptable levels, the test point need not be considered elevated risk. This may be especially true if the analysis model has been validated through other simulation or test activity.

Chapter 5

TEST SAFETY REVIEW PHASE

5.1. Safety Review Preparation. In preparation for an independent safety review, test teams should perform the following:

5.1.1. Determine the type of safety review (examples in **Paragraph 5.2.2)** and consult Wing/Complex Test Safety office for concurrence.

5.1.2. Evaluate the probability and severity category for each Test Hazard Analysis (THAs) or Baseline Hazard Analysis (BHAs) (**Chapter 4**). Provide to the safety reviewers the proposed overall risk level and any test points or test phases which may have a lower risk than the overall risk level (if they exist). Include the rationale for the varying risk levels. The proposed risk level(s) will be considered during the independent safety review.

5.1.3. Develop a list of safety reviewers following guidance in **Section 2.3**

5.2. Safety Review. The purpose of the Safety Review phase is to allow an independent team to formally review the test unit's safety planning to ensure that all test hazards have been identified and sufficiently mitigated, and then affirm or modify the residual risk. The documentation from the Safety Review phase should reflect a suitable level of clarity and maturity for the Test Execution Authority to make an informed decision on whether to proceed with test execution. The Wing/Complex Test Safety office is the focal point for the Safety Review phase.

5.2.1. Objectives:

5.2.1.1. Ensure appropriate test hazards associated with the test activity are identified.

5.2.1.2. Ensure the proposed risk control measures sufficiently mitigate (minimize or eliminate) the hazards caused by the test/activity to an acceptable level.

5.2.1.3. Assess and recommend an appropriate residual risk level for the test/activity.

5.2.1.4. Ensure the safety annex clearly and adequately provides enough information to support an approval decision by the TEA.

5.2.2. Types of Independent Safety Reviews. Below are four types of independent safety reviews that may be used to complete the safety review phase. The Wing/Complex Test Safety office may advocate additional types of reviews as defined in local supplements to this instruction. The test team will review relevant documentation and propose a review type to the Test Safety office, who will make the final determination. The four types of independent safety reviews are:

5.2.2.1. Safety Review Board (SRB)**.** The SRB is a formal safety review meeting attended by independent safety reviewers and project personnel, and is chaired by a designated Wing/Complex Test Safety office representative. The decision to conduct SRB vs an Electronic Safety Review (ESR) or Combined TRB/SRB is based primarily on the test plan size, complexity, maturity of test item/methodology, and expected risk level and is determined by the Test Safety Office. If no SRB is required, the independent reviewers and the test safety staff review the test and safety planning to ensure all hazards have been identified, controls have been developed, determines the overall risk level of

the test and recommends to the TEA whether or not to execute the test. To the maximum extent possible, independent safety reviewers chosen for the SRB should be the same individuals that served as independent reviewers for the technical review. This is to ensure continuity of information regarding test methodology is preserved throughout the review and approval process and should result in a more insightful and thorough SRB.

5.2.2.2. Combined TRB/SRB**.** For those tests that are easily understood, less complex, or lower in risk, the test team may request a combined TRB/SRB in lieu of separate technical and safety reviews to minimize impact to resources and shorten the timeline. Teams should contact the Test Safety Office for final determination on this course of action. Teams will ensure that the test plan is sufficiently mature for safety review prior to the combined TRB/SRB.

5.2.2.3. Electronic Safety Review (ESR)**.** The ESR is a formal safety review of test packages by independent safety reviewers, to include the Test Safety office that occurs without a meeting. The test package is typically distributed electronically and reviewed in parallel by the safety reviewers. An Electronic Safety Review is appropriate when test activities are readily understood by reviewers, tend to be less complex, and are lower in risk.

5.2.2.4. Negligible Risk Review**.** A Negligible Risk Review (NRR) is a streamlined technical and safety review process applicable to a subset of low risk tests as indicated on (See **Figure 4.1,** Risk Assessment Matrix). Test activities that are normal, routine, and operationally representative (e.g., incidental to another routine flight activity or test) are excellent candidates for an NRR process since the risk is effectively the same as the operational risk. During risk assessment if all identified hazards fall within the negligible risk and occasional probability area on Figure 4.1, a NRR can be accomplished. A minimum of two test safety personnel must review the proposed assessment and at least one of them must have experience in the area being assessed as determined by the Chief of Test Safety.

5.2.2.4.1. NRR Qualification. NRR qualification of a test project should be proposed by the test team to either the TSO (if the TSO is outside the Wing/Complex Test Safety Office) or Wing/Complex test safety officer to make a preliminary assessment of risk and probability before forwarding to the Wing/Complex test safety office. The Test Safety Office will make the final determination based on the following criteria:

5.2.2.4.2. The risk level for the test activity must be assessed as negligible and fall within the hashed blocks in the Risk Assessment Matrix, (see **Figure 4.1**). Examples of these activities are listed in **Paragraph 4.5.2**.

5.2.2.4.3. Testing will adhere to normal operating procedures and existing risk control measures as defined in the approved flight manual(s), technical orders, test facility procedures, and/or operational guidance/instructions (e.g., Air Force Instructions, Air Force Materiel Command Instructions, and Air Force Test Center Instructions).

5.2.2.4.4. GMPs are allowed only to the extent that they clarify or further restrict already existing guidance. If the test team or reviewers identify test unique hazards that warrant a THA document, then the NRR process is not appropriate.

5.2.2.4.5. Routine and existing aircrew/operator training, qualification, and proficiency are sufficient to perform the test activity, test or maneuver.

5.2.2.4.6. Test procedures do not involve the use of abnormal or emergency procedures, checklists or configurations.

5.2.2.4.7. For flight test, the SUT has no airworthiness impact, such that a failure or malfunction of the SUT would cause the use of abnormal or emergency procedures to safely recover the aircraft.

5.2.2.4.8. NRR documentation will be located in the Safety Annex to the Test Plan.

5.2.2.4.9. Each Wing/Complex may define a NEGLIGIBLE Risk Review and approval process in a local supplement to this instruction. If defined locally, the NRR process will comply with NRR qualification guidance in this Chapter and the approval coordination path defined in **Table 6.1**.

Chapter 6

TEST SAFETY APPROVAL PHASE

6.1. Approval Authorities and Notification Levels. All activities conducted in accordance with paragraph 1.6 require approval before beginning execution. The approval phase provides appropriate leadership the opportunity to make an informed risk acceptance and test approval decision based on the safety review and risk assessment completed in the safety review phase. The Test Execution Authority (TEA) for these activities is based on the proposed risk level as outlined in **Table 6.1**. Approval is defined as permission to conduct or participate in the test project or activity granted by the appropriate TEA. The TEA may require a Test Approval Brief (TAB) to assist in making an informed decision. Signature of the TEA on AFTC Form 5001 or equivalent, *Test Project Safety Review*, constitutes acceptance of the risk and approval to begin activities under the conditions set forth in the test package. A signed safety package does not authorize deviation from Air Force, AFMC, or AFTC instructions or directives.

Table 6.1. Approval Process Coordination Path.

Organization Level	NEGLIGIBLE Risk	LOW Risk	MEDIUM Risk	HIGH Risk
Safety Office	Coord	Coord	Coord	Coord
Squadron CC (or equivalent)	Coord	Coord	Coord	Coord
Group CC (or equivalent)	Approve[1]	Approve[2]	Approve	Coord
Wing/Complex CC	Not Required	Info	Info	Coord
AFTC SE	Not Required	Not Required	Not Required	Coord
AFTC CC	Not Required	Not Required	Not Required	Approve[3]
HQ AFMC/SE/A3	Not Required	Not Required	Not Required	Info

1. Negligible risk approval may be delegated in writing to Squadron CC (or equivalent)
2. Low risk approval may be delegated in writing to Squadron CC (or equivalent)
3. High risk approval may be delegated in writing to Test Wing/Complex Commanders. In the absence of the Test Wing/CC, CV can approve the testing; however, this cannot be further delegated.

6.2. Delegation. When approval authority is delegated to a lower organization level for LOW and HIGH risk, the approval coordination path in **Table 6.1** is still followed but with an info copy sent to the original approving authority or per locally developed guidance. Signature delegation will be no lower than the applicable deputy/vice commander or technical director.

6.3. LOW Risk Activities.

6.3.1. The Group CC (or equivalent) is the TEA for approval to execute all low-risk test events. However, final approval to execute low risk test may be delegated in writing to the Squadron CC (or equivalent) in compliance with AFI 91-202 as supplemented by AFMC.

6.3.2. NEGLIGIBLE Risk activities, as defined in **Paragraph 4.5**, are a subset of LOW Risk and may be approved no lower than the Squadron CC (or equivalent) with Group CC (or

equivalent) delegation. If the Squadron CC (or equivalent) is unavailable for approval, NEGLIGIBLE Risk activities default to LOW Risk approval requirements.

6.4. Elevated Risk Activities. Elevated risk activities are those that result in a residual risk level of MEDIUM or HIGH.

6.4.1. MEDIUM Risk Test Approval**.** Medium risk tests require approval of the Group CC or equivalent (minimum O-6 or civilian equivalent).

6.4.2. HIGH Risk Test Approval.

6.4.2.1. The AFTC/CC is the TEA for all HIGH risk test events. Final approval to execute HIGH risk test may be delegated in writing to the Wing/Complex CC.

6.4.2.2. If non-AFTC assets/personnel are involved, the asset owner must be notified of the high residual risk prior to test execution. Notification method will be established in local supplements.

6.4.2.3. HQ AFMC/SE/A3 must be notified of high risk tests prior to execution in accordance with AFI 91-202 AFMC Sup para 13.3.4.6. AFTC/SE will send this notification in conjunction with HIGH risk safety plan approval. The Wing/Complex safety office, or designee, will ensure AFTC/SE is notified within 24 hours when a test project has been approved for conduct as HIGH risk.

6.5. Test Approval Brief. The TEA or any other Commander on the Approval Coordination Path may require a Test Approval Brief (TAB) to assist in making an informed decision. A TAB should be an executive level meeting that provides a test project overview and highlights test unique hazards, mitigation measures, discussion points during the independent review (e.g., SRB, ESR, combined TRB/SRB), and any contention or disagreement by the independent board and the test team. The approval authority can attend the SRB and eliminate the potential need for a TAB. If a separate TAB is held, if slides are used, the slides will be archived with the test package documentation.

6.6. Acceptance of Safety Planning across AFTC.

6.6.1. An AFTC test project which has been approved through an AFTC Wing/Complex's technical and safety review processes may be executed by a different, supporting, AFTC test wing/complex.

6.6.2. The originating test wing/complex will notify the supporting wing/complex when the technical and safety review processes are complete and the test project is approved for execution. The originating test wing/complex will provide the supporting wing/complex with test and safety planning documentation required under the originating test wing/complex processes. The supporting wing/complex may accept this documentation as written, or may request additional safety or test review following their wing/complex supplement to this instruction. Differences will be resolved by equivalent TEAs from each wing/complex. The supporting wing/complex may then execute any assigned portion of a test project which has been approved to execute under the originating test wing/complex processes.

6.6.2.1. If changes are made to the safety package at the supporting wing/complex, such as additional GMPs due to range, complex or facility differences, the originating test wing/complex will be notified via memorandum for record (MFR). The MFR will

include, as a minimum, the project title, additions to the package and rationale for the additions. If amendments are required for test or safety planning reasons, or an unusual event, the supporting wing/complex will provide the originating wing a copy of the amendment.

6.6.3. Test execution materials (e.g., test cards or mission decks) may be developed by either the originating or supporting test wing. The organization creating the mission materials will adhere to local guidance for formatting, content and approval. Mission materials will be approved by the executing organization in accordance with their local procedures.

Chapter 7

TEST EXECUTION PHASE

7.1. General. Risk management must be integrated and documented into all stages of T&E activities to identify test hazards, mitigating measures and acceptance/rejection of the residual risk by an appropriate Test Execution Authority (TEA). The safety plan records due diligence in risk management and acceptance, and also communicates (e.g., provides a written copy of) hazards and mitigating measures to test personnel. The procedures, restrictions, and mitigations documented in the safety planning must be observed while conducting the test in order to maintain the accepted level of risk. Safety Plan requirements take precedence over those specified in the test plan. The safety plan is a contract between the test team and the TEA.

7.2. Test Card/Test Period Directive Preparation and Approval.

7.2.1. Test Cards/Test Period Directives/etc. are documents describing the test activity procedures in a step-by-step or checklist format. These documents are used by test teams to successfully complete test activities. They may be reused for multiple test projects but should not be overly general in documentation. Inherently, they should be a synopsis of operation, test and/or manufacturing technical data immediately available to reference for the test team in executing test activities effectively, efficiently and safely.

7.2.2. During test card or test period directive preparation, the test team will review applicable GMPs, THAs and BHAs to ensure the procedures comply with safety limits, procedural constraints or approved Test Plan requirements.

7.2.3. Test execution procedures, whether documented in test cards or another format, must be approved prior to use during testing. Test card approval levels will be documented in local Wing/Complex instructions.

7.2.4. The order or sequence of the test cards may have a direct effect on the safety of a given test mission. Approved test cards, or “test decks”, may be reordered or re-sequenced without re-approval if there is no impact to the required buildup order or test safety. Test teams must ensure that test approach and build-ups, as defined or intended in the test and safety annex, are adhered to in all cases, and they should carefully analyze test point sequencing to avoid hidden pitfalls. Resequencing of test cards with a safety build-up as prescribed in the safety annex requires a safety review and amendment.

7.3. Test/Mission Execution Briefing. During the test/mission execution brief, the test team will address the procedures and restrictions specified in the safety annex. Test unique hazards applicable to the scheduled testing, risk minimizing procedures or controls, and go/no-go criteria must be briefed at the test/mission execution briefing. These can be captured in GMPs or THAs.

7.4. Unexpected Test Result. An unexpected test result is any occurrence that warrants a test safety-related pause in the test project. If an unexpected event occurs, the test team will put the test on hold and consult with the Wing/Complex Test Safety Office. Test points associated with the unexpected event will be placed on hold, but if the test team and the safety office concur, other unrelated test points can continue. Once a recovery plan of action is determined, unexpected events will be documented with a safety plan amendment or a memo for record which will be included in the safety annex. Return to flight must be authorized by the TEA. The

Wing/Complex test safety office will provide notification through the appropriate chain of command for any unexpected test result. The SRB chair may also elect to reconvene the SRB to review and revalidate that all associated risks have been mitigated/addressed before testing can continue. Any necessary modifications to the applicable safety plan will be documented and approved for the appropriate risk level. Testing of the suspended test points may be resumed upon approval of the appropriate change documentation, as described in **Chapter 8**. An Unexpected Test Result amendment does not take the place of mishap investigations as required in AFI 91-204. Unusual events include, but are not limited to:

7.4.1. Unexpected or unplanned damage to the system under test or support equipment.

7.4.2. Exceeding safety of test limits.

7.4.3. Unfavorable departure from predicted simulation/analysis.

7.4.4. Occurrence of a THA/BHA hazard requiring corrective action.

7.4.5. Occurrence of a hazard requiring corrective action not already mitigated by the procedures defined in a THA/BHA form.

7.4.6. Any lesson learned that warrants notifying the entire test team.

Chapter 8

CHANGES AND TIME LIMITS

8.1. Changes. It is not unusual for project changes to arise after receiving test approval. Unexpected results, overly restrictive controls in THAs or GMPs, hazards not previously identified or adequately controlled, and proposed changes in risk level all constitute reasonable grounds for changing safety planning. All project changes will re-accomplish the following test safety review process phases: Safety planning, safety review, and approval. However, the scope of each phase may differ significantly from that of an original safety plan, depending on the changes and documentation method used.

8.2. Major Changes. Any potential change in risk level (higher or lower), major test plan change, changes to safety planning, and unusual events are considered major changes that affect test conduct or safety planning. Major changes require additional safety planning, independent safety review, and approval before continued testing with these changes incorporated.

8.2.1. Risk Level Change. During the course of testing, information may be obtained that potentially warrants a change in risk level. This could be an increase in the risk based on unexpected results or a decrease in risk level due to increased system maturity.

8.2.1.1. The approval authority for an increase in risk level will be based on the "new" risk level IAW **Chapter 6** (i.e. an upward change <u>to</u> HIGH risk requires AFTC/CC approval if not already delegated).

8.2.1.2. The approval authority for a decrease in risk level will be based on the "original" risk level IAW **Chapter 6** (i.e. a downward change <u>from</u> HIGH risk requires AFTC/CC approval if not already delegated).

8.2.1.3. Changes to testing approved with split risk levels. For amendments to test packages with split risk levels (see paragraph 4.6.3.2), the approval authority for the amendment will be based on the portion of the test package that is being changed. Information copies will be sent to the original approver.

8.2.1.3.1. For example, a test package has been approved as HIGH risk for test points over 800 KCAS and MEDIUM risk for all other test points. An amendment is submitted that only affects test points below 800 KCAS. The approval authority for the amendment corresponds to the MEDIUM risk TEA as IAW Table 6.1.

8.2.2. Major Test Plan Change. The definition of major test plan change will be outlined in local supplements. Substantive changes to test objectives, technical approach, or test procedures may require an amendment to safety planning as defined in the Safety Annex. Individuals performing the final safety review should be the same as those from the original package, if available. For multi-discipline test plans, only the discipline(s) affected by the amendment need to be included for review along with an operations representative.

8.2.3. Change to Safety Planning. Any change to the content of the safety plan is considered a change to safety planning. The desired changes could be more restrictive or less restrictive than the approved safety planning. Changes to safety planning will be accomplished via an amendment to the original safety package. Amendments will be approved using an AFTC

Form 5001, or locally developed electronic or hard copy document which captures the appropriate coordination and approval signatures.

8.2.4. Unusual Event. Safety plan documentation following an unusual event will describe the occurrence of the event, summarize the cause(s) as they are understood by either analysis or hypothesis, and identify the test team's intended path for the resumption of testing. Once suspended for safety, only the TEA (or higher) can authorize resumption of testing.

8.3. Minor and Administrative Changes. Some changes to the approved test package may be classified as minor or administrative only and will be defined in local supplements. Minor test plan changes may include changing the flight conditions of test points, adding test points (provided the new conditions are within the approved envelope of test points), or deleting test points that are not a part of safety build-up. An administrative change to the test package clarifies information contained in the package and does not affect test conduct or safety planning. Locally approved procedures for documenting and approving minor or administrative changes may be defined in supplements to this instruction. The test unit commander (or equivalent) may be the approval authority for any changes not defined as Major Changes in **Section 8.2**.

8.4. Time Limit. As part of the RM process, safety plans will be reviewed at least every three years to ensure identified hazards and mitigation measures are appropriate and to incorporate any lessons learned. Baseline Safety Reports and USAF Test Pilot School standard curriculum event safety plans will be reviewed at least every four years. During this review, test teams will identify any new risks and mitigation measures; highlight key issues experienced since approval or the last review; and purge non-applicable guidance from the plan. Teams will document reviews on an AFTC Form 5001, or equivalent, in accordance with **Chapter 6**.

8.5. Closure Amendments/Lessons Learned. A closure amendment or close-out notification email provided by the Test Director may be used to notify the test safety office that the existing safety plan is no longer in use. Closure amendments can be used to document lessons learned over the course of the test project (see section 2.1.7.9) or other formats as specified in local supplements to this instruction. A well-written closure amendment could close the loop on a test package by re-assessing the GMPs and THAs. In addition, it could help future researchers benefit from the lessons learned during testing and obtain pertinent information that the test team would have liked to know at the beginning of the test project. Lessons learned can also be captured when the three year time limit has been reached.

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Commander

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFI 33-360, *Publications and Forms Management*, 25 September 2013

AFI 91-202, *The US Air Force Mishap Prevention Program*, 5 August 2011

AFI91-204, *Safety Investigations and Reports*, 12 February 2014

AFI 91-202_AFMCSUP, *The US Air Force Mishap Prevention Program*, 9 July 2013

MIL-STD-882E, *Standard Practice for System Safety*, 11 May 2012

AFPAM 90-803, *Risk Management (RM) Guidelines and Tools*, 11 February 2013

AFI 99-103, *Capabilities-Based Test and Evaluation*, 16 October 2013.

AFTCI 62-602, *Developmental Engineering, Airworthiness*, 18 February 2015.

AFI 11-215, *USAF Flight Manuals Program (FMP)*, 3 January 2011

AFI 11-215_AFMCSUP1, *USAF Flight Manuals Program (FMP)*, 25 May 2011

Prescribed Forms

AFTC Form 5000, *Test Hazard Analysis*

AFTC Form 5001, *Test Project Safety Review*

Abbreviations and Acronyms

BHA —Baseline Hazard Analysis

BSR —Baseline Safety Report

ESR —Electronic Safety Review

GMP —General Minimizing Procedures

LDTO —Lead Developmental Test Organization

NRR —Negligible Risk Review

RM —Risk Management

SE —Safety Office

SOC —Statement of Capability

SRB —Safety Review Board

SUT —System Under Test

T&E —Test and Evaluation

TAB —Test Approval Brief

TEA —Test Execution Authority

TEO —Test Execution Organization

THA —Test Hazard Analysis

TIS —Test Information Sheet

TRB —Technical Review Board

Terms

Acceptable Risk — That part of identified risk which is allowed by the managing activity to persist without further engineering or management action.

Baseline Hazard Analyses (BHA) — An analysis used to document known hazards concerned with the normal day-to-day operation and maintenance of a test system, subsystem or ground test facility.

Baseline Safety Report (BSR) — A compilation of BHAs that constitute the hazards associated with the specific operation of a test system, subsystem or ground test facility and includes a BHA for all systems to be operated or maintained. The BSR allows the individual hazard analyses that make up the baseline to be evaluated in a comprehensive package and thus shows the interaction of the systems and interfaces.

Control/Safety Measure — An action taken to eliminate or reduce a potential test hazard to a more acceptable risk level.

Deviation — The intent of the requirement is not met and a waiver must be approved through the appropriate authority.

General Minimizing Procedure (GMP) —Statements that direct a specific action or procedure that mitigates general test execution risk; these generally include the words “will” or “shall”. GMPs are used to address system under test restrictions, test build-up, critical parameter monitoring, go-no-go criteria, weather or environmental criteria, and flight test chase requirements among other items of test safety concern.

Hazard — Any real or potential condition that can cause injury, illness, or death to personnel; damage to or loss of a system, equipment or property; or damage to the environment. It is the threat of harm and is a precursor state to a mishap.

Identified Risk — That risk which has been determined through various analysis techniques.

Independent Review — A review by an individual or group that does not have a vested interest in the successful accomplishment of the test objectives and was not directly responsible for the development of the safety plan.

Initial risk — The first assessment of the potential risk of an identified hazard. Initial risk establishes a fixed baseline for the hazard.

Mishap — An unplanned event or series of events resulting in death, injury, occupational illness, or damage to or loss of equipment or property, or damage to the environment.

Mishap Accountability —The organization that pays for test-related repairs and replacements must be written and approved in the test planning documentation. Testing often requires the preplanned damage/destruction of a unique test asset. Even where damage is not planned, testing involves unknowns that could increase the likelihood of damage/loss. Mishap accountability is

part of the cost of conducting the test and in no way implies blame or mishap responsibility. (AFMCI 99-103)

Mitigation Measure — Action required to eliminate the hazard or when a hazard cannot be eliminated, reduce the associated risk by lessening the severity of the resulting mishap or lowering the likelihood that a mishap will occur. (MIL-STD-882). These are also referred to as a countermeasure or a control/safety measure and can be captured as a GMP.

Probability — An expression of the likelihood of occurrence of a mishap.

Residual Risk — The remaining mishap risk that exists after all mitigation measures have been implemented or exhausted, in accordance with the system safety design order of precedence.

Risk — A combination of the severity of the mishap and the probability that the mishap will occur.

Risk Level — An expression of the danger posed by a hazard in terms of the severity of outcome and the probability of occurrence. Risk level is assigned to a hazard or to a combination of hazards. As such, risk levels are assigned to both a test event and the test as a whole.

Risk Management (RM) — The systematic process of identifying threats/hazards/problems, assessing risk, analyzing risk control options and measures, making control decisions, implementing control decisions, accepting residual risks, and supervising/reviewing the activity for effectiveness.

Safety Annex — The safety annex (i.e. the safety plan) is part of the test package where all safety planning documentation is located.

Safety Plan — Safety documentation that details the specific safety criteria and parameters to allow safe conduct of a test. The safety plan can identify targets, munitions, aircraft, and other equipment to used; defines danger areas; identifies the potential hazards associated with the test; and establishes the specific safety requirements necessary to conduct the test, such as special handling, flight termination systems, surveillance requirements, communication requirements, etc.

Safety Review Board — A formal safety review meeting chaired by Wing/Complex Chief of Test Safety or delegate and consisting of independent reviewers as voting members. The meeting is also supported by appropriate project personnel. The product of an SRB is an independently reviewed safety plan and proposed overall risk level of the test for consideration by the TEA.

Safety Reviewers — An independent panel of subject knowledgeable individuals that review the test and associated safety plan to ensure test hazards are identified; then eliminated, minimized or controlled to an acceptable level; and to establish the overall risk level. As a minimum, the safety reviewer panel will be composed of a technical and operations representative who will review the test package. Technical representatives are chosen based on their experience and expertise in the engineering discipline(s) associated with the test activity to be reviewed. Operations representatives are chosen based on their test and operations experience in similar test activities. An SRB chair will be appointed as one of the safety reviewers. Other independent reviewers can include range safety, maintenance, logistics, etc. as appropriate for the test.

Senior Leadership — Collective reference to the various Operations Group, Test Wing, Test Complex, and AFTC authorities who coordinate, approve, and review test packages.

Severity — The magnitude of potential consequences of a mishap to include: death, injury, occupational illness, damage to or loss of equipment or property, damage to the environment, or monetary loss. Damage to the environment will be assessed through the appropriate channels and documented on an AF Form 813.

System Safety — The application of engineering and management principles, criteria, and techniques to achieve acceptable risk within the constraints of operational effectiveness and suitability, time, and cost throughout all phases of the system life-cycle. (MIL-STD-882)

Test Execution Authority (TEA) — The Test Execution Authority (TEA) is the individual responsible for accepting the SRB and Technical Review Board results and approving the test to proceed with any residual risk.

Test Hazard Analysis (THA) — A document that identifies test unique hazards, causes, and effects and establishes controls which are used to determine risk level. For AFTC test projects, test hazard analysis will be documented on an AFTC Form 5000 or equivalent.

Test Organization/Unit — The organization or unit providing the test facilities, equipment or personnel to conduct a test. The system under test may or may not be a resource of the test organization/unit. Also known as the test executing organization (TEO).

Test Organization/Unit Commander — The highest ranking individual at the test organization or unit (commander or director). This individual has responsibility for the personnel, equipment and/or facilities for accomplishing the test, and is the individual responsible for reporting mishaps involving the system under test or the facilities.

Test Package — As a minimum, the test package includes the test plan, safety plan, and any other appendices or documentation that supports the test planning.

Test Plan— The test plan describes the system under test, defines the test objectives and outlines the test methodology in sufficient detail to demonstrate technical adequacy and execute a technically effective test project.

Test Safety — The application of engineering and management principles, criteria, and techniques to optimize all aspects of safety within the constraints of operational effectiveness, time and cost throughout the defined test cycle.

Test Safety Office — The safety office responsible for oversight and support of the Lead Designated Test Office. This responsibility may reside in the test organization's safety office or the Center/Installation safety office.

Test Unique Hazards — Hazards that are a result of the specific test being accomplished and not present in the normal operational hazards associated with the system or environment. These hazards include those inherent to the article being tested as well as those hazards associated with the testing of any systems.

Unacceptable Risk — That risk which cannot be tolerated by the managing activity. It is a subset of identified risk. Unacceptable risk is either eliminated or controlled.

Waiver —Approval from the appropriate authority to deviate from both the intent and the letter of the requirement.