ORDER

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

4040.26A

3/23/01

SUBJ : **AIRCRAFT CERTIFICATION SERVICE FLIGHT SAFETY PROGRAM**

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1. PURPOSE. This order identifies specific elements of Federal Aviation Administration (FAA) Order 4040.9D, FAA Aircraft Management Program, Chapter 5 (FAA Flight Safety Program) which are unique to the Aircraft Certification Service (AIR). All elements of Order 4040.9D, Chapter 5 shall be observed by Aircraft Certification Service participants unless otherwise stated in this order.

2. DISTRIBUTION. This order is distributed to the branch level in Washington headquarters Aircraft Certification Service (AIR), regional Aircraft Certification Directorates, all Aircraft Certification Offices (ACO), and the Brussels Aircraft Certification Division.

3. CANCELLATION. Order 4040.26, Aircraft Certification Service Flight Safety Program, dated August 1, 1997, is cancelled.

4. FUNCTIONAL LEVELS AND ASSOCIATED ROLES.

a. Service Level. The Director of the Aircraft Certification Service, AIR-1, will appoint a Lead Flight Safety Officer (LFSO) to manage the AIR Flight Safety Program. The AIR LFSO will be a member of the FAA National Safety Council (NSC). The LFSO will develop a system of collecting and disseminating flight test incident and accident information to the AIR flight test community.

(1) The Flight Program Oversight Committee (FPOC) will fulfill the role of the Flight Safety Committee (FSC) required by Order 4040.9D, paragraph 514(d). The primary purpose of the FSC is to set goals and review safety-related recommendations. The FPOC should review the AIR plans, policies, procedures, conditions, instructions for recent flight experience, and the responsiveness to corrective recommendations.

(2) The LFSO represents the highest level of safety management within AIR. As the safety representative for the organization, the LFSO shall:

(a) Provide proactive leadership regarding safety matters while performing as a liaison between the Senior Flight Safety Officer (SFSO, Washington D.C.), respective organizational managers and the regional Flight Safety Officers (FSOs).

(b) Manage an organizational Flight Safety Plan (FSP) that meets the policy, standards, and guidelines of the national program.

(c) Provide safety concerns and findings to appropriate senior operations managers for appropriate corrective action.

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(d) Participate in the development and/or review of internal and external operational audit procedures.

(e) Coordinate aircraft accident/incident safety investigations within AIR.

(f) Attend training in safety program management, including FAA Course No. 12060, Crew Assessment and Flight Program Management for Flight Safety Officers (Initial), and FAA Course No. 12061, Crew Assessment and Flight Program Management for Flight Safety Officers (Recurrent).

(g) Act as the focal point within AIR for Crew Resource Management (CRM).

(h) Schedule and conduct FAA FSO conferences, participate in NSC meetings, and relevant aviation industry flight safety events within the available resources.

b. Directorate Level. Each directorate manager will appoint a FSO. Aircraft Certification Offices that are geographically detached from their reporting directorate shall appoint an Assistant Flight Safety Officer (AFSO), except where there are no flight test personnel assigned. FSO's must be flight program participants. Flight safety files and records will be maintained by the directorate FSO or AFSO if so organized. The FSO's manage and represent Flight Safety Programs (FSP's) at the directorate level. They provide proactive leadership regarding safety matters while performing as a liaison between the LFSO, respective organizational managers, flight program participants, and flight test engineers that are routinely assigned to and participate in flights. The FSO's comply with the policy, standards, and guidelines of organizational and national programs. The FSO shall:

(1) Attend training in safety program management, including FAA Course No. 12060, Crew Assessment and Flight Program Management for Flight Safety Officers (Initial), and FAA Course No. 12061, Crew Assessment and Flight Program Management for Flight Safety Officers (Recurrent).

(2) Coordinate safety issues common to operations. When necessary, elevate and coordinate with the LFSO.

(3) Promote the use of standard operating procedures that enhance safety.

(4) Conduct or provide safety meetings at least once for each quarter and maintain meeting records that include subjects, dates, presenters, and attendance. Safety meetings should be structured to include both the Order 4040.9D flight program and flight test project flying. Flight test engineers should attend the meetings.

(5) Identify and analyze trends in all Safety Significant Events (SSE), safety issues, and hazards reported to the FSO. An SSE is an event that does not qualify as an incident or accident but is sufficiently significant to warrant attention for trend analysis and sharing of lessons learned. This definition includes occurrences as defined in Chapter 5 of Order 4040.9D, FAA Aircraft Management Program.

(6) Maintain copies of all reported internal SSE's, safety issues, and hazards.

(7) Initiate accident prevention measures and/or track corrective actions, and retain a record of actions taken.

(8) Develop and maintain an internal plan for responding to aircraft accidents/incidents within the flight program. This plan must take into consideration both the Order 4040.9D, Flight Program and flight test project flying.

5. PROCEDURES.

a. Flight Test Risk Management. Risk management is the process by which: (1) hazards are identified, (2) an assessment is made of the risks involved, (3) mitigating procedures are established to reduce or eliminate the risks, and (4) a conscious decision is made, at the appropriate level, to accept residual risks. Risk assessment is normally done by a safety review process in which a flight test plan is reviewed by project and non-project personnel in order to draw out potential hazards and recommend mitigating (or minimizing) procedures.

(1) Definitions.

(a) HAZARD – A condition, event, or circumstance which could lead to an unplanned or undesired event (Injury to personnel, damage to equipment, loss of material, or loss of function).

(b) RISK – Expression of the impact of an undesired event in terms of event severity and probability.

(c) RISK ASSESSMENT – The process of identifying hazards and systematically quantifying or qualifying the degree of risk they pose for exposed individuals, populations, or resources.

(2) Concepts. All flight testing within AIR will be based on the following concepts:

(a) Accept no unnecessary risks. An "unnecessary risk" is any risk that, if taken, will not contribute meaningfully to the task.

(b) Reduce risks to an acceptable level. Risk is a part of flight test, but by applying risk management principles, flight-testing can be accomplished in a safe and efficient manner.

(c) Manage risks in the concept and planning stages of operations. Risk management is a deliberate team approach.

(d) Make risk decisions at the appropriate level. The level of risk management decisions must be commensurate with the level of risk. The higher the risk, the higher the level of management supervision.

(3) Requirement. The AIR Risk Management Process will be performed and documented for all FAA flight tests. Appendix 2 establishes the minimum standard for risk management within AIR. Regional Directorates/ACO's may develop local implementation and administrative procedures to

address unique regional requirements and office policies. However, local procedures must not be less conservative than the minimum standard. The AIR Risk Management Process applies to both TIA's that cover tests flown by FAA flight test crews and also those that are delegated to a Designated Engineering Representative (DER) test pilot since DER's must follow applicable orders. In addition, this process applies when official FAA Flight Certification Tests are conducted in accordance with a TIA by either a DOA or DAS or other recognized delegated organization. The AIR Risk Management process also applies to any other flight where FAA aircrews will participate (i.e., familiarization, company tests, proof of concept, etc.).

(4) Type Inspection Authorization (TIA) and Letters of Authorization (LOA) approvals will be the vehicle by which management insures that the AIR Risk Management Process has been satisfactorily accomplished for each TIA or LOA signed. Aircraft Certification Office managers or Flight Test Managers or their designees will sign **all** Type Inspection Authorizations (TIA). These managers **must understand** that by signing a TIA, they are stating that they have assessed and accepted the flight test risks involved with the project. Therefore, it is necessary for the manager or his/her designee, to ensure that the proper risk assessment be completed **before** signing the TIA. The degree and depth of the risk assessment process to be used for each test project will be determined by, and is the responsibility of, the ACO manager or the designee. Factors to be considered when making such a determination include, but not limited to, type of tests (avionics or airframe), knowledge base of particular tests (first time vs. done many times in the past), level of sophistication demonstrated by the applicant (experienced aircraft manufacturer vs. limited flight test experience), and flight crew currency in both the test method (s) and aircraft type.

b. Accidents, Incidents, Safety Significant Events, Safety Issue/Hazard Reports, and Data Collection. It is the intent of AIR to provide the highest level of safety while accomplishing the certification mission which may involve a higher than normal degree of risk associated with flight testing of new or modified aircraft. To enhance operational safety, each directorate within AIR will be responsible for establishing and maintaining their own internal program which identifies and reports accidents, incidents, SSE's, safety issues, and hazards.

(1) Throughout AIR, pilots and operators must report all accidents, incidents, and occurrences (SSE's) in accordance with Chapter 5, Section 2 of Order 4040.9D, as well as to their organizational management. For the purpose of clarification, the following definitions are provided:

(a) Accident – Aircraft accident means an event associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage.

1 Serious injury means any injury which:

(aa) Requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received;

(bb) Results in a fracture of any bone (except simple fractures of fingers, toes, or nose);

(cc) Causes severe hemorrhages, nerve, muscle, or tendon damage;

(dd) Involves any internal organ; or

(ee) Involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface.

2 Substantial damage means damage or failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component. Engine failure or damage limited to an engine if only one engine fails or is damaged, bent fairings or cowling, dented skin, small puncture holes in the skin or fabric, ground damage to rotor or propeller blades, and damage to landing gear, wheels, tires, flap, engine accessories, brakes, or wingtips are not considered "substantial damage" for the purpose of accident reporting.

(b) Incident – An event that requires immediate notification to the National Transportation Safety Board (NTSB) using the following criteria:

1 Flight control system malfunction or failure.

2 Inability of any required flight crewmember to perform his normal flight duties as a result of injury or illness.

3 Failure of structural components of a turbine engine excluding compressor and turbine blades and vanes.

4 In-flight fire.

5 Aircraft collide in flight.

6 Damage to property, other than the aircraft, estimated to exceed $25,000 for repair (including material and labor) or fair market value in the event of total loss, whichever is less.

7 For large multiengine aircraft (more than 12,500 pounds maximum certificated takeoff weight).

(aa) In-flight failure of electrical systems which requires the sustained use of an emergency bus powered by a back-up source such as a battery, auxiliary power unit, or air-driven generator to retain flight control or essential instruments.

(bb) In-flight failure of hydraulic systems that results in sustained reliance on the sole remaining hydraulic or mechanical system for movement of flight control surfaces.

(cc) Sustained loss of the power or thrust produced by two or more engines.

(dd) An evacuation of an aircraft in which an emergency egress system is utilized.

(c) Safety Significant Event (SSE) - Any ground or flight event that **does not** qualify as an Incident or Accident, as defined in 49 CFR, part 830 (National Transportation Safety Board rules pertaining to the notification and reporting of aircraft accidents or incidents, etc.), that affects or could affect the safety of an FAA aircraft (including rental aircraft) or crewmember. This definition includes occurrences as defined in Chapter 5 of Order 4040.9D.

(2) The primary focus of SSE reporting is to document and disseminate information, to capture lessons learned and, to minimize the chance of another occurrence.

(a) Events which meet the criteria below will be immediately reported by the personnel involved verbally and/or via electronic mail to, at least, the following personnel: The Aircraft Certification Office Assistant Flight Safety Officer (AFSO), the Directorate FSO, the AIR LFSO, and the FAA SFSO. Events to be reported include ground or flight events whose outcome:

1 Affected the safety of a crewmember.

2 Increased the identified level of risk (Flight test only).

3 Were unexpected and developed into an unsafe condition..

4 Involved aircraft damage (except for RTO and other runway testing, where damage is sometimes expected, i.e. blown tires).

5 Resulted in injury to personnel.

6 Produce lessons learned which could be beneficial to the FAA.

(b) SSE reports shall follow the format described in the Figure 1. Part 1 of the SSE report must be submitted on the initial immediate report. The remaining items (Part 2) may be completed on the initial report if the information is known or available at the time. Depending on the nature of the event, a more comprehensive Part 2 of SSE report form will be prepared by the local FSO at the request of the AIR LFSO. The suspense for submitting the final report will be mutually agreed to by the AIR LFSO and the local FSO.

(3) Accidents or incidents should be reported using the same format as described in the figure 1 for internal AIR processing. Additional information is required by the NTSB as described in Order 4040.9D, Chapter 5, Figure 5.1.

(4) The LFSO will use these reports to resolve problems, identify trends, and disseminate useful information for discussion at periodic safety meetings. Flight test-related reports will be distributed by the LFSO to the AIR flight test community for information.

c. Accident Response Plan. Each operating organization within AIR will establish a detailed accident response plan reflecting pertinent steps to be taken by various office personnel in case of an

aircraft accident. The provisions and requirements of FAA Order 4040.25, FAA Aircraft Accident/Incident Response Plan, and FAA Order 8020.11, Aircraft Accident and Incident Notification, Investigation, and Reporting, should be addressed in this plan. The accident response plan must be flexible enough to accommodate variations in the appropriate response. As an example, the variations should accommodate an accident that may occur as a result of flight activity within the scope of Order 4040.9D, flight testing of an applicants aircraft in conjunction with a TIA, an LOA, or assistance to field inspectors on some other authority (e.g., memo, record of telecon, etc.). The plan must also account for variations in the organizational structure of the office or facility involved, and the resources available to those personnel tasked with implementing the response plan.

d. Accident Investigation Responsibilities.

(1) The manager of the regional Flight Standards division is responsible for assuring that all aircraft accidents/incidents that occur in the division's geographical area of responsibility are investigated and reported to ensure the proper discharge of FAA responsibilities. The NTSB shall investigate all accidents and incidents involving FAA aircraft or airmen (reference: Order 8020.11A).

(2) The AIR LFSO will recommend to AIR-1 the formation of an AIR mishap safety investigation team, when deemed necessary, in order to capture "lessons learned" from a procedural perspective. These investigations will be performed in coordination with the FAA Office of Accident Investigation (AAI) and the FAA SFSO.

e. Audits and site visits. Formal safety evaluations throughout AIR will be conducted in conjunction with the flight program audits, in order to assure the least possible interruption to normal operational or organizational activities.

FIGURE 1. AIR Safety Significant Event (SSE) and Incident Report
(Use a Word document as an attachment to e-mail messages)

NOTE: This document is for FAA official use only and is protected under the Deliberative Process Privilege incorporated into Exemption 5 of the FOIA, 5 USC 552(b)(5).

PART 1

1. Date, UTC, and location of event
2. Who notified (if incident):
3. Aircraft type:
4. Purpose of test
5. Personnel aboard and any injuries:
6. Synopsis of event:

PART 2 (to be completed with part one if known)

7. Description of prior testing:
   a. Company:
   b. Build-up to event test condition:

8. Risk Management Process:
   a. Implementation and effectiveness:
   b. Adequacy of mitigation procedures:

9. Contributing factors:
   a. Weather conditions:
   b. Training and pilot proficiency (FAA/company):
   c. Adequacy of instrumentation/telemetry:
   d. Crew Resource Management considerations:
   e. Adequacy of program management:
   f. Conformity issues:
   g. Other:

10. Lessons learned:

11. Recommendations (optional):

12. Name of submitter:

f. Safety Support Activities.

(1) Safety Plan. All ACO's shall develop a program to include an accident response plan and method of reporting accidents, incidents, SSE's, and other mishaps to the LFSO.

(2) Crew Resource Management (CRM). Flight test pilots and engineers throughout AIR are required to attend initial and recurrent CRM courses as follows: Initial - FAA Course No. 12062; recurrent (Course No. 12066) - in conjunction with the National Test Pilot School 3 Year Recurrent Course Cycle.

John Hickey
Director, Aircraft Certification Service

APPENDIX 1. FAA FLIGHT TEST BRIEFING GUIDE

PRE-FLIGHT

- Flight no./test no.
- Purpose of test
- TIA signed/revision level
- Test aircraft configuration
- Ballast configuration
- Inoperative systems versus MEL and/or data requirements
- Conformity inspection (Recency of the inspection)
- Airworthiness certificate
- Changes since last flight
- Gross weights: takeoff GW/desired GW
- Center of gravity: takeoff CG/desired CG
- Fuel on board
- Aircraft performance versus takeoff conditions
- Airfield environment (runway conditions and obstructions)
- Takeoff time/crew show time/chase check-in time
- Communications: primary/secondary/emergency
- Ground station personnel/responsibilities
- Test area: location/altitude(s)
- Weather
- Fuel reserve requirements
- Recovery and landing
- Expected landing time
- Primary/alternate/emergency landing sites

TEST PROCEDURES

- Flight test plan reviewed
- Applicant's flight test report reviewed
- Detailed review of flight cards
- Buildup to end conditions
- Test predictions
- Procedures for monitoring test
- Instrumentation status
- AFM limitations
- Test limitations

APPENDIX 1. FAA FLIGHT TEST BRIEFING GUIDE (CONTINUED)

FLIGHT TEST PERSONNEL

- Pilot/PIC/copilot
- Flight test engineer (s)
- Observer (s)
- Seat assignments/inflight changes
- Crew status/rest
- Personnel safety equipment (helmets, parachutes, etc.)

SUPPORT / CHASE AIRCRAFT

- Type
- Call sign
- Registration number
- Crew
- Duties/procedures

CONTINGENCIES

- Lost sight/lost comms
- Emergency procedures (primary/secondary)
- Aircraft recovery devices procedures (spin chutes)
- Crew egress features/procedures
- Emergency/survival equipment procedures
- Chase/crash rescue procedures
- Alternate mission

POST-FLIGHT

- Aircraft discrepancies
- Post flight inspection results
- Landing time
- Discussion of test points
- Chase observations
- Data analysis observations
- FAR compliance
- Discussion of test points which approached / exceeded test limits
- Reports required

APPENDIX 2. AIR FLIGHT TEST RISK MANAGEMENT PROCESS

PURPOSE: This appendix establishes the minimum requirements for the AIR Risk Management Process for flight test and flight test-related operations within AIR.

PROCEDURES: The AIR Risk Management Process will be performed and documented for all FAA flight tests. The AIR Risk Management Process applies to both TIA's that cover tests flown by FAA flight test crews and also those that are delegated to a Designated Engineering Representative (DER) test pilot since DERs must follow applicable orders. This Process also applies to any non-certification flights and flight tests flown by FAA flight test crews (i.e. familiarization flights, participation in company flight tests, Proof of Concept, etc.).

1. Projects With Applicants With A Well Developed and FAA-Accepted Risk Management Process. In cases where flight testing is done with a company that has a well-developed risk management process, all AIR flight test crew members will conform to that company's process and perform accordingly. Flight test managers and/or crews, however, always have the option to modify flight test profiles, procedures, and/or limitations as necessary to satisfy FAA-unique safety concerns.

a. Manufacturers may implement an internal risk management process. To be found acceptable by the FAA, the process must comply, as a minimum, with the requirements of this order. The local ACO may accept company risk assessment and risk alleviation processes to assure that the company risk management process adequately reflects the requirements of the AIR Risk Management Process. In addition, the ACO must ensure that appropriate items of the FAA Flight Test Briefing Guide (appendix 1) are incorporated in company-developed briefing guides. Acceptance of the risk management process must be formally documented.

b. Acceptance of a company risk management process does not relieve the ACO responsibility to review each project's risk assessment in order to assess the possibility of additional mitigating procedures.

2. Projects With Applicants Without an FAA-accepted Risk Management Process. For those certification flight test projects where the applicant has no developed risk management process, the following applies:

a. A formal risk assessment must be conducted by the Aircraft Certification Office (ACO) prior to signing the TIA or LOA.

b. The FAA flight test crew must use the briefing guide contained in FAA Order 4040.26, appendix 1. When flights are scheduled in blocks, the briefing guide must be used for the first flight. For subsequent flights in the same block, appropriate parts of the briefing guide should be used as necessary.

c. Manufacturers who are regularly engaged in activities requiring FAA certification flight tests should be encouraged to develop a risk assessment process.

APPENDIX 2. AIR FLIGHT TEST RISK MANAGEMENT PROCESS (CONTINUED)

d. Safety Review Board (SRB). The SRB is a method which provides an opportunity for review of flight test programs after test teams have determined that they are ready for the tests. The real value of the SRB is in the preparation by the team members prior to the actual board. Most of the technical details and issues should be resolved prior to the SRB in order to permit a clear focus on the safety aspects of the tests. Experience has shown that knowledgeable non-project personnel who are similarly involved in other projects provide valuable contributions to this process. They can identify areas that may have been overlooked by the project team. A Safety Review Board (SRB) as described below is an accepted method for conducting safety reviews, especially for medium and high risk tests. This may be done via face-to-face meetings or telephonic conference. Directorate/ACO implementation procedures should establish when an SRB is required. Safety Review Boards should include the following participants, particularly for complex tests or for tests with medium, high risk or unique safety issues :

- Chairperson: A Manager, a Flight Safety Officer, or Test Pilot or Flight Test Engineer.
- Project Manager and/or Project Engineers
- Project Flight Test Pilot and Flight Test Engineer
- Flight Test Branch representative (if assigned Project Pilot or FTE unavailable)
- Outside Observer with the appropriate experience. (desired for independent look at safety issues)
- Project MIDO Specialist (desired for conformity and airworthiness issues)
- Applicant Representative(s)
- DER Pilot (when delegated)
- Project AEG Pilot, if appropriate

The following agenda is provided as a guideline for discussion topics in a safety review.

- Description of aircraft configuration to be certified (especially, any recent configuration changes, software changes, and changes to control laws).
- Review of the results of applicant's ground and structural tests, and flutter test analysis results, if applicable. (Specifically address any configuration changes or aircraft limitations that have resulted based on test results.)
- Review aircraft operating and airspeed limitations and any unique operating procedures required for safety reasons.

APPENDIX 2. AIR FLIGHT TEST RISK MANAGEMENT PROCESS (CONTINUED)

- Review the results of any company critical flight tests flown by the applicant in the aircraft configuration to be certified. This should include a summary of any "open" certification test requirements that have not yet been pre-flown by the applicant and a review of the applicant pre-TIA flight test report.
- Review the certification test plan with emphasis on test requirements and test procedures that may present an increased risk.
- Assessment of hazards, addressing potential risks and risk alleviation procedures to be used during the certification tests (Sample hazard categories and alleviation measures are presented in appendix 3.
- Review of test installations, test equipment and non-standard or non-test systems.

2. Risk Management Administrative Procedures. Implementation and administrative Procedures may be developed at the local level. However, documentation of risk assessment and applicable minimizing procedures shall be documented within or attached to the TIA or applicable LOA. Appendix 4 contains recommended risk assessment documentation forms. For low risk tests, Table I may be used as an alternative to developing specific mitigating procedures.

3. Risk Assessment Approval Authority. Risk assessment approval/signature must be commensurate with the risk level. Ultimately, the authority in each case resides with each ACO Manager. The ACO manager may delegate this authority as follows, but no lower than:

a. Low Risk - The Project Pilot or Project Flight Test Engineer (FTE), if no pilot assigned.

b. Medium Risk - The Manager in charge of flight test or the Project Pilot for large programs where there is more than one pilot assigned. In other cases (smaller ACO's) this authority may be delegated to the FSO or another ACO test pilot not associated with the program. Except for company-accepted risk management processes, the test pilot/FTE flying the test shall not approve his/her own risk assessment. For tests with applicants with FAA-accepted risk management processes, this authority may be delegated to the test pilot (or FTE if no pilot assigned).

c. High – The Manager in charge of flight test or next higher management level if the Flight Test Manager is the pilot flying the test.

4. Aircraft Configuration. To achieve safe operation it is important to maintain the conformity of the aircraft prior to and during flight testing, particularly whenever project delays occur. Conformity and inspection requirements identified in Part I of the TIA must be carefully reviewed when project delays are encountered. Prior to conducting flight tests, flight test personnel will verify aircraft conformity via an

APPENDIX 2. AIR FLIGHT TEST RISK MANAGEMENT PROCESS (CONTINUED)

appropriate form signed by a MIDO representative or, alternatively, by direct communication with the MIDO or DAR, where necessary. If the project is delayed, aircraft conformity is limited to 90 days unless it is documented by a member of the project team that a longer time period does not adversely impact flight test safety.

5. Reassessment of Risk. If, at any time, it becomes apparent that the assessed risk involved in any test event has been underestimated, that test event will be deleted or discontinued. The postflight briefing for such an event must include reference to any risk assessment levels that were inaccurately assessed or considered unsatisfactory and that information must be verbally forwarded by the involved FAA flight test personnel to the ACO FSO (See SSE reporting procedures, paragraph 4b of this order). The risk assessment process must then be reevaluated for adequacy. Approval to fly the event on a subsequent flight will be contingent on reassessing the risk and risk alleviation measures in accordance with the AIR Risk Management Process.

6. Change of Test Profile. Risk management is a deliberate team approach. However, in situations where it may be necessary to make changes to the flight test points (between flights and/or inflight) due to unusual circumstances and operational considerations (such as remote locations, aircraft availability, etc.), these changes are only permitted if they fall within the scope of the previously approved test plan with which the risk assessment was made, without an increase of risk, and with concurrence of all crewmembers onboard. Involvement of the on-site project team is preferable if questions of benefit are raised, or increased risk is suspected. Care must be taken that all foreseeable scenarios are considered in making this determination; changes shall not exceed the limits of the approved test plan nor compromise build-up to the desired test condition. Statements such as "perform other tests deemed necessary" in Part 2 of the TIA must be taken within the context of the requirements of this paragraph. Alternate statements may include "identify other tests which may be necessary as a result of this TIA."

APPENDIX 3. GUIDANCE FOR RISK ASSESSMENT AND RISK ALLEVIATION

1. DEFINITIONS. The following definitions address levels of risk relative to the conduct of a specific test condition. These definitions are very subjective in nature and are used in the assignment of risk levels. Figure 1 below is presented for illustration purposes only. It reflects risk levels using FAA hazard categories in relation to flight test probabilities instead of design requirements. The risk level is determined by entering the risk assessment chart with both the hazard category and probability, and seeing what risk category it fits into.

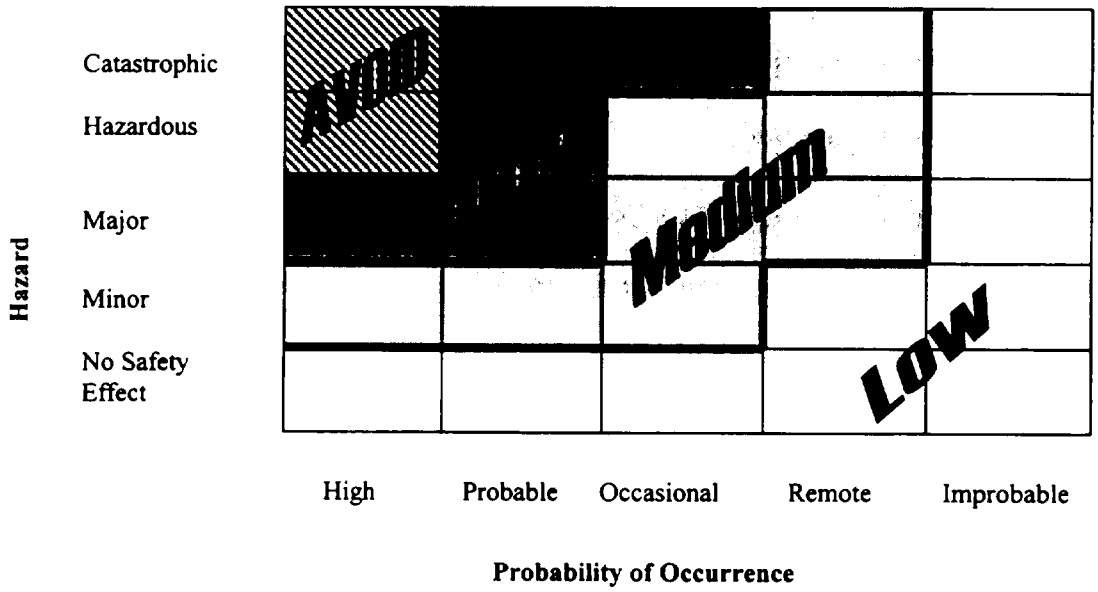
HIGH RISK - Test or activities which present a significant risk to personnel, equipment, or property, even after all precaution measures have been taken. This necessitates close oversight at all levels.

MEDIUM RISK - Test or activities which present a greater risk to personnel, equipment, or property than normal operations and require more than routine oversight.

LOW RISK - Test or activities which present no greater risk to personnel, equipment, or property than normal operations.

Typical examples of HIGH, MEDIUM, and LOW risk tests are included on pages A2-9 through A2-11 of this document.

Figure 1. Subjective Risk Assessment



APPENDIX 3 . GUIDANCE FOR RISK ASSESSMENT AND RISK ALLEVIATION (CONTINUED)

2. CONTRIBUTORS TO RISK RATING ASSESSMENT. The following list contains examples of factors which should be considered in assigning risk rating to test conditions:

a. Test technique and workload.

b. Altitude and airspeed in relation to terrain and/or airplane recovery equipment.

c. Gross weight and center of gravity.

d. Environment (weather, air traffic control, particular airport conditions, darkness, turbule, etc.).

e. Airplane internal environment (smoke, temperature, pressurization level, etc.).

f. Design maturity.

g. Test condition sequencing.

h. Adverse system or software effects.

i. Specific aircraft limitations.

j. Consequence of failure in technique, system, or structure.

k. Intentional multiple failure conditions.

l. Simulator/lab results/historical experiences/predictive studies.

m. FAA test pilot proficiency/currency/familiarity with the type of test aircraft.

3. RISK ALLEVIATION. Risk alleviation procedures are actions to minimize, understand or respond to risk. They should be actions the flight test crew has control over or events that the test crew can confirm have occurred (i.e., lab testing, simulator evaluations, etc.). The following items are examples, but by no means all inclusive, of considerations in defining risk alleviation procedures:

a. Is the test condition in its present form really needed? Does the FAA really need to repeat the test, or can it be delegated based on the applicant's testing?

APPENDIX 3. GUIDANCE FOR RISK ASSESSMENT AND RISK ALLEVIATION (CONTINUED)

b. How long has it been since the conformity on the test airplane configuration was conducted? Has anything changed since the design was reviewed?

c. Review test techniques and specify steps to reduce the risk.

d. Design the test for a conservative build-up of maneuvers.

e. Review the test environment and specify steps to reduce the risk (temperatures, winds, visibility are some examples.)

f. Provide predictions and expectations to prepare participants. Update performance predictions with flight test data when possible.

g. Run test in simulator, lab, etc.

h. Provide special training and consultation.

i. Specific training and equipment requirements (helmets, goggles, masks, oxygen, escape provisions, parachutes, fire extinguishers, etc.).

j. Use of chase plane observations to provide visual data.

k. Use of photo/video coverage.

l. Use of telemetry to monitor the tests in "real time".

m. Install hardware to protect structure and personnel (Vmu tailskid is an example.)

n. Limit personnel onboard to the absolute minimum required to safely conduct the test (do not arbitrarily set a limit on the number of personnel-take the right number to safely conduct the test.)

o. For build-up tests, utilize the "right" personnel to evaluate the data and plan for subsequent tests. Allow for adequate time to evaluate the build-up test points.

p. Schedule flight crews based on pilot qualifications and recent experience relative to the required tests being conducted.

q. Request a thorough briefing of the applicant's testing, techniques and results. On tests that are highly dependent on pilot technique, allow the applicant's pilot to conduct the initial tests and observe his/her performance before conducting the tests.

APPENDIX 3 . GUIDANCE FOR RISK ASSESSMENT AND RISK ALLEVIATION (CONTINUED)

r. On certain potentially hazardous ground tests (e.g., high energy RTOs), experienced ground crews should be briefed during the preflight briefing and be immediately available to support the tests if necessary (e.g., cooling fans, fire trucks, aircraft jacks, etc.). The ground crews should be advised as to "who is in charge" regarding their participation.

s. Review weight and balance computations. Weigh the loaded aircraft if possible. This is particularly important on critical handling qualities tests at the extremes of the weight/c.g. envelope and on WAT limited performance tests.

t. Minimize the number of actual engine cuts during runway performance testing if spool-down thrust can be properly accounted for by analysis and related systems failures can be accurately simulated.

u. All test personnel should be briefed on egress procedures.

v. For high altitude flights, all crewmembers must be briefed on oxygen use/ location.

w. For overwater flights, all crewmembers must be briefed on water survival equipment use/location.

x. Test personnel involved with cold/hot weather testing should be briefed on appropriate survival skills, and be properly equipped to endure the anticipated environment.

TYPICAL EXAMPLES OF FLIGHT TESTS AT VARIOUS RISK LEVELS

NOTE: These are typical examples only and are provided here for general guidance. The actual risk category must be evaluated on a case-by-case basis and it may be different than these examples depending on actual project-specific circumstances.

HIGH RISK

- Stall characteristics:

  a. Aft cg. accelerated stalls with rapidly changing dynamic conditions.

  b. On airplanes equipped with unproved pusher systems that are masking potential deep stalls.

  c. High altitude stalls on airplanes with potential engine flameout problems.

  d. With critical ice shapes.

- High speed tests above $V_{ne}/V_{MO}/M_{MO}$
- V_{MCA} tests at low altitude; particularly dynamic V_{MCA}.
- Flight control malfunction testing during takeoff and landing phases of flight, and asymmetric deployment of roll controls at high speeds.
- Ice shape testing, especially during the takeoff phase where special procedures are required.
- Maximum energy RTO's where wheel/brake fires are a possibility.
- Autopilot malfunction tests at low altitudes.
- WAT limited takeoffs with actual engine cuts.
- V_{MU} test at low thrust to weight ratios.
- V_{MCG} tests.
- Nosewheel steering malfunction tests.
- Spin testing.
- Lateral-directional testing on aircraft that can achieve extremely large sideslip angles.

TYPICAL EXAMPLES OF FLIGHT TESTS AT VARIOUS RISK LEVELS (CONTINUED)

- Dynamic lateral stability testing (dutch rolls) on airplanes that are extremely unstable under certain conditions.
- Inflight thrust reverser deployments.
- Systems installation (with unproved design aspects) where FHA has identified catastrophic events.
- Stall characteristics on Restricted Category airplanes with asymmetric wing store configurations.
- H/V envelope determination
- Helicopter low speed testing
- Autorotation
- PIO Testing
- Flight tests in which the FAA pilot is the sole occupant because of the nature of the test and/or configuration of the airplane and pilot proficiency is in question.

MEDIUM RISK

- Any tests involving low altitude operations (e.g., tower fly by)
- Formation flying and flights conducted in aerobatic airplanes.
- Icing tests flown behind a tanker (formation flying with potential restricted vision).
- Engine out engine operations at low altitude.
- Actual V_1 fuel cuts for takeoff performance.
- Inflight unusable fuel tests that result in engine flameout.
- Low speed and high speed stability and control tests.
- Emergency electrical power landings at night using standby instruments and reduced lighting (both external and internal).
- Emergency descents to demonstrate high altitude special conditions (possible physiological effects).

TYPICAL EXAMPLES OF FLIGHT TESTS AT VARIOUS RISK LEVELS (CONTINUED)

- Abnormal flight control configuration testing. Includes pitch and roll disconnects or manual reversion for hydraulic systems.
- Natural ice flights with large shapes on unprotected surfaces.
- Cockpit and cargo smoke evacuation tests.
- Engine water ingestion tests.
- Asymmetric thrust reverser deployments on the ground.
- Abnormal operations of various on-board systems.
- Flights involving FADEC testing (EMI, software, etc).
- TAWS (GPWS/EGPWS)

LOW RISK

- Basic system function tests (electrical, hydraulic, fuel, environmental, anti-ice, avionics, etc.).
- High altitude airspeed calibrations (e.g., trailing cone).
- Climb performance/speed power, etc.
- STC follow-on tests (e.g., TCAS (no intruder/target aircraft), FMS, etc.).

NOTE: TABLE I, TIA RISK ASSESSMENT TABLE FOR LOW RISK TESTS, CONTAINS RECOMMENDED GUIDANCE FOR LOW RISK TESTING.

Table I - TIA RISK ASSESSMENT TABLE FOR LOW RISK TESTS

This table contains recommendations for low risk testing with no further consideration of risk mitigation necessary. The Flight Safety/Risk Management TIA requirement can be satisfied by referencing the applicable "*INDEX*" from the table below for repetitive type, low risk flight tests in the Risk Assessment Block on the Type Inspection Authorization. In consideration of the above, this implies no flight operations outside the normal flight envelope of the test aircraft are required and all test points will honor AFM Limitations, including weight and balance considerations.

When flight characteristics or handling qualities are not altered as a result of the modification(s) to the test aircraft, the table can be referenced. If flight characteristics or handling qualities are altered, then the table is not applicable and a more formal risk assessment must be accomplished prior to TIA signature.

NOTE: All operations must adhere to basic FAR 91 requirements, i.e., cloud clearance, visibility, safe altitudes, etc.

INDEX	*TYPE OF TEST*	*AIRCRAFT CLASS*	*TEST/OPERATING AREA ALTITUDE RANGE*	*WEATHER REQUIREMENTS & FLIGHT CONDITIONS*	*REMARKS*
A	Avionics (including FMS functional GPS, TCAS II)	ASE, AME, Rotorcraft, LTA	Within gliding distance of land for aircraft not equipped for overwater ops or not capable of sustained OEI flight.	VMC (Day or Night) (See remarks)	No operations below 500' AGL, no high sink rates below 1500' AGL. At discretion of test crew rotorcraft tests may be conducted below 500' AGL where nature of test requires such exception, and has been thoroughly pre-briefed. TCAS testing limited to VMC Day conditions. No flight involving formation flying or intruder/target aircraft. Testing in IMC may be performed when system integrity has been proven (successful ground EMI/RFI tests) and means other than the system being tested are available to fly under IFR. However, for the first takeoff and the first landing, the weather conditions are limited to no lower than circling minimums.
B	Night Evaluation of cockpit lighting	All	Within the National Airspace System or test area acceptable to flight crew.	VMC Night	Excludes emergency electrical system evaluation.
C	EMI for cabin electrical systems installations	All (See remarks)	Within the National Airspace System or test area acceptable to flight crew.	VMC (Day or Night) (See remarks)	Limited to aircraft without Fly-By-Wire Flight Controls. Autoland, FADEC, etc. Testing in IMC may be performed when system integrity has been proven (successful ground EMI/RFI tests). However, for the first takeoff and the first landing, the weather conditions are limited to no lower than circling minimums.
D	Climb Performance	All	Within gliding distance of land for aircraft not equipped for overwater ops or not capable of sustained OEI flight.	VMC Day	No operations below 500' AGL, no high sink rates below 1500' AGL. IMC may be acceptable for aircraft not on an experimental CofA.
E	Engine Cooling	Airplane, Rotorcraft	Within gliding distance of land for aircraft not equipped for overwater ops or not capable of sustained OEI flight.	VMC day, no visible moisture.	
F	Basic Systems Functional Tests	All	In accordance with Program Letter Limits.	VMC/IMC Day or Night	These tests are simple functional tests similar to Production Flight testing or Return to Service after Maintenance.
G	High Altitude airspeed calibration	All	IAW Program Letter	VMC Day	
H	Cockpit Evaluation for layout or Human Factors issues.	All	IAW Program Letter	VMC/IMC Day or Night	

APPENDIX 4. RECOMMENDED TIA DOCUMENTATION FOR HIGH OR MEDIUM RISK TESTS

TYPE INSPECTION AUTHORIZATION
(NAME OF PROJECT)

PROJECT NUMBER:
PAGE X X OF XX

GENERAL

(*General description of the project goes here.*)

TIA RISK ASSESSMENT

This TIA has been assessed as *(HIGH / MEDIUM)* risk. The following significant risk factors have been identified and procedures integrated to reduce or mitigate to the extent possible the level of risk expected during the following tests described in this TIA:

(*List identified risk factors and mitigating procedures.*)

Flight Test Branch Manager : _____ _____
Signature Date

TIA OPERATING LIMITATIONS

(*List additional limitations resulting from safety reviews.*)

18A The Manufacturing Inspection (Branch) will accomplish the following:

1.

18B The Flight Test (Branch) will accomplish the following:

1.

APPENDIX 4. RECOMMENDED TIA DOCUMENTATION FOR LOW RISK TESTS

TYPE INSPECTION AUTHORIZATION
(NAME OF PROJECT)

PROJECT NUMBER:
PAGE X X OF XX

GENERAL

(*General description of the project goes here.*)

TIA RISK ASSESSMENT

The risks associated with the testing described in this TIA have been reviewed, and it has been determined that these tests fall within the TIA risk assessment table for low risk tests in FAA Order 4040.26A. It is expected that the risks associated with the testing will be mitigated by adhering to the restrictions and limitations set forth in the table and are therefore considered acceptable.

Risk Assessment Index: _____

(or)

The risks associated with the testing described in this TIA have been assessed as low risk and the following mitigating procedures presented below have been established

Test Pilot : _____ _____
Signature Date

TIA OPERATING LIMITATIONS

(*List limitations that may be in addition to those presented in the TIA risk assessment table for low risk tests in FAA Order 4040.26A.*)

(or)

(List applicable procedures or limitations, if not using table I)

18A The Manufacturing Inspection (Branch) will accomplish the following:

1.

18B The Flight Test (Branch) will accomplish the following:

1.

APPENDIX 4. RECOMMENDED TIA DOCUMENTATION FOR FAA-ACCEPTED COMPANY RISK MANAGEMENT PROCESS

TYPE INSPECTION AUTHORIZATION
(NAME OF PROJECT)

PROJECT NUMBER:
PAGE X X OF XX

GENERAL

(*General description of the project goes here.*)

TIA RISK ASSESSMENT

The flight safety and risk assessment program of the [*applicant's name*] will be used to analyze hazards and minimize risks associated with flight testing authorized by this TIA. (*Reference ACO's documented acceptance of the applicant's risk management process.*)

*Flight Test Branch Manager : _____ _____
Signature Date

*May be signed by the Flight Test Pilot or FTE for medium or low risk tests.

TIA OPERATING LIMITATIONS

(*List additional limitations resulting from the ACO's review of the company's risk assessment for this specific project.*)

18A The Manufacturing Inspection (Branch) will accomplish the following:

1.

18B The Flight Test (Branch) will accomplish the following:

1.

U.S. Department
of Transportation

Federal Aviation Administration

Directive Feedback Information

Please submit any written comments or recommendations for improving this directive, or suggest new items or subjects to be added to it. Also, if you find an error, please tell us about it.

Subject: Order _____

To: Directive Management Officer, AIR-520

(Please check all appropriate line items)

☐ An error (procedural or typographical) has been noted in paragraph _____ on page _____.

☐ Recommend paragraph _____ on page _____ be changed as follows:
(attach separate sheet if necessary)

☐ In a future change to this directive, please include coverage on the folowing subject
(briefly describe what you want added):

☐ Other comments:

☐ I would like to discuss the above. Please contact me.

Submitted by: _____ Date: _____

FTS Telephone Number: _____ Routing Symbol: _____

FAA Form 1320—19 (8-89)