Aircraft Airworthiness Certification

Department of CAAC

Management Procedure

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Aircraft Type Certification Flight Test Safety Program

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Aircraft Type Certification Flight Test Safety Program

1. General

1.1 Purpose

This procedure defines the requirements, responsibilities and safety related procedures of flight test personnel for type certification, in order to ensure that CAAC flight test personnel and flight test DERs can safely conduct flight tests, which keeps CAAC flight test in a relatively high safety level.

1.2 Authority

This procedure is established according to “Certification Procedures for Civil Aviation Products and Parts” (CCAR-21).

1.3 References

(1) FAA Order 4040.26A, Aircraft Certification Service Flight Safety Program, March 23 2001;

(2) FAA Order 4040.9D, FAA Aircraft Management Program, September 20 2004;

(3) ICAO Annex 13, Aircraft Accident and Incident Investigation, 10th edition, July 2010;

(4) Rules for the Production Safety Accident Report and Investigation, State Council’s Order 493;

(5) Regulation of Civil Aircraft Accidents and Incidents Investigation, CCAR-395-R1, March 26 2007;

(6) Regulation of Civil Aviation Safety Information Management, CCAR-396-R2, November 23 2009.

1.4 Applicability

This procedure applies to the management of all flight test activities participated by CAAC test pilots, flight test engineers, flight test engineer DER and flight test pilot DER. Flight tests conducted by company pilots and flight test engineers are recommended to use this procedure when applicable.

1.5 Background

On Feb 15, 2008, the aircraft airworthiness certification department of CAAC (CAAC-AAD) issued the management procedure AP-ARJ21-07, Aircraft Certification Flight Test Safety Program, which is specifically applicable to ARJ21-700 program, with reference to FAA order 4040.26A, Aircraft Certification Safety Program. And the management procedure is applied in the type certification procedure of ARJ21-700. With the development of aircraft manufacturing and increasing flight tests of aircraft/simulators participated by CAAC test personnel, for the purpose of better safety management, CAAC-AAD decides to revise the management procedure, and make it applicable to all aircraft type certification programs. The revised procedure was issued on April 5, 2012, and the number of the procedure changed to AP-21-AA-2012-31.

During the implementation of the procedure to manage the flight test safety in aircraft type certification, CAAC-AAD has collected many comments and

recommendations, such as clarifying the responsibilities of flight test safety management organization and personnel, improving the report and analysis process of the Safety Significant Event (SSE), defining the responsibilities of accident, incident and SSE investigation etc. CAAC-AAD decides to revise the procedure and incorporate the experiences gathered in the practices to enhance the flight test safety management of aircraft type certification.

1.6 Cancellation

AP-21-AA-2012-31, Aircraft Certification Flight Test Safety Program, is replaced by this procedure.

2. Associated Roles and functions

2.1 Aircraft Airworthiness Certification Department of CAAC

(1) Fight Program Oversight Committee (FPOC) is established by the Aircraft Airworthiness Certification Department of CAAC (CAAC-AAD) at the airworthiness certification system level. The director general or deputy director general of CAAC-AAD acts as the chairman of the committee, and the members of the committee include the representatives from CAAC-AAD, certification divisions of the CAAC regional administration and the airworthiness certification centers.

The primary purpose of FPOC is to set goals and review safety-related recommendations. FPOC must review the CAAC-AAD’s flight test safety policy and management procedure. FPOC will also review the corrective recommendations resulting from the accident, incident and SSE investigation,

and track the response to the corrective recommendation implementation.

(2) CAAC-AAD will collect and disseminate flight test accident, incident and SSE information from and to the organizations conducting certification flight test in the airworthiness certification system. CAAC-AAD will also manage the following certification flight test safety management activities:

(a) Provide safety related guidance.

(b) Manage Flight Test Safety Plan (FTSP) that meets the policy, standards, and guidelines of the national program.

(c) Collect safety findings and require the corrective action.

(d) Coordinate aircraft accident, incident and SSE investigations within the airworthiness certification system when necessary.

(e) Organize training in flight test safety management.

(f) Schedule and conduct flight test relevant conferences, participate in meetings, and relevant aviation industry flight safety events when necessary.

2.2 Regional Airworthiness Certification Offices

Regional Airworthiness Certification Offices mean certification divisions of the CAAC regional administration and the airworthiness certification centers. Regional Airworthiness Certification Offices conduct the following certification flight test safety management activities:

(1) Organize and attend training in safety program management, the training can be conducted in accordance with AP-21-AA-2012-33, The Responsibilities, Procedures and Training Requirements for Flight Test Pilot and Flight Test

Engineer of CAAC.

(2) Coordinate safety issues that is common in flight test. If necessary, coordinate with CAAC-AAD.

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

(4) Addend or organize safety meetings periodically and maintain meeting records that include subjects, dates, presenters, and attendance. Flight test engineers must attend the meetings.

2.3 Aircraft Type Certification Team

For the aircraft type certification program in which the authority flight tests are necessary, the certification team must manage the flight safety files and flight safety records. The certification team must appoint a staff responsible for the management and for the coordination among CAAC-AAD, responsible regional airworthiness certification office, flight test pilots and flight test engineers. The responsible staff must be the certification team member, and normally is the certification team leader, or the deputy leader responsible for the flight performance or flight test, or the leader of flight performance or flight test sub-team. The certification team conducts the following activities:

(1) Develop and implement a specific flight test safety plan related to the aircraft type certification flight test, for responding to accidents, incidents and SSEs in aircraft type certification flight test.

(2) Track the accidents, incidents and SSEs in applicant flight test, investigate and analyze the incidents, SSEs and safety issues in certification flight test, and

analyze trends when necessary.

(3) Report all incidents and SSEs to responsible regional airworthiness certification office and CAAC-AAD, and the conclusion of incident and SSE investigation. And coordinate the further investigation, when CAAC-AAD deems necessary.

(4) Maintain copies of all reported incidents, SSEs, safety issues and hazards.

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

3. Procedures

3.1 Flight Test Risk Management

Risk management is the process by which:

(1) Hazards are identified;

(2) Assessment is made for the related risks;

(3) Mitigating procedures are established to reduce or eliminate the risks, and

(4) 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 Aircraft Airworthiness Certification Systems of CAAC 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 work.

(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 CAAC Risk Management Process will be performed and documented for all CAAC flight tests. Appendix 2 establishes the minimum standard for risk management at the level of CAAC-AAD. Regional Airworthiness Certification

Offices 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 CAAC-AAD Risk Management Process applies to both TIA's that cover tests flown by CAAC flight test crews and also those that are delegated to a Designated Engineering Representative (DER) test pilot since DER's must follow applicable orders. The CAAC-AAD Risk Management process also applies to any other flight where CAAC aircrews will participate (i.e., familiarization flight, company tests, proof of concept, etc.).

(4) Type Inspection Authorization (TIA) and Letters of Authorization (LOA) approvals (Refer to AP-21-AA-2012-33, The Responsibilities, Procedures and Training Requirements for Flight Test Pilot and Flight Test Engineer of CAAC) will be the vehicle by which management insures that the CAAC-AAD Risk Management Process has been satisfactorily accomplished for each TIA or LOA signed. CAAC-AAD, Regional Airworthiness Certification Office managers or Flight Test Program 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 Type

Certification Team Leader. 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.

3.2 Accidents, Incidents, Safety Significant Events, Safety Issue/Hazard Reports, and Data Collection.

It is the intent of CAAC-AAD 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 type certification team will be responsible for establishing and maintaining their own flight test plan which identifies and reports accidents, incidents, SSEs, safety issues, and hazards.

(1) The definition of accident, incident and SSE

Throughout aircraft airworthiness certification system, pilots must report all accidents, incidents, and occurrences to their organizational management. For the purpose of clarification, the 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.

A. The criteria of serious injury must comply with “Rules for the Production Safety Accident Report and Investigation” (State Council’s Order 493).

B. The criteria of aircraft substantial damage must comply with ICAO Annex 13, Aircraft Accident and Incident Investigation.

(b) Incident

A. Flight control system malfunction or failure.

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

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

D. In-flight fire.

E. Aircraft conflict in flight.

F. Damage to property, other than the aircraft, estimated to exceed 200,000 RMB for repair (including material and labor) or fair market value in the event of total loss, whichever is less.

G. For large multiengine aircraft (maximum certificated takeoff weight exceeds 5,700 kg):

(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 will affect or possibly affect the safety of CAAC aircraft or crewmember.

(2) Report and analyze SSE

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 the certification team staff responsible for flight test safety. Events to be reported include ground or flight events whose outcome:

A. Affected the safety of a crewmember.

B. Increased the identified level of risk (flight test only).

C. Were unexpected and developed into an unsafe condition.

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

E. Resulted in injury to personnel.

F. Produced lessons learned which could be beneficial to the CAAC.

(b) The certification team is responsible for reporting and analyzing SSE. SSE

reports must follow the format described in the Appendix 7. 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 certification team at the request of CAAC-AAD, and submit to the regional airworthiness certification office and CAAC-AAD.

(3) Report and analyze incident

The certification team is responsible for reporting and preliminarily analyzing incident. Incident reports also must follow the format described in the Appendix 7. Depending on the nature and preliminary analysis result of the incident, the regional airworthiness certification office and CAAC-AAD decide whether the detailed investigation is necessary and organize the related tasks.

(4) Report and analyze accident

According to “Regulation of Civil Aviation Safety Information Management” (CCAR-396-R2), the Special Flight Permit holder of such flight test must report accident to CAAC, and accept the investigation according to the national law and CAAC regulations.

For the purposes of capturing technical lessons learned, identifying the deficiencies of the safety management and procedure, the certification team must report the accident to the regional airworthiness certification office and CAAC-AAD by using the format described in the Appendix 7, according to the

Accident Response Plan required by section 3.3 of this procedure.

CAAC-AAD is responsible for the internal accident investigation with the airworthiness certification system, finding the cause of the accident, requiring accident prevention measures and corrective actions, and improving the flight test safety management.

(5) CAAC-AAD will use the accident analysis to resolve problems, identify trends, and disseminate useful information for discussion at periodic safety meetings.

3.3 Accident Response Plan

Each regional airworthiness certification office must establish a detailed accident response plan reflecting pertinent steps to be taken by various office personnel in case of an authority certification flight test accident. The accident response plan must be flexible enough to accommodate variations in the appropriate response, and must account for an accident that may occur as a result of flight activity, flight testing of an applicant’s aircraft in conjunction with a TIA, an LOA, or assistance to field inspectors on some other authority (e.g., memo, record of communication, 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.

3.4 Audits and site visits

Formal safety evaluations throughout the airworthiness certification system will

be conducted in conjunction with the flight program audits, in order to assure the least possible interruption to normal operational or organizational activities.

3.5 Safety support activities

(1) Safety plan

Each regional airworthiness certification office must develop a program to include an accident response plan and method of reporting accidents, incidents SSEs, safety issues/hazard reports to CAAC-AAD.

(2) Crew resource management (CRM)

Flight test pilots and engineers throughout Airworthiness Certification System are required to attend initial and recurrent CRM courses, refer to AP-21-AA-2012-33, The Responsibilities, Procedures and Training Requirements for Flight Test Pilot and Flight Test Engineer of CAAC for detail requirements.

4. Supplementary Provision

CAAC-AAD is responsible for interpretation of this management procedure.

APPENDIX 1 CAAC FLIGHT TEST BRIEFING GUIDE

1. 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 (The most recent inspection)
- Special Flight Permit
- 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)
- Crew show time/chase check-in time/takeoff 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 site

2. 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

3. FLIGHT TEST PERSONNEL

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

4. SUPPORT / CHASE AIRCRAFT

- Type

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

5. CONTINGENCIES

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

6. POST-FLIGHT

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

APPENDIX 2 CAAC-AAD FLIGHT TEST RISK MANAGEMENT PROCESS

1. PURPOSE

This appendix establishes the minimum requirements for the Risk Management Process for flight test and flight test-related operations within CAAC-AAD.

2. PROCEDURES

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

2.1 Projects with Applicants with a Well Developed and CAAC-Accepted Risk Management Process.

In cases where flight testing is done with a company that has a well-developed risk management process, all 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 CAAC-unique safety concerns.

(1) Applicant may implement an internal risk management process. To be found

acceptable by the CAAC, the process must ensure that appropriate items of the CAAC Flight Test Briefing Guide (appendix 1) are incorporated in company-developed risk management process. Acceptance of the risk management process must be formally documented, through an airworthiness management document.

(2) Acceptance of a company risk management process does not relieve the Regional Certification Office responsibility to review each project's risk assessment in order to assess the possibility of additional mitigating procedures.

2.2 Projects with Applicants without a CAAC-accepted Risk Management Process.

For those certification flight test projects where the applicant has no developed risk management process, the following applies:

(1) A formal risk assessment must be conducted by the Regional Airworthiness Certification Office prior to signing the TIA or LOA.

(2) The CAAC flight test crew must use the briefing guide contained in 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.

(3) Manufacturers who are regularly engaged in activities requiring CAAC certification flight tests should be encouraged to develop a risk assessment process.

(4) 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. Regional aircraft certification office 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: Certification Team Leader, a Certification Team Staff responsible for flight test safety, or Test Pilot or Flight Test Engineer.
- Certification Team Leader and/or Project Engineers
- Project Flight Test Pilot and Flight Test Engineer
- Flight Test Facility representative (if assigned Project Pilot or FTE unavailable)
- Outside Observer with the appropriate experience. (desired for independent look at safety issues)

- Project manufacturing inspection 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.
- 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.

2.3 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, 5, 6 contains recommended risk assessment documentation forms. For low risk tests, Table 1 may be used as an alternative to developing specific mitigating procedures.

2.4 Risk Assessment Approval Authority.

Risk assessment approval/signature must be commensurate with the risk level. Ultimately, the authority in each case resides with each Regional Airworthiness Certification Office Manager. The Regional Airworthiness Certification Office director may delegate this authority as follows, but no lower than:

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

(2) Medium Risk - The Manager in charge of flight test or the Project Pilot for large programs where there is more than one pilot assigned.

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 CAAC-accepted risk management processes, this authority may be delegated to the test pilot (or FTE if no pilot assigned).

(3) High Risk– The manager in charge of flight test or next higher management level if the Flight Test Manager is the pilot flying the test.

2.5 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 appropriate form signed by a Manufacturing Inspection Specialist. 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.

2.6 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 post flight 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 reported by the involved CAAC flight test

personnel to the Certification Team Staff responsible for flight test safety. 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 CAAC-AAD Risk Management Process.

2.7 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 in flight) 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 CAAC 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.

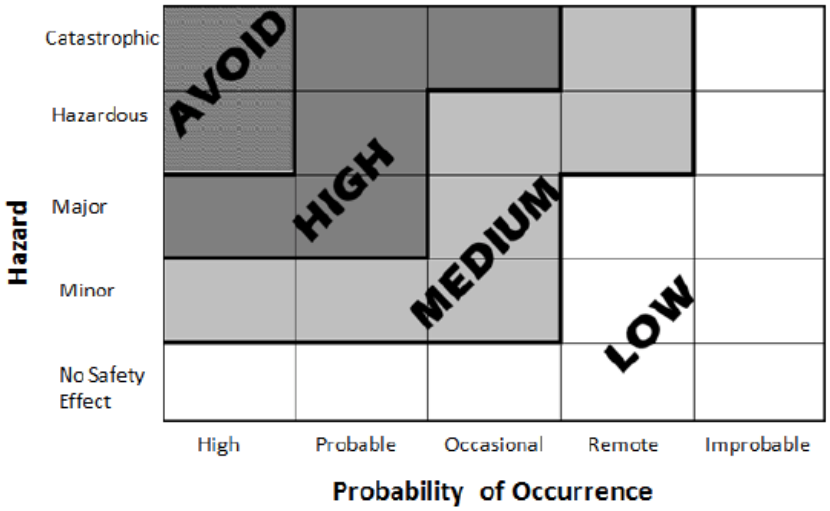
HIGH RISK – Test or activities which present a significant risk to personnel, equipment, or property, even after all precaution measures have been taken. This necessitates close oversight at all levels.

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 appendix 4, 5, 6 of this document.

Figure 1. Subjective Risk Assessment



2. CONTRIBUTORS TO RISK RATING ASSESSMENT.

The following list contains examples of factors which should be considered in assigning risk rating to test conditions:

(1) Test technique and workload.

(2) Altitude and airspeed in relation to terrain and/or airplane recovery equipment.

(3) Gross weight and center of gravity.

(4) Environment (weather, air traffic control, particular airport conditions, darkness, turbulence, etc.).

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

(6) Design maturity.

(7) Test condition sequencing.

(8) Adverse system or software effects.

(9) Specific aircraft limitations.

(10) Consequence of failure in technique, system, or structure.

(11) Intentional multiple failure conditions.

(12) Simulator/lab results/historical experiences/predictive studies.

(13) CAAC test pilot proficiency/currency/familiarity with the typeof 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:

(1) Is the test condition in its present form really needed? Does the CAAC really need to repeat the test, or can it be delegated based on the applicant’s testing?

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

(3) Review test techniques and specify steps to reduce the risk.

(4) Design the test for a conservative build-up of maneuvers.

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

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

(7) Run test on simulator or in lab, etc.

(8) Provide special training and consultation.

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

(10) Use of chase plane observations to provide visual data.

(11) Use of photo/video coverage.

(12) Use of telemetry to monitor the tests in “real time”.

(13) Install hardware to protect structure and personnel (V_{MU} tailskid is an example.)

(14) 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.)

(15) 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.

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

(17) 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.

(18) 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.

(19) 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.

(20) 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.

(21) All test personnel should be briefed on egress procedures.

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

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

(24) 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 TEST AT VARIOUS RISK LEVELS

NOTE: These typical examples are provided here only 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.

1. 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 exceed $V_{ne}/V_{MO}/M_{MO}$
- V_{MCA} tests at low altitude; particularly dynamic V_{MCA} test.
- 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.
- Nose wheel steering malfunction tests.
- Spin testing.
- Lateral-directional testing on aircraft that can achieve extremely large sideslip angles.
- 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 CAAC pilot is the sole occupant because of the nature of the test and/or configuration of the airplane and pilot proficiency is in question.

2. 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.
- In flight 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).
- 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)

3. 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 1, TIA risk assessment table for low risk tests, contains recommended guidance for low risk testing.

Table 1 - 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 CCAR 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.	V_{MC} (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 V_{MC} 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.

INDEX	TYPE OF TEST	AIRCRAFT CLASS	TEST/OPERATING AREA ALTITUDE RANGE	WEATHER REQUIREMENTS & FLIGHT CONDITIONS	REMARKS
B	Night Evaluation of cockpit lighting	All	Within the National Airspace System or test area acceptable to flight crew.	V_{MC} 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.	V_{MC} (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.	V_{MC} Day	No operations below 500’ AGL, no high sink rates below 1500’ AGL. IMC may be acceptable for aircraft not on an SFP.
E	Engine Cooling	Airplane, Rotorcraft	Within gliding distance of land for aircraft not equipped for overwater ops or not capable of sustained OEI flight.	V_{MC} day, no visible moisture.	

INDEX	TYPE OF TEST	AIRCRAFT CLASS	TEST/OPERATING AREA ALTITUDE RANGE	WEATHER REQUIREMENTS & FLIGHT CONDITIONS	REMARKS
F	Basic Systems Functional Tests	All	In accordance with Program Letter Limits.	V_{MC}/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	In accordance with Program Letter Limits.	V_{MC} Day	
H	Cockpit Evaluation for layout or Human Factors issues.	All	In accordance with Program Letter Limits.	V_{MC}/IMC Day or Night	

Table 2 TIA RISK ASSESSMENT TABLE

(V_{MCA})

Hazard Number: A13	Risk Assessment				
Test Plan: Aero 1	**Catastrophic**	Avoid	High	**High**	Medium	Low
Flight Test Technique: V_{mca} Static.	**Hazardous**	Avoid	High	Medium	Medium	Low
Hazard: *Loss of control*	**Major**	High	High	Medium	Medium	Low
	Minor	Medium	Medium	Medium	Low	Low
	No Safety Effect	Low	Low	Low	Low	Low
Cause: Low altitude stall.	Severity / Probability	Frequent	Probable	Occasional	Remote	Improbable
Effect: Ground impact, Loss of aircraft and crew.						

Minimizing Procedure:

1 The pilots must be familiar with the airplane's handling characteristics at low-speed, high angle-of-attack, and stall departure recovery techniques.

2. Monitor structural loads real-time

3. Pre-flight briefing to include engine failure procedures, the quick-start procedure, along with ditching procedures (if over water).

4. Directional control handling qualities testing and Light / Aft stall characteristics will be completed prior to any V_{MCA} tests.

5. Entry altitude should be a minimum of xxxx ft AGL.

6. Spin-chute (if installed) must be operational and pilot familiar with its operation.

7. Minimum crew only.

8. etc.

Emergency Procedures: Reduce angle-of-attack, increase airspeed and retard throttle as necessary to maintain directional control

Weather Requirement and/or Flight Conditions: V_{MC}, no clouds below.

Minimum Essential Aircrew: **YES** NO | Parachutes Required: **YES** NO

RISK	LOW	MEDIUM	**HIGH**	AVOID

APPENDIX 4 RECOMMENDED TIA DOCUMENTATION FOR HIGH/MEDIUM RISK FLIGHT TEST

TYPE INSPECTION AUTHORIZATION — PROJECT NUMBER:
(NAME OF PROJECT) — PAGE XX OF XX

GENERAL

(General description of the project goes here.)

TIA RISK ASSESSMENT

This TIA has been assessed as high/medium risk. Major risk contributing factors have been identified, with certain procedures applied in order to lower the risk level to the estimated level described in this TIA.

(List potential hazards and recommend mitigating (or minimizing) procedures)

Flight Test Principal: (Signature) (Date)

TIA OPERATING LIMITATIONS

(List additional limitations resulting from the 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.

APPENDIX 5 RECOMMENDED TIA DOCUMENTATION FOR LOW RISK FLIGHT TEST

TYPE INSPECTION AUTHORIZATION PROJECT NUMBER:
(NAME OF PROJECT) PAGE XX 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] has been assessed with flight testing authorized by this TIA, and consider these tests as low risk. We anticipate the risk can be mitigated by applying limitations listed in this document. Thence the risk assessment is acceptable.

Risk assessment index number : _____

OR

Flight tests in accordance within this TIA have been assessed as low risk, mitigating procedures been established as follow:

test pilot: (Signature) (Date)

TIA OPERATING LIMITATIONS

(List additional limitations resulting from the low risk test assessment for this specific project.)

OR

(List applicable procedures or limitations if not using Table 1)

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

1.

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

1.

APPENDIX 6 RECOMMENDED APPLICANT'S RISK MANAGEMENT PROCEDURE TIA DOCUMENTATION ACCEPTED BY AUTHORITY

TYPE INSPECTION AUTHORIZATION — PROJECT NUMBER:
(NAME OF PROJECT) — PAGE XX 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] here is to analyze and minimizing risks associated with this TIA. (Quote here: Air Certification System Acceptance approval document of applicant's risk management program)

* Flight Test Branch Director: (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 low risk test assessment for this specific project.)
OR
(List applicable procedures or limitations if not using Table 1)

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

1.

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

1.

APPENDIX 7 SAFETY SIGNIFICANT EVENT (SSE) AND INCIDENT REPORT

NOTE: This document is for CAAC official use only

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:

(1) Company:

(2) Build-up to event test condition:

8. Risk Management Process:

(1) Implementation and effectiveness:

(2) Adequacy of mitigation procedures:

9. Contributing factors:

(1) Weather conditions:

(2) Training and pilot proficiency (CAAC/company):

(3) Adequacy of instrumentation/telemetry:

(4) Crew Resource Management considerations:

(5) Adequacy of program management:

(6) Conformity issues:

(7) Other:

10. Lessons learned:

11. Recommendations (optional):

12. Name of submitter:

Revision 1 Amendment Explanation

1. This procedure revises “Aircraft Type Certification Flight Test Safety Program” (AP-21-AA-2012-31).
2. Adjust the setup of safety management personnel. The original 2 levels management (CAAC-AAD appoints FPOC and LFSO, the regional airworthiness certification offices appoint FSO) changes to 3 levels management (CAAC-AAD, the regional airworthiness certification offices and aircraft type certification team). Keep the mechanism of setting FPOC at CAAC-AAD, FPOC is responsible to set safety goal and review the safety related recommendations.
3. Adjust the functions of FPOC, CAAC-AAD, the regional airworthiness certification offices, and the certification team staff responsible for flight test safety.
4. Define the reporting and analysis process of accident, incident and SSE. Except that the accident is reported and investigated according to the national law and CAAC regulations, the incident and SSE are analyzed by the certification team staff responsible for flight test safety, and reported to CAAC-AAD.

Revision 0 Explanation

1. The main content of this procedure is established according to FAA ORDER 4040.26A, but the format is arranged as per the requirement for procedure.
2. Due to difference between the CAAC management organization and FAA, the personnel responsibility part is significantly adjusted, the personnel responsibility is partly simplified compared to the definition in 4040.26A, the functions related to National Transport Safety Board (NTSB) is deleted in this procedure. And the functions of the FAA certification center and Aircraft Certification Office (ACO) are put under the regional airworthiness certification system.
3. The safety management personnel are set in two classes, the CAAC-AAD set the leader flight safety officer (LFSO), the regional airworthiness certification system set the flight safety officer (FSO).
4. As to the content of training, the requirement in 4040.26A is not fully adopted. Considering the training fee and the actual situation of China, part of the training content is adjusted according to current courses of training organization in China.
5. The 4040.26A mentioned FAA order 4040.9D in many places, as CAAC do not have the similar procedure, we deleted the content and

rule relate to 4040.9D.

6. (Omitted, note on the Chinese terminology).

7. In the definition of incident and significant safety event, the definition of international standard is referred. And the “serious injury” is adjusted according to GB14648-93, Classification for Flight Accidents of Civil Aircraft, add “(ff) proved exposure to infectious material or hazardous radiation”, the content is coordinated.

8. For the purpose of procedure content coordination, figure 1 in Order 4040.26 is put as appendix 7 of this procedure.

9. “Letters of Authorization (LOA)” is determined in AP-21-AA-2012-33, The Responsibilities, Procedures and Training Requirements for Flight Test Pilot and Flight Test Engineer of CAAC, please refer to this procedure.

10. As the responsibility of incident investigation is already specified in the rules of CAAC aircraft incident and significant safety event investigation, this procedure does not specify it any more, the related part in 4040.26A is deleted in the this procedure.