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SMOKEJUMPER AIRCRAFT EVALUATION PROCESS

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SMOKEJUMPER AIRCRAFT EVALUATION PROCESS

Date Approved by SASEB: _____

Foreword. This document is maintained by the Missoula Technology and Development Center (MTDC). As needed, recommendations for revisions can be submitted by smokejumping or aviation groups or by individuals. Contents of this document are "approved" by the Smokejumper Aircraft Screening and Evaluation Board (SASEB). Suggested revisions will be accomplished by MTDC after they are approved by the SASEB.

The purpose of this Guide is to:

1. Document the process of conduction a Smokejumper Aircraft Evaluation.

2. Provide a reference that explains the rational for various technical requirements for smokejumping aircraft.

3. Serve as an Evaluation Plan for those assigned responsibilities for accomplishing a Smokejumper Aircraft Evaluation.

PART 1 - STANDARD SMOKEJUMPER AIRCRAFT EVALUATION

Introduction. The USDA Forest Service (FS), the USDI Bureau of Land Management (BLM), and the USDI Office of Aircraft Services (OAS), maintain a list of "approved" smokejumper aircraft. For an aircraft to be placed on the "approved" list, it must successfully demonstrate suitability for smokejumping. Complete information necessary to determine an aircraft's suitability for smokejumping is obtained by conducting an aircraft evaluation.

The criteria for an "approved" smokejumping aircraft were developed and are maintained by the Smokejumper Aircraft Screening and Evaluation Board (SASEB). SASEB membership includes smokejumping and aviation representatives from the FS, BLM, and OAS.

A smokejumper aircraft evaluation may be called for when fire management planning has identified a need for an aircraft of a certain size, airspeed, or configuration and an aircraft meeting the identified requirements is not available on the approved list. Or, an evaluation may be called for if a new aircraft model appears on the market which seems likely to provide favorable, and needed, cost competition. Another reason for an evaluation would be if to few "approved" aircraft were available tomeet firefighting needs.

Evaluation of a candidate smokejumper aircraft is initiated by a "sponsor," typically a smokejumping/aviation organization.

Steps Leading to a Smokejumper Aircraft Evaluation. The steps leading to a smokejumper aircraft evaluation are as follows:

1. The sponsor of a candidate smokejumper aircraft prepares a preliminary investigative report on the aircraft (see Part II below) and forwards this report to SASEB.

2. The SASEB reviews the sponsors preliminary report and recommends technical acceptance, or rejection, of the sponsors proposal to management in the FS, BLM, and OAS.

3. FS, BLM, and OAS management review, approve, or reject the SASEB recommendation to evaluate the candidate aircraft.

4. Pending the availability of funding needed to accomplish the evaluation, an Evaluation Director is appointed and the Flight Performance and Functional Evaluations are accomplished.

5. If the Flight Performance and Functional Evaluations are successful, needed accessories (static-line anchor cables, jump steps, etc.) are designed and fabricated.

6. An operational smokejumping unit (typically the aircraft's sponsor) arranges to contract the candidate aircraft for a field evaluation.

7. If the field evaluation is successful, work to obtain Federal Aviation Administration (FAA) Supplemental Type Certificates (STC's) for the static-line anchor cables is accomplished. The Evaluation Director then submits a package of complete staff work documenting that the candidate aircraft has met all requirements for an "approved" smokejumper aircraft. SASEB reviews this package. If the package is complete and acceptable, SASEB recommends to management that the aircraft be added to the list of "approved" smokejumping aircraft.

Smokejumper Aircraft Evaluation Structure. A smokejumper aircraft evaluation is structured to identify flight performance characteristics, safe deployment of standard smokejumping parachutes, special accessories needed, and procedures to allow safe smokejumping. A complete evaluation consists of the following evaluations, design work, and reports:

1. Pre-evaluation identification, design, fabrication, and installation of temporary smokejumping accessories, and special exterior camera mounts, needed to accomplish the evaluation.

2. Flight Performance Evaluation and Functional Evaluation. Development of preliminary operational guidelines for a Field Evaluation.

3. Design, drawing, fabrication, and installation of prototype smokejumping accessories for field evaluation.

4. Field evaluation.

5. Final accessories refinement, pull test, drawings of accessories and FAA STC of anchor cables designs.

6. Preparation of the Final Evaluation Package to documentation the evaluation.

A complete smokejumper aircraft evaluation takes place over an extended time period and portions of the evaluation may take place in different locations. However, all steps of the evaluation must take place with coordination and leadership provided by an Evaluation Director.

Organization Chart

Evaluation Staffing. A successful smokejumper aircraft evaluation depends upon the participation of aviation managers, working jumpship pilots, and smokejumpers from the FS, BLM, and OAS. Accomplishing an evaluation also depends heavily upon design engineering, drafting, machine shop fabrication capabilities, professional photography, and knowledge of test and evaluation procedures.

For many evaluation team members, participation during the 3 to 5 day Flight Performance Evaluation and Functional Evaluation is the only commitment of work time required. However, for the Evaluation Director and the Accessories Design Team, a significant commitment to work on the evaluation spanning one or more years is required to oversee and complete all aspects of an evaluation.

Since the smokejumper aircraft evaluation process was first used in the mid-1970's, responsibility for overseeing evaluations has been assigned to MTDC. MTDC maintains a staff that is experienced in conducting tests and evaluations. Also, for the photography, engineering, and drafting needed for accessories design work, MTDC maintains an appropriate staff.

Since the mid-1970's, MTDC Evaluation Directors have assigned responsibility for conducting the Flight Performance Evaluation to an aeronautical engineer, or to a professional aviator from the FS, BLM, or OAS. While it is desirable to have an aeronautical engineer involved, the Flight Performance Evaluation does not require flight maneuvers outside those allowed by the aircraft's flight manual. For this reason, an aeronautical engineer is not absolutely required. When possible, both a professional aviator and an aeronautical engineer should be involved in the Flight Performance Evaluation.

--Duties and Responsibilities--

Standard duties and responsibilities of the various members of the evaluation team are outlined below. Additional duties and responsibilities specific to a particular evaluation will be covered in briefings as required.

AIRCRAFT SPONSOR. The sponsor of a candidate smokejumper aircraft is usually a smokejumping unit. With support from their aviation staff, the sponsor is responsible for preparing a report as described in Part II of this document. The sponsoring unit provides this report to the chairman of the Smokejumper Aircraft screening and Evaluation Board (SASEB). SASEB's annual meeting is generally in the fall. It is desirable if the preliminary report is submitted to SASEB in advance of their meeting to allow members to review the report. The aircraft sponsor should be prepared to contract a candidate aircraft for field evaluation.

SASEB. SASEB is responsible for:

1. Receiving, reviewing, and evaluating the technical merit of reports received from aircraft sponsors.

2. Recommending approval or rejection of aircraft evaluation proposals to the Director of Aviation and Fire Management, USDA Forest Service, and the Director of the Office of Aircraft Services, Department of the Interior.

3. Forwarding the aircraft sponsor's report and other pertinent information to the appointed Evaluation Director when an aircraft evaluation has been approved.

4. Reviewing the final evaluation documentation at the completion of the aircraft evaluation, and recommending to the Director of Aviation and Fire Management, and the Director of the Office of Aircraft Services, whether to accept or reject the aircraft for inclusion on the list of "approved" smokejumper aircraft.

EVALUATION DIRECTOR. The Evaluation Director is appointed by the management of the unit assigned responsibility for the evaluation.

The Evaluation Director has overall responsibility for conducting the evaluation, including planning, coordinating, scheduling, logistics, and preparation of required reports. The Evaluation Director is responsible to insure that each evaluation activity is staffed with appropriate personnel. The Evaluation Director has final authority to modify, extend, or terminate all evaluation activities.

SAFETY OFFICER. The Safety Officer is responsible to analyze and bring to the attention of the Evaluation Director any circumstance or aspect of the evaluation that requires special attention to reduce potential risks and hazards. The Safety Officer will have no additional role or responsibility in the evaluation except those of Safety Officer.

PROJECT AIR OFFICER (PAO). The PAO is typically a senior pilot or aviation manager in the host organization. Responsibilities include:

1. Assign qualified contract pilots to fly evaluation flights.

2. Verify the qualifications of Agency and contract pilots assigned to the evaluation program and insure that they are properly equipped with protective clothing and equipment for the evaluation flight.

3. Ensure that pilots are briefed before the evaluation program and as needed before each flight. Briefing topics must include air safety, air-to-air and air-to-ground communications, formation flying techniques and procedures.

4. Monitor the air safety of the evaluation program through all evaluation flights. The PAO has the authority to stop any evaluation flight if specific or immediate safety concerns arise.

SMOKEJUMPER BASE MANAGER'S LIAISON. The Smokejumper Base Manager's liaison is appointed by the manager of the smokejumper base chosen to support the evaluation. This position gives the Evaluation Director a contact point for coordinating evaluation support with the host organization.

EVALUATION TECHNICAL WRITER. This position assists the Evaluation Director in collecting and organizing notes, photos, and data accumulated during the course of the evaluation.

ACCESSORIES DESIGN TEAM LEADER. Typically, the Accessories Design Team Leader is a mechanical or aeronautical engineer. This individual must work closely with the Functional Evaluation Conductor to insure that accessories meet operational needs. The team leaders's responsibiliteis begin before the Functional Evaluation takes place and extend beyond the Field evaluation. Specific duties and responsibilities are listed below:

1. Before the Functional Evaluation, the Accessories Design Team Leader ensures that adequate smokejumping accessories are constructed and installed in the aircraft which will permit safe accomplishment of the air drop portions of the Functional Evaluation. Also, provisions for externally mounting cameras needed for the Functional Evaluation must be developed.

2. During the Functional Evaluation the Accessories Design Team Leader works with the Functional Evaluation Conductor to insure that accessories compatible with operational procedures identified during the "functional evaluation" can be designed.

3. Before the Field Evaluation, the Accessories Design Team Leader insures that accessories are designed and fabricated, that an engineering structural analysis is completed, and that drawings are prepared.

4. After the Field Evaluation, the Accessories Design Team Leader ensures that designs are modified and finalized as appropriate and that work to obtain FAA STC's is completed.

5. The Accessories Design Team Leader is responsible for providing final drawings of all smokejumper accessories for the aircraft.

6. Through all stages of this work, the Accessories Design Team Leader insures that the design and configuration of accessories conform to established technical and operational standards, and that designs are professionally engineered to pass strength tests when required.

ACCESSORIES DRAFTING TECHNICIAN. Drafting duties include:

1. The Accessories Drafting Technician assists the Accessories Design Team Leader by insuring that adequate measurements and photographs of the aircraft structure are obtained to permit preliminary and final accessories drawings.

2. As assigned, the Accessories Drafting Technician is responsible for producing the preliminary and final drawings of required smokejumping accessories.

ACCESSORIES PHOTOGRAPHER. The Accessories Photographer is responsible for providing all photographs of aircraft configuration and structure as requested by the Accessories Design Team Leader and the Accessories Drafting Technician.

SMOKEJUMPER ACCESSORIES OPERATIONAL EXPERT. This position provides the Accessories Design Team Leader with information regarding operational compatibility of aircraft accessories with standard smokejumper procedures.

SMOKEJUMPER PILOT REPRESENTATIVE/ACCESSORIES. This pilot provides the Accessories Design Team Leader information regarding the compatibility of aircraft accessories with flight safety.

STATIC-LINE ANCHOR PULL-TEST CONDUCTOR. This person conducts the pull-tests of anchors to demonstrate that they meet SASEB strength requirements. Also, when an FAA STC is obtained, a pull-test is required. It is desirable for the Pull Test Conductor to be the engineer who designed the anchor system. The Pull-Test conductor is responsible to prepare a separate test plan for the pull test. This person has authority and responsibility to terminate a pull tests because of concerns regarding personal safety or possible damage to an aircraft.

FLIGHT PERFORMANCE EVALUATION CONDUCTOR. The Flight Performance Evaluation Conductor has the overall responsibility for organizing and conducting the flight performance evaluation program. These duties include:

* Liaison with aircraft manufacturer regarding aircraft performance and technical data.

* Providing technical advice on aircraft operation and performance.

* Preparing load schedule and calculating weight and balance data for the flight performance evaluation.

* Conducting the prescribed performance evaluation flights and recording data.

* Providing the Functional Evaluation Conductor with information regarding recommended drop speeds and flap settings after the performance evaluation flight, and before the Functional Evaluation.

The Flight Performance Evaluation Conductor has authority and responsibility to terminate the prescribed Flight Performance Evaluation flight before completion for reasons concerning flight safety.

FLIGHT PERFORMANCE EVALUATION ASSISTANT(S). As needed, these individuals assist the Flight Performance Evaluation Conductor in reading and recording data during the performance evaluation flight.

PILOTS. Pilots are responsible for flying their aircraft in accordance with established agency policies and the evaluation plan. Their duties include:

1. Attending briefings and debriefings.

2. Complying with all standard procedures and requirements for designated flights and complying with any special evaluation requirements.

3. Aircraft communications.

4. Verifying weight and balance data provided by the loadmaster.

Pilots have final authority in flight safety matters aboard the aircraft.

FLIGHT PERFORMANCE EVALUATION LOADMASTER. As instructed by the Flight Performance Evaluation Conductor, the Loadmaster prepares ballast load bundles, positions them on the evaluation aircraft, and restrains the loads using standard procedures. The Loamaster will insure that the Flight Performance Evaluation Conductor and the evaluation aircraft pilot review weight and balance data before flights.

FUNCTIONAL EVALUATION CONDUCTOR. This position is responsible for conducting the work sessions and evaluation flights prescribed for the Functional Evaluation. Specific duties include:

* Determining that it is safe to conduct airdrops using standard smokejumper cargo and personnel parachutes before conducting any airdrops.

* Obtaining information from the Flight Performance Evaluation Conductor regarding airspeeds and flap settings for functional evaluation flights and obtaining information regarding weight and balance of the functional evaluation loads.

* When appropriate, coordinating with the Accessories Design Team Leader to refine of accessories or the design new accessories.

* Briefing evaluation jumpers, cargo droppers, pilots, drop zone personnel, photographers, the loadmaster, spotter, and other personnel at the beginning of the evaluation and as needed before each flight.

* Ensuring that all FAA notifications required by FAR Part 105 have been obtained before air drops.

* Evaluating weather conditions that may postpone evaluation flights.

* Ensuring that required procedures, schedules, and communications are followed.

* Determining, with the help of other evaluation team personnel, the proper procedures for spotting, exiting the aircraft, cargo dropping, and emergency exits.

* Conducting debriefing and critique sessions after each evaluation flight to resolve problems and questions.

* Maintaining a list of unresolved questions that need answering before the evaluation is complete and conducting an evaluation team meeting to resolve these questions before the end of the functional evaluation.

* Ensuring that all required documentation is complete.

The Functional Evaluation Conductor has authority to stop or postpone any phase of the evaluation for safety reasons.

FUNCTIONAL EVALUATION PHOTOGRAPHER. Responsibilities include:

* Providing still, video, and 16mm motion picture coverage required in the Functional Evaluation.

* Advising the Evaluation Conductor of support requirements needed to accomplish the photographic mission.

* Having film processed to meet schedules and deadlines.

* Providing projectors for work sessions.

* Attending briefings and advising participants of special photographic needs and considerations.

* Advising the Evaluation Conductor of special problems in obtaining good photographic coverage once the evaluation begins.

DROP ZONE MANAGER. Responsibilities include:

* Procuring and preparing standard drop zone equipment, including marker panels, radio, retrieval equipment, and other equipment needed for the drop zone.

* Procuring a standard EMT kit and litter for the drop zone (DZ). Arranging for DZ EMT, and for evacuation of injured.

* Monitoring the drop aircraft radio frequency during all drops.

* Providing transportation to and from the DZ for evaluation personnel and observers.

* Retrieving and returning cargo to the Loadmaster after evaluation flights.

* Supervising DZ personnel assigned to retrieve cargo. Providing tree climbing equipment, if needed.

FUNCTIONAL EVALUATION LOADMASTER. Loadmaster responsibilities include:

* Preparing all cargo to be placed on the aircraft for each flight.

* Weighing, loading, and restraining all cargo for each flight in accordance with standard procedures and aircraft restrictions.

* As necessary, calculating the weight and balance of each load for review by the pilot and Functional Evaluation Conductor.

* Supervising persons assigned to help rigg cargo bundles and load aircraft.

* Ensuring compliance with other standard policies and procedures related to loadmaster responsibilities not covered in this document.

SPOTTER(S). The spotter's responsibilities include:

* Performing a prejump safety check of all jumpers.

* Inspecting the drop aircraft for proper loading and correct installation of the static-line anchor.

* Filling out drop sheets for each flight, noting any problems, and providing copies of drop manifests to the Evaluation Conductor at the end of the evaluation.

* Attending briefings for each evaluation flight.

* Assisting the Loadmaster with proper loading of cargo and jumpers.

* Dropping cargo and jumpers according to load manifests and instructions from the Functional Evaluation Conductor.

* Complying with other standard policies and procedures related to "spotting" that are not covered in this document. The spotter has the authority to immediately stop or postpone jumping or cargo dropping for reasons related to the safety of the airdrop.

JUMPERS. Responsibilities of the jumpers include:

1. Following procedures described by the Functional Evaluation Conductor for each jump and following standard smokejumper safety procedures or procedures specified under "Special Safety Concerns" of the evaluation workbook.

2. Pointing out operational or safety problems with procedures or equipment during the evaluation.

3. As requested, attending briefings, debriefings, and photo review sessions.

4. Complying with standard policies and procedures related to smokejumping that are not covered in this document.

Note: Jumpers shall be experienced personnel. When possible, the same jumpers shall be used throughought the evaluation so that comparative feedback can be obtained.

SMOKEJUMPER OPERATIONAL EXPERT(S). The Smokejumper Operational Expert(s) responsibility is to provide the Functional Evaluation Conductor with input regarding optimum smokejumper procedures for the evaluation aircraft. Also, these individuals may be assigned to help document the evaluation.

SMOKEJUMPER PILOT REPRESENTATIVE: FUNCTIONAL EVALUATION. The Smokejumper Pilot Representative provides the Functional Evaluation Conductor with information about the flight safety implications of smokejumper procedures developed during the evaluation with flight safety.

FIELD EVALUATION CONDUCTOR. The Smokejumper Base Manager who operates an evaluation aircraft during its first season of operational use is the Field Evaluation Conductor. The Evaluation Director will provide the Field Evaluation Conductor with written preliminary Operational Guidelines. The Field Evaluation Conductor is responsible for refining modifying those guidelines as he gains experience operating the aircraft. At the conclusion of the field evaluation, the Field Evaluation Conductor shall provide the Evaluation Director with a report as outlined in this document.

Air Operations and Smokejumper Safety. Procedures, equipment, and qualifications of smokejumpers, cargo droppers, spotters, pilots, and other personnel participating in the flight and airdrop portions of the evaluation will conform to requirements of FSM 5700 and the "National Smokejumpers Training Guide." Where exceptions to standard procedures are required, specific safety procedures will be covered in detail during evaluation briefings.

Responsibility for flight and airdrop safety rests with the Evaluation Director and is also an inherent responsibility of all members of the evaluation organization. Proper safety procedures and communications procedures are inherent in the structure of an smokejumper aircraft evaluation.

Normal Smokejumper Aircraft Evaluation Time Frames. While time requirements may vary with specific candidate aircraft, the complete process of evaluating and approving an aircraft for smokejumping can generally be expected to take 2 years or more. The following are normal time requirements:

Aircraft Sponsors Preliminary Report:	This report must be prepared and distributed to SASEB members before the annual SASEB meeting. SASEB normally meets in the fall.

SASEB Review of Aircraft Sponsors	SASEB should approve or reject a proposed evaluation at their meeting.
FS WO F&AM, BLM, and OAS Review, Approval, or Rejection, of a SASEB Recommendation Regarding a Proposed Aircraft Evaluation:	3 months. However, funding restrictions may delay the evaluation 1 or more years.
Preparation of Evaluation Schedules and Evaluation Planning:	1 month
Preliminary Design, Fabrication, and Installation of Accessories Before the Performance Evaluation Test and, Functional Evaluation:	4 months
Performance Test and Functional Evaluation.	5 days
Draft Preliminary Operational Guidelines and Design, Draw, Fabricate, and Install Prototype Accessories:	4 months+
Field Evaluations:	4 months
Final Accessories Drawings, Static-Line Anchor Pull Test, obtain FAA STC's, and compile final evaluation documentation:	6 months+
SASEB, FS , BLM, and OAS Management Review of Final Report. Final Approval of the candidate Aircraft as an Approved Smokejumper Aircraft:	3 months

Costs of a smokejumper aircraft evaluation, including flight time, design, fabrication, and FAA STC of accessories can easily total $50,000 to $100,000 (1997 dollars).

PART II - AIRCRAFT SPONSORS PRELIMINARY INVESTIGATION

Introduction. Any smokejumper or aviation unit desiring to sponsor a new airplane for evaluation must conduct a preliminary investigation to determine whether the candidate aircraft is likely to be suitable and available. If the sponsor considers prospects to be good, a report of investigation findings will be prepared and forwarded to the Chairperson of the Smokejumper Aircraft Screening and Evaluation Board (SASEB). If the Board recommends an evaluation, and if management concurs, the SASEB Chairperson will deliver the Sponsor's Report to the appointed Evaluation Director.

Objective. Conducting a formal Smokejumper Aircraft Evaluation and designing special accessories for smokejumping is an expensive and time-consuming exercise. Before management is asked to authorize a formal evaluation, the aircraft's sponsor needs to conduct a very thorough preliminary investigation to determine that the candidate aircraft has a high potential to be a successful smokejumping aircraft.

Much of this investigation can be accomplished by referring to the aircraft's Flight Manual. Conversations with operators and the aircraft's manufacturer can also be helpful. Physical inspection of an actual aircraft will almost certainly be required to prepare a satisfactory Sponsor's Report.

The SASEB has identified certain objective criteria for an "approved" smokejumping aircraft. These are related to aircraft performance and physical suitability for the smokejumper mission. However, many additional factors are considered to determine if an aircraft is a suitable candidate smokejumping aircraft.

The sponsor's investigation is one of the most important steps in the process of evaluating a candidate aircraft. When complete, the Sponsor's Report should provide all the information needed to determine that the aircraft is a viable candidate smokejumper aircraft. In fact, it should provide a significant percentage of the information needed to document that the aircraft meets the requirements for an "approved" smokejumper aircraft. The smokejumper aircraft evaluation process depends on the Sponsor's Report because the formal evaluation exercises do not provide information supplied in the Sponsor's Report.
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Sponsor's Report Outline. The Sponsor's Report should be prepared using the following outline:

Compliance with SASEB Requirements.

All Aircraft.

1. FAA Certified as a Normal or Transport Category Aircraft.

2. FAA approved to fly with the jumper exit door removed.

3. Airspeed at 1.3 Vstall (jump configuration) not to exceed 115 Kts.

4. Jumper exit door at least 25 inches wide and 36 inches high.

Multi-engine Aircraft.

1. Ability to achieve a single engine (critical engine inoperative) rate of climb of 50 feet per minute (fpm) at 9,000 feet density altitude.

2. Ability to achieve a single engine climb capability of +.6 percent or better at 5,000 feet pressure altitude and at 81 degrees F, with 2-1/2 hours fuel on board, with no more than a 25 percent reduction in useful load. This ability shall be achievable with the aircraft in the following configuration: Critical engine inoperative and the propeller of that engine feathered (or pitch set to the minimum drag position) with landing gear retracted (if equipped with retractable gear).

Single Engine Aircraft.

1. Payload capability sufficient for at least two jumpers, their equipment, and a spotter, while carrying 2-1/2 hours fuel.

2. Power loading at maximum certificated gross weight of 13.2 lbs. per horsepower or less.

3. Supercharged, if equipped with a reciprocating engine.

Administrative Considerations. The "Sponsor's Report" needs to provide agency managers with information needed to make an informed judgment about the prospects for the proposed aircraft to fulfilling agency needs at an acceptable cost. Successful completion of this part of the report will generally require the skills of both experienced aviators and smokejumpers.

1. **Support the need for the aircraft**. Why are you proposing that this aircraft be evaluated? Why do you want to use this particular aircraft? What are the perceived advantages over aircraft already on the approved list? How many aircraft of this type do you propose to use, and how soon? Note: Careful reasoning here will help preclude the expenditure of time and money for aircraft that may "look good" but for which there is no real identifiable need.

2. **Number of aircraft potentially available for smokejumper use?** This information is necessary to determine whether there will likely be a "payoff" following an aircraft evaluation. The candidate aircraft may offer excellent performance and an optimum configuration for smokejumping. But if it is not available for

smokejumping contracts, or is too expensive, the costs of conducting an evaluation will be wasted.

3. **Versatility of the aircraft; multi-use capabilities (i.e., crew and/or cargo haul, administrative use, etc.** Describe how the aircraft can be effectively used for non-smokejumping missions and indicate if this was a consideration in your decision to sponsor the aircraft.

4. **Payload capabilities - Smokejumper/paracargo, crew and cargo haul (figured with 2-1/2 hours of fuel on board).** Show the maximum number of smokejumpers that can be carried on fire runs. Show the maximum weight of both paracargo and freight loads that can be hauled. Show the number of fully equipped firefighters that can be transported from airport to airport. Show all your calculations and consider cabin volume, floor space, available seating, and weight and balance data for either a typical aircraft, or for a specific aircraft.

5. **Range and cruise speeds with operational loads.** Show the range in nautical miles, the cruise speed in knots and the maximum flight duration with the above loads at maximum cruise, normal cruise and maximum range power settings. Do two sets of calculations based on an airport elevation of sea level and flight altitudes of 2,000 feet MSL and 12,000 feet MSL. Do two more sets of calculations based on an airport elevation of 5,000 feet MSL and flight altitudes of 7,000 feet MSL and 12,000 feet MSL. For all calculations use standard conditions, no wind and 45 minute fuel reserve. Consider any door off performance penalty that may be relevant for smokejumper and paracargo loads. If door off information is not available, estimate any performance reduction and/or speed restriction, and your reasoning for the estimate you used.

6. **Landing field requirements.** For the above listed loads, show standard condition runway requirements for airports at sea level, 5,000 feet MSL, and at 84° F, 5,000 feet MSL.

7. **Total aircraft purchase cost.** List the cost to acquire this aircraft. If new, show equipped price with IFR avionics, seats, and "other normal and required equipment". If used, show the range of prices for aircraft in the age class and equipment range that you would contract.

   Estimated contract rate:

   --Rate per hour
   --Daily availability
   --Other costs

   Note: An aircraft Contracting Officer may be able to suggest techniques that help estimate a contract rate.

8. **Date of certification date and last manufacture.**

9. **Maintenance/support requirements.**

10. **Single pilot certification.** Is the aircraft certificated for single pilot? If so, are there restrictions?

Flight Performance Data. This section is designed to compile as much relevant information as possible from the Aircraft Flight Manual. Along with the informed provided by operators or the aircraft's manufacturer, this should enable a judgement as to the suitability of the aircraft's flight performance characteristics as these relate to the smokejumper mission.

1. **General performance envelope (all calculations made with aircraft at maximum gross weight).**

Stall speed, clean ___ knots
Stall speed landing configuration ___ knots
Stall speed, most probable smokejumper configuration ___ knots
Rate of climb, all engines, sea level std. conditions ___ fpm
Rate of climb, all engines, 5,000 ft, ISA plus 25 ^{o}C ____ fpm
Rate of climb, one engine (critical engine) out ___ fpm
Service ceiling, all engines (residual 100 fpm climb) ____ ft
Critical engine out service ceiling (residual 50 fpm climb) ___ ft
Landing distance over 50 ft obstacle ____ ft
Takeoff distance over 50 ft obstacle ____ ft
Maximum cruise speed ____ knots
Normal cruise speed ____ knots

2. **Stall and stall recovery characteristics.** Show stall and stall recovery characteristics as determinable from the flight manual. Also give an opinion from your aviation unit on any concerns they would have about stall characteristics in this aircraft.

3. **Stall warning or stability augmentation system.** What type of stall warning system and/or stability augmentation system does the aircraft have?

4. **Slow flight characteristics and attitude.** What type of slow flight characteristics do you anticipate from this aircraft? Is there a distinct "tail low" attitude in slow flight?

5. **Turning capability into dead critical engine at 1.3V_{so} for deep canyon get-away.** Are there any indications of problems or concerns with the engine-out turning capabilities of this aircraft?

6. **Center of gravity limits in relation to payload compartment and smokejumper exit door location.** Does there appear to be potential to load the aircraft either forward or aft of allowable CG limits with "normal" smokejumper loads? Consider all

conditions including jumpers in the exit door (at near maximum gross weight and with the last two jumpers in the load in the exit door). Consider take off at gross weight with jumpers and spotters forward, and landing with minimum fuel and remaining jumpers and spotters forward.

7. **Engine compatibility to a wide range of power settings and negative thrust.** What type of engines are on the aircraft? If the aircraft has piston engines, are there restrictions on RPM settings or power settings that will adversely affect cargo or smokejumper missions? Are the engines prone to problems associated with a wide range of power settings? (i.e., shock cooling, or unacceptable main or master-rod bearing loads when the propeller is driving the engine?)

8. **Trim change with speed and power variations and gear or flap deployment and retraction.** Address the pitch changes associated with power changes and gear and flap deployment and retraction. Examine the trim response needed to deal with these changes, both manual and power trim (if applicable). Does the aircraft have any interconnect systems associated with the trim/flaps, and how will their function affect the pilot's feel for the aircraft and the workload?

9. **Straight forward and easy to manage systems.** Look at the aircraft systems and evaluate them for ease of use and emergency procedures in relation to pilot workload, especially in single-pilot aircraft.

10. **Gear retraction time and gear speeds.** What is the gear retraction time, and what is the maximum air speed to extend and retract the gear? What is maximum speed with gear extended? Are these speeds compatible with using the gear as a drag device for cargo dropping?

11. **Door removed cruise speed?** What are the penalties for in-flight performance with the smokejumper exit door removed? Are these penalties verified from the Aircraft Flight Manual, or as estimated?

<u>Smokejumper Functional Suitability Data</u>. Completing of this section will almost certainly require that the sponsor gain physical access to a representative aircraft.

1. **Proximity of the horizontal stabilizer position to the jump and cargo door in slow flight at maximum forward CG.** Is there a potential for tail strikes (either by jumpers or paracargo)? Is there a possibility for parachutes to deploy over the top of the stabilizer or in the area of the elevator hinge? Is the distance from the anticipated primary static-line anchor location to the horizontal stabilizer compatible with the use of standard 15-foot static-lines?

2. **Potential to deploy smokejumper personnel and cargo parachutes without damage to static-lines caused by contact with parts of the aircraft or exit door.** Is the aircraft "clean" around the exit door and aft along the fuselage? If not, what would be required to "clean up" any conflict item or area? This is a critical safety issue which, if not resolvable, would be sufficient sole cause to reject an aircraft that might otherwise prove suitable.

3. **Amenability of the aircraft to installation of a functionally adequate smokejumper and cargo restraint system.** What provisions exist, or can as a practical matter be arranged, to restrain smokejumpers and paracargo? Is the aircraft compatible with installation of 42-inch smokejumper restraint benches? Or, are there raised bulkheads, etc., that would prevent their use? Are suitable alternatives to smokejumper restraint benches available for the aircraft?

4. **Is the jumper exit door opening flush with the floor?** If not, could a ramp be configured to level the opening in an acceptable fashion?

5. **Flight and environmental characteristics with the exit door removed.** Is a spoiler likely to be necessary? Are exhaust fumes in the cabin a likely possibility? If so, how sever a problem will they be, and during what phases of flight/ground operation will fumes be a problem?

6. **Are the pilot's and spotter's external field of view and overall visibility adequate for smokejumper/paracargo operations.**

7. **Is the aircraft amenable for install a standard smokejumper communications package?**

11. **Are there any other factors (positive or negative), not addressed above, that would assist in making a case (for or against) adapting the aircraft for smokejumping?**

12. **Has the aircraft been used by the military for delivery of personnel equipment with static-line parachutes?** If such history can be established, indicate where and by whom. Attempt to obtain operational information relating to this use.

SASEB Review. The SASEB board will review the Sponsor's Report and recommend if the proposal to evaluate a candidate aircraft should be accepted or rejected. The SASEB will not recommend a formal evaluation if the "sponsor's report" does not provide the information needed.

PART III - SMOKEJUMPER ACCESSORY REQUIREMENTS AND DESIGN

Introduction. The accessories design team designs (and if required, tests) accessories needed to configure an aircraft for smokejumping. When this work is complete, accessory designs will be available that meet the SASEB-established strength requirements and that are compatible with safe smokejumping. Standard accessories allow the use of standard training and procedures in all locations. Mechanical drawings and an engineering structural analysis of accessories are needed for FAA approval. Also, mechanical drawings of accessory designs allow contractors to efficiently fabricate and install a full complement of standard accessories that have been accepted by the FS, BLM, and OAS.

Accessories typically needed to configure an aircraft for smokejumping include static-line anchors for personnel and cargo parachutes, spotter tether anchors, jump door handrails, jump steps, door boots, floor platforms, special in-flight doors, etc.

The Accessories Design Team works throughout the process of evaluating a smokejumping aircraft:

1. Before a formal evaluation, the Team works to design and fabricate temporary accessories needed to conduct the Functional Evaluation.

2. During the Functional Evaluation, the Team works to identify the best configuration for permanent accessory designs.

3. After the Functional Evaluation, the Team works to design, fabricate, and install prototype accessories for the Field Evaluation.

4. After the Field Evaluation, the Team works to refine accessory designs, complete mechanical drawings, and obtain required FAA STC's.

Accomplishing the engineering work needed to ensure that accessory designs meet established strength requirements is a primary role of the accessories design team, as is the administrative work needed to obtain required FAA STC's. Equally important is work to ensure that the design of the various accessories are compatible with safe smokejumping operations. For example, it is unacceptable to design an adequately strong anchor cable that is located where smokejumpers can easily produce a misroute by dropping their arm over a static-line. For this reason, the accessories design team must rely heavily on input from smokejumping operational experts, as well as on the expertise of engineers.

Organization Chart. The Design Team must include expertise needed to accomplish engineering, structural analysis, and test work, and to produce technical drawings. The Design Team must also include operational smokejumping expertise to insure that accessory designs are compatible with safe smokejumping.

(Chart)

--General Information--

Strength Requirements for Static-Line Anchors and Tether Anchors. Based upon tests accomplished by MTDC, the SASEB has established strength requirements for static-line anchors used to deploy personnel parachutes, for emergency exits, for deploying cargo parachutes, and for tethering a smokejumper spotter. These requirements, and the rationale that supports them, follow:

1. **Primary Static-Line Anchor:** The minimum strength requirement for a primary static-line anchor used by smokejumpers to deploy their main parachute is 2,000 pounds. The SASEB requires that an FAA STC be obtained for primary static-line anchors. The STC process requires a 50% safety factor. Therefore, primary anchors are designed for 3,000-pound loads, adequate for a 2,000-pound STC.

   This strength requirement is based upon a worst-case scenario of taking a smokejumper into tow. MTDC testing established that loads taking a smokejumper into tow will not exceed 2,000 pounds.

2. **Emergency Exit Static-Line Anchor:** The minimum strength requirement for an emergency exit static-line anchor is 750 pounds. The SASEB requires that an FAA STC be obtained for emergency exit static-line anchors. With the required 50% safety factor, emergency exit anchors are designed for 1,125 pounds, adequate for a 750 pound STC.

   The rationale for the strength requirement for an emergency exit anchor is as follows: Emergency exit anchors frequently are an overhead cable configuration. The overhead design provides for efficient and quick hookup and evacuation of smokejumpers in an emergency. However, in typical small smokejumping aircraft, it is difficult or impossible to design an overhead anchor cable that will withstand the loads needed for a 2,000-pound STC. The SASEB considers a 750-pound STC strength requirement adequate for an emergency exit static-line anchor. This is adequate for normal parachute deployment forces and for typical static-line misroutes loads. Emergency exits occur infrequently and the potential for taking a jumper into tow during an emergency exit is considered extremely remote. The SASEB considers that the safety advantage of overhead anchor configurations for emergency exits is important in some aircraft.

3. **Cargo-Only Parachute Static-Line Anchor**. The minimum strength requirement for a cargo static-line anchor is 1,125 pounds. An FAA STC is not required. This strength requirement corresponds to a 750 pound STC design with a 50% safety factor. The rationale for the cargo static-line anchor strength requirement is that all smokejumper cargo parachutes are configured with a 500-pound "weak link" in the static-line. This weak link is controlled by an MTDC drawing. MTDC tests explored the extremes of sewing

errors for cargo static-line weak links. These tests showed that a 750-pound minimum strength requirement is appropriate for a cargo anchor.

4. **Smokejumper Spotter Tether Anchor.** The minimum strength requirement for a smokejumper spotter tether anchor is 750 pounds. An FAA STC is required.

   Smokejumper spotters are equipped with a pig-tail tether attached to a parachute harness. The pig-tail is clipped to the spotter's tether anchor. The objective is to restrain spotters and prevent them from falling out an open smokejumper door, particularly during turbulent conditions.

   The 750 pound minimum strength for tether anchors is based on MTDC tests using anthropomorphic dummies. In these tests, loads were measured for a variety of slips and falls that simulated a spotter restrained by the tether anchor. A worst case test scenario was used to determine the strength requirement. Here the test dummy was dropped horizontally from aircraft ceiling height. The dummy fell so that the knees contacted the floor but the upper torso was caught by the tether anchor. For even worst-case loads, the 750-pound strength requirement is conservative.

5. **Strength Requirements for a BLM Ram-Air Anchor.** Current BLM ram-air parachute equipment does not use a static-line to deploy the main parachute. However, a short static-line is used to deploy the ram-air system stabilizing drogue chute when a smokejumper exits the aircraft. The BLM drogue static-line incorporates a 500-pound weak link. Therefore, any of the above anchor types possess adequate strength to deploy the BLM ram-air drogue parachute.

   The BLM ram-air drogue parachute static-line is shorter that the standard 15-foot static-lines used to deploy FS parachutes. It is critical to ensure that BLM ram-air drogue static-lines can be attached to an anchor located an appropriate distance from the jump door to insure proper drogue deployment. This can typically be accomplished using one of the above anchors in combination with an "extender" of appropriate length. Usually there is no need to design a special anchor to accommodate deployment of BLM ram-air equipment. The anchor used for deploying the BLM ram-air system, and the length and configuration of any extender needed, must be identified and documented during the Functional Evaluation.

Note: The strength of all anchor cable designs depend upon a prescribed amount of slack in the cable. For this reason, turnbuckles that allow a smokejumper to adjust cable slack should be avoided. This prevents those who do not understand the need for cable slack from over-tightening the cable. With any of the above anchor designs, shock absorbers installed in an anchor

cable design can reduce the maximum cable tension and external loads applied to the airframe structure.

Requirements for Other Smokejumping Accessories.

1. **Handrails.** Handrails are typically installed around the jump door from a point approximately midway on the vertical sides of the door and run over the top of the jump door. The configuration of some aircraft requires adjusting this basic configuration. Strength requirements for handrails have not been established. However, design engineers must ensure that these accessories provide adequate strength for worst-case loads smokejumpers may apply to these installations. A maximum stand-off distance of 2-1/2 inches from the aircraft door frame has been established by the SASEB. Less standoff makes the handrail hard to grip, more stand-off presents smokejumpers with the risk of getting their arm wedged through the handrail during exit.

2. **Jump Steps.** If the exit door is not large enough to allow smokejumpers to make a standing exit, the aircraft will be equipped with a jump step. Strength requirements for jump step installation have not been established. Design engineers traditionally use 3-g's force for a maximum 285-pound smokejumper, plus a safety factor, to design a jump step attachment. If expanded metal is used to cover the floor and sides of a jump step, this material must be selected so that it does not catch dangling boot laces or jump pocket ties.

3. **Floor Platforms.** If the aircraft floor is not flush with the bottom edge of the jump door, a platform will need to provide a flush surface for jumper exits.

4. **Door Boots.** One of the most critical smokejumping accessories is the door boot or door edge protector. This device is installed on the aft edge and bottom edge of the smokejumper exit door. In some aircraft where overhead anchor cables are used for exits, the door boot extends to the top aft corner of the jump door and may extend across the top of the door. The purpose of the door boot is to provide a smooth nonabrasive surface for static-lines during smokejumper exits. Sharp edges or abrasive material can cut a static-line, a life-threatening situation. Close attention is needed to ensure that suitable door boots are configured for approved smokejumping aircraft.

5. **Smokejumper Restraint Systems.** Agency policy requires that smokejumpers be seated and restrained during takeoffs and landings. Seats and restraints must be FAA certified if they will carry "passengers." However, seats and restraints used only by smokejumpers do not need to be FAA certified. Strength requirements for FAA certification depend upon the certification basis for the aircraft involved. For smokejumper-only seats and

restraints, minimum design requirements are based upon a 250-pound fully-equipped smokejumper. The following load requirements are used for evaluating adequate strength for smokejumper-only seats:

Forward.	9.0 g's
Aft.	1.5 g's
Side.	3.0 g's
Up.	3.0 g's
Down.	6.0 g's

In addition to strength, the compatibility of the seat configuration for fully equipped smokejumpers must be considered. For example, smokejumpers equipped with parachutes may be improperly positioned on conventional passenger seats. Conventional passenger seat belts may need to be extended to fit smokejumpers. This extension may result in a improper fit of the seat belt. For example, restraint system experts have advised that smokejumpers should not be seated on many conventional forward-facing passenger seats because smokejumpers will be mispositioned on the seat pan and the restraint belts will not fit correctly and could cause injuries.

The Smokejumper Restraint Bench developed by MTDC and Simula, Inc., provides an accepted seat and restraint system that can be adapted to most smokejumper aircraft. Other seat designs may be acceptable however, evaluation by personnel with suitable expertise is needed to verify suitability.

6. **In-Flight Doors.** In-flight jump doors that can be opened when the aircraft arrives over a fire are not required for an "approved" smokejumper aircraft. However, an in-flight door is required for aircraft that will be used by BLM Alaska. At minimum, these in-flight doors can be a removable plug. However, an in-flight door that hinges inward or slides upward is preferred.

7. **Other Accessories.** The need for and location of spotter communication panels, cargo bell and light systems, special cargo restraint systems, etc., are identified in the course of the Functional Evaluation. Unless these accessories require design and fabrication of special equipment, the Accessories Design Team is not involved with these accessories.

FAA Field Approval and STC Requirements for Smokejumping Accessories. Installations of all smokejumping accessories in an aircraft must be FAA "approved." In FAA-certified aircraft, accessories are installed using the routine FAA Field Approval process.

In addition, Agency policy requires that FAA STC's be obtained for Primary Static-Line Anchors, Emergency Exit Anchors, and Tether Anchors. STC's are also obtained for special in-flight doors, and for seats and restraints that will be used to carry both smokejumpers and passengers.

"Multiple" STC's are always obtained so that these STC's can be used for installations in many smokejumping aircraft, not just one specific aircraft. An FAA STC ensures that these accessories can be installed in an aircraft without the need to answer technical questions during each installation exercise.

Cargo-only static-line anchors, jump steps, hand rails, floor ramps, etc., are typically installed with a field approval. The administrative work required for an STC is not needed.

The process of obtaining an FAA STC is not technically more rigorous than the process used for designing non-STC'd accessories. However, the administrative work needed to obtain an STC is significant. The STC process requires preparing a compliance plan, an engineering structural analysis, mechanical drawings, a conformity inspection, conducting a witnessed pull-test, and preparing material to supplement the aircraft's flight manual.

Fabrication and Installation of Accessories. Mechanical drawings of accessory designs and FAA STC's make it possible to efficiently configure an aircraft for smokejumping at the start of a contract. Smokejumper aircraft contracts list the MTDC accessory drawings required. The operator is provided with these drawings and uses them to fabricate and install the accessories. In rare circumstances, a departure from operator-fabricated accessories is used. It is legal for MTDC, as holder of an accessory STC, to fabricate equipment for installation in an operator's aircraft. Or, accessories could be manufactured by a company that holds an FAA Parts Manufacturing Approval (PMA) who then sells these accoesories to an operator.

--Accessories Design Team Work Activities--

Temporary Accessories Needed to Conduct an Evaluation. Accomplishing the "Functional Evaluation" of a candidate smokejumper aircraft requires actual torso dummy drops and evaluation jumps. However, until the Functional Evaluation is complete, the configuration appropriate for final accessory designs will not be known. In order to be able to accomplish the Functional Evaluation, a minimum complement of temporary accessories must be designed, fabricated, and installed in the evaluation aircraft. These accessories do not need to conform to an optimum design, but they must be functional and safe for use during the evaluation. Several months before the Functional Evaluation is scheduled, the Accessories Design Team Leader must determine what temporary accessories will be needed to accomplish the evaluation.

At minimum, a primary static-line anchor is required. This temporary static-line anchor must be located appropriately in the aircraft for safe deployment of static-line parachutes, or be compatable with the use of "extenders" to adjust static-lines to an appropriate length based on the location of the horizontal stabilizer. If an extender is used, the extender hardware cannot extend out the jump door. An engineering structural analysis demonstrating that the temporary anchor provides a minimum of 1,000 pounds strength has been considered adequate for an evaluation.

A floor anchor design has frequently been used during Functional Evaluations because it is very strong (typically providing a full 2,000-pound strength) and is easy to adapt to a variety of aircraft. A floor anchor is awkward for smokejumpers to use and it is unlikely that this anchor configuration would be acceptable as a final design. If a floor anchor is used during the Functional Evaluation, evaluation smokejumpers will need to be briefed regarding hookup procedures.

For the Functional Evaluation, the aircraft must be inspected to ensure that there are no protuberances that could interfere with safe deployment of static-lines and parachutes. If necessary, protuberances must be removed, relocated, or covered with fairings. Also, provisions must be made to ensure that the jump door edge is smooth and safe in the area where static-lines contact it during deployment.

For the Functional Evaluation, the aircraft must be configured with some form of personnel restraint, and restraints for cargo, carried during evaluation flights. This equipment must be functional for the evaluation, but it does not need to represent an optimum configuration for a final design.

The final complement of accessories for an aircraft may include a jump step, jump door handrails, an overhead tether anchor, etc. Using special procedures, it is acceptable to conduct the Functional Evaluation without these accessories.

Note: The 1,000-pound strength requirement for a temporary static-line anchor used in an evaluation is strong enough to withstand normal parachute deployment loads and static-line mis-route loads. While a 1,000 pound static-line anchor could fail in the remote circumstance of a jumper in tow, a jumper-in-tow situation has not occurred in more than 50 years of smokejumping. During a few evaluation jumps using controlled exit procedures, an anchor with a strength of 2,000 pounds is considered unnecessary.

Accessories Design Team Work During the Functional Evaluation. Indentifying the optimum accessory designs is part of the Functional Evaluation. This task must be a team effort between the Functional Evaluation Team and the Accessories Design Team. For example, the location of an anchor cable desired by Functional Evaluation personnel may not be compatible with the structure of the aircraft. In this case, Design Team personnel may be able to suggest an alternative location or configuration for the anchor cable.

Accessories Design Team Work Before the Field Evaluation. After the Functional Evaluation and before the Field Evaluation, the Accessories Design Team must prepare drawings, complete an engineering structural analysis, and to fabricate the various accessories needed for the Field Evaluation. These prototype accessories will be configured as agreed during the Functional Evaluation. While the Functional Evaluation can be accomplished with temporary accessories, the Field Evaluation should be accomplished with a full complement of prototype accessories. This allows the configuration of these accessories to be evaluated and verified during the Field Evaluation. Note: Typically, MTDC fabricates the prototype accessories. The smokejumping unit that hosts the Field Evaluation is responsible to arrange installation of these accessories in the evaluation aircraft.

Accessories Design Team Work After the Field Evaluation. The Field Evaluation may identify refinements needed for the configuration of prototype accessories, or may identify additional accessory needs. Based on this input, the Accessories Design Team makes the needed revisions. Final drawings and FAA STC's are then obtained.

"Pull tests" used to verify the strength of various anchor designs are a significant activity during the final stages of accessories design work. These tests are typically conducted in an actual aircraft. This work is accomplished using a separate test plan that identifies test methods, instrumentation, and safety procedures.

Suggested Briefing Topics. Accessories Design Team personnel need certain types of information from the Evaluation Director before accomplishing designing temporary accessories, during the Functional Evaluation, and before and after the Field evaluation. Suggested briefing topics include:

Briefing Topics: Accessories Design Team Leader

1. Specific minimum accessories that need to be installed in the evaluation aircraft before the Flight Performance Evaluation and Functional Evaluation.

2. Documentation and photos of accessories design work required.

3. Expected coordination with Flight Performance Test Conductor and Functional Evaluation Conductor.

4. Critical timetables for accomplishing accessories design work.

Briefing Topics: Accessories Drafting Technician

1. Critical timetables for completing drawings.

2. Attendance requirements at design work sessions conducted at the aircraft.

Briefing Topics: Accessories Photographer

1. Special camera equipment required.

2. Objectives of photography and photos required.

3. Dates and times for photo work.

4. Prints required.

Briefing Topics: Smokejumper Accessories Operational Expert

1. Attendance requirements at design work sessions conducted at the aircraft.

2. Coordination expected with the Functional Evaluation Conductor.

Briefing Topics: Smokejumper Pilot Representative (Accessories)

1. Attendance requirements at design work sessions.

2. Expected coordination with the Flight Performance Evaluation Conductor and Functional Evaluation Conductor.

Briefing Topics: Static-Line Anchor Pull Test Conductor

1. Standard pull test procedures.

2. Scheduling and logistics.

3. Documentation and coordination with FAA to obtain required STC's.

PART IV - THE FLIGHT PERFORMANCE AND FUNCTIONAL EVALUATION

Introduction. The Flight Performance Evaluation and Functional Evaluation are typically accomplished during a 3 to 5 day period. Besides the Evaluation staff, typically SASEB personnel, interested FS, BLM, and OAS aviation and fire managers and smokejumpers attend and observe Evaluation Activities. The Evaluation Director must organize Flight Performance and Functional Evaluation activities to include observers while ensuring that the observers do not interfere with the work of technical personnel conducting the evaluations.

Before these evaluations begin, the Evaluation Director needs to provide members of the evaluation staff, and others, with information. This includes:

General Information
- --Specific Evaluation Aircraft Configuration and Performance data
- --Schedule of Events
- --Organization
- --Organization Assignments
- --Ground Rules for Observers
- --Special Safety Concerns
- --Evaluation Support and Logistics

Flight Performance Test Data Sheets
- --Worksheets
- --Comments and Conclusions

Functional Evaluation Data Sheets
- --Air Drop Load Manifests
- --Air Drop Conclusions
- --Work Session Recommendations and Conclusions

The Evaluation Director must ensure that all arrangements for evaluation logistics are complete, that the evaluation aircraft is available and configured for the evaluation flights, and that the evaluation staff are present.

A. THE FLIGHT PERFORMANCE EVALUATION.

Evaluation Objectives. The smokejumper aircraft Flight Performance Evaluation explores the safety of an aircraft's flight characteristics for dropping smokejumpers and cargo. Specifically, the evaluation is structured to identify that:

1. An adequate airspeed margin exits between stall warning and anticipated smokejumper drop airspeed in a variety of power-off approach to stall maneuvers.

2. No adverse control characteristics are encountered in a variety of maximum available power-on approach to stall maneuvers similar to those that could be used to clear terrain in the mountains.

3. Stall break is not inadvertently encountered in a variety of approach to stall maneuvers.

4. Stall warning is not encountered in normal or worst-case drop pattern maneuvers at prescribed airspeeds and banks.

5. The aircraft can descend steeply for cargo dropping, stop descent, and establish a climb without significant altitude loss.

6. Multi-engine aircraft can be operated with the critical engine out and maximum available power on the good engine(s).

7. All emergency procedures can be successfully accomplished by a single pilot in aircraft intended for single-pilot smokejumping operations.

8. Prompt engine power response is achieved after throttle movement.

9. Trim response is adequate through all power, airspeed, and configuration changes.

Organization Chart.

--General Information--

Factors that support the structure of the Flight Performance Evaluation are discussed below:

Stall Warning vs Stall Break. The flight performance evaluation focuses on the airspeed margin between prescribed smokejumper drop airspeeds and stall warning. Since stall warning systems are designed to provide a margin between the stall warning and the stall break, maneuvers that produce an actual stall break are not necessary. The purpose of several maneuvers in the flight performance evaluation is to ensure that selected drop airspeeds provide an adequate airspeed margin before triggering the stall warning.

Prescribed Airspeeds and Bank. The structure of the flight performance evaluation takes into account normal and worst case smokejumper and cargo drop airspeeds and banks.

Normal airspeeds are the prescribed smokejumper drop, cargo drop, and drop pattern airspeeds established using the procedure described below. Normal bank on drop run final is the bank that produces a "standard-rate" turn, or about 15 degrees. A 30-degree bank is considered normal for other drop pattern maneuvers.

Smokejumper drop pattern airspeeds may vary occasionally from a prescribed airspeed by plus or minus 5 KCAS due to pilot latitude in maintaining a prescribed airspeed. Therefore, some evaluation flight maneuvers specify an airspeed 5 KCAS below the prescribed smokejumper or cargo drop airspeed.

Five-degree variations from prescribed banks occur in real-world operations. Therefore, some evaluation flight maneuvers specify standard-rate bank increased by 5 degrees. Drop pattern turns, such as turns from base to final, are performed with a 30-degree bank. To allow for normal variations, some evaluation flight maneuvers call for a 35-degree bank.

Maneuvers in cargo drop patterns, and in streamer observation patterns, may occasionally require 45-degree bank turns. Such banks are considered an extreme, "worst case" maneuver. Therefore, 45-degree bank turn maneuvers are included in the flight performance evaluation.

Airspeed Margins. Parts of the Flight Performance Evaluation are structured to identify margins between prescribed airspeeds and stall warning in various maneuvers. Throughout the flight evaluation, a margin of 5 KCAS is required from an airspeed reduced 5 KCAS below prescribed drop airspeed.

Stall Warning System vs Aerodynamic Indication of Stall. Flight performance evaluation maneuvers call for recording airspeeds at which a "stall warning" is encountered. If an aircraft is equipped with a stall warning light, buzzer, stick shaker, or other stall warning system, this system will be used to identify stall warning. In aircraft that are not equipped with such a stall warning system, the first aerodynamic indication of a stall before the stall break will be used to identify stall warning.

Single-Engine Aircraft, Aircraft With More Than Two Engines, and Large Transport Aircraft. In the past, most candidate smokejumper aircraft have been twin-turbine aircraft carrying 6 to 10 smokejumpers. The flight performance evaluation is structured with such aircraft in mind.

In the case of a single-engine candidate aircraft, the flight performance evaluation will be accomplished as prescribed, with the exception of the one-engine-out maneuvers. In the case of aircraft with more than two engines, the engine-out evaluation will be tailored to the specific aircraft. Usually, one engine-out (the critical engine) maneuvers will be used for the engine-out maneuvers in these aircraft. For any aircraft, if the prescribed maneuvers are incompatible with the manufacture's approved procedures, the Evaluation Director will modify the structure of the prescribed maneuvers appropriately.

Subjective vs Objective Flight Data. Some evaluation flight maneuvers call for objective pass-fail data, such as a prescribed airspeed margin from drop airspeed to stall warning. Other evaluation maneuvers call for the subjective opinion of an experienced smokejumper evaluation pilot regarding flight characteristics. The opinion of an experienced smokejumper evaluation pilot will be considered to provide valid data for pass-fail determinations.

Smokejumper Drop Pattern Airspeeds.

KCAS vs KIAS. Before the flight test, flight manual stall data for calibrated airspeed (KCAS) shall be used to calculate anticipated indicated (KIAS) smokejumper and cargo drop airspeeds.

Airspeed on Final vs Drop Pattern Airspeed. Two distinct airspeeds need to be identified for use in smokejumper drop and cargo drop patterns: (1) drop airspeed on final, and (2) maneuvering airspeed for turns accomplished from final to crosswind, to downwind, to base, and from base to final.

Minimum drop airspeed on smokejumper and cargo drop final shall be the airspeeds determined using the procedures described below. Minimum maneuvering airspeed for smokejumper drop pattern turns may be the same as for drop airspeed, or may be drop airspeed plus 5 KCAS. Note: The selected maneuvering airspeed

must allow 45-degree bank turns without encountering stall warnings.

Smokejumper and Cargo Drop Airspeeds. Smokejumper drop and cargo drop airspeeds shall be 90 KIAS or the airspeeds determined using the procedures listed below, whichever is greater.

Standard Procedure for Determining Minimum Smokejumper Drop Airspeed.

-- 1.3V Stall (idle power, smokejumper drop configuration, selected drop flap setting, maximum gross weight, maximum aft CG). The standard FAA safety factor for establishing a minimum maneuvering speed is 1.3 times stall speed. Idle power rather than drop pattern power setting must be used because temperature, altitude, and variations in specific aircraft influence the effect of a particular power setting on stall speed. Power-off stall figures in calibrated airspeeds can be obtained from the aircraft flight manual. Power-on figures generally are not provided. Finally, because some pilots use an idle power decelerating final, this configuration represents a worst-case maximum stall speed configuration.

-- Calculated using calibrated airspeed, converted to indicated airspeed for operational use--On smokejumper missions, pilots fly at a prescribed airspeed using their airspeed indicator. However, indicated airspeed (KIAS) shown on an aircraft airspeed indicator varies in accuracy through a range of airspeeds because the aircraft pitot tube position is fixed and does not point directly into the relative wind at varying angles of attack. Calibrated airspeeds (KCAS) shown in an aircraft flight manual are determined during aircraft certification using a special hinged pitot tube that is always pointed directly into the relative wind. Aircraft flight manuals provide data to convert KCAS to KIAS. Accurate determination of drop airspeed requires converting KCAS stall data to KIAS stall data using the flight manual information. In determining smokejumper drop airspeeds, the use of KIAS rather than KCAS data could introduce as much as a 5 to 10 knot error in stall speed for some aircraft.

-- Not to exceed 115 KCAS--Smokejumper personnel parachute systems are stress tested with an appropriate safety factor for 115 KCAS drop airspeeds. Maximum drop airspeed for cargo dropping (discussed below) is also 115 KCAS. Cargo drop airspeeds in excess of 115 KCAS are too fast for smokejumper cargo parachutes, adversely affect accuracy, and require excessive banking for short-radius turns in mountainous terrain.

-- Exceeds VMC by at Least 5 KCAS

-- Accommodates Smokejumper Mission Requirements--Smokejumper parachutes must deploy with adequate clearance past the horizontal stabilizer. Also, smokejumper position for exit, the exits themselves, and freedom from excessive occurrence of line twists, must be provided.

Note: Flaps reduce stall airspeed. Full flaps increase drag and require additional power to maintain altitude (which could adversely affect smokejumper exits). Partial flap settings reduce stall airspeed with only a negligible increase in drag. Consideration should be given to the benefits of a partial flap setting when determining aircraft configuration for dropping smokejumpers.

Procedure for Determining a Reduced Minimum Smokejumper Drop Airspeed on Final. If during the Functional Evaluation, or during the Field Evaluation, a drop airspeed of 1.3V stall proves to be too fast for smokejumping, the Flight Performance Evaluation may be used to determine the safety of a drop airspeed below 1.3V stall. This evaluation is based on the adequacy of the stall warning system in the aircraft (or, if a stall warning system is not provided, the margin between drop airspeed and the first aerodynamic indication of the stall).

A 1.3V stall is the same as a 53.7-degrees bank stall airspeed. A 1.25V stall is the same as a 50.2-degrees bank stall airspeed. Since a 45-degree bank can be considered a worst case (highest stall airspeed) configuration on final, 1.25V stall may be used for drop speed if:

-- Stall warning is not encountered in a 20-degree bank at 1.25V stall minus 5 KCAS. The stall warning should not be encountered in normal maneuvers or it ceases to be a red-flag warning requiring corrective action. A 20-degree bank is about 5 degrees more that the prescribed bank used for heading corrections on final during jump run. A speed of 5 KCAS less than the 1.25V stall airspeed is used because the prescribed drop airspeed must take into account plus or minus 5 knots for pilot latitude in maintaining airspeed.

-- Stall warning is not encountered at an airspeed 5 KCAS less than the selected drop pattern maneuvering airspeed in a 35-degree bank. A 35-degree bank is 5 degrees more than the normal bank used for drop pattern maneuvering.

Procedure for Determining Minimum Cargo Drop Airspeed

-- 1.3V stall (idle power, drop flap setting, worst case loading) or VXSE whichever is higher.

-- Calculated using calibrated airspeed, converted to indicated airspeed for operational use.

-- Not to exceed 115 KCAS.--Cargo drop airspeeds in excess of 115 KCAS are too fast for smokejumper cargo parachutes, adversely affect accuracy, and require excessive banking for short-radius turns in mountainous terrain.

-- Exceeds VMC by at least 5 KCAS

-- Accommodates cargo parachute deployment.--Provides adequate clearance for deploying parachutes past the horizontal stabilizer.

Drop airspeeds increased above 1.3V stall (or 1.25V stall). In some cases, it may be necessary or desirable to increase smokejumper or cargo drop airspeeds above 1.3V stall (or 1.25V stall). For example, if 1.3V stall is exceptionally slow, a faster airspeed may be used. The requirement to exceed VMC or VXSE for cargo dropping may require increasing drop airspeeds. An aircraft may fail to provide prescribed margins from 1.3V stall drop airspeed to stall warning during evaluation maneuvers. In these cases, drop airspeed will need to be increased above 1.3V stall to a drop airspeed that provides the prescribed margin. So long as the increased drop airspeed does not exceed 115 KCAS, drop airspeed may be increased above 1.3V stall.

--Flight Performance Evaluation Procedures--

Flight Preparations. If any reason exists to question weight and balance data, the evaluation aircraft shall be weighed to certify weight and balance configuration before conducting the Flight Performance Evaluation.

The aircraft shall be ballast to maximum gross weight with the CG in the aft most location. Weight and balance will be computed for take-off conditions.

A video camera with audio recording capability will be mounted in the aircraft to monitor flight instruments during the Flight Performance Evaluation. Flight instruments will be recorded during all evaluation maneuvers, and the evaluation pilot will call off appropriate data for the audio recorder as maneuvers occurs.

The Flight Performance Evaluation shall be conducted with a fully qualified crew. The crew on the evaluation flight will usually be limited to the designated pilot in command who will operate the aircraft and perform the evaluation maneuvers (usually a factory or company pilot) and the

Smokejumper Evaluation Pilot. When possible, the Smokejumper Evaluation Pilot will sit in the right seat, call out data, and evaluate aircraft performance. If the Flight Performance Evaluation Conductor is not serving as the smokejumper evaluation pilot, this individual may need to be aboard the flight to direct and monitor correct performance of the various evaluation maneuvers.

The factory or company pilot, and the smokejumper evaluation pilot, will be provided with one full day before the evaluation flight to review the evaluation flight procedures, the aircraft flight manual, and to accomplish an orientation flight in the evaluation aircraft. During this flight, evaluation maneuvers can be rehearsed with the aircraft loaded to less than maximum gross weight and aft CG. Also, this flight may serve to qualify the Smokejumper Evaluation Pilot to be fully qualified to function as co-pilot in the aircraft during the Evaluation Flight.

It is desirable for the Evaluation Flight to be conducted away from an air traffic control environment to minimize radio chatter. The Flight Performance evaluation will be conducted at a minimum base altitude of at least 5,000 feet AGL. After each maneuver, the aircraft will return to base altitude. The Flight Performance Evaluation will be conducted in stable air conditions.

The Flight Performance Evaluation will be conducted with the aircraft in smokejumper configuration with the jump door open or removed.

Air Safety. The following air safety standards will be adhered to during the Flight Performance Evaluation:

1. Weather: The Flight Performance Evaluation will be performed under basic VFR conditions. Before the start of the evaluation, the Flight Performance Evaluation Conductor will check the weather and will determine if visibility, wind, turbulence, and other weather factors are acceptable.

2. The Flight Evaluation will be performed at an adequate altitude to recover from all flight maneuvers.

3. The Project Air Officer will coordinate the Flight Evaluation with local authorities and FAA air traffic control personnel.

4. Aircraft loading, weight and balance: Computations will be made before the Evaluation Flight; the Flight Performance Evaluation Test Conductor, the evaluation Aircraft Pilot in Command, and the Smokejumper Evaluation Pilot will review each computation.

5. Briefings: Pilot and support personnel will be briefed on objectives, evaluation procedures, air-to-ground communications, and emergency procedures.

6. Inspections: Aircraft will be inspected by the Project Air Officer to assure that all airworthiness, STC, 337, or additional special requirements are in order. Aviation personnel will comply with qualification standards.

7. Maintaining air safety will require the maximum awareness of each person involved in the Flight Performance Evaluation.

8. The safety of prescribed flight maneuvers for the specified candidate aircraft will be reviewed by the Evaluation Director, with the technical assistance of the Evaluation Flight Conductor, Project Air Officer, Smokejumper Evaluation Pilot, and Evaluation Aircraft Pilot in Command, to ensure that the maneuvers do not exceed specific flight manual limitations.

Mandatory GO NO-GO Criteria. BEFORE THE EVALUATION FLIGHT, THE EVALUATION SAFETY OFFICER WILL ENSURE THAT THE FOLLOWING CRITERIA ARE SATISFIED:

1. ADEQUATE CEILING IS AVAILABLE TO ALLOW ALL MANEUVERS TO BE ACCOMPLISHED AT A MINIMUM OF 5000 FEET AGL.

2. APPROPRIATE ATMOSPHERIC CONDITIONS EXIST FOR SAFELY CONDUCTING THE EVALUATION AND FOR ACCURATELY RECORDING DATA.

3. THAT EVALUATION PERSONNEL HAVE REVIEWED THE PRESCRIBED FLIGHT MANEUVERS, ALONG WITH APPROPRIATE STALL RECOVERY TECHNIQUES, AND DETERMINED THAT THEY CAN BE ACCOMPLISHED SAFELY IN THE EVALUATION AIRCRAFT.

Communications. During the Flight Performance Evaluation, the evaluation aircraft will maintain air-to-ground communications with the evaluation organization, usually through local dispatch.

Flights and Evaluations

--**POWER-OFF STALL WARNING EVALUATION.** This evaluation focuses on the performance of the stall warning system in worst-case maneuvers on final. A decelerating power-off final is sometimes used dropping smokejumpers and cargo. Therefore, the power-off stall warning evaluation represents the most adverse (highest stall airspeed) drop run configuration.

Evaluation Procedure. Reduce engine power to idle. Maintain altitude and allow airspeed to bleed off. Increase angle of attack until stall warning is encountered. Apply power and recover. Record the airspeed that the stall warning was encountered.

Repeat this procedure using left and right standard-rate turns plus 5-degrees (this will be approximately 20-degrees bank).

Repeat the above maneuvers using the potential flap settings for smokejumper drop configuration.

If the reduced 1.25V stall drop airspeed is being evaluated, calculate the airspeed margin from 1.25V stall minus 5-KCAS airspeed to stall warning.

In all configurations, note the control characteristics of the aircraft when the stall warning is encountered and during recovery.

Pass/Fail Criteria:

1. The aircraft must not stall inadvertently in any of the maneuvers.

2. A suitable drop airspeed and flap setting must be available that provides at least a 5-KCAS margin from stall warning when the airspeed is reduced by 5 KCAS and a bank of standard-rate plus 5-degrees is used in the power-off approach to stall evaluation.

3. The Evaluation Pilot must determine (in the pilot's opinion) that the power-off stall warning system functions adequately and that no adverse control characteristics are encountered.

--**POWER-ON STALL WARNING EVALUATION**. This evaluation focuses on the performance of the aircraft's stall warning system with maximum climbing power wings-level, and during 30 degree and 45-degree bank turns. This corresponds to maneuvers necessary to avoid terrain after cargo has been dropped. A 45-degree bank produces 1.4 g's of force corresponding to a rapid wings-level pull-up to avoid terrain.

Evaluation Procedure. At base altitude, with flaps at the prescribed best-rate-of-climb setting, slow the aircraft to cargo drop airspeed and apply maximum climbing power. With wings level, gradually pull the nose up and allow airspeed to bleed off until stall warning is encountered. Drop the nose and recover to best-climb airspeed. Record the stall warning airspeed.

Repeat using 30-degree banking right and left turns, then 45 degree banking turns, right and left.

Repeat the evaluation for all potential cargo drop flap settings.

In all configurations, note the control characteristics of the aircraft when the stall warning is encountered and recovery is accomplished.

Pass/Fail Criteria.

1. The aircraft must not stall inadvertently in any of the maneuvers.

2. After the stall warning, the aircraft must not lose any altitude in recovering to best-climb airspeed.

3. In the opinion of the Evaluation Pilot, the power-on stall warning system must function properly and the aircraft must not exhibit any adverse control characteristics.

--**SMOKEJUMPER DROP PATTERN STALL WARNING EVALUATION**. In routine drop pattern maneuvers, an aircraft should not encounter a stall warning. The stall warning should provide a red-flag alert that the aircraft is exceeding reasonable drop pattern maneuvers and that corrective action is necessary. The drop pattern stall warning evaluation is intended to ensure that normal drop pattern maneuvers can be accomplished without encountering the stall warning. Two basic drop pattern maneuvers are evaluated: banked corrections on final, and banked turns to change course, such as turns from base to final. The maneuvers are accomplished with airspeed reduced 5 KCAS, and the bank increased about 5 degrees, from recommended airspeeds and banks for these maneuvers. The 45-degree bank turns are the worst-case banks that may be encountered in drop pattern turns or when observing streamers.

Evaluation Procedures. At the minimum power that will maintain altitude, with landing gear up and flaps at the potential smokejumper drop setting, establish an indicated airspeed equivalent to 5 KCAS less than 1.3V stall (or 1.25V stall minus 5 KCAS if reduced drop airspeed is being evaluated). Maintain altitude and initiate a 20-degree left bank. Record whether or not a stall warning wasencountered. Repeat for each potential smokejumper drop flap setting under consideration.

At the power setting appropriate for the crosswind, downwind, and base portions of a drop pattern, with gear up and flaps at the appropriate setting for drop pattern maneuvering, establish an airspeed of 1.3V stall (or 1.25V stall if reduced drop airspeed is being evaluated). Maintain altitude and initiate a 35-degree left bank. Record whether or not a stall warning is encountered. Repeat using a 45-degree left bank.

Pass/Fail Criteria. Stall warnings should not be encountered during these maneuvers. If a stall warning is encountered, smokejumper drop airspeed will need to be increased so that stall warning is not encountered. This increased smokejumper drop airspeed must be less than 115 KCAS.

--**CARGO DROP RUN SIMULATION**. This evaluation measures the ability of the aircraft to descend steeply for cargo dropping, stop descent, and then to establish a climb.

Evaluation Procedure. To determine descent rates, with the aircraft in normal drop configuration, reduce power to idle setting. Maintain 1.3V stall drop airspeed by pitch change.

When rate of descent is stable, record altitude, airspeed, and vertical speed.

Continue with each drag device available, for example, increase flaps to the maximum permissible at 1.3V stall, then lower the landing gear. When vertical speed and drop airspeed are stable, record the altitude, airspeed, and vertical speed.

When the maximum rate of descent has been established, select an altitude to start recovery. When passing this altitude, apply maximum climb power, clean up the aircraft and establish normal climb airspeed. Record altitude when recovery was initiated, and the altitude where the aircraft stopped descending and started climbing.

Repeat this evaluation with gear and flaps down using a power setting that provides a stable 1500 feet/minute rate of descent. When this rate of descent has been established, select an altitude to start recovery. When passing this altitude, apply maximum climb power, clean up the aircraft, and establish normal climbing airspeed. Record the altitude when recovery was initiated, and the minimum altitude where the aircraft stopped descending and started climbing.

Pass/Fail Criteria.

1. The aircraft must achieve at least a 1,500 fpm rate of descent with gear and flaps down.

2. At idle power maximum descent rate, the altitude loss after recovery has been initiated shall not exceed the maximum descent rate multiplied by 1/10 minute (i.e. 3,000 fpm X 1/10 minute = 300 foot overshoot).

3. At a 1,500 fpm rate of descent, the aircraft must not lose more than 150 feet of altitude before recovery has been initiated.

4. In the opinion of the evaluation pilot, the aircraft performance must be adequate for descent into typical steep terrain and recovery to a climbing mode.

--**ONE-ENGINE-OUT CHARACTERISTICS (TWIN-ENGINE AIRCRAFT)**. The one-engine-out performance evaluation is intended to show how controllable a multi-engine aircraft would be if an engine failed in the drop pattern with the aircraft in drop configuration. In drop configuration, a smokejumper aircraft should be able to make 30-degree banked turns right or left with maximum available power on the good engine(s).

Evaluation Procedure. Following normal procedures, stop the critical engine and feather its propeller (on a free turbine engine you may feather the propeller and allow the engine to idle per manufacturer's

recommended procedure). Maintaining a constant base altitude, gradually reduce airspeed and engine power while making gradual turns up to 30-degree banks in each direction. Gradually decrease airspeed to 1.3V stall (or 1.25V stall if special drop airspeed is being evaluated. Record any change in controllability. Do not allow airspeed to drop below VMC.

At minimum 1.3V stall or 1.25V stall airspeed, increase power gradually to maximum available power on the good engine. Continue turns up to 30-degree bank to evaluate the general controllability with maximum available power on one engine .

Note: The Engine-Out Performance Evaluation should be accomplished with the engine shut down and feathered, not at a reduced power setting that simulates an engine out. If the aircraft manufacturer advises against actually shutting down and feathering an engine, the Evaluation Director will authorize this evaluation to be conducted with a simulated engine out power setting.

Pass/Fail Criteria. The aircraft shall be able to make 30-degree bank turns, left and right, with the critical engine feathered and maximum available power on the good engine(s).

--**ERGONOMICS, EMERGENCY PROCEDURES, AND AIRCRAFT SYSTEMS**. The Smokejumper Evaluation Pilot will write a narrative report covering aircraft emergency procedures and aircraft systems. Particular attention must be paid to pilot work load and the skill level required to perform emergency procedures and operate systems in normal and emergency situations during smokejumper missions. The report should address the following items: engine response, trim response, gear and flap retraction time with one engine-out, and any other traits of the aircraft systems that would affect smokejumper missions.

--**SINGLE-PILOT EMERGENCY PROCEDURE EVALUATION (FOR AIRCRAFT NORMALLY OPERATED WITH TWO PILOTS)**. If the candidate aircraft is intended for single-pilot smokejumping operations, the pilots will examine the cockpit layout and flight manual procedures to ensure that a single pilot can manage all emergencies listed in the flight manual.

One pilot will "dry run" the procedures while the other observes, noting the workload to perform the procedures, requirements to concentrate inside the cockpit, rapid or exaggerated head movements, extended reach that would preclude heads-up visibility or compromise any control, and the potential for mistakes because of nonstandard or poorly designed procedures or systems.

If any questions arise that can be answered by flight evaluation, the pilots should advise the Evaluation Director.

Suggested Briefing Topics. The Evaluation Director will ensure that personnel are briefed on pertinent topics. Briefings on the following topics are suggested before the evaluation flight.

Briefing Topics: Flight Performance Evaluation Conductor

1. Standard evaluation procedures
2. Specific safety considerations regarding the performance of the evaluation aircraft, including emergency procedures.
3. Required coordination with the Functional Evaluation Conductor on recommended airspeeds and flap settings for air drop, and on the weight and balance calculation for functional evaluation loads.
4. Required documentation of Evaluation Flight results

Briefing Topics: Flight Performance Evaluation Pilot

1. Standard procedures
2. Specific instruction regarding which aircraft instrument readings must be monitored and recorded, and the data points that must be called out for the audio recorder.

Briefing Topics: Flight Performance Loadmaster

1. The specific load and load location to achieve the required weight and balance configuration.

Briefing Topics: Pilot

1. Standard procedures for the Flight Performance Evaluation
2. Emergency procedures
3. Communications

Briefing Topics: Copilot (in two-pilot aircraft)

1. Copilot duties and cockpit coordination procedures.

Documentation Requirements. At the end of the flight performance evaluation, the Smokejumper Evaluation Pilot will complete the evaluation data sheets, and prepare written comments and conclusions on the aircraft's performance throughout the Evaluation Flight maneuvers. Any adverse performance will be discussed in the comments. The Smokejumper Evaluation Pilot will present the written findings to the Evaluation Director.

B. THE FUNCTIONAL EVALUATION.

Objectives. The objectives of the functional evaluation are to:

1. Identify the suitability of the aircraft for smokejumping and cargo dropping, using both FS-14 and Ram-Air smokejumper parachute equipment.

2. Identify practical smokejumper load configurations compatible with cabin size, weight and balance considerations, and potential operational fuel loads.

3. Identify accessories needed to configure the aircraft for optimum efficiency and safety during smokejumping missions.

4. Identify the best, safest, and most efficient smokejumping procedures for spotting, smokejumper exits, and cargo drops, and the best emergency exit procedures.

ORGANIZATION CHART

--Functional Evaluation Procedures--

Air Safety and Communications. The following standards will be adhered to:

1. Weather: All flights will be performed under basic VFR conditions as defined by the FAA. If additional visibility and cloud clearance is needed, the Functional Evaluation Director will establish this standard before test flights begin. At the start of each test day, the Project Air Officer will check weather and will determine if visibility, wind, turbulence, and other weather factors are conducive for the day's test.

2. The Project Air Officer will coordinate air traffic control procedures with local authorities and FAA traffic control personnel. If in the judgement of the Project Air Officer, the flight test cannot be conducted in a safe manner because of air traffic problems, the flight tests will be altered or canceled.

3. Aircraft loading, weight and balance: Computations will be made before each flight.

4. Pilot and support personnel will be briefed on total mission objectives, daily flight intentions, air-to-ground communications, and emergency procedures.

5. Aircraft will be inspected by the Project Air Officer and/or Maintenance Specialist to assure that all airworthiness requirements are in order. Aviation personnel will be reviewed to make sure they have proper qualification and recent of experience.

6. Air safety will require the maximum awareness of each person involved in the evaluation.

7. Radio communications will be established linking the Function Evaluation Conductor, Drop Zone Manager, local dispatch, and drop aircraft on a common frequency.

   To further enhance communication, pilots will be briefed before the evaluation and as necessary before each flight. These briefings will discuss:

   --Standard terminology.

   --Primary and backup radio frequencies will be assigned.

   --Drop patterns and radio contact points will be established.

Work Sessions and Flights. The following standard series of evaluation work sessions and flight tests are intended to satisfy the objectives of the Functional Evaluation, and to document the conclusions, load configurations, and smokejumper procedures identified by the evaluation team. The flights and work sessions will be conducted in the order listed. Detailed briefings and debriefings will be conducted by the Functional Evaluation Conductor before and after each evaluation flight or work session.

--**WORK SESSION A: INITIAL BRIEFING**. Work Session A is a briefing of the members of the functional evaluation organization and evaluation pilots to ensure that they understand the evaluation's objectives, structure, schedules, and logistics. Duties, responsibilities, and pertinent topics regarding safety and communications will be discussed.

--**WORK SESSION B: PRE-FLIGHT STATIC-LINE TRAIL EVALUATION**. Work Session B is an on-the-ground exercise. It is conducted at the aircraft. Standard smokejumper cargo and personnel static-lines will be extended out the jump door to full extended length as they would trail in flight. With the D-bag positioned underneath and aft of the leading edge of the horizontal stabilizer, but forward of the elevator hinge, note the location of the static-line snap inside the aircraft. This is the correct location for the static-line anchor. The temporary static-line anchor installed for use during the Functional Evaluation must be configured to position D-bags correctly under the stabilizer. If necessary, an extender can be used to correctly potion the static-line snap.

During this exercise, static-lines will be moved throughout the extremes of the range they potentially may travel in-trail--up over the fuselage and down under the fuselage. Potential contact with antennas, beacons, or the horizontal stabilizer will be evaluated. Any adverse indication of potential for static-lines or D-bags to entangle in aircraft protrusions must be corrected before any static-line trial flight tests or airdrops. Also, the aft door edge and lower door corner must be inspected to ensure that they have a smooth surface that will not fray or cut static-lines. If problems are identified, they must be corrected before evaluation flights.

--**FLIGHT 1: STATIC-LINE TRAIL**. Note: Some aircraft are configured with a very high horizontal stabilizer, such as a T-tail. In this case, there are no real concerns about smokejumper parachutes contacting the stabilizer during deployment. It may be appropriate to combine Flight 1 and Flight 2 (actual drops) in these aircraft. Some aircraft may have a history of use as a parachute deployment platform. This may, or may not, be an indication that Flight 1 and Flight 2 can be combined. The deployment characteristics of smokejumper parachutes, and the length of smokejumper parachute static-lines, may differ from those previously used in the aircraft. For many candidate aircraft, the potential for deploying static-line

parachutes to contact the horizontal stabilizer during deployment is a very real concern. The Functional Evaluation Conductor, Evaluation Director, and other appropriate members of the evaluation team must concur in decisions to combine Flight 1 and Flight 2.

Flight 1 will be conducted with the aircraft fueled and loaded to maximum gross weight and maximum forward CG to produce maximum tail low flight attitude. During the static-line trail evaluation, airspeed will be 5 knots CAS less than identified airdrop speed, although not less than the V stall speed. Flap settings will be none, or the minimum that may be used for airdrop of cargo and smokejumpers.

Several video cameras attached to the aircraft fuselage will be focused to show the clearance of trailing D-bags underneath the horizontal stabilizer. In aircraft where there is particular concern about clearance, a 16-mm high-speed (slow motion) camera will be used in addition to video cameras. A 200-frames per second provides an excellent view of D-bag trail behavior.

Conduct the static-line trail evaluation as follows:

With video (and 16-mm) cameras running, a single cargo static-line and D-bag will be attached to the static-line anchor and trailed. Then an additional cargo static-line and D-bag will be trailed. These static-lines will be allowed to trail at full extension for about 15 seconds before being retrieved. The procedures will be repeated using personnel static-lines and D-bags, gradually working first one, then another, to full extension. If more than one static-line anchor location may be used for cargo, jumpers, or emergency exits, trail tests will be accomplished from all anticipated attachment points.

--**WORK SESSION C: REVIEW OF VIDEO OR HIGH-SPEED FILM OF STATIC-LINE TRAIL.** Before proceeding to the actual air drop phases of the evaluation, the video footage of the static-line trail test flight will be reviewed by the Evaluation Director, Functional Evaluation Conductor, and other appropriate members of the evaluation team. If necessary, the high-speed film will be processed and reviewed before proceeding.

The position and movement of the trailing static-lines and D-bags will be evaluated and the probable proximity of deploying parachute canopies to the horizontal stabilizer, or other aircraft protuberances, will be evaluated. If there is a possibility that a canopy may catch or hang up, corrective action will be taken before the evaluation continues. If serious questions exist, the evaluation will be delayed to allow the high-speed 16-mm film to be reviewed.

Next, the video footage will be reviewed to anticipate the probable deployment characteristics of cargo and personnel parachutes. During deployment, the parachute D-bag goes down, then rises as the lines and canopy deploy. The apex breaks free of the static-line in about the

same position that the D-bag trails. Therefore, it is possible to anticipate the probable path that the apex of the deploying canopy will follow when it breaks free of the static-line.

If trailing D-bags show a tendency to rise above the horizontal stabilizer, the selected static-line anchor location may be unacceptable, or the aircraft may be incompatible with safe deployment of smokejumper parachutes. D-bags must trail naturally under the stabilizer. If the video or film footage shows that the anticipated path of a deploying canopy will be in close proximity to the bottom surface of the horizontal stabilizer, there may, or may not, be reason for concern. In many satisfactory smokejumping aircraft, the parachute apex passes within 6 inches or so of the underside of the horizontal stabilizer. However, the canopy apex does not contact with the underside of the stabilizer, apex damage does not occur, and there is no risk of the canopy apex becoming entangled in the elevator hinge mechanism. Apparently a "cushion" of air on the bottom surface of the stabilizer prevents apex contact. However, if video footage shows that the apex will pass close to the bottom surface of the horizontal stabilizer, particular care is needed in proceeding with the evaluation. It may be appropriate to consider an adjust the location of the static-line anchor to increase the clearance of a deploying canopy apex from the elevator hinge mechanism. It may be appropriate to review the 16-mm high-speed film before proceeding.

--**FLIGHT 2: CARGO AND TORSO DUMMY DROPS.** Flight 2 determines actual cargo and personnel parachute deployment characteristics and captures these deployments on video and high-speed film.

Fuel load, ballast load, CG, and flap settings will be as specified for Flight 1. The number of bundles dropped and number of torso dummies dropped depends on the size of the aircraft, but generally does not need to exceed four typical cargo bundles and two torso dummies. All types of smokejumper cargo parachutes will be dropped. Torso dummies will be equipped with standard smokejumper personnel main parachutes.

Video and high-speed film of these drops will be taken from cameras mounted in appropriate locations on the evaluation aircraft.

A qualified observer should observe these deployments from in front of the jump door in the evaluation aircraft to observe these deployments. After the first drop, the observer must determine that there is no concern regarding the proximity of deploying parachutes and control surfaces or protuberances of the aircraft before any additional drops. If the observer has concerns, the evaluation may be delayed to allow review of video or high-speed slow film of the deployment(s).

--**WORK SESSION D: REVIEW OF FLIGHT 2.** Video footage, and if necessary, high-speed footage of the Flight 2 drops will be reviewed. Particular attention will be focused on the safe deployment of canopies past the horizontal stabilizer. The decision to proceed with live drops of smokejumpers will be based on review of the video and films.

--**WORK SESSION E: POTENTIAL LOAD CONFIGURATIONS.** Work session D will identify potential practical load configurations of suited smokejumpers and cargo in the evaluation aircraft. Maximum smokejumper loads with short-and long-range fuel loads should be determined. Maximum training jump loads should be determined.

Practical loads should be evaluated with consideration to cabin room and weight and balance. In considering weight and balance, fuel burnoff and movement of spotters and jumpers to aft positions near the jump door must be considered.

Cargo and smokejumper restraint procedures and configurations should be considered for these various loads.

The Evaluation Technical Writer and Photographer may help document the load configurations identified. The Performance Test Conductor may assist with weight and balance considerations.

--**WORK SESSION F: EVALUATION OF SMOKEJUMPER ACCESSORY NEEDS.** Work Session F will determine the need for and configuration of special smokejumping accessories.

Configuration and location of primary, emergency, and cargo static-line anchor systems must be considered. Tether hard points or cables needs must be identified. Handrails, jump steps, door boots, fairings, spotter/pilot communications systems, and any other accessory needs must be considered.

The Accessories Design Team Leader provide information on practical locations and configurations for accessories compatible with the strength of the aircraft's structure. If the aircraft is not available, measurements and photographs must be obtained so the accessories can be designed.

In considering the optimum configuration of accessories for the candidate aircraft, standardization with the configuration of accessories in other smokejumping aircraft should be considered. When possible, a configuration similar to that found in other smokejumping aircraft should used. This allows standard training in static-line hookup and mis-route avoidance. When possible, it is best to locate vertical static-line anchors adjacent to or behind the second jumper in a stick. This minimizes the risk that jumpers might exit with a static-line under their arm.

--**WORK SESSION G: OPERATIONAL PROCEDURES.** The purpose of Work Session G is to identify and document operational procedures for spotting, jumper exits, cargo drops, and emergency exit procedures.

Preference will be given to application of standard procedures used in similar smokejumper aircraft. The safety and operational efficiency of proposed procedures must be evaluated.

--**FLIGHTS 3 to 6: EVALUATION OF DROP PROCEDURES.** Flights 3, 4, 5, and 6 will evaluate the load configurations identified in Work Session E, and the operational procedures identified in work session G. Cargo drops and live jumps will be conducted.

These flights are structured after questions raised during Work Session E and G have been answered. Both fire and training mission loads should be evaluated. At least one flight must include drops of representative smokejumper cargo bundles.

All drops will be filmed with video cameras located in appropriate locations outside the aircraft. At least the first two flights of jumpers and cargo drops will be filmed with high-speed camera equipment. High-speed filming of additional flights will be at the discretion of the Functional Evaluation Conductor.

Smokejumpers and spotters will be thoroughly briefed before each flight on objectives of the test flight, specific procedures, and special safety concerns.

Smokejumpers will be selected based on their level of experience, their ability to offer qualified opinions, and their ability to compare various procedures used during the evaluation. If possible, the same evaluation jumpers should be used for all evaluation jumps so they can compare procedures.

Additional live jump or cargo drop flights may be scheduled at the discretion of the Functional Evaluation Conductor.

--**WORK SESSION H: CONCLUSIONS AND RECOMMENDATIONS.** During this work session, participants document their conclusions and recommendations. Participants will compile the written material and photographs that document the Functional Evaluation. The Functional Evaluation Director will use this material to prepare the final Functional Evaluation Report.

Documentation Requirements.

Work Session A. None

Work Session B. Description of any adverse potential for static-line and D-bag entanglement in aircraft structures, and identified solutions.

Description of sharp edges on aircraft door or fuselage that may fray or cut static-lines. Description of solutions.

Work Session C. Conclusions regarding static-line trail characteristics during Flight 1.

Work Session D. Conclusions regarding cargo and torso dummy drops during Flight 2.

Work Session E. Description of primary loads considered, including those rejected and the reasons for rejection.

Work Session F. Lists and descriptions of needed accessories. Rationale for those accessories.

Work Session G. Operating procedures considered, including those rejected, and reasons for rejections.

Flights 3 to 6 Objectives, configurations, and procedures for each flight. Comments and conclusions from spotters and jumpers for each flight.

Work Session H. Final recommendations of the Functional Evaluation regarding:

--Practical load configurations

--Required accessories

--Spotting procedures

--Smokejumper exit procedure

--Cargo dropping procedures

--emergency exit procedures

Photographs Required.

Work Session A. None

Work Session B. 35 mm-slides and black and white prints of:

--Static-lines extended

--Clearance of static-lines and D-bags from the horizontal stabilizer

--Aircraft protuberances that could potentially snag or catch a static-line or D-bag

--Sharp edges on the aircraft door or fuselage that may fray or cut static-lines.

--Provisions made to eliminate anticipated static-line trail problems.

Flight 1	High-speed film of the cargo static-line and personnel static-line D-bag trail test.
Work Session C.	High speed film.
Flight 2.	High-speed film of cargo and torso dummy canopy deployments. Focus on the proximity of deploying canopies to the horizontal stabilizer.
Work Session D.	None
Work Session E.	35-mm slides and black and white prints of all seriously considered load configurations.
Work Session F.	35-mm slides and black-and-white prints of all accessories in the evaluation aircraft. 35-mm slides and black-and-white prints as required by the Accessories Design Team Leader and the Drafting Technician showing the location of accessories and the aircraft structure in the vicinity of proposed accessories.
Work Session G.	35-mm color slides and black-and-white prints documenting the various spotter and exit procedures considered.
Flights 3 -6.	High-speed film of air drops as assigned.
Work Session H.	Ensure that all required photography has been obtained.

Suggested Briefing Topics. Before the Functional Evaluation, before each Work Session, and before each Evaluation Flight, personnel must be briefed. The following briefing topics are recommended.

Suggested Briefing: Functional Evaluation Conductor. The Evaluation Director shall brief the Functional Evaluation Conductor on the following topics:

1. Standard evaluation procedures.
2. Specific evaluation procedures.
3. Special safety concerns.
4. Data recording and collection.

5. Coordination required with the Flight Performance Test Conductor and the Accessories Design Team Leader.

6. Communications procedures.

The Functional Evaluation Conductor shall brief the evaluation team as follows:

*<u>Briefing Topics: Functional Evaluation Photographs</u>.

1. Type of photography and projection equipment required.

2. Objective of photography in the various phases of the evaluation.

3. Critical timetables for film processing and review.

<u>Briefing topics: DZ Manager</u>.

1. Listing of the specific DZ equipment, radio, and vehicles required.

2. Amount of cargo to be retrieved.

3. Communications responsibilities.

<u>Briefing Topics: Functional Evaluation Loadmaster</u>

1. Specific cargo and smokejumper loads for each Evaluation Flight.

2. Weight and balance information.

*<u>Briefing Topics: Spotter(s)</u>.

1. DZ location.

2. Specific spotting and cargo dropping procedures to be used.

3. Special safety concerns regarding spotting procedures.

4. Communications.

*<u>Briefing Topics: Smokejumpers</u>.

1. Specific aircraft and exit procedures to be used.

2. Objectives of the Evaluation Flight.

3. Special safety considerations.

4. Input expected after the jump and attendance requirements at post-flight work sessions.

Briefing Topics: Pilot(s)

1. Procedures for each flight.

2. DZ location.

3. Airspeeds and flap settings desired.

4. Spotter/pilot communications procedures.

5. Communications procedures and requirements.

*The Functional Evaluation Conductor will brief the Evaluation Aircraft Pilot, Photo Aircraft Pilot, Photographer, Spotter, and Jumpers before each flight.

PART V -FIELD EVALUATION

Critera to Operate an Evaluation Aircraft. A field Evaluation consisting of a full season of operational use is needed to validate smokejumping procedures and the configuration of smokejumping accessories developed for the aircraft. The critera for using an evaluation aircraft in field operations are:

1. Successful completion of the Flight Performance Evaluation and Functional Evaluation.

2. Completion of design, engineering structural analysis, drawings, fabrication, and installation of a full complement of smokejumping accessories for the aircraft. This includes a primary static-line anchor and a spotter tether anchor. The anchor used for emergency exits and for cargo parachute deployment must be identified. A suitable smokejumper seat/restraint system must be provided. Additional accessories identified in the Functional Evaluation are required. These may include jump door handrails, a jump step, a floor platform, a spoiler, a spotter communication system, and other special accessories. Note: Anchor installations that require an FAA STC will be installed using the FAA Field Approval Process. This allows evaluation and refinement of the Anchor(s) before work to obtain an FAA STC is accomplished. The engineering structural analysis must show that these accessories meet established strength requirements.

Preliminary Operational Guidelines. Before the Field Evaluation, the Evaluation Director is responsible for preparing Preliminary Operational Guidelines for smokejumper operations using the evaluation aircraft. These guidelines will be provided to the Field Evaluation Conductor. These Guidelines will be based on the information gained during the preceding stages of the evaluation. These guidelines include:

--Aircraft Performance Information, drop airspeeds and flap settings.

--Preparation for Airdrop (accessories).

--Load Configurations.

--Spotter Procedures.

--Smokejumper Procedures.

--Cargo Dropping Procedures.

--Special Considerations.

Field Evaluation Procedure. The Field Evaluation Conductor will be the Smokejumper Base Manager where the aircraft is based. The Field Evaluation Conductor is responsible for operating the aircraft as described in the "Preliminary Operational Guidelines." Coordinating with the Evaluation Director, the Field Evaluation Director should refine or modify these guidelines appropriately as experience is gained operating the aircraft.

Documentation Requirements. At the conclusion of the field evaluation, the Field Evaluation Conductor will provide the Evaluation Director with a report that includes:

1. Extent of Aircraft Use.

2. Flight Performance on Smokejumper Missions.

3. Best Operational Procedures.

4. Evaluation of Accessories.

5. Best Load Configuration(s).

PART IX - EVALUATION DOCUMENTATION

Evaluation Summary Report. At the completion of all evaluation activities, the Evaluation Director will prepare a "Summary Report." This report will briefly document that the aircraft meets the requirements for an "approved" smokejumper aircraft. It will also provide general information about the aircraft in a format useful to future aircraft users. This report must include:

1. Documentation that a complete evaluation was accomplished:

   --Date the "Sponsor's Report" was received, evaluated by SASEB, and accepted by management.

   --Date the evaluation responsibility was assigned and an evaluation organization staffed.

   --Date the "Flight Performance Evaluation" was accomplished.

   --Date the "Functional Evaluation" was accomplished.

   --Date the Field Evaluation was accomplished.

   --Date the required FAA STC's were obtained.

2. General aircraft description and pictures.

3. Preparation for airdrop. This is a list of MTDC drawing numbers for accessories, STC numbers, restraint systems, and identification of other special requirements to configure the aircraft for smokejumping. Pictures of these accessories should be provided.

4. Aircraft capabilities:

   --**Typical Smokejumper Mission Load:** Number of smokejumpers, pounds of initial attack cargo, hours of fuel, range, etc.

   --**Performance:** Mission airspeed, runway requirements, density altitude considerations.

   --**Drop configuration:** Smokejumper drop airspeed and flap setting, and the paracargo drop airspeed and flap setting.

   --**Support requirements:** The number of pilots and number of spotters required.

   --**Multi-purpose capabilities:** Pounds of point-to-point cargo and number of passengers that can be carried.

5. Brief summary of the evaluation and any special considerations regarding the aircraft's use for smokejumping.

Final Report Package. At the completion of the evaluation, the Evaluation Director will compile a "Final Report Package." This package will fully document the suitability of the evaluation aircraft's suitability to be placed on the list of "approved" smokejumper aircraft. Copies of this package will be delivered to the Chairperson of the SASEB. The "Final Report Package" includes:

1. Sponsor's Report.

2. Flight Performance Evaluation Report.

3. Functional Evaluation Report.

4. Field Evaluation Report.

5. Evaluation Summary Report.