

# Columbia Space Shuttle Debris Recovery Flight Operations Risk Analysis

The overall risk analysis was conducted on 3 & 4 April, 2003 using Chapter 3 “Operational Planning” of the Interagency Helicopter Operations Guide (IHOG). Team members included:

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- Boo Walker – (Texas Forest Service) Air Operations Manager
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The risk analysis listed in Chapter 3 of the IHOG takes into consideration the probability of an event happening & effect level if the event occurs and yields a subsequent risk level. The initial risk analysis identified the following risk levels:

<u>Event</u>	<u>Effect</u>	<u>Probability</u>	<u>Risk Level</u>
Low Level / Low altitude / Over Trees	Catastrophic	Frequent	Extreme
Aircraft Operation w/ Doors Removed	Catastrophic	Occasional	High
Unimproved Landing Zone	Critical	Likely	High
Crew Fatigue	Critical	Likely	High
Blade Strike	Occasional	Critical	High
Engine Failure	Catastrophic	Unlikely	Medium
Weather	Moderate	Likely	Medium

The risk levels listed above will be mitigated by incorporating the following controls / guidelines:

**Note:** All aircraft operations will comply with the guidance dictated in their specific aircraft operations manual.

### Low Speed / Low Altitude / Over Trees

- The intent is to search areas “clear” of trees that would prevent a safe landing (a safe landing is any landing from which all crewmembers can walk away in the event of any aircraft emergency requiring an immediate landing).
- No “search” operations are to be conducted over areas where the trees (canopy) or terrain prevents the ability of the observers to visually detect objects 12” x 12” in size or larger, with a 75% probability or higher. ~~to clear said terrain to a 75% Probability of Detecting objects 12”x12” in size.~~
- A high and mid-level recon will be completed prior to commencing low-level search operations.
- A 20’ minimum over all obstacles will be adhered to (considered best altitude to keep helo above the majority of potential obstacles while still enabling crew survivability upon landing in case of mechanical failure).

- If flight operations are conducted over areas where in the advent of an engine failure, a safe autorotation / emergency landing cannot be executed, it is incumbent on the pilot and crew to assess and mitigate the risk prior to the operations in that environment.
- Personal Protective Equipment (PPE) will be worn at all times.
- In order to reduce exposure, the total crew complement will be limited to 4 personnel. As such, the helicopter performance capabilities must allow safe operations with 4 personnel.
- Transit to and from Search Grids
  - o Transit from the helibase to search grids and between search grids & refueling locations will be accomplished at 1500' MSL.
  - o Transit from search grids and refueling locations to the helibase will be accomplished at 1200' MSL.
- Transit between searchable (clear) areas in a search grid
  - o Transitions within grids will be accomplished while maintaining altitude and airspeed commensurate with accomplishing a survivable crash landing in the event of mechanical malfunction.

### **Aircraft Operation w/ Doors Removed**

- FOD: Crews must be thoroughly briefed to ensure FOD control in the event the doors are removed.
- Doors may be removed to improve mission effectiveness.
- Seat Belts &. Harnesses
  - o The mission shall not necessitate the utilization harnesses which allow crewmembers to hang beyond the helicopter airframe.
  - o No part of any individual or any item should be outside the airframe of the helicopter during flight.
  - o **Seat belt restraint is for crash survivability.** No tape or modification of any kind over the seat belt actuator is **permitted**. ~~recommended~~. The belt should never be relied on to keep personnel in the aircraft under normal flight operations. As such, if accidental actuation of the seat belt actuator occurs, the individual should be seated firmly in their seat and belt actuation should be of no effect. Bottom line ... the seat belt should not be relied on to keep personnel in the helicopter under normal operations (i.e. do not lean out against the belt and rely on it to keep you in the helicopter).

### **Unimproved Landing Areas**

- The helicopter will land to retrieve debris only in safe landing areas as determined by the pilot and the helicopter manager. All landing zones will be "In Ground Effect" with a minimum 15'x15' solid, level touchdown pad with minimum 75' safety circle clearance for rotor system. This determination will be in accordance with established rules for unimproved helispots.
- If a determination is made to land, the pilot will state their intentions to the crewmembers on board and to the air tactical group supervisor for the assigned zone.

All crewmembers will cease search operations and assist with the safe landing of the aircraft. The cockpit will become a sterile environment using all crew to communicate hazards to the pilot.

- If it is determined that an item cannot be retrieved safely it will be marked on the map and the coordinates will be written on the data sheet for retrieval by ground forces.

### **Crew Endurance During Search Operations**

- Flight at the required search altitudes for extended periods can be very fatiguing. As such, the following controls will be implemented to ensure the risk of detrimental fatigue is mitigated:
  - o Flight in the low-level search environment will be restricted to 1.5 hours between refueling cycles (not to include time transiting to and from grids).
  - o Total search time will not exceed 4.5 hours per day.
  - o Total flight time will not exceed 6.5 hours per day.

### **Blade Strike**

- Ensure pilots are made aware of hazards associated with blade strikes, loss of situational awareness/focus during the Operational and Safety Procedures briefing.
- Ensure observers are made aware of hazards associated with blade strikes, loss of situational awareness/focus during the Operational and Safety Procedures briefing.
- Proper Crew Resource Management (CRM) necessitates warning all crewmembers of potential hazards as soon as they are identified.
- The daily safety briefing will address the high potential of blade strikes.
- 20 feet, both vertically and horizontally, from all obstacles will be maintained at all times during mission flight operations.
- A sterile cockpit must be observed during search and takeoff & landing operations.
- We will use only "Type 3" helicopters since the rotor diameter is smaller which is considered a mitigating factor for blade strike potential.

### **Engine Failure**

- The aircraft shall have a current interagency card showing that the aircraft has been inspected and approved for the mission to be performed.
- Certification that the pilot has the appropriate knowledge of the emergency procedures to be performed in the event of engine failure as prescribed in the "Helicopter Pilot Flight Evaluation Guide."
- Further mitigation listed previously in the Trees / Low Speed / Low Altitude section.

### **Weather**

- The mitigation measures previously in place are acceptable with the exception of ...
  - o Remove the "Icing" guidance for the Air-Attack aircraft from the Aircraft Operations Minimums as FAR guidance is sufficient.
  - o Follow the aircraft VFR minimums sheet published per the aircraft operations plan.

## Summary

At the user level there must be an avenue in place to ensure the previously listed controls are implemented and effective. As such, a feedback capability from each end user (Pilot, Manager, and Searcher) will be implemented. The helibase manager will gather “Risk Mitigating” feedback from each helicopter flight crew at each helibase on a daily basis. The helibase manager will submit a daily written report of all issues brought to their attention. This form must be signed off daily by the Operations Aviation Safety Officer, Air Operations Branch Director, Aviation Coordinator, Texas Forest Service Air Boss (Boo Walker) and the NASA Air Operations Officer. Fixed-wing issues will be brought forward from the ATGS directly to the Air Operations Branch Director. Each identified issue must be addressed in a timely manner (1 day if possible) and feedback given to the initiator. If issues, which effect overall operations are identified, prompt attention will be given to alleviate the problem.

The initial risk analysis was reassessed with the mitigating factors incorporated and the following risk levels were attained.

<u>Event</u>	<u>Effect</u>	<u>Probability</u>	<u>Risk Level</u>
Low Level / Low altitude / Over Trees	Moderate	Likely	Medium
Aircraft Operation w/ Doors Removed	Catastrophic	Unlikely	Medium
Unimproved Landing Zone	Negligible	Likely	Low
Crew Fatigue	Critical	Seldom	Medium
Engine Failure	Critical	Unlikely	Low
Blade Strike	Seldom	Critical	Medium

The composite risk assessment has been reduced from “HIGH” to “MEDIUM”.