Aviation
Risk Management Workbook

US Forest Service
DOI Bureau of Land Management

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Assessments

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INTRODUCTION TO AVIATION RISK MANAGEMENT

Objective: The objective of a Safety Management System (SMS) is to provide structure to control risk in operations. A formal system of hazard identification and safety risk management is essential in controlling risk to acceptable levels. System Safety is centered on an organized approach to hazard identification and risk management with intent to minimize the effect on property, financial, environmental, human and societal losses.

Significant attention to good practices in the aviation industry has evolved over many years. Continuous improvement in accident rates are being experienced internationally. Participants in System Safety continually challenge the processes, the culture, and the systems to identify weaknesses that can be mitigated toward the greater purpose of mishap prevention.

Description: The System Safety concept is a comprehensive process to analyze system characteristics and engineer solutions to prevent mishaps from occurring. Aviation Safety Management System (SMS) is an approach to managing safety that includes the necessary organizational structures, accountabilities, policies and procedures. The SMS process identifies hazards and control risks, then provides assurance that risk controls are effective. Although we currently do a good job of identifying hazards and controlling risks, we are not realizing the full benefit that a system wide approach provides.

The foundation of SMS consists of four "components," they are **Policy, Risk Management, Assurance and Safety Promotion**. When fully implemented SMS provides and promotes a Positive Safety Culture. The desired positive Safety Culture is informed, flexible, learning, just and a reporting culture that captures the operational knowledge and experience of the employees. The end result of this cultural shift is to achieve the status of a High Reliability Organization (HRO). **

Following your review of the stated Objective and Description of System Safety**,** you probably have questions on how to best utilize the Guide, as well as how this fits into "the big picture". First the big picture; the agencies started looking into System Safety in 2005. The findings were positive and in 2006 the BLM and USFS partnered in their work on Aviation Safety Assessments. The first assessments were completed by Interagency Subject Matter Experts (SME) in March of 2007 and were made available on line in May of 2007. This third revision, completed in March of 2009, is posted online and has been distributed in hard copy as the **Aviation Risk Management Workbook.** This workbook helps to establish an Interagency Safety Management System that incorporates all four of the SMS components mentioned earlier. Adoption of SMS also brings the agencies into alignment with the minimum aviation safety standards agreed to internationally within guidelines of the International Civil Aviation Organization. (ICAO 9859).

** Weick and Sutcliff, Managing the Unexpected

What are the four "components" that will achieve the SMS goal?

1. **Safety Policy**. We have existing policy in place that supports the foundation of SMS in our aviation safety programs. This policy is reflected in the "Red Book", Interagency Standards for Fire and Fire Aviation Operations.

2. **Safety Risk Management**. This workbook contains the completed program assessments on Helicopter Operations, Rappel/RADs, External Loads, Aerial Supervision, SEATs, Heavy Airtankers, Infra-Red, EHELL, and Forest Health programs.

3. **Safety Assurance.** Accident Investigation, Program Reviews, Fire Aviation Safety Teams (FAST), Aviation Safety Technical Assistance Teams (STAT), Aviation Safety Assistance Teams (ASAT), and numerous other tools monitor and report the health of our prevention efforts. Currently we are working towards implementation of an Aviation Lessons Learned web site and work towards a "Reporting Culture".

4. **Safety Promotion**. We have the ability to implement very positive change in this area by creating a positive "Learning Culture". Communication is the key to success in this component. Training systems are being updated to reflect the principles and procedures being implemented in SMS. Other tools include SAFECOMs, Safety Alerts, Technical Bulletins, Lessons Learned, SAFECOM trending, safety memoranda, Aviation Safety Committees, tailgate sessions and video clips such as the Six Minutes for Safety series.

How should I use this workbook as a Risk Management tool?

Local action plans should incorporate some or all of the best practices that will effectively accomplish hazard mitigation. These assessments can and should be used for briefing tools, tailgate safety sessions, Project Aviation Safety Plans (PASP), and especially during periods of increased fire activity. Area Command, Aviation Safety Assistance Teams (ASAT), Incident Management Teams (IMT), Contractor/Vender employees, as well as all aviation users can benefit from reviewing and utilizing this valuable information. We encourage Interagency personnel to request pilots to participate in morning briefings and After Action Reviews (AAR) utilizing the applicable mission assessments.

HOW DO I USE THIS WORKBOOK ON MY LOCAL UNIT?

Risk Management Workbook: This workbook is intended for use in the management of flight operations**.** Each section is designed to provide you with information regarding the hazards, risks, and suggested mitigations for most of the agencies aviation missions.

Program Risk Assessments. The tabbed sections contain individual Hazard Logs developed by an SME Team for each mission. These sections depict mission sub-systems, hazards, risk assessments and suggested mitigations associated with each hazard. The workbook is designed for local use to determine if the suggested mitigation is accomplished.
Follow these steps during your review:

1. Review the description of each hazard, risk level and mitigation.
2. Determine if your local unit complies with the suggested mitigation(s). Log your answer by checking the YES/NO column.
3. If you checked NO; and if the associated risk level is Yellow or RED; you need to assure that the risk is mitigated to an acceptable level.
4. Go to the reverse side of the page to the blank spreadsheet.
5. Enter your list of Hazards that require mitigation.
6. Enter new or additional hazards not identified, assess the level of risk, and enter the new mitigation to be completed.

Risk Assessment Matrix. This section contains the risk assessment matrix used by the SME teams. The matrix is accompanied by the definitions of each of the levels of Severity and Probability that result a final risk level stated as Low, Medium, Serious, or High.

Flow Chart. The final tab contains a flow chart that provides a checklist of items to monitor when preparing a JHA, PASP, or during the planning stage for any flight operation.

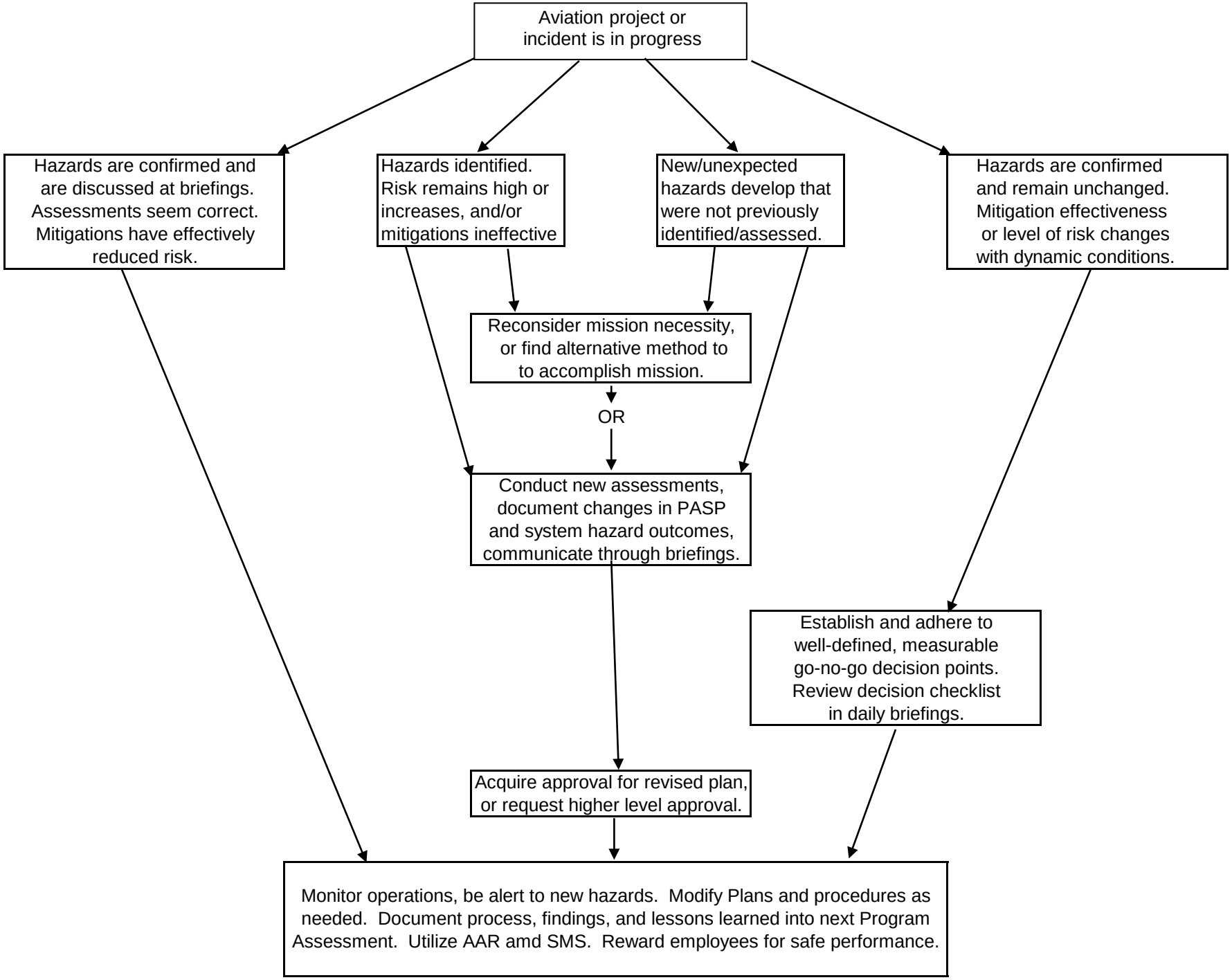
This workbook was developed by the US Forest Service and DOI Bureau of Land Management Aviation Safety staff. Your feedback is critical to improve these assessments. You are encouraged to contact Ron Hanks at rhanks@fs.fed.us 208-387-5607 or Joe Bates Joseph_Bates@nifc.blm.gov 208-387-5879 with any comments, questions or ideas.

Risk Assessment Matrix				
	Severity			
Likelihood	Negligible IV	Marginal III	Critical II	Catastrophic I
Frequent A				
Probable B				*High 4*
Occasional C			*Serious 3*	
Remote D		*Medium 2*		
Improbable E	*Low 1*			

Severity Scale Definitions	
Catastrophic	Results in fatalities and/or loss of the system.
Critical	Severe injury and/or major system damage.
Marginal	Minor injury and/or minor system damage.
Negligible	Less that minor injury and/or less than minor system damage.

Likelihood Scale Definitions		
Frequent	Individual Fleet	Likely to occur often. Continuously experienced.
Probable	Individual Fleet	Will occur several times. Will occur often.
Occasional	Individual Fleet	Likely to occur sometime. Will occur several times.
Remote	Individual Fleet	Unlikely to occur, but possible. Unlikely but can reasonably be expected to occur.
Improbable	Individual Fleet	So unlikely, it can be assumed it will not occur. Unlikely to occur, but possible.

Appropriate Management Level for Risk Decisions		
Risk Level	**Fire**	**Project**
High	Incident Commander or Operations Sections Chief	Line Officer/Manager
Serious	Incident Commander or Operations Sections Chief	Line Officer/Manager
Medium	Air Operations Branch Director	Project Aviation Manager
Low	Base Manager	Helicopter or Flight Manager


Aviation project or incident is in progress
Hazards are confirmed and are discussed at briefings. Assessments seem correct. Mitigations have effectively reduced risk.
Hazards identified. Risk remains high or increases, and/or mitigations ineffective
New/unexpected hazards develop that were not previously identified/assessed.
Hazards are confirmed and remain unchanged. Mitigation effectiveness or level of risk changes with dynamic conditions.
Reconsider mission necessity, or find alternative method to to accomplish mission.
OR
Conduct new assessments, document changes in PASP and system hazard outcomes, communicate through briefings.
Establish and adhere to well-defined, measurable go-no-go decision points. Review decision checklist in daily briefings.
Acquire approval for revised plan, or request higher level approval.
Monitor operations, be alert to new hazards. Modify Plans and procedures as needed. Document process, findings, and lessons learned into next Program Assessment. Utilize AAR amd SMS. Reward employees for safe performance.

System - Aircraft		Aerial Supervision Assessment									
		Pre Mitigation				Post mitigation					
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Avionics	Avionics failures: overheating, faulty wiring, etc.	Occasional	Marginal	Medium	Integrate into preflight checklist. Add to phase/hourly inspections. Thorough post season inspection. Identify radio location to ensure adequate ventilation. Use extra radio sparingly. Proactive maintenance schedule. When one wire fails replace entire wiring harness.	Improbable	Marginal	Medium			
	Inaccessible avionics components	Occasional	Negligible	Low	Mount components in accessible areas. Change contract to reflect this? Standardize within AC Models?	Improbable	Negligible	Low			
	Flight crew unfamiliar with components.	Occasional	Marginal	Medium	Training, briefings, carding, pre-flight inspection.	Remote	Marginal	Medium			
Configuration	Poor visibility	Occasional	Negligible	Low	Avoid low wing for ATGS operations. High wing provides substantially more visibility. Ensure aircraft is appropriate for the mission.	Improbable	Negligible	Low			
Performance Standards	Poor engine performance (single/twin, turbin/recip).	Occasional	Catastrophic	High	Avoid high density altitudes. Download cargo/fuel load. Relocate to favorable location. Alter the mission. Upgrade the aircraft. Ensure aircraft is appropriate for the mission. Perform pre-flight planning.	Remote	Catastrophic	Serious			
Contracting - CWN VS Exclusive Use	Sub-standard avionics components.	Occasional	Negligible	Low	Add TCAS/AFF to CWN contracts.	Improbable	Negligible	Low			
	Low ATGS CWN pilot skill/fire experience leading to sub-standard performance during flight operations.	Remote	Critical	Medium	Conduct thorough briefings. Ride along with veteran fire pilot. Document performance via contract evaluation process. CWN/ARA Contractors need to receive better training, possibly in the form of computer-based training. Require Air Attack pilots to take a check ride every three years.	Improbable	Critical	Medium			
Fuel	Bad fuel	Occasional	Critical	Serious	Prior to re-fueling from an unknown source, ensure fuel is tested for type and quality. Monitor quantity pumped.	Remote	Critical	Medium			

System - Flight Operations

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Fire Operations	Poor visibility (smoke)	Frequent	Catastrophic	High	Determine effectiveness of the operation (risk vs. benefit) and discontinue if warranted. Limit number of aircraft in operating area. Increase vertical/horizontal separation of aircraft.	Occasional	Catastrophic	High			
	Wake turbulence and speed differential (SEATs)	Frequent	Critical	High	Use show me or chase profile. Use lead profile only when necessary. Performance maneuvers (e.g.. Steep turns and pushovers) should be communicated to other aircraft. SEAT performance (speed) needs to be pre-determined in order to set the correct drop speed.	Occasional	Critical	Serious			
	Weather (turbulence/wind/thunderstorms)	Frequent	Critical	High	Adjust tactics or shut down air ops. Increase vertical/horizontal separation of aircraft. Utilize human aided technology (weather radar, etc.). Encourage dispatch to obtain/communicate weather information. Utilize and share pilot reports of severe weather.	Occasional	Critical	Serious			
	Fuel management	Occasional	Critical	Serious	Monitor fuel quantities. Follow fuel transfer procedures. Pre-flight the aircraft. Plan the flight; know refueling locations. Query other aircraft.	Remote	Critical	Medium			
	Density altitude	Frequent	Catastrophic	High	Relocate aircraft. Consult performance charts. Download fuel.	Remote	Catastrophic	Serious			
	Exposure to terrain in low level environment (Lead/ASM).	Frequent	Catastrophic	High	Ensure high and mid-level recon is completed prior to commencing low level flight. ASM - ATS assists ATP with aerial/ground hazard identification and instrument monitoring (airspeed, altitude, hard deck, etc.). Perform only pertinent radio communication.	Remote	Catastrophic	Serious			
	Operating in close proximity to other aircraft (collision potential).	Frequent	Catastrophic	High	Conduct only pertinent communication with the ground (line clearance, etc). Maintain "eyes out" for hazards (terrain, vegetation, birds, other aircraft, etc). ASM - ATS assists ATP with tracking other aircraft (spacing, location, closure, etc).	Remote	Catastrophic	Serious			
	Obstructions (towers, cables, wires, etc)	Probable	Catastrophic	High	High level recon, hazard/sectional map, consult ground personnel/other AC.	Remote	Catastrophic	Serious			
	Reliance on technology: TCAS, WSI, GPS, Laptops. Flight crew members spending too much time looking at things inside the cockpit instead of out.	Frequent	Critical	High	Remember the eyes are the primary tool for spotting traffic. Don't rely too much on TCAS. Don't ignore TCAS traffic warnings with a tanker in tow (Lead). Prioritize tasks (i.e.: mapping vs. looking for traffic/hazards while in low level ops). Utilize good CRM practices.	Occasional	Critical	Serious			
	Aircraft emergency	Remote	Catastrophic	Serious	Crew should be trained and remain familiar with a/c systems and emergency procedure checklists.	Remote	Catastrophic	Serious			

System - Flight Operations (cont.)

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Mitigation	Post Mitigation Likelihood	Post Mitigation Severity	Post Mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Fire Operations	Lack of situational awareness	Occasional	Catastrophic	High	Proper rest, thorough briefing (incoming and change out between aerial supervisors), use TCAS/TCAD, use appropriate tactics, maintain commo with other AC/ground/disp. Utilize CRM.	Remote	Catastrophic	Serious			
	Sense of urgency	Frequent	Critical	High	Monitor radio traffic, remain calm, follow incident strategy/tactics.	Remote	Critical	Medium			
	Exceeded span of control	Frequent	Catastrophic	High	Ensure roles and responsibilities are assigned and understood within aerial supervision crew. Assign aircraft to common functions and tasks with a single point of contact. Hold aircraft at base to limit the number of assigned aircraft over the incident.	Remote	Catastrophic	Serious			
	Urban interface/congested areas	Remote	Catastrophic	Serious	Establish flight paths; avoid creating hazards to persons or property on the ground. Lead/ASM must be on order and ATGS must be on scene prior to airtanker operations. Aerial supervision must have positive communication with the IC or designated ground contact.	Remote	Catastrophic	Serious			
	Lack of air to ground coordination	Frequent	Critical	High	Use proper frequencies, maintain positive communication, ensure strategy and tactics are clear and understood, use only common terminology, ensure line clearance, solicit feedback. Move helicopters to Division or tactical frequencies as needed. Request more frequencies as needed.	Occasional	Critical	Serious			
	Improper drop heights	Occasional	Critical	Serious	Strictly adhere to minimum drop heights (60 feet for SEATs and 150 feet for heavy tankers). Solicit and utilize feedback from ground. Improve and conduct training for tanker/SEAT pilots.	Remote	Critical	Medium			
	Target fixation	Probable	Critical	High	ASM should assist single pilot operations in maintaining situational awareness.	Remote	Critical	Medium			
	Missing radio calls/Poor communications (air to air)	Frequent	Critical	High	Make sure Air to Air frequency is clear when lead and tankers are on final drop run. Ensure frequency assignments are understood by air and ground personnel. Ensure volume knobs are adjusted properly. Prioritize radios during fire ops (i.e.: Air to Air vs. dispatch). Provide flight crew training.	Probable	Critical	High			
	Missing radio calls/Poor communications (air to ground)	Frequent	Critical	High	Make sure ground contact is available on the radio during tactical operations. A ground contact with a non-scanning radio dedicated to the air to ground frequency is helpful. Provide training to ground personnel. Debrief/conduct AAR after incidents.	Probable	Critical	High			
	Poor/unclear tactics	Frequent	Critical	High	Maintain positive communications with ground resources. Ensure strategy and tactics are clear/understood. Use only common terminology, solicit/utilize feedback. Provide communication training for ground crews.	Occasional	Critical	Serious			
	Low aircrew experience levels	Occasional	Critical	Serious	Training/mentoring, qualifications/currency, CRM, brief/debrief, honest feedback.	Remote	Critical	Medium			

System - Flight Operations (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Fire Operations	PPE not utilized	Occasional	Critical	Serious	Ensure flight crews understand/implement PPE policies and are held accountable.	Remote	Critical	Medium			
	Checklists not utilized	Occasional	Critical	Serious	Ensure flight crews are using checklists.	Remote	Critical	Medium			
	Shoulder restraints not utilized when available.	Occasional	Critical	Serious	Ensure flight crews are using restraints.	Remote	Critical	Medium			
	Inefficient operational use of tactical aircraft	Probable	Critical	High	SOPs for all tactical aircraft types. Right tool for job. Training, feedback, brief/debrief.	Remote	Critical	Medium			
Airspace	FTA: Aircraft not complying with procedures.	Frequent	Catastrophic	High	Aerial supervision is trained and enforces FTA procedures. Utilize virtual fences, IP's, quadrants, etc.	Occasional	Catastrophic	High			
	Special use airspace: Aircraft not complying with procedures.	Probable	Critical	High	Deconflict SUA. See and avoid. Know SUA areas. Establish commo with controlling agency. Thorough briefings. Training for flight crews.	Remote	Critical	Medium			
	TFR: Aircraft not complying with procedures.	Probable	Catastrophic	High	Dispatch in contact with media. Utilize airspace coordinator. Communicate intrusions. Monitor/assign TFR Frequency.	Remote	Catastrophic	Serious			
	Incident location: Fires in proximity to congested airspace (airport approaches/high GA traffic areas). Potential for mid-air collision.	Probable	Catastrophic	High	Validate TFR as incident expands, Deconflict SUA, Establish commo with controlling agency, notify other aircraft. Provide TFR transition corridors for non-incident aircraft on large incidents. Increase awareness of GA operators and other agency flight crews not assigned to incident.	Remote	Catastrophic	Serious			
Planning	Flight routes need to be planned to account for average terrain height. Sufficient time in emergency to glide to safe landing area.	occasional	critical	Serious	Prepare pre-season route planning to identify best enroute cruise altitude, single engine glide distance, and locations of safe landing areas or back country airports.	Occasional	Marginal	Medium			

System - Dispatch

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Communications	Radio frequency congestion	Frequent	Critical	High	Make alternative frequencies readily available. Publish secondary frequencies.	Remote	Critical	Medium			
	Flight following on district frequencies	Probable	Critical	High	Assign local flight following frequencies. Utilize AFF. Utilize National Flight Following.	Remote	Critical	Medium			
	Lack of available frequencies	Frequent	Critical	High	Obtain and publish more FM and AM frequencies for fire operations.	Remote	Critical	Medium			
	Frequency management - lack of timely response to additional frequency orders.	Probable	Marginal	Serious	ROSS orders through NICC are too slow. Make frequencies available at the GACC level.	Remote	Marginal	Medium			
	State/County/Rural resources on different bandwidth.	Probable	Critical	High	Design a system which establishes compatibility between Fed and State/County/Rural radios. Provide training to agency personnel addressing the differences between radio systems.	Remote	Critical	Medium			
	Non dedicated/published frequencies within geographic areas.	Frequent	Critical	High	Obtain and publish more FM and AM frequencies for fire operations at the GACC/local level.	Remote	Critical	Medium			
	Centers assigning Leadplanes as ATGS	Occasional	Critical	Serious	Ensure dispatchers are aware that most lead pilots are not ATGS qualified.	Remote	Critical	Medium			
	Duplicate frequency assignments within same geographic area.	Probable	Marginal	Serious	Better oversight of frequency allocation/use at local/GACC level during periods of high/large fire activity.	Remote	Marginal	Medium			
Equipment	Outdated radio equipment/poor reliability.	Probable	Critical	High	Allocate funding for equipment and personnel to repair/replace radio/commo systems.	Remote	Critical	Medium			
	Lack of technical support for radio system repair.	Frequent	Critical	High	Establish dedicated positions for radio techs. Scrap outsourcing and centralizing. It's too slow.	Remote	Critical	Medium			
Training	Aircraft dispatcher experience/currency.	Frequent	Critical	High	Funding for training and proficiency. Establish an aircraft dispatcher position with IADP as a requirement.	Remote	Critical	Medium			

System - Personnel

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Human Factors	Aircrew fatigue/burnout	Probable	Critical	High	Maintain a sensible diet and hydration. Limit mission time and request relief to allow for adequate rest periods. Monitor fatigue levels of flight crews. Adjust flight schedules to incorporate adequate rest that consider environmental factors that contribute to fatigue.	Occasional	Critical	Serious			
	Lack of CRM	Probable	Critical	High	Training, brief/debrief, maintain positive attitude.	Remote	Critical	Medium			
	Acceptance of risk as normal.	Probable	Catastrophic	High	Validate mission, solicit feedback from others, reevaluate risk vs benefit, or remove the high risk taking individual from the mission.	Remote	Catastrophic	Serious			
	Task saturation	Frequent	Critical	High	Delegate duties, Employ CRM using span-of-control guidelines. Adjust tactics as needed.	Occasional	Critical	Serious			
	Hazardous attitude: Anti authority, macho, invulnerability, impulsiveness, and resignation.	Frequent	Critical	High	Remove the individual from the mission. Properly supervise employees. Adhere to work-rest guidelines, flight and duty limitations policy, etc. Validate and stick to incident strategy and tactics.	Occasional	Critical	Serious			
	Conflicting personalities	Frequent	Critical	High	Brief/debrief, CRM, honest feedback, maintain positive attitude.	Occasional	Critical	Serious			
Government	Lapsed qualifications (currency)	Occasional	Critical	Serious	Track mission/refresher experience annually as per the IASG.	Remote	Critical	Medium			
	Lack of AD training/currency	Probable	Critical	High	Track mission/refresher experience annually as per the IASG. Utilize GACC ATGS Reps.	Occasional	Critical	Serious			
	Proficiency/currency: Non compliance with established standards.	Probable	Critical	High	Plan/budget for annual, bi-weekly proficiency simulations; include actual flight time.	Remote	Critical	Medium			
	Lack of tracking work/rest for relief pilots	Occasional	Critical	Serious	Establish tracking system through CO or COR. Modify contract to indicate relief pilot hours.	Remote	Critical	Medium			
	Lack of qualified ATGS in the system (too many trainees).	Frequent	Marginal	Serious	Identify dedicated training platforms. Analyze current ATGS qualification standards. Incorporate simulator training into taskbook completion. Develop a list of trainee priorities based on state/unit level approval/support.	Occasional	Marginal	Medium			

System - Maintenance											
		Pre Mitigation				Post Mitigation					
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
General Aircraft Maintenance	Maintenance not tracked well (CWN)	Occasional	Critical	Serious	Vendor needs to share maintenance information as aircraft moves between assignments. ATGS should be proactive during the initial briefing. COR/PI should proactively seek maintenance information when the aircraft reports for it's assignment.	Remote	Critical	Medium			
	Unqualified maintenance personnel working on the aircraft.	Occasional	Critical	Serious	Ensure task specific qualified mechanics are performing repairs/maintenance.	Remote	Critical	Medium			
	Undue pressure on mechanics to keep the aircraft available for assignment.	Occasional	Critical	Serious	Accept the fact that maintenance problems will occur during high use periods. Allow maintenance crews to perform tasks in a stress free environment. COR/PI should encourage maintenance and show lattitude when enforcing contract maintenance/availability.	Remote	Critical	Medium			

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System Safety Assessment - Heavy Airtanker Program

Heavy Airtanker Program System - Airworthiness

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Mitigation	Post mitigation Likelihood	Post mitigation Severity	Post mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Operational Service Life	Forest Service has not historically conducted airworthiness inspections; it has relied upon the FAA for that expertise. The perceived role was one of contract compliance.	Remote	Catastrophic	Serious	Continue contractual requirements commensurate with industry standards required by FAR 25.571 for aircraft continued airworthiness. Incorporate the latest inspection technology.	Remote	Marginal	Medium			
	Forest Service has not identified metrics that define the fire environment for the purpose of establishing effects on airworthiness.	Remote	Catastrophic	Serious	Employee additional workforce with the skills to determine airworthiness.	Remote	Marginal	Medium			
Maintenance and Inspections	Overloading Structure	Remote	Catastrophic	Serious	Encourage the design and procurement of purpose built aircraft. Incorporate the latest inspection technology.	Remote	Marginal	Medium			
	Engine Failures	Probable	Marginal	Serious	Changing to turbine engines.	Remote	Marginal	Medium			
Airframe Fatigue Damage	The NTSB surmised that significant exposure to airframe stresses in the firefighting mission profile poses additional fatigue factors that shorten airframe life expectancy.	Remote	Catastrophic	Serious	Incorporate structural health monitors and technologies to detect structural fatigue damage resulting from aircraft operations in the firefighting mission environment.	Remote	Marginal	Medium			

Heavy Airtanker Program System - Contract Process

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Mitigation	Post mitigation Likelihood	Post mitigation Severity	Post mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Cost	Current contracting fosters best value process which guarantees only minimum standards.	Frequent	Critical	High	Incorporate addition contract incentives that give credit in the competition process for going "beyond minimum programs."	Remote	Marginal	Medium			
	Lack of contract incentive to develop a system safety driven program.	Frequent	Critical	High	Incorporate addition contract incentives that give credit in the competition process for going "beyond minimum programs."	Remote	Marginal	Medium			
	Modernization of the airtanker fleet will take significant funding. As new equipment is brought into the mix of aircraft, unplanned events are inevitable. The agency does not have the skill mix to oversee flight testing and development in house.	Occasional	Catastrophic	High	Implement airtanker modernization and evaluation criteria in best value contracts including but not limited to: performance, sustainable airframes, ergonomics, additional contractor offered innovation and technology, damage tolerant design and technology.	Remote	Catastrophic	Serious			

Heavy Airtanker Program System - Mission Environment

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Mitigation	Post mitigation Likelihood	Post mitigation Severity	Post mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Performance Planning	Quality of performance data and reference charts at typically high density altitudes is a concern for safe flight in the fire mission environment.	Probable	Catastrophic	High	Develop a contract requirement for airtanker pilots to complete weight and balance calculations prior to each mission.	Remote	Critical	Medium			
Flight Profile	Mission operations below 500' AGL.	Probable	Catastrophic	High	Incorporate human aided technology to assist in decision making including tools to aid in time critical risk assessments. Adapt technology for in flight decision making, post flight mission debriefs, and accident investigation. Consider CVR and cockpit c.	Remote	Critical	Medium			
Mission Creep	Operations in the urban interface have led to an increase in expectations, exposure to hazards, and cumulative aircraft and pilot fatigue.	Probable	Catastrophic	High	Return to the initial attack mission doctrine as a driving force in aircraft selection and approval, operations standards, and program/infrastructure design.	Remote	Critical	Medium			
	Transfer of risk from ground firefighters to airborne firefighters.	Probable	Catastrophic	High	Return to the initial attack mission doctrine as a driving force in policies that govern the airtankers role in wildland fire suppression.	Remote	Critical	Medium			

Heavy Airtanker Program System - Facilities

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Mitigation	Post mitigation Likelihood	Post mitigation Severity	Post mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Tanker Bases	Overloading and mixing errors	Occasional	Critical	Serious	Ensure micro motion meters have been calibrated. Vendor and government personnel review mixing procedures.	Remote	Marginal	Medium			

Heavy Airtanker Program System - Ground Fire Personnel

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Mitigation	Post mitigation Likelihood	Post mitigation Severity	Post mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
	Use of tankers for escaped fire situations has increased risk, exposure, and failure. This issue rests outside of the control of the aviation program.	Probable	Critical	High	National leadership through regional/state organizations must promote safe and efficient use of aircraft. Incident Commanders at all levels need to be persistent in working with team members to keep efforts based on obtainable goals.	Remote	Marginal	Medium			

Heavy Airtanker Program System - Human Factors

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Pilot Proficiency and Training	Lack of fire mission training and Lack of proficiency flight time.	Probable	Catastrophic	High	Vendors have instituted training programs such as CRM, risk management, and flight safety with the intent to standardize cockpit procedures. Increase the scope and complexity of the NAFA program, develop the McClellan training center for fire environment.	Occasional	Critical	Serious			
	Aircraft performance planning for successful outcome in a high rate of descent, level off, and climb out profile.	Probable	Catastrophic	High	Address airtanker pilot training and proficiency to reduce frequency of accidents occurring from CFIT.	Occasional	Critical	Serious			
	High number of target fixation and tactical maneuvering errors.	Probable	Catastrophic	High	Address human factors including target fixation, situational awareness, task overload, performance/tactical planning errors.	Occasional	Critical	Serious			

Heavy Airtanker Program System - Policy, Procedure, and Doctrine

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Management Oversight	No requirement to implement a system safety program that is common between the contractor and the agency.	Probable	Catastrophic	High	Establish a requirement to initiate a safety management system between the contractor and the agency. Require the contractor to designate a safety officer.	Remote	Marginal	Medium			
Agency Culture	"Can do" philosophy has developed aviation programs with minimal budgets and staffing.	Probable	Critical	High	The Blue Ribbon Panel stated: "significant funding will provide adequate knowledge of aircraft conditions, training and maintenance, that will serve to improve the safety record."	Remote	Marginal	Medium			
	A culture of acceptable loss has evolved in the agency regarding airtanker losses.	Probable	Critical	High	Establish a higher expectation beyond minimum requirements for safety with a lower tolerance for accidents. This will encourage a cultural change away from one of acceptable loss.	Remote	Marginal	Medium			
Quality Assurance and Inspections	Lack of an operative quality assurance and inspection program.	Probable	Critical	High	Develop a QA program for improved oversight of the contracted fleet ranging from improved checkrides, workforce efficiency, adequate staffing of trained inspectors, and standardized procedures.	Remote	Marginal	Medium			
Public Perception	Influence on the agency	Probable	Marginal	Serious	Establish doctrine	Remote	Marginal	Medium			

Heavy Airtanker Program System - Technology

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Human Aided Technology	HAT underutilized	Occasional	Critical	Serious	Incorporate HAT with the intent to raise situational awareness, reduce cockpit workload, reduce distractions, and assist with environmental conditions of high density altitude and low visibility.	Occasional	Marginal	Medium			

Heavy Airtanker Program System - Training

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Internal	Pilot currency and proficiency.	Occasional	Critical	Serious	Increase the scope and complexity of NAFA and require tanker crew attendance. Fund the development and implementation of fire simulation training in the flight environment for contract and agency personnel.	Occasional	Marginal	Medium			
External	Pilot currency and proficiency	Occasional	Critical	Serious	Increase the scope and complexity of NAFA and require tanker crew attendance. Fund the development and implementation of fire simulation training in the flight environment for contract and agency personnel.	Occasional	Marginal	Medium			

2008- System Safety Assessment - Single Engine Airtankers (SEAT)

SEAT System - SEAT Aircraft

Sub-System	Hazards	Pre-Mitigation Likelihood	Pre-Mitigation Severity	Pre-Mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Capabilities	High Density Altitude effects the aircraft quantity/performance	Frequent	Critical	High	Assign appropriate SEAT aircraft for mission and typical DA (Turbine vs. Radial Engine). Conduct pre-project performance planning. Reinforce HHH Training. Acquire incident altitude information when available.	Remote	Critical	Medium			
	Inappropriate Aircraft for Mission	Occasional	Critical	Serious	Ensure SEAT is appropriate for temperatures, altitude terrain and mission. Receive feedback from pilots and Aerial Supervisor.	Remote	Critical	Medium			
Maintenance	Mechanical Failure	Occasional	Catastrophic	High	Pilot & SEMG monitor maintenance schedule. Pilot reviews & understands emergency procedures.	Remote	Catastrophic	Serious			
	Aircraft Improperly Maintained	Occasional	Catastrophic	High	Follow Contract requirements and Aircraft Maintenance Manual. Aircraft inspectors check that FAA maintenance requirements are met. SEMG ensure pre/post flight inspections completed.	Remote	Critical	Medium			
Visibility	Smoke/Inversion - Inclement Weather conditions between Airbase & Incident	Frequent	Catastrophic	High	Maintain VMC. Practice See & Avoid. Establish Communications. Ensure sound mission planning is performed and weather briefing is received. Know and understand Fire Traffic Area (FTA). Keep windscreen clean. Pilot and ground resources must maintain Situational Awareness. Pilot should exercise go/no-go option.	Remote	Critical	Medium			
	High Visibility aircraft lighting systems	Occasional	Critical	Serious	Aircraft lighting systems need to be utilized and maintained.	Remote	Critical	Medium			
	Congested Airspace, Military Airspace, Uncontrolled Airports, Ramp/Taxi Communications.	Frequent	Catastrophic	High	Comply with Interagency Aerial Supervision guide. Ensure effective airspace coordination is conducted between Dispatch & FBOs & Military Units. Understand, review, and discuss the Fire Traffic Area (FTA) in briefings. Review known aerial hazards and acquire complete Dispatch forms prior to dispatching or diverting SEATs. Comply with sterile cockpit procedures & policy . Establish local ramp and taxi protocols in cooperation with local airport operations.	Remote	Catastrophic	Serious			

SEAT System - SEAT Aircraft

Sub-System	Hazards	Pre-Mitigation Likelihood	Pre-Mitigation Severity	Pre-Mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Inspection	Lack of Standardization	Occasional	Marginal	Medium	Ensure implementation of standardized SEAT aircraft and pilot inspection process. Train inspectors on new standards.	Remote	Marginal	Medium			
Equipment	Ineffective and out dated equipment	Occasional	Critical	Serious	Equipment required in the contract should be monitored and evaluated. Determine if it is viable to retain as a requirement in the contract. If it does not work - replace it. If it is not needed - remove it from the contract.	Remote	Critical	Medium			
	Inadequate Pre-Flight/Post-Flight Inspections	Occasional	Critical	Serious	Agency and vendor should ensure adequate time for Inspection. Encourage pilot to utilize time to complete Inspections. Document Pre/Post Flight Inspections daily.	Remote	Marginal	Medium			

SEAT System - SEAT Aircraft (Cont.)

Sub-System	Hazards	Pre-Mitigation Likelihood	Pre-Mitigation Severity	Pre-Mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Communications	Changing Technology & Lack of Training	Probable	Critical	High	Inspection & carding process ensure Contractors (Pilots) are skilled with equipment provided - GPS, VHF & UHF Radios, AFF, etc.	Remote	Critical	Medium			
	Lack of Radio Equipment Compatibility (Narrow Banding & Frequencies). Future considerations: Digital requirements.	Occasional	Critical	Serious	Continue to work with State, City & County Fire Departments to meet future Federal Standards and compatibility issues. Work with national agency/interagency radio program leaders ensure the policies they develop are compatible with aviation requirements.	Remote	Critical	Medium			
	Inadequate Frequency Management	Frequent	Catastrophic	High	Conduct effective air base in-briefings. Develop specialized training-simulations. Conduct frequent AARs and/or sand table exercises. Perform periodic reviews of frequency lists and avionics equipment operations. Check radio systems following relief pilot duty. Ensure that positive communications are established.	Remote	Critical	Medium			
	Radio Frequency Congestion	Frequent	Critical	High	Make alternative frequencies readily available. Publish secondary frequencies. Utilize AFF when possible to reduce congestion. Maintain effective working relations with frequency coordinators.	Remote	Critical	Medium			
	Lack of District flight following frequencies	Probable	Critical	High	Assign discreet local flight following frequencies whenever possible. Utilize standardized AFF procedures. Utilize National Flight Following if necessary.	Remote	Critical	Medium			

SEAT System - Maintenance

Sub-System	Hazards	Pre-Mitigation Likelihood	Pre-Mitigation Severity	Pre-Mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Documentation	Maintenance not tracked well.	Occasional	Critical	Serious	Vendor needs to share maintenance information as SEAT moves between assignments. SEMG should be proactive during the pre-use inspection. PI should proactively seek and document maintenance information when the aircraft and pilot reports for assignment.	Remote	Critical	Medium			
Inspection/ Evaluation Process	Not Enough Inspectors	Occasional	Critical	Serious	Train and utilize more Interagency Inspectors with past SEAT program experience and knowledge.	Remote	Critical	Medium			
	Experience and/or knowledge level of contractor personnel assigned to perform maintenance duties is unknown.	Occasional	Critical	Serious	Emphasis should be focused on verification of credentials by Government Inspectors. PI should coordinate with COTR.	Remote	Critical	Medium			
	Distractions created by Collateral Duties (A&P/driver/mixer etc).	Occasional	Critical	Serious	Avoid overloading support personnel with responsibilities and workload. Utilize additional crew members as necessary.	Remote	Marginal	Medium			

SEAT System - SEAT Base Facilities (Permanent & Temporary)

Sub-System	Hazards	Pre-mitigation Likelihood	Pre-mitigation Severity	Pre-mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Communications	Lack of Adequate Radio Equipment, Computers & IT Support	Occasional	Critical	Serious	Continue efforts to upgrade/improve communications and IT equipment, and program support on an annual basis.	Remote	Critical	Medium			
Security	Unsecured Air Base Facilities increase risk of sabotage.	Frequent	Critical	High	Comply with Contract requirements. Discuss and exercise after-hours options to provide security. Address security concerns during initial briefings.	Remote	Critical	Medium			
SEAT Base Standards	Inadequate Runway Minimums.	Frequent	Critical	High	Verify that length, width and surface conditions, congested area and elevation for minimum operational use are adequate. (Make & Model of aircraft).	Remote	Critical	Medium			
	Inadequate Ramp Space Minimums	Frequent	Critical	High	Verify that length, width and surface conditions for type and number of equipment and aircraft are adequate.	Remote	Critical	Medium			

SEAT System - SEAT Contracts

Sub-System	Hazards	Pre-mitigation Likelihood	Pre-mitigation Severity	Pre-mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
On-Call vs. Variable Term	Lack of Continuity, Efficiency, Training, Familiarization and CRM with Contractor Personnel and Local Operations.	Frequent	Critical	High	Utilizing more Variable Term contracts will increase continuity between contractor and local unit which produces better CRM and reduces exposure/safety issues for managers and ground personnel.	Remote	Critical	Medium			

SEAT System - Personnel (Government)

Sub-System	Hazards	Pre-mitigation Likelihood	Pre-mitigation Severity	Pre-mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Utilization	Span of Control	Frequent	Critical	High	Ensure that base operations plans address contingency to handle events where span-of-control may be exceeded. Home units need to mitigate this issue by pre-training and recruitment of supplemental personnel.	Occasional	Critical	Serious			
Management	SEAT Managers & ATB Managers are not fully aware of Aircraft Maintenance Issues.	Frequent	Marginal	Serious	Agency personnel need to rely upon AMD Technical Service Maintenance Inspectors to determine proper maintenance procedures and authorization to return the aircraft to contract availability.	Remote	Marginal	Medium			
Training	Lack of knowledge and experience in Aviation Contract Administration and Aviation Program Management for SEAT Manager Trainees.	Occasional	Marginal	Medium	Recommend SEAT Manager at least attend ACE or equivalent aviation contract administration courses. Add new information in the next rewrite of S-273. Also highly recommend a season of wildland fire line experience.	Remote	Marginal	Medium			
Human Factors	Fatigue	Probable	Critical	High	Adhere to established work-rest policy/guidelines and promote additional off-time when possible. Request additional staffing and/or detailers during peaks of high fire activity.	Remote	Critical	Medium			
	Acceptance of Risk as Normal	Probable	Critical	High	Emphasize importance of "situational awareness" as a means to recognizing risk. Consider utilization of the SEAT Coordinator, SEAT Program Manager positions as a method of mitigating risk. Provide Risk Management Training for the SEMG.	Remote	Critical	Medium			
	Changes in standard operating procedures not known	Probable	Marginal	Serious	Clarify & Confirm Program changes. Notify appropriate personnel, in a timely manner. Accept questions and seek out responses.	Remote	Marginal	Medium			

SEAT System - Personnel (Government cont.)

Sub-System	Hazards	Pre-mitigation Likelihood	Pre-mitigation Severity	Pre-mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Experience	Variable Term vs. On-Call SEAT Manager.	Frequent	Marginal	Serious	Provide program oversight (Local, State or Natl., IQCS) to ensure that SEMG meet currency experience requirements and have completed tri-annual refresher as per ISOG.	Remote	Marginal	Medium			
	Aerial Supervision - Lack of SEAT specific knowledge and experience	Probable	Critical	High	Provide thorough pre-mission briefing, conduct post-mission AARs and have an experienced ATGS ride-along if available. Include specific SEAT section for ATGS training.	Remote	Critical	Medium			
Policy/ Procedure	Policy Deviation	Occasional	Marginal	Medium	Re-enforce and emphasize to SEGMs to communicate with SECOs, Contracting Officers, SAMs, etc. when questions and issues arise.	Remote	Marginal	Medium			
	Multiple Agencies - Differing Standards (State vs Fed)	Frequent	Critical	High	Recommend continued development & implementation of Interagency standardized SEAT program management and policy.	Occasional	Critical	Serious			
Utilization	Drivers not understanding/following DOT Policy/Regulations	Occasional	Marginal	Medium	Stronger emphasis by agency to contractor regarding their responsibility to comply with policies and regulations (rest, driving and duty).	Remote	Marginal	Medium			
Training - Pilot	Potential for Inadequate SEAT Pilot Training	Occasional	Critical	Serious	Continue with further development of contractor SEAT Pilot training program opportunities and/or BLM/FS NAFA & SEAT Pilot Academy.	Remote	Critical	Medium			
Training - Mixers & Loaders	Not all Mixers & Loaders are adequately trained and qualified.	Occasional	Critical	Serious	Ensure that contractors provide adequate training to ground personnel prior to fire assignment. Provide training documentation to agency aviation managers on the mixing and loading of fire chemical retardant products.	Remote	Critical	Medium			

SEAT System-Personnel (Contractor)												
		Pre-mitigation				Post-mitigation						
Sub-System	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Human Factors	Ground support personnel fatigue	Probable	Critical	High	Ensure contractor compliance with rest and duty limitations for ground support personnel so as not to overextend. (Company and agencies are responsible to monitor closely). Utilize additional crew members as necessary.	Remote	Critical	Medium			
	Ground Personnel - poor decision making, multi tasking, mission focus, sense of urgency, peer pressure	Probable	Critical	High	Ensure that these items are addressed in the contract pre-work meeting and re-enforced in the daily air base briefings, post mission briefings or whenever the need is identified.	Remote	Critical	Medium			
	Pilot fatigue	Probable	Critical	High	Ensure contractor compliance with rest and duty limitations for Pilots so as not to overextend. (Company and agencies responsibility to monitor closely). Allow additional time off if needed or requested. Request relief Pilot if available.	Remote	Critical	Medium			
	Pilot - poor decision making: multi tasking, mission focus, sense of urgency, peer pressure	Frequent	Critical	High	Ensure that these items are addressed in the contract pre-work meeting and re-enforced in the daily air base briefings, post mission briefings or whenever the need is identified.	Remote	Critical	Medium			
	Acceptance of Risk as Normal	Probable	Catastrophic	High	Emphasize importance of "situational awareness" as a means to recognizing risk. Consider providing Risk Management Training for the Pilot. Re-address complacency and self discipline in daily air base briefings.	Occasional	Critical	Serious			
	Poor CRM with crew rotations; Crew rotation may affect aircraft/equipment knowledge transfer.	Probable	Critical	High	Make effort to ensure that contractor relief personnel arrive at base prior to relief cycle with sufficient overlap time to receive good in-brief from primary pilot.	Occasional	Critical	Serious			
	Single Pilot workload may be considered to be excessive based on demands that he/she be able to operate several cockpit equipment items during mission performance (i.e. Multi-Tasking Overload.).	Frequent	Critical	High	Utilize Aerial Supervision if available to reduce cockpit workload. Utilize newer technology such as AFF to minimize radio traffic. Conduct AARs, sand table exercises and on ground CRM Exercises. Incorporate Operations personnel in simulations and exercises.	Occasional	Critical	Serious			
	Conflicting and/or Difficult Personalities	Probable	Critical	High	Conduct effective and objective briefings and debriefings. Encourage honest feedback. Maintain positive and proffessional attitude. Document discussions and briefings.	Occasional	Critical	Serious			

SEAT System-Personnel (Contractor cont.)

Sub-System	Hazards	Pre-mitigation Likelihood	Pre-mitigation Severity	Pre-mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
New Technology	Lack of familiarity with technology, inability to utilize and operate equipment.	Occasional	Critical	Serious	Take a stronger approach with all personnel (Pilots, Dispatchers, Managers, etc.) to ensure that they are trained in the function and operation of newer tech-equipment and systems prior to implementation and utilization.	Remote	Critical	Medium			
Standardization	Lack of standardized aircraft, support equipment, and communications equipment.	Occasional	Critical	Serious	Standardize equipment specifications through the procurement process and mandate within the contract solicitation. Work with contractors to emphasize the importance of standardization.	Remote	Critical	Medium			
Agency Radio System	Lack of technical support/inadequate support system.	Frequent	Critical	High	Agency radio system needs to be replaced, re-designed and upgraded to accommodate current demand and volume of use for current Fire & Aviation programs, as well as those of the future. (Standardize and buy user friendly equipment.) Maintain close working relations with agency radio program leaders to ensure aviation needs are addressed.	Occasional	Critical	Serious			

SEAT System - SEAT Operations

Sub-System	Hazards	Pre-mitigation Likelihood	Pre-mitigation Severity	Pre-mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Missions	Inefficient use of SEATs may result in unnecessary risk exposure to SEAT Pilot and ground personnel. (Risk vs. Reward)	Frequent	Critical	High	SEAT Pilot, Fire Managers, Dispatchers, line personnel, and aerial supervisors need proper education on use of SEATs. Use AAR as mitigation tool to prevent re-occurrence. Conduct pre and post -mission briefings.	Occasional	Marginal	Medium			
	Jurisdiction & Border Issues	Occasional	Critical	Serious	Agency and Contractor should provide training and orientation. Local unit to brief and initiate utilization of the local Airspace Boundary Plan.	Remote	Critical	Medium			
	Defined standard Lead Plane profiles for SEATs	Probable	Critical	High	Re-enforce local Interagency Lead Plane SOPs for SEAT aircraft tactical operations. Contractors need to also address SEAT/Lead Plane SOPs during annual training.	Remote	Critical	Medium			
	Flying low level at operational weights and airspeeds in areas with hazards.	Frequent	Catastrophic	High	Perform high level reconnaissance prior to descending to work in the low-level environment. Utilize aerial supervision when available. Utilize proper aircraft energy management techniques.	Remote	Catastrophic	Serious			
	Inexperienced Personnel-Government & Contractors	Frequent	Critical	High	Agency & Contractors need to evaluate required training to determine if personnel are staying current with program needs.	Remote	Critical	Medium			
	A Sense of urgency may be placed on Contractor personnel at various points in the mission.	Occasional	Critical	Serious	Address the SAFETY vs. URGENCY issue as a special-emphasis item during in-briefing with contractor and agency employees. Reinforce this throughout the entire operational period.	Remote	Critical	Medium			
	Drop Height Minimums	Frequent	Catastrophic	High	Define 60 ft. obstacle clearance as the minimum decent altitude for all fire operations except during takeoff and landing.	Remote	Catastrophic	Serious			
	Poor fuel management	Remote	Catastrophic	Serious	Monitor fuel quantities. Follow fuel transfer procedures. Pre-flight the aircraft and plan the flight. Know refueling locations. Query other aircraft - fuel status and availability.	Remote	Catastrophic	Serious			
	Wake Turbulence	Occasional	Critical	Serious	Exercise "CAUTION" when sharing local airspace.	Remote	Critical	Medium			

SEAT System - SEAT Operations

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Environment	Conflicting Airspace Environment	Occasional	Critical	Serious	Local agency must provide orientation and "situational awareness" overview to SEAT pilots on Special Use Airspace, MTRs, TFRs etc. Assure that Dispatch and aviation program personnel are trained in Dispatch procedures for SUA. Use aerial supervision when available.	Remote	Critical	Medium			
	Hazardous and Extreme Weather Conditions.	Frequent	Critical	High	Confirm weather information flow is in place. Confirm that red-flag warnings are distributed. Ensure there are continual updates on changing weather conditions shared between pilots, air base mangers, dispatchers, etc. Go-No-Go is PIC decision.	Remote	Critical	Medium			
	Hazards and Extreme Terrain	Frequent	Critical	High	Get an adequate mission briefing and use performance planning to prevent CFIT events. Perform high level reconnaissance prior to descending to the low level environment. Use Aerial Supervision when available.	Remote	Critical	Medium			
	Congested areas and Urban Interface.	Frequent	Critical	High	Comply with congested area policies and ensure that aerial supervision is in place or has been requested.	Remote	Critical	Medium			
Communications	Lack of Available Frequencies	Frequent	Critical	High	Manage available frequencies as best as possible. Request additional frequencies as needed and release frequencies in a timely manner when no longer needed. Train all users in radio discipline.	Occasional	Critical	Serious			
	Inadequate clarification of Chain of Command- Who is in charge.	Occasional	Critical	Serious	Validate tactical (A-G & A-A) contacts identied on the Aircraft Dispatch form. Ensure the pilot has a copy.	Remote	Critical	Medium			
Performance Planning	Lack of Planning - incorrect calculation of allowable retardant load; weight & balance	Occasional	Critical	Serious	Pilots need to ensure that proper weight and balance and performance planning is completed and shared with base personnel. Utilize appropriate aircraft performance charts for the designated base and area of operations. Base personnel should be aware of trigger points for downloading retardant, water, etc.	Remote	Critical	Medium			
	Inadequate runway lengths and/or surface conditions	Occasional	Critical	Serious	Specify length, width and surface conditions, congested areas and elevations for minimum operational use for each make and model of aircraft. This information must be validated by performance planning.	Remote	Critical	Medium			
	Lack of information on incident conditions	Occasional	Critical	Serious	Utilize A/C dispatch form, obtain as much information as possible from other aerial and ground resources. Obtain information from Pilot after initial load on additional downloads . Use Aerial Supervision when available. PIC has final authority on go/no go.	Remote	Critical	Medium			

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System: Flight Operations		2008 Infared Program Assessment									
		Pre Mitigation				Post Mitigation					
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Avionics	Loss of electrical power	Remote	Critical	Medium	Keep your cell phone handy (and charged up). Have the required 2 "D" cell flashlight working and charged. Have a spare hand-held VHF-AM radio. Training on emergency procedures.	Remote	Critical	Medium			
	Erroneous read-outs from the equipment	Occasional	Critical	Serious	Training, Pre and post season avionics checks	Remote	Marginal	Medium			
	Non-Standard (type/lay-out/location) of equipment	Frequent	Critical	High	Update the equipment/design for standardization, train to the new equipment, maintain currency in all A/C, standardize fleet to same make aircraft	Improbable	Marginal	Medium			
IR Equipment	Electrical Interface (A/C Mods)	Frequent	Negligible	Medium	Coordinate with all staffs on modifications prior to the installations, refresher (preseason) mission training and equipment calibration	Occasional	Negligible	Low			
	Increased exposure to land/take-off to hand-off immagery	Frequent	Critical	High	Install and utilize satellite up-link capability	Occasional	Critical	Serious			
Maintenance	Nitrogen servicing (Improper technique), not wearing proper PPE and ultimately causing personal injury	Frequent	Marginal	Serious	Proper training/procedures	Frequent	Negligible	Medium			
	Maintenance providers (lack of skilled technicians/repair stations)	Occasional	Catastrophic	High	Coordination with maintenance personnel and repair stations	Remote	Catastrophic	Serious			
	Undocumented open discrepancies	Occasional	Marginal	Medium	Follow SOPs	Improbable	Marginal	Medium			
	Not performing Functional Check Flight (FCF) before releasing aircraft after maintenance (when applicable)	Remote	Catastrophic	Serious	Perform FCFs when applicable, coordinate with maintenance technician; if possible take maintenance technician on FCF	Improbable	Critical	Medium			
Standarization	Non-Standard Aircraft	Frequent	Critical	High	Update the equipment/design for standardization & Train to the new equip. & Maintain currency in all A/C, Standardize fleet to same make aircraft	Improbable	Marginal	Medium			

System: Flight Operations (cont.)

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Mitigation	Post Mitigation Likelihood	Post Mitigation Severity	Post Mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Modifications	Effects of modifications that decrease aircraft capabilities causing additional crew workload/exposure/performance issues(fuel burn, flight planning)	Frequent	Marginal	Serious	Correction to existing modification; coordination and testing of future modifications.	Remote	Negligible	Low			
	Increased exposure to mid-air collision due to necessity of turning off TCAS during mission because of interference between TCAS and IR equipment.	Frequent	Catastrophic	High	Testing and relocation of system components to correct the interference; for future modifications include testing for interface interference.	Improbable	Negligible	Low			
Fuel	Bad Fuel	Remote	Catastrophic	Serious	Observe fueling; sump fuel as required.	Improbable	Catastrophic	Medium			
	Improper fuel loading	Remote	Catastrophic	Serious	Observe fueling; confirm loading.	Improbable	Catastrophic	Medium			

System: Environmental

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Mitigation	Post Mitigation Likelihood	Post Mitigation Severity	Post Mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Weather	Flying in bad weather	Probable	Critical	High	Preflight planning;Just say NO (accept the fact that the mission cannot be completed)! PIREPS, Call local area, change priority of mission flight, Equip monitoring (i.e., Wx Radar, Storm scope, XM radio, etc.)	Occasional	Critical	Serious			
	Pressure to complete the mission regardless of the Wx	Frequent	Critical	High	Just say NO! Education/Training of the ground personnel regarding go-no-go situations. Preflight planning. Give options.	Occasional	Critical	Serious			
	Icing equipment (aircraft) failing	Remote	Marginal	Medium	Preflight checks of icing equipment, proper maintenance of icing equip.	Improbable	Marginal	Medium			
	Smoke Column	Occasional	Critical	Serious	IR Technician reports, PIREPS, Debrief other fire air ops crews (lead plane, airattack, etc…) Fly out of column	Remote	Critical	Medium			
Topography	Contolled flight into terrain	Improbable	Catastophic	Medium	Maintain Situational Awareness, File IFR, Train and remain proficient	Improbable	Catastrophic	Medium			
	Moderate (plus) turbulence	Occasional	Marginal	Serious	Preflight briefing, PIREPS, Fly different altitude or out of area	Remote	Marginal	Medium			

System: Airports

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Location	Mountainous Terrain-Unfamiliar, leading to CFIT,	Occasional	Catastrophic	High	Preflight planning, instrument approaches, refusal of delivery point, landing during daylight hours	Remote	Critical	Medium			
	Collision with wildlife on the runways leading to damage/injury of personnel or property	Occasional	Critical	Serious	Perform fly-by, contact personnel on ground to check field, air-drop, install gun on nose of aircraft	Improbable	Critical	Medium			
Limitations	Airport surface condition is not conducive to landing resulting in damage to aircraft	Remote	Critical	Medium	Check the AFD, NOTAMS, local traffic, Tower,	Improbable	Critical	Medium			
	Runway length is not appropiate for the aircraft's capabilities	Occasional	Critical	Serious	Perform performance calculations/preflight planning, NOTAMS	Improbable	Critical	Medium			
	construction hazards/equipment	Occasional	Critical	Serious	NOTAMS, ATIS, Local traffic, Tower, UNICOM	Improbable	Critical	Medium			
IAP	Lighting systems are inop/inadequate leading to a short landing/go-around, CFIT	Remote	Catastrophic	Serious	ATIS UNICOM, visual cues, preflight planning	Improbable	Catastrophic	Medium			
	Unfamiliar with the missed approach procedures (MAP), leading to CFIT	Remote	Catastrophic	Serious	Preflight planning. Performing approach briefings, training/profeciency, current charts, CRM	Improbable	Catastrophic	Medium			
	Not having an IAP leading to a CFIT	Occasional	Catastrophic	High	Preflight planning. Performing approach briefings, training/profeciency, current charts, CRM, Do NOT land if conditions are such that it is unsafe to make a safe visual approach and landing	Improbable	Catastrophic	Medium			
Airspace	Congested, task saturation of controller and/or pilots/crew, midair possibility	Remote	Catastrophic	Serious	TCAS, SA, CRM, Training, Communications, Chose another airport	Improbable	Catastrophic	Medium			
	No Tower-pilots operating without radio or wrong frequency-Possible midair	Remote	Catastrophic	Serious	SA, communicattions, CRM, UNICOM, PIREPS, aircraft lighting, TCAS,	Improbable	Catastrophic	Medium			
	Incursions on the runway and parking areas	Occasional	Critical	Serious	SA, CRM, TCAS, Communications, A/C lighting, training, parking tenders, familiar with the airport	Remote	Critical	Medium			
Support Personnel	Unqualified Personnel (ground/ramp or agency) leading to misfueling, hazardous parking, leading to damage to the aircraft or injury to personnel	Occasional	Critical	Serious	SA, CRM, Communication, Training of support personnel	Remote	Critical	Medium			

System: Personnel

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Human Factors	Fatigue-Cronic, errors due to fatigue (SA)	Frequent	Critical	High	Scheduling management (reduce duty hrs and/or flight time), **sufficient staffing levels**, sleep-power naps, Training, CRM, support of crew decision to decrease duty day,	Remote	Marginal	Medium			
	Fatigue-Acute, errors due to fatigue (SA)	Frequent	Critical	High	Training, CRM, sleep-power naps, support of crew decision to decrease duty day	Remote	Negligible	Low			
	Trans-cockpit authority gradient, junior crewmember not confident in speaking up about a hazard	Occasional	Critical	Serious	Education/Training, CRM, communications, tailgate sessions/AAR (after action review, debrief)	Remote	Critical	Medium			
	Mission pressure from management, leading to fatigue, harried decisions leading to hazardous mistakes	Frequent	Catastrophic	High	Training, CRM, Support of crew decisions, neutral person (arbitrator) to share issues/disputes/conflict resolution	Remote	Marginal	Medium			
	Mission pressure from other factions (dispatch/fire teams), leading to fatigue, anxiety, harried decisions leading to hazardous mistakes	Frequent	Catastrophic	High	Education/training, attending the IMT/dispatch meetings, ensuring open communication between IMTs, dispatch and coordinators, AARs (debriefings)	Occasional	Marginal	Medium			
	Stress and fatigue from insufficient staffing levels leading to the can-do/will-do attitudes	Frequent	Critical	High	Staff and budget at appropiate levels, support the crews decision to manage workloads that are commencerate with the staffing levels	Remote	Negligible	Low			
	Logisitical issues with non-co-located personnel leading to additional exposure of flight/landings/take-offs ultimately leading to fatigue/stress/damage/injury to the aircraft and or personnel	Frequent	Catastrophic	High	Co-locate personnel at single base/unit, RON at single location	Improbable	Negligible	Low			
	Personnel dissention between factions of the IR "System" leading to stress and anxiety, resulting in degraded decision making and ultimately possible damage/injury to aircraft or personnel	Probable	Critical	High	CRM & teambuilding training for all IR systems staff; open communications; pre/post season meeting to include all factions of IR systems staff; AARs; clearly defined policies, procedures & roles (Infrared Operations Guide).	Improbable	Negligible	Low			
Training	Unqualified personnel flying the aircraft- Resulting in: CFIT, emergency procedures, incidents, accidents	Occasional	Critical	Serious	Qualified and mission profecient personnel flying the aircraft, adequate staffing levels.	Improbable	Negligible	Low			
	Unqualified IR technicians leading to damage to aircraft and/or personnel	Remote	Critical	Medium	Qualified and mission profecient personnel operating/maintaining the equipment.	Improbable	Negligible	Low			
Medical	Flying with known physiological conditions leading to degraded decisions, and hazardous mistakes	Occasional	Critical	Serious	CRM, communications, training and education, take additional time off to recover, see the Doctor, support from other factions	Improbable	Negligible	Low			

System: Personnel (continued)

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Mitigation	Post Mitigation Likelihood	Post Mitigation Severity	Post Mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Night Ops	Accidents while driving to lodging after mission completion late at night.	Occasional	Critical	Serious	Use of shuttles, most alert crewmember drives	Remote	Critical	Medium			
	Incidents or errors caused by physiological challenges (circadian rhythem deviations, vision, fatigue)	Frequent	Catastrophic	High	Education and training; implement CRM; knowing and employing personnal limitations	Occasional	Critical	Serious			
Management	Lack of skilled leadership/managerial skills in supervisors and upper management leading to stress/anxiety of crews resulting in errors and/or degraded decision-making skills.	Probable	Critical	High	Leadership training, participation in pre/post meetings of IR system staff.	Remote	Marginal	Medium			

System: Policy

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Mitigation	Post Mitigation Likelihood	Post Mitigation Severity	Post Mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Duty Day	Fatigue-Cronic, errors due to fatigue (SA)	Frequent	Critical	High	Scheduling management (reduce duty hrs and/or flight time), **sufficient staffing levels**, sleep-power naps, training, CRM, support crew decision to decrease duty day	Remote	Marginal	Medium			
	Fatigue-Acute, errors due to fatigue (SA)	Frequent	Critical	High	Training, CRM, sleep-power naps, support crew decision to decrease duty day	Remote	Negligible	Low			
Qualifications	Unqualified personnel flying the aircraft- Resulting in: CFIT, emergency procedures, incidents, accidents	Occasional	Critical	Serious	Qualified and mission proficient personnel flying the aircraft, adequate staffing levels.	Improbable	Negligible	Low			
Ill-defined policy and procedures	Procedures that do not reflect the entire IR system leading to ambiguity in the decisions that need to be made, adding stress and anxiety to the crew's workload ultimately leading to hazardous decision making with possible damage/injury to aircraft or crew	Occasional	Critical	Serious	Clearly defined policies, procedures, and roles (Infrared Operations Guide); Have IR Ops Guide approved by line officer authority.	Improbable	Negligible	Low			

System: Flight Operations											
		Pre Mitigation				Post Mitigation					
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
CWN/Other A/C	Use of uncarded aircraft and crew. Failure to follow policy/safety recommendations resulting in use of pilots who are not proficient or current for the mission. Using aircraft that may have exceeded inspection and or component replacement deadlines.	Occasional	Negligible	Low	Check aircraft data cards and pilot qualification cards	Improbable	Negligible	Low			
Night Ops	Incidents or errors caused by physiological challenges (circadian rhythm deviations, impaired vision, fatigue)	Frequent	Catastrophic	High	Education and training; implement CRM; Recognize and operate within personal limitations.	Occasional	Critical	Serious			
Communication	Losing radio communications	Remote	Negligible	Low	Carry back up hand-held radio in the survival kit; cell phones available	Remote	Negligible	Low			
	Chance of striking person or property with drop tube because of a lack of clear communications during air drop	Occasional	Critical	Serious	Ensure clear communications prior to drop--no drop if no communications; follow established drop procedures	Improbable	Negligible	Low			
Instrument Flying	Inadvertant flight into IMC Conditions	Remote	Marginal	Medium	Filing IFR; preflight planning; if you encounter IMC inadvertantly fly instruments and exit IMC conditions	Improbable	Marginal	Medium			
	Lack of currency and proficiency	Remote	Catastrophic	Serious	Maintain currency and proficiency; Do not allow non-current crewmembers to fly missions	Improbable	Catastrophic	Medium			
	Controlled flight into terrain (CFIT)	Improbable	Catastrophic	Medium	Maintain situational awareness; training; file IFR	Improbable	Catastrophic	Medium			

System: Flight Operations (continued)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Airspace	Congestion, mid-air collision potential	Remote	Catastrophic	Serious	File IFR, TCAS, Situational awareness, visual scanning	Improbable	Catastrophic	Medium			
	Non-radar/uncontrolled airspace-unknown aircraft, possible mid-air collision	Remote	Catastrophic	Serious	See and avoid, Use TCAS	Improbable	Catastrophic	Medium			
Delivery of Imagery	Hot hand-offs resulting serious injury or death	Remote	Catastrophic	Serious	Ensure crew is adequately trained. Maintain Situational Awareness. Be sure communications are clear between air-ground personnel.	Improbable	Catastrophic	Medium			
	Air drop tubes striking an object or person causing damage or personnal injury	Remote	Catastrophic	Serious	Ensure crew is adequately trained. Maintain Situational Awareness. Be sure communications are clear between air-ground personnel. employ data transfer via satellite, No communications-NO drop	Improbable	Catastrophic	Medium			
	Low/slow flight profile in delivery of air drop resulting CFIT	Probable	Catastrophic	High	Training, Situational Awareness, CRM, clear and positive air to ground communications, IAPs, Use radio altimeter, Determine criteria for go-no go situations/decisions. Drop only during clear VFR conditions.	Remote	Catastrophic	Serious			

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System: FHP Aerial Application - Aircraft												
		Pre Mitigation				Post Mitigation						
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Avionics (for radios see "Technology" tab)	Unplanned avionics failures (overheating, faulty wiring, etc.)	Occasional	Marginal	Medium	Have portable radio/handheld, users prepared to use alternate frequencies (guard), land and repair or replace aircraft	Remote	Marginal	Medium			
	Unavailable or disfunctional emergency locator (analog ELT systems will be discontinued affecting most aircraft; not required for P-137 but may be equipped)	Remote	Marginal	Medium	Switch to 406 MHz digital ELT systems before February 1, 2009; require digital ELT in all contracts; recommend ELTs with real time or satellite flight following functionality	Improbable	Negligible	Low			
Aircraft Configuration	Helicopter may be more difficult to land in event of engine failure (flight below 500')	Remote	Catastrophic	Serious	Select appropriate aircraft based on project profile weighing risk factors such as helicopter manuverability compared to fixed wing glide distance	Improbable	Catastrophic	Medium			
	Contract may not accurately specify application equipment, pesticide formulation, and rates of application (EPA, NEPA & possibly state violations - env. Hazard, double applications increase exposure)	Improbable	Negligible	Low	Specify in project design and in agency and state contracts: nozzle type, rate of application, pesticide formulation, dose, droplet size, swath width, and environmental parameters during application.	Improbable	Negligible	Low			
	Reduced visibility if aircraft not purpose built for aerial application or if using bi-wing	Remote	Catastrophic	Serious	Contracts use only aircraft designed and built for aerial application, conduct reconnaissance for aerial hazards prior to project, recognize bi-wing may not be the best choice for some applications	Improbable	Critical	Medium			
Performance Standards- Fixed Wing	Insufficient planning considering project needs and aircraft capabilities (mission profile, horsepower, etc.)	Improbable	Catastrophic	Medium	Contract to address minimum requirements: observation aircraft capable of transporting a minimum payload of 530 pounds on a standard day at sea level and Power loading not greater than 13.5 pounds, (aircraft with a power loading greater than 13.5 pounds per horsepower (PPH) must be turbo-charged), if multi-engine aircraft are used they shall have 240-horsepower per engine, or more, unless turbo-charged. Application aircraft must be Turbine engine powered.	Improbable	Critical	Medium			
	Overloading aircraft	Remote	Catastrophic	Serious	Perform load calculations based on weight of pesticide formulation, weight of fuel and consider distance to treatment area; download for pilots with minimal experience	Improbable	Catastrophic	Medium			
	High density altitude operations	Remote	Catastrophic	Serious	Match machine to task & environment, monitor weather, reduce load	Improbable	Catastrophic	Medium			

System: FHP Aerial Application - Aircraft (cont.)											
		Pre Mitigation			Mitigation	Post Mitigation					
Sub-systems	Hazards	Likelihood	Severity	Outcome		Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
	Possibility of fixed wing operating near stall speeds in downwind turns/operations in general	Frequent	Catastrophic	High	Brief on heavy load, wind direction & speed/downwind leg, avoid "high G" turns, pay attention to winds	Occasional	Catastrophic	High			
Terrorist or malicious activity	Remote, unsecure work areas and service landings (risk to containment, aircraft, personnel… theft or damage to aircraft/equipment… threat to public safety) 24 hr security/agency-supplied at airport is not required for all Agency and state contracts.	Remote	Catastrophic	Serious	Adhere to Project Aviation Safety and Security Plans. Contract to address security in remote locations, reference local Unit Aviation Plan (on all agency and state contracts, security plan required for both insecticide & aircraft/support equipment… prop lock, fuel lock, chain of custody for insecticide)	Remote	Critical	Medium			
Performance Standards - helicopter	Hover out of ground effect (HOGE), increased likelihood if using observation helicopter	Remote	Catastrophic	Serious	Maintain forward airspeed, utilize higher performance aircraft… OR to eliminate need for additional aircraft/personnel, consider other monitoring techniques in contract (e.g. real-time AFF subscription)	Improbable	Catastrophic	Medium			
	Propensity to operate within height-velocity curve, increased likelihood if using observation helicopter	Remote	Catastrophic	Serious	Maintain forward airspeed, utilize higher performance aircraft, maintain adequate height above canopy… OR to eliminate need for additional aircraft/personnel, consider other monitoring techniques in contract (e.g.. realtime AFF subscription)	Improbable	Catastrophic	Medium			

System: FHP Aerial Application - Aircraft (cont.)												
		Pre Mitigation			Mitigation	Post Mitigation						
Sub-systems	Hazards	Likelihood	Severity	Outcome		Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Inspection & Maintenance	Existence of corrosion/fracture in aircraft components due to weights and chemical exposure (e.g.. Skids, landing gear, wing struts/attach fittings)	Remote	Catastrophic	Serious	Partially mitigated by annual inspections per FAA part 91, recommend increasing contractual requirement to 100hr inspections (as in part 135), use only purpose built aircraft, utilize carding procedures	Improbable	Catastrophic	Medium			
	Currently some states have no aircraft and pilot inspection procedures.	Probable	Catastrophic	High	Agency will assist in the development and suggest use of an aircraft and pilot check list. The Agency will provide training to state program managers. Even though aircraft will be inspected by state program managers, agency personnel will not be permitted to board application and observation aircraft unless carded per part 135.	Occasional	Catastrophic	High			
	Aircraft not design/built for the specific mission profile (i.e. low-level, mountainous terrain, high cycle flight) on agency and state contracts.	Remote	Catastrophic	Serious	Require and implement a Structural Health Monitoring Program approved by the aircraft's manufacturer. A copy of the program shall be provided to the CO and agency aviation inspectors.	Remote	Marginal	Medium			
	Aging aircraft and/or not identifying inspecting critical stress points (aerial application aircraft subject to multiple cycles and maximizing payloads)	Remote	Catastrophic	Serious	Require and implement a Structural Health Monitoring Program approved by the aircraft's manufacturer. A copy of the program shall be provided to the CO and agency aviation inspectors.	Remote	Marginal	Medium			
	Corrosion/fracture of spray tanks, delivery components leading to leakage, parts detaching	Remote	Critical	Medium	Develop monitoring program for spray operations, critical aircraft components and delivery system	Remote	Marginal	Medium			
	Insufficient daily cleaning of aircraft to reduce corrosion (all aircraft)	Remote	Critical	Medium	Agency and state contracts require that all equipment which comes in direct contact with the pesticides must be kept thoroughly clean and free of residues and foreign particulate matter, ensure adequate preflight/postflight inspection, provide for containment of residue in contract	Improbable	Marginal	Medium			
	Insufficient cleaning of tanks and delivery components between projects, when changing chemicals (env. hazard)	Remote	Critical	Medium	Agency and state contracts require that all tanks and pesticide delivery systems must be thoroughly cleaned and free of rust, residues, and particulate matter, such as grit and sand and will inspect all tanks before they are filled with insecticide or water.	Improbable	Marginal	Medium			
	Unapproved modifications to equipment or unapproved equipment	Remote	Catastrophic	Serious	Both agency and state contracts require a supplemental Type Certificate (STC) or FAA field approval for modified equipment (e.g. pheromone flake pods)	Improbable	Catastrophic	Medium			

System: FHP Aerial Application - Aircraft (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Contract Aircraft (common to both State and Federal operations = mix of fixed and rotor wing, CWN or Exc Use)	Minimally skilled pilots	Remote	Catastrophic	Serious	Require in all agency and state contracts (1500 hrs minimum for application pilot, 25 hrs in make/model used, 100 hrs experience in aerial application & 200 hrs experience in typical terrain)	Improbable	Negligible	Low			
	Using incorrect aircraft type for terrain (fixed vs. rotor wing)	Occasional	Catastrophic	High	Project planning shall determine the type of aircraft required, contracts may specify when important to do so. Establish parameters for a/c type (e.g. some mountainous terrain may be better suited for helicopter)	Remote	Catastrophic	Serious			
	Incentive to maximize flight time, regardless if paid by acre treated or hours flown	Remote	Catastrophic	Serious	Flight Managers & Project Supervisor need to be involved in flight hour/duty day monitoring, flight duty limitations, agency standards apply to agency and state operations through contracts.	Improbable	Negligible	Low			
	Operations in densely populated/high air traffic areas	Probable	Critical	High	Contractors must file Congested Area Plans with FAA. Contractors must adhere to FAA requirements (i.e. some FAA offices require rotor only, others may allow fixed wing operations)	Probable	Marginal	Serious			
	There are no maintenance requirements 'per se' for aircraft operating under FAA part 137, only the minimum requirements per FAA part 91 (annual inspection)	Probable	Catastrophic	High	Consider contract requirements to include 100 hr inspection; establish TBO or TBO extension program through FAA	Occasional	Catastrophic	High			
	Too many or too few aircraft for production needs/project area, unsuitable spray platform for mission profile	Remote	Catastrophic	Serious	Project planning shall determine and contracts specify quantity & type of aircraft needed to complete the project. For example number of a/c or production rates (ac/hr) may be specified in contracts. In cases where planning is unable to determine (ie, county coordinators may not be certain of needs), specify two choices in the contract or utilize RFP and review procedures to determine acceptability	Remote	Critical	Medium			
	No pre-application survey of area prior to project for aerial hazards	Remote	Catastrophic	Serious	Contract requirement that all application pilots are responsible for the reconnaissance of each area before treatment.	Improbable	Catastrophic	Medium			
Fuel	Starvation	Occasional	Catastrophic	High	Monitor quantity pumped during fueling, monitor flight time and distance to services	Remote	Critical	Medium			
	Bad fuel (more likely in portable fuel systems)	Remote	Critical	Medium	Ensure fuel is tested for type and quality prior to fueling. Monitor quantity pumped. Ensure fuel filters are changed as required by manufacturer.	Improbable	Critical	Medium			
Foreign Aircraft	Not carded/inspected for use in other country (e.g., US in Canada, Canada in US)	Remote	Critical	Medium	Use in foreign territory not authorized and illegal	Improbable	Marginal	Medium			
Availability	Sense of urgency & pressure to perform (pilot, manager, organization)	Occasional	Catastrophic	High	Involve Supervisor, Program Manager & flight Manager in all stages of planning and risk assessment.	Remote	Catastrophic	Serious			
	Tendency to over utilize single vendor/pilot & maximize flight hours due to limited availability of other aircraft	Remote	Catastrophic	Serious	Flight Managers & Program Manager need to be involved in flight hour/duty day monitoring. Adhere to contract specifications regarding flight hour/duty limitations.	Improbable	Catastrophic	Serious			

System: FHP Aerial Application - Environmental

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Weather	High wind, high temperatures, low humidity (pesticide drift)	Frequent	Marginal	Serious	Contract specifies thresholds for allowable winds, temperature & relative humidity, cease operations when drift conditions exist	Occasional	Marginal	Medium			
	High wind, low humidity, high temperatures (affect on aircraft performance)	Frequent	Catastrophic	High	Contract specifies performance requirements, conduct load calculations/weight & balance; cease operations when conditions out of parameter	Remote	Catastrophic	Serious			
	Thunderstorms, lightening, hail, high winds	Occasional	Catastrophic	High	Suggest pilots utilize on-board, real time weather program (such as XM weather on Garmin-type GPS); program managers monitor weather stations provided at airport office, use observation aircraft to help monitor weather conditions	Remote	Catastrophic	Serious			
	Typically morning operations & in shadows/glare conditions	Frequent	Catastrophic	High	Preflight briefing to raise awareness	Probable	Catastrophic	High			
Topography/Hi Alt	Turbulence	Frequent	Critical	High	Time application based on anticipated prevailing winds, cease operations if unsafe/out of parameter	Remote	Critical	Medium			
	Terrain - box canyons	Occasional	Catastrophic	High	Plan project/treatment block such that application flight lines allow egress; brief pilot	Remote	Critical	Medium			
	High Altitude - density altitude	Occasional	Catastrophic	High	Perform load calculations for departure and destination	Remote	Critical	Medium			
Remote Areas or Poor Road Access	Lack of communications	Probable	Catastrophic	High	Test radio communications prior to project implementation	Remote	Catastrophic	Serious			
	Long response time in event of search and rescue	Occasional	Catastrophic	High	Mishap Response Plan to address search and rescue procedures, observation aircraft may be used to assist guiding rescue vehicles/personnel to accident site	Remote	Catastrophic	Serious			
	Fuel starvation, proper fuel unavailable	Remote	Catastrophic	Serious	Monitor flight time/fuel consumption, utilize fuel trucks or have optional fuel sources identified	Improbable	Critical	Medium			

System: FHP Aerial Application - Environmental (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Remote Areas or Poor Road Access (cont.)	Unimproved landing strips or helipads with poor dust abatement and/or poor surface condition	Remote	Marginal	Medium	Contractor required to locate and inspect all landing zones prior to project implementation, secure written permission if on private property; for fixed-wing operations, contractor must obtain permission from airport manager, airstrips must be accessible to vehicles, therefore mostly utilizing developed airports (may use unimproved landing strip only in event of emergency); for rotor wing operations water is available for dust abatement if needed	Improbable	Marginal	Medium			
Biological Window	Prioritizing treatment based on pest phenology over safety (must treat within window)	Occasional	Catastrophic	High	Contract specifications include adequate number of aircraft to accomplish mission within biological window, brief daily emphasizing safety over production, adhere to flight and duty limitations	Remote	Critical	Medium			
Airspace	Working within Military Operating Area, potential mid air collision	Probable	Catastrophic	High	Contact flight service station or ATC to determine if active and, if so, may request traffic advisories from the controlling agency prior to entry; address during premission planning and briefing	Remote	Catastrophic	Serious			
	Working within or proximity to Military Training Route, potential mid air collision	Probable	Catastrophic	High	Address during permission planning and briefing; keep alert (application aircraft and observation aircraft); contact flight service station to determine if active and, if so, request times of scheduled activity, altitudes in use, actual route width (route may extend several miles beyond shown center line); not all MTRs are published on sectionals... obtain copy of AP1B for phone numbers to military installations and contact schedulers to deconflict MTR; project manager post NOTAM for military to review during their daily briefing	Remote	Catastrophic	Serious			
	Unable to establish TFR for applications projects	Probable	Catastrophic	High	Post applications projects as NOTAM, remain aware of potential for other aircraft to enter project area	Remote	Catastrophic	Serious			
	Military training operations distracting application aircraft	Occasional	Catastrophic	High	COR/Project Manager & National Airspace Coordinator to communicate "training" problem to military, describe distraction to application operations and risk (Air Force & Navy have contact points, also a primary single contact "Airspace Manager" for all branches)	Remote	Catastrophic	Serious			
	Inability to post NOTAMs due to FAA office closures and difficulty identifying contact point	Occasional	Catastrophic	High	Go to FAA.gov to identify contact and follow procedures for filing NOTAMs... post aerial application NOTAM within 3 days of project	Remote	Catastrophic	Serious			

System: FHP Aerial Application - Environmental (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Airspace (cont.)	Working in proximity to/or within FTA or TFR	Remote	Catastrophic	Serious	Typically avoid, however, Project Manager may request permission to work within FTA or TFR if possible and absolutely necessary, coordination between dispatch, application pilot, and aerial supervision is required; ability to "XM download" to on board GPS will help with TFRs.	Remote	Critical	Medium			
	Restricted Areas (artillery firing, guided missiles or aerial gunnery)	Remote	Catastrophic	Serious	Typically avoid, however, if necessary permission to enter may be coordinated through ATC; know intercept procedures, reference in contracts/prework and include in daily briefings.	Remote	Critical	Medium			
	Prohibited Areas (e.g.. lack of coordination prior to entering Camp David, White House, Presidential Ranch…)	Remote	Catastrophic	Serious	For all intents and purposes "permanently off limits", typically avoid, however, applications projects are sometimes prescribed within PAs; if necessary permission to enter may be coordinated through ATC, DOD, Secrete Service... Example: procedure for P-40 (Camp David) Project Manager contacts Park Service, Park Service contacts Secrete Service; at minimum prebrief by Project Manager includes Secrete Service to establish agreed flight plan/flight lines, pilot must strictly adhere to plan; know intercept procedures, reference in contracts/prework and include in daily briefings	Remote	Critical	Medium			
	Mid Air collision while working within or crossing Class B, C, D Airspace	Remote	Catastrophic	Serious	Observation and application aircraft remain aware of other traffic, pilot request clearance, maintain communication with ATC or tower as required	Remote	Catastrophic	Serious			
	Airspace in general - near miss/collision in congested areas	Occasional	Catastrophic	High	Communicate with & utilize observation aircraft, ATC, etc... see and avoid, consider TCAS to warn of transponding aircraft in proximity to application aircraft	Remote	Catastrophic	Serious			
Airstrip Availability, Condition and Services	No alternative or suitable landing location for emergency situations	Probable	Catastrophic	High	Identify emergency landing zones in advance (fields, open areas, meadows)	Remote	Critical	Medium			
	No alternative fuel source	Occasional	Marginal	Medium	Call FBO/airport ahead of time to determine fuel availability, use alternate airport or fuel tender	Remote	Critical	Medium			
	One-way landing/departure	Probable	Marginal	Serious	Be aware that preferred approach/departure based on wind may not be an option, be aware of the potential for oncoming air traffic	Probable	Negligible	Low			
	No windsock at landing zones	Frequent	Marginal	Serious	Use vegetation (grass, tree tops) as reference; if available, ground support can call pilot with conditions prior to landing, hang flagging	Remote	Marginal	Medium			
	Effects of prevailing wind	Frequent	Marginal	Serious	Know local conditions, retrieve automated weather	Frequent	Negligible	Medium			

System: FHP Aerial Application - Environmental (cont.)

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Mitigation	Post Mitigation Likelihood	Post Mitigation Severity	Post Mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Terrain/Obstructions	Operations below 500' in either helicopter or fixed-wing, potential to impact terrain or obstruction - aerial application typically 50-200 feet above tree tops	Frequent	Catastrophic	High	Contract specifications require FAA part 137-qualified pilots. Maintain situational awareness, identify emergency landing zones (fields, open areas, meadows); preflight briefing, review aerial hazard map, contract specifies reconnaissance of area prior to treatment	Remote	Critical	Medium			
Animal activity	Potential for serious injury/aircraft damage from birds	Occasional	Critical	Serious	Know flyways, observation aircraft and ground support to communicate avian activity if present in area	Remote	Critical	Medium			
	Potential for serious injury/aircraft damage from wildlife on runway (common at remote and county airports)	Occasional	Critical	Serious	Ground support to clear runway, communicate activity to pilot; keep deer away by scattering "Irish Spring" soap around runway perimeter	Remote	Marginal	Medium			
Containment & Handling	No spill plan for fuel & chemicals, no label and MSDS for pesticide, no PPE	Remote	Marginal	Medium	Contractor is required to have spill plan, agency and state contracts require safety plan (includes spill plan) follow pesticide label regarding PPE	Improbable	Negligible	Low			
	Human exposure due to treatment areas not posted	Remote	Marginal	Medium	Treatment areas are posted on public lands only (not necessary for private landowners requesting treatment), roads may be closed on public lands at discretion of site manager	Improbable	Negligible	Low			

System: FHP Aerial Application - Personnel

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Pilot and/or vendor	Minimal local experience/unfamiliar with area	Frequent	Catastrophic	High	Preflight briefing, review aerial hazard maps, conduct reconnaissance flights	Frequent	Marginal	Serious			
	No current State Applicator License	Remote	Marginal	Medium	Agency and state contracts require contractor to obtain current State Applicator License… obtain certification within all states where project is planned, be aware that project may cross state lines	Improbable	Negligible	Low			
	State contracts are not required to meet agency standards for aerial application	Probable	Critical	High	Maintain/improve working relationship with state agencies (most states voluntarily adopt agency standards), involve states in risk management	Remote	Marginal	Medium			
	Minimal flight hours/mission hours	Occasional	Catastrophic	High	Contract specifies number of hours by mission type (number of hours in typical terrain, number of hours in make/model), check flight log files & be aware possibility exists for these to be falsified/unable to verify	Remote	Marginal	Medium			
	Inordinate attention to application, impacting aerial hazards (new hazards installed often, e.g. cell towers)	Occasional	Catastrophic	High	Agency and state contracts provide aerial hazard maps of known hazards on aerial photo or topo, some states will GPS hazards prior to project implementation, agency and state contract require "all application pilots are responsible and required for the reconnaissance of each area before treatment"	Remote	Catastrophic	Serious			
	Coerced into uncomfortable situation	Occasional	Catastrophic	High	Not all pilots equally skilled, do not pressure into uncomfortable situations (encourage all to speak up)	Remote	Catastrophic	Serious			
	Inadequate briefings from Project Manager	Occasional	Critical	Serious	Make contract requirement to hold preseason, premission/daily, postmission briefings	Remote	Marginal	Medium			
	lack of awareness leading to fuel starvation	Occasional	Catastrophic	High	Proper preflight planning, Project Manager & pilot monitor flight time	Remote	Catastrophic	Serious			
	Self-medication	Occasional	Catastrophic	High	All project personnel to be aware of illness (may be colds to serious health issue), ask if medicated, know FAA regs for use of over-the-counter and prescription drugs while operating equipment	Remote	Critical	Medium			

System: FHP Aerial Application - Personnel (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
	Incomplete preflight inspection	Occasional	Catastrophic	High	Pilot to utilize preflight check list, FAA requirement	Remote	Critical	Medium			
	Accepting unreasonable risk, "barnstormer" attitude	Occasional	Catastrophic	High	Preflight briefing to establish tone for the day, "aviation program first, pest management second"	Remote	Critical	Medium			
	Pilot incapacitated	Remote	Catastrophic	Serious	Contracts specify that pilot may be relieved of duties (in event of sickness, under influence of alcohol or drugs, insufficient rest/time off)	Improbable	Negligible	Low			
	Fatigue	Occasional	Catastrophic	High	Contract specifies duty limitations and rest periods; contract specifies contractor not allowed to do other projects until completing current agency or state project; assure enough personnel to support aircraft and project schedule	Remote	Marginal	Medium			
	Complacency	Occasional	Catastrophic	High	Be aware that experienced pilots may tend toward complacency… conduct morning safety briefings, retain situational awareness throughout day	Remote	Critical	Medium			
Agency or State Personnel	Exposure to increased risk by boarding unauthorized aircraft (FAA part 137 not carded for personnel transport)	Remote	Critical	Medium	Most fixed-wing application aircraft seat pilot only, federal and state personnel may not fly in restricted category (FAA part 137) aircraft	Improbable	Marginal	Medium			
	Minimal experience with mission type	Probable	Critical	High	Include expert aviation and pest management personnel in project planning, briefing and implementation; train and mentor new employees (subordinates and supervisors)	Occasional	Critical	Serious			
	Undue pressure upon employees or contractor to perform by Program Manager/Supervisor	Occasional	Catastrophic	High	Utilize crew resource management, all are empowered to stop an unsafe act	Remote	Critical	Medium			
	Exposure to risk for personnel if participating in observation flight	Frequent	Marginal	Serious	State and federal employees never ride in application aircraft under FAA part 137 but may in observation aircraft (federal requirements: pilot carding per FAA part 135, monitoring personnel on board must be qualified Fixed-wing Flight Manager or Helicopter Manager); consider utilizing AFF to monitor operation	Frequent	Negligible	Medium			

System: FHP Aerial Application - Personnel (cont.)												
		Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-systems	Hazards	Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
	Fatigue (air or ground personnel)	Probable	Catastrophic	High	Outline project schedule within the RFP, proposals to address how intended to meet production requirements/assure adequte rest, recommend RFP provide vendor weekly opportunity to specify changes to state or ageny for review; Positive safety culture will encourage adequate rest for all, appropriate number of aircraft assigned to project; Responsibility of Project Manager to ensure adequate rest for all personnel (crew resource management);	Remote	Marginal	Medium			
	Complacency (air or ground personnel)	Occasional	Critical	Serious	Be aware that experienced project personnel may tend toward complacency… conduct morning safety briefings, retain situational awareness throughout day (crew resource management)	Remote	Marginal	Medium			
	Condoning unreasonable risk	Occasional	Catastrophic	High	Complete Risk Assessment for each project; preflight briefing to establish tone for the day, "aviation program first, pest management second"	Remote	Marginal	Medium			
Training	Lack of educational opportunities for pilots and pilot operators that help reduce aircraft and drift accidents	Remote	Catastrophic	Serious	Consider including in contract specs that all application pilots must attend Professional Aerial Applicator Support System (PAASS) certification course	Remote	Marginal	Medium			
	Minimal experience in areas with sporadic application programs (particularly in west, occasionally in east)	Frequent	Catastrophic	High	Agency to support and fund aerial application and safety training for all agency and state personnel, implement mentoring program, share expertise across regions	Occasional	Marginal	Medium			
	Lack of aviation awareness training and risk management in general	Frequent	Catastrophic	High	Consistent with the goals of the Aerial Application Safety Council, develop and provide aerial application training program (e.g., ACE training for agency & state personnel)	Occasional	Marginal	Medium			

System: FHP Aerial Application - Personnel (cont.)											
		Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-systems	Hazards	Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Flight Following Personnel (typically dispatch on FS contracts, FS land)	Lack of mission understanding and scheduled activities	Remote	Critical	Medium	Notify dispatch of planned activities and provide Project Aviation Management Plan for Agency contracts and any state contracts in proximity to National Forest	Remote	Marginal	Medium			
	Inconsistent flight following procedures - federal	Occasional	Critical	Serious	Agency follow established protocol… address flight following procedures in communications plan	Improbable	Negligible	Low			
	No dispatch available/inability to communicate to center	Probable	Catastrophic	High	Establish flight following in the field using ground personnel in treatment area - specify in communication plan and utilize a combination of communication methods (e.g., ground to ground, air to ground, cell phone)	Remote	Catastrophic	Serious			
	Inconsistent flight following procedures - state	Occasional	Catastrophic	High	Recommend states utilize protocol similar to federal... State projects often conducted with no dispatch but with flight following performed by state employees positioned at airport… adhere to procedures in communications plan	Occasional	Critical	Serious			
	Flight following personnel fatigued or complacent	Occasional	Marginal	Medium	Ensure adequate rest; follow agency protocol for duty limitations, recommend similar for state contracts	Remote	Marginal	Medium			
	Poor frequency management/frequency congestion	Occasional	Marginal	Medium	Coordinate with dispatch or communication technicians to obtain additional frequencies and set up portable repeaters if necessary	Remote	Marginal	Medium			
	Lack of staffing on weekends or outside of flight hours	Occasional	Catastrophic	High	Brief dispatch on operational periods, ensure dispatcher staffing or flight following personnel	Remote	Marginal	Medium			
	Jurisdictional/boundary awareness and inability to maintain flight following	Occasional	Critical	Serious	Circulate flight plan to all dispatch centers in project area, communication plan includes all necessary frequencies/brief pilot, assure handoff from one center to next	Remote	Marginal	Medium			

System: FHP Aerial Application - Personnel (cont.)											
		Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-systems	Hazards	Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Maintenance Inspector (aircraft & support vehicles)	Not current on maintenance issues for specific aircraft that could lead to accidents	Occasional	Catastrophic	High	Regularly check for new Airworthiness Directives, stay current on required training	Remote	Critical	Medium			
	Insufficient number of inspectors may lead to fatigue, complacency, accepting or transferring unreasonable risk	Occasional	Catastrophic	High	Ensure adequate staffing, Project Managers attend aircraft inspections	Remote	Critical	Medium			
Oversight & Coordination in General	Lack of mission understanding among RAOs/RASMs, FAOs, state directors, etc…	Probable	Catastrophic	High	Project Managers participate in annual Forest Aviation Officer meetings, RAOs/RASMs review/approve aviation management plan	Remote	Critical	Medium			
	Lack of trend information helpful in preventing incidents/accidents	Probable	Critical	High	Expand knowledge & how to use SAFECOM system, should include all agency funded aerial application projects (e.g., gypsy moth cooperative suppression projects); periodically query, review and report any trends	Remote	Critical	Medium			
	Lack of safety awareness and need to further develop safety culture within state and federal agencies	Probable	Catastrophic	High	Encourage initiatives through the Aerial Application Safety Council that foster interagency safety awareness (e.g., through training, presentations at annual meetings, close coordination with other state and federal aviation staffs)	Remote	Critical	Medium			
	Lack of (or minimal) interagency coordination on aerial application projects that span private, state, and federal lands	Occasional	Catastrophic	High	Host annual interagency coordination meetings (e.g., Gypsy Moth Program Managers Meeting includes all state and federal agencies involved with gypsy moth)	Remote	Critical	Medium			
Contracting	CO, COR/COTR turnover leading to lack of mission understanding and shortage of personnel performing oversight	Occasional	Catastrophic	High	Include expert aviation and pest management personnel as COTRs during contract development and administration; train and mentor new employees (future CORs, COTRs)	Remote	Critical	Medium			
	Short time frame from contract advertising to implementation (impacts operating season, quality of contract, limits desirable/qualified bidders and awarded contractor readiness)	Occasional	Catastrophic	High	Begin drafting contract early enough to ensure that a quality contract has been developed, draw highest number of qualified bidders possible	Remote	Critical	Medium			

System: FHP Aerial Application - Technology (Hardware/Software)											
		Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-systems	Hazards	Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
AFF	Typically not used in application projects, dispatch centers do not have visual display of application aircraft relative to other aviation operations	Frequent	Catastrophic	High	Utilize observation aircraft to monitor operations and alert other aircraft that may approach project area, consider including AFF requirement in state and agency contracts	Remote	Catastrophic	Serious			
	Possible AFF antenna conflicts with other antenna on aircraft	Remote	Critical	Medium	Maintain separation between antenna per manufacturer, check that AFF is working prior to take off	Improbable	Negligible	Low			
	When in use AFF may lead to a false sense of security if user thinks dispatch always knows location OR if dispatch thinks all aircraft are visible	Occasional	Catastrophic	High	Be aware that all aircraft are not visible to flight following personnel (not everyone uses AFF) and that AFF is not "air traffic control" (intended to augment radio communication); maintain positive radio communication at all times	Remote	Critical	Medium			
	AFF system failure in aircraft or on ground at computer	Occasional	Catastrophic	High	Always maintain positive radio communication, radio checks/position reports are still required (may be at greater time interval, 30 minute checks instead of 15 minute) per communications plan	Remote	Critical	Medium			
Aircraft GPS	Application aircraft flying in wrong area and/or misapplication of pesticide	Occasional	Critical	Serious	State and agency contracts require all application aircraft have panel-mounted aerial application GPS (limitations are called out in the contract: able to update location 5 times per second, upload shapefile of treatment blocks, download flight files, etc...); contract requires application aircraft to return to base if GPS malfunction	Remote	Marginal	Medium			
	Observation aircraft unable accurately navigate to specific treatment area(s)	Occasional	Critical	Serious	State and agency contracts require all observation aircraft have at a minimum handheld GPS and "...conveniently located for the pilot"	Remote	Marginal	Medium			
	Inexperienced users pay too much attention to GPS (head in cockpit) rather than flying the mission	Frequent	Catastrophic	High	Contract requires that application pilots must demonstrate GPS proficiency (examples of flight files working in similar operations)	Remote	Catastrophic	Serious			
	Cockpit clutter/loose equipment in observation aircraft (handheld GPS with wires for power and external antenna)	Occasional	Marginal	Medium	Properly mount antenna, stow handheld GPS and cables so as not to interfere with flight or utilize yoke-mounted GPS (if fitted for yoke-mounted GPS and unit is not in use, remove any protruding brackets that may cause injury)	Remote	Marginal	Medium			

System: FHP Aerial Application - Technology (Hardware/Software - cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Radios	No repeater available in project area	Occasional	Catastrophic	High	Test frequencies and set up portable repeaters if necessary; communication plan requires backup communication by cell phone or satellite phone if necessary; in federal plans/suggest requiring in state plans	Remote	Catastrophic	Serious			
	No communications (in general) air-to-ground, with other aircraft or dispatch centers	Remote	Marginal	Medium	FAA requires ability to communicate with general aviation aircraft; contracts include necessary radio specifications; communications plan lists frequencies	Remote	Marginal	Medium			
	Inaccessible radios/controls, difficult to operate	Improbable	Marginal	Low	Break from flight pattern to access radio and make adjustments	Improbable	Negligible	Low			
	P-25 Digital, Analog & Narrow Banding compatibility issues	Probable	Marginal	Serious	Identify issues prior to contract and operation, radio check prior to project implementation - address in communication plan; provide time and training on new equipment	Occasional	Marginal	Medium			
	Portable radios - not secure, controls easily bumped	Remote	Marginal	Medium	Secure and properly place portables so as not to interfere with aircraft operations, use keypad/control locks	Occasional	Marginal	Medium			
	Panel mounted radios - bump controls	Improbable	Marginal	Medium	Use keypad/control locks	Improbable	Negligible	Low			
	Flight crew unfamiliar with components	Probable	Marginal	Serious	Preflight to include familiarization & programming radios	Remote	Marginal	Medium			
TCAS	If not using TCAS: potential for midair collision	Remote	Catastrophic	High	Use TCAS, continue practice of "see and avoid", apply CRM	Improbable	Catastrophic	Medium			
	If using TCAS: false sense of security that all other aircraft have functioning transponders	Occasional	Catastrophic	High	Recognize that all other aircraft may not have functioning transponders, continue practice of "see and avoid", apply CRM	Remote	Catastrophic	Serious			
	If using TCAS: Signal interference, antenna positioned too close to other antennas	Occasional	Catastrophic	High	Follow manufacturer's installation requirements	Remote	Catastrophic	Serious			

System: FHP Aerial Application - Technology (Hardware/Software - cont.)											
		Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-systems	Hazards	Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Pesticide Delivery Systems	Atomizer blades detaching and impacting fuselage, rotor, or ground	Occasional	Catastrophic	High	Contract requires that rotary atomizer must be installed in strict accordance to manufacturers recommendations. All atomizers must be serviced and in good working condition. Agency and state program managers inspect nozzles prior to project implementation	Remote	Catastrophic	Serious			
	Emergency dump valve malfunction causing load to dump (misapplication of pesticide)	Occasional	Marginal	Medium	Inspect and assure functioning dump valves for helicopter & fixed-wing	Remote	Marginal	Medium			
	Hose to nozzle detaching, pesticide misapplication (not aviation hazard)	Occasional	Marginal	Medium	Preflight inspection to include examining pesticide delivery components	Remote	Marginal	Medium			
	Inability to jettison in event of emergency	Remote	Catastrophic	Serious	Inspect and assure functioning dump valves for helicopter & fixed-wing	Remote	Catastrophic	Serious			
	Improper pesticide application rate	Occasional	Marginal	Medium	Agency and state contracts specify all aircraft must be equipped with an electronic flow metering system and delivery system must be calibrated prior to project implementation	Remote	Marginal	Medium			

System: FHP Aerial Photography - Aircraft											
		Pre Mitigation				Post Mitigation					
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Avionics (for radios see "Technology" tab)	Unplanned avionics failures (overheating, faulty wiring, etc.)	Occasional	Marginal	Medium	Have portable radio/handheld as back up, users prepared to use alternate frequencies (guard), land and repair or use alternate aircraft	Remote	Marginal	Medium			
	Loss of emergency locator ability (analog ELT systems will be discontinued)	Remote	Marginal	Medium	Switch to 406 MHz digital ELT systems before February 1, 2009	Improbable	Negligible	Low			
Configuration	Window configuration - poor visibility of hazards in certain models	Occasional	Marginal	Medium	Consider aircraft with better visibility	Occasional	Negligible	Low			
	If non-pressurized aircraft operating at high altitude, encumbrance caused by canulas/mask/hose	Occasional	Negligible	Low	Use pressurized aircraft	Remote	Negligible	Low			
	Insufficient work space, inability to use seatbelts during photo mission	Remote	Critical	Medium	None	Remote	Critical	Medium			
	Open camera port in belly - cold, fatigue	Occasional	Marginal	Medium	Wear warm clothes, fly fewer hours to avoid fatigue or use aircraft with sealed port (such as King Air)	Remote	Negligible	Low			
	Open camera port in belly - loosing items	Occasional	Marginal	Medium	Secure items, keep from port or use aircraft with sealed port (such as King Air)	Remote	Marginal	Medium			
Terrorist or malicious activity	Theft or damage to aircraft or gear & equipment (remote , unsecured overnight parking, risk to aircraft, personnel … theft or damage to aircraft and equipment… threat to public safety.)	Remote	Catastrophic	Serious	Adhere to Project Aviation Safety and Security Plans; remove valuable equipment if overnight parking, use prop lock and fuel lock	Remote	Critical	Medium			

System: FHP Aerial Photography - Aircraft (cont.)											
		Pre Mitigation				Post Mitigation					
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Performance Standards - mountainous terrain	High density altitude operations	Remote	Catastrophic	Serious	Project Aviation Safety Plan and contract to address minimum requirements, reference Airman's Information Manual (AIM) for mountainous terrain.	Improbable	Critical	Medium			
	Insufficient Horsepower	Occasional	Catastrophic	High	Project Aviation safety plan & contract to address minimum requirements, reference local unit Aviation Plan if operating out of area	Remote	Critical	Medium			
	Insufficient payload capabilities - camera type mismatch to platform, overnight gear	Probable	Critical	High	Match machine to task, perform weight and balance calculation, reduce load	Improbable	Critical	Medium			
Contract Aircraft	Many contract aircraft not configured for equipment or experienced with mission type (if turn-key, very expensive)	Probable	Critical	High	Conduct thorough market analysis and solicitation, request performance history, require Part 135	Occasional	Marginal	Medium			
	Aging aircraft	Probable	Marginal	Serious	Consider aircraft health monitoring program to include strain gauge, oil analysis, special inspection program	Occasional	Marginal	Medium			
WCF (fleet) Aircraft	Identifiable as agency aircraft may encourage vandalism	Remote	Catastrophic	Serious	Utilize secure overnight parking if available	Remote	Catastrophic	Serious			
	Most agency pilots have tendency to lack experience with mission type, not dedicated to photography work	Probable	Marginal	Serious	Establish mentoring program for photo pilots, performance plan addresses support to other aviation functions (e.g., fire & photo)	Occasional	Marginal	Medium			
	Very few photo-capable aircraft in agency fleet, increases likelihood of contracting minimally skilled pilots/poor performing aircraft through contracting	Probable	Marginal	Serious	Conduct thorough market research and consider best value for contracting if no agency available	Occasional	Marginal	Medium			
	Aging aircraft	Probable	Marginal	Serious	Consider aircraft health monitoring program to include strain gauge, oil analysis, special inspection program (FHTET King Air '74, SPO Beavers '59-'64, DFO C206 newer)	Occasional	Marginal	Medium			

System: FHP Aerial Photography - Aircraft (cont.)												
		Pre Mitigation				Post Mitigation						
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Fuel	Bad fuel	Occasional	Critical	Serious	Ensure fuel is tested for type and quality prior to fueling	Remote	Critical	Medium			
	Starvation	Occasional	Catastrophic	High	Monitor quantity pumped during fueling, monitor flight time and distance to services	Remote	Critical	Medium			
Availability	Lack of back up aircraft in event preferred aircraft unavailable (scrambling to find suitable substitute or settling for less than optimum)	Remote	Negligible	Low	R8 has two configured King Airs for back up	Remote	Negligible	Low			
	Minimal availability of photo platforms leading to maximizing flight hours with those aircraft/pilots that are available	Remote	Negligible	Low	Adhere to flight duty limitations	Remote	Negligible	Low			
	Sharing aviation assets (non-local pilot unfamiliar with area, photographer unfamiliar with pilot and aircraft)	Remote	Negligible	Low	R8 has two configured King Airs for back up	Remote	Negligible	Low			
	Not sharing aviation assets (overworking a single asset)	Remote	Negligible	Low	Utilize other aircraft equipped with camera hole (however, others are prioritized for fire... fire season and photo season overlap)	Remote	Negligible	Low			

System: FHP Aerial Photography - Environmental											
		Pre Mitigation				Post Mitigation					
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Weather	Working in less-than-optimum conditions in order to take advantage of preferred sun angles	Occasional	Critical	Serious	Preflight briefing to include unacceptable conditions for safe photography	Remote	Critical	Medium			
	Lack of visibility - smoke, haze	Probable	Catastrophic	High	Maintain VFR, establish good communication w/air attack, remain outside of FTA/TFR w/out permission, practice see & avoid	Remote	Catastrophic	Serious			
	High winds	Frequent	Critical	High	Abort mission until more favorable wind conditions	Remote	Marginal	Medium			
	IFR conditions take off/landing, ferry	Probable	Negligible	Medium	Stay on ground or use twin engine/IFR qualified	Remote	Catastrophic	Serious			
	Sudden changes in weather, unexpected extreme conditions	Remote	Negligible	Low	Preflight weather briefing, maintain VFR	Remote	Negligible	Low			
	Lack of visibility - fog	Probable	Critical	High	Maintain VFR, continuously monitor conditions, have contingency plans for alternate airports/survey areas, consider utilizing twin engine aircraft in project areas w/strong likelihood of fog during take-off/landings.	Remote	Catastrophic	Serious			
	Lack of visibility during IFR take off/landing (OK for twin engine only)	Remote	Catastrophic	Serious	Pilot maintain IFR currency, abort mission until conditions improve.	Remote	Critical	Medium			
	Marginal VFR (having to avoid scud runners)	Remote	Catastrophic	Serious	Preflight weather briefing, maintain VFR, see and avoid scud runners	Remote	Negligible	Low			

System: FHP Aerial Photography - Environmental											
		Pre Mitigation				Post Mitigation					
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Topography/Hi Alt	Turbulence	Frequent	Critical	High	Obtain weather briefings, move to alternate location or abort mission until more favorable weather.	Remote	Critical	Medium			
	Terrain - operating in box canyons (rare, photo mission altitude fixed high above terrain)	Remote	Critical	Medium	Maintain awareness of altitude above terrain, fly ridges rather than drainage bottoms	Remote	Critical	Medium			
	High Altitude - density altitude	Frequent	Critical	High	Obtain weather briefings, review aircraft performance charts and data or abort mission until more favorable weather.	Remote	Critical	Medium			
	High Altitude above 18 thousand	Frequent	Marginal	Serious	Mission planning, IFR clearance, working with IFR traffic	Frequent	Marginal	Serious			
	Large scale photography/closer to terrain	Frequent	Critical	High	change lens or camera	Remote	Critical	Medium			
Minimal Topography/Low Alt	Increased probability of encountering aerial hazards in areas with minimal topography	Probable	Catastrophic	High	Address in safety briefing, consider TCAS, practice see and avoid	Occasional	Catastrophic	High			
Remote areas	lack of communications	Probable	Catastrophic	High	Utilize AFF, know and use local repeaters (guard in emergency), possibly carry satellite phone	Remote	Catastrophic	Serious			
	Search and Rescue - delayed response within critical period	Probable	Catastrophic	High	UtilizeAFF, carry aircraft and personal survival gear, handheld radio/know frequencies, satellite phone	Occasional	Critical	Serious			
	Fuel availability	Occasional	Marginal	Medium	Ensure mission planning includes fuel resources (call ahead), considers ferry distance/time, monitor flight time & distance to fuel location during flight	Remote	Marginal	Medium			
	Oxygen availability to aircraft (if using non pressurized aircraft)	Occasional	Marginal	Medium	Ensure mission planning includes oxygen resources (call ahead) & ferry distance/time, monitor flight time & distance to location or if not available, spend less time at high elevations	Remote	Marginal	Medium			

System: FHP Aerial Photography - Environmental (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Urgent Photography (Pest Signature, Fall Colors, Fire/Other Damage)	Forcing timing of flights to meet photo needs rather than safety	Probable	Catastrophic	High	Utilize additional assets to complete survey or prioritize high interest areas & complete first, it's okay not to finish	Remote	Marginal	Medium			
Water	Amphibious aircraft landing on water with gear down	Occasional	Catastrophic	High	Use pilot check list, confirm gear up… (typically not using amphibious aircraft for photo missions)	Improbable	Catastrophic	Medium			
	Amphibious aircraft landing on land with gear up	Occasional	Critical	Serious	Use pilot checklist, confirm gear down… (typically not using amphibious aircraft for photo missions)	Improbable	Catastrophic	Medium			
	Poor depth perception to surface of water during landing	Occasional	Critical	Serious	Be aware during hazy conditions or dead-calm, more difficult to see water surface; Use experienced pilots, scan for water surface irregularities (wind, wake, fish, etc	Remote	Marginal	Medium			
	Ill-equipped with survival gear and beyond glide distance to shore	Occasional	Catastrophic	High	Carry survival/mustang suits cold water, PFDs	Remote	Critical	Medium			
	Difficulty exiting aircraft after ditching or crashing in water	Probable	Catastrophic	High	Attending water ditching course, consider adding area-specific currency requirement in task book (alternatively, other companies and universities offer)	Remote	Critical	Medium			
	Other watercraft & recreational users	Occasional	Catastrophic	High	Pilot/crew increase SA (watch for fishermen, swimmers, jet skis, canoes, etc. speed boats can become a hazard quickly...), no radio communication with these hazards; make reconnaissance pass prior to landing and search for watercraft/other users	Remote	Catastrophic	Serious			
	Turbidity - subsurface obstructions obscured	Probable	Catastrophic	High	Utilize pilots experienced with local waters; acquire local knowledge if operating away from familiar areas, check with dispatch; emergency landing only in unfamiliar waters	Remote	Catastrophic	Serious			
	River current	Occasional	Critical	Serious	Landing typically into wind and may be up or down stream, dock upstream	Occasional	Marginal	Medium			
	Floating debris	Probable	Catastrophic	High	Be aware not all floating debris may be visible on surface; Increase situational awareness… make reconnaissance pass prior to landing, all flight crew search for hazards	Occasional	Marginal	Medium			

System: FHP Aerial Photography - Environmental (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Airspace	Working within active MTR, MOA, warning areas	Probable	Catastrophic	High	Call ATC/military agency (possibly flight service station, less reliable) to determine "hot" or not, see and avoid, request deconfliction through dispatch	Remote	Catastrophic	Serious			
	Working in proximity to or within FTA/TFR	Probable	Catastrophic	High	Maintain VFR, establish good communication w/air attack, remain outside of FTA/TFR w/out permission, practice see & avoid	Remote	Catastrophic	Serious			
	Working within restricted (military, presidential, nuclear, etc.)	Remote	Catastrophic	Serious	Check TFRs daily, know intercept procedures, Call ATC/ military agency to gain permission, determine if any other activity	Remote	Catastrophic	Serious			
	Grid & altitude is fixed and within high traffic or controlled airspace	Occasional	Catastrophic	High	Comm. w/ATC… pilot & photographer to be extra vigilant in scanning for other aircraft & hazards while flying in a fixed patter (maintain SA, pilot to avoid inordinate focus on following GPS/photographer on operating camera)	Remote	Catastrophic	Serious			
	All B, C, D Class	Frequent	Catastrophic	High	Mission planning, requesting prior permission from controlling tower & conducting mission during minimal traffic times	Remote	Catastrophic	Serious			
	Risk of mid-air IFR altitudes (>18,000')	Occasional	Catastrophic	Serious	Mission planning, IFR flight plan, comm. w/ATC	Remote	Catastrophic	Serious			

System: FHP Aerial Photography - Environmental (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Airstrip Availability, Condition and Services	No alternative or suitable landing location (surface condition, environmental limitations)	Remote	Critical	Medium	Premission planning to maintain options, call ahead to check on runway condition, check NOTAM	Occasional	Negligible	Low			
	No fuel source	Occasional	Negligible	Low	Call ahead to check availability of fuel	Remote	Negligible	Low			
	One-way landing - wind, terrain	Probable	Catastrophic	High	Premission planning for terrain/fixed approach, plan for alternative airports	Remote	Catastrophic	Serious			
	One-way departure - wind, terrain	Probable	Catastrophic	High	Premission planning for terrain/fixed departure, stay on the ground & wait for favorable conditions	Improbable	Catastrophic	Medium			
	No windsock	Occasional	Critical	Serious	Observe ground/water conditions (tree lean, dust, water ripples, etc.)	Remote	Critical	Medium			
	Prevailing wind may not be favorable to landing/departure	Probable	Critical	High	Know prevailing wind premission, use alternate airport	Occasional	Critical	Serious			
Animal activity	Areas of high bird activity (flyways, nesting areas, etc.)	Occasional	Critical	Serious	Some areas are marked on sectional charts, local knowledge of flyways - incorporate in premission planning; see and avoid	Remote	Critical	Medium			
	Survival in hostile wildlife habitat	Remote	Catastrophic	Serious	Stay with the plane, carry appropriate survival equipment for survey area/time of year (pepper spray, fire arm & mitigate carrying such items)	Improbable	Catastrophic	Medium			
	Potential for serious injury/aircraft damage from wildlife on runway (common at remote and county airports)	Occasional	Critical	Serious	Contact ground to clear runway, communicate any observed activity to pilot	Remote	Marginal	Medium			

System: FHP Aerial Photography - Personnel

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Pilot	Minimal local experience	Occasional	Critical	Serious	Manager to brief pilot on project and area to be photographed, frequencies, hazards, refueling sites, etc.	Remote	Critical	Medium			
	LackJurisdictional/boundry awareness	Occasional	Negligible	Low	Premission planning/briefing, utilize digital mapping system information, load backgrounds on portable GPS	Remote	Negligible	Low			
	Unfamiliar with mission type - carded for reconnaissance/photo but no FHP mission-specific flight review	Frequent	Critical	High	Conduct mission-specific flight review/training and utilize FHP flight review checklist as required (applicable to agency-contracted pilots)	Remote	Critical	Medium			
	Unaware of hypoxia effects in event of loss of cabin pressure (whether nonpressurized or pressurized aircraft)	Probable	Critical	High	Recommend hyperbaric chamber training for pilots and crew members/flight managers if program includes high altitude photography	Remote	Critical	Medium			
	Minimal flight hours or experience with mission type (varies annually)	Probable	Critical	High	Thorough preflight briefing to new pilots, utilize FHP flight review checklist as required	Occasional	Critical	Serious			
	Inordinate attention to photo mission rather than flying	Occasional	Critical	Serious	Thorough preflight briefing to new pilots, observer/flight manager let pilot know if becoming a problem	Remote	Critical	Medium			
	Pilots may not have dedication, skills to perform mission or may be "pushed" into uncomfortable situations	Probable	Critical	High	CRM, discuss comfort level and environmental conditions, adjust flight profile accordingly	Remote	Critical	Medium			
	No preflight mission briefing from flight manager (photo area, profile, objectives, aerial hazards)	Occasional	Critical	Serious	Pilot request thorough briefing, manager provides	Remote	Marginal	Medium			
	lack of awareness leading to fuel starvation	Occasional	Critical	Serious	Proper preflight planning, monitor consumption, CRM to include crew observe flight time and fuel gauge; consider fuel totalizer for monitoring consumption & reset when fueling	Remote	Critical	Medium			
	Has not checked for current NOTAM	Remote	Catastrophic	Serious	Proper preflight planning to include checking NOTAMs, CRM to include crew.	Remote	Negligible	Low			

Hazards	Likelihood	Severity	Outcome		Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Incomplete preflight/post flight inspection	Occasional	Critical	Serious	Take the time necessary to evaluate aircraft thoroughly, CRM to include crew in inspection & feel comfortable reporting anomalies	Remote	Marginal	Medium			
Self-medicated (could range from a simple cold to serious health issue)	Occasional	Critical	Serious	All crew to crosscheck how each other is doing, ask if medicated, know FAA regulations pertaining to prescription & over-the-counter medication	Remote	Critical	Medium			
Check list not utilized	Remote	Critical	Medium	Utilize appropriate check lists, CRM to encourage crew ask for check list.	Remote	Negligible	Low			
Accepting unreasonable risk (e.g., fixed photo transect and proximity to rising terrain)	Remote	Catastrophic	Serious	Conduct project-specific risk assessment, job hazard analysis and incorporate into premission briefing	Remote	Critical	Medium			
Incapacitated	Remote	Catastrophic	Serious	Crew/Manager attend pinch hitter	Remote	Critical	Medium			
Under the influence or hung over	Remote	Catastrophic	High	CRM to include awareness of regulations for 8 hours no alcohol, BA < .04 - crew to cancel mission if in question	Improbable	Catastrophic	Medium			
Fatigue, complacency	Probable	Catastrophic	High	10 hours off duty, limit flight day to 8 hrs or less depending on conditions (usually not prudent to push for full 8-hour flight days)	Remote	Critical	Medium			
Shortage of qualified, skilled pilots	Probable	Marginal	Serious	Implement mentoring program	Remote	Marginal	Medium			
Gear up landing	Remote	Critical	Medium	Pilot training including simulation training twice a year and aircraft check ride, utilize checklist & CRM	Remote	Critical	Medium			

System: FHP Aerial Photography - Personnel (cont.)												
		Pre Mitigation				Post Mitigation						
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Photographer (or flight manager)	Minimal experience with aircraft	Occasional	Catastrophic	High	Obtain pilot safety briefing, don't board or egress w/engine(s) running	Remote	Marginal	Medium			
	Minimal experience with mission type	Probable	Marginal	Serious	Utilize Fixed-wing Flight Manager Special-Use Task Books (sections relevant to aerial photography)	Remote	Negligible	Low			
	Fatigue, complacency	Probable	Marginal	Serious	Consider flying less than 8 hour/ day, CRM	Remote	Marginal	Medium			
	Self-medicated (colds to serious health issue)	Occasional	Critical	Medium	All crew to crosscheck how each other is doing, ask if medicated, know FAA regulations pertaining to prescription & over-the-counter medication	Remote	Marginal	Medium			
	Not ensuring pilot checklist used	Occasional	Critical	Medium	Practice CRM, assure checks complete	Remote	Marginal	Medium			
	Accepting unreasonable risk in general (refers to individual's character and state of mind)	Occasional	Critical	Serious	Participate in project-specific risk assessment, job hazard analysis and incorporate into permission briefing	Remote	Negligible	Low			
	Lack of mentoring	Remote	Marginal	Medium	Use experienced photographers, keep them current; train new people that have interest	Remote	Negligible	Low			
	Not obtaining safety briefing	Probable	Negligible	Medium	Photographer/Flight Manager refer to 5 steps to safe flight & request safety briefing from pilot	Remote	Negligible	Low			
	Not using CRM	Remote	Catastrophic	High	Involve pilot or crew (as appropriate) during project-specific risk assessment, job hazard analysis and incorporate into permission briefing	Remote	Marginal	Medium			
	Pressure employees to complete project	Remote	Catastrophic	Serious	Photographer/Flight Manager refer to "5 steps to safe flight" card & request safety briefing from pilot	Remote	Negligible	Low			
	Lack of qualified photographer/flight manager	Occasional	Catastrophic	High	Cancel mission until rectified	Improbable	Negligible	Low			

System: FHP Aerial Photography - Personnel (cont.)												
		Pre Mitigation				Post Mitigation						
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Supervisor/Program Manager	Fatigue, complacency	Probable	Marginal	Serious	Communicate w/FWFMSU, consider requiring employees to fly less than 8-hrs/day, practice CRM to include all aviation personnel	Remote	Marginal	Medium			
	Accepting/promoting unreasonable risk	Probable	Marginal	Serious	Supervise and set tone "aviation program first" - participate in programmatic and project-specific risk assessments, do job hazard analysis and ensure incorporated into permission briefing; FWFMSU communicate with supervisor, FHP supervisors to attend required aviation safety training	Remote	Marginal	Medium			
	Lack of project level knowledge & involvement	Occasional	Critical	Serious	Supervisor briefed during mission planning	Remote	Marginal	Medium			
	Not ensuring subordinates adequately trained on aviation safety/mission tasks	Probable	Critical	High	Supervisor monitor employees training requirements, have training identified on individual training plan (assures subordinates stay current as Flight Manager or other positions as appropriate in FHP IAT Matrix)	Remote	Marginal	Medium			
	Not completing required Supervisor training	Probable	Marginal	Serious	Complete appropriate modules per FHP IAT Matrix and stay current	Remote	Marginal	Medium			
	ABS issues - contributing to long duty day & vendors/pilots not being paid (contract aviation services only)	Remote	Marginal	Medium	Supervisor, program manager/UAO to remain alert for flight managers having trouble using ABS and/or vendors not getting paid; if occurring, potential to affect daily operations and safety... Respond to needs for additional ABS training (contact CO, other FHP COR's or F&AM staff for assistance)	Remote	Negligible	Low			
	Personality conflicts up/down leading to stress and poor communication	Remote	Marginal	Medium	Brief/debrief, CRM, maintain positive attitude, promote honest/open communication	Remote	Negligible	Low			
	General lack of mission understanding (within flight crew, also includes aviation support functions)	Frequent	Critical	High	Ensure agency personnel complete appropriate level of training/task books for position, recommend for states. Have regional program managers interact w/FAO, RAO, RASM, dispatchers, State Foresters, etc to increase understanding of photo operations and awareness	Remote	Marginal	Medium			

System: FHP Aerial Photography - Personnel (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Dispatch	Uninformed or misinformed of Flight Plan	Occasional	Marginal	Medium	FHP UAO disseminate PASP and annual schedule to dispatch centers and FAOs as early as possible; FWFMSU to submit Flight Plan, call dispatch in each area prior to mission, ensure good communication in all areas to be flown	Occasional	Negligible	Low			
	Limited FM capability in photo projects due to distance to centers	Occasional	Critical	Serious	Have and utilize a plan for using phone and AFF systems.	Remote	Marginal	Medium			
	Work load, fatigue, or complacency resulting in missed flight following	Remote	Catastrophic	Serious	FWFMSU coordinate with dispatch centers, consider moving flight following services or project to alternate area if dispatch workload too high	Remote	Marginal	Medium			
	Inconsistent flight following procedures	Probable	Critical	High	FHP UAO clearly identify radio/AFF procedures in PASP, communicate to dispatch, FWFMSU call dispatch daily	Remote	Negligible	Low			
	Frequency congestion	Frequent	Critical	High	Consider utilizing local repeater frequencies to ease congestion, provide alternative frequencies; augment radio use with AFF; or, file FAA flight plan	Remote	Marginal	Medium			
	Inoperability of National Flight Following	Probable	Critical	High	Have and utilize forest net frequencies, submit safecom for outages or areas that should have NFF coverage	Occasional	Critical	Serious			
	Lack of staffing on weekends or outside of flight hours	Occasional	Negligible	Low	Use alternate methods of flight following, request additional staffing, adjust flight hours to accommodate dispatch hours	Remote	Negligible	Low			
	Jurisdictional/boundary awareness and inability to maintain flight following	Occasional	Critical	Serious	Ensure positive radio communication and successful hand-off to neighboring dispatch, close out flight following with previous dispatch area.	Remote	Negligible	Low			

	Hazards	Likelihood	Severity	Outcome		Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
	Frequency guides unavailable or not current	Occasional	Critical	Serious	GACC's to publish current frequency guides on the internet & have links to neighboring GACC frequency guides	Remote	Negligible	Low			
	Not filing flight plan or initiating flight following/closing flight plan	Occasional	Catastrophic	High	FWFMSU or pilot shall initiate and close flight following w/dispatch for each leg of flight.	Remote	Marginal	Medium			
	Poor communication between local dispatch, GACC, NICC regarding flight plan	Occasional	Critical	Serious	When utilizing dispatch flight following, FWFMSU to assure mission specifics are communicated; communicate not only with unit through which order is placed but with local centers where project is planned, USFS and other other agencies as needed - assure appropriate distribution of flight plan; FAA flight following required at a minimum	Remote	Marginal	Medium			
	Unable to adequately communicate aerial hazards	Occasional	Catastrophic	High	Review hazard maps prior to flight (more of a factor for lower altitude photography, King Air frequently operates out of range from aerial hazards)	Remote	Critical	Medium			
	Minimally qualified/new dispatchers	Occasional	Critical	Serious	Develop mentoring program for growing centers or for areas where turn over is anticipated (be proactive, provide OJT to potential recruits)	Remote	Marginal	Medium			
Maintenance Inspector	Insufficient number of inspectors	Occasional	Critical	Serious	Managers to assure enough inspectors to fulfill area needs; hire additional and/or share inspectors across regional boundaries	Remote	Marginal	Medium			
	Not current on AD's	Remote	Catastrophic	Serious	Use FAA website for new AD's, get subscription (CD is available with 28-day updates)	Remote	Marginal	Medium			
	Fatigue, complacency	Remote	Catastrophic	Serious	Utilize other region's/agency inspectors to help workload, provide second set of eyes	Remote	Marginal	Medium			
	Accepting & transferring unreasonable risk to aviation users	Remote	Critical	Medium	UAO's to participate in inspections for the purposes of 1) gaining knowledge about inspections and 2) for raising general awareness to new issues/ideas on aircraft health	Improbable	Marginal	Medium			
Contracting	CO/COR turnover and/or lack of experience	Frequent	Critical	High	Aviation CO developmental positions, mentoring programs, UAOs coordinate with Cos to assure best value	Remote	Marginal	Medium			
	Very short timeframe from advertising to award of aircraft contracts (affects operating season, potentially limits pool of most desirable/most qualified bidders)	Frequent	Critical	High	Determine budget, funds available, and start preparing contracts as early as possible	Remote	Marginal	Medium			
	Stress in planning and completing missions while coordinating product delivery to customers (added complexity due to contracted services - film acquisition, processing, delivery)	Frequent	Critical	High	Aviation CO developmental positions, mentoring programs, aviation specific training, create contract template, FHP UAO's participate in contract development	Remote	Marginal	Medium			

System: FHP Aerial Photography - Personnel (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Oversight & Coordination in General	Lack of mission understanding among some RAOs/RASMs, FAOs, other aviation functions	Remote	Critical	Medium	FHP to be proactive, educate and interact with other aviation staff during annual meetings (national and regional)	Improbable	Negligible	Low			
	Lack of knowledge, use or misuse of SAFECOM system	Occasional	Critical	Serious	Encourage FHP personnel to use system, provide constructive quarterly summaries to field	Improbable	Marginal	Medium			
	Lack of mission understanding among aviation users	Frequent	Critical	High	Ensure agency personnel complete appropriate level of training/task books for position, recommend for states. Have regional program managers interact w/FAO, RAO, RASM, dispatchers, State Foresters, etc to increase awareness.	Remote	Marginal	Medium			
	Aviation Management Plan, PASP not current or non existent (required for agency)	Remote	Catastrophic	Serious	FHP UAOs and Safety Manager (as appropriate) to assure plans are completed and distributed within project areas	Improbable	Negligible	Low			

System: FHP Aerial Photography - Technology (Hardware/Software)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
ABS (if contract aircraft)	Difficulty inputting flight time for payment processing through ABS can cause frustration and long duty days	Occasional	Critical	Serious	Utilize ABS Helpdesk; acquire additional ABS training if necessary; report software problems to be addressed in future ABS versions	Occasional	Negligible	Low			
	Disgruntled pilots/vendors due to process or not being paid (rippling effect on attitudes throught operation)	Probable	Critical	High	FWFMSU work with Pilot and/or CO as necessary to assure prompt payment for services	Occasional	Marginal	Medium			
AFF	False sense of security (not a method for air traffic control)	Occasional	Critical	Serious	Better communication between pilot and dispatch centers, train dispatchers and flight crew on proper use & limitations of AFF, dispatch must time and monitor display at required intervals	Remote	Negligible	Low			
	Flight manager trusting AFF absolutely with minimal voice communication	Occasional	Critical	Serious	Maintain positive radio communication, safety plan & flight plan include protocol for flight following (reference MOB Guide, chapter 20)	Remote	Marginal	Medium			
	Signal interruption due to antenna conflicts with other aircraft antenna	Remote	Critical	Medium	Install and inspect per manufactures recommendation (maintain separation from other antenna)	Remote	Negligible	Low			
	Portable units not secured, could become projectile in event of emergency landing	Remote	Catastrophic	Serious	securely mount portable components in tail section or strap down to floor	Remote	Negligible	Low			

System: FHP Aerial Photography - Technology (Hardware/Software - cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Aircraft GPS	Not having latest software or map updates	Occasional	Critical	Serious	Contract to include GPS specifications and requirement for updates	Occasional	Marginal	Medium			
	Waypoint input errors	Remote	Marginal	Medium	Train pilots on GPS operation, double check waypoints prior to mission	Remote	Negligible	Low			
	Hand-held units not secured, could become projectile in event of emergency landing	Probable	Marginal	Serious	securely mount portable components in tail section or strap down to floor	Remote	Negligible	Low			
Radios	No frequency or repeater available in project area	Occasional	Catastrophic	High	Test frequencies and set up portable repeaters if necessary; communication plan requires backup communication by cell phone or satellite phone if necessary; in federal plans/suggest requiring in state plans	Remote	Catastrophic	Serious			
	No communications (in general) air-to-ground, with other aircraft or dispatch centers	Remote	Marginal	Medium	FAA requires ability to communicate with general aviation aircraft; contracts include necessary radio specifications; communications plan lists frequencies	Remote	Marginal	Medium			
	Inaccessible radios/controls, difficult to operate	Improbable	Marginal	Low	Break from flight pattern to access radio and make adjustments	Improbable	Negligible	Low			
	P-25 Digital, Analog & Narrow Banding compatibility issues	Probable	Marginal	Serious	Identify issues prior to contract and operation, radio check prior to project implementation - address in communication plan; provide time and training on new equipment	Occasional	Marginal	Medium			
	Portable radios - not secure, controls easily bumped	Remote	Marginal	Medium	Secure and properly place portables so as not to interfere with aircraft operations, use keypad/control locks	Occasional	Marginal	Medium			
	Panel mounted radios - bump controls	Improbable	Marginal	Medium	Use keypad/control locks	Improbable	Negligible	Low			
	Flight crew unfamiliar with components	Probable	Marginal	Serious	Preflight to include familiarization & programming radios	Remote	Marginal	Medium			
	Frequency congestion	Occasional	Catastrophic	High	alternate frequency planning	Remote	Marginal	Medium			
	Faulty wiring leading to intermittent operations	Remote	Marginal	Medium	Have portable radio/handheld, users prepared to use alternate frequencies (guard), land and repair or replace aircraft	Remote	Marginal	Medium			
	Inoperability of National Flight Following	Occasional	Negligible	Low	Identify and rectify NFF system failures (computer, satellite and aircraft equipment)	Remote	Negligible	Low			

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System: FHP Aerial Photography - Technology (Hardware/Software - cont.)											
		Pre Mitigation				Post Mitigation					
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
TCAS	If not using TCAS: potential for midair collision	Remote	Catastrophic	High	Use TCAS, continue practice of "see and avoid", apply CRM	Improbable	Catastrophic	Medium			
	If using TCAS: false sense of security that all other aircraft have functioning transponders	Occasional	Catastrophic	High	Recognize that all other aircraft may not have functioning transponders, continue practice of "see and avoid", apply CRM	Remote	Catastrophic	Serious			
	If using TCAS: Signal interference, antenna positioned too close to other antennas	Occasional	Catastrophic	High	Follow manufacturer's installation requirements	Remote	Catastrophic	Serious			
Camera & Associated Equipment	Loose Items	Occasional	Critical	Serious	properly secure loose equipment, brief on hazards	Occasional	Marginal	Medium			
	Electronic failures & diagnosis cause confusion, mission interruption, deviation from flight plan	Occasional	Marginal	Medium	Make equipment checks before flight in the lab and on the ground	Remote	Marginal	Medium			

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System: FHP Aerial Detection Surveys - Aircraft

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Avionics (for radios see "Technology" tab)	Unplanned avionics failures (overheating, faulty wiring, etc.)	Occasional	Marginal	Medium	Have portable radio/handheld as back up, users prepared to use alternate frequencies (guard), land and repair or use alternate aircraft	Remote	Marginal	Medium			
	Loss of emergency locator ability (analog ELT systems will be discontinued)	Remote	Marginal	Medium	Switch to 406 MHz digital ELT systems before February 1, 2009	Improbable	Negligible	Low			
Configuration	Reliability of non-turboprop-powered fixed wing (if used)	Occasional	Critical	Serious	Check into availability of other better performing a/c. Include language in MOU, grant, cooperative agreement for state operations.	Remote	Critical	Medium			
	Selection of inappropriate platform for terrain & objectives - windows, low wing, seating (certain models)	Remote	Critical	Medium	Utilize technical specialists in project design and contract preparation	Remote	Negligible	Low			
Terrorist or malicious activity	Theft or damage to aircraft or gear & equipment (remote, unsecure overnight parking (risk to aircraft, personnel… theft or damage to aircraft/equipment… threat to public safety)	Remote	Catastrophic	Serious	Project Aviation Safety Plan & contract to address security in remote locations, reference local Unit Aviation Plan, use aircraft locking devices	Remote	Critical	Medium			
Performance Standards - mountainous terrain (AIM)	Insufficient Performance (including horsepower, turbo vs. normally aspirated, etc.)	Occasional	Catastrophic	High	Project Aviation Safety Plan & contract to address minimum requirements, reference Airman's Information Manual (AIM) for "mountainous terrain"… carding process doesn't necessarily address FHP performance needs… FHP UAOs remain involved in a/c selection; if concerns, consult regional mtc inspector or subject matter expert	Remote	Critical	Medium			
	High density altitude operations	Probable	Catastrophic	Serious	Match machine to task & environment, monitor weather, reduce load	Remote	Critical	Medium			
	Insufficient payload capabilities	Probable	Catastrophic	High	Perform weight & balance/load calculations, consider multiple observer and overnight gear	Improbable	Critical	Medium			
Performance - low elevation	Increased probability of encountering aerial hazards in areas with minimal topography	Probable	Catastrophic	High	Review current Aeronautical Sectional Charts, aerial hazard maps	Remote	Catastrophic	Serious			

System: FHP Aerial Detection Surveys - Aircraft (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Performance - helicopter	Hover out of ground effect (HOGE)	Remote	Catastrophic	Serious	Maintain forward airspeed, utilize higher performance aircraft, maintain adequate height above canopy	Remote	Critical	Medium			
	Reduced lift due to surface conditions (tall grass, native soil/gravel vs. hard surface like helipad)	Remote	Critical	Medium	Flight manager/observer discuss flight plan and potential landing zones with helicopter manager	Improbable	Marginal	Medium			
	Loss of power	Remote	Catastrophic	Serious	Perform regular power checks	Remote	Critical	Medium			
	Propensity to operate within height-velocity curve (if survey is low and slow)	Remote	Catastrophic	Serious	Maintain forward airspeed, utilize higher performance aircraft, maintain adequate height above canopy	Remote	Critical	Medium			
CWN (agency)	Minimally skilled pilots	Occasional	Catastrophic	High	Address in Contract requirements and with flight reviews.	Remote	Marginal	Medium			
	Incentive to fly for hourly rate, accept more risk	Remote	Catastrophic	Serious	Flight Managers & Project Supervisor need to be involved in flight hour/duty day monitoring.	Remote	Marginal	Medium			
	Aging aircraft (has been a real concern for F&AM's heavy airtankers/heli - likelihood may be more remote for lighter recon. aircraft)	Occasional	Catastrophic	High	(Status: FAA currently defining "aging aircraft", 16 years being considered, more specific mitigations may evolve). Establish more thorough structural inspection program; damage tolerance, maintenance and overhaul standards to address older aircraft operating within FHP mission profile as needed; adhere to original type certificate & maintain manufacturer support (e.g., Rockwell, Aerocommander... original manufacturer Pratt & Whitney not supporting, new manufacturer supporting Beaver); if in doubt about condition, defer use & contact maintenance inspector	Remote	Critical	Medium			
	Tendency to have less crew continuity and familiarity with all involved in mission and mission objectives	Occasional	Marginal	Medium	Conduct thorough premission briefing, document performance issues, select another CWN or agency aircraft; consider exclusive use contracts	Remote	Marginal	Medium			

System: FHP Aerial Detection Surveys - Aircraft (cont.)												
		Pre Mitigation				Post Mitigation						
Sub-systems	**Hazards**	**Likelihood**	**Severity**	**Outcome**	**Mitigation**	**Likelihood**	**Severity**	**Outcome**	**Mitigation Achieved? Yes or No**	**Additional Local Mitigation**	**Post Mitigation Value**
Exclusive Use (agency)	Incentive to fly for hourly rate, accept more risk	Remote	Catastrophic	Serious	Flight Managers & Project Supervisor need to be involved in flight hour/duty day monitoring.	Remote	Marginal	Medium			
	Aging aircraft (has been a real concern for F&AM's heavy airtankers/heli - likelihood may be more remote for lighter recon. aircraft)	Remote	Catastrophic	Serious	(Status: FAA currently defining "aging aircraft", 16 years being considered, more specific mitigations may evolve). Establish more thorough structural inspection program; damage tolerance, maintenance and overhaul standards to address older aircraft operating within FHP mission profile as needed; adhere to original type certificate & maintain manufacturer support (e.g., Rockwell, Aerocommander... original manufacturer Pratt & Whitney not supporting, new manufacturer supporting Beaver); if in doubt about condition, defer use & contact maintenance inspector	Remote	Critical	Medium			
	Committed to unsatisfactory vendor and platform	Remote	Critical	Medium	Specify project objectives in solicitation and contract, conduct thorough premission briefing, document performance issues, terminate for performance and use a different aircraft/vendor	Remote	Negligible	Low			

System: FHP Aerial Detection Surveys - Aircraft (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Cooperating Aircraft particularly state operations not under MOU with FS (could be private, guard, other… may not be P135, and usually not carded)	Minimally skilled for mission	Probable	Catastrophic	High	Recommend states complete Aviation Safety Plans & describe minimum skill level... Also address within MOU, grant or cooperative agreement	Occasional	Critical	Serious			
	State possibility to utilize inappropriate platform	Probable	Catastrophic	High	Recommend states complete Aviation Safety Plans & include preferred make(s)/model(s)... Also address within MOU, grant or cooperative agreement	Occasional	Critical	Serious			
	Uncertain if meeting federal safety standards, no carding or letter of authorization	Probable	Catastrophic	High	Check for pilot and aircraft carding, federal employees will not fly in uncarded aircraft	Remote	Marginal	Medium			
	Relaxed maintenance standards if Part 91 operator	Probable	Catastrophic	High	Federal employees will not fly uncarded, encourage states adopt Part 135 maintenance standards	Occasional	Critical	Serious			
	Aging aircraft (has been a real concern for F&AM's heavy airtankers/heli - likelihood may be more remote for lighter recon. aircraft)	Probable	Catastrophic	High	(Status: FAA currently defining "aging aircraft", 16 years being considered, more specific mitigations may evolve). **Recommend states use pilots and aircraft meeting Part 135 experience and maintenance standards.** Establish more thorough structural inspection program; damage tolerance, maintenance and overhaul standards to address older aircraft operating within FHP mission profile as needed; adhere to original type certificate & maintain manufacturer support (e.g., Rockwell, Aerocommander... original manufacturer Pratt & Whitney not supporting, new manufacturer supporting Beaver); if in doubt about condition defer use; consider agency maintenance inspection in cooperative agreements?	Occasional	Critical	Serious			
	No flight hour/duty day limitation if pilot operating under Part 91	Probable	Catastrophic	High	Recommend states establish limitations similar to agency - state Project Supervisors/observers monitor pilot & crew fatigue, flight hour/duty day	Remote	Marginal	Medium			

System: FHP Aerial Detection Surveys - Aircraft (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
WCF Aircraft	Aging aircraft (has been a real concern for F&AM's heavy airtankers/heli - likelihood may be more remote for lighter recon. aircraft)	Remote	Catastrophic	Serious	(Status: FAA currently defining "aging aircraft", 16 years being considered, more specific mitigations may evolve). Establish more thorough structural inspection program; damage tolerance, maintenance and overhaul standards to address older aircraft operating within FHP mission profile as needed; adhere to original type certificate & maintain manufacturer support (e.g., Rockwell, Aerocommander... original manufacturer Pratt & Whitney not supporting, new manufacturer supporting Beaver); if in doubt about condition, defer use & contact maintenance inspector	Remote	Critical	Medium			
	Agency pilots have tendency to lack experience with mission type, not dedicated to FHP	Probable	Critical	High	Use experienced agency pilots dedicated to FHP program	Remote	Marginal	Medium			
	Minimal availability, necessitating looking to minimally skilled pilots/poor performing aircraft through contracting (increased probability)	Frequent	Catastrophic	High	Hire dedicated pilots and purchase aircraft for FHP and/or carefully address skills/performance through contracts	Remote	Marginal	Medium			
	Identifiable as agency aircraft may encourage vandalism	Remote	Catastrophic	Serious	Use secure airport/tanker base facilities or hanger aircraft, use locking devices.	Remote	Negligible	Low			
Foreign Agency Aircraft	Minimal or no standards for pilot, aircraft, or operations	Occasional	Catastrophic	High	Look for a/c that meet specifications. Familiarization with aircraft, do thorough pre-flight, set up communication/dispatch plan.	Remote	Catastrophic	Serious			

System: FHP Aerial Detection Surveys - Aircraft (cont.)											
		Pre Mitigation				Post Mitigation					
Sub-systems	**Hazards**	**Likelihood**	**Severity**	**Outcome**	**Mitigation**	**Likelihood**	**Severity**	**Outcome**	**Mitigation Achieved? Yes or No**	**Additional Local Mitigation**	**Post Mitigation Value**
Fuel	Bad fuel	Occasional	Critical	Serious	Ensure fuel is tested for type and quality prior to fueling	Remote	Critical	Medium			
	Starvation	Occasional	Catastrophic	High	Monitor quantity pumped during fueling, monitor flight time and distance to services	Remote	Critical	Medium			
Availability of Aircraft (in general)	Tendency to settle for less-than optimal platform/pilot	Occasional	Critical	Serious	Delay project until adequate a/c and or pilot is available	Remote	Negligible	Low			
	Less than enough acceptable aircraft available to project, may be coupled with pressure to perform/sense of urgency to complete (from pilot, flight manager/crew, or upper management), slow progress or aircraft becoming unavailable further threatens completion	Probable	Critical	High	Involve Supervisor, Project Manager & flight Manager in all stages of planning and risk assessment… identify and assign sufficient number of appropriate resources to complete project, schedule conservatively with room for unexpected delays	Remote	Critical	Medium			
	Sharing assets from other regions/areas (pilot unfamiliar w/area, observer unfamiliar w/pilot, aircraft)	Probable	Marginal	Serious	Conduct thorough premission briefing identifying expectation and local hazards, practice CRM	Remote	Marginal	Medium			
	Not sharing assets across regional/area boundaries (adds burden & pressure on the few assets that are available)	Occasional	Critical	Serious	COR's & FWFMSU monitor flight hours, educate Program Managers and Supervisors of inter-regional needs, FHP coordinate more with RAO's.	Remote	Marginal	Medium			
	Tendency to maximize flight hours ("make hay while the sun is shinning")	Probable	Critical	High	Operational risk assessment to address fatigue, consider flying less than 8 hours per day (6 hours is a prudent recommendation)	Remote	Marginal	Medium			
Damaged Aircraft	Utilizing aircraft with any perceived mtc. issue or physical damage	Occasional	Catastrophic	High	Mtc Inspect to return to service, FWFMSU and/or Crew to speak up if uncomfortable with the condition of aircraft, components or instruments	Remote	Catastrophic	Serious			

System: FHP Aerial Detection Surveys - Environmental

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Weather	Inappropriate clothing for "field operation"	Occasional	Critical	Serious	Clothing to improve survivability and footware suitable to hike out of remote areas	Remote	Marginal	Medium			
	Lack of visibility - smoke	Probable	Catastrophic	High	Maintain VFR, establish good communication w/air attack, remain outside of FTA/TFR w/out permission, practice see & avoid	Remote	Catastrophic	Serious			
	High winds	Frequent	Critical	High	Abort mission until more favorable wind conditions	Remote	Marginal	Medium			
	Lack of visibility - fog	Probable	Catastrophic	High	Maintain VFR, continuously monitor conditions, have contingency plans for alternate airports/survey areas, consider utilizing twin engine aircraft in project areas w/strong likelihood of fog during take-off/landings.	Remote	Catastrophic	Serious			
	Extreme weather - thunderstorms	Probable	Critical	High	Abort mission until more favorable weather conditions, obtain weather briefings; always be prepared for rapidly changing conditions and have alternative landing locations	Remote	Marginal	Medium			
	Lack of visibility during IFR take off/landing (twin engine only)	Remote	Catastrophic	Serious	Pilot maintain IFR currency, abort mission until conditions improve.	Remote	Critical	Medium			
	Lack of visibility - eyestrain caused by shadows/glare and/or collision due to loss of day light	Frequent	Catastrophic	High	Time survey for higher sun angles, wear color enhancing sun glasses to reduce eye strain, use CRM and maintain SA	Remote	Critical	Medium			
Topography/Hi Alt	Turbulence	Frequent	Critical	High	Obtain weather briefings, move to alternate location or abort mission until more favorable weather.	Remote	Critical	Medium			
	Terrain - box canyons	Probable	Catastrophic	High	Maintain awareness of altitude above terrain, fly ridges rather than drainage bottoms	Remote	Critical	Medium			
	High Altitude - density alt	Frequent	Critical	High	Obtain weather briefings, review aircraft performance charts and data or abort mission until more favorable weather.	Remote	Critical	Medium			
	Lack of oxygen availability to crew causing hypoxia	Probable	Critical	High	Comply with FAR 135.89 and 135.157, not limited to the following: If more than 30 minutes of operation between 10,000'-12,000', ensure pilot uses oxygen continuously; if more than 30 minutes between 10,000'-15,000', ensure at least 10% of occupants use oxygen; over 15,000' ensure oxygen is used by each occupant (one-hour supply required unless aircraft able to safely descend to 15,000' within four minutes, in which case 30-minute supply is required) or utilize pressurized aircraft	Remote	Marginal	Medium			

System: FHP Aerial Detection Surveys - Environmental (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Remote areas	Lack of fuel availability	Frequent	Critical	High	Ensure mission planning includes fuel resources (call ahead) & ferry distance/time, monitor flight time & distance to fuel location	Remote	Marginal	Medium			
	Oxygen availability to aircraft	Frequent	Marginal	Serious	Ensure mission planning includes oxygen sources (call ahead) & ferry distance/time, monitor flight time & distance to location or if not available, spend less time at high elevations	Remote	Marginal	Medium			
	Using backcountry airstrips	Occasional	Catastrophic	High	Include back country risk assessment in pre-mission planning, check www.fs.fed.us/fire/aviation/av_library/AAD2000.pdf for airstrip category by state, ensure pilot is carded and current for back country mission (mitigated if USFS mission) and that communications are established	Remote	Critical	Medium			
	lack of communications	Probable	Catastrophic	High	Utilize AFF, know and use local repeaters, possibly carry satellite phone and/or handheld emergency GPS transmitter	Remote	Catastrophic	Serious			
	Search and Rescue - delayed response within critical period	Probable	Catastrophic	High	UtilizeAFF, carry aircraft and personal survival gear, handheld radio/know frequencies, satellite phone	Occasional	Critical	Serious			
Pest Signatures	Forcing timing of flights (or operations in general) to meet survey needs rather than safety	Probable	Critical	High	Utilize additional assets to complete survey or prioritize high-interest areas to complete first, it's okay not to finish	Remote	Marginal	Medium			

System: FHP Aerial Detection Surveys - Environmental (cont.)												
		Pre Mitigation				Post Mitigation						
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Water	Amphibious aircraft landing on water with gear down	Occasional	Catastrophic	High	Use pilot check list, confirm gear up	Improbable	Catastrophic	Medium			
	Amphibious aircraft landing on land with gear up	Occasional	Critical	Serious	Use pilot checklist, confirm gear down	Improbable	Catastrophic	Medium			
	Poor depth perception to surface of water during landing	Occasional	Critical	Serious	Be aware during hazy conditions or dead-calm, more difficult to see water surface; Use experienced pilots, scan for water surface irregularities (wind, wake, fish, etc	Remote	Marginal	Medium			
	Ill-equipped beyond glide distance to shore (possible during ferry); applies to both float planes and to planes not equipped with floats operating over large water bodies	Probable	Catastrophic	High	Carry survival/mustang suites for cold water, gain altitude to increase glide distance	Remote	Critical	Medium			
	Difficulty exiting aircraft in water	Probable	Catastrophic	High	Attending water ditching course, consider adding area-specific currency requirement in task book (alternatively, other companies and universities offer)	Remote	Critical	Medium			
	Other watercraft & recreational users	Occasional	Catastrophic	High	Pilot/crew increase SA (watch for fishermen, swimmers, jet skis, canoes, etc. speed boats can become a hazard quickly...), no radio communication with these hazards; make reconnaissance pass prior to landing and search for watercraft/other users	Remote	Catastrophic	Serious			
	Turbidity or subsurface obstructions obscured during landing	Probable	Catastrophic	High	Utilize pilots experienced with local waters; acquire local knowledge if operating away from familiar areas, check with dispatch; recon prior to landing, emergency landing only in unfamiliar waters	Remote	Catastrophic	Serious			
	River current may "grab" aircraft on landing, drift after landing	Occasional	Critical	Serious	Landing typically into wind and may be up or down stream, dock upstream	Occasional	Marginal	Medium			
	Floating debris	Probable	Catastrophic	High	Be aware not all floating debris may be visible on surface; Increase situational awareness… make reconnaissance pass prior to landing, all flight crew search for hazards	Occasional	Marginal	Medium			

System: FHP Aerial Detection Surveys - Environmental (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Airspace	Working within active MTR, MOA, warning areas	Probable	Catastrophic	High	Call ATC/military agency (possibly flight service station, less reliable) to determine "hot" or not, see and avoid, request deconfliction through dispatch	Remote	Catastrophic	Serious			
	Working in proximity to or within FTA/TFR	Probable	Catastrophic	High	Maintain VFR, establish good communication w/air attack, remain outside of FTA/TFR w/out permission, practice see & avoid	Remote	Catastrophic	Serious			
	Working within restricted (military, presidential, nuclear, etc… improbable for survey)	Improbable	Catastrophic	Medium	Check TFRs daily, know intercept procedures, Call ATC/ military agency to gain permission, determine if any other activity.	Improbable	Catastrophic	Medium			
	Lack of coordination leading to conflicts within all Class B, C, D (operations or conflicts less likely in A and G)	Frequent	Catastrophic	High	Mission planning, know your airspace categories, request prior permission from controlling tower & conduct mission during minimal traffic times	Remote	Catastrophic	Serious			
Airstrip Availability, Condition and Services	No alternative or suitable landing location (surface condition, grass, native soil, pavement/concrete)	Occasional	Critical	Serious	Premission planning to maintain options, call ahead to check on runway condition, NOTAM	Occasional	Marginal	Medium			
	No fuel available	Probable	Negligible	Medium	Call ahead to check availability of fuel, always have options	Remote	Negligible	Low			
	One-way landing - wind, terrain	Probable	Catastrophic	High	Premission planning for terrain/fixed approach, plan for alternative airports	Remote	Catastrophic	Serious			
	One-way departure - wind, terrain	Probable	Catastrophic	High	Premission planning for terrain/fixed departure, stay on the ground & wait for favorable conditions	Improbable	Catastrophic	Medium			
	IFR conditions at the airstrip - potential for mid-air or controlled flight into terrain	Occasional	Catastrophic	High	Maintain VFR, delay landing if reasonable, use alternate airstrip or use twin engine aircraft w/IFR rating	Remote	Critical	Medium			
	No windsock	Occasional	Critical	Serious	Observe ground/water conditions (tree lean, dust, water ripples, etc.)	Remote	Critical	Medium			
	Prevailing wind may not be favorable to landing/departure	Probable	Critical	High	Know prevailing wind premission, use alternate airport	Occasional	Critical	Serious			

System: FHP Aerial Detection Surveys - Environmental (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Animal activity	Areas of high bird activity (flyways, nesting areas, etc.)	Occasional	Critical	Serious	Some areas are marked on sectional charts, local knowledge - incorporate in premission planning; see and avoid	Remote	Critical	Medium			
	Survival in hostile wildlife habitat	Remote	Catastrophic	Serious	Stay with the plane, carry appropriate survival equipment for survey area/time of year (pepper spray, fire arm & mitigate carrying such items)	Improbable	Catastrophic	Medium			
	Potential for serious injury/aircraft damage from wildlife on runway (common at remote and county airports)	Occasional	Critical	Serious	Contact ground to clear runway, communicate any observed activity to pilot; plan for possibility of delay, keep sufficient fuel reserve	Remote	Marginal	Medium			
Project over densely populated areas	Emergency landing developed areas (fewer suitable landing areas, increased risk to public safety)	Remote	Catastrophic	Serious	Consider alternative survey methods, increase altitude to improve glide distance to safe landing, complete conjested airspace plan if applicable	Remote	Catastrophic	Serious			

System: FHP Aerial Detection Surveys - Personnel

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Pilot	Minimal local experience	Occasional	Critical	Serious	Manager to brief pilot on project and area to survey, frequencies, hazards, refueling sites, etc.	Remote	Critical	Medium			
	Lack of jurisdictional/boundary awareness	Occasional	Negligible	Low	Premission planning/briefing, utilize digital mapping system information, load backgrounds on portable GPS	Remote	Negligible	Low			
	Carded for reconnaissance but no FHP mission-specific flight review	Frequent	Critical	High	Conduct mission-specific flight review/training (applicable to agency contracted pilots), utilize FHP flight review checklist as required	Remote	Critical	Medium			
	Unaware of hypoxia effects in event of loss of cabin pressure	Probable	Critical	High	Brief on hazard whether using nonpressurized or pressurized aircraft, pressurized may lead to false sens of security - recommend hyperbaric chamber training for pilots and crew members/flight managers if program includes high altitude operations (NOTE: use of pressurized aircraft is listed as mitigation under "Hi Altitude")	Remote	Critical	Medium			
	Minimal flight hours or experience with mission type	Probable	Critical	High	Thorough preflight briefing to new pilots or pilots new to survey, utilize FHP flight review checklist as required; plan and prioritize flight in less challenging terrain before entering more difficult areas	Occasional	Critical	Serious			
	Inordinate attention to survey rather than flying	Probable	Critical	High	Thorough preflight briefing to new pilots, observer/flight manager let pilot know if becoming a problem	Remote	Critical	Medium			
	Pilots may not have dedication, skills to complete mission or may be "pushed" into uncomfortable situations	Occasional	Critical	Serious	CRM, discuss comfort level and environmental conditions, adjust flight profile accordingly or return to base	Remote	Critical	Medium			
	No preflight mission briefing from flight manager (survey area, profile, objectives)	Occasional	Critical	Serious	Pilot request thorough briefing, manager provides	Remote	Marginal	Medium			
	Lack of awareness leading to fuel starvation	Remote	Catastrophic	Serious	Proper preflight planning, monitor consumption, CRM to include crew observe flight time and fuel gauge; consider fuel totalizer for monitoring consumption & reset when fueling	Remote	Critical	Medium			
	Self-medicated (could range from a simple cold to serious health issue)	Occasional	Critical	Serious	All crew to crosscheck how each other is doing, ask if medicated, know FAA regulations pertaining to prescription & over-the-counter medication	Remote	Critical	Medium			

Hazards	Likelihood	Severity	Outcome		Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Incomplete preflight/post flight inspection	Occasional	Critical	Serious	Take the time necessary to evaluate aircraft thoroughly, CRM to include crew in inspection & feel comfortable reporting anomalies	Remote	Marginal	Medium			
Aircraft check lists not utilized (for preflight, run up, & all flight regimes)	Probable	Catastrophic	High	Utilize appropriate check list, CRM to encourage crew ask for check	Remote	Marginal	Medium			
Has not checked for current NOTAM	Occasional	Critical	Serious	Proper preflight planning to include checking NOTAMs, CRM to include crew.	Remote	Negligible	Low			
Accepting unreasonable risk in general (refers to individual's character and state of mind)	Remote	Catastrophic	Serious	Conduct project-specific risk assessment, job hazard analysis and incorporate into premission briefing	Remote	Critical	Medium			
Incapacitated	Remote	Catastrophic	Serious	Crew/Manager attend pinch hitter	Remote	Critical	Medium			
Under the influence or hung over	Remote	Catastrophic	High	CRM to include awareness of regulations for 8 hours no alcohol, BA < .04 - crew to cancel mission if in question	Improbable	Catastrophic	Medium			
Fatigue, complacency	Probable	Catastrophic	High	10 hours off duty, limit flight day to 8 hrs or less depending on conditions (usually not prudent to push for full 8-hour flight days)	Remote	Critical	Medium			
Gear up landing	Remote	Critical	Medium	Pilot training including simulation training twice a year and aircraft check ride, utilize checklist & CRM	Remote	Critical	Medium			

System: FHP Aerial Detection Surveys - Personnel (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Observer (FWFMSU trainee; contract or state employee in non-agency aircraft)	Minimal experience with aircraft	Occasional	Catastrophic	High	Obtain pilot safety briefing, don't board or egress w/engine/s running	Remote	Marginal	Medium			
	Minimal experience with mission type	Probable	Marginal	Serious	Complete Position Task Books	Remote	Negligible	Low			
	Self-medicated (colds to serious health issue)	Occasional	Marginal	Medium	All crew to crosscheck how each other is doing, ask if medicated, know FAA regulations pertaining to prescription & over-the-counter medication	Remote	Marginal	Medium			
	Fatigue, complacency	Probable	Marginal	Serious	Consider flying less than 8-hrs/day, CRM	Remote	Marginal	Medium			
	Accepting unreasonable risk (likely for trainees)	Occasional	Critical	Serious	Participate in project-specific risk assessment, hazard analysis and incorporate into premission briefing, qualified FWFMSU to fly with trainees	Remote	Critical	Medium			
	Not obtaining safety briefing	Remote	Catastrophic	Serious	Observer refer to "5 steps to safe flight" card & request safety briefing from pilot	Remote	Negligible	Low			
	Personality conflicts among crew	Occasional	Critical	Serious	Brief/debrief, CRM, maintain positive attitude, allow for & provide honest feedback	Remote	Critical	Medium			

System: FHP Aerial Detection Surveys - Personnel (cont.)											
		Pre Mitigation				Post Mitigation					
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Flight Manager	Lack of qualified Fixed-wing Flight Manager Special-Use	Occasional	Catastrophic	High	Cancel mission until rectified (FHP FWFM-SU must be current with IAT and have completed task book for the position)	Improbable	Negligible	Low			
	Lack of qualified Helicopter Manager/Special-Use	Occasional	Catastrophic	High	Cancel mission until rectified (there are DRAFT task books for Helicopter Manager Special-Use, these need to be finalized and required)	Improbable	Negligible	Low			
	Self-medicated (colds to serious health issue)	Occasional	Critical	Serious	All crew to crosscheck how each other is doing, ask if medicated, know FAA regulations pertaining to prescription & over-the-counter medication	Remote	Marginal	Medium			
	Fatigue, complacency	Probable	Marginal	Serious	Consider flying less than 8-hrs/day, CRM	Remote	Marginal	Medium			
	Accepting unreasonable risk in general (refers to individual's character and state of mind)	Occasional	Critical	Serious	Participate in project-specific risk assessment, job hazard analysis and incorporate into permission briefing	Remote	Negligible	Low			
	ABS issues - contributing to long duty day & vendors/pilots not being paid (contract aviation services only)	Probable	Marginal	Serious	Supervisor, program manager/UAO to remain alert for flight managers having trouble using ABS and/or vendors not getting paid; if occurring, potential to affect daily operations and safety... Respond to needs for additional ABS training (contact CO, other FHP COR's or F&AM staff for assistance)	Remote	Negligible	Low			
	Managing personality conflicts among crew	Occasional	Critical	Serious	Brief crew before flight... use CRM, maintain positive attitude, promote honest/open feedback… debrief following flight	Remote	Marginal	Medium			
	Not ensuring pilot checklist used	Probable	Critical	High	Practice CRM, FWFMSU assures checks completed	Remote	Marginal	Medium			
	Pressured by/pressuring employees during the mission or to complete the project	Occasional	Critical	Serious	CRM - recognize when doing this & back off, recognize when others do & speak up	Remote	Negligible	Low			

System: FHP Aerial Detection Surveys - Personnel (cont.)											
		Pre Mitigation				Post Mitigation					
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Supervisor/Manager	Fatigue, complacency	Probable	Marginal	Serious	Communicate w/FWFMSU, consider requiring employees to fly less than 8-hrs/day, practice CRM to include all aviation personnel	Remote	Marginal	Medium			
	Accepting/promoting unreasonable risk	Probable	Marginal	Serious	Supervise and set tone "aviation program first" - participate in programmatic and project-specific risk assessments, do job hazard analysis and ensure incorporated into permission briefing; FWFMSU communicate with supervisor, FHP supervisors to attend required aviation safety training	Remote	Marginal	Medium			
	Not ensuring subordinates adequately trained and current on aviation safety and clear on mission tasks	Occasional	Critical	Serious	Supervisor monitor employees training requirements, have training identified on individual training plan (assures subordinates stay current as Flight Manager or other positions as appropriate in FHP IAT Matrix)	Remote	Marginal	Medium			
Training	"Generic" IAT & ACE training for flight managers (as compared to mission-specific training)	Remote	Critical	Medium	ACE training is very good and acceptable, however, AS2M is preferred (at least for initial flight manager qualification) due to AS2M curriculum being more specific to FHP operations and including additional courses that are not offered in any other venue	Remote	Marginal	Medium			
	Lack of mission understanding among aviation users, cooperators, and support staff	Frequent	Critical	High	Ensure agency personnel complete appropriate level of training/task books for position, recommend for states. Have regional program managers interact w/FAO, RAO, RASM, dispatchers, State Foresters, etc to increase awareness	Remote	Marginal	Medium			

System: FHP Aerial Detection Surveys - Personnel (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Dispatch	Inconsistent flight following procedures	Probable	Critical	High	FHP UAO clearly identify radio/AFF procedures in PASP, communicate to dispatch, FWFMSU call dispatch daily	Remote	Negligible	Low			
	Uninformed or misinformed of Flight Plan	Occasional	Marginal	Medium	FHP UAO disseminate PASP and annual schedule to dispatch centers and FAOs as early as possible; FWFMSU to submit Flight Plan, call dispatch in each area prior to mission, ensure good communication in all areas to be flown	Occasional	Negligible	Low			
	Work load, fatigue, complacency resulting in missed flight following at crucial point	Remote	Catastrophic	Serious	FWFM work with dispatch centers, consider moving to alternate area if dispatch workload too high	Remote	Marginal	Medium			
	Surveyor not having local frequencies (frequency management in general)	Occasional	Critical	Serious	Flight Plan and premission briefing to address, get alternate frequencies/tones from dispatch, return to airport until communication is reestablished	Remote	Marginal	Medium			
	Frequency congestion	Frequent	Critical	High	Consider utilizing local repeater frequencies to ease congestion, provide alternative frequencies; augment radio use with AFF	Remote	Marginal	Medium			
	Known aerial hazards not communicated	Occasional	Catastrophic	High	Review hazard maps at dispatch center or request copy of hazard map before mission. FWFM to request updates as to daily activities.	Remote	Critical	Medium			
	Inoperability of National Flight Following	Probable	Critical	High	Have and utilize forest net frequencies, submit safecom for outages or areas that should have NFF coverage	Occasional	Critical	Serious			
	Lack of staffing on weekends or outside of flight hours	Occasional	Negligible	Low	Use alternate methods of flight following, request additional staffing, adjust flight hours to accommodate dispatch hours	Remote	Negligible	Low			
	Jurisdictional/boundary awareness and inability to maintain flight following	Occasional	Critical	Serious	Ensure positive radio communication and successful hand-off to neighboring dispatch, close out flight following with previous dispatch.	Remote	Negligible	Low			
	Frequency guides unavailable or not current	Occasional	Critical	Serious	GACC's to publish current frequency guides on the internet & have links to neighboring GACC frequency guides	Remote	Negligible	Low			
	Not filing flight plan or imitating flight following/closing flight plan	Occasional	Catastrophic	High	FWFMSU or pilot shall initiate and close flight following w/dispatch for each leg of flight.	Remote	Marginal	Medium			

System: FHP Aerial Detection Surveys - Personnel (cont.)											
		Pre Mitigation				Post Mitigation					
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Maintenance Inspector	Not current on AD's	Remote	Catastrophic	Serious	Use FAA website for new AD's, get subscription (CD is available with 28-day updates)	Remote	Marginal	Medium			
	Inspectors do not know what to look at in aging aircraft operating in survey profile	Occasional	Critical	Serious	Develop structural health monitoring program as needed for aircraft operating in survey profile (mountainous, turbulent, frequent maneuvering, high number of cycles)	Remote	Marginal	Medium			
	Insufficient number of inspectors	Occasional	Critical	Serious	Managers to assure enough inspectors to fulfill area needs; hire additional and/or share inspectors across regional boundaries	Remote	Marginal	Medium			
	Fatigue, complacency	Occasional	Critical	Serious	Utilize other region's/agency or AD inspectors to help workload, provide second set of eyes	Remote	Marginal	Medium			
	Accepting & transferring unreasonable risk to aviation users	Remote	Critical	Medium	UAO's to participate in inspections for the purposes of 1) gaining knowledge about inspections and 2) for raising general awareness to new issues/ideas on aircraft health	Improbable	Marginal	Medium			
Oversight & Coordination in General	Lack of mission understanding among aviation users	Frequent	Critical	High	FHP to be proactive, educate and interact with other aviation staff during annual meetings (national and regional)	Improbable	Negligible	Low			
	Lack of knowledge, use or misuse of SAFECOM system	Occasional	Critical	Serious	Encourage FHP personnel to use system, provide constructive quarterly summaries to field	Improbable	Marginal	Medium			
	Aviation Safety Plan, PASP not current or non existent (frequently the case for states)	Frequent	Catastrophic	High	Encourage State aviation to include survey mission in their plans	Occasional	Marginal	Medium			
	Aviation Safety Plan, PASP not current or non existent (required for agency)	Remote	Catastrophic	Serious	UAO's to complete comprehensive & current FHP AMP for their areas, coordinate as needed for consistency through FHP safety manager	Improbable	Negligible	Low			
Contracting	CO/COR turnover and/or lack of experience	Frequent	Critical	High	Aviation CO developmental positions, mentoring programs, UAOs coordinate with COs to assure quality contract & best value/participate in contract development	Remote	Marginal	Medium			
	Stress in planning for all in system	Frequent	Critical	High	Start contract development earlier	Occasional	Critical	Serious			
	Short windows from advertising to award (limits most desirable/most qualified bidders)	Frequent	Critical	High	Determine budget, funds available, and start preparing contracts as early as possible	Remote	Marginal	Medium			

System: FHP Aerial Detection Surveys - Technology (Hardware/Software)											
		Pre Mitigation				Post Mitigation					
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Electronic Payments using Aviation Business System (ABS)	Difficulty inputting flight time for payment processing through ABS can cause frustration and long duty days	Occasional	Critical	Serious	Utilize ABS Helpdesk; acquire additional ABS training if necessary; report software problems to be addressed in future ABS versions	Occasional	Negligible	Low			
	Disgruntled pilots/vendors due to process or not being paid (rippling effect on attitudes throughout operation)	Probable	Critical	High	FWFMSU work with Pilot and/or CO as necessary to assure prompt payment for services	Occasional	Marginal	Medium			
AFF	False sense of security (not a method for air traffic control)	Occasional	Critical	Serious	Better communication between pilot and dispatch centers, train dispatchers and flight crew on proper use & limitations of AFF, dispatch must time and monitor display at required intervals	Remote	Negligible	Low			
	Flight manager trusting AFF absolutely with minimal voice communication	Occasional	Critical	Serious	Maintain positive radio communication, safety plan & flight plan include protocol for flight following (reference MOB Guide, chapter 20)	Remote	Marginal	Medium			
	Signal interruption due to antenna conflicts with other aircraft antenna	Remote	Critical	Medium	Install and inspect per manufactures recommendation (maintain separation from other antenna)	Remote	Negligible	Low			
	Portable units not secured, could become projectile in event of emergency landing	Remote	Catastrophic	Serious	Securely mount portable components in tail section or strap down to floor	Remote	Negligible	Low			
Digital Mapping Systems	Sketchmappers pay more attention to mapping system than flying the mission	Probable	Catastrophic	High	Get familiarity with software updates prior to mission, make sure map groups/backgrounds and projects are created correctly before flight	Remote	Marginal	Medium			
	Lack of training and proficiency leads to operator problems, confusion in the cockpit and one less set of eyes outside the cockpit	Probable	Catastrophic	High	Run flight simulations in the office to be thoroughly familiar with software before mission, be familiar with troubleshooting software problems, test operation of equipment before/do not distract pilot during take-off	Remote	Negligible	Low			
	Loose equipment, cables & wires	Occasional	Catastrophic	High	Preference to use tablet systems with fewer components; secure peripheral equipment & neatly tuck cables and equipment so as not to interfere with aircraft operations and egress; brief on securing any remaining loose equipment in event of emergency landing	Remote	Marginal	Medium			
	Portable antennae	Occasional	Critical	Serious	Check with pilot on preferred location, avoid compromising view out front window	Remote	Negligible	Low			
	Voltage incompatibility with aircraft	Occasional	Critical	Serious	Use voltage tester to confirm aircraft power supply voltage before operating equipment off aircraft power	Remote	Marginal	Medium			

System: FHP Aerial Detection Surveys - Technology (Hardware/Software) (cont.)												
		Pre Mitigation				Post Mitigation						
Sub-systems	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Paper maps	Fumbling with maps, attempting to track position detracts from managing the flight	Occasional	Catastrophic	High	Utilize surveyors that are familiar with local area and/or use the digital mapping system	Remote	Marginal	Medium			
	Lack of training and mapping proficiency leads to confusion and one less set of eyes outside the cockpit	Occasional	Catastrophic	High	Demonstrate proficiency before flight, attend survey workshops, utilize digital mapping system	Remote	Marginal	Medium			
	Difficulty managing both paper sectional maps and paper survey maps, do not have easy access to aeronautical chart information (e.g.. TFR, MTR, MOA, Restricted & other airspace)	Frequent	Catastrophic	High	Preflight briefing to include any airspace issues, utilize digital mapping system to simply toggle from real-time shetchmap base to chart map display	Remote	Marginal	Medium			
Aircraft GPS	Not having latest software or map updates	Occasional	Critical	Serious	Contract to include GPS specifications and requirement for updates	Occasional	Marginal	Medium			
	Waypoint input errors (if using to aid flying grid survey pattern)	Remote	Marginal	Medium	Train pilots on GPS operation, double check waypoints prior to mission	Remote	Negligible	Low			
	Hand-held units not secured, could become projectile in event of emergency landing	Probable	Marginal	Serious	securely mount portable components in tail section or strap down to floor	Remote	Negligible	Low			

System: FHP Aerial Detection Surveys - Technology (Hardware/Software) (cont.)

Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Radios	No frequency or repeater available in project area	Occasional	Catastrophic	High	Test frequencies and set up portable repeaters if necessary; communication plan requires backup communication by cell phone or satellite phone if necessary; in federal plans/suggest requiring in state plans	Remote	Catastrophic	Serious			
	No communications (in general) air-to-ground, with other aircraft or dispatch centers	Remote	Marginal	Medium	FAA requires ability to communicate with general aviation aircraft; contracts include necessary radio specifications; communications plan lists frequencies	Remote	Marginal	Medium			
	Inaccessible radios/controls, difficult to operate	Improbable	Marginal	Low	Break from flight pattern to access radio and make adjustments	Improbable	Negligible	Low			
	P-25 Digital, Analog & Narrow Banding compatibility issues	Probable	Marginal	Serious	Identify issues prior to contract and operation, radio check prior to project implementation - address in communication plan; provide time and training on new equipment	Occasional	Marginal	Medium			
	Portable radios - not secure, controls easily bumped	Remote	Marginal	Medium	Secure and properly place portables so as not to interfere with aircraft operations, use keypad/control locks	Occasional	Marginal	Medium			
	Panel mounted radios - bump controls	Improbable	Marginal	Medium	Use keypad/control locks	Improbable	Negligible	Low			
	Flight crew unfamiliar with components	Probable	Marginal	Serious	Preflight to include familiarization & programming radios	Remote	Marginal	Medium			
	Frequency congestion	Occasional	Catastrophic	High	alternate frequency planning	Remote	Marginal	Medium			
	Faulty wiring leading to intermittent operations	Remote	Marginal	Medium	Have portable radio/handheld, users prepared to use alternate frequencies (guard), land and repair or replace aircraft	Remote	Marginal	Medium			
	Inoperability of National Flight Following	Occasional	Negligible	Low	Identify and rectify NFF system failures (computer, satellite and aircraft equipment)	Remote	Negligible	Low			
TCAS	If not using TCAS: potential for midair collision	Remote	Catastrophic	High	Use TCAS, continue practice of "see and avoid", apply CRM	Improbable	Catastrophic	Medium			
	If using TCAS: false sense of security that all other aircraft have functioning transponders	Occasional	Catastrophic	High	Recognize that all other aircraft may not have functioning transponders, continue practice of "see and avoid", apply CRM	Remote	Catastrophic	Serious			
	If using TCAS: Signal interference, antenna positioned too close to other antennas	Occasional	Catastrophic	High	Follow manufacturer's installation requirements	Remote	Catastrophic	Serious			

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System Safety Assessment - Helicopters

Helicopter System -Aircraft

Sub-System	Hazards	Pre-mitigation Likelihood	Pre-mitigation Severity	Pre-mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Capabilities	High DA will overgross the aircraft	Occasional	Catastrophic	High	Use appropriate aircraft for mission. Conduct thorough pre-mission planning, load calculations, etc. Reinforce HHH Training.	Remote	Catastrophic	Serious			
	AC not appropriate for mission. ICS Typing	Occasional	Critical	Serious	Ensure appropriate aircraft is ordered & utilized. Conduct thorough pre-mission planning, load calculations, etc.	Remote	Critical	Medium			
	Mechanical failure - flight component	Remote	Catastrophic	Serious	Follow IHOG Policy Ch 14 Sched Maint, Pre & Post Flight, etc.	Remote	Catastrophic	Serious			
	Equipment not well maintained & operational	Occasional	Critical	Serious	Follow IHOG Policy Ch 9. Ensure personnel receive adequate basic training.	Occasional	Marginal	Medium			
Visibility	Lack of Hi Vis AC Markings	Occasional	Catastrophic	High	Identify paint schemes that are NOT highly visible & add that to the contract as NOT approved.	Improbable	Catastrophic	Medium			
Inspection	Lack of standardization of Gov't Inspectors	Frequent	Critical	High	Recommend development & implement of Interagency Standardized inspection process. If one Agency does not approve an aircraft or contractor for operation other agencies should follow and accept that decision.	Occasional	Critical	Serious			
	Level of Training for HEMGs on inspection process is inadequate	Frequent	Marginal	Serious	Develop training for HEMGs on MEL, maintenance buzz words (Watch-Outs). Act on opportunity for HEMGs to attend inspections.	Occasional	Marginal	Medium			
Equipment	Personnel not proficient with equipment	Frequent	Marginal	Serious	Inspectors ensure Contractors (Pilots) are adequately trained & skilled with equipment provided. Ensure contract language requires equipment to be commensurate with current technology.	Occasional	Marginal	Medium			
Maintenance	Maintenance in the field	Frequent	Critical	High	Fly aircraft to shop/hanger for maintenance whenever possible. Allow adequate time for mechanics to work in field. Provide light/power/water if possible.	Remote	Critical	Medium			
	Lack of thorough documentation	Occasional	Critical	Serious	Develop training for HEMGs on MEL, maintenance buzz words (Watch-Outs). Enhance awareness through training for HEMGs on when to call MI for assistance with Contractor & maintaining equipment.	Remote	Critical	Medium			
	Poor Communications between all parties (Contractor, GACC,CO, ACO, COR, PI, MI, HEMG)	Frequent	Critical	High	Enhance and integrate tracking of maintenance records AND Contract Evaluations of the a/c over the duration of the contract period in order to recognize issues-CWN & Ex Use. Hire additional Maintenance Inspectors to keep up with this increased workload.	Occasional	Critical	Serious			

Helicopter System - Facilities (permanent and temporary)

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Communications	Lack of adequate base station VHF & FM radios-Not able to adequately communicate to helicopters out working missions/projects with handheld radios.	Occasional	Critical	Serious	Provide all Ex Use crews with mounted FM & AM radios on chase trucks (NOT just handhelds). Utilize Ex Use crews more often on incidents because they have the support equipment. Helibase Commo trailers should be on a National Contract instead of Geographic Area in order to lower cost.	Remote	Critical	Medium			
	Lack of adequate computers-not able to access necessary flight planning, ABS, and weather documents prior to missions.	Frequent	Critical	High	Have Cache computers available for Incident/Unit personnel to check out that are Intranet accessible. These computers should be able to access Internet as well for Weather updates, TFR information, filing of flight plans, completing electronic payment forms, etc. **Ensure ALL Ex Use bases have Internet as well as Intranet access in order to access critical WX, TFR & Flight Planning information.**	Remote	Critical	Medium			
Environment	Haz Mat concerns/spills-Lack of adequate spill prevention/mitigation equipment on site and the knowledge to utilize it.	Frequent	Marginal	Serious	Provide permanent as well as temporary helibases with approved Haz Mat storage facilities/equipment. Solicit for National Contracts to provide portable haz mat storage facilities for Incidents	Remote	Marginal	Medium			
Inspection/Evaluation	Lack of Accountability/Follow Up on Annual/Triennial Helibase Reviews	Probable	Marginal	Serious	Hold Management accountable to conduct follow up and remedy critical issues found in reviews and adhere to interagency and OSHA standards.	Remote	Negligible	Low			
Utilization	Span of Control/Collateral Duties. Personnel are often tasked with multiple duties especially during the emergence of an incident. Focused on Task at hand & not able to provide adequate oversight.	Probable	Catastrophic	High	Ensure existing staffing, supervision and management policies & procedures are met. Place aviation resource needs at higher priority level in the resource ordering process. Need to ensure situation is recognized & ensure additional resources/supervision is ordered. Limit collateral duties in key supervisory positions. If unable to fill key positions operations will be shut down or limit use of aircraft until span of control issues are resolved.	Remote	Catastrophic	Serious			

Helicopter System - Personnel (Government) - (cont.)

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Policy	Operational and mission goals during all-hazard assignments may be unstated or unclear and may conflict with interagency standards and policy	Probable	Critical	High	Adequate in-brief and dissemination of Commander's intent. Clarification of scope of authority & policy in place. Adhere to interagency policy, procedures and guidelines (e.g., IHOG). If unable to perform duties utilizing interagency policy, perform a separate Risk Assessment with appropriate approval sign off. Ensure personnel are working within the scope of their employment. Implementation of Aviation Doctrine may further mitigate conflicts between direction and policy.	Occasional	Critical	Serious			
Training	Unable to bring seasonals on early enough to provide all the required training prior to sending on incidents	Frequent	Critical	High	Ensure line officers are committed to providing adequate time and funding to develop personnel as necessary.	Occasional	Critical	Serious			
	Lack of CRM	Probable	Critical	High	Provide adequate time for training and provide time for Modules to develop CRM prior to field season. Provide training in CRM for Modules annually. Brief/debrief, maintain positive attitude.	Occasional	Critical	Serious			
Human Factors	Fatigue/burnout due to incident duration as well as year round All Risk incident support .	Probable	Critical	High	Adhere to work/rest guidelines. Monitor fatigue levels of crews. Rotate personnel and helicopter programs to manage fatigue and burnout. Manage number and duration of assignments. Ensure adequate time off and provide quality R & R while on assignments.	Occasional	Critical	Serious			
	Acceptance of high risk missions as normal.	Probable	Catastrophic	High	Review risk assessment & existing policy/procedures, brief/debrief with all personnel and utilize risk management tools to include Go-No-Go Checklists. Educate personnel on the hazards of normalization of risk and complacency. Mission decision made at appropriate level. Must have better communication and collaboration between Operations and Aviation.	Remote	Catastrophic	Serious			
	High workload for Maintenance Inspectors may compromise their ability to perform thorough inspections. Standard inspections criteria not followed consistently among agencies or regions.	Probable	Critical	High	Increase amount of personnel available to perform the duties of Maintenance Inspector in proportion with span of control. Ensure inspection standards are developed and maintained by agencies.	Remote	Critical	Medium			
	Conflicting personalities resulting in hazardous attiitudes.	Occasional	Critical	Serious	If individuals cannot professionally resolve differences, managers and supervisors must intervene immediately. Brief/debrief, employ CRM, provide honest and objective feedback, maintain positive attitude. Maintain professionalism and mission focus at all times.	Remote	Critical	Medium			

Helicopter System - Personnel (Contractors)

Sub-System	Hazards	Pre-mitigation Likelihood	Pre-mitigation Severity	Pre-mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Training/Experience	Inadequate/falsification of documentation	Occasional	Catastrophic	High	Adhere to existing contract requirements requiring Contractors to validate pilots' experience and training. Ensure HIPs review pilots' experience records.	Remote	Catastrophic	Serious			
	Lack of training in Firefighting strategy, tactics, terminology, basic ICS, frequency mgmt, etc.	Probable	Critical	High	Establish requirements for documentation of online training to meet basic, minimum level of knowledge for all contracts. Consider pilot academy.	Occasional	Critical	Serious			
	Pilots unfamiliar and not proficient using and programming contract required radio and navigation equipment	Frequent	Marginal	Serious	Inspectors ensure Contractors (Pilots) are adequately trained & skilled in use and programming of avionics equipment. Ensure contract language requires equipment to be commensurate with current technology.	Occasional	Marginal	Medium			
Pilot Experience & Capabilities	Low flight time/experienced pilots	Probable	Critical	High	Develop, implement and support a pilot mentoring program in appropriate contracts. Consider pilot academy.	Occasional	Critical	Serious			
Human Factors	Fatigue	Probable	Critical	High	Managers work with company personnel to ensure adequate rest. Manage missions to be most effective with proper use of pilots & aircraft. Implement Phase Duty Limitations as appropriate.	Remote	Critical	Medium			
	Acceptance of high risk missions as normal.	Probable	Catastrophic	High	Conduct thorough risk assessments & brief/debrief. Pilot and Helicopter Manager train in CRM and work together on mission planning. Mission approval made at appropriate level.	Occasional	Catastrophic	High			
	Low CRM with crew rotations (multiple relief pilots)	Frequent	Critical	High	Ensure there incoming crews are thoroughly briefed. Practice CRM, conduct effective AARs, etc. Enforce contract language regarding relief pilot/personnel changes.	Occasional	Critical	Serious			
	Conflicting personalities	Occasional	Critical	Serious	Brief/debrief, CRM, honest feedback, maintain positive attitude and professionalism. Immediately take action. Notify Contracting Officer/Inspector Pilot. **Don't let problem persist.**	Remote	Critical	Medium			
	Sense of urgency/pressure/mission driven	Probable	Critical	High	Ensure Managers are not placing undue pressure on pilot. Thorough risk assessment & brief/debrief. Pilot training in CRM with the Helicopter Manager. Pilot participate in Mission development. Mission decision made at appropriate level.	Occasional	Critical	Serious			
	Pre-flight/Post-flight inspections not thorough	Occasional	Catastrophic	High	Managers ensure adequate **REVENUE** time for Inspections. Ensure Managers are briefed/trained on the contract & realize that Contractors do get paid for this time. Encourage Pilot/Mechanic to utilize time to complete Inspections.	Remote	Catastrophic	Serious			

Helicopter System - Technology

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Utilization	Lack of standardization of equipment	Frequent	Critical	High	Allow time for the pilot, mechanic, and Helicopter Manager to conduct thorough pre-use familiarization with cockpit layout and avionics equipment.	Remote	Critical	Medium			
	Some pilots do not know how to operate radios, GPS, etc. Managers not familiar with equipment.	Probable	Critical	High	Train all personnel to be proficient in the use of avionics equipment on the helicopter as per contract requirements. Provide computer based or hands-on training for various models of GPS units and radios for helicopter managers.	Remote	Critical	Medium			
Human Factors	Cockpit overload, pilots flying, programming radios/GPS, dropping water, talking on three different radios, etc.	Frequent	Critical	High	Experience, OJT w/experienced supervision (HIP or Chief Pilot), CRM-work with experienced Helicopter Manager. Ensure appropriate levels of aerial supervison are in place. Encourage pilots to speak up when starting to get overloaded. Discuss safety options with the pilot.	Occasional	Critical	Serious			

Helicopter System - Operations

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Missions	Multi tasking-Pilot, Helicopter Manager, Helibase Manager, Helitack Crew personnel, fueler.	Frequent	Critical	High	Ensure existing staffing, supervision and management policies & procedures are met. Order resources early when the need is anticipated. Dispatchers need to recognize aviation staffing is a critical safety priority. Limit collateral duties in key supervisory positions. If unable to fill key positions, operations will be shut down or use of aircraft will be limited until span of control issues are resolved.	Occasional	Critical	Serious			
	Complexity beyond capabilities/experience of available resources	Probable	Critical	High	Disengage, reassess & realign objectives until appropriate level of supervision is present. Conduct risk analysis. Ensure situation is recognized & ensure appropriate supervision/resources are ordered. Provide OJT and conduct frequent simulations of highly complex situations.	Occasional	Critical	Serious			
	Poor Aviation Strategy (poor risk vs. reward, heli-mopping, overuse-are there alternative ways of doing this)	Frequent	Catastrophic	High	Utilize safe and effective strategy & tactics. Involve pilot in mission planning. Conduct thorough risk assessment prior to mission. Brief/debrief. Seek appropriate level of approval for high risk missions, i.e. Helicopter Manager, IC, District Manager, Forest Supervisor, etc. Involve Aviation overhead with operational planning of strategies and tactics for the Appropriate Management Response. Avoid risk/exposure transference.	Remote	Catastrophic	Serious			
	Jurisdiction/Borders-Mid Air collision avoidance	Frequent	Catastrophic	High	Boundary Airspace Plan developed/utilized. Follow FTA procedures. Utilize airspace coordinator. **COMMUNICATE.** Establish TFRs as needed. See & Avoid. Utilization of TCAS. Make AFF a requirement on all aircraft contracts.	Remote	Catastrophic	Serious			
	Low level flight profile-below 500', Special Use (recons, aerial survey, game count, mapping, etc)	Occasional	Catastrophic	High	Conduct thorough risk assessment training. Thorough risk assessment/mission plan/performance planning is completed and signed at the appropriate level. Minimize exposure time. Utilize Part 27 certificated T3 helicopters. Ensure that the appropriate PPE/ALSE is used and that the flight is limited to essential flightcrew members. Ensure aircraft and pilot are carded for the mission. Conduct high level recon prior to working below 500' AGL.	Remote	Catastrophic	Serious			
	PASP/Go-NO-Go Checklist absent or not complete (Policy Deviation)	Occasional	Critical	Serious	Ensure PASP and risk assessment are completed and approved at appropriate level. Ensure Unit Aviation Managers and Forest Aviation Officers are involved in mission planning when necessary. PASP should be used as a briefing tool. Stress that on the "GO/NO-GO" checklist a "NO GO" halts the operation. Ensure that if there are multiple briefings that all information is given at the primary briefing.	Remote	Critical	Medium			

Helicopter System - Operations (cont.)

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Management Decisions	Incident Management Team strategies shift risk from ground operations to aviation operations.	Frequent	Catastrophic	High	Utilize safe and effective strategy & tactics. Involve Pilot in mission planning. Conduct thorough risk assessment prior to mission. Brief/debrief. Acquire appropriate-level approval signatures for high-risk complex missions; i.e. Helicopter Manager, IC, District Manager, Forest Supervisor, etc. Involve Aviation overhead with Operational planning of strategy and tactics for the Appropriate Management Response. Avoid risk/exposure transference.	Remote	Catastrophic	Serious			
Utilization	Inefficient or improper use of Aircraft for the assigned mission (wrong aircraft selected for a mission, flying without tactical/logistical objectives, etc.)	Frequent	Critical	High	Use only an appropriate aircraft for the mission. Conduct thorough pre-mission planning and load calculations. Ensure that tactical/logistical missions have clear, obtainable goals (i.e., Appropriate Aviation Management Response is used). Aircraft assigned should be based on performance and capabilities.	Occasional	Critical	Serious			
Environment	Weather: Poor Visibility/Thunder storms/Hot-High DA/Turbulence	Frequent	Catastrophic	High	Obtain most current/accurate weather reports available. Conduct risk assessment & determine need to conduct mission. Wait until conditions improve. Follow policy on visibility, wind speed, updating load calcs, etc. Utilize part 27 certificated T3 helicopters or better. Establish trigger points to stop operations.	Remote	Catastrophic	Serious			
	Mountainous Terrain	Frequent	Catastrophic	High	Ensure Pilot is trained, experienced & qualified/carded. Non-local flight crews obtain thorough briefing on local conditions before starting operations. Aircraft appropriate for the mission. Performance planning is completed for environmental conditions. Consider dual pilot operations or utilize a mentor pilot for low experience pilots.	Remote	Catastrophic	Serious			
	Urban Interface: Wires, General Aviation Traffic, Major Airport Traffic, Communications, Congestion, High Complexity	Probable	Catastrophic	High	Conduct thorough briefings. Review/establish Interagency agreements. Provide preseason briefing for Media aircrews. Preplan dipsites, staging area, helispots, etc. Update aerial hazard maps. Establish TFRs & issue NOTAMs as appropriate. Require dipsite management. Order/utilize aerial supervision (HLCO). Perform Airspace deconfliction and coordination. Provide frequency and airspace management training. Complexity is managed at appropriate level.	Remote	Catastrophic	Serious			

Helicopter System - Operations (cont.)

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Communications	Lack of Compatibility (Banding/Frequencies)	Probable	Critical	High	Utilize Unified Command. Review/establish interagency agreements to reduce/eliminate compatibility issues. Continue education/training.	Remote	Critical	Medium			
	Frequency management - lack of timely response for Incident Support to obtain additional frequencies.	Probable	Critical	High	Evaluate prior reviews and conduct additional national Interagency reviews of frequency management. Release frequencies back to NICC as soon as they are no longer needed. Encourage Dispatch offices to order additional frequencies early in emerging incidents.	Occasional	Critical	Serious			
	Cockpit overload	Frequent	Critical	High	Encourage pilots to speak up when starting to get overloaded. Discuss safety options with the pilot. Practice division of workload and CRM on incidents and in simulations.	Occasional	Critical	Serious			
	Inadequate briefing	Occasional	Critical	Serious	Stress to Managers & Pilots the need to slow down & ensure adequate briefings. Follow Policy and guidelines, use existing checklists (IHOG, IRPG, etc) as a minimum. Solicate feedback, reiterate information given, use of maps, IAPS, and frequency lists. Ensure AARs are being conducted and documented.	Remote	Critical	Medium			
Training	Lack of training for specialized missions i.e. rehab (Bale dropping, waddle placement), guzzler placement, etc.	Occasional	Critical	Serious	Consider and encourage using End Product Contracts. When end-product is not feasible, develop standardized description of how to sling unusual items. Develop a source list for approved equipment. Utilize PASPs. Utilize subject matter experts. Use "Tech Tips" to share information/procedures.	Remote	Critical	Medium			
	Lack of standardized training with non-Federal cooperators (non-standard terminology, target description, resource capability & limitations)	Probable	Critical	High	Promote joint training with non-Federal cooperators. Ensure thorough briefings are conducted prior to starting operations. Check Incident Qualification cards.	Remote	Critical	Medium			
Human Factors	Lack of Crew Resource Management (CRM)	Probable	Critical	High	Training, Brief/debrief, maintain positive attitude. Promote and attend formalized CRM training for contractors as well as agency employees. Include CRM training/topics at Helicopter Manager Workshops (RT-372). Include CRM as part of the training curriculum for S-372.	Occasional	Critical	Serious			

System Safety Assessment - Rappel

Rappel System - Aircraft

Sub-System	Hazards	Pre-mitigation Likelihood	Pre-mitigation Severity	Pre-mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Adequate Screening/Evaluation	Lack of Standardization	Frequent	Critical	High	Develop National Rappel Standards/Evaluation Board.	Remote	Critical	Medium			
	Aircraft perform near limits of capabilities due to mission, payload, and environment	Occasional	Catastrophic	High	Create national rappel specifications template for Schedule B. Utilize SMEs - Helicopter managers/HOSs/rappel specialists when developing aircraft contract specifications/ modifications	Remote	Catastrophic	Serious			
Performance, Capabilities, Limitations	Operating close to performance limitations of aircraft (weight/balance, DA, height/velocity curve, CG)	Frequent	Catastrophic	High	Strict compliance with flight manual and increased awareness training of aircraft performance for helicopter managers and proper mission planning. Continue using high performace Type 2 Helicopters and Part 27 Type 3 Helicopters.	Remote	Critical	Medium			
	Pilot visibility/vertical & horizontal reference.	Occasional	Critical	Serious	Develop National screening/evaluation process, identify minimum standards for visibility in rappel aircraft	Remote	Critical	Medium			
	Pilot moving from right to left seat to fit mission in Bell medium helicopters.	Occasional	Critical	Serious	Ensure that Schedule B contract language is standardized Nationally for Type 2 Helicopters.	Remote	Critical	Medium			
Equipment	Rappel anchor failure	Remote	Catastrophic	Serious	Ensure anchor is approved with proper & vaild STCs, tested annually, installed correctly, and inspected at manufacturer's recommendations.	Improbable	Catastrophic	Medium			
	Spotter anchor failure	Occasional	Catastrophic	High	Ensure anchor is approved with proper & vaild STCs, tested annually, installed correctly, and inspected at manufacturer's recommendations.	Improbable	Catastrophic	Medium			
	Aircraft modifications improperly installed/false documentation	Remote	Catastrophic	Serious	Thorough maintenance inspections, verification of STC documentation and compliance, increased training for helicopter managers.	Improbable	Catastrophic	Medium			
	ICS communications not available to all rappellers	Occasional	Critical	Serious	National rappel template for Schedule B.	Improbable	Critical	Medium			
Communications	Spotter cannot independently manipulate FM radios from back seat (pilot task saturation)	Occasional	Critical	Serious	Audio panel conveniently available for pilot and spotter to individually manipulate.	Remote	Critical	Medium			

Rappel System - Aircraft (cont.)

Sub-System	Hazards	Pre-mitigation Likelihood	Pre-mitigation Severity	Pre-mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Configuration	Doors off flight; crash survivability	Remote	Catastrophic	Serious	Minimize doors off operation to essential missions only, create doors off checklist for IHOG and IHRG.	Improbable	Catastrophic	Medium			
	Doors off flight; non secured items	Remote	Catastrophic	Serious	Training on proper storage of equipment when flying with doors off. Create doors off checklist for IHOG and IHRG.	Improbable	Catastrophic	Medium			
	External basket security	Remote	Catastrophic	Serious	Assure security of external loads prior to mission.	Improbable	Catastrophic	Medium			
Maintenance	Lack of compliance with AD's, manufacture's inspections	Remote	Catastrophic	Serious	Strict compliance with flight manual, increased awareness training of maintenance requirements and AD's for helicopter managers, spot inspections of aircraft. **Recommend all rappel contract helicopters require a mechanic.**	Improbable	Catastrophic	Medium			
Aircraft Health	Undetected corrosion, stress crack, structural. limited, and/or unknown amount of aircraft health testing and monitoring being performed on current aircraft (fatigue, corrosion, airframe, etc.).	Remote	Catastrophic	Serious	Ensure Maintenance Inspectors are conducting thorough reviews of aircraft maintenance logs	Improbable	Catastrophic	Medium			

Rappel System - Equipment

Sub-System	Hazards	Pre-mitigation Likelihood	Pre-mitigation Severity	Pre-mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Common factors	Misuse/mistreatment	Occasional	Catastrophic	High	Education, supervision for following equipment use standards. When in doubt about equipment's usage, retire it.	Remote	Catastrophic	Serious			
	Use of non-standard equipment	Occasional	Critical	Serious	Maintain current equipment standards for rappel equipment, only utilize approved rappeling equipment, random peer inspections	Remote	Critical	Medium			
	Improper inspections	Occasional	Catastrophic	High	Education, supervision for following equipment inspection standards (IHRG)	Remote	Catastrophic	Serious			
	Improper rigging	Occasional	Catastrophic	High	Proper training. Standardization. Maintain currency, proficiency, checks and balances. Place photos of correct model specific rigging on national rappel website and in IHRG.	Remote	Catastrophic	Serious			
	Inconsistent documentation	Occasional	Critical	Serious	Education, supervision for following equipment documentation standards, random inspections. Utilize rap records database.	Remote	Critical	Medium			
	Not following established procedures/policy	Occasional	Critical	Serious	Peer monitoring, annual base reviews, accountability at all levels for compliance, follow-up of action items. Mandatory attendance of spotters to biennial rappel workshop or rappel academy.	Remote	Critical	Medium			

Rappel System - Equipment (cont.)

Sub-System	Hazards	Pre-mitigation Likelihood	Pre-mitigation Severity	Pre-mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Spotter tether/Gunner strap	Improper adjustment	Occasional	Critical	Serious	Initial set-up of gunner straps and spotter tethers for specific model aircraft, pre-mission check. Post photos of correct adjustments on national rappel website and IHRG.	Remote	Critical	Medium			
Research & Development	Improper use of newly approved equipment or during testing phase.	Occasional	Catastrophic	High	Education, training, documentation, thorough field testing in mutliple platforms and obtain feedback from field users. If one component of the system gets changed, the entire system needs to be re-evaluated.	Remote	Catastrophic	Serious			
Cargo delivery system	No standard configuration	Frequent	Critical	High	Identify and establish model specific configuration and procedures.	Remote	Critical	Medium			
	Use of unapproved containers	Occasional	Marginal	Medium	Supervisors, managers ensure only approved containers are properly utilized. All approved equipment is posted on the MTDC website.	Remote	Marginal	Medium			
	Improper cargo restraint straps/cargo compartment netting (internal only)	Occasional	Critical	Serious	Establish minimum standard for cargo restraint straps and protective netting.	Remote	Critical	Medium			

Rappel System - Operations

Sub-System	Hazards	Pre-mitigation Likelihood	Pre-mitigation Severity	Pre-mitigation Outcome	Mitigation	Post-mitigation Likelihood	Post-mitigation Severity	Post-mitigation Outcome	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Training	Non standard/inconsistent	Frequent	Marginal	Serious	Utilize joint training. Train the trainer to one standard.	Occasional	Marginal	Medium			
Supervision	Not properly qualified for firefighting mission	Remote	Catastrophic	Serious	Ensure Spotter and firefighters adhere to qualifications outilned in the IHRG.	Improbable	Catastrophic	Medium			
	Escape routes and safety zones not identified	Occassional	Catastrophic	High	Ensure Spotter and ALL firefighters have knowledge and location of safety zones, and escape routes prior to fast rope deployment.	Remote	Catastrophic	Serious			

Rappel System - Operations

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Rappel procedure	Non-standard procedures / policy deviation	Occasional	Catastrophic	High	Frequent unscheduled inspections by HOS/check spotter/peers/SME, suspend operations until corrections are made. Violations will result in program suspension. Utilize joint training when practical. Check spotters from other bases and regions will conduct combined training. Attendance of National or Regional Rappel Spotter Workshop is mandatory every two years.	Remote	Catastrophic	Serious			
	Non-standard verbiage, direction, and interaction between spotter and pilot during rappel operations	Frequent	Critical	High	Increase simulation training, mock-ups, and proficiency (especially with relief pilots). Ensure proper briefing for new/relief personnel. Develop Challenge and Response criteria between spotter and pilot. Develop CRM training specific to pilot-spotter relationship to be included in IHRG or 310-1.	Remote	Critical	Medium			
	Deviation from intended mission with limited information	Frequent	Critical	High	Obtain necessary information prior to accepting mission, obtain frequencies, contacts, coordinates, additional aircraft, known hazards, deconflict airspace, follow all FTA procedures. Ensure crew is "re-briefed" on new mission.	Occasional	Critical	Serious			
	Exposure to off site landing	Frequent	Critical	High	Follow standard procedures (high-low recon, power checks, verify load calculations as valid, etc.) Follow risk management process. Site selection needs to be mutually agreed upon by pilot and spotter. Respond to the incident configured to rappel when appropriate.	Occasional	Critical	Serious			

Rappel System - Operations (cont.)

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Rappel site selection	Poor site selection	Occasional	Catastrophic	High	Spotter training, develop national standard Spotter Training Handbook, CRM, depth of fire experience, minimal redcard qualification of single resource boss with ICT4 being preferred.	Remote	Catastrophic	Serious			
External cargo letdown	Rappellers on board helicopter during delivery of cargo which translates to longer exposure to personnel during high power settings in hover	Frequent	Critical	High	Follow standard procedures (high-low recon, power checks, verify load calculations as valid, etc.) Follow risk management process. Site selection needs to be mutually agreed upon by pilot and spotter. Respond to the incident configured to rappel when appropriate.	Occasional	Critical	Serious			
	Overflying highways, major population area, personnel	Occasional	Critical	Serious	Establish and brief on proper flight paths, update maps, see and avoid, find other means for mission	Remote	Critical	Medium			
Internal cargo letdown	Security of Cargo without appropriate or approved hardware	Frequent	Critical	High	Establish minimum standard for cargo restraint straps and protective netting.	Remote	Critical	Medium			
	Exposure to rappellers during internal load operations due to additional weight on board the aircraft and denied living space	Frequent	Critical	High	Consider performing cargo operation seperately. Ensure that method of securing cargo is adequate for the size and weight of the cargo in the event of an accident. When possible secure the cargo outside of the passenger compartment. Limit internal cargo weight. Require DOT approved containers for hazardous materials.	Occasional	Critical	Serious			
Emergency Procedures	Lack of adequate training / Proficiency	Occasional	Critical	Serious	Increase simulation training, utilize tower/elevated platform to increase rappeller / spotter emergency procedure proficiency, develop training which includes pilot, spotter and rappeller. Improve / update spotter/rappeller training syllabus.	Remote	Critical	Medium			
	Non standard verbiage for mission critical / non-critical situations (Emergency vs. Non-Emergency "in hover" during rappel ops)	Occasional	Critical	Serious	Increase simulation training, fund and utilize current simulators at McClellan, develop challenge/response criteria between spotter and pilot	Remote	Critical	Medium			

System Safety Assessment - External Loads

External Load System - Aircraft

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Visibility	Pilot visability, vertical/horizontial reference	Occasional	Critical	Medium	National screening/evaluation process, identify standard for visiability	Remote	Critical	Medium			
	Placement of gauges and warning lights in cockpit does not allow pilot to monitor quickly and easily while looking down at load	Frequent	Catastrophic	High	National screening/evaluation process, identify standard for placement of gauges	Remote	Catastrophic	Serious			
	Pilots inability to see the load due to aircraft design limitations	Occasional	Critical	Serious	Consider modifications to aircraft to improve pilot visibility i.e.; bubble window, floor window. Utilize proper mission planning and aircraft selection for the mission.	Remote	Critical	Medium			
	Pilot moving from right to left seat to fit mission in Bell medium helicopters without shutting down the helicopter.	Remote	Critical	Medium	Enforce contract language regarding shut down before pilot exiting the aircraft.	Improbable	Critical	Medium			
	Location of aircraft controls and switches not consistent, not standardized	Occasional	Critical	Serious	Establish standard configuration in helicopter contracts.	Remote	Critical	Medium			
Doors off flight	In-flight exposure to environmental conditions	Occasional	Marginal	Medium	Provide appropriate clothing for weather conditions for occupants.	Remote	Marginal	Medium			
Aircraft Equipment	Belly hook/remote hook not standardized	Occasional	Marginal	Medium	Familiarize crews with specific equipment. Cargo personnel should be briefed on equipment and aircraft to be used. (i.e. training and cross training on different hook types).	Remote	Marginal	Medium			
	Non-standard ring size	Occasional	Critical	Serious	Ensure rings are compatible with specific helicopter rigging. Reference flight manual, and manufacturer data. Recommend hook placarding identify proper ring sizes.	Remote	Critical	Medium			
	Cargo hook/remote hook failure leading to dropped load or inability to release load	Remote	Critical	Medium	Follow manufacturer's inspection and maintenance procedures. Check for proper operation before every mission.	Improbable	Critical	Medium			
	Failure of electrical connection or electrical disconnect	Frequent	Critical	High	Inspect equipment and check for proper operation before every mission. Research and develop design for new, more reliable electrical connection system.	Occasional	Critical	Serious			

System Safety Assessment - External Loads

External Load System - Aircraft

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Performance, Capabilities, Limitations	Operating outside design limitations of aircraft (weight/balance, DA, Height Velocity Curve)	Probable	Catastrophic	High	Strictly comply with approved flight manual. Increase awareness of aircraft performance by training Helicopter Managers in proper mission planning.	Occasional	Catastrophic	High			
	Pilot visibility/vertical & horizontal reference.	Occasional	Critical	Serious	Develop National screening/evaluation process. Identify minimum standards for visibility in rappel aircraft.	Remote	Critical	Medium			
	Pilot moving from right to left seat to fit mission in Bell medium helicopters.	Occasional	Critical	Serious	Ensure that Schedule B contract language is standardized Nationally for Type 2 Helicopters.	Remote	Critical	Medium			
Aircraft Health	Limited and/or unknown amount of testing and monitoring being preformed on current airframe (fatigue, corrision, etc)	Remote	Catastrophic	Serious	Ensure maintenance inspectors are conducting thorough reviews of aircraft maintainence logs.	Improbable	Catastrophic	Medium			

External Load System - Operations

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Communications	Lack of positive communication due to frequency overload, wrong frequencies	Frequent	Critical	High	Proper mission planning, effective frequency management, and thorough briefing / debriefings, better utilization of Helicopter Coordinators, commo checks prior to departure.	Occasional	Critical	Serious			
	Poor communications from ground to aircraft (background noise)	Frequent	Critical	High	As a minimum, increase the use of available communication cords from handheld radios to flight helmets, or handhelds to headsets. This should be required at all helibases that have a high volume of cargo operations.	Occasional	Critical	Serious			
	Lack of common terminology	Occasional	Marginal	Medium	Utilize IAT website as a training tool (update on-line course if necessary). Stress use of common terminology during training and in briefings.	Remote	Marginal	Medium			
Human Factors	Pilot/agency personnel fatigue	Probable	Catastrophic	High	Prioritize missions, evaluate risk vs. benefits. Consider rescheduling missions, avoid unnecessary flights, utilize optional days off as needed/requested. Promote open & honest communications regarding fatigue levels.	Remote	Catastrophic	Serious			
	Lack of depth perception due to pilot not wearing prescription lenses	Occasional	Catastrophic	High	Brief with pilot on status of vision.	Remote	Catastrophic	Serious			
	Pilot unfamiliar with aircraft	Probable	Critical	High	Utilize pilot check in process. Allow adequate time for pilot transitions. Address with Contractors via the CO.	Occasional	Critical	Serious			
	Pilot unfamiliar with mission	Probable	Critical	High	Conduct proper briefings, encourage incident orientation flight. Utilize Helicopter Coordinators for pilot familiarization. Consider using a second pilot or mentor pilot for orientations.	Occasional	Critical	Serious			
	Ergonomics; aircraft not configured well (bubble window, adjustable seating, etc.)	Occasional	Critical	Serious	Consider using a screening and evaluation board to assess the issue. Use appropriate flight crew and aircraft for the mission.	Remote	Critical	Medium			
	Selection of aircraft inadequate for mission	Occasional	Critical	Serious	Improve education of key personnel on helicopter capabilities and limitations. (i.e. Update on-line IAT courses.) Obtain critical mission information from ground personnel, ATGS, HLCO. Select appropriate aircraft and pilot for mission via risk analysis.	Remote	Critical	Medium			

External Load System - Operations (cont.)

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
In-flight Hazards	Controlled flight into towers, wires, trees, etc. (Aerial hazards) with external load.	Occasional	Catastrophic	High	Post updated hazard map(s), communicate with field personnel/pilots for additional hazard map updates. Always perform high level reconnnaissance before transition to low level operations. Use extreme caution when diverted from intended mission/known flight paths. Utilize Helicopter Coordinators.	Remote	Catastrophic	Serious			
	Other aircraft, congested airspace	Frequent	Catastrophic	High	Perform proper mission planning and utilize see and avoid tactics overcongested areas. Order airspace coordinator earlier. Ensure that TFRs are practical/realistic for the incident, are validated for each operational period, and are adjusted as needed. Require TCAS in all aircraft. Ensure pilots are checking NOTAMs for TFRs. Establish flight routes over incidents. Ensure appropriate level of aerial supervision is in place and there is compliance with FTA protocols. Follow boundary fire protocols/plans. Coordinate early and often with military.	Remote	Catastrophic	Serious			
In-flight Hazards (Cont)	Dropped load in congested area	Remote	Catastrophic	Serious	Utilize updated hazard maps in briefings. Establish flight paths. Helibases and cargo areas should be established in areas to minimize flights over congested areas with external loads. Utilize alternative methods of cargo transport.	Improbable	Catastrophic	Medium			
	Unstable load during flight	Occasional	Catastrophic	High	Improve crew training on load preparation/assembly. Prepare cargo correctly using approved equipment. Consider and use other means of transport when possible (ground, internal cargo). Standardize procedures for recurring missions.	Remote	Catastrophic	Serious			
In-flight Hazards	Overgross load	Occasional	Critical	Serious	Ensure proper mission planning (i.e. proper performance planning, load calculations, manifesting). Improve training through A-219. Utilize load cell.	Remote	Critical	Medium			
	Inappropriate length of line for mission	Probable	Catastrophic	High	Better mission planning, better site assessment, improve training through A-219. Follow IHOG standards for site selection & rotor clearance. Ensure thorough communications from the field/incident to the helibase and from the helicopter to the ground personnel.	Remote	Catastrophic	Serious			
	Poor visibility due to smoke, sun, shadows	Occasional	Critical	Serious	Time missions for optimal visibility, obtain feedback from on-site personnel and pilots regarding conditions, utilize aerial supervision, Stress that sunrise/sunset charts are minimums.	Remote	Critical	Medium			

External Load System - Operations (cont.)

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Ground Hazards	Dragged load	Frequent	Critical	High	Provide for pilot proficiency while on contract, improve the carding process for approving external load operations. Ensure site is adequate. Monitor fatigue.	Occasional	Critical	Serious			
	Personnel too close to drop site	Occasional	Critical	Serious	Provide pilot with ground contact. Improve utilization of Helicopter Coordinators. Provide training for ground personnel to emphasize hazard identification and communication methods.	Remote	Critical	Medium			
	Inexperienced ground personnel	Probable	Critical	High	Check qualifications prior to mission acceptance, provide additional pre-season training (A-219).	Occasional	Critical	Serious			
	Snagged load (net, bucket)	Occasional	Catastrophic	High	Better site evaluation and preparation, trained personnel at site for positive communication with pilot.	Remote	Catastrophic	Serious			
	Rotor wash, falling snags	Occasional	Catastrophic	High	Improve process of site evaluation and preparation. Utilize trained personnel at site for positive communication with pilot.	Remote	Catastrophic	Serious			
	Pilot unfamiliar with dipsite, sling spot	Frequent	Critical	High	Conduct proper pre-mission briefing. Improve utilization of Helicopter Coordinators.	Occasional	Critical	Serious			
	Unsecured load on steep terrain	Occasional	Critical	Serious	Ensure experienced personnel are at the site, develop approved tag line(s) for some equipment (blivet)	Remote	Critical	Medium			
	Cable or line inadvertently placed over skid	Occasional	Catastrophic	High	Mitigation possible through better raining, increasedexperience, and good communications with pilot during preflight checks. Emphasize thorough visual aircraft safety walk around and checks by ground personnel prior to flight.	Remote	Catastrophic	Serious			
	Working in close proximity to hovering helicopter	Frequent	Critical	High	Better site evaluation and preparation, trained personnel at site for positive communication with pilot.	Occasional	Critical	Serious			
	Poor site selection	Occasional	Critical	Serious	Improve utilization of Helicopter Coordinators to assist ground personnel. Don't utilize aircraft if site can't be improved or relocated.	Occasional	Critical	Serious			
Equipment	Component failure resulting in dropped load	Remote	Catastrophic	Serious	Ensure contractor equipment meets requirements under Part 133, agency personnel need to inspect and maintain all rigging equipment.	Remote	Catastrophic	Serious			
	Snorkel snagged on object	Remote	Catastrophic	Serious	Utilize **experienced** dipsite managers whenever possible, encourage managers to approve site, perform high recon. Ensure dip tanks are clean of hardware that may cause snag.	Remote	Critical	Medium			
	Non standard or approved method of securing cargo to steep terrain	Probable	Critical	High	Use approved tag lines for blivets.	Occasional	Critical	Serious			

External Load System - Operations (cont.)

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Training	Inadequate pilot longline proficiency	Frequent	Catastrophic	High	Provide opportunities and funding for pilot proficiency flights while on contract.	Occasional	Catastrophic	High			
	Lack of experience	Frequent	Catastrophic	High	Implement longline training school, contractor mentoring program, use of simulators, etc.	Occasional	Catastrophic	High			
	Pilots with little experience being qualified for external load operations	Frequent	Catastrophic	High	Hold contractors accountable to what is stated in the Vertical Reference Standards located in the national contract. Additional Helicopter Inspector pilots may be needed to ensure contractors meet these standards. Pilot(s) should NOT be issued a card unless these standards are being met.	Remote	Critical	Medium			
Environment	High wind or poor visibility	Occasional	Catastrophic	High	Increase the use of Helicopter Coordinators. Establish trigger points and shut down missions early if necessary. Treat IHOG standards as limits. Limit or stop operations before limits are met or exceeded. Receive briefing on local weather and wind conditions to encourage proactive decision making.	Remote	Catastrophic	Serious			
	Flight routes not identified	Occasional	Catastrophic	High	Improve use of Helicopter Coordinators. Require better maps at Helibases and in IAP's. Allow for input and concurrence from pilots at briefings. Utilize Airspace Coordinators as necessary.	Remote	Catastrophic	Serious			
Hover Hookups	Working in close proximity to hovering helicopter	Frequent	Critical	High	Minimize exposure (only personnel essential to the mission should be in area) Use proper ---- Develop, brief, and utilize emergency egress procedures when working under hovering helicopter.	Occasional	Critical	Serious			
	Damage to aircraft (antenna, bubble)	Remote	Marginal	Medium	Brief personnel on aircraft	Remote	Marginal	Medium			
Emergency Procedures	No **established procedure** for extracting critically injured personnel as an external load with contracted aircraft	Frequent	Catastrophic	High	Develop a standard procedure for extracting critically injured personnel.	Remote	Catastrophic	Serious			

External Load System - Loading

Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome			
Training	Inconsistent training among interagency personnel (exclusive use vs. CWN helitack, handcrew, hotshot, smokejumpers, etc.). Using untrained or unqualified personnel.	Frequent	Critical	High	Fully implement IAT A-219 course. Provide training to appropriate supervisory and key personnel. External load operations should be supervised by trained personnel.	Occasional	Critical	Serious			
	Unfamiliarity with specific aviation BAER projects (rigging, procedures, equipment)	Occasional	Critical	Serious	Utilize experienced helitack personnel to assist with preplanning, mission planning and implementation of project. Provide training specific to new equipment and procedures. Verify that all equipment and procedures are approved. Use SME's when implementing projects.	Remote	Critical	Medium			
	Inconsistent inspections and improper repair of rigging equipment	Occasional	Critical	Serious	Follow manufacturers' maintenance requirements. Post inspection sheets where equipment is stored. Perform pre-use inspection of equipment. Remove any damaged/faulty equipment from use.	Remote	Critical	Medium			
Equipment	Use of unapproved equipment for flying loads that won't fit in a net	Occasional	Critical	Serious	Use only proper and approved equipment for flying external loads. Consider other ways to accomplish the mission and avoid making hasty, poor decisions under pressure to get the job done.	Improbable	Critical	Medium			
	Inability to weigh some cargo items due to size, shape	Probable	Critical	High	Evaluate alternative scales through market research, procure/evaluate new products, and make them available for helicopter cargo operations.	Occasional	Critical	Serious			
Human Factors	Estimating cargo weights	Probable	Critical	High	Provide appropriate scales, allow adequate time to prepare loads for missions. Rely upon standard equipment weight lists. When in doubt overestimate weights. Do not fly loads if weights cannot be adequately determined.	Occasional	Critical	Serious			
	Changing priorities and weights	Probable	Critical	High	Conduct better mission planning. Be flexible for changes and anticipate/plan for most reasonable occurances.	Occasional	Critical	Serious			

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System Safety Assessment - WCF Maintenance								
System: Aircraft Maintenance (In House)								
		Pre Mitigation						
Sub-systems	**Hazards**	**Likelihood**	**Severity**	**Outcome**	**Suggested Mitigation**	**Mitigation Achieved? Yes or No**	**Additional Local Mitigation**	**Post Mitigation Value**
Manuals	Manuals or maintenance instructions which are not current, on hand, or complete could cause use of improper parts and procedures	Remote	Critical	Medium	Incorporate manual updates automatically. Incorporate manual hard copy updates when they are received.			
	Maintenance instructions for added equipment unavailable which could cause the use of improper parts and procedures	Remote	Critical	Medium	Ensure maintenance instructions for additional equipment are incorporated and complete in the aircraft maintenance procedures prior to use			
Records	Record entries which are not accomplished may cause insufficient knowledge of airworthiness	Occasional	Critical	Serious	Ensure maintenance entries are made upon completion of work			
	Record entries which do not sufficiently describe discrepancy or work performed, or illegible, may cause insufficient knowledge of airworthiness	Occasional	Critical	Serious	Ensure entries are complete and legible			
	Aircraft removed from maintenance facility prior to maintenance entries being accomplished into aircraft records could indicate the work was not completed	Occasional	Critical	Serious	Ensure personnel are aware of proper aircraft release procedures from maintenance			
Field Maintenance	Insufficient equipment and tools may cause improper workmanship	Occasional	Catastrophic	High	Ensure proper equipment and tools are available prior to performing work			
	Inhospitable working environment may result in improper workmanship or contamination	Occasional	Catastrophic	High	Change working hours to adjust for more acceptable temperatures. Utilize temporary wind breaks/weather shelters. Some mitigations may not be possible.			
	Lack of technical support can cause improper maintenance procedures	Remote	Critical	Medium	Prearrange support prior to departure from home base.			
	Lack of sufficient personnel could result in injuries and damage to aircraft of equipment	Occasional	Catastrophic	High	Ensure sufficient number of personnel prior to performing work			
	Availability or insufficient parts may result in improvisation or the reuse of used parts	Remote	Catastrophic	Serious	Ensure sufficient quantity of airworthy parts prior to performing work			

System: Aircraft Maintenance (In House - cont.)

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Test Equipment	Specialized test equipment which is not calibrated could cause improper adjustments (torque wrenches, scales, multimeters, etc.)	Remote	Critical	Medium	Verify calibration prior to use. Maintain a list of tools requiring calibration with expiration dates. Assign person to manage tools requiring calibration. Make notation of aircraft inspection checklist to check calibration of tools requiring calibrati			
	Test equipment not available or properly used could result in improper adjustments or calibration of aircraft systems	Remote	Critical	Medium	Ensure test equipment is available and personnel are properly trained on use prior to performing work			
	Test equipment functioning improperly could result in improper adjustments, improper calibration/damage to aircraft systems, or injure personnel	Occasional	Critical	Serious	Take test equipment out of service when it fails. Keep test equipment properly maintained and calibrated. Attach "Red Tag" or "Do Not Use" tag to non-functional equipment			
Special Mission Equipment	Temporary electrical equipment not installed with engineering data or per AC 43-13 could result in damage to aircraft or personnel	Occasional	Critical	Serious	Ensure all equipment installed has proper engineering or acceptable data prior to installation			
	Special mission equipment installed/removed without weight & balance being recalculated can cause the aircraft to be out of center of gravity (CG) limits	Occasional	Critical	Serious	Ensure weight & balance is properly calculated upon completion of removal or installation of special equipment			
	Modifications to special equipment, such as equipment racks, does not have updated engineering data which could damage aircraft and personnel	Occasional	Critical	Serious	Ensure engineering data is updated prior to installation of modified special equipment			

System: Facilities (Hanger)

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Power	Power required for the task could overload existing capacity which may cause a fire and damage to equipment	Remote	Critical	Medium	Increase power capacity of facility.			
	Frayed power cords or cords missing ground pin could cause a fire, injury to personnel, and damage to equipment	Occasional	Critical	Serious	Inspect power cords before use. Replace frayed/damaged power cords. Repair/destroy frayed/damaged power cords.			
	Power cart old/unreliable could cause damage to aircraft and/or personnel	Remote	Catastrophic	Serious	Replace old/unreliable power carts with new.			
Water	High mineral content in water can damage engines and aircraft surfaces when used for cleaning	Remote	Marginal	Medium	Install water conditioning system			
	Standing water can be a slipping hazard causing injuries to personnel	Probable	Marginal	Serious	Ensure proper drainage and remove water from floor prior to work being accomplished.			

System: Facilities (Hanger- cont.)								
		Pre Mitigation						
Sub-systems	Hazards	Likelihood	Severity	Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Tools	Tools not calibrated could cause improper adjustments (torque wrenches, scales, multimeters, etc.)	Occasional	Critical	Serious	Verify calibration prior to use. Maintain a list of tools requiring calibration with expiration dates. Assign person to manage tools requiring calibration. Make notation of aircraft inspection checklist to check calibration of tools requiring calibrati			
	Tools broken, missing pieces, and tools not properly maintained can cause injury to personnel and damage to aircraft and equipment	Occasional	Critical	Serious	Inspect tools before use. Replace damaged/broken tools. Maintain tools in good working condition.			
Ground Support Equipment (GSE)	GSE leaking may cause spill hazards resulting in injuries to personnel and aircraft in addition to damage to aircraft	Occasional	Critical	Serious	Ensure GSE is maintained. Inspect GSE before use and repair/replace as necessary.			
	GSE not being maintained or used improperly may cause personnel injury or damage to aircraft	Remote	Critical	Medium	Ensure GSE is maintained. Inspect GSE before use and repair/replace as necessary. Train personnel on GSE prior to it being used.			
Lighting	Lighting insufficient can create an unsafe working environment leading to damage to aircraft and injuring personnel	Probable	Critical	High	Ensure adequate lighting available.			
	Lighting device not properly installed or maintained can cause injury to personnel or damage equipment	Occasional	Critical	Serious	Ensure all lighting devices are maintained and safe to operate			
Towing Equipment	Aircraft towing capacity of tug exceeded may cause loss of control during towing operations damaging aircraft and possible injury to personnel	Occasional	Critical	Serious	Ensure towing vehicle is proper size for make and model of aircraft and personnel are properly trained in towing procedures.			
	Use of incorrect tow bar may cause loss of control during towing operations and could cause damage to aircraft and equipment and possible injury to personnel	Remote	Critical	Medium	Ensure proper tow bar is used and train personnel in proper towing procedures			
	Ramp conditions not considered during tow operations may cause loss of control during towing operations damaging aircraft and possible injury to personnel	Occasional	Critical	Serious	Inspect ramp for conditions (ice, water, snow and etc) prior to towing operations. Do not tow if adverse conditions are observed.			

System: Maintenance Contracting (contracting WCF Fleet maintenance)

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Facilities	Contractor does not have the correct tools/equipment (i.e. hand tools, GSE, test equipment) for the task which could result in damage to the aircraft and improper maintenance procedures.	Probable	Critical	High	Ensure contract specifies what is required to properly perform maintenance per model aircraft. Conduct site visit on contractor to ensure they have correct and properly maintained tools, GSE, and test equipment.			
	Contractor does not have hanger and/or hanger door to accommodate aircraft being contracted	Occasional	Critical	Serious	Ensure hanger is of proper size for contracted aircraft. Conduct site visit to ensure hanger meets requirements.			
Technical Data (Manuals, ADs, SBs, etc)	No technical data available/out of date/incomplete to properly maintain aircraft which could result in the aircraft's improper maintenance	Probable	Critical	High	Ensure contractor has proper/current technical data for contracted aircraft			
Oversight	Contractor facilities are located at a distant site which causes oversight to be limited due to travel/time constraints	Probable	Critical	High	Issue contracts to only those facilities which are within a reasonable distance (where possible) from oversight personnel's home base.			
	Oversight personnel not available due to time/other duties which may result in improper/incomplete maintenance	Probable	Critical	High	Adjust staffing and budget to meet demands to provide proper oversight of contractors			

System: Safety

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Personnel Protective Equipment	Inadequate hearing protection can cause permeate hearing loss	Occasional	Marginal	Medium	Provide hearing protection (ear plugs and/or ear muffs)			
Medical Equipment	Annual audio testing not being accomplished can result in undetected hearing loss	Frequent	Critical	High	Provide annual audiogram testing			
	Insufficient medical supplies (first aid kit, eye wash station) on hand may result in injuries not being treated In a timely manner	Occasional	Critical	Serious	Provide adequate medical supplies and inspect monthly for serviceability and inventory			
Safecom	Not using the Safecom System reduces awareness of problems in the field	Probable	Critical	High	Identify a standardized procedure for all maintenance personnel to use the Safecomm System			
	Safecomm System does not provide information needed for awareness	Probable	Critical	High	Revise Safecomm System to meet the needs of maintenance			

System: Safety (cont.)

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Policy & Doctrine	The lack of a standardized procedures in using the Safecom System can result in invalid maintenance trending data	Probable	Marginal	Serious	Create standardized Safecom trending procedures. Create a centralized collection point to develop and analyze trend data			
	FSH 5709.16, CH 40 is not kept current so procedures are not standard	Occasional	Marginal	Medium	Assign a person or committee to update and maintain manuals as required			
Communications	The lack of a central bulletin board to relay maintenance issues between regions	Probable	Marginal	Serious	Create a central bulletin board accessible to all FS maintenance personnel. (Intranet based)			
Risk Management	Job Hazard Analysis (JHA) use is not standardized	Frequent	Marginal	Serious	Create standardized JHAs and conduct annual refresher training			
	Non-standard operational risk management (ORM) process is not available	Probable	Marginal	Serious	Develop a standard ORM procedure			
	Material Safety Data Sheets (MSDS) binders are not current which exposed personnel to unknown hazards	Probable	Critical	High	Maintain current MSDS binder along with implementing recommended safety measures. Ensure personnel are properly trained in use of chemicals per MSDS.			

System: Personnel (Government)

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Human Factors	Fatigue	Frequent	Catastrophic	High	Adhere to establish work-rest policy/guidelines and promote additional off-time. Request additional staffing and/or detailers during high fire activity			
	Acceptance of risk as normal	Occasional	Critical	Serious	Emphasize importance of "situational awareness" as a means to recognize risk. Provide human factors and risk management training.			
	Task saturation	Frequent	Critical	High	Prioritize assigned tasks. Request additional staffing, detailers, and/or contractors as needed.			
	Conflicting personalities	Occasional	Marginal	Medium	Bring issues to supervision. Discuss conflict with nemesis. Attend CRM training. Give honest feedback. Keep a positive attitude. Take immediate action.			
	Sense of urgency/pressure/mission driven	Frequent	Critical	High	Special emphasis with personnel in regard to safety vs. urgency and re-enforce this throughout entire operational period			

System: Personnel (Government - cont.)								
		Pre Mitigation						
Sub-systems	Hazards	Likelihood	Severity	Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Policy/ Procedures	Policy deviation causing differences in maintenance procedures which could lead to non-standard maintenance practices	Remote	Critical	Medium	Emphasize the importance of understanding policy and be familiar with consequences of policy deviation			
	Differing standards between regions causing confusing and differences in maintenance procedures	Occasional	Marginal	Medium	Stress standardization between regions to adhere to established policies and procedures. Place all maintenance personnel under a single manager.			
	Policies subject to differing interpretations creating an unclear direction to accomplish the work	Frequent	Marginal	Serious	Create policies which are clear. Have a single person to interpret policy once a question arises which would be disseminated among all involved.			
Utilization	Insufficient personnel to accomplish maintenance in a timely manner which could cause improper maintenance, damage to aircraft and/or injuries to personnel	Occasional	Critical	Serious	Increase staffing to a level where safe maintenance practices occur.			
Training	Aircraft Specific Technical training insufficient or lack of may cause improper maintenance procedures resulting in damage to the aircraft	Occasional	Critical	Serious	Provide aircraft specific training			
	Lack of regulatory training can result in inconsistent application of policy (CFRs, FS regulations, COR, etc)	Occasional	Critical	Serious	Provide regulatory training annually or as mandated			
	Lack of equipment / facilities training (GSE and test equipment) may cause injury to personnel and equipment	Occasional	Critical	Serious	Provide equipment/facilities training annually			

System: Personnel (Contractor)								
		Pre Mitigation						
Sub-systems	Hazards	Likelihood	Severity	Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Human Factors	Fatigue	Frequent	Catastrophic	High	Adhere to established work-rest policy/guidelines and promote additional off-time. Request additional staffing.			
	Acceptance of risk as normal	Occasional	Critical	Serious	Emphasize importance of "situational awareness" as a means to recognize risk. Provide human factors and risk management training.			
	Task saturation	Frequent	Critical	High	Prioritize assigned tasks.Request additional staffing or subcontract work.			
	Conflicting personalities	Occasional	Marginal	Medium	Bring issues to supervision/management. Discuss conflict with nemesis. Attend CRM training. Give honest feedback. Keep a positive attitude. Take immediate action.			
	Sense of urgency/pressure/mission driven	Frequent	Critical	High	Have discussion with contractor and personnel in regard to safety vs. urgency and re-enforce this throughout entire contract operational period			
Policy/contract Procedures and FAA regulations	Policy/contract specification deviation could lead to non-standard maintenance practices	Remote	Critical	Medium	Emphasize the importance of understanding policy/contract requirements and FAA regulations. Be familiar with consequences of deviations			
	Policies/contract specifications and regulations subject to differing interpretations creating an unclear direction to accomplish the work	Frequent	Marginal	Serious	Create policies/contract specifications and regulations which are clear. Have a single person to interpret policy once a question arises which would be disseminated among all involved.			
Utilization	Insufficient personnel to accomplish maintenance in a timely manner which could cause improper maintenance, damage to aircraft and/or injuries to personnel	Occasional	Critical	Serious	Increase staffing to a level where safe maintenance practices occur.			
Training	Aircraft Specific Technical training insufficient or lack of may cause improper maintenance procedures resulting in damage to the aircraft and/or possible injury to personnel	Occasional	Critical	Serious	Provide aircraft specific training			
	Lack of regulatory training can result in inconsistent application of policy (CFRs, FS regulations)	Occasional	Critical	Serious	Provide regulatory training annually			
	Lack of equipment / facilities training (GSE and test equipment) may cause injury to personnel and equipment	Occasional	Critical	Serious	Provide equipment/facilities training annually			

Draft System Safety Assessment - Dry Lease Contracts Maintenance								
System: Contracts								
		Pre Mitigation						
Sub-systems	**Hazards**	**Likelihood**	**Severity**	**Outcome**	**Suggested Mitigation**	**Mitigation Achieved? Yes or No**	**Additional Local Mitigation**	**Post Mitigation Value**
Maintenance Specifications	Experienced maintenance personnel are not being used to evaluate and write the specification in the solicitation. Which can result in improperly altered or un-airworthy aircraft being awarded. This can result in damage to equipment and injury to personnel	Occasional	Probable	High	Ensure experienced maintenance personnel review and help write the maintenance specifications of all contracts.			
	Specifications not writen to hold vendors accountable to comply with federal aviation regulations and the manufactures maintenance recommendations. Which can cause damage to equipment and injury to personnel.	Frequent	Critical	High	Ensure language in contract provides a means to hold the vendor accountable for not complying with Federal Aviation Regulations and Manufactures Recommendations			
	Specifications are not adequate to ensure proper over site for airworthiness. This can result in injury to personnel.	Occasional	Critical	Serious	Ensure contract maintenance specifications are adequate to ensure oversight for quality control by maintenance inspectors.			
Proposal Evaluation	Proposal package technical information not always correct or complete which could result in awarding un-airworthy aircraft. This can result in injury to personnel and damage to equipment.	Frequent	Critical	High	Ensue experienced maintenance personnel are on evaluation team to look for and chatch inproper information.			
	Aircraft specific experienced personnel not always used to evaluate proposals which can result in un-airworthy aircraft	Probable	Critical	High	Ensure maintenance personnel with specific aircraft experience are on evaluation team.			
System: Initial & Recurrent Inspection								
		Pre Mitigation						
Sub-systems	**Hazards**	**Likelihood**	**Severity**	**Outcome**	**Suggested Mitigation**	**Mitigation Achieved? Yes or No**	**Additional Local Mitigation**	**Post Mitigation Value**
Time Available	Hurried time frame to do inspections causes insufficient inspections and items missed. Missed items can cause improper maintenance procedures causing damage to equipment and injury to personnel.	Occasional	Marginal	Medium	Ensure there is enough time to do the inspection properly and with in the inspectors schedule.			

System: Initial & Recurrent Inspection								
		Pre Mitigation						
Sub-systems	Hazards	Likelihood	Severity	Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Facility	Facilities and equipment available are not always adequate to perform a proper inspection where the aircraft is located.This could result in an inadequate inspection. This may cause injury to personnel and damage to aircraft.	Occasional	Marginal	Medium	Ensure the facilities are adequate and proper euipment is availabele or have the aircraft moved to a proper facility.			
	Aircraft are not always inspected at the vendors facility, so their capabilities are overlooked or not evaluated at all. This could lead to improper maintenance peocedures and damage to equipment and injury to personnel.	Frequent	Critical	Serious	Have all pre-use inspections performed at the vendors base facility			
	Some vendors have no in-house maintenance capabilities so the maintenance is performed by a sub-contracted facility which allows no oversight by the gov. inspector for quality or technical capability on specific aircraft. This could lead to improper maintenance which could result in damage to equipment and injury to personnel.	Frequent	Critical	High	Require vendors to have in house maintenance facilities and support or use only Manufaactures Service Centers			
	Current and proper maintenance manuals for specific make, model and s/n aircraft are not always available at inspection site. This can cause improper maintenance pricedures which could cause damage to equipment and injury to personnel.	Frequent	Critical	Serious	Ensure proper manuals are available during inspections			
Records	Copies of the current aircraft maintenance records are not always available with the aircraft which could lead to improper maintenance procedures and items missed on inspection.	Remote	Marginal	Medium	Ensure copies of current maintenance records are available for the inspections			

System: Continuous Maintenance		Pre Mitigation						
Sub-systems	Hazards	Likelihood	Severity	Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Airworthiness Oversight	Contract specifications do not always provide for adequate maintenance oversight during operation under contract	Occasional	Critical	Serious	Ensure Maintenance specifications in contract provide for adequate adequate oversight for quality control during operation period of contract.			
	Vendors are not being held accountable for not complying with the federal aviation regulations, and manufactures recommendations	Frequent	Critical	High				
	Personnel are not always available to provide adequate quality assurance oversight during contract period of operation	Probable	Critical	High	Privide sufficient number of personnel to provide oversight for quality control during operation period of contract.			
Return to Contract Availability	Maintenance inspectors only do a return to contravt availability ony when they are asked and not after the aircraft has had unscheduled maintenance performed	Occasional	Critical	Serious	Provide in contract maintenance specifications for the maintenance inspector to do a return to contract availability after unscheduled maintenance.			

System: Writing Contract Specifications		Pre Mitigation						
Sub-systems	Hazards	Likelihood	Severity	Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Program	Personnel not familiar with aviation maintenance and/or program requirements can cause improper aircraft equipment and maintenance requirements	Occasional	Critical	Serious	Ensure experienced maintenance personnel are involved when writing contract specifications			
Aircraft	FAA approved maintenance programs not being required in contract specifications	Remote	Marginal	Medium	Ensure experienced maintenance personnel are involved when writing contract specifications			
	No specifications for Maintenance records to be maintained in accordance with FAA requirements	Remote	Marginal	Medium	Ensure experienced maintenance personnel are involved when writing contract specifications			
Maintenance Personnel	Specifications for qualified/experienced maintenance personnel are not in all contracts	Frequent	Critical	High	Ensure specifications for qualified and experienced mechanics are written in contracts			
	No duty limitations for maintenance personnel in most contracts which can cause fatigue leading to mistakes being made and causing damage to equipment and injury to personnel.	Probable	Critical	High	Ensure specifications for duty limitations are written in all contracts			

System: Vendor Proposals

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Evaluating	There is not always an aviation maintenance person on the evaluating team resulting in vendors with unapproved maintenance programs and unqualified maintenance personnel being awarded contracts	Occasional	Negligible	Low	Ensure Maintenance personnel are included on evaluation teams			
	Evaluating team not paying close attention to what the proposals are stating, which results in the FS receiving poor or substandard equipment and personnel	Occasional	Negligible	Low	Ensure Qualified Maintenance personnel are included on evaluation teams and are and aware of all the solicitation requirements			

System: Inspection of Aircraft after Award for Contract Compliance

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Aircraft	Aircraft records not maintained in accordance with FAA requirements which can cause improper maintenance procedures due to lack of proper documentation	Remote	Marginal	Medium	Inspector verify records are maintained in accordance with FAA CFR's			
Personnel	Adequate number of trained and experienced maintenance personnel can cause fatigue and injuries to personnel	Remote	Critical	Medium	Inspector verify the training and experience of the maintenance personnel that will be working on the aircraft offered under the contract			
Human Factors	Inadequate number of inspectors to complete work load in time frame required resulting in inadequate inspections	Probable	Critical	High	Provide adequate number of inspectors to accomplish the work load in a timely fashion			
	Fatigue resulting in lack of detail on inspections	Occasional	Critical	Serious	Provide adequate number of inspectors to accomplish the work load in a timely fashion			
	Urgency of mission results in missed items on inspection	Remote	Critical	Medium	Provide sufficient amount of time to accomplish the inspection properly			
	When vendors uses contract maintenance the quality of work is usually a lower standard than when performed in house on owned aircraft	Probable	Critical	High	Ensure more and better oversight of contracted maintenance			

System: Evaluating Vendors Maintenance Facility

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Facilities	Facilities not adequate in size to house aircraft during maintenance can cause inadequate maintenance to be performed	Remote	Marginal	Medium	Inspector verify facility is adequate in size for aircraft offered under the contract			
	Sufficient tools and special equipment to properly maintain aircraft can cause improper maintenance procedures	Remote	Marginal	Medium	Inspector verify vendors specialized tools are available to maintain the aircraft offered under the contract			
	Improper and not current manuals for aircraft offered under contract can cause improper maintenance procedures	Probable	Catastrophic	High	Inspector verifies the vendor has correct and current manuals for the aircraft offered under the contract			
	Sufficient lighting and equipment (heater, janitorial and etc) to maintain a proper work environment can cause inadequate inspections	Remote	Marginal	Medium	Inspector verify condition of work area			
	The vendors sometimes uses special tools that are equivalent to and not what the manufacturer call out in the manual	Remote	Marginal	Medium	Ensure when equivalent tools are used, they meet the minimum performance standard			

System: Evaluating Vendor Maintenance Program

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Instructions for Continued airworthiness	Not incorporating instructions into inspection program causes items on aircraft to not be inspected properly	Occasional	Critical	Serious	Inspector verifies that the ICA's for installed items have been incorporated into the inspection program			
Tracking of time compliance Items	Tracking programs not kept up to date causes time items to be over flown (overhaul times, retirement times and etc) and possible failure of component	Probable	Critical	High	Inspector verifies the latest revision date on the tracking sheet with maintenance record entries			
Manuals	No or partial manuals for specific make, model and serial Number May cause improper maintenance procedures causing damage to equipment and injury to personnel	Remote	Critical	Medium	inspector verify complete set of manuals for specific aircraft offered			
	Out of date manuals may cause improper maintenance procedures causing damage to equipment and injury to personnel	Probable	Catastrophic	High	Inspector verify the latest revisions are installed in manuals for the specific aircraft offered			
Approved Parts	Unapproved parts may cause damage to equipment and/or injury to personnel	Remote	Critical	Medium	Inspector check maintenance records and aircraft for any suspected unapproved parts			
	Improper tracking of time life parts can cause the retirement time to be over-flown and possible failure of part causing damage to aircraft and/or injury to personnel	Remote	Critical	Medium	Inspector verify the tracking records in aircraft maintenance records for tracking of timed components			

System: Evaluating Mechanic Qualifications

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Experience/ Training on make and model	Mechanic **with lack of experience** on make and model could result in improper maintenance procedures and/or damage to aircraft and/or personnel injury	Occasional	Catastrophic	High	Ensure maintenance personnel have the experience and training on the make and model of aircraft offered under the contract.			

System: Personnel (Vendor)

Sub-systems	Hazards	Pre Mitigation Likelihood	Pre Mitigation Severity	Pre Mitigation Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Experience	Mechanic has little experience on make and model aircraft can cause improper maintenance procedures	Occasional	Catastrophic	High	Inspector verify experience level of maintenance personnel on make and model of aircraft provided under contract			
Training	Lack of technical training on make and model aircraft offered under the contract can cause improper maintenance procedures leading to damage to equipment and/or injury to personnel	Occasional	Catastrophic	High	Inspector verify technical training of maintenance personnel on make and model of aircraft provided under contract			
Human Factors	Fatigue and stress can cause errors resulting in damage to equipment and/or injury to personnel	Probable	Critical	High	Ensure contract duty limitations are not exceeded			
	Mission urgency may cause neglect of policy and/or regulations which can cause injury to personnel	Occasional	Marginal	Medium	Ensure sufficient time is provided for proper maintenance procedures			
	Distractions may cause things to be overlooked or procedures forgotten during maintenance	Occasional	Critical	Serious	Ensure as few distractions as possible during maintenance functions			
	Not enough personnel to do maintenance functions properly could cause mechanic to improvise and may cause damage to equipment and/or injury to personnel	Remote	Critical	Medium	Ensure sufficient personnel are provided to accomplish maintenance procedures properly			

System: Personnel (Government)

Sub-systems	Hazards	Pre Mitigation Likelihood	Severity	Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Utilization	Too many duties and not enough personnel to do a proper job	Frequent	Critical	High	Provide sufficient personnel to accomplish work load			
Policy	Not following set policies can cause injury to personnel	Occasional	Catastrophic	High	Ensure policies are followed			
Training	Lack of technical training for specific aircraft may result in lack of thorough inspection of critical areas	Occasional	Marginal	Medium	Provide technical training to inspectors on specific make and model aircraft			
	Lack of knowledge of current regulations, manufacturer requirements may allow improper maintenance procedures resulting in damage to equipment and/or injury to personnel	Occasional	Critical	Serious	Provide training and/or refresher training for inspectors and inspectors should verify requirements as they come due.			
	Lack of knowledge of current aviation contracts of how to read and interpret language and specifications may allow improper maintenance procedures resulting in damage to aircraft and/or injuries to personnel.	Occasional	Critical	Serious	Provide training and/or refresher training for inspectors on reading and interpreting aviation contracts			
Human Factors	Fatigue due to long hours and urgency of getting job accomplished can cause injury to personnel and damage to equipment	Probable	Catastrophic	High	Provided sufficient time to accomplish tasks required in a timely manner			
	High workload for maintenance inspectors may compromise their ability to do a thorough inspection resulting in possible improper maintenance procedures and injuries to personnel and/or damage to equipment	Probable	Critical	High	Provide sufficient personnel and time to accomplish proper inspections			

System: Avionics

Sub-systems	Hazards	Pre Mitigation Likelihood	Severity	Outcome	Suggested Mitigation	Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Human factors	Fatigue due to long hours and urgency of getting job accomplished can cause injury to personnel and damage to equipment	Probable	Negligible	Medium	Provided sufficient time to accomplish tasks required in a timely manner			
	High workload for avionics inspectors may compromise their ability to do a thorough inspection resulting in possible improper maintenance procedures and injuries to personnel and/or damage to equipment	Probable	Negligible	Medium	Provide sufficient personnel and time to accomplish proper inspections			

SMS Assessment and Mitigation

Assessment and Mitigation of:

System-

		Pre Mitigation				Post Mitigation					
Sub-system	Hazards	Likelihood	Severity	Outcome	Mitigation	Likelihood	Severity	Outcome	Mitigation Achieved ?	Additional Local Mitigation	Post Mitigation Value

Final Assessment Value:	**Prepared By:**		**Date:**
Operation Approved by:		**Title:**	**Date:**

Use additional sheets if necessary

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Assessment and Mitigation of:

System-

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