

System: FHP Aerial Application - Aircraft										Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation						
		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, 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 maneuverability 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: <u>observation aircraft</u> 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. <u>Application aircraft</u> 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				

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	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			

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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			

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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											
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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			

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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			

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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			

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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

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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 pre-season, 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			

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	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				

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	Fatigue (air or ground personnel)	Probable	Catastrophic	High	Outline project schedule within the RFP, proposals to address how intended to meet production requirements/assure adequate rest, recommend RFP provide vendor weekly opportunity to specify changes to state or agency 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			

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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				

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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)										Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation						
		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.)										Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-systems	Hazards	Pre Mitigation			Mitigation	Post Mitigation						
		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.)											
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			
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			