

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

#### SEAT System - SEAT 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			
Capabilities	High Density Altitude effects the aircraft quantity/performance	Frequent	Critical	High	Assign appropriate SEAT aircraft for mission and typical DA. Conduct pre-mission performance planning. Reinforce HHH Training. Acquire incident altitude and route 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. Utilize electronic map technology when possible.	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. Pilot performs/ensures that daily pre-flight inspections are complete and that all life/time limit maintenance items are within limits. SEMG ensure pre/post flight inspections completed.	Remote	Critical	Medium			
Collision Avoidance	Smoke/Lighting/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			
	Un-used or inoperable 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,	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.	Remote	Catastrophic	Serious			

SEAT System - SEAT Aircraft (continued)										Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-System	Hazards	Pre-Mitigation			Mitigation	Post-mitigation						
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome				
<b>Aircraft Carding and Pilot Inspection Process</b>	Lack of Standardization	Occasional	Marginal	Medium	Ensure implementation of standardized SEAT aircraft and pilot inspection process. Train inspectors on new standards.	Remote	Marginal	Medium				
<b>Equipment</b>	Not Enough Inspectors to consistently detect unsafe equipment, inadequate skills, etc.	Occasional	Critical	Serious	Train and utilize more Interagency Inspectors (include all agencies) with past SEAT program experience and knowledge.	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				
<b>Communications</b>	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		Provide programming software		
	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				
	No Communications between SEAT pilot and ground/air ops.	Occasional	Catastrophic	High	Follow appropriate checklists and procedures. If no contact can be established on incident return to base.	Occasional	Catastrophic	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. During high fire activity consider ordering stand alone frequency coordinator.	Remote	Critical	Medium				
	Lack of 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										Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-System	Hazards	Pre-Mitigation			Mitigation	Post-mitigation						
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome				
Documentation	Maintenance not tracked well	Occasional	Critical	Serious	SEMG should be proactive during the pre-use inspection. SEMG should proactively seek and document maintenance information when the aircraft and pilot reports for assignment. Vendor needs to share maintenance information as SEAT moves between assignments.	Remote	Critical	Medium				
Responsibilities	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. SEMG/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)										Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation						
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome				
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. Ensure thorough pre-use inspections on all equipment and facilities.	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. Consider ordering qualified Ramp Manager with communications.	Remote	Critical	Medium				
Haz Mat concerns/spills	Lack of adequate spill prevention/mitigation equipment on site and the knowledge to use it.	Frequent	Marginal	Serious	Provide SEAT base operations (both government/vendor) with approved Haz Mat storage and containment facilities/equipment. Solicit for National Contracts to provide portable haz mat storage facilities for incidents. Provide hands on training.	Remote	Marginal	Medium				

SEAT System - SEAT Contracts			Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-System	Hazards	Likelihood	Severity	Outcome	Likelihood		Severity	Outcome				
On-Call vs. Variable Term	Lack of Continuity, Efficiency, Proficiency, 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. Both Government and Vendor should secure adequate funding to provide training and simualtions.	Remote	Critical	Medium				

SEAT System - Personnel (Government)			Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-System	Hazards	Likelihood	Severity	Outcome	Likelihood		Severity	Outcome				
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. Comply with ISOG.	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. SEMG notifies local UAO of any maintenance issues.	Remote	Marginal	Medium				
Training	Lack of knowledge and experience in Aviation Contract Administration and Aviation Program Management for SEAT Manager Trainees.	Frequent	Marginal	Medium	Recommend SEAT Manager attend aviation contract administration course. Also highly recommend a season of wildland fire line experience.	Remote	Marginal	Medium				
	Lack of knowledge and experience in ramp operations	Frequent	Critical	High	Develop standardized ramp management training for SEAT managers.	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. Ensure adequate facilities and supplies are available.	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. Ensure SEAT Manager reviews Risk Management Workbook with the vendor.	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 continued)										Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation						
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome				
Human Factors (continued)	Conflicting personalities resulting in hazardous attitudes	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				
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.	Remote	Critical	Medium				
Policy/ Procedure	Policy Deviation	Occasional	Marginal	Medium	Re-enforce and emphasize to SEMGs to communicate with local UAO, 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 those bases using agency personnel for loading operations 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)										Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation						
		Likelihood	Severity	Outcome		Likelihood	Severity	Outcome				
Human Factors	Ground support personnel fatigue and workload	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. Monitor number of aircraft being loaded and additional workload.	Remote	Critical	Medium				

SEAT System-Personnel (Contractor)											
Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
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Human Factors (continued)	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. All personnel involved in operations should recognize hazardous situations or behavior. Communicate issues or concerns.	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. Review Risk Management Workbook and/or Vendor SMS Manual on a regular basis.	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 personnel.	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 AAR's, sand table exercises and on ground CRM Exercises. Incorporate Operations personnel in simulations and exercises, as well as AAR's.	Occasional	Critical	Serious			
	Conflicting and/or Difficult Personalities	Probable	Critical	High	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.	Occasional	Critical	Serious			
Pilot Training and Experience	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. Develop the McClellan training center for fire environment and make available for vendor use. Other training includes aircraft performance and limitations.	Occasional	Catastrophic	Serious			
	High number of target fixation and tactical maneuvering errors.	Probable	Catastrophic	High	Company training plans should address human factors including target fixation, situational awareness, task overload, and performance/tactical planning errors.	Occasional	Critical	Serious			
	Inadequate flight experience	Occasional	Catastrophic	High	Adhere to existing contract requirements requiring contractors to validate pilots' experience and training.	Remote	Catastrophic	Serious			
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 continued)											
Sub-System	Hazards	Pre-mitigation			Mitigation	Post-mitigation			Mitigation Achieved? Yes or No	Additional Local Mitigation	Post Mitigation Value
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New Technology	Lack of familiarity with technology, inability to utilize and operate equipment.	Occasional	Critical	Serious	Take a stronger approach with all Vendor personnel 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.	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 and manufacturers to ensure aviation needs are addressed.	Occasional	Critical	Serious			
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			
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 SOP's 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	Maintain 60 ft. obstacle clearance as the minimum decent altitude for all fire operations except during takeoff and landing.	Remote	Catastrophic	Serious			

SEAT System - SEAT Operations (continued)											
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			
Mission (continued)	Poor fuel management	Remote	Catastrophic	Serious	Monitor fuel quantities. Monitor fuel flow vs time. 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			
	Single Pilot cockpit workload	Occasional	Catastrophic	Serious	Maintain sterile cockpit policy, minimize in-flight diversions and frequency changes.	Remote	Critical	Medium			
	Wake Turbulence	Occasional	Critical	Serious	Exercise "CAUTION" when in congested airspace or in trail.	Remote	Critical	Medium			
	Lack of standardized dispatch form	Probable	Critical	High	Implement utilization of National standard Aircraft Dispatch Form.	Remote	Critical	Medium			
	Ramp/Taxi operations and communications	Frequent	Critical	Serious	Establish local ramp/taxi protocols in cooperation with local airport operations. Ensure thorough in-briefing and monitor assigned ramp frequency.	Remote	Critical	Medium			
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. Utilize updated electronic equipment if possible. 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 resources are available. Utilize updated electronic equipment if possible. Confirm that red-flag warnings are distributed. Ensure there are continual updates on changing weather conditions shared between pilots, air base managers, 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. Utilize electronic map technology if possible.	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			



**SEAT System - SEAT Operations (continued)**

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 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. Utilize AFF when possible.	Occasional	Critical	Serious			
	Inadequate clarification of Chain of Command-Who is in charge.	Occasional	Critical	Serious	Validate tactical (A-G & A-A) contacts identified on the Aircraft Dispatch form. Ensure the pilot has a copy and validate frequencies.	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 (National standard) 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. Monitor AFF if possible.	Remote	Critical	Medium			