

Table 1 - Rappel, Personnel System

Personnel System												
Sub-System	ID	Hazards	Probability	Severity	Rating	ID	Mitigation	Probability	Severity	Rating	Mitigation Comments and References	
Pilot	PR1	Inadequately trained and unqualified for the mission.	Possible	Critical	High	PR1M1	Interagency Helicopter Pilot Practical Test Standards (IHPPTS) are officially established and referenced in the Forest Service Standards for Rappel Operations (FSSFR0).	Rare	Critical	Medium	HSS MATOC Exhibit 2, FSSFR0 Chapter 3	
						PR1M2	Ensure the Pilots meet and follow the standards. Pilot carding verified by HMGB/Spotter.	Rare	Critical	Medium	FSSFR0 Chapter 3	
						PR1M4	Ensure compliance with standardized training.	Rare	Critical	Medium	FSSFR0 Chapter 3	
	PR1.1	Not proficient in the Rappel mission.	Possible	Moderate	Medium	PR1.1M1	Provide opportunity for currency and identify proficiency protocols.	Rare	Moderate	Low	FSSFR0 Chapter 3	
						PR1.1M2	Ensure compliance with established proficiency requirements as outlined in the FSSFR0.	Rare	Moderate	Low	FSSFR0 Chapter 3	
						PR1.1M3	Use contract specs to ensure the appropriate number of carded rappel Pilots.	Rare	Moderate	Low	HSS MATOC Exhibit 2	
						PR1.1M4	Ensure the Rappel Spotter has the authority to stop the operation before the mission flight can occur if the Pilot is not properly carded or proficient.	Rare	Moderate	Low	HSS MATOC, FSSFR0 Chapter 3, CRM Training	
	PR1.2	Not fit or prepared for duty.	Possible	Moderate	Medium	PR1.2M1	Ensure the Spotter's authority to stop the operation at any point before flight or during the mission flight before rappel operations if the person considers the Pilot not fit or prepared for the mission, is understood and respected.	Rare	Moderate	Low	CRM, NSHO, HSS MATOC, GAR	
						PR1.2M2	Spotter / HMGB and Pilot ensure adherence to Pilot duty limitations.	Unlikely	Moderate	Low	NSHO, HHS MATOC	
						PR1.2M3	Use the initial pre-operational briefing and GAR to establish expectations and position CRM by the Spotter, Pilot, and Crew.	Unlikely	Moderate	Low	FSSFR0 Appendix O	
	PR1.3	Overly aggressive tendencies and flying techniques by the Pilot.	Possible	Critical	High	PR1.3M1	Use the initial pre-use briefing to establish expectations and positive CRM management by the Rappel Spotter, HMGB and Pilot.	Unlikely	Critical	Medium	FSSFR0 Appendix O	
						PR1.3M2	Ensure the Spotter's authority to stop the operation at any point before the flight or during the mission flight. Before rappel operations if the spotter considers the Pilot not fit or prepared for the mission, the spotters decision will be respected and understood.	Rare	Critical	Medium	CRM Training	
	PR1.4	Flying rappel mission in congested airspace	Possible	Critical	High	PR1.4M3	CRM will be emphasized and delegation of non flight related duties shared with rappel spotter. Ensure communication with ATGS or other air resources is established prior to beginning rappel operations. Adherence to fire traffic area (FTA) rules.	Rare	Critical	Medium	CRM Training.	
	PR1.5	Pilots not communicating safety concerns.	Unlikely	Moderate	Low	PR1.5M1	Spotters and crew establish open communication with the Pilot to develop mission specific rapport and use CRM.	Rare	Moderate	Low	CRM Training	
						PR1.5M2	Seek and encourage feedback during the GAR process, After Action Review (AAR) and debriefings.	Rare	Moderate	Low	FSSFR0 Appendix G	
	Spotter and Rappel Personnel	PR2	Rappel Spotters not qualified in the rappel mission.	Possible	Critical	High	PR2M1	Utilize the Spotter Task Sheet when training Spotters.	Rare	Critical	Medium	FSSFR0 Appendix B
							PR2M2	Adhere to the FSSFR0 currency and performance standards for Rappel Spotters.	Rare	Critical	Medium	FSSFR0 Chapter 3
PR2.1		Rappeler not qualified in the Rappel mission.	Possible	Critical	High	PR2.1M1	Utilize the Initial Rappeller Training Syllabus and Initial Certification Record	Unlikely	Critical	Medium	FSSFR0 Appendix A & C	
						PR2.1M2	Adhere to the FSSFR0 currency and performance standards for Rappellers.	Unlikely	Critical	Medium	FSSFR0 Chapter 3	
PR2.2		Rappeler or Spotter not fit for duty.	Unlikely	Moderate	Low	PR2.2M1	Ensure the Rappel Spotter and Rappel personnel follow CRM principles enabling all personnel to speak up.	Rare	Moderate	Low	CRM training, GAR	
	PR2.2M2					Ensure initial operational briefing includes expectations for Rappel personnel.	Rare	Moderate	Low	Daily briefings and FSSFR0 Appendix G		
Incident Commander Rappeler	PR3	Rappeler not qualified as incident commander for incident.	Possible	Moderate	Medium	PR3M1	Ensure a minimum of one employee is qualified as an Incident Commander relative to the complexity of the incident. The IC will be inserted onto the incident on the first evolution.	Unlikely	Moderate	Low	IQCS (Red Card)	
Human Factors	PR6	Fatigue impacting agency personnel and Pilot capability to perform their duties at the necessary level.	Possible	Critical	High	PR6M1	Crew will evaluate the fatigue level of the Pilot and crew and allow for rest and recuperation as needed. Contact Contracting Officer as needed to allow for contractual allowances.	Unlikely	Critical	Medium	FSSFR0 Appendix G, HSS MATOC	
	PR6.1	Rapid transition between mission types interfering with situational awareness.	Possible	Moderate	Medium	PR6.1M1	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.	Possible	Negligible	Low	CRM training, FSSFR0 Appendix G & H, GAR, RT-372	
	PR6.2	Spotter tether not attached to anchor by Spotter	Possible	Critical	High	PR6.2M1	Pilot/Rappellers and Spotter will verify connection of tether and emphasize standard communication. Familiarity with equipment connection is needed.	Unlikely	Critical	Medium	FSSFR0 Appendix O	
	PR6.3	Low frequency of mission	Possible	Moderate	Medium	PR6.3M1	Ensure proper briefings and remind personnel to stay focused on the mission and ensure proficiencies of Pilots, Rappellers, and Spotters.	Unlikely	Moderate	Low	FSSFR0 Chapter 3, GAR	

Table 2 - Rappel, Training System

Training System											
Sub-System	ID	Hazards	Pre-mitigation			ID	Mitigation	Post-mitigation			Mitigation Comments and References
			Probability	Severity	Rating			Probability	Severity	Rating	
Policy	TR1	Deviation from the intended mission of the Forest Service Rappel Program	Possible	Negligible	Low	TR1M1	Ensure clear direction in policy and guide.	Unlikely	Negligible	Low	Annual review/edits of plans incorporating organizational learning
						TR1M2	Conduct quality assurance reviews to ensure direction is followed.	Unlikely	Negligible	Low	FSSFR0 Appendix I
	TR1.2	Non standardized training procedures and equipment within the program.	Possible	Moderate	Medium	TR1.2M1	Utilize the Initial Rappeller Training Syllabus and Initial Certification Record	Unlikely	Moderate	Low	FSSFR0 Appendix A, B, & C
						TR1.2M2	Review training and equipment through quality assurance process.	Unlikely	Moderate	Low	FSSFR0 Appendix F
Training Delivery	TR2	Lack of Spotters and Rappellers during new program establishment.	Likely	Moderate	High	TR2M1	Establish new base start up protocols to minimize time needed for a new crew to rely on the assistance of spotter and rappel boosters to maintain proficiency and receive training to the point of spotter certification.	Possible	Moderate	Medium	FSSFR0 Appendix J
	TR2.1	Lack of standardized training.	Possible	Moderate	Medium	TR2.1M1	Utilize the Initial Rappeller Training Syllabus and Initial Certification Record	Rare	Moderate	Low	FSSFR0 Appendix A, B, & C
						TR2.1M2	Effectively deliver training curriculum through standardized training.	Rare	Moderate	Low	FSSFR0 Appendix A, B, & C

Table 3 - Rappel, Operations System

Operations System												
Sub-System	ID	Hazards	Probability	Severity	Rating	ID	Mitigation	Probability	Severity	Rating	Mitigation Comments and References	
Site Selection	OP1	Selection of an inadequate rappel site could result in an unsafe environment for personnel also increasing the exposure to rotor strikes, entanglements, and lack of Escape Routes and Safety Zones.	Possible	Critical	High	OP1M1	Rely on the Pilot in Command and Spotter for approval of all rappel sites.	Unlikely	Critical	Medium	FSSFRO Appendix H, O	
						OP1M2	Pilot should ensure site selections meet NWCG Standards for Helicopter Operations (NSHO) standards during below canopy operations.	Unlikely	Critical	Medium	NSHO Chapter 8	
						OP1M3	Use a reconnaissance flight with the Pilot, Spotter, and rappellers to evaluate the proposed operation.	Unlikely	Critical	Medium	FSSFRO Appendix H, O	
						OP1M4	Any personnel already at the site shall confirm and communicate any additional hazards and the suitability of the location.	Unlikely	Critical	Medium	FSSFRO Appendix H, O	
						OP1M5	Evaluation of fire behavior and LCES is required during the reconnaissance phase of the operation. Communication of site hazards can be discussed during size-up of the fire. Cancel rappel if situation dictates.	Unlikely	Critical	Medium	FSSFRO Appendix H, O GAR	
Standardization of procedures	OP2	Pilot confusion from non-standardized verbal, and non-verbal communications.	Possible	Moderate	Medium	OP2M1	Utilize standardized verbal, and non-verbal communications with Pilot, Spotters, and Rappellers.	Unlikely	Moderate	Low	FSSFRO Appendix O	
Management	OP3	Uncontrolled personnel at configuration site.	Possible	Moderate	Medium	OP3M1	Conduct reconnaissance flight and provide for scene safety	Unlikely	Moderate	Low	FSSFRO Appendix O	
	OP3.1	Lack of adequate helicopter crewmembers/Rappellers/IC's for the overall mission.	Possible	Negligible	Low	OP3.1M1	Coordinate with ground personnel, ATGS, and other functions involved in operations.	Unlikely	Moderate	Low	FSSFRO Appendix O	
	OP3.2	Lack of program oversight to ensure standardization and quality assurance.	Possible	Critical	High	OP3.2M1	Ensure qualified personnel are available prior to mission.	Unlikely	Negligible	Low	FSSFRO Chapter 3 GAR	
	OP3.2	Lack of program oversight to ensure standardization and quality assurance.	Possible	Critical	High	OP3.2M1	Have standard unit organizational chart including Aviation Officer and full compliment of helicopter management in place.	Unlikely	Critical	Medium	FSSFRO Chapter 3	
Briefings (Pre-operations and Post-operations)	OP4	Not all personnel have received a briefing resulting in confusion prior or during mission.	Possible	Moderate	Medium	OP4M1	Ensure all participants are briefed prior to the mission.	Rare	Moderate	Low	FSSFRO Appendix O	
	OP5	Post-flight debriefings are not consistently performed resulting in loss of mission information and lessons learned.	Possible	Moderate	Medium	OP5M1	Emphasize the importance of AAR's and sharing lessons learned through the use of SAFERAP, SAFECON, and other avenues as appropriate.	Unlikely	Moderate	Low	FSSFRO Appendix O, SAFERAP	
Procedures	OP7	Non-standardized operational procedures.	Possible	Critical	High	OP7M1	Follow standardized operational procedures identified in FSSFRO.	Unlikely	Critical	Medium	FSSFRO Appendix O	
	OP7	Non-standardized operational procedures.	Possible	Critical	High	OP7M2	Ensure Quality Assurance Teams review programs.	Unlikely	Critical	Medium	FSSFRO Appendix I	
	OP7.1	Requesting a rappel mission that exceeds the capabilities of the resource and personnel.	Possible	Critical	High	OP7.1M1	Work within the scope of the FSSFRO and qualification levels of personnel.	Rare	Critical	Medium	FSSFRO Appendix H, O, GAR, IRPG Turndown Protocols	
	OP7.2	Spotter cannot independently manipulate radios from back seat (Pilot task saturation).	Almost Certain	Critical	Extremely High	OP7.3M1	Only use aircraft where radio placement has been installed in a location where it is available for the pilot and spotter to individually manipulate the radio.	Rare	Critical	Medium	HSS MATOC	
Emergency Procedures	OP8	Lack of emergency procedures training prior to actual missions	Unlikely	Catastrophic	High	OP8M1	Standardized EP's are in place. Spotters, Rappellers, and Pilots will review EP's annually and periodically throughout the season to prepare for an emergency situation.	Rare	Catastrophic	Medium	FSSFRO Appendix O	
	OP8.2	Inflight aircraft emergency of an immediate or delayed nature.	Rare	Catastrophic	Medium	OP8.1M1	Follow emergency procedures identified in the FSSFRO.	Rare	Catastrophic	Medium	FSSFRO Appendix O	
	OP8.2	Cargo entanglement and risk to personnel on the ground due to cut away cargo	Possible	Critical	High	OP8.2M1	No personnel will be allowed directly below or downhill of the cargo delivery site during cargo operations. Spotter will coordinate with pilot and cut away cargo in the event of an entanglement or aircraft emergency.	Unlikely	Critical	Medium	FSSFRO Appendix O, NSHO	
	OP8.3	Rappeller unable to rappel to the ground due to entanglement or knots in the rope	Unlikely	Catastrophic	High	OP8.3M1	Complete training on emergency tie off (ETO) procedure as outlined in Appendix A.	Unlikely	Moderate	Low	FSSFRO Appendix A and O	
Human Factors	OP9	Pilot loss of vertical and/or horizontal reference.	Unlikely	Critical	Medium	OP9M1	Pilot and crew will assess the rappel site to assure the capability to maintain adequate references via recon.	Rare	Critical	Medium	FSSFRO Appendix O	
	OP9	Pilot loss of vertical and/or horizontal reference.	Unlikely	Critical	Medium	OP9M2	Spotter on board will assist Pilot with identifying hazards and radio communications.	Rare	Critical	Medium	FSSFRO Appendix O	
	OP9.1	Unclear/misunderstood communications.	Unlikely	Moderate	Low	OP9.1M1	Utilize clear text and standardized challenge and response communications when applicable.	Rare	Moderate	Low	FSSFRO Appendix O	
Environmental Hazards	OP10	Falling debris	Possible	Critical	High	OP10M1	Utilize appropriate head protection when working under or in the vicinity of a hovering helicopter.	Possible	Moderate	Medium	FSSFRO Chapter 3	
	OP10	Falling debris	Possible	Critical	High	OP10M2	Include hazard awareness in training and refresher courses as well as daily operation plans and briefings.	Unlikely	Critical	Medium	FFSFRO Appendix A	
	OP10.1	Fire Behavior	Possible	Critical	High	OP10.1M1	Ensure LCES is in place. If necessary relocate Rappellers to more suitable site.	Unlikely	Critical	Medium	Annual Fire Refresher, FFSFRO Appendix B, H GAR	
	OP10.1	Fire Behavior	Possible	Critical	High	OP10.1M2	Ensure helicopter does not impact fire behavior by maintaining sufficient height and distance from fire.	Unlikely	Critical	Medium	FFSFRO Appendix B, H	
	OP10.2	Terrain and Vegetation	Possible	Moderate	Medium	OP10.2M1	Site selection should be in a location acceptable for Rappellers to land. i.e. slope, vegetation, terrain, etc.	Unlikely	Moderate	Low	FFSFRO Appendix B, H	
	OP10.3	Low visibility due to smoke, dust, darkness, glare, etc.	Possible	Critical	High	OP10.3M1	Follow NSHO standards. Establish trigger points to cease operations.	Unlikely	Critical	Medium	NSHO Chapter 6	
	OP10.3	Low visibility due to smoke, dust, darkness, glare, etc.	Possible	Critical	High	OP10.3M2	Select site that allows spotter to maintain positive visual contact with rappellers to the ground, surrounding hazards, and allows pilot to maintain visual reference.	Unlikely	Critical	Medium	FFSFRO Appendix B, H	
Safecom and Saferap Systems	OP11	Lack of training rappel mishaps being reported.	Possible	Moderate	Medium	OP11M1	All Rappel mishaps will be reported through the Saferap reporting system for rappel specific issues and utilize the Safecom system for items affecting the helicopter community at large.	Unlikely	Moderate	Low	FFSFRO Chapter 4	

Table 4 - Rappel, Equipment System

Equipment System											
Sub-System	ID	Hazards	Probability	Pre-mitigation Severity	Rating	ID	Mitigation	Probability	Post-mitigation Severity	Rating	Mitigation Comments and References
Rappel Equipment	EQ1	Non-standard and non-agency approved equipment resulting in unfamiliarity in utilization of equipment.	Possible	Critical	High	EQ1M1	Forest Service Rappel Program will ensure quality assurance and oversight.	Rare	Critical	Medium	FFSFRO Chapter 4
						EQ1M2	Use only equipment identified and approved in the FSSFRO and NSHO.	Rare	Critical	Medium	NSHO, FSSFRO Chapter 4
						EQ1M3	Involve NTDP to validate equipment use through quality assurance reviews.	Rare	Critical	Medium	FFSFRO Appendix D
	EQ1.1	Rappel equipment damaged/expired.	Unlikely	Catastrophic	High	EQ1.1M1	Utilize inspection criteria as well as documentation in FSSFRO. Retire equipment as outlined in the FSSFRO and manufacturer requirements	Rare	Catastrophic	Medium	FFSFRO Chapter 4, RAPREC
	EQ1.2	Rappel equipment not adequately inspected.	Likely	Moderate	High	EQ1.2M1	Ensure training protocols for inspection equipment have been completed.	Unlikely	Moderate	Low	FFSFRO Chapter 4, Appendix A & D
	EQ1.3	Harness and tether do not allow for emergency egress from A/C	Possible	Critical	High	EQ1.3M1	Utilize the training that promotes ease of release and egress without the use of a cut away knife to comply with FAA policies.	Rare	Critical	Medium	FFSFRO Appendix A, O
	EQ1.4	Improper rigging	Possible	Catastrophic	Extremely High	EQ1.4M1	Spotter will perform the initial rigging check of the aircraft prior to rappel or cargo operations.	Rare	Catastrophic	Medium	FFSFRO Appendix O
						EQ1.4M2	Utilize the training that includes change blindness and standardized equipment rigging.	Unlikely	Catastrophic	High	FFSFRO Appendix A, B, & O
	EQ1.5	Spotter anchor failure	Unlikely	Catastrophic	High	EQ1.5M1	Ensure anchor is approved with proper and valid STCs, tested annually, installed correctly, and inspected to manufacturer's recommendations.	Rare	Catastrophic	Medium	HSS MATOC and FSSFRO Chapter 4
	EQ1.6	Rappel anchor failure	Unlikely	Catastrophic	High	EQ1.6M1	Ensure anchor is approved with proper and valid STCs, tested annually, installed correctly, and inspected to manufacturer's recommendations.	Rare	Catastrophic	Medium	HSS MATOC and FSSFRO Chapter 4
	EQ1.7	Misuse/mistreatment	Unlikely	Catastrophic	High	EQ1.7M1	Conduct training for following equipment use standards. When in doubt about equipment's usage, retire it.	Rare	Catastrophic	Medium	FFSFRO Chapter 4, Appendix A
	EQ1.10	Inconsistent documentation	Possible	Moderate	Medium	EQ1.10M1	Conduct training for following equipment documentation standards, utilize RapRec database.	Unlikely	Moderate	Low	FFSFRO Chapter 4
	EQ1.11	Rappeller without Personal Protective Equipment (PPE) or supplies.	Possible	Moderate	Medium	EQ1.11M1	Ensure standardized belly deployment bag with personnel protective equipment is used.	Rare	Moderate	Low	FFSFRO Chapter 4
						EQ1.11M2	Utilize minimum Rappeller initial attack cargo equipment list.	Rare	Moderate	Low	FFSFRO Chapter 4

Table 5 - Rappel, Aircraft System

Aircraft System											
Sub-System	ID	Hazards	Probability	Severity	Rating	ID	Mitigation	Probability	Severity	Rating	Mitigation Comments and References
Performance and Capabilities	AC1.1	Exceeding the performance capability of the helicopter.	Possible	Catastrophic	Extremely High	AC1.1M1	Operate per NSHO, Rotorcraft Flight Manual (RFM), and FSSFRO	Unlikely	Catastrophic	High	NSHO, RFM, FSSFRO Appendix O
						AC1.1M2	Ensure make and model meet contract specifications.	Rare	Catastrophic	Medium	HSS MATOC
	AC1.2	Environmental conditions such as terrain, density altitude, elevation, winds and temperature impacting helicopter performance.	Likely	Catastrophic	Extremely High	AC1.2M1	Ensure environmental conditions within the load calc reflect actual mission conditions, utilize GAR risk assessment tool, and HOGE power checks.	Unlikely	Catastrophic	High	Load Calculations, FSSFRO Appendix O, NSHO, GAR
	AC1.4	Hazard posed by single engine helicopters operating within the height velocity curve in the case of an engine failure.	Unlikely	Catastrophic	High	AC1.4M1	Minimize time of operation in the height velocity curve by efficiently deploying rappellers and cargo.	Unlikely	Catastrophic	High	HSS MATOC, Exhibit 1
	AC1.5	Hazard posed by twin-engine helicopters operating within the height velocity curve in the case of an engine failure.	Unlikely	Catastrophic	High	AC1.4M1	Minimize time of operation in the height velocity curve by efficiently deploying rappellers and cargo and using hover set up heights allowing for forward flight utilizing single engine inoperable available flight profile.	Rare	Catastrophic	Medium	HSS MATOC, Exhibit 1
Communications	AC2	Spotter not having intercom communication with Pilot.	Unlikely	Moderate	Low	AC2M1	Prior to mission, ensure communication. If verbal comms are lost, hand signals can be used to communicate and complete mission or mission can be terminated.	Rare	Moderate	Low	FFSFRO Appendix O
Doors Open Operations	AC3	Hazard posed by flight missions when doors are open in respect to crash survivability, falling objects, etc.	Unlikely	Critical	Medium	AC3M1	Ensure cabin objects/items are secured before flight commences.	Rare	Critical	Medium	FFSFRO Appendix O
						AC3M2	Minimize doors open operation.	Rare	Critical	Medium	FFSFRO Appendix O
						AC3M3	Occupants will utilize a secondary restraint as outlined in the NSHO.	Rare	Critical	Medium	FFSFRO Appendix O
PA Communication System	AC6	No viable communication with ground personnel at or near the rappel site	Unlikely	Moderate	Low	AC6M1	PA system will be utilized in the event of loss of comms with ground personnel near the rappel site.	Rare	Moderate	Low	HSS MATOC