





Interagency Helitorch/Mixing System Training – 01/16/2004
Lesson Plan Unit 1: Helitorch History and Capabilities

ITEM	DESCRIPTION
<p>Unit Objectives</p> 	<p>Upon Completion of this unit, the trainee will be able to:</p> <ol style="list-style-type: none"> 1. Become familiar with the evolution of the helitorch. 2. Identify advantages and disadvantages of helitorch operations.
<p>Training Aid</p>	<p><i>Interagency Aerial Ignition Guide (IAIG)</i></p>
<p>History</p>	<p>I. History</p> <ol style="list-style-type: none"> A. A Canadian conceived the idea for a helitorch, which dispensed a gasoline and diesel fuel mix similar to that used in drip torches. Western Helicopters of Oregon working with the Canadians refined the helitorch and field-tested it. B. The torch concept was greatly improved upon by the development of fuel thickening compounds, which gelled the fuel, thus reducing its volatility. This also increased the safety in handling the fuel, improved its drop characteristics, put more fuel onto the ground (rather than burning off in the air), and increased residual burning time allowing the aircraft to be flown higher and faster. C. During the evolution period, safety was identified as a critical limitation to the use of the helitorch. D. In a 1984 University of Montana survey, prescribed burn practitioners throughout the United States and Canada listed the following types of safety problems they had experienced relating to helitorch ignition: <ol style="list-style-type: none"> 1. Striking tree with helitorch. 2. Accidental torch jettison. 3. Fouling of helitorch suspension cables (one resulting in a fatality).



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	<p>4. Unstable flight of helitorch. 5. Hazardous electrical malfunctions of the torch. 6. Dropping fuel outside the burn perimeter. 7. Dropping fuel on or near ground personnel. 8. Fire occurring during fuel mixing operations.</p> <p>E. Because of these safety concerns, all helitorch personnel need to complete a certified training program.</p>
	<p>Instructor note: Have the students read page 1, chapter IV, of the IAIG in class.</p>
<div data-bbox="207 674 431 850"> <p>ADVANTAGES</p> <ul style="list-style-type: none"> • Easier to handle than burning by hand • Cost effective - covers large areas in short time • Limited fire by developing quick convection column • Thickened fuel burns longer on the ground • Lay down continuous line of fire • Helitorch easily jettisoned by pilot </div> <div data-bbox="207 856 431 1012">  </div> <div data-bbox="207 1018 431 1194"> <p>ADVANTAGES</p> <ul style="list-style-type: none"> • Effective under marginal weather, etc. or fuel conditions • Burns in inaccessible areas • Burns more areas in less time than hand lighting • Smoke emissions reduced by reducing prescription volume </div> <div data-bbox="207 1201 431 1377">  </div>	<p>II. Advantages</p> <p>A. The helitorch is associated with fewer hazards than burning by hand. B. The method is cost effective because of the amount of area that can be covered in a short amount of time. C. The convection column can be developed quicker, increasing control over the fire. D. Thickened fuel provides a longer residual burning time on the ground. E. Helitorch operations have the potential of laying a more continuous line of fire. F. The helitorch can be jettisoned in the event of an emergency. G. On sites with sparse or patchy fuel distribution and higher fuel moisture content, the pattern of fire laid down by the torch can provide a greater chance of ignition. H. Burning is possible in less accessible areas, reducing hazards to ground personnel. I. More acres can be burned in less time than in hand lighting. J. Emissions may be reduced due to widening of the prescription window.</p>
<div data-bbox="207 1518 431 1694"> <p>DISADVANTAGES</p> <ul style="list-style-type: none"> • May produce more fire than expected • Unsafe - driver must be DOT approved • Gasoline is hazardous & highly flammable • Substantial personnel & equipment needed • Extensive training & certification • Requires good access for fuel transportation • Costs can be significant </div> <div data-bbox="207 1701 431 1856">  </div>	<p>III. Disadvantages</p> <p>A. Using the helitorch may produce more fire than expected. B. DOT hazmat regulations apply as outlined in the Code of Federal Regulations, Title 49, and parts 100 to 180. C. The use of gasoline is hazardous since it is highly flammable in its ungelled state. D. There is substantial outlay of manpower and equipment: three- to five-person crew with one or two vehicles and/or trailer units for most burning operations.</p>

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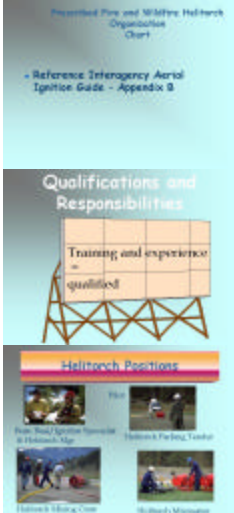

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<p>DISADVANTAGES</p> <ul style="list-style-type: none"> • Requires considerable planning & organization • Safety procedures are rigorous & extensive • Hazmat removal & storage • Easy to lose control of column during break in ignition 	<ul style="list-style-type: none"> E. The crew requires extensive training and a certain degree of commitment to the program for the duration of the burning season. This crew may not be available for suppression duties. F. Bulk fuel and chemicals must be transported to the site, which may be a problem if access is poor. G. Fuel, helicopter, and chemical costs can be significant. Helicopter must return frequently to the mixing/loading site to refill with gel. H. Operation requires considerable planning and setup time to organize the mixing/loading site and landing pad. I. Rigorous and extensive safety procedures must be followed. Hazmat removal and storage may be a problem. J. Although it may be easier to establish a convection column because of the rapid fuel consumption associated with helitorch mass ignition, it is easy to lose control of the column during a break in ignition. K. Helitorch does not lend itself favorably to underburning operations; the burning fuel globules could ignite the tree crowns.



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Lesson Plan Unit 2: Personnel Qualifications and Responsibilities

ITEM	DESCRIPTION
<p>Unit Objectives</p> 	<p>Upon completion of this unit, the student will become familiar with:</p> <ol style="list-style-type: none"> 1. Initial certification and training requirements. 2. Wildfire and prescribed burning organizational structure. 3. Prerequisite qualifications, responsibilities, and duties of the personnel involved in the aerial ignition operation. 4. Annual recertification approval requirements and maintaining currency status.
<p>Materials and Handouts</p>	<p><i>Interagency Aerial Ignition Guide (IAIG)</i></p> <p>Handouts:</p> <ol style="list-style-type: none"> 1. Position Task Sheet 2. Recertification document 3. Prescribed and Wildfire Organization Charts <p>Instructor note: Students should reference the charts for chain of command.</p>
<p>Training Requirements</p> <ul style="list-style-type: none"> -Organization and communication -Special safety procedures and concerns -Dealing with hazardous materials -Equipment testing, troubleshooting, and maintenance -Briefing and checklist requirements <p>Training Requirements</p> <ul style="list-style-type: none"> -Operational procedures and requirements -Live-run exercise to consist of: <ul style="list-style-type: none"> -Briefing burn boss and all personnel -Mixing -Torch test procedure -Dropping gel -Dropping gel use be on training exercise or actual burn project 	<p>I. Initial Training and Certification</p> <p>Initial certification and training for helitorch module members (helitorch manager, mixmaster, and parking tender) shall consist, at a minimum, of a one-day session on each type of equipment. Training will cover:</p> <ol style="list-style-type: none"> A. Organization and communication requirements. B. Special safety procedures and concerns, including emergencies. C. Hazardous materials identification, health hazards, safety precautions, transportation regulations, and emergency procedures. D. Equipment testing, troubleshooting, and maintenance. E. Briefing and checklist requirements. F. Operational procedures and requirements. G. A live run exercise. For the helitorch, the live run shall consist of briefing the burn boss/firing boss and all personnel, mixing, torch test procedures, and dropping of gel. The dropping of gel may be accomplished either as a training exercise or as part of an actual burn project. <p>Instructor note: Review the task sheet with the students.</p>


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ITEM	DESCRIPTION
<p>Re-Certified annually: Helitorch Manager Helitorch Mixmaster Helitorch Parking Tender</p> <p><small>All certification is the delegated responsibility of the applicable Regional Helicopter Operations Specialist or designee. For OIC Helicopters, this is accomplished through Recency/Agency authority at the State or Area office level or as otherwise established by the individual from agency.</small></p> <p>RE-CERTIFICATION</p> <ul style="list-style-type: none"> 1. Each helitorch module member shall review the applicable sections of the Interagency Aerial Ignition Guide, as well as agency-specific guidance and direction; and 2. A re-certification training session consisting of items 1-6 in Chapter II.I.V.A. 3. Must be documented on the Interagency Helitorch Module Annual Recurrency Training form identified in the IAIG. 	<p>II. Annual Approval and Recertification</p> <p>A. All individuals functioning in the following aerial ignition positions will be recertified annually:</p> <ol style="list-style-type: none"> 1. Helitorch manager 2. Helitorch mixmaster 3. Helitorch parking tender <p>B. In the USDA Forest Service, certification for the above positions is the delegated responsibility of the applicable regional helicopter operations specialist or designee. For DOI bureaus, certification is accomplished through bureau/agency authority at the State, area office level, or as otherwise established by the individual bureau/agency. Once a helitorch module has been initially trained and certified, the required annual recertification shall consist of the following:</p> <ol style="list-style-type: none"> 1. Each helitorch module member shall review the applicable sections of the <i>Interagency Aerial Ignition Guide</i> as well as agency-specific guidance and direction; and 2. A recertification training session consisting of items 1-6 in Chapter II, section IV, paragraph A. 3. Must be documented on the Interagency Helitorch Module Annual Recurrency Training form identified in the IAIG. The form must be submitted to the appropriate agency aviation manager/helicopter operations specialist (HOS). <p>C. Aerial ignition personnel who transfer from region, State, or area office within an agency or who transfer from one agency to another shall show documentation that they have successfully completed the requirements outlined above for certification and training.</p>
<p>Currency Requirements</p> <p><small>-Must perform in the position at least once every three years to maintain currency and remain eligible for re-certification training.</small></p> <p><small>-If individual does not meet the currency requirement, must complete the initial certification and training.</small></p>	<p>III. Currency Requirements</p> <p>In addition to initial and annual recertification training, a member of a helitorch module must perform in the position at least once every 3 years to maintain currency and remain eligible for recertification training. If an individual does not meet the currency requirement, he or she must complete the initial certification and training.</p>

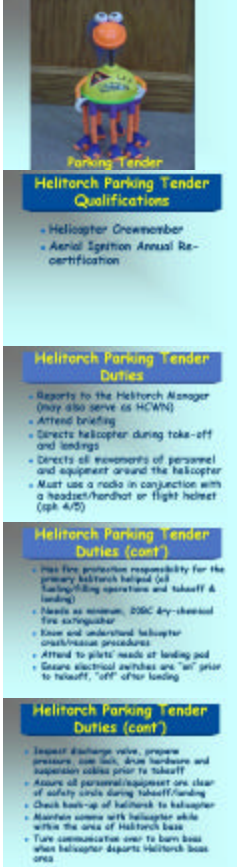
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	<p>IV. Personnel Qualifications and Responsibilities</p> <p>Instructor note: The instructor should use a flipchart or marker board to illustrate organizational variations for helitorch operations: show minimum organization through a multi-aircraft operation.</p>
	<p>A. Pilot</p> <ol style="list-style-type: none"> 1. Qualifications. The pilot must receive a checkride from an approved pilot inspector. Examples of inspection criteria are: <ol style="list-style-type: none"> a. Exhibits a basic knowledge of wildland and prescribed fire operations. b. Exhibits knowledge of communications and coordination required with the burn boss and parking tender. c. Exhibits knowledge of limitation section of the flight manual regarding limitations to flight with doors off. d. Exhibits knowledge of helitorch operation and installation procedures. e. Demonstrates the ability to maintain a constant airspeed and altitude above the ground while staying within the burn area. f. Demonstrates the ability to maintain reserve power/airspeed in the event of an emergency. g. Explains how to set up flight patterns according to the relative winds in relation to the terrain h. Is aware of problems encountered with steep hillsides and the relation of convective and radiant heat. 2. Position duties and responsibilities. <ol style="list-style-type: none"> a. The pilot and the aircraft must be carded by an agency helicopter inspector for any type of aerial ignition before being utilized in such a capacity.


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	<ol style="list-style-type: none"> b. The pilot shall have approval for aerial ignition operations and receive a briefing on the operational objectives and ground and flight procedures. c. The pilot must receive familiarization with fire behavior/fire shelter and terminology used during burning before operations commence. d. The pilot will operate the helitorch according to the burn plan and under the direction of the burn boss/ignition specialist. e. The pilot-in-command is responsible for all matters related to the helicopter operations and flight safety.
 <p>Burn Boss- Qualifications</p> <ul style="list-style-type: none"> • Prescribed Fire Burn Boss • Received helicopter safety and aerial ignition training • Knowledgeable of ICS organization and aerial ignition concepts • Can interpret weather & fire behavior <p>Burn Boss- Responsibilities</p> <ul style="list-style-type: none"> • Complete authority for & directs firing operation, develops firing plan • Performs the initial briefing and covers assignments • Instructs pilot as to the plan & firing sequence • Keeps pilot informed throughout entire operation • May be in another aircraft or at other vantage point • Cannot conduct operations from the Helitorch helicopter 	<p>B. Burn Boss</p> <ol style="list-style-type: none"> 1. Qualifications. The Burn Boss has received training in helicopter safety and is knowledgeable of ICS organization and concepts and is familiar with aerial ignition operations. 2. Position duties and responsibilities. <ol style="list-style-type: none"> a. Has complete authority for and directs the firing operation. b. Develops the firing plan(s). c. Performs the initial briefing from the firing plan. d. Covers the assignments of each burn boss/supervisor and pilot. e. Instructs the pilot as to the plan and firing sequence. f. Keeps the pilot informed throughout entire operation. g. Cannot conduct operations from the helitorch helicopter. May be in another aircraft or at some other vantage point for helitorch operations.
 <p>Ignition Specialist- Qualifications</p> <ul style="list-style-type: none"> • Qualified as Ignition Specialist • Received training in helicopter safety • Knowledgeable of ICS organization and aerial ignition concepts 	<p>C. Ignition Specialist</p> <ol style="list-style-type: none"> 1. Qualifications. The ignition specialist has received training in helicopter safety and is knowledgeable of ICS organization and concepts and is familiar with aerial ignition operations. 2. Position duties and responsibilities. As requested by the burn boss, the ignition specialist: <ol style="list-style-type: none"> a. Directs the aerial firing operation(s). b. Instructs the pilot and helitorch manager as to the

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<p>Ignition Specialist Responsibilities</p> <ul style="list-style-type: none"> At requested by Burn Boss, directs the aerial firing operation. Directs the pilot & Helitorch Mgr. to the plan & firing sequence. Keeps pilot informed throughout the operation. Cannot conduct operations from the Helitorch Helicopter. 	<p>plan and firing sequence.</p> <ol style="list-style-type: none"> Keeps the pilot informed throughout the operation. Cannot conduct operations from the helitorch helicopter. May be in another aircraft or at some other vantage point.
 <p>Helitorch Manager</p> <p>Helitorch Manager Qualifications</p> <ul style="list-style-type: none"> Helicopter Manager (Exclusive-use Fire, CWN, or Project), HTMM qualified, and Aerial Ignition Annual Re-certification Minimum HEB2 <p>Helitorch Parking Tender Duties (cont)</p> <ul style="list-style-type: none"> Has fire protection responsibility for the primary helitorch helipad (all fueling/filling operations and takeoff & landing) Needs as minimum, 4D-B-C dry-chemical fire extinguisher Know and understand helicopter crash/rescue procedures Attend to pilots' needs at landing pad Ensure electrical switches are "on" prior to takeoff, "off" after landing <p>Helitorch Manager Responsibilities (cont)</p> <ul style="list-style-type: none"> Assure overall helitorch operation Provides technical info on helibase location and operation Assure safety precautions have been completed prior to mixing Assure Aerial Ignition Safety Plan and Go/No Go Checklist is approved, posted & followed Assure comm link between Helitorch base/Dispatch and/or Operations 	<p>D. Helitorch Manager</p> <ol style="list-style-type: none"> Qualifications and prerequisites: helicopter manager (exclusive-use fire, CWN, or project), HEB2(T), and helitorch mixmaster: aerial ignition annual recertification. Position duties and responsibilities. <ol style="list-style-type: none"> On operations utilizing only one helitorch helicopter, the Helitorch Manager may have collateral duties as the Helicopter Manager as well as either (not both) the HTMM or HTPT. On operations utilizing more than one helitorch helicopter, the Helitorch Manager may have collateral duties as the Helibase Manager providing that they do not assume duties as the HTMM or HTPT. Ensures all required equipment is on site and operational. Serves as helitorch manager and provides technical assistance to the burn boss/ignition specialist. Supervises all helitorch operations. Assigns qualified personnel to positions. Briefs pilots. Identifies hazards and safety requirements at the operations briefing. Monitors overall helitorch operations on the helibase. Provides technical information on the base location and operation. Ensures safety precautions have been completed prior to mixing. Ensures Aerial Ignition Safety plan and Go/No Go Checklist are approved, posted, and followed. Ensures a communication link is established between the helitorch helibase, dispatch, and/or operations. Must have a qualified helibase manager on multiple helicopter operations. Assists the burn boss in development of the aviation portion of the burn plan.

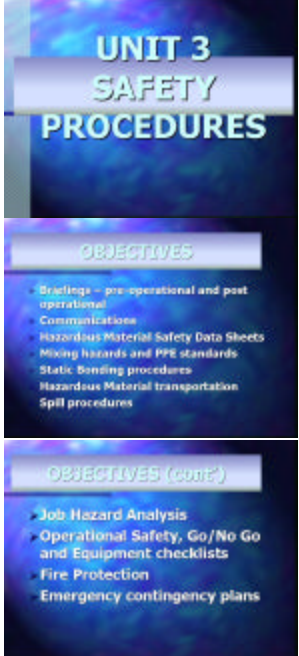

ITEM	DESCRIPTION
 <p>Mixmaster</p> <p>Helitorch Mixmaster Qualifications</p> <ul style="list-style-type: none"> • Helicopter Crewmember • HTAM qualified, and Aerial Ignition Annual Re-certification <p>Helitorch Mixmaster Responsibilities</p> <ul style="list-style-type: none"> • Reports to the Helitorch Manager (may have additional duties as MCW/HTAM on single aircraft project basis) • Attends briefings • Supervise mixing/filling operation, manages fire hoses to maintain availability of gel • Places equipment and assures it is operational • Hook helitorch to helicopter <p>Helitorch Mixmaster Responsibilities (cont)</p> <ul style="list-style-type: none"> • Assure bonding procedures are followed • Perform preflight tests of helitorch with pilot • Conduct drills prior to operations to assure mixing and filling operations are coordinated between all personnel • Perform maintenance and cleaning of all helitorch equipment • Supervise helibase fire protection <p>Helitorch Mixmaster Responsibilities (cont)</p> <ul style="list-style-type: none"> • Conduct drills and assure coordination prior to operation • Perform preventative maintenance • Insure all equipment cleaned and operational at end of each shift 	<p>E. Helitorch Mixmaster</p> <ol style="list-style-type: none"> 1. Qualifications and prerequisites: helicopter crewmember (exclusive-use fire, CWN, project): interagency ignition annual recertification. 2. Position duties and responsibilities. <ol style="list-style-type: none"> a. Reports to the helitorch manager positioned at the helibase. b. Is responsible for supervising mixing activities. c. Is knowledgeable of mixing equipment, gelling agents, and safe operating procedures. d. Supervises emergency crash rescue operations. e. Attends briefings. f. Plans and supervises the helibase mixing operations in conjunction with the helitorch manager. g. Places equipment and ensures all is functioning properly. h. Determines quantities of fuel, gelling agent, etc., needed. i. Manages time frames between batch mixes. j. Is responsible for hooking helitorch to the helicopter and for making the electrical connections from torch to helicopter. k. Ensures bonding procedures are adhered to. l. Supervises the drum filling operation. m. Operates the mixing system. n. Supervises the mixing crew. o. Is responsible for testing the helitorch prior to operation. p. Supervises the helitorch fire protection organization. q. Conducts drills before actual operations are started to ensure coordination exists among all personnel. r. Performs preventative maintenance on the helitorch/mixing system during and after each use. s. Ensures the equipment is cleaned and operational at the termination of each shift. t. May have simultaneous duties as the helitorch manager.


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	<p>F. Helitorch Parking Tender</p> <ol style="list-style-type: none"> 1. Prerequisites: helicopter crewmember (exclusive-use fire, CWN, project): interagency aerial ignition annual recertification. 2. Position duties and responsibilities. <ol style="list-style-type: none"> a. Reports to the helitorch manager. b. Attends briefings. c. Directs the helicopter during takeoffs and landings. d. Directs all movement of personnel and equipment around the helicopter. e. Must have a radio equipped with headset and hardhat or SPH-4/5 flight helmet with a remote transmit button/switch for takeoffs and landings during helitorch operations. f. Has fire protection responsibility for the primary helitorch helipad with, at a minimum, a 40-B:C dry chemical fire extinguisher. g. Oversees helicopter activities at the landing pad. h. Knows and understands helicopter crash/rescue procedures. i. Attends to pilot's needs at the landing pad. j. Ensures that pump and ignition switches on the helitorch are turned off immediately after landing and turned on just prior to liftoff, if identified to perform this task by the helitorch mixmaster. k. Inspects discharge valve for cleanliness, proper propane pressure, vapor cam-lock cap (secured), helitorch component, all drum hardware, helitorch frame (intact), and suspension cables (clear of skids) prior to helitorch departure. l. Ensures all personnel and equipment are clear of safety circle during liftoff and landing operations. m. Checks hookup of the helitorch to helicopter, accomplishes checkout procedures, and staffs fire extinguisher during reloading. n. Maintains communications with the helicopter with helitorch while within the area of the helibase. o. Turns control over to the operations section chief or burn boss/ignition specialist when helicopter departs the helibase area.


ITEM	DESCRIPTION
 <p>Mixing Crew Member</p> <p>Mixing Crew Qualifications</p> <ul style="list-style-type: none"> Initial Training and Recurrency to include: <ul style="list-style-type: none"> A-101 Aviation Safety A-105 Aviation Life Support Equipment A-106 Aviation Mishap Reporting A-108 Preflight Briefing/Debriefing A-113 Crash Survival Or S-271 S-271 Helitorch operation instruction (any kind must be performed annually or can be accomplished as part of live burn operation) <p>Mixing Crew Duties</p> <ul style="list-style-type: none"> Report to Mixmaster Attend briefings Assist mixmaster with operation of mixing plant Assists with the filling of the helitorch and fire protection Perform any other miscellaneous tasks during helitorch operation 	<p>G. Mixing Crew</p> <ol style="list-style-type: none"> Provides assistance to the mixmaster with setting up the torch base and measuring and adding gelling agent to the mixing system, connects hoses, assists with the filling process, assists with fire protection, and performs any miscellaneous required tasks during the helitorch operation. Initial training and recurrency to include S-271 or the modules listed below and located at http://www.iat.nifc.gov. OJT helitorch operation instruction must be performed annually and can be accomplished as part of a live burn operation. All training must be completed every 3 years. <ol style="list-style-type: none"> A-101 Aviation Safety A-105 Aviation Life Support Equipment A-106 Aviation Mishap Reporting A-107 Aviation Policy and regulations A-108 Preflight Briefing/Debriefing A-109 Aviation Radio Use A-113 Crash Survival Position duties and responsibilities. <ol style="list-style-type: none"> Attends briefings. Assists with the operation of the mixing system. Assists in mixing gelling agent with fuel. Connects and disconnects vapor recovery/removal hose. Resecures vapor cam-lock. Connect discharge line and fill the helitorch drum as required by the Mixmaster.
<p>Helitorch Base Radio Operator Qualifications</p> <ul style="list-style-type: none"> For complex burns or at multiple aircraft helibase use qualified aircraft base radio operator (ABRO) <p>Radio Operator Duties</p> <ul style="list-style-type: none"> Reports to Helitorch Manager Attends briefings Receives orders from burn boss/ignition specialist and relays to helitorch manager Maintains communication with appropriate aircraft Provide communication between H/T Manager, Burning Tender, Helicopter Pilot, Burn Boss/ignition Specialist and Dispatch and/or Operations Maintain on Flight Following log 	<p>H. Radio Operator</p> <ol style="list-style-type: none"> An experienced aircraft radio operator shall be used on complex burns or at complex helitorch helibases. Duties and responsibilities. <ol style="list-style-type: none"> Obtains briefing. Receives orders from the burn boss/ignition specialist and relay to helitorch manager. Maintains communications with appropriate aircraft.

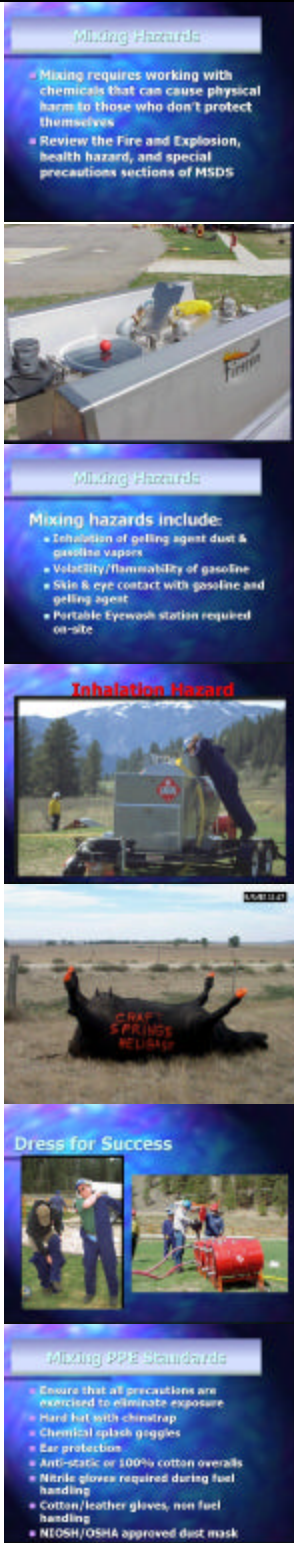
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	<p>d. Provides communications link among helitorch manager, parking tender, helicopter pilot, burn boss/ignition specialist, and dispatch or operations.</p> <p>e. Maintains a flight following log.</p>
 <p>Helitorch Fire Protection Personnel Duties</p> <ul style="list-style-type: none"> • Reports to HTMM • Attend briefings • Staffed engine with Class B foam capability, or a minimum of 2, 3 gallon class B portable Compressed Air Foam extinguishers on site • Familiar with crash/rescue operations • Familiar with fire extinguisher operation • Charge hoses and attend nozzles during operations <p>Transfer System</p> <p>Batchee</p> <p>Helitorches</p> <p>Pump</p>	<p>I. Helitorch Fire Protection Personnel</p> <ol style="list-style-type: none"> 1. A trained engine crew with class B foam capability, familiar with crash/rescue procedures, and fire extinguisher operation or Class B portable foam extinguishing system. 2. Duties and responsibilities. <ol style="list-style-type: none"> a. Reports to mixmaster. b. Attends briefing. c. Charges hoses and attends nozzles during operations. <p>Instructor note: Ensure nozzles are attended and hoses are charged on engine or class B foam extinguishing system.</p>

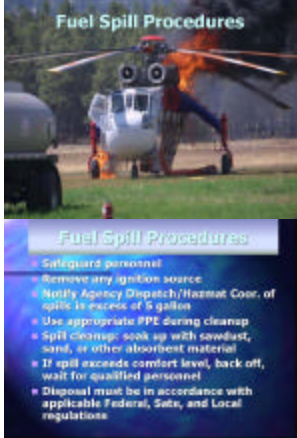
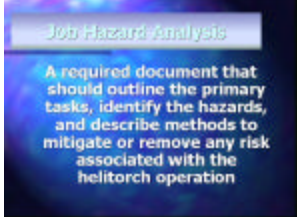
ITEM	DESCRIPTION
<p>Unit Objectives</p>  <p>The slide displays the title 'UNIT 3 SAFETY PROCEDURES' and lists the following objectives:</p> <ul style="list-style-type: none"> Briefings – pre-operational and post-operational Communications Hazardous Material Safety Data Sheets Mixing hazards and PPE standards Static Bonding procedures Hazardous Material transportation Spill procedures <p>OBJECTIVES (cont.)</p> <ul style="list-style-type: none"> Job Hazard Analysis Operational Safety, Go/No Go and Equipment checklists Fire Protection Emergency contingency plans 	<p>Upon completion of this unit, the students will become knowledgeable of the safety elements pertaining to the helitorch/mixing systems operations:</p> <ol style="list-style-type: none"> 1. Briefings: pre-operational and post-operational 2. Communications 3. Hazardous Material Safety Data Sheet (MSDS) 4. Mixing hazards and personal protective equipment standards 5. Static bonding procedures 6. Hazardous material transportation 7. Spill procedures 8. Job hazard analysis (JHA) 9. Operational safety, Go/No Go, and equipment checklists. 10. Fire protection 11. Emergency contingency plan
<p>Handouts</p>	<ol style="list-style-type: none"> 1. Unleaded gasoline MSDS (IAIG Appendix C) 2. Gelling agent MSDS (IAIG Appendix C) 3. JHA examples (Appendix B) 4. Operational safety checklist (Appendix B) 5. Go/No Go checklist (Appendix B) 6. Equipment checklist (Appendix B) 7. Communications plan (Appendix B)
 <p>The top image shows a 'Briefing' scene with several people in a dark room, illuminated by red lights, possibly a fire drill or safety meeting. The bottom image shows 'Briefing Postings' on a board, which appears to be a checklist or set of instructions for a briefing.</p>	<p>I. Pre-Operational Briefings</p> <ol style="list-style-type: none"> A. Standard pilot preflight briefing to include load calculation, fire shelter use, flight hazards, and mission objectives. B. Briefings should be conducted with the following personnel present: pilot, fuel truck drivers, aerial ignition burn boss/ignition specialist, helitorch personnel, and fire protection personnel. C. The pre-operational briefing should cover the burn objectives and sequence of events. D. Reference pertinent items on the helitorch operations checklists and the job hazard analysis.


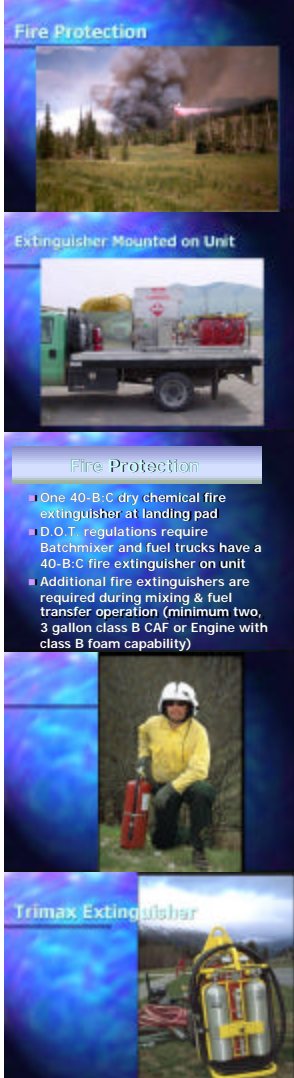
ITEM	DESCRIPTION
<p>Pre Operational Briefings</p> <ul style="list-style-type: none"> • Pilot pre-flight briefing, including load calculation, fire shelter use, flight hazards & mission objectives • Pre-operational briefing will include the pilot, fuel truck drivers, Burn Boss, Ignition Specialist, Helitorch/Helibase, and fire protection personnel. • Should cover the burn plan objectives and sequence of events <p>Pre Operational Briefings (cont)</p> <ul style="list-style-type: none"> • Reference pertinent items on the Aviation Safety Plan, Helitorch Operations Checklist & Job Hazard Analysis <p>Pre Operational Briefings (cont)</p> <ul style="list-style-type: none"> • Helitorch Manager will brief/debrief helitorch personnel on: <ul style="list-style-type: none"> • Hazards and safety requirements • Emergency procedures • Personnel assignments • Inform pilot of helibase operation procedures and alternate emergency landing areas <p>Orientation Flight</p>  <p>In Flight Briefing</p> <p>Burn Boss/Ignition Specialist shall brief the pilot separately about:</p> <ul style="list-style-type: none"> • Unit orientation • Terminology/commands • Fire patterns • Fire behavior • Unit control lines/boundaries • Equipment and personnel locations • Hang-fire flight procedures • Alternate landing areas (helicopter Manager must approve all landing areas) <p>Operational De-Briefing</p> <ul style="list-style-type: none"> • All personnel must attend • Discuss successes, and failures • Determine necessary corrective actions • Complete documentation <ul style="list-style-type: none"> • Unit Log • Sitreps • Commo Log • Etc. 	<p>E. The helitorch manager will brief the helitorch personnel on hazards and safety requirements, emergency procedures, and personnel assignments and will inform the pilot of the operating procedures on the helitorch base and alternate emergency landing areas.</p> <p>F. In-flight briefing. The burn boss/ignition specialist shall brief the pilot separately about terminology, unit orientation, firing patterns, and unit control lines/boundaries, equipment and personnel locations, hang fire flight procedures, alternate landing areas (a qualified helicopter manager must approve landing areas), etc. This should be done during the orientation flight.</p> <p>G. Post-operational briefing. A debriefing shall be held with all personnel to critique and correct any operational problems encountered and discuss successes/failures and closeout documentation.</p>
<p>Communications Plan</p> <ul style="list-style-type: none"> • Discreet tactical frequency between PIOT, Parking Tender, and Burn/Ignition Specialist • All aircraft and ground personnel must have assigned tactical frequency for operations use only • Air-to-air frequency with other aircraft • Flight following communications • Helibase must maintain a commo link to activate emergency services 	<p>II. Communications</p> <p>Establish a communications plan considering the following:</p> <p>A. A discreet tactical frequency must be established among the pilot, burn boss/ignition specialist, and parking tender.</p> <p>B. All aircraft and ground personnel must have an assigned tactical frequency for operations use only.</p>

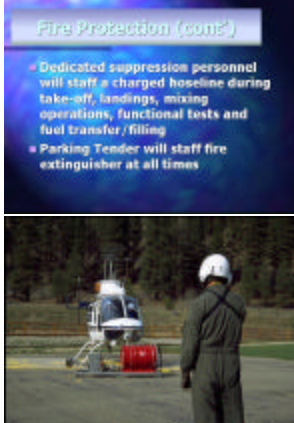
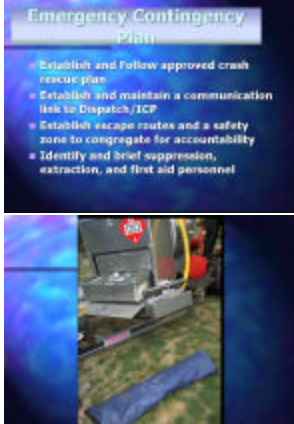
ITEM	DESCRIPTION
 <p>HELITORCH/RESOURCES FIRE COMMUNICATIONS PLAN</p> <p>HELITORCH/RESOURCES COMMUNICATIONS PLAN</p> <p>Communications Plan</p> <ul style="list-style-type: none"> • Parking Tender: headset or SPH-4 or 5 helmet w/ remote transmit button to talk with pilot prior to take-off, landings, and while on the pad • Qualified radio operator should be used on complex aerial ignition operations. 	<p>C. Aircraft must monitor an air-to-air frequency for communication with other incident aircraft.</p> <p>D. The helitorch helibase must have flight following communications and maintain a communication link to implement emergency services if needed.</p> <p>E. The parking tender must have a radio equipped with headset and hardhat or SPH-4/5 flight helmet with a remote transmit button/switch for takeoffs and landings during helitorch operations.</p> <p>F. A qualified aircraft radio operator should be used on complex aerial ignition operations.</p>
<p>Hazardous Material Safety Data Sheets</p> <ul style="list-style-type: none"> • ALL EMPLOYEES SHALL receive info regarding hazardous materials to which they may be exposed to • MSDS - designed to help us understand how to work safely with hazardous material • MSDS explains proper ways to use, handle, and store chemicals, health hazards, precautionary measures to follow, and emergency procedures for spills, fire, and first aid 	<p>III. Hazardous Material Safety Data Sheets (MSDS)</p> <p>A. All employees shall receive information regarding hazardous substances to which they may be exposed and receive copies of appropriate MSDS.</p> <p>B. MSDS are designed to help understand how to work safely with hazardous materials (chemicals) that are used during the helitorch operation.</p> <p>C. MSDS explain the proper ways to use, handle, and store chemicals.</p> <p>D. MSDS provide information regarding the health hazards associated with the use of chemicals, the precautionary measures to follow, and the emergency procedures for spills, fire, and first aid.</p> <p>Instructor note: Cover pertinent elements/sections of MSDS.</p>

ITEM	DESCRIPTION
	<p>IV. Mixing Hazards and PPE Standards</p> <p>A. Mixing requires working with chemicals and substances that can cause physical harm to those who do not protect themselves with the proper personal protective equipment.</p> <p>B. Review the fire and explosion, health hazard special protection information, and special precautions sections of the applicable MSDS.</p> <p>C. Hazards to personnel involved with mixing include:</p> <ol style="list-style-type: none"> 1. Inhalation of gelling agent dust and gasoline vapors. 2. Volatility/flammability of gasoline. 3. Skin and eye contact with gasoline and gelling agent. Ensure that all precautions are exercised to eliminate direct exposure of the airway, skin, eyes, and mouth to gelling agent or gasoline/fuels. <p>D. PPE requirements for individuals involved with mixing.</p> <ol style="list-style-type: none"> 1. Hardhat with chinstrap: required within the safety circle. 2. Eye protection. 3. Ear protection. 4. Fire resistant clothing labeled as non-static or 100% cotton coveralls. 5. Chemical resistant gloves: Nitrile, required during fuel handling. 6. Cotton/leather gloves: non-fuel handling. 7. NIOSH-approved dust masks. <p>E. Mixing system mechanical hazards.</p> <ol style="list-style-type: none"> 1. Engine noise. 2. Exhaust muffler can cause burns. 3. Drive shaft/belts should be protected with cover shields.

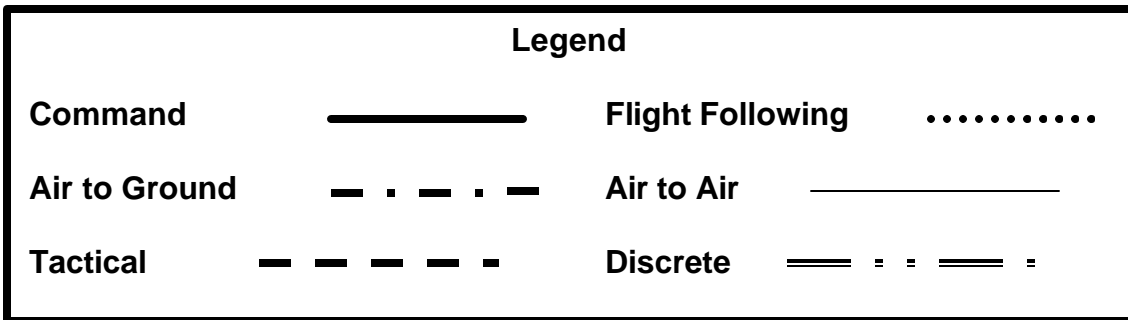
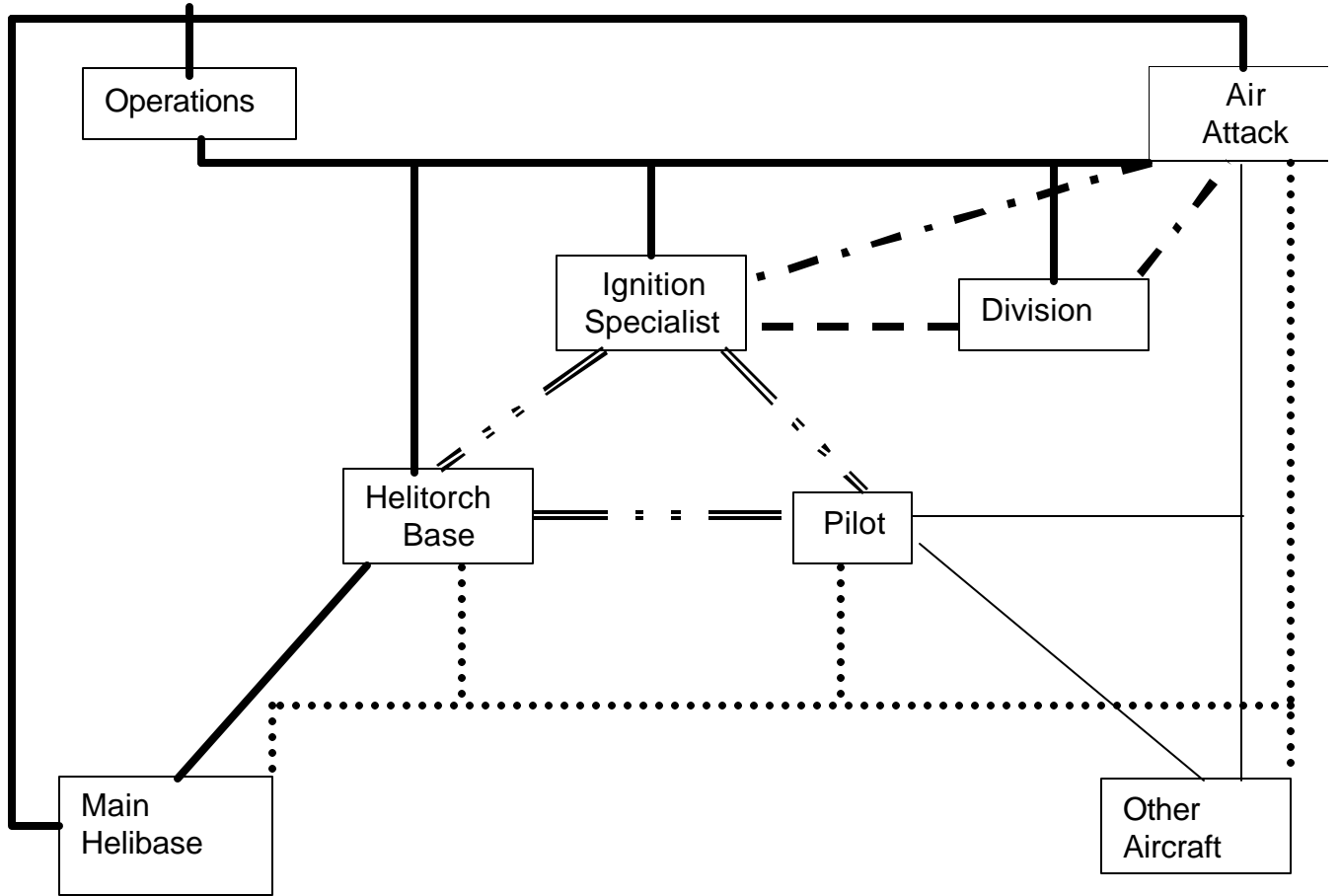
ITEM	DESCRIPTION
 <p>Mixing System Mechanical Hazards</p> <ul style="list-style-type: none"> High engine noise Exhaust muffler can cause burns Drive shaft should be protected with cover shield 	
<p>Static Bonding</p> <ul style="list-style-type: none"> Bonding is the process of joining objects with a conductive wire to neutralize the potential charge between them One technique for protecting against the dangers of static electricity is bonding Federal & local codes require bonding connections during gravity transfer of flammable liquids and on fuel handling equipment  <p>Static Bonding</p> <p>All hoses used in helitorch operations must have bonding built into their structure</p> <p>Bonding Components and Testing</p> <ul style="list-style-type: none"> Use only approved 1 1/2" or 2" gasoline transfer hose Use only approved 2" vapor hose All hardware and equipment will be bonded prior to contact with mixing system (bare metal) Continuity testing shall be done on all fuel transfer and vapor hoses and bonding cables prior to use 	<p>V. Bonding Procedures</p> <p>Refer to appendix F in the IAIG.</p>
<p>Hazardous Material Transportation</p> <ul style="list-style-type: none"> A driver must know and follow the regulations pertaining to hauling hazardous materials on public highways There are Federal, State, and local regulations concerning the transportation of flammable liquids on public highways Federal regulations concerning the transportation of flammable liquids are listed in the Code of Federal Regulations, Title 49, Parts 100-180 <p>Employer Responsibility</p> <ul style="list-style-type: none"> Employer must provide to driver HM-126F training (every 3 years) that shall at a minimum include: <ul style="list-style-type: none"> General awareness Function specific Safety Driver training 	<p>VI. Hazardous Material Transportation</p> <p>A. A driver must know and follow regulations pertaining to hauling hazardous materials on public highways.</p> <p>B. Regulations: There are Federal, State, and local regulations concerning the transportation of flammable liquids on public highways.</p> <p>C. Federal regulations concerning the transportation of flammable liquids are found in the Code of Federal Regulations, Title 49, parts 100 to 180, 383 and 390-397.</p> <p>D. Reference the Transporting Class 3 Flammable Liquids matrix in the <i>Interagency Aerial Ignition Guide</i>.</p>

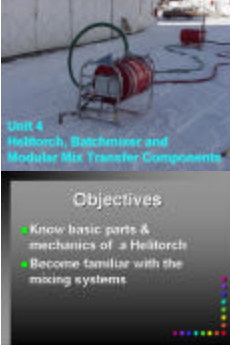



ITEM	DESCRIPTION
	<p>E. Employees that transport hazardous materials are required to receive HM-126F every 3 years that shall at a minimum include:</p> <ol style="list-style-type: none"> 1. General awareness 2. Function specific 3. Safety 4. Driver training
	<p>VII. Fuel Spill Procedures</p> <ol style="list-style-type: none"> A. Notify agency dispatch immediately of spills more than 5 gallons. B. Safeguard personnel by reviewing firefighting measures and procedures before proceeding with cleanup. Use appropriate PPE during cleanup. C. Remove any ignition source, sparks, flame, impact, friction, and electricity. D. Initial containment: prevent material from entering sewers, waterways, or low areas. E. Spill cleanup: soak up with sawdust, sand, or other absorbent material. F. Disposal must be in accordance with applicable Federal, State, and Local regulations. G. The best disposal method is to burn the gelled fuel if practical and safe.
	<p>VIII. Job Hazard Analysis</p> <p>A required document that should outline the primary tasks, identifies the hazards, and describes methods to mitigate or remove any risk associated with the helitorch operation. Reviewing a helitorch operation JHA with helitorch personnel prior to commencing a project is required.</p> <p>Instructor note: Hand out examples of helitorch operations JHA. Reference IAIG appendix B.</p>

ITEM	DESCRIPTION
 <p>Operational Safety & Equipment Checklist</p> <ul style="list-style-type: none"> Go/no go check list must be completed prior to commencing a Helitorch operation Checklists work as a reminder to what elements, items, and inspections are necessary before initiating a Helitorch operation Stop operations if all checklist items do not remain a Go 	<p>IX. Operational Safety, Go/No Go, and Equipment Checklists</p> <p>Checklists must be completed prior to a helitorch operation. The checklists work as a reminder to what elements, items, and inspections are necessary before initiating a helitorch operation.</p> <p>Instructor note: Hand out Helitorch Operations, Go/No Go, Helitorch Inspection, and Mixing System Inspection checklists. Reference IAIG.</p>
 <p>Fire Protection</p> <p>Extinguisher Mounted on Unit</p> <p>Fire Protection</p> <ul style="list-style-type: none"> One 40-B:C dry chemical fire extinguisher at landing pad D.O.T. regulations require Batchmixer and fuel trucks have a 40-B:C fire extinguisher on unit Additional fire extinguishers are required during mixing & fuel transfer operation (minimum two, 3 gallon class B CAF or Engine with class B foam capability) <p>Trimax Extinguisher</p>	<p>X. Fire Protection</p> <ol style="list-style-type: none"> One 40 B: C dry chemical fire extinguisher meets the minimum requirement at the landing pad. In addition to the 40 B:C fire extinguisher, fire protection requirements for helitorch operations will include a minimum of two three gallon compressed foam system extinguishers capable of using class B foam or a staffed foam capable engine with class B foam. DOT regulations require MC 306 and DOT 406 mixing systems to possess a 40-B: C fire extinguisher. Additional fire extinguishers are required during mixing and fuel transfer operations. Helitorch personnel should be trained on fire extinguisher use or other adequate aqueous foam forming extinguishing system. A dedicated person will staff fire extinguishing equipment during takeoffs and landings, mixing operations, functional tests, and fuel transfers.


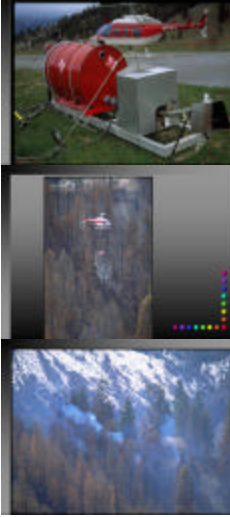
ITEM	DESCRIPTION
	
	<p>XI. Emergency Contingency Plan</p> <ul style="list-style-type: none"> A. Establish and follow approved crash rescue plan. B. Establish and maintain a communication link to dispatch/ICP. C. Establish emergency contact procedure via radio notification. D. Establish escape routes and a safety zone to congregate for personnel accountability. E. Identify and brief suppression, extraction, and first aid personnel.





**Helitorch Wildfire Communications Plan
 (Example)**









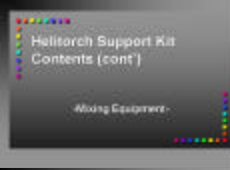


ITEM	DESCRIPTION
<p>Unit Objectives</p>  <p>Unit 4 Helitorch, Balchmittler and Modular Mix Transfer Components</p> <p>Objectives</p> <ul style="list-style-type: none"> Know basic parts & mechanics of a Helitorch Become familiar with the mixing systems 	<p>Upon completion of this unit, the student will be able to:</p> <ol style="list-style-type: none"> 1. Know the basic parts and mechanics of a helitorch. 2. Become familiar with mixing systems.
<p>Training Aids</p>	<ol style="list-style-type: none"> 1. Helitorch 2. Mixing system 3. Helitorch support kit 4. Sawhorses
 <p>Basic function of mixing system is to combine raw fuel with a gelling agent to create a thickened mixture, then transfer it to the helitorch</p>  <p>The purpose of a Helitorch is to dispense ignited gelled fuel via a helicopter</p>	<p>I. Introduction</p> <p>Instructor note: Place a helitorch on a pair of carpenter sawhorses with a drum attached. Have a mixing system configured without fuel for demonstration.</p> <ol style="list-style-type: none"> A. The basic function of the mixing system is to combine raw fuel (e.g., gasoline, diesel, or Jet A) with a gelling agent (chemical - metal salt of organic acid) such as aluminum soap to create a thickened mixture suitable for aerial ignition applications. Besides mixing and recirculation, some mixing systems are configured with a primary discharge line, an auxiliary discharge line, and draft capabilities. B. The helitorch purpose is to dispense ignited gelled fuel via a helicopter.
<p>Helitorch Primary Parts</p> 	<p>II. Helitorch Primary Parts and Their Function</p> <ol style="list-style-type: none"> A. Parts <ol style="list-style-type: none"> 1. Frame 2. Fuel tank with site glasses 3. Ignition system 4. Pump and positive shutoff nozzle 5. Clay & Bailey relief valve 6. Cam-lock and dry break fittings 7. Single point suspension and adjustable attachment point with electrical cable

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 Lesson Plan Unit 4: Helitorch, Mixing System, and Fuel Transfer Components




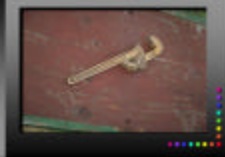
ITEM	DESCRIPTION
 <p>Helitorch Primary Parts</p> <ul style="list-style-type: none"> • Line • Fuel tank with sight glasses • Ignition system • Pump and positive shut-off nozzle • Clay/Bailey relief valve • Cam-lock and dry break fittings • Single point suspension with adjustable attachment point and electrical cable 	
	<p>B. An example of parts and functions can be found using the Simplex 5400 below:</p> <ol style="list-style-type: none"> 1. Standard frame: constructed of heavy gauge aluminum. The frame supports the components of the helitorch. 2. Short frame: constructed of heavy gauge aluminum, same as above but shorten to fit lengthwise in the bed of a full size pickup. <ol style="list-style-type: none"> a. Helitorch refilling drums: approved 55-gallon drums that are designed to attach onto the frame of the helitorch. These drums are equipped with two male dry break connectors. One dry break located on the bottom of the drumhead for refilling and the other at the base or bottom for suction/drafting. The drums are equipped with sight glasses for observation during the gel loading and inspection, a pressure relief valve, a cam-lock vapor recovery/removal fitting, and a removable head to facilitate cleaning. b. Propane ignition system: ignites the gelled fuel. The system consists of a solenoid relay, a guarded electrical switch, coil, vibrator, igniter rod, disposable propane bottle, propane gas regulator, pressure gauge, solenoid (skinner) valve, tubing, and torch tip. c. Gelled fuel discharge system: pumps gelled fuel from the drums through the discharge valve. The system is composed of a female dry break, 2-inch inline swivel, 2-inch draft/suction hose, solenoid relay, a guarded electrical switch, 24-volt electric motor, motor pulley, drive belt, pump pulley, pillow block bearing assembly, Oberdofer gear pump 900055, 1-inch discharge fuel pipe, pump bypass valve assembly, drain cock valve, positive shutoff discharge nozzle with interchangeable tips, wind baffle cover hood, and a fuel pipe support bracket. d. Single point suspension and adjustable clevis pear

ITEM	DESCRIPTION
	<p>link with electrical cable: connects and suspends helitorch to the helicopter.</p> <p>e. Miscellaneous parts: housing cover, Teflon insulators, miscellaneous clamps and torch tip mounting sleeve.</p> <p>f. Simplex 5400 helitorch operational weight with a full 55-gallon drum is approximately 600 lb.</p> <p>g. Vapor recovery system consisting of 2-inch transparent vapor hose with cam-lock fittings and double male cam-lock fitting, to either vent the vapors a minimum of 50 ft away or connected together to return the vapors to the mixing systems, or fuel truck recovery system.</p>
 <p>Batchmixer</p> <ul style="list-style-type: none"> Designed to mix gelling agents and fuel to a thick consistent mix Tank designed to meet U.S. O.G.T. regulations Capable of mixing large quantities of fuel & pumping to Helitorch drums  <p>Batchmixer Components</p> <ul style="list-style-type: none"> Motor Pressure gauge Manifold Drain valve MSC 208 or DOT 404 tank Post fill port Mix/recirculation tank Discharge hose with dry break valves Emergency shut-off transfer valve Emergency shut-off transfer valve Emergency shut-off transfer valve 	<p>III. Batchmixer Systems</p> <p>A. Batchmixer systems are designed to mix gelling agents with a wide variety of fuels to a safe thick consistent mix for ground or aerial firing operations.</p> <p>B. The batch mixing system is capable of mixing large quantities of fuel and pumping it into helitorch drums. An example of the primary components of a batch mixing system are motor, pump, pressure gauge, plumbing, three-way valve, suction valve, main mix tank shutoff valve, mix/recirculation tank, manhole cover, discharge/suction hoses with dry break valves, auxiliary dry break fitting port, auxiliary discharge line with dry break valves, fuel inlet, gelling agent inlet, and vapor removal/recovery ports with cam-lock fittings, and transparent vapor recovery hose and double male cam-lock fitting.</p>
 <p>Modular Mix Transfer System</p>  <p>Modular Mix Transfer Systems</p> <ul style="list-style-type: none"> Serve purpose as a batchmixer Not plumbed to a mix tank Pumps gelled fuels from one drum to another Less costly to manufacture O.G.T. regulated for public highway transportation 	<p>IV. Modular Mix Transfer Systems</p> <p>A. Serve the same purpose as batch mixer systems but are not plumbed with a mixing tank. Modular mix transfer systems pump gelled fuels from one drum to another.</p> <p>B. Drums are an integral component in the mixing process. They are less complex to operate, lighter, and less costly to manufacture.</p>

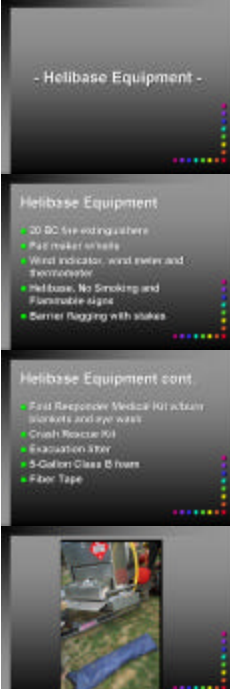
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 Lesson Plan Unit 4: Helitorch, Mixing System, and Fuel Transfer Components

ITEM	DESCRIPTION
  	<p>C. Modular Mix System Components</p> <ol style="list-style-type: none"> 1. Motor 2. Pump 3. Pressure gauge 4. Drums 5. Fuel fill port 6. Clay/Baily relief valve 7. Powder dispenser 8. Sight glasses 9. Discharge hose with dry break valves 10. Suction/recirculation dry break fittings 11. Suction hose with dry break valves
  	<p>V. Helitorch Support Kit Content Example</p> <p>A. PPE</p> <ol style="list-style-type: none"> 1. Nitrile, leather, and cotton gloves 2. Cotton or non-static coveralls 3. OSHA-approved respirator dust masks 4. Chemical splash goggles 5. Ear plugs
 	<p>B. Mixing Equipment:</p> <ol style="list-style-type: none"> 1. Spring scale 2. Aluminum container for powder measuring 3. Non-ferrous mixing paddle 4. Commercial gelling agent 5. Fuel thermometer 6. Approved powder dispenser
	<p>C. Static Bonding Equipment</p> <ol style="list-style-type: none"> 1. Bonding cables with clamps and clips 2. Approved transparent vapor hose 3. Gasoline-approved transfer hose








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 Lesson Plan Unit 4: Helitorch, Mixing System, and Fuel Transfer Components


ITEM	DESCRIPTION
<p>Static Bonding</p> <ul style="list-style-type: none"> • Bonding cables w/clamp and clips • Approved transparent safety shoes • Gasoline approved transfer hose • Both the ropes and fuel transfer hose should have wire built into the construction tested prior to use 	
<p>- Communications -</p>  <p>Communications</p> <ul style="list-style-type: none"> • Hand held radio with chest harness • Headset with hardhat or SPH 4/5 flight helmet with push to talk capability • Extra clam shells with extra batteries • Discrete radio frequency 	<p>D. Communications</p> <ol style="list-style-type: none"> 1. Handheld radio with chest harness 2. Headset with hardhat or SPH 4/5 flight helmet with push to talk capability 3. Extra clam shells with batteries 4. Discrete radio frequency
<p>Helitorch/Mixing System Misc. supplies and parts</p> <ul style="list-style-type: none"> • Extra drums • 24 volt system for mixing tank • Extra parts including spark plug drive belts, solenoid valve, single pole guarded electrical switch, propane regulator, dry break trade and female, grease gun • Propane bottles <p>MISC. Supplies cont.</p> <ul style="list-style-type: none"> • 24Vg • 5000-200 impaler • 1 gal. of diesel or jet A • Cotton rags, hand gloves, steel wool, duct tape, wire brush, wire tie, garbage bags, etc. • 1 gal. Can of water • Tools and 2 large non-ferrous pipe wrenches • Spare drum shell 	<p>E. Helitorch/Mixing System Miscellaneous Supplies and Parts</p> <ol style="list-style-type: none"> 1. Extra helitorch drums 2. 24-volt battery system: two 12-volt marine batteries connected in series 3. Mixing system spark plug 4. Helitorch drive belt 5. Solenoid valve 6. Single pole guarded electrical switch 7. Propane regulator 8. Propane bottles 9. Extra dry breaks connectors 10. O ring grease and small grease gun 11. 5 gallons of solvent/diesel 12. Cotton rags 13. Garbage bags 14. Duct tape 15. Wire ties 16. Steel wool 17. Wire brush

Interagency Helitorch/Mixing System Training – 01/16/2004
 Lesson Plan Unit 4: Helitorch, Mixing System, and Fuel Transfer Components

ITEM	DESCRIPTION
	18. Large non-ferrous pipe wrenches 19. Miscellaneous helitorch parts 20. Toolbox with miscellaneous tools 21. 5-gal Cubie of water 22. Hand cleaner 23. Extra drum seals
	<p>F. Helibase Equipment</p> <ol style="list-style-type: none"> 1. 40 B: C fire extinguishers 2. Pad marker with nails 3. Wind sock or indicator 4. Helibase, no smoking, and flammable signs 5. Fiber tape 6. Barrier flagging with stakes 7. Thermometer 8. Wind meter 9. First responder medical kit with burn pads and eye flush kit 10. Crash/rescue kit 11. Evacuation litter 12. 5 gallons of class B foam

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Lesson Plan Unit 5: Bench Testing, Maintenance, and Troubleshooting


ITEM	DESCRIPTION
<p>Course Objectives</p>   	<p>Students will become familiar with helitorch bench testing, performing helitorch/mixing system maintenance, and helitorch troubleshooting.</p>
<p>Training Aids</p>	<ol style="list-style-type: none"> 1. IAIG 2. Helitorch 3. Mixing system 4. Helitorch support kit 5. 24-volt battery system 6. Two sawhorses
   	<p>I. Helitorch Bench Testing</p> <ol style="list-style-type: none"> A. Prior to a helitorch operation, a bench test should be conducted to check the serviceability of the helitorch. A 40 B:C rated dry-chemical fire extinguisher must be available during the helitorch bench test. The helitorch should be purged of gel for the bench test. B. Bench Test <ol style="list-style-type: none"> 1. Place the helitorch on a pair of sawhorses. 2. Connect two 12-volt batteries in series to produce 24 volts. 3. Connect (if applicable) a propane bottle to the helitorch and adjust the propane pressure to 5 to 10 psi. 4. Ensure both pump and igniter switches are in the off position, and attach the battery adapter cord to the ninepin plug of the helitorch.


ITEM	DESCRIPTION
	<p>5. With the pump switch off, turn on the igniter switch and check for igniter rod arcing and propane ignition.</p> <p>Note: The propane flame should have a blue/yellow hue characteristic to it. Do not keep the igniter switch on for a prolonged period so that the discharge nozzle valve internal components are not jeopardized by heat.</p> <p>6. With the igniter switch off, turn on the pump switch and check that the motor and pump function properly. The pump pulley should spin counter clockwise. Do not operate the pump for a prolonged period of time dry.</p> <p>7. Disconnect the ninepin plug from the battery adaptor cord.</p> <p>8. Check suspension cables, wire ties, motor pulley bolt nuts, bolts, connectors, and drum tie-down straps for tightness and serviceability.</p>
	<p>II. Helitorch Maintenance</p> <p>It is important to properly service and store the helitorch to maintain dependability. Obtain major component service/maintenance publications from manufacturers and distributors.</p> <p>A. Flush the helitorch plumbing with diesel fuel or Jet A after each use. Example:</p> <ol style="list-style-type: none"> 1. Remove the wind baffle cover hood, loosen the igniter rod support bracket and propane torch tip support bracket, and offset to provide clearance to remove the discharge nozzle valve. 2. Remove the discharge nozzle valve and connect a 3/4" to 1" reducer adaptor to the 1" discharge fuel pipe. 3. Connect a drum with a couple of gallons of diesel to the helitorch. 4. Remove the motor/pump housing cover and remove the coil cable.

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 Lesson Plan Unit 5: Bench Testing, Maintenance, and Troubleshooting





ITEM	DESCRIPTION
	<p>5. Connect the 24-volt battery system to the helitorch ninepin plug.</p> <p>6. Connect a section of 3/4" garden hose on the reducer adaptor and insert the discharge end into the drum via one of the top bungs.</p> <p>7. With the igniter switch off, turn on the pump switch. Recirculate for a few minutes.</p> <p>8. During recirculation, observe the pump shaft for a fluid leak.</p> <p>9. Turn the bypass valve on to clean out the bypass line.</p> <p>10. Prior to terminating the diesel flush, turn the pump switch off and remove the garden hose from the drum.</p> <p>11. Place the garden hose into a disposal container and turn the pump switch on to remove the diesel from the drum and helitorch plumbing.</p> <p style="text-align: center;">Note: Secure the garden hose when the pump is operating due to the high discharge pressure.</p> <p>B. Disconnect flushing hardware and reassemble the helitorch.</p> <p>C. Remove drumhead, first being careful to relieve any built up pressure, then scrape out any remaining residue using non-ferrous paddle or squeegee into a suitable container for later proper disposal.</p> <p>D. Do not store the helitorch with gel or fuel remaining in the plumbing and suction hose.</p> <p>E. Remove the propane bottle from the helitorch and depressurize the system during storage. Ensure that the system is sealed for storage.</p> <p>F. Keep the internal components and cylinder of the discharge nozzle valve free of dirt and debris. Keep the valve covered during transport. Grease the cylinder periodically during use.</p>

Interagency Helitorch/Mixing System Training – 01/16/2004
 Lesson Plan Unit 5: Bench Testing, Maintenance, and Troubleshooting






ITEM	DESCRIPTION
	<p>G. Grease the pillow block bearing every 10 hours of use if applicable.</p> <p>H. Replace the suction hose when no longer flexible and cracks are visible.</p> <p>I. Disassemble the propane torch tip and remove carbon from the orifice outlet and the torch tip to ensure propane flame reliability.</p> <p>J. Maintain a minimum 1/4"-gap between the igniter rod and propane torch tip. The igniter rod and torch tip should be offset from the discharge valve nozzle to prevent gel contamination.</p> <p>K. Check the electrical cable to ensure wire ties are spaced at one per every foot along the suspension cable.</p> <p>L. Service and repair the Emco Wheaton dry break coupler. Reference the J1401 (now called J72) dry break coupler maintenance and repair manual.</p> <p>M. Twenty-four volt motor brushes should be periodically inspected. Reference motor maintenance publication.</p> <p>N. Keep all helitorch components clean and free of moisture.</p> <p>O. Reference the Helitorch Inspection Checklist during maintenance inspections.</p> <p>P. Store the helitorch in a sheltered, clean, dry area.</p> <p>Q. Apply service tag after maintenance is performed with name, date, repairs needed, etc.</p>
 <p>The image shows two posters. The top poster is titled 'General Mixing System Maintenance' and lists several bullet points: 'Helitorches that meet MC 306 or DOT 406 design specifications comply with DOT regulations', 'Annual visual inspection by DOT certified inspector', 'Operational pressure test every 5 years by a DOT certified inspector', and 'Maintain water hoses, wheel bearings, electrical system, engine oil, air filter, spark system, and general condition of the unit'. The bottom poster is titled 'Mixing System Maintenance' and lists: 'Provide copies of publications, see note', 'Review publications at least once a year', 'Clean and inspect air filter and spark plug', 'Perform tank tests as needed', 'Purge water lines', 'Keep mixing system clean and store in dry place', and 'Maintain a log of all maintenance performed'.</p>	<p>III. General Mixing System Maintenance</p> <p>A. Mixing systems that meet MC 306 or DOT 406 design specifications must comply with DOT regulations. This includes an annual visual/leak inspection and a hydrostatic tank pressure test every 5 years. The tests must be performed by a DOT-certified licensed inspector.</p> <p>B. Have equipment shop personnel or competent mechanics inspect and maintain the mixing system trailer brakes, wheel bearings, electrical system, engine oil, air filter, spark</p>

ITEM	DESCRIPTION
	<p>arrester, etc., and the general integrity of the unit on an annual basis. Record and log all work performed.</p> <p>C. Reference maintenance publications for the major components of the mixing system (e.g., engine motor, pump, valves, etc.) to maintain the equipment and to help remedy any problems (troubleshoot).</p> <p>D. Clean and purge the mixing system tank, plumbing, suction line, and discharge lines of gel/fuel when the unit is not operated for a prolonged period of time.</p> <ol style="list-style-type: none"> 1. Pump as much of the remaining gel out of the plumbing and tank. Use a nonferrous metal or wood paddle to scrape gel toward outlet valve if needed. 2. Put several gallons of diesel into the tank and recirculate. Flush all hoses with diesel. 3. Purge the entire system of diesel. <p>Note: Fuel remaining in the system can absorb moisture and could jeopardize the life span of the tank by pitting and rusting the internal walls. Also, moisture can degrade gel consistency, rendering it unsafe.</p> <p>E. Care must always be taken not to introduce foreign matter (i.e., rocks, grit, debris, etc.) from getting into the system; it may damage the pump or valves.</p> <p>F. Prevent rust from forming on the tank. Paint the unit when necessary.</p> <p>G. Keep the mixing system clean and store in a dry place.</p>
 <p>Drum & Associated Hardware Maintenance</p> <ul style="list-style-type: none"> • Keep drum purged of gel fuel • Filter as used to prevent clog • Store in clean, dry environment • Regularly break valve clean of dirt & debris • Dry & Rubby, Shie Glasses, Cam Locks, line of gel residues. CLEAN WITH SOLVENT. 	<p>IV. Drum and Associated Hardware Maintenance</p> <p>A. Keep the drum purged of gel/fuel when not in use.</p> <p>Note: Fuel left in the drum for a prolonged period of time (e.g., over winter) can absorb moisture, resulting in the formation of internal pitting and rust pockets, which could jeopardize the drum integrity.</p> <p>B. Prevent rust from forming on the drum. Paint if necessary.</p>





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ITEM	DESCRIPTION
	<p>C. Keep the drums clean and store in a dry environment.</p> <p>D. Keep the dry breaks clean of dirt, debris, and gel residue. Clean with solvent.</p> <p>E. Keep Clay & Bailey relief valve, site glasses and vapor removal/recovery cam-lock free of gel residue. Clean with solvent.</p>
	<p>V. Vapor Hose Maintenance</p> <p>A. Store hoses in dry location away from sunlight.</p> <p>B. Ensure that debris does not enter the hose by keeping the cam-lock caps on during storage.</p> <p>C. Perform continuity test prior to use.</p> <p>D. Replace brittle/dry cracked hoses.</p>
	<p>VI. Helitorch Troubleshooting</p> <p>Troubleshooting is a process to help determine the probable cause or possible reasons for a faulty mechanical symptom. It is a procedure that should be initiated whenever a mechanical problem occurs.</p>
	<p>A. Circuit breakers on helicopter stay tripped open.</p> <ol style="list-style-type: none"> 1. Check for electrical shorts in wiring. 2. Check 24-volt motor for short. 3. Check pump for drag or obstruction. 4. Check gel for consistency. 5. Check motor bearing. 6. Check polarity of plug to helicopter or helitorch.



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ITEM	DESCRIPTION
	<p>B. No spark from igniter.</p> <ol style="list-style-type: none"> 1. Check igniter switch. 2. Check electrical connection from the helicopter. 3. Check vibrator. 4. Check coil. 5. Check coil wire. 6. Check wire connector on igniter rod. 7. Check gap between igniter rod and propane torch tip if propane is used. 8. Check polarity of plug to helicopter. 9. Trace electrical wiring system and continuity test.
	<p>C. Propane does not light (if applicable).</p> <ol style="list-style-type: none"> 1. Check propane gas quantity and gauge for pressure. 2. Check solenoid valve for opening. 3. Check for clogged propane torch tip or orifice. 4. Replace propane bottle with another. 5. Ensure propane torch tip slit is in line with the arcing rod (5400).
	<p>D. No gel being pumped.</p> <ol style="list-style-type: none"> 1. Check pump switch. 2. Ensure dry break valve is open. 3. Check pump for obstruction. 4. Check hose for obstruction. 5. Check for gel consistency. 6. Check drive belt on pump. 7. Check 24-volt motor.
	<p>E. Pump turns backwards (clockwise is backwards).</p> <p>The helicopter or the ninepin plug on the helitorch is not properly wired/polarity is wrong. Check the helitorch first.</p>
	<p>F. Gel comes out the top of the discharge nozzle valve.</p> <p>Check the O ring on the internal cylinder disk. The spring may need to be replaced</p> <p>G. Gel leaks from the pump shaft.</p> <p>Replace pump shaft seal or replace pump</p>


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 Lesson Plan Unit 6: Helitorch Operations/Exercises





ITEM	DESCRIPTION
<p>Unit Objectives</p>  <p>Objectives</p> <ul style="list-style-type: none"> Understand what constitutes a suitable Helitorch operation site. Successfully hook-up a Helitorch to the Helicopter. Demonstrate how to test Helitorch with aircraft power. <p>Objectives</p> <ul style="list-style-type: none"> Demonstrate procedures for filling a Helitorch from mixing systems. Perform Final Helitorch systems check, Fueling on Site or abundant. Demonstrate the mixing procedures for mixing systems. 	<p>Upon completion of this unit, the student will be able to:</p> <ol style="list-style-type: none"> Understand what constitutes a suitable helitorch operation site. Successfully hook up a helitorch to the helicopter. Demonstrate how to test helitorch with aircraft power. Demonstrate the mixing procedures for mixing systems. Demonstrate the procedures for filling a helitorch from mixing systems. Perform final helitorch systems check and finalize Go/No Go checklist.
Class Time	Time will vary due to class size.
Training Aids	<ol style="list-style-type: none"> IAIG Helitorch Mixing system Helitorch support kit Fuel vendor
	<p>Instructor note: Suggest the students shadow experienced helitorch personnel as they function in the respective helitorch positions. When the student feels comfortable with the task, have an experienced helitorch person monitor their ability to work independently.</p>
<p>Helitorch Site Locations</p> <ul style="list-style-type: none"> Helitorch site large enough to safely accommodate all necessary equipment. Establish clear approach and departure paths, over flight of personnel, vehicle traffic, and property not allowed. Maintain safety circle. Close proximity to base site desired. Consider impacts from smoke/embers.  <p>Helitorch Site Locations (cont)</p> <ul style="list-style-type: none"> Authorized personnel only. Establish alternate landing area. Separate Helitorch base from wildland fire helibase. Establish escape routes for personnel & equipment in event of escaped fire. Consider dust abatement needs. 	<p>I. Helitorch Site Location Considerations</p> <ol style="list-style-type: none"> The helitorch site should be large enough to accommodate and provide a safe working distance between all the required pieces of equipment. The site should have established takeoff and landing corridor that has no equipment placed within that zone. A safety circle shall be maintained around the landing pad. The site should be located in close proximity to the burn site to minimize turnaround times. Choose a site that will not be impacted by the smoke column or embers from the burn. Consider the prevailing and forecasted wind direction. Keep location upwind of the burn.





ITEM	DESCRIPTION
	<p>F. Helicopter flight paths must not pass over any personnel, structures, and areas of human occupancy. When overflights of traveled roads occur, traffic control must be established.</p> <p>G. The helitorch operation site should be reserved for authorized personnel only.</p> <p>H. Establish alternate landing areas.</p> <p>I. During wildland incidents, helitorch base operations shall be separated from the primary helibase.</p> <p>J. Establish an escape route for all personnel in the event of an emergency at the work site if threatened by an escaped fire.</p> <p>K. Try to choose a site that has no, or a minimum, need for dust abatement.</p>
	<p>II. Helitorch Installation to the Helicopter</p> <p>A. Remove pilot's door.</p> <p>B. Complete the helitorch inspection checklist.</p> <p>C. Place the helitorch in front of the helicopter with the discharge nozzle end towards the pilot's side of the aircraft.</p> <p>D. Check to ensure the guarded electrical switches are in the off position.</p> <p>E. Layout the single point suspension system under the helicopter. Make certain the cables are placed between the skids and will not snag a skid during takeoff. Ensure the attachment is correctly configured for helicopter being used.</p> <p>F. Do not attach suspension system to the cargo hook. Failure to follow this procedure can result in damage to the helicopter wiring if polarity on the helicopter is not correct. Have the pilot check for both manual and electrical releases.</p> <p>G. Connect the helitorch ninepin plug to the electrical receptacle on the helicopter.</p>


ITEM	DESCRIPTION
	<p>III. Helicopter/Helitorch Electrical, Pump, and Propane Test</p> <p>Note: This test is intended to ensure that the helicopter electrical system and helitorch is working properly before commencing mixing operations. The helicopter is not in operation during this test.</p> <p>A. Ensure both electrical switches are in the off position.</p> <p>B. Install a propane bottle.</p> <p>Note: If the propane bottle does not have a protective cap on the discharge port, blow out any dust or dirt that may have accumulated. Debris can cause the propane regulator to malfunction.</p> <p>C. Turn the propane on, adjusting the propane tip pressure gauge between 5 to 10 psi.</p> <p>D. Have the pilot activate the electrical power to the helitorch.</p> <p>E. Momentarily turn on the igniter switch and check for propane ignition.</p> <p>Note: The propane flame should have a distinct yellow/blue hue characteristic to it.</p> <p>F. With the igniter switch off, very briefly turn on the pump switch and check for operation and correct polarity.</p> <p>Note: This test is not to be conducted with a full drum and assumes the helitorch plumbing has been purged of all fuel. If you suspect fuel remains in the plumbing, place a pail under the discharge nozzle to collect any dispensed fuel. A fire extinguisher should be staffed during this test.</p> <p>G. Attach suspension system to helicopter cargo hook.</p>
	<p>IV. Mixing System Safety Standards</p> <p>A. The mixing area shall be located outside the helicopter safety circle.</p> <p>B. During the mixing operation, fire protection will be staffed and ready.</p>



ITEM	DESCRIPTION
  <p data-bbox="215 600 423 747"> Mixing Area <ul style="list-style-type: none"> • Located outside of the helicopter safety zone • Check the mixing operation fire protection will be staffed and ready • Restricted to Helitorch personnel only • No smoking within 50 feet of any operation or the Helitorch team, including the vapor removal discharge hose outlets </p> <p data-bbox="215 768 423 915"> Mixing Area (cont.) <ul style="list-style-type: none"> • Precautions must be taken to eliminate sources of ignition • Use approved gelling agent dispenser • SOP/ASHTD of any kind should be used in the mixing operation </p> 	<p data-bbox="513 275 1349 348">C. The mixing area will be restricted to helitorch operations personnel only.</p> <p data-bbox="513 380 1365 453">D. No smoking is permitted within 50 feet of helitorch/mixing system operations and vapor removal hose outlets.</p> <p data-bbox="513 485 1382 527">E. Precautions must be taken to eliminate sources of ignition.</p> <p data-bbox="513 558 1146 600">F. Use an approved gelling agent dispenser.</p> <p data-bbox="513 632 1276 705">G. No plastic of any kind should be used in the mixing operation. Must be metals.</p> <p data-bbox="561 747 1373 852"> Note: Dumping powered gelling agent through the manhole opening of the batchmixer is not acceptable. Use an appropriate dispensing mechanism. </p>
 <p data-bbox="215 1287 423 1444"> Bonding Sequence <ul style="list-style-type: none"> • Connect bonding cable from bulk fuel truck to the mixing system or extension bonding point • Connect vapor removal hose • Open fueling port and begin fueling • When fueling ceases, close port • Remove bonding cable • Note: The goal is to provide continuity </p> <p data-bbox="215 1465 423 1623"> Bonding from the mixing system to the Helitorch drum for gel bonding  </p> <p data-bbox="215 1644 423 1801"> <ul style="list-style-type: none"> • Connect vapor removal hose • Use a fuel transfer hose with wire braid and a dry-break connector and connect into the Helitorch dry-break • When done disconnect dry-break • Remove vapor hose </p>	<p data-bbox="464 1108 740 1150">V. Static Bonding</p> <p data-bbox="513 1182 1382 1434"> Flammable liquids will build up a static electrical charge when flowing through plumbing and agitation and during dispensing (spraying or pouring). Fire and explosion can result when static electricity discharges at or near vapors of highly flammable fuel such as gasoline. Bonding of equipment must be adhered to when conducting mixing and fuel transfer operations. </p> <p data-bbox="513 1476 1382 1770"> A. Bonding is the process of joining two or more objects or containers with electrically conductive wires to neutralize the potential charge between them. Bonding wires fitted with a wide variety of approved clamps are available: e.g., "C" clamps, pipe clamps, and alligator clips. Bonding should be performed by eliminating paint from the location that will be bonded. Bonding requirements: refer to IAIG appendix F. </p> <p data-bbox="513 1801 1398 1875"> B. Continuity testing shall be conducted on fuel transfer hoses, vapor hoses, and bonding cables prior to use. </p>


ITEM	DESCRIPTION
	<p>VI. Commercial Gelling Agent</p> <p>A. Use a commercially made gelling agent such as Fire-Trol fire gel from Chemonics Industries Inc. Must have an MSDS.</p> <p>Note: Military gelling agents have no MSDS available and should not be used.</p> <p>B. Maintain the proper mix quantity ratio of gelling agent to fuel. Reference manufacturer's instruction data.</p> <p>Note: A very thick mix may not pump from the mixing system to the helitorch.</p> <p>C. Gelling agent should be dry with no foreign substances in the powder. The powder should be free of clumps/lumps.</p> <p>Note: The helitorch and mixing system use gear-driven pumps, which cannot pass objects that are harder than the brass gears. Hard objects will result in jamming the pump. It is essential to keep the fuel, gelling agent, and equipment clean and dry.</p> <p>D. Powder gelling agent added to partially gelled fuel will not dissolve, which can cause large un-dissolved powder clumps to form and float on the surface.</p> <p>Note: Undissolved powder can cause discharge lines to clog and prevent the flow of gel.</p> <p>E. Addition of gelling agent to a batch of gasoline with any more than 5 to 10 percent residual gel left in the drum or mixing system can result in severe clumping. It can take up to 48 hours for the clumps to dissipate in the mix.</p> <p>F. Gelling agent should be added to the agitated fuel at a moderate rate.</p> <p>G. You can determine gelling powder and fuel compatibility before proceeding with mixing large quantities by taking a 1-quart sample of fuel and adding gelling agent proportionately.</p>

ITEM	DESCRIPTION
 <p>Fuel</p> <ul style="list-style-type: none"> • Gasoline or a gasoline (70%) / diesel (30%) combination is preferred • Use clean fuels, avoid contaminants • Warmer fuels will gel more quickly • Fuel additives used for formulating oxygenated fuel have had a negative effect on maintaining gel consistency 	<p>VII. Fuel</p> <p>A. Commercial gelling agents can be utilized for gelling all types of hydrocarbon fuels including gasoline, diesel, Jet A, etc.</p> <p>B. Use clean fuels (water contamination must be avoided). The presence of a small amount of water in the fuel can cause rapid breakdown of the gel after initially having the proper consistency. If high levels of water are present in the fuel, the gel will not form at all.</p> <p>Note: A water-detecting paste is available through your local fuel distributor.</p> <p>C. Warmer fuel will gel more quickly than colder fuel. Fuel temperature determines the amount of gelling agent required and also the time it takes the gel to reach the proper consistency. More gelling agent is required with colder fuel to accelerate the gelling process.</p> <p>Note: Follow the manufacturer’s mixing instructions. Use a fuel thermometer to determine temperature.</p> <p>D. The fuel additives used for formulating oxygenated fuel have had a negative effect on maintaining gel consistency.</p> <p>Note: Successful mixing using 70% gasoline and 30% diesel maximum, or avgas as an alternative to unleaded oxygenated fuel has had positive results.</p>
 <p>Mixing Systems</p>	<p>VIII. Mixing</p> <p>Due to exposure concerns and the new vapor recovery system, drum mixing is no longer permitted.</p>
  <p>Mixing Systems</p> <ul style="list-style-type: none"> • Personnel required: <ul style="list-style-type: none"> • Mixer operator • Mixing crew • Fuel truck driver • Mixing system should be as empty as possible of residual oil • Road to bulk fuel source • Hook up vapor recovery hose (50 ft minimum), lower and post “no smoking” signs 	<p>IX. Mixing System Mixing</p> <p>There are many different mixing systems, each having inherently different pumping and operating systems. Each unit should develop a mixing system operating plan tailored to their specific equipment.</p> <p>A. Three personnel are required for this procedure:</p> <ol style="list-style-type: none"> 1. Fuel vendor operator

ITEM	DESCRIPTION
  <p data-bbox="217 590 422 758"> Mixing Systems • Fill mixing system with desired amount of fuel. • Dispense fuel according to instructions and check. • Dispense gelling agent into fuel at a moderate rate. • Continue recirculation for 2 minutes for 55 gallons; 4 minutes and 5 minutes for larger quantities. Then shut off system and wait. • Gelling should be complete in 5-20 minutes. </p>  <p data-bbox="217 936 422 1104"> Mixing Systems • Check for proper gel consistency with a paddle or appropriate paddle. • The gel should envelope around the paddle when inserted into the gel batch slowly. • When removed from the gel there should be no liquid dripping and gel should fall right off paddle and not stick to it. </p> 	<ol style="list-style-type: none"> 2. Mixing system pump operator 3. Mixmaster, or designee <p>B. Mixing system tank or drum should be empty, with little gel residue remaining.</p> <p>C. Mixing system needs to be bonded to the bulk fuel source.</p> <p>D. Attach the vapor recovery/removal hose to the vapor removal cam-lock on the mixing system. If applicable, attach the vapor hose to the fuel tender. If vapor removal is used, a minimum 50-foot section of vapor hose placed downwind from the mixing system is required. The outlet of the removal hose requires posting of a no smoking sign. Open vapor removal valve prior to adding fuel to mixing system when using a batchmixer.</p> <p>E. Fill the mixing system with the desired amount of fuel.</p> <p>Note: Agitation could be jeopardized if overfilled with fuel.</p> <p>F. Begin the agitation/recirculation process. Check to see that agitation/recirculation is working properly.</p> <p>G. Dispense the gelling agent at a moderate rate while agitating.</p> <p>H. After completely adding the gelling agent, continue agitation: 50-gallon mixing systems approximately 2 minutes; over 50 gallons, approximately 5 minutes. Then discontinue the agitation process.</p> <p>I. Gelling should be complete in 10 to 20 minutes.</p> <p>Note: Continued agitation/recirculation can cause a thinning of the gel due to a shearing action of the gear-driven pump. The gelling process is not dependent upon continued agitation.</p> <p>J. Check for proper gel consistency by placing a mixing paddle or an appropriate tool into the gel. When the gel is at its optimal consistency for helitorch use, the gel should envelope around the paddle and, without assistance; the paddle should slowly descend to the tank bottom.</p>



ITEM	DESCRIPTION
	<p>Removing the paddle from the gel, there should be no liquid dripping from the paddle. The gel should fall freely and not adhere to the surface of the paddle. The gel should resemble jelly with a waxy surface.</p> <p>Note: During helicopter landings/takeoffs or when the helicopter is on the pad running, ensure all lids and covers of mixing equipment are closed.</p>
 <p>Filling the Helitorch</p> <ul style="list-style-type: none"> Personnel required: <ul style="list-style-type: none"> Parking Tender Mixmaster Mixing system operator (2) Parking Tender controls helicopter then secures switches as needed off Parking Tender has 2 people with personnel that they can start back filling operation <p>Filling the Helitorch</p> <ul style="list-style-type: none"> Parking Tender then staffs fire extinguisher for duration of all operations. Mix Master ensures that switches are off then looks up vapor recovery hose. Looks up fuel transfer hose and 2 people secure operator to begin fuel transfer Visuals through sight glass to monitor fuel level 	<p>X. Gel Transfer System Procedures</p> <p>Three helitorch personnel are needed at a minimum to execute a successful mixing system to drum fuel transfer. For a more efficient operation, an additional helitorch mixing crewmember can be utilized to expedite the processes outlined below.</p> <p>A. The parking tender conducts the landing of the helicopter and, if designated, turns off the switches and signals the mixmaster, or designated helitorch crewmember (mix crew) to approach the helitorch to fill the drum.</p> <p>Note: Use a pad marker as a target for the pilot to place the helitorch on. This will ensure having adequate vapor and discharge hose to reach the helitorch.</p> <p>Note: The vapor recovery/removal hose must be positioned a minimum 50 feet away with a “no smoking” sign posted at the outlet end or returned and attached to the mixing system. The vapor hose may need to be anchored due to the effects of rotor wash.</p> <p>B. During the entire fuel transfer process, the parking tender will staff the fire extinguisher.</p> <p>C. The mixmaster or designee attaches the discharge hose/dry break valve and vapor hose onto the drum dry break and vapor cam-lock, turns the dry break valve on, looks through the sight glass, and signals mixing system operator to start pumping.</p> <p>D. The mixmaster should signal (e.g., thumbs up) to the mixing system operator that the gel is flowing.</p> <p>E. When the drum is near full, the mixmaster should, with one hand, prepare to signal to the mixing system operator to shut off the flow and, with the other hand on the dry break</p>

ITEM	DESCRIPTION
 <p data-bbox="207 604 435 758"> Filling the Helitorch <ul style="list-style-type: none"> • Signal pump operator (via pump operator through radio) when full, get to bottom of sight glass and shut off dry brake. • Identify vapor lines that fuel hose and replace them with 2" new hose. </p>	<p data-bbox="558 239 1024 275">valve, prepare to close the valve.</p> <p data-bbox="558 310 1325 384">Note: Fill the drum to the bottom level of the sight glass.</p> <p data-bbox="513 422 1373 674">F. When the drum is full, the mixmaster should signal the mixing system operator to shut off the flow. After the shutoff signal, the mixmaster should then close the dry break valve, disconnect from the drum both the discharge and vapor hoses, secure the clay bailey camlock valve on drum, secure the hoses several feet away from the helitorch, and exit to a safe area.</p> <p data-bbox="558 716 1406 852">Note: It is important to have the mixing system operator shut off the flow of gel before the mixmaster closes dry brake valve due to the positive displacement of the gear-driven pump.</p> <p data-bbox="558 894 1252 961">Note: Protect the dry break valve from debris contamination.</p>
 <p data-bbox="207 974 435 1136"> Helitorch Test - First Load <ul style="list-style-type: none"> • With helicopter not running, and switches in off position, signal to pilot to turn on power to Helitorch. • Place a bucket under the nozzle and turn on the pump switch until gel comes out, test helitorch for fuel flow, ensure nozzle valve is not leaking. • Ensure both switches are off. </p> <p data-bbox="207 1157 435 1318"> Final Helitorch Systems Check <ul style="list-style-type: none"> • Inspection should be done by the Helitorch Manager with the Helitorch, Tanker and Mixmaster present. • Check helitorch fuel system, re-inspect the helitorch. </p>	<p data-bbox="467 968 802 1003">XI. Preflight Helitorch</p> <p data-bbox="513 1045 1357 1262">After installing the helitorch to the helicopter and conducting successful function checks, the mixing process usually commences. When the mix is ready and the initial helitorch drum is full of gel, a test should be performed to insure gel dispenses from the discharge nozzle and the nozzle closes properly to prevent a hang fire occurrence.</p> <p data-bbox="513 1304 1341 1371">Note: This test is performed while the helicopter is not operating.</p> <p data-bbox="513 1413 1406 1879"> A. Remove the motor pump housing cover from the helitorch and disconnect the coil cable wire. B. Place a bucket under the discharge nozzle. Keep the top of the discharge nozzle free from obstruction to observe the movement of the piston assembly. C. Have the pilot activate the electrical power to the helitorch. D. Open the drum dry break valve, ensure the igniter switch is off, turn the pump switch on, and wait a moment for gel to be discharged. If a few seconds elapse without gel discharge, place a pail under the fuel pipe drain cock. Try </p>





ITEM	DESCRIPTION
	<p>again with the drain cock open. Shut off drain cock when gel dispenses.</p> <p>Note: An airlock can form when the helitorch has been purged of all fuel.</p> <p>E. When gel dispenses from the discharge valve, turn off the pump switch while observing the piston rod. The rod should bolt upward when the discharge valve is dispensing fuel and close rapidly downward during shutoff.</p> <p>Note: Hang fire is eliminated if the discharge nozzle is operating properly.</p> <p>F. Reconnect coil cable wire and replace motor/pump housing cover.</p> <p>G. The parking tender shall staff the fire extinguisher during this test.</p>
	<p>XII. Final Helitorch Systems Check</p> <p>A. The initial inspection should be done by the helitorch manager/mixmaster with the parking tender and subsequent inspections by the parking tender.</p> <p>B. During helicopter fuel cycle stops, it is advisable to have the helitorch manager/mixmaster reinspect the helitorch.</p> <p>C. Inspection items:</p> <ol style="list-style-type: none"> 1. Suspension system. 2. Cam locks caps secure. 3. Visual inspection of drum straps. 4. Propane pressure between 5 to 10 psi. 5. Dry break valve open. * 6. Ignition component properly adjusted and clean. <p>*Note: Recommend using duct tape to prevent inadvertent closure.</p>

ITEM	DESCRIPTION
	<p>D. After the fuel exchange, the parking tender ensures that the helitorch is ready for flight (i.e., drum is secure to helitorch, integral components are securely fastened, suspension lines are in proper position, propane gauge setting is correct), ensures the switches are activated, and informs the pilot that the system is ready.</p> <p>Note: The mixmaster or designee may assume the above tasks.</p> <p>E. Parking tender marshals takeoff and advises the pilot of any unsafe conditions as needed.</p> <p>Note: Maintain cleanliness of arcing rod and propane torch tip to prevent igniter failure.</p> <p>F. Check pump shaft on occasion to ensure seal is still intact and not expelling gel.</p>
	<p>XIII. Propane Bottle Replacement</p> <p>Propane gas use is gauged by the quantity of drums used on the helitorch. To ensure continuous, non-interrupted ignition, the propane bottle must be replaced before it becomes empty during flight.</p> <p>The duration of a 14-oz disposable propane bottle when the pressure is set between 5 to 10 psi is usually after five to seven 55-gallon drums of gel have been expelled from the helitorch.</p> <p>A method should be devised when to replace the propane bottle. Example: Have the mixmaster or designee with a permanent marker make a mark on the bottle as each drum is used. When a total of six slash marks are indicated on the bottle, have a designated person or mix master replace the bottle. The radio operator can also inform when to replace the propane bottle.</p>

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 Lesson Plan Unit 7: Fuel and Firing Considerations

ITEM	DESCRIPTION
<p>Unit Objectives</p> <p>Fuels and Fire Behavior (Optional)</p>  <p>OBJECTIVES</p> <ul style="list-style-type: none"> • Identify key elements of the fire environment. <ul style="list-style-type: none"> • Fuel • Weather • Topography • Fire behavior • Discuss how the fire environment influences burn execution. 	<p>Upon completion of this unit, the student will be able to:</p> <ol style="list-style-type: none"> 1. Understand that a successful aerial ignition "burn" is dependent upon many critical elements besides the actual mechanics of the helitorch operation. 2. Identify fuel factors affecting fire behavior and burn execution. 3. Identify weather factors affecting fire behavior and burn execution. 4. List the three primary fire types and associated burn results produced by each. 5. List the four ignition methods and burn result produced by each. 6. Use knowledge of fuel, weather, and firing methods to design an aerial firing sequence that will meet specific burn objectives. 7. Describe how to adjust firing patterns to compensate for fire behavior.
<p>Pre-burn Reconnaissance</p> <p>Key participants</p> <ul style="list-style-type: none"> • Pilot • Burn Designation Specialist <p>Pre-burn Reconnaissance</p> <ul style="list-style-type: none"> • A thorough recon of the burn area and a discussion of the burn objectives are essential to a successful firing operation. • Fire environment elements to consider during the recon are: <p>Pre-burn Reconnaissance: Fuel Characteristics</p> <ul style="list-style-type: none"> • Type and loading • Continuity • Fuel moisture • Chemical properties • Fuel size, shape, and compactness • Vertical arrangement and horizontal continuity. 	<p>I. Fuel Reconnaissance</p> <p>A thorough recon of fuel distribution and availability is an essential part of burn planning.</p> <p>A. Fuel characteristics to consider in burn planning and execution are:</p> <ol style="list-style-type: none"> 1. Fuel loading 2. Fuel size, shape, and compactness 3. Fuel vertical arrangement and horizontal continuity 4. Fuel moisture content 5. Chemical properties of fuels <p>B. An accurate assessment of fuel availability is essential in evaluation of which portion of the fuel bed will burn.</p>
<p>Pre-burn Reconnaissance: Weather Factors</p> <ul style="list-style-type: none"> • Temperature • Relative humidity • Barometric • Wind speed • Wind direction • Wind gusts • Cloud cover and precipitation 	<p>II. Weather Factors</p> <p>To accurately predict fire behavior in various fuel types, the following weather factors must be considered:</p> <ol style="list-style-type: none"> A. Wind speed and direction B. Air temperature C. Relative humidity

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	<p>D. Recent and expected precipitation E. Weather patterns - atmospheric instability</p>
<p>Pre-burn Reconnaissance: Topography</p> <ul style="list-style-type: none"> • Slope • Aspect • Elevation • Local influences <p>Pre-burn Reconnaissance: Fire Behavior</p> <ul style="list-style-type: none"> • Fire types • Surface • Crown • Fire growth characteristics • Head fires • Backing fires • Flanking fires 	<p>III. Fire Types</p> <p>Different fire types produce varying fire behavior, fire effects, and burn results.</p> <p>A. Head fires B. Backing fires C. Flanking fires</p>
 <p>Aerial Firing Ignition Patterns</p> <ul style="list-style-type: none"> • Strip-head • Spot • Chevron • Center • Backing fire • Or a combination of the above 	<p>IV. Ignition Types</p> <p>Each ignition type influences both fire behavior and effects.</p> <p>A. Line ignition patterns B. Spot ignition patterns C. Strip ignition patterns D. Ring ignition patterns</p>
<p>Interaction</p> <ul style="list-style-type: none"> • Fuels, weather, topography, fire behavior, and ignition patterns all interact to create fire effects. • Adjustments to firing patterns can be made to produce fire effects that will meet burn objectives. 	<p>V. Interaction</p> <p>Fuels, weather, fire type, and ignition pattern all interact to produce characteristic fire behavior.</p>
 <p>SEE YA!</p> 	<p>VI. Aerial Firing Patterns</p> <p>Adjustments may be used to compensate for fire behavior.</p> <p>A. Vegetation such as hardwood stands can be ringed using closely spaced ignitions to provide a buffer of burned fuels in sensitive areas.</p> <p>B. Some areas may be ring-fired well inside burn unit boundaries to promote a very hot burn to kill off unwanted vegetation such as exotic plants and hardwood in pine plantations.</p> <p>C. Second lines of fire can be ignited to influence the main fire and pull smoke columns away from the line.</p>

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	<p>D. Secondary ignition may be used to break up fuels ahead of the main fire.</p> <p>E. All of these applications are difficult by ground ignition due to safety concerns.</p>