

Chapter III – Plastic Sphere Dispenser Operations

The *Premo Mark III Aerial Ignition Device* is the only Plastic Sphere Dispenser authorized and is distributed by Aerostat, Inc., Leesburg, Florida.

I. Introduction

The Plastic Sphere Dispenser (PSD) machine was developed to provide a method of igniting ground fuels, in a short time, on large acreage without causing undue damage to the overstory. This method had to be cost-effective, environmentally acceptable, and readily available.

During the early 1960s, Australian foresters developed a spot-firing technique whereby ignition devices were dropped from aircraft onto 5,000 to 10,000 acre blocks of eucalyptus forests to consume the litter and reduce the fire hazard. This early system consisted of a small plastic capsule containing potassium permanganate. A syringe was used to inject ethylene glycol into the plastic capsule, then the charged device was dropped from an aircraft. The exothermic reaction resulted in spot fires where the device landed. The pharmaceutical vials used by the Australians to contain the potassium permanganate were satisfactory for manual dispensers, but their irregular shape caused malfunctions when used in faster machines. The Alberta Department of Land Management and Forest, Equipment Development Section introduced a spherical container. This container was modified for use in the Pacific Forest Research Center (PFRC) dispenser. The Aerial Ignition Device (AID) has proved to be an effective aerial ignition system ignite fuels.

II. Description

The sphere is made of high impact polystyrene, 32-mm (1.25 inches) in diameter and contains approximately 3.0 grams of potassium permanganate. The rate of chemical reaction is dependent on the particle size and concentration of the chemicals involved. An undiluted, glycol-based antifreeze is required. It provides a reliable ignition and a time delay of at least 20 seconds.

III. Dispenser Function

The PSD injects glycol into the plastic sphere, initiating an exothermic reaction and then to expel the primed sphere from the aircraft. Incorporated in the mainframe are the power train, water and glycol reservoirs (with separate pumps), slipper blocks, and injection mechanism. The PSD contains four slipper blocks and feed chutes. Feed chutes can alternate patterns to regulate the number of spheres being dispensed, establishing ignition patterns on the ground. Power to the PSD is supplied by the aircraft's electrical system. The PSD may be ordered for use with either 12 to 24-volt DC electrical systems.

IV. Safety Precautions

- A. The PSD will not be permanently affixed to the helicopter. It will be mounted with straps that can be cut to jettison the PSD in case of malfunction.**
- B. Glycol tank must be filled and tightly capped at least 25 feet away from the aircraft.**
- C. Lead acid batteries will not be carried in the cabin to power the PSD. The PSD must be powered through the aircraft's electrical system.**
- D. A 20 B/C fire extinguisher will be available on site.**
- E. Operator shall wear a restraining harness as per agency requirement**
- F. Extra supplies of glycol will not be carried in the cabin during burning operations.**
- G. A metal container will be available during testing for containment of plastic spheres.**
- H. Ignition time should not be less than 20 seconds.**
- I. Helicopter speed should not exceed 50 mph during ignition operations.**
- J. Do not remove feed chute while in operation.**
- K. Potassium permanganate is a strong oxidizer; it should be stored in a cool, dry place and must be kept completely separate from glycol.**
- L. The area to be burned must be clear of people and equipment.**
- M. At least 5 gallons of water will be available on-site**

CAUTION: An inadequate quantity of glycol injected into the plastic sphere can induce a violent reaction that can cause the sphere to spin or roll and spray a hot, mixture of potassium permanganate and glycol a considerable distance.

Advantages and Disadvantages Compared with the Helitorch	
ADVANTAGES	DISADVANTAGES
<p>Logistically less complicated--plastic spheres can be safely and easily transported in bulk quantity to the burn site. Separate helibase is not required for PSD set-up and operation.</p> <p>Essentially a self-contained operation. PSD Operator and possibly one assistant are the only personnel required.</p> <p>Safety procedures are less complicated than those for the helitorch.</p> <p>Requires little set-up time apart from installation of PSD machine in helicopter.</p> <p>Operator in a hands-on position, able to immediately assess and/or address minor problems without returning to helipad.</p> <p>Equipment costs less than helitorch unit.</p> <p>Operator can see how many plastic spheres are left in hopper, and can approximate how much ignition time is left before having to return to helipad.</p> <p>Possible to lay very long ignition lines, if necessary.</p> <p>Less cost in support staff, set-up, and demobilization time than helitorches.</p> <p>Minimum damage to tree canopy resulting from ignition procedures.</p> <p>Narrow burning windows can be better utilized due to shorter set-up time.</p> <p>Burn Boss can be on board during ignition sequences. Command and control can more easily be maintained.</p>	<p>The Premo Mark III Aerial Ignition Device poses several disadvantages compared with the helitorch.</p> <p>Plastic spheres burn for a shorter time on the ground than do gelled fuels.</p> <p>Even a dense drop pattern of plastic spheres cannot duplicate the characteristics of the helitorch drop pattern.</p> <p>Firelines take longer to form and interact with each other.</p> <p>The pilot cannot jettison the PSD. Operator must manually jettison the PSD in the event of an emergency.</p> <p>PSD requires continuous attention of operator to watch for proper operation and keep balls in the hopper.</p> <p>Possibility of fires developing in the PSD.</p>

Table 2

V. Situations Favorable for Plastic Sphere Ignition

General guidelines are offered here for the plastic sphere system that might be preferable to the helitorch. This is by no means an exhaustive list. The fire manager must select the tool to meet the mission objectives under existing and/or forecasted burning conditions.

- A. **Understory Burning – Plastic Sphere ignition may be used in any stand that can be burned by conventional methods. The plastic sphere ignition system is an excellent tool for hazard fuel reduction in pine plantations. This system is safe, efficient and economical, and users can burn with less risk to the plantation than by using the helitorch.**
- B. **Burns where a long line of fire must be laid down in a short period of time. Because a large number of plastic spheres can be carried on board the helicopter, a longer line can be laid without having to return to the helibase. Set-up and support is simpler and faster.**
- C. **Burns where, due to size, poor access, etc., fixed costs of helitorch operations (mixing crew, fuel, and fuel delivery) may result in a higher cost per acre.**

VI. PSD System Organization

See Charts in Appendix A

A. PSD Operator

Position Responsibilities—Serves as PSD Operator to the Burn Boss/Firing Boss. The Operator briefs pilot, (including the use of the shelter) identifies safety requirements at the operations briefing, and monitors overall operation. May serve as Helibase/Helispot Manager. Provides information on aerial safety procedures to be used by the Burn Boss/Firing Boss. The Operator is responsible for the preparation, installation, operation, maintenance, and care of the PSD. The operator verifies for Burn Boss/Firing Boss that prescribed spacing of ignition is occurring and makes necessary adjustments. Determines if malfunction occurs and acts accordingly. If an onboard fire takes place, it must be determined if fire can be extinguished, or if unit must be jettisoned. The Operator will communicate with the pilot and Burn Boss/Firing Boss on all procedures associated with operation and/or emergencies occurring during operation.

Note: *The following agencies require the operator to wear a restraining harness during operation: USDA Forest Service, Bureau of Land Management, National Park Service, US Fish and Wildlife Service, and Bureau Of Indian Affairs. If your agency is not identified, refer to approving Agency official for Agency/Bureau-specific direction. Seat belts must be worn during take off and landing.*

Harness information: The rappel/smokejumper spotter harness is recommended, model # B49001 & the tether, # MSTC-946. Contact MTDC for current information regarding harness and hard point connections.

Source: Missoula Technology and Development Center (MTDC)

Contact: George Jackson, 406-329-3967

- B. **Pilot Position Responsibility** – The pilot will follow lighting plan, under the direction of Burn Boss/Firing Boss. Pilot-in-command is responsible for all matters related to aircraft operations and safety, and PSD installation oversight and helicopter load calculation.

C. Helibase/Helispot Support (as needed)

1. Helibase/Helispot Fire Protection
 - a. At a minimum, one 20 B/C rated fire extinguisher and five gallons of water will be positioned at the helibase/helispot.
 - b. Provide crash rescue equipment at helibase/helispot.
2. Radio Operator
 - a. Will be positioned at the helibase/helispot.
 - b. Will initiate radio communications with Burn Boss and Dispatch.

VII. Communication

A. Prescribed Fire Communication Plan

A discrete channel should be assigned for communication with the Burn Boss and helibase. A frequency is required for helicopter aerial ignition operations that will be free from other traffic. A separate channel is recommended for ground operations. The amount of coverage is dependent on organization and layout of the project area. The following depicts a PSD prescribed fire communication flow plan.

Plastic Sphere Dispenser Communication Plan

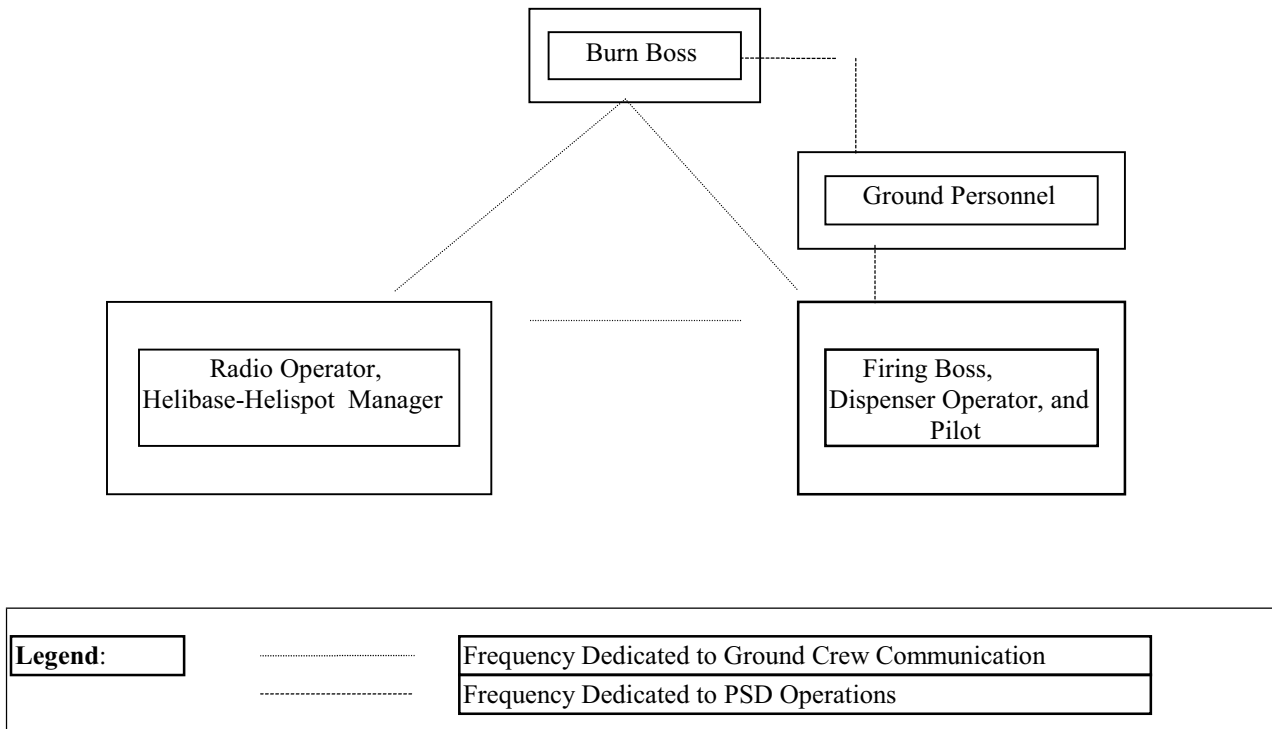


Figure 1

B. Wildland Fire Communication Plan

Aerial ignition missions for wildland fire requires additional communication links. Because of the need for a discrete frequency between the Firing Boss and the aerial ignition helicopter, the discrete air to ground channel need not be published in the Incident Action Plan (IAP). All other frequencies must be included in the IAP Complex Burn Plan and their use covered during briefings. Listed below are the minimum frequencies required:

1. A discrete frequency is required between the aircraft and Firing Boss.
2. Separate command and tactical channels will be used for ground operations.
3. A frequency will be assigned for Flight Following.
4. Air to air frequency is required between the ignition helicopter and other aircraft, it may be the same frequency for Flight Following.

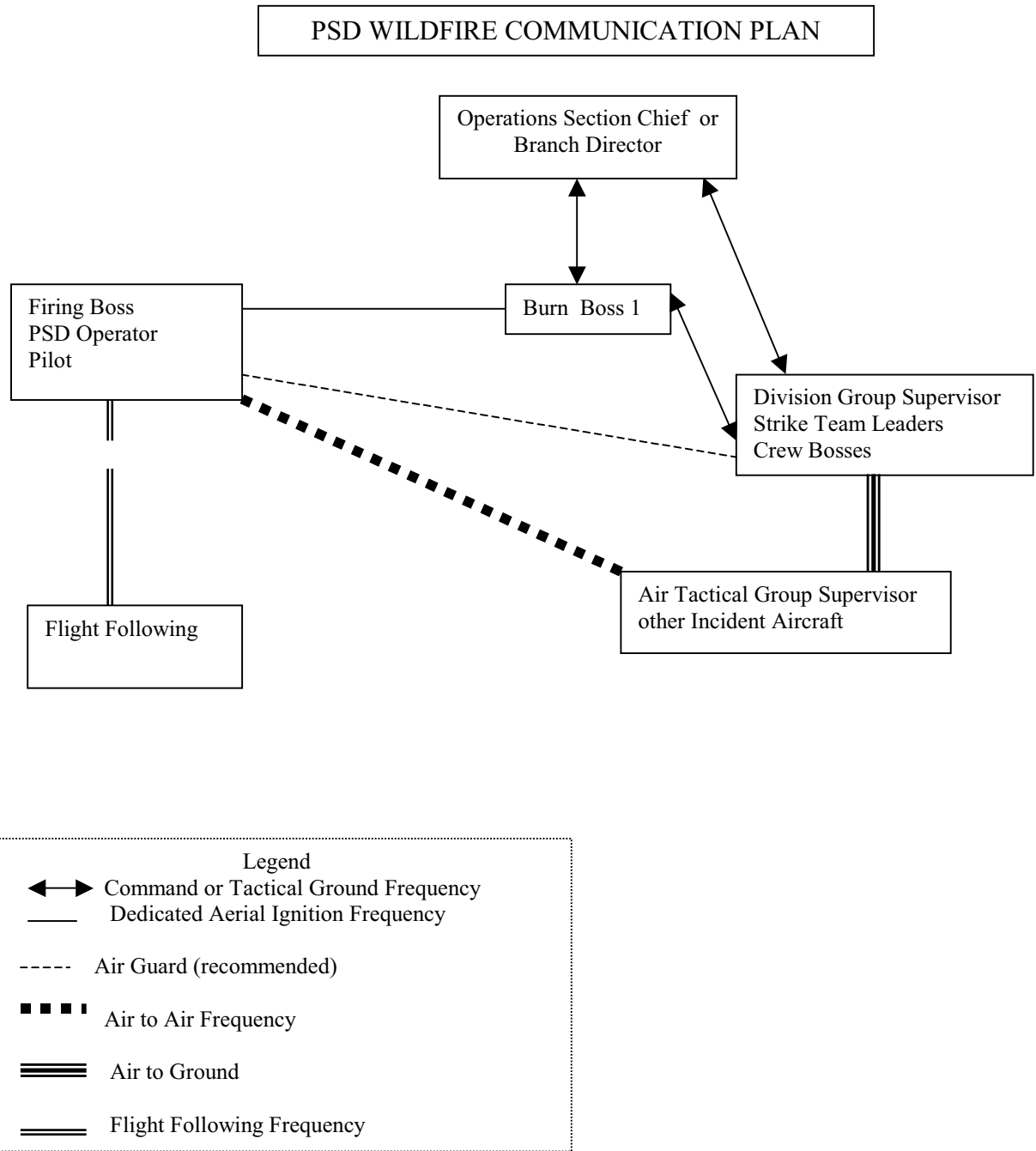


Figure 2

VIII. Bench Testing and Cleaning

Bench tests should be performed prior to actual burn. The following outlines the steps to be performed during a bench test.

A. Review applicable portion of operations checklist.

1. Fill PSD with ethylene glycol and water.
2. Mount the PSD securely on a suitable table or bench approximately 30 inches high.
3. Connect the power cord to power supply. Two 12-volt batteries wired in series or a 24-volt power converter are the most common bench test sources.
4. Prime both pumps and plungers.

CAUTION: *Ensure Potassium Permanganate Does Not Come In Contact With Battery Acid.*

5. Place metal bucket under chute.

CAUTION: *Do Not Put Water In Bucket.*

6. Insert an “EMPTY” plastic sphere in one slipper block. Rotate the sphere through machine with pump operating. Sphere should be $\frac{1}{4}$ - to $\frac{1}{2}$ -full of ethylene glycol for proper ignition. Repeat for other slipper blocks.
7. Injector controls are preset by the factory and should not need to be adjusted. If adjustments are needed, adjust injector control valves by loosening lock nut and rotating valve screw. Increase amount of glycol by turning valve to left until desired volume is obtained. Turn off PSD for adjustments and insert a sphere in each of the other blocks. About $\frac{1}{4}$ to $\frac{1}{3}$ full of glycol will give a 20-second delay.
8. After adjustment has been made, using spheres with potassium-permanganate, turn on the glycol pump and drive, and rotate spheres through a cycle until the spheres drop out of the chute into the bucket. A stopwatch should be used to time injection to ignition. Ignition delay should be at least 20 seconds.

Note: Temperature and humidity may affect ignition delay, causing delays to be greater than 20 seconds. Colder temperatures will cause longer ignitions, often as long as 40 to 60 seconds. This is OK if all spheres are igniting. Very small amounts of ethylene glycol ($\frac{1}{4}$ cc) will give erratic ignition. Excessive amounts of ethylene glycol (2 cc or more) will not give adequate ignition.

Note: Calibration instructions are contained in manufacturer’s manual.

Note: During machine start up, it is normal for two of the first four spheres that pass through the machine to not be injected.

B. Cleaning should follow the bench test. Clean with water and compressed air. Lubricate moving components with Triflow, Never Seize or equivalent. WD-40 should not be used for this purpose.

IX. Preparation for Aerial Ignition

A. Preparation of Helicopter

1. Remove appropriate door/doors.
2. Remove all loose cushions and other loose materials.
3. Locate and assure proper electrical connections.

Note: Only PSD Operator will have control (electrical or manual) of the machine.

B. Preparation of Premo Mark III Aerial Ignition Device (PSD)

1. Fill glycol tank at least 25 feet from aircraft.
2. Fill water storage tank.
3. Assure adequate supply of plastic spheres are available to complete project.
4. Ensure one-gallon container of water is on board, secured, and is readily accessible.
5. Fire shelters for all occupants must be on board and accessible, and one or more hand tools are recommended.

C. Installation

The PSD is designed to be operated from the right rear of a Bell 206 series Jet/Long Ranger helicopter. Other types of helicopters may require an auxiliary support bracket so the exit chute clears the aircraft fuselage. Installation instructions for various helicopters are included at the end of this unit.

1. Install in doorway with exit chute attached and overhanging.
2. Attach tie-down strap:
 - a. Y-end attached to PSD beside exit chute, fasten from the inside-out.
 - b. Pass strap under the fuselage, making sure it clears all wiring and accessories attached to the bottom of the aircraft.
 - c. Return through the opposite door.
 - d. Fasten to buckle attached to machine.
 - e. Cinch tight and secure loose ends.
3. Connect power supply cord.
4. Perform electrical power check by turning on drive switch and hopper feed switch. Manual assist must rotate counter-clockwise (direction of arrow).
5. Recheck the installation.
6. Ensure a sharp knife is available to cut holding strap in case it is necessary to jettison the PSD.

X. Preflight Test Procedures

A. Sphere ignition delay time need not be checked in the Preflight Test if Bench Test has been performed.

CAUTION: Do not conduct this test near refueling area or in flashy ground fuels.

B. Test procedures are as follows.

1. Place metal container under the exit chute.
2. Start up the PSD (hopper off) as follows:
 - a. Power on.
 - b. Hopper feed on.
 - c. Glycol pump on.
3. Drive motor on.
4. Lift chute feed levers.
5. Deposit 1 sphere in a slipper block to track calibration. Repeat for each remaining slipper block.
6. Once the sphere has dropped into the metal container, remove it from the vicinity of the aircraft.
7. Time ignition delay by measuring time of injection to ignition.
8. Shut down machine as follows:
 - a. Drive motor off.
 - b. Glycol pump off.
9. Repeat for other three slipper blocks.
10. Check system for leaks.
11. Test the on-board fire extinguisher system by pushing red water button on control panel.
12. Check intercom communications and air-to-ground communications.

XI. In-flight Operations

A. Dry Run over Burn Area Procedures

1. Check burn area is clear of personnel.
2. Identify burn area boundaries.
3. Ensure communication with ground personnel.
4. Make practice run of the first firing sequence.
5. Coordinate machine speed, sphere spacing, and number of chutes to be used on first run with Burn Boss/Ignition Specialist.
6. Identify helispots and emergency landing areas.
7. After a dry run and prior to installation of aerial firing, the Burn Boss/Firing Boss will confirm that all ground personnel are clear of the area and that firing may commence.

XII. In-Flight Procedures

A. Burn Boss/Ignition Specialist communicates to PSD Operator, “Prepare to fire.”

1. Operator actions:
 - a. Hopper feed on.
 - b. Glycol pump on.
 - c. Drive motor on.
 - d. PSD Operator communicates to Burn Boss/Ignition Specialist, “Ready to fire.”
2. Burn Boss/Ignition Specialist communicates to PLDO to “Start firing/Number of chutes”
3. PSD Operator replies, “Firing x chutes”
4. Operator monitors machine operation and refills hopper as needed.
5. When appropriate, Burn Boss/Ignition Specialist communicates, “Prepare to stop firing.”
6. PSD Operator places hand on chute handles and communicates, “Ready to stop.”
7. Burn Boss/Ignition Specialist gives the order “Stop firing.”
8. Operator closes chute handles and responds, “Chutes closed, firing stopped.”
9. Operator observes last sphere clear of the PSD and relays, “Machine cleared.”

XIII. Emergency Procedures

A. Operator notifies pilot of problem and gives brief description.

B. Operator closes chute feed handles.

1. If necessary, operator turns on or off drive motor.
2. If problem is a jammed machine, operator pulls manual assist wheel outward and rotates forward then backward. If obstruction clears, turn on drive motor, check circuit breaker, and notify flight crew before resuming operations.
3. If fire starts, operator pushes red button (emergency water) and holds button depressed for up to 30 seconds. If necessary, uses additional container of water to extinguish fire by pouring down feed chutes in hopper. If problem persists, land if possible.
4. If fire proves uncontrollable during flight, the PSD must be jettisoned, unless the emergency occurs over a congested or developed area. The pilot must be made aware that a fire exists and must direct that the PSD be jettisoned.
5. To jettison a PSD, the following procedures must be performed:
 - a. Cut the restraining strap between the buckle and aircraft door with knife.
 - b. Grasp dispenser, lift and jettison clear of aircraft.

Note: In addition, specific crash procedures and crash seating positions should be discussed for aircraft being used.

XIV. Ignition Operations

- A. The Burn Boss/Ignition Specialist gives the directions as to where he/she wants the spheres to be placed in the burn area. This should be made clear during the dry run before any firing begins. It is important that all parties (Burn Boss/ Ignition Specialist, Pilot, and PSD Operator) all understand where the firing is to be done. This includes starting points, ending points, and desired placement and spacing.
- B. The Helicopter should not exceed 50 mph. Optimum application speed for the firing operation is 25-35 mph.
- C. The Burn Boss/Ignition Specialist gives direction to the Pilot once the firing run has begun and during the dry run to assure correct placement of the injected spheres.
- D. Occupants of the helicopter shall be limited to the Pilot, PSD Operator, and Burn Boss/Ignition Specialist, instructor or trainees if essential to the mission.
- E. When the PSD helicopter leaves the burn area and crosses a fire control line with the intent of returning for another live firing run, the switches on the PSD are not required to be turned off. The Operator's right hand must remain on the feed control levers in the closed position. This is not required if locking handles are installed. If leaving the burn area the machine will be completely shut off.

General Features of Plastic Sphere

Material	High-impact Polystyrene
Mass empty	2.3 Grams
Mass KmnO	3.0 + 0.3 Grams
Mass total	5.3 + 0.3 Grams
Diameter	32 mm
1 box of 1000 spheres	16 LBS

Table 3

General Features for Premo Mark III Aerial Ignition Device

Specifications		
Measurement	metric	us
;Main Fame Mass, Glycol Full	27.5 kg	61.0 lb
Hopper and Chutes	10 kg	23.0 lb
Emergency Water Tank (Full)	3.8 kg	8.5 lb
Hopper Capacity (450 Spheres)	2.7 kg	6.0 lb
Approximate Operational Weight	44.5 kg	98.0 lb
Glycol Tank Volume	9.0 liter	2.4 US gal
Emergency Water Tank Volume	3.2 liter	0.8 US gal
PSD Dimensions – Length	68.5 cm	27.25 in
PSD Dimensions – Width	27.0 cm	10.5 in
PSD Dimensions – Height	66.0 cm	26.0 in
Overall Dimensions – Length	83.0 cm	33.0 in
Overall Dimensions – Width	33.0 cm	13.0 in
Overall Dimensions – Height	69.0 cm	27.0 in
Total Shipping Weight	45.0 kg	98.5 lb

Table 4

F. Power Requirements

1. 24-volt DC (control housing, motor, and pumps are coded red).
2. 12-volt DC (control housing, motor, and pumps are coded blue).

Note: *A specially built crate with hinged top is provided with each PSD machine for maximum protection during shipping and storage of the equipment in the field.*

XV. Ignition Spacing**A. Ignition spacing is a function of ground speed.**

	Motor Shaft Sprocket - 13 Teeth					
Ground speed in MPH Camshaft speed of 27 RPM (slow)	10	20	30	40	50	60
	Approximate feet between ignition points FT.					
USING						
1 PSD Chute	33'	65'	98'	130'	163'	195'
2 PSD Chutes	16'	33'	49'	65'	82'	97'
4 PSD Chutes	8'	16'	25'	33'	41'	50'
Camshaft speed of 41 RPM (fast)						
USING						
1 PSD Chute	22'	43'	64'	86'	107'	129'
2 PSD Chutes	11'	21'	32'	43'	54'	65'
4 PSD Chutes	6'	11'	16'	23'	27'	33'

Table 5

Using one chute requires the installation of the “Spacing Kit” which allows only one chute to be loaded with plastic spheres.

CAUTION: *To achieve continuous reliable feed when using two chutes it is imperative to only operate the center chute.*

XVI. Cleaning and Preventive Maintenance

A. Suggested Tools, Supplies, and Spare Parts

1. Suggested Tools
 - a. Small 3-inch slotted screwdriver
 - b. Medium 5-inch slotted screwdriver
 - c. No. 2 Robertson screwdriver (square tip)
 - d. Set of Allen wrenches
 - e. Small, smooth file for emergency touch-up of needles
 - f. Toothbrush
 - g. Set of adjustable tubing wrenches
 - h. Combination box end wrenches (5/16", 3/8", 7/16", 1/2", and 11/16")
 - i. Small, adjustable (crescent) wrench.
 - j. Toothbrush/Bottle brush
2. Suggested Supplies
 - a. Lubricant
 - b. Teflon tape
 - c. Brass wool
 - d. Scotch-Brite pad
3. Suggested Spare Parts
 - a. Fuses 5A, 3A, 1.5A (newer PSDs have circuit breakers)
 - b. Needles (set of 4)
 - c. Valve springs (set of 4)
 - d. "O" rings for valve stems (set of 4)
 - e. Bulbs for indicator lights
 - f. ¼ x 20 wing nuts (2)
 - g. Electric drive motor*
 - h. Electric fuel pump*
 - i. Solenoid valve*

* Items are field serviceable, but may result in delays of one to two hours.

B. Preventive Maintenance

1. Keep the needles sharp; sharpen to same angle.
2. Keep moving parts lubricated.
3. Keep clean by removing residuals from balls and potassium as soon as possible.
4. Check slipper blocks for powder build-up after approximately 6,000 spheres.

C. Cleaning and Storage

1. After each use clean as follows:
 - a. Use cleaner-degreaser and brush to clean slipper block area.
 - b. Dry machine.
 - c. Lubricate all moving parts.
 - d. Cycle by hand.
 - e. Wipe off excess lubricant.
 - f. Wipe down machine with cloth dampened with lubricant.
 - g. Wipe down helicopter floor when PSD is removed.
2. For prolonged storage perform the following:
 - a. Drain water reservoir.
 - b. Drain and flush glycol reservoir.
 - c. Remove and clean valve spring plugs, springs, and valves.
 - d. Remove and clean needles; sharpen if needed.
 - e. Lubricate all parts before reassembling.
 - f. Check drive chain and lubricate.
 - g. Check and clean electrical connections.

XVII. Troubleshooting the PSD

- A. Spheres Do Not Move Freely In Chute**
- Check the feed control handles.
 - Check to assure no jam has occurred in the hopper.
 - Check if only recommended chutes are used - either four, two center, or only one.
- B. Drive Motor Does Not Start**
- Check aircraft power supply connection, aircraft main switch circuit breaker, motor switch and fuses. Check quick disconnect to mainframe and control housing.
 - Check wiring to motor; repair wiring or replace motor.
- C. Motor Starts but PSD Jams**
- Turn off motor switch, if PSD jams.
 - Check for plastic sphere fragment, box staples, or other foreign objects.
 - Check for damaged needle, replace using box-end wrench to prevent damage. Crushed spheres will indicate damaged or dull needles.
 - Slipper blocks may seize and stop the motor, which will necessitate removal, cleaning, and lubricating.
- D. Glycol Pump Does Not Start**
- Bleed air from system by removing valve adjuster and operating pump.
 - Check glycol pump wiring; repair wiring or replace pump.
- E. Incorrect Amount of Glycol**
- Check glycol level in tank and pump operation.
 - Open or close adjustment valves on top of valve blocks; DO NOT OVER CLOSE. Needle should provide 1/4 to 1/3 full of glycol with each activation of valve.
 - Check needles for blockage; remove, clean, and/or replace.
- F. Leakage of Glycol**
- If leak occurs during flight, land to make repairs.
 - Check coupling for tightness.
 - Check valve stems and springs for obstructions in valve block.
 - Replace “O” rings on valve stems with neoprene “O” rings.

Note: *Any spilled glycol must be cleaned up.*

- G. Plastic Spheres Do Not Ignite**
- Check fluid level in glycol tank.
 - Taking precautions against delayed ignition, examine spheres.
 - Contents of Primed sphere appear too dry - insufficient glycol (see “E” or “F” above).
 - Contents of Primed sphere are soupy (too much liquid) – excess glycol (see “E” above).
 - Spheres receiving appropriate glycol - check glycol concentration or glycol quality.
- H. Ignition Too Soon (less than 20 seconds)**
- Follow bench test procedure to adjust glycol concentration.
- I. Water System Does Not Function**
- Check reservoir.
 - Check line for routing kinks or blockage.
 - Check water ports in valve block.
 - Check push button, wiring, solenoid, fuse, and pump.
 - Repair and replace as necessary.
 - Check for frozen lines when working in cold temperatures.

XVIII. Installation Procedures (General): Premo Mark III Aerial Ignition Device

Installation of the Premo Mark III AID will be specific to individual helicopter models. Model specific procedures are outlined later in this chapter. Consult the manufacturer of Premo Mark III for specific installation procedures for those helicopters not listed below. The following apply to all PSD installations.

- A. The operator must read the Premo Mark III Operator’s Manual before installation.**
- B. Operator and the pilot must read the limitations section of the Flight Manual and be familiar with the limitation of flight with the door(s) removed.**
- C. Helicopters shall be equipped with a power source for Hand-held Infrared Imaging Systems or Premo Mark III Aerial Ignition Device. A bulkhead mounted MS 3112E- 12-3S, 3-pin connector shall be provided. Pin B shall be airframe ground. Pin A shall be +28 V.C., for a 28-volt aircraft system. Pin C shall be +14 for a 14 volt aircraft system. The circuit shall be protected by a 5-amp circuit breaker. The mating connector for the government furnished Infrared or Premo device shall be an MS 3116E-12-3P wired with the same pin assignments. Reference a wiring diagram in Appendix D.**
- D. Helicopter load calculation unit weight is 98.0 lbs. with all reservoirs filled.**
- E. The mounting area must be cleaned, which includes vacuuming if there is powder from broken spheres, and cleaning any glycol that may have spilled on the floor from previous installation. All carpet and porous floor coverings must be removed.**
- F. A one-gallon container of water and a sharp knife must be carried on board and be within reach of the operator.**
- G. Fire shelters for all occupants available and accessible.**

CAUTION: *Do not service the machine with glycol while it is installed in the helicopter.*

CAUTION: *Under no circumstances will extra ethylene glycol (anti-freeze) be carried in the same compartment with plastic spheres.*

XIX. Installation Procedures for Specific Helicopter Types

A. Bell 206 Series Helicopters

Note: *Consult flight manual for doors-off limitations and center-of-gravity.*

1. Remove right rear door of helicopter.
2. Use duct tape or other means to protect the paint finish around the right rear door sill. (consult with pilot/vendor before doing this)
3. Place the PSD mainframe over the door sill and connect the Y-end buckles of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down strap.
4. Install exit chute. Tighten and lock nuts.
5. Install hopper on the mainframe and make electrical hook-up between units.

6. Slide the assembled PSD as far forward as possible to provide leg-room between machine and rear seat. Some helicopters have a cabin fire extinguisher mounted on the rear of the pilot's seat and it may interfere with the opening of the hopper lid. The fire extinguisher must be removed from its holder and secured on the floor, or the machine must be slid far enough aft to allow the hopper lid to open. Either option must ensure enough room for access to the PSD control panel.
7. Connect and tighten the belly hold-down strap making sure the strap is not twisted and does not interfere with any external fittings, wiring, or release cables.
8. Make sure the PSD switches are in the OFF position, and connect the power supply plug from the helicopter to the PSD.
9. Turn the PSD on and watch the rotation of the hand wheel. Rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
10. Proceed with ignition timing tests, briefings, etc.
11. All manufacturer's safety precautions must be adhered to during operation of the PSD.

B. Hughes (McDonnell-Douglas) 500 Series

Note: Consult flight manual for doors-off limitations and center-of-gravity.

1. A plywood adapter board must be constructed to mount the PSD in the Hughes 500 Series helicopters (see figure 3).
2. Remove right rear door of helicopter.
3. Use duct tape or other means to protect the paint finish around the right rear door sill.
4. Place the plywood adapter on the floor and the PSD mainframe on the adapter and connect the Y-end clips of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down strap.
5. Install exit chute. Tighten and lock nuts.
6. Install the hopper on the mainframe and make electrical hook-up between the two units.
7. Slide the assembled PSD as far forward as possible to provide leg-room between machine and rear seat. The fire extinguisher may need to be removed from its holder and secured on the floor, or the machine must be slid far enough aft to allow the hopper lid to open. Either option must ensure enough room for access to the PSD control panel on the side of the mainframe.
8. Connect and tighten the belly hold-down strap ensuring it is not twisted and does not interfere with any external fittings, wiring, or release cables.
9. Make sure the PSD switches are in the OFF position and connect the power supply plug from the helicopter to the PSD.
10. CAUTION: A metal container shall be placed under the exit chute at this time to catch any spheres that may be triggered from the PSD during the polarity check.
11. Turn the PSD on and watch the rotation of the wheel. Rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
12. Proceed with ignition timing tests, briefings, etc.
13. Manufacturer's safety precautions must be adhered to during operation of the PSD.

Auxiliary support bracket for Hughes 500; construction is of 1-inch welded aluminum on a 3/4-inch plywood base.

Adapter Bracket

	2"
	x
	6"
	x
	8
	1/2
	"
3/4" Plywood x 8 1/2" x 18"	

C. Aerospatiale 350-355 Series

Note: *Consult flight manual for doors-off limitations and center-of-gravity.*

1. A plywood adapter must be constructed to use the PSD in the Aerospatiale 350-355 series helicopters.
2. A one-foot extension must be added to the hold-down strap when using this type of helicopter. The extension must be added to the short buckle portion that is attached to the PSD. The smooth, flat portion of the hold-down strap must pass through the doorframe without hanging up.
3. Remove right forward and right rear doors of the helicopter.
4. Use duct tape or other means to protect the paint finish around the right rear door sill.
5. Place the plywood adapter on the floor and the PSD mainframe on the adapter, and connect the Y-end clips of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down strap.
6. Install exit chute. Tighten and lock nuts.
7. Install the hopper on the mainframe and make electrical hook-up between the two units.
8. Connect and tighten the belly hold-down strap making sure the strap is not twisted and does not interfere with any external fittings, wiring, or release cables.
9. Make sure PSD switches are in the OFF position, and connect the power supply plug from the helicopter to the PSD.
10. CAUTION: A metal container shall be placed under the exit chute at this time to catch any spheres that may be triggered from the PSD during the polarity check.
11. Turn the PSD on and watch the rotation of the hand wheel; rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
12. Proceed with ignition timing tests, briefings, etc.
13. All manufacturers safety precautions must be adhered to during operation of the PSD.

D. SA 315B Lama

Note: *Consult flight manual for doors-off limitations and center-of-gravity.*

1. A left passenger seat that has been modified in accordance with Heli-Support drawings and approved by the FAA must be installed. The seat has a high head restraint and is approved for aft-facing installation. The aft-facing position allows the operator ample room to operate the PSD.
2. Remove the left door.
3. Cover the forward left skid tube to prevent damage to the aircraft's finish.
4. If the floor is not covered by a ¼-inch thick piece of plywood or other material, the tie-down rings must be removed to allow the PSD to sit flat on the floor.
5. Place the PSD mainframe on the floor forward of the left cross tube.
6. Connect the Y-end clips of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down.
7. Install exit chute.
8. Install the hopper on the mainframe and make electrical hook-up between the two units.
9. Connect and tighten the belly hold-down strap ensuring the strap is not twisted and does not interfere with any external fittings, wiring, or release cables.
10. Make sure the PSD switches are in the OFF position and connect the power supply plug from the helicopter to the PSD.
11. CAUTION: A metal container shall be placed under the exit chute at this time to catch any spheres that may be triggered from the PSD during the polarity check.
12. Turn the PSD on and watch the rotation of the hand wheel; rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
13. Proceed with ignition timing tests, briefings, etc.
14. All manufacturers safety precautions must be adhered to during operation of the PSD.

E. Hiller 12E Series (Three-Place)

Note: *Consult flight manuals for doors-off limitation and center-of-gravity.*

1. This series helicopter must be flown from the left seat position, and the center position cyclic control must be removed.
2. Remove the right door.
3. An adapter block must be installed on the floor on the right side of the instrument pedestal.
4. Place the adapter block on the floor on the side of the instrument pedestal.
5. Place the PSD on the floor so it is snug against the block and is as far forward as possible.
6. Connect the Y-end buckles of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down strap.
7. Install exit chute. Tighten and lock nuts.
8. Install the hopper on the mainframe and make electrical hook-up between the two units.
9. Connect and tighten the belly hold-down strap, ensuring the strap is not twisted and does not interfere with any external fittings, wiring, or release cables.
10. Make sure the PSD switches are in the OFF position and connect the power supply plug from the helicopter to the PSD.
11. CAUTION: A metal container shall be placed under the exit chute at this time to catch any spheres that may be triggered from the PSD during the polarity check.
12. Turn the PSD on and watch the rotation of the hand wheel. Rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
13. Proceed with ignition timing tests, briefings, etc.
14. Manufacturer's safety precautions must be adhered to during operation of the PSD.

XX. MSDS (Material Safety Data Sheets)

See Appendix C.