
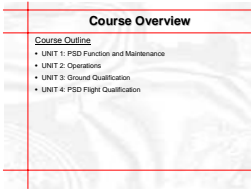
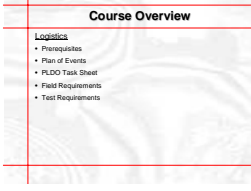
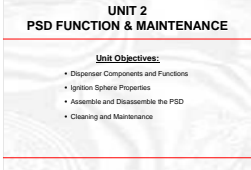
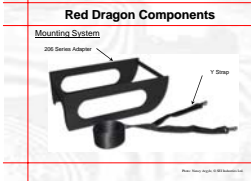





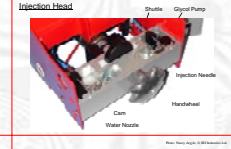

Interagency Aerial Ignition Guide
 Red Dragon PSD Cross Training (12-01-07)
 UNIT 0: COURSE OVERVIEW

ITEM	DESCRIPTION
 <p>RED DRAGON PSD CROSS TRAINING</p>	<h2>INTERAGENCY RED DRAGON PSD CROSS TRAINING</h2>
<p>Instructor Qualifications</p>	<ol style="list-style-type: none"> 1. Qualified and current as a plastic sphere dispenser operator and any helicopter manager qualifications. 2. Approval of regional helicopter operations specialist or state/regional aviation manager.
	<ol style="list-style-type: none"> I. Introduction <ol style="list-style-type: none"> A. Welcome and cadre introductions B. Housekeeping <ol style="list-style-type: none"> 1. Phone messages 2. Restrooms 3. Fire exits 4. Vending machines 5. Coffee 6. Local area accommodations/directions
	<ol style="list-style-type: none"> II. Course Outline <ol style="list-style-type: none"> A. UNIT 1: PSD Function and Maintenance B. UNIT 2: Operations C. UNIT 3: Ground Qualification D. UNIT 4: PSD Flight Qualification
	<ol style="list-style-type: none"> III. Logistics <ol style="list-style-type: none"> A. Review prerequisites. B. Discuss the plan of events: class, bench test, field ops. C. Distribute and explain the PLDO Task Sheet. D. Review field requirements: PPE, lunches, water, and transportation. E. Review the test requirements.
<p>Instructor Note</p>	<p>Information in this syllabus corresponding to test questions is highlighted with a contrasting background.</p>

Interagency Aerial Ignition Guide
 Red Dragon PSD Cross Training (12-01-07)
 UNIT 1: PSD FUNCTION AND MAINTENANCE

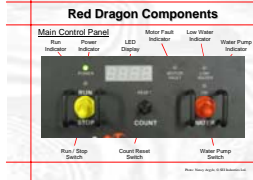
ITEM	DESCRIPTION
UNIT 1: PSD FUNCTION AND MAINTENANCE	
Unit Objectives 	<ol style="list-style-type: none"> 1. Know the basic parts of the dispenser and their function. 2. Become familiar with the ignition spheres used in the unit. 3. Be able to assemble and disassemble the dispenser. 4. Perform routine cleaning and maintenance.
Class Time	2 classroom hours
Materials, Equipment, & Handouts	Materials: <ol style="list-style-type: none"> 1. <i>Interagency Aerial Ignition Guide (IAIG)</i> 2. <i>Red Dragon Operations Manual</i> Equipment: Red Dragon PSD Handouts: None
Instructor Note	You will need to set up the Red Dragon PSD in front of the class.
	I. Introduction The function of the dispenser is to inject an ethylene glycol mixture into a plastic sphere containing potassium permanganate and to expel the primed sphere from the aircraft after which an exothermic reaction takes place.
Red Dragon Operations Manual Section 1 	II. Parts of the dispenser and function A. Mounting System <ol style="list-style-type: none"> 1. Removable adapter fits body contour of Bell 206 series aircraft. For aircraft with flat cabin floors, adapter is not required. 2. Nylon “Y” strap secures dispenser to the aircraft. Standard strap suits all type III helicopters.
Red Dragon Operations Manual Section 1 	B. Tank Assembly: <ol style="list-style-type: none"> 1. Acts as a frame to which other components are mounted 2. Contains the water and glycol tanks. 3. Water Level Switch. 4. Drain valves for tanks.

UNIT 1: PSD FUNCTION AND MAINTENANCE

<p>Red Dragon Operations Manual Section 1</p> <p>Red Dragon Components</p>  <p>Ref: Red Dragon Operations Manual, Sec 1</p>	<p>C. Hopper:</p> <ol style="list-style-type: none"> 1. Stores 950 unprimed spheres. 2. Agitator provides a constant supply of spheres to the feed gates. 3. Receives power from gate assembly via an automatically mating plug.
<p>Red Dragon Operations Manual Section 1</p> <p>Red Dragon Components</p>  <p>Ref: Red Dragon Operations Manual, Sec 1</p>	<p>D. Feed Gate Assembly:</p> <ol style="list-style-type: none"> 1. Controls the flow of spheres from the Hopper into the Injection Head. 2. Easily removable from the Injection Head. 3. Feed gate position controlled by a toggle switch on the remote control. 4. Manual override to close and lock the feedgate.
<p>Red Dragon Operations Manual Section 1</p> <p>Red Dragon Components</p>  <p>Ref: Red Dragon Operations Manual, Sec 1</p>	<p>E. Injection Head:</p> <ol style="list-style-type: none"> 1. Injects the spheres with glycol. 2. One reciprocating shuttle with two sphere cavities. 3. Two constant displacement glycol pumps that inject the same amount of glycol regardless of drop rate. No need to calibrate. 4. Water nozzles connected to the emergency water tank and pump to direct water into the injection chamber. 5. Manual handwheel to drive cam and shuttle in case of power failure. Machine can be turned in either direction.
<p>Red Dragon Operations Manual Section 1</p> <p>Red Dragon Components</p>  <p>Ref: Red Dragon Operations Manual, Sec 1</p>	<p>F. Outlet Chute:</p> <ol style="list-style-type: none"> 1. Guides primed spheres from the Injection Head to a point below the aircraft.

UNIT 1: PSD FUNCTION AND MAINTENANCE

**Red Dragon
Operations Manual
Section 1**



G. Main Control Panel:

1. Houses the main control board, switches and indicators.
2. "RUN/STOP" switch controls the hopper motor and enables the injection drive motor.
3. "WATER" switch activates the emergency water pump. This switch is always active because of battery backup.
4. "RESET" switch controls the count display. Pushing the switch toggles between trip count and lifetime count. Pushing and holding resets the trip count.
5. "POWER" indicator illuminates when the machine is connected to an external power source.
6. "RUN/STOP" indicator illuminates when the hopper motor is turned on. It flashes when the injection drive motor is running.
7. "MOTOR FAULT" indicator illuminates when the injection drive is jammed.
8. "LOW WATER" indicator illuminates when the water level is too low and the machine will not start.
9. Pump indicator illuminates when the emergency water pump is operating.
10. Segment LED displays the sphere count and low battery warning message.


**Red Dragon
Operations Manual
Section 1**






H. Tethered Remote Control:

1. Controls the feed gates and adjusts the drop rate.
2. Seven-position "SPEED" knob to adjust the drop rate.
3. "FEED GATE" momentary toggle switch opens and closes the feed gates and controls the injection drive motor.
4. "POWER" indicator illuminates when dispenser is connected to an external power source.
5. "RUN/STOP" indicator illuminates when hopper motor is turned on. It flashes when injection drive motor is running.
6. "FAULT" indicator flashes when there is a problem.





Interagency Aerial Ignition Guide
 Red Dragon PSD Cross Training (12-01-07)
 UNIT 1: PSD FUNCTION AND MAINTENANCE

<p style="text-align: center;">Red Dragon Operations Manual Section 1</p> <hr/> <p style="text-align: center;">Red Dragon Components</p> <p style="text-align: center;"><u>Power Cords</u></p> 	<p>I. Power Cords:</p> <ol style="list-style-type: none"> 1. Main power cord connects dispenser to aircraft's power system using standard MS3116F-12-3P plug. 2. Auxiliary power cord connects to auxiliary power supply or batteries. 																																																																																																				
<p style="text-align: center;">Red Dragon Operations Manual Section 5</p> <hr/> <p style="text-align: center;">Red Dragon Specifications</p> <p><u>Performance</u></p> <table style="font-size: small;"> <tr><td>Number of Spheres</td><td>7</td></tr> <tr><td>Min Drop Rate</td><td>25 spheres / min</td></tr> <tr><td>Max Drop Rate</td><td>175 spheres / min</td></tr> <tr><td>Hopper Capacity</td><td>950 spheres</td></tr> </table> <p><u>Power</u></p> <table style="font-size: small;"> <tr><td>Voltage</td><td>24-32 VDC</td></tr> <tr><td>Connector</td><td>MS3116F-12-3P</td></tr> <tr><td>Circuit Breaker</td><td>5A, MS3320</td></tr> </table> <hr/> <p style="text-align: center;">Red Dragon Specifications</p> <p><u>Fluid Volumes</u></p> <table style="font-size: small;"> <tr><td>Glycol Tank</td><td>0.8 gal</td><td>3.2 liter</td></tr> <tr><td>Water Tank (Full)</td><td>0.5 gal</td><td>1.9 liter</td></tr> <tr><td>Water Tank (Min)</td><td>0.4 gal</td><td>1.5 liter</td></tr> </table> <p><u>Weights</u></p> <table style="font-size: small;"> <tr><td>Dispenser</td><td>48.0 lb</td><td>21.8 kg</td></tr> <tr><td>Spheres (950)</td><td>10.0 lb</td><td>4.5 kg</td></tr> <tr><td>Ethylene Glycol</td><td>7.9 lb</td><td>3.6 kg</td></tr> <tr><td>Water</td><td>4.1 lb</td><td>1.9 kg</td></tr> <tr><td>Operational Weight</td><td>70.0 lb</td><td>31.8 kg</td></tr> </table> <hr/> <p style="text-align: center;">Red Dragon Specifications</p> <p><u>Dimensions</u></p> <table style="font-size: small;"> <tr><td>Length</td><td>24.5 in</td><td>63 cm</td></tr> <tr><td>Width</td><td>10.8 in</td><td>27 cm</td></tr> <tr><td>Height (No Base)</td><td>19.0 in</td><td>61 cm</td></tr> <tr><td>Height (with Base)</td><td>24.0 in</td><td>48 cm</td></tr> </table>	Number of Spheres	7	Min Drop Rate	25 spheres / min	Max Drop Rate	175 spheres / min	Hopper Capacity	950 spheres	Voltage	24-32 VDC	Connector	MS3116F-12-3P	Circuit Breaker	5A, MS3320	Glycol Tank	0.8 gal	3.2 liter	Water Tank (Full)	0.5 gal	1.9 liter	Water Tank (Min)	0.4 gal	1.5 liter	Dispenser	48.0 lb	21.8 kg	Spheres (950)	10.0 lb	4.5 kg	Ethylene Glycol	7.9 lb	3.6 kg	Water	4.1 lb	1.9 kg	Operational Weight	70.0 lb	31.8 kg	Length	24.5 in	63 cm	Width	10.8 in	27 cm	Height (No Base)	19.0 in	61 cm	Height (with Base)	24.0 in	48 cm	<p>III. Red Dragon Specifications</p> <p>A. Performance:</p> <table style="width: 100%;"> <tr> <td style="width: 50%;"># of Speeds</td> <td style="width: 50%; text-align: center;">7</td> </tr> <tr> <td>Min Drop Rate</td> <td style="text-align: center;">25 spheres per minute</td> </tr> <tr> <td>Max Drop Rate</td> <td style="text-align: center;">175 spheres per minute</td> </tr> <tr> <td>Hopper Capacity</td> <td style="text-align: center;">950 spheres</td> </tr> </table> <p>B. Power:</p> <table style="width: 100%;"> <tr> <td style="width: 50%;">Voltage</td> <td style="width: 50%;">24-32 VDC</td> </tr> <tr> <td>Connector</td> <td>MS3116F-12-3P (A +28, B Gnd)</td> </tr> <tr> <td>Circuit Breaker</td> <td>5A, MS3320</td> </tr> </table> <p>C. Fluid Volumes:</p> <table style="width: 100%;"> <tr> <td style="width: 30%;">Glycol Tank</td> <td style="width: 20%;">0.8 gal</td> <td style="width: 50%;">3.2 liter (5000 spheres)</td> </tr> <tr> <td>Water Tank (Full)</td> <td>0.5 gal</td> <td>1.9 liter</td> </tr> <tr> <td>Water Tank (Min)</td> <td>0.4 gal</td> <td>1.5 liter</td> </tr> </table> <p>D. Weights:</p> <table style="width: 100%;"> <tr> <td style="width: 30%;">Red Dragon</td> <td style="width: 20%;">48.0 lb</td> <td style="width: 50%;">21.8 kg</td> </tr> <tr> <td>Spheres (950)</td> <td>10.0 lb</td> <td>4.5 kg</td> </tr> <tr> <td>Ethylene Glycol</td> <td>7.9 lb</td> <td>3.6 kg</td> </tr> <tr> <td>Emergency Water</td> <td>4.1 lb</td> <td>1.9 kg</td> </tr> <tr> <td>Operational Weight</td> <td>70.0 lb</td> <td>31.8 kg</td> </tr> </table> <p>E. Dimensions:</p> <table style="width: 100%;"> <tr> <td style="width: 30%;">Length</td> <td style="width: 20%;">24.5 in</td> <td style="width: 50%;">63 cm</td> </tr> <tr> <td>Width</td> <td>10.8 in</td> <td>27 cm</td> </tr> <tr> <td>Height (No Base)</td> <td>19.0 in</td> <td>61 cm</td> </tr> <tr> <td>Height (with Base)</td> <td>24.0 in</td> <td>48 cm</td> </tr> </table>	# of Speeds	7	Min Drop Rate	25 spheres per minute	Max Drop Rate	175 spheres per minute	Hopper Capacity	950 spheres	Voltage	24-32 VDC	Connector	MS3116F-12-3P (A +28, B Gnd)	Circuit Breaker	5A, MS3320	Glycol Tank	0.8 gal	3.2 liter (5000 spheres)	Water Tank (Full)	0.5 gal	1.9 liter	Water Tank (Min)	0.4 gal	1.5 liter	Red Dragon	48.0 lb	21.8 kg	Spheres (950)	10.0 lb	4.5 kg	Ethylene Glycol	7.9 lb	3.6 kg	Emergency Water	4.1 lb	1.9 kg	Operational Weight	70.0 lb	31.8 kg	Length	24.5 in	63 cm	Width	10.8 in	27 cm	Height (No Base)	19.0 in	61 cm	Height (with Base)	24.0 in	48 cm
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UNIT 1: PSD FUNCTION AND MAINTENANCE

<p>Dragon Egg Specifications</p> <table><tr><td>Diameter</td><td>1.0 in</td><td>25 mm</td></tr><tr><td>Potassium Permanganate</td><td>0.11 oz</td><td>3.0 g</td></tr><tr><td>Total Mass</td><td>0.17 oz</td><td>4.8 g</td></tr><tr><td>Shell Material</td><td colspan="2">High Impact Polystyrene</td></tr><tr><td>Ignition Delay</td><td colspan="2">20-30s @ 50°F</td></tr></table>  <p>Dragon Egg Ignition Spheres</p> <p><u>Ignition Delay Variables</u></p> <ul style="list-style-type: none">• Temperature• Humidity• Amount of Glycol 	Diameter	1.0 in	25 mm	Potassium Permanganate	0.11 oz	3.0 g	Total Mass	0.17 oz	4.8 g	Shell Material	High Impact Polystyrene		Ignition Delay	20-30s @ 50°F		<h3>IV. Dragon Egg Aerial Ignition Spheres</h3> <p>A. One inch diameter plastic sphere containing potassium permanganate (KMnO₄) which reacts with ethylene glycol to produce a delayed ignition.</p> <p>B. Specifications:</p> <table><tr><td>Diameter</td><td>1.0 in</td><td>25 mm</td></tr><tr><td>Potassium Permanganate</td><td>0.11 oz</td><td>3.0 g</td></tr><tr><td>Total Mass</td><td>0.17 oz</td><td>4.8 g</td></tr><tr><td>Shell Material</td><td colspan="2">High Impact Polystyrene</td></tr><tr><td>Ignition Delay</td><td colspan="2">20-30s @ 50°F</td></tr></table> <p>C. Ignition Delay Variables:</p> <p>Ignition delay is typically 20-30s, but depends on the following parameters:</p> <ol style="list-style-type: none">1. Temperature2. Humidity3. Amount of Ethylene Glycol	Diameter	1.0 in	25 mm	Potassium Permanganate	0.11 oz	3.0 g	Total Mass	0.17 oz	4.8 g	Shell Material	High Impact Polystyrene		Ignition Delay	20-30s @ 50°F	
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<p>Ethylene Glycol</p> <p><u>Which Antifreeze to Use?</u></p> <ul style="list-style-type: none">• Use Standard Vehicle Antifreeze (90 - 100% Ethylene Glycol)• Do not use 50/50 Pre-Mixed Antifreeze• Do not use Propylene Glycol Antifreeze (Non-Toxic) 	<h3>V. Ethylene Glycol</h3> <p>A. Use standard vehicle antifreeze which is 90-100% ethylene glycol.</p> <p>B. Do not use 50/50 premix antifreeze.</p> <p>C. Do not propylene glycol based antifreezes which are usually labeled as non-toxic.</p>																														

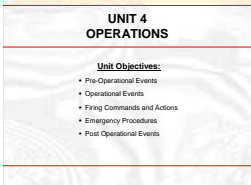
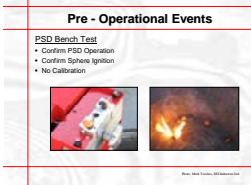
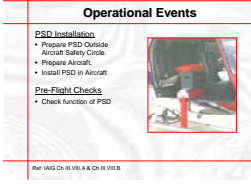
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 UNIT 1: PSD FUNCTION AND MAINTENANCE

<p style="text-align: center;">Red Dragon Operations Manual Section 6</p> <p style="text-align: center;">Cleaning and Maintenance</p> <p>Tool Kit</p> <ul style="list-style-type: none"> • 1/4" Slotted Screwdriver • #1 Phillips Screwdriver • 7/16" Combination Wrenches • Long Nose Pliers • 1/8" Allen Key Wrench • 2.5mm Allen Key Wrench • Metal Bristle Brush • Sharpening Stone • Tip Cleaner Set • Scotch Brite Abrasive Pad 	<p>VI. Cleaning and Maintenance</p> <p>A. Tool Kit</p> <ol style="list-style-type: none"> 1. 1/4" Slotted Screwdriver 2. #1 Phillips Screwdriver 3. 7/16" Combination Wrenches 4. Long Nose Pliers 5. 1/8" Allen Key Wrench 6. 2.5 mm Allen Key Wrench 7. Tip Cleaner Set 8. Metal Bristle Brush 9. Scotch Brite Abrasive Pad
<p style="text-align: center;">Red Dragon Operations Manual Section 6</p> <p style="text-align: center;">Cleaning and Maintenance</p> <p>Spare Parts</p> <ul style="list-style-type: none"> • 8mm x 32" Red Drain Tube • 6mm x 12" Blue Tube • 6mm x 12" Red Tube • (2) Injection Needles • (2) 6mm Tube Caps 	<p>B. Spare Parts</p> <ol style="list-style-type: none"> 1. (2) Injection Needles 2. 6mm x 12" Blue Tube 3. 6mm x 12" Red Tube 4. 8mm x 32" Red Drain Tube 5. (2) 6mm Tube Caps
<p style="text-align: center;">Red Dragon Operations Manual Section 6</p> <p style="text-align: center;">Cleaning and Maintenance</p> <p>Cleaners & Lubricants</p> <ul style="list-style-type: none"> • Use Citrus Based Cleaner / Degreaser • No Petroleum Based Lubricants 	<p>C. Cleaners and Lubricants</p> <ol style="list-style-type: none"> 1. Use a citrus based cleaner / degreaser to clean the Red Dragon (Simple Green® or equivalent). 2. The running surfaces of the injection head are self-lubricating. Do not lubricate with products such as WD-40 or light machine oil These will cause potassium permanganate residue to accumulate and may cause mechanical seizure.
<p style="text-align: center;">Red Dragon Operations Manual Section 6</p> <p style="text-align: center;">Daily Cleaning</p> <p>Hopper</p> <ul style="list-style-type: none"> • Wipe down hopper • Check linkages for wear 	<p>D. Daily Cleaning</p> <ol style="list-style-type: none"> 1. Hopper <ol style="list-style-type: none"> a. Remove the hopper from the Red Dragon b. Empty any remaining spheres. c. Wipe down interior of hopper d. Check agitator and linkage for signs of wear.

UNIT 1: PSD FUNCTION AND MAINTENANCE

<p>Daily Cleaning</p> <p><u>Gate Assembly</u></p> <ul style="list-style-type: none"> Remove gate assembly from injection head. Unlock the feed gate control rod. Clean the sphere paths. 	<p>2. Gate Assembly</p> <ol style="list-style-type: none"> Unlock gate and remove assembly from injection head. Unlock the feed gate control rod using screwdriver. Clean the sphere paths using a cloth and a citrus based cleaner / degreaser. Close gates using manual knob and check lock.
<p>Daily Cleaning</p> <p><u>Glycol Pumps</u></p> <ul style="list-style-type: none"> Remove glycol pump assemblies from injection head. Clean using cloth and cleaner / degreaser as required. Check condition of needles and sharpen as required. Check pump operation. 	<p>3. Glycol Pumps</p> <ol style="list-style-type: none"> Remove glycol pump assemblies from injection head. Clean using cloth and cleaner / degreaser as required. Check condition of needles and sharpen as required. Check pump operation.
<p>Daily Cleaning</p> <p><u>Injection Head</u></p> <ul style="list-style-type: none"> Wire brush the injection shuttle and injection block as required. Clean using a cloth and cleaner / degreaser. Rotate handwheel and check for smooth operation and signs of wear. 	<p>4. Injection Head</p> <ol style="list-style-type: none"> Loosen any potassium permanganate residue from the shuttle and injection block using the wire brush provided. Clean the surfaces of the injection block and shuttle using a cloth and cleaner / degreaser as required. Rotate the handwheel and check for smooth operation. Check cam guides and shuttle guides for signs of wear. Replace the glycol pumps.
	<p>5. Tank Assembly</p> <ol style="list-style-type: none"> Wipe down surfaces with cloth to remove and glycol. Check tanks and lines for signs of leakage.
<p>Long Term Storage</p> <p><u>Drain Tanks</u></p> <ul style="list-style-type: none"> Drain the glycol tank. Drain the water tank. 	<p>E. Long Term Storage</p> <ol style="list-style-type: none"> Drain the glycol tank. <ol style="list-style-type: none"> Insert drain tubing into drain valve. Using screwdriver, rotate drain valve so slot is vertical. Close drain valve when empty. Drain the water tank. <ol style="list-style-type: none"> Insert drain tubing into drain valve. Using screwdriver, rotate drain valve so slot is vertical. Close drain valve when empty.

Interagency Aerial Ignition Guide
 Red Dragon PSD Cross Training (12-01-07)
 UNIT 2: OPERATIONS

ITEM	DESCRIPTION
UNIT 2: OPERATIONS	
Unit Objectives 	<ol style="list-style-type: none"> 1. Bench Testing 2. Installation & Pre-Flight Checks 3. Firing Commands and Actions 4. Emergency Procedures
Class Time	1 hour classroom
Materials, Equipment, & Handouts	Materials: 1. <i>Interagency Aerial Ignition Guide (IAIG)</i> 2. <i>Red Dragon Operations Manual</i> Equipment: Red Dragon PSD Handouts: None
	<ol style="list-style-type: none"> I. PSD Bench Test <ol style="list-style-type: none"> A. The purpose of the bench test is to confirm proper operation of PSD and proper sphere ignition. B. This test need only be conducted once at the start of a multi-day operation.
Instructor Note	Details of the Bench Test Procedure will be covered in Unit #3.
	<ol style="list-style-type: none"> II. Installation & Pre-Flight Checks <ol style="list-style-type: none"> A. Machine Installation B. Pre-flight Checks

Interagency Aerial Ignition Guide
 Red Dragon PSD Cross Training (12-01-07)
 UNIT 2: OPERATIONS

IAIG Ch III.XI.A

PSD Operation

Firing Commands and Actions

Firing Boss Command	PSD Operator Action	PSD Operator Reply
"Prepare to Fire"	Switch to RUN	"Ready to Fire"
"Start Firing Speed X"	Select SPEED X Feed Gate OPEN	"Firing Speed X"
"Prepare to Stop Firing"	Grasp Remote Control	"Ready to Stop Firing"
"Stop Firing"	Feed Gate CLOSE Check Gate Closed	"Gates Closed"
"Secure Machine"	Check Drive Stopped Switch to STOP	"Machine Cleared" "Machine Secured"

Ref: IAGC Ch III.XI.A

III. PSD Operation

A. Firing Commands and Actions

Firing Boss Command	PSD Operator Action	PSD Operator Reply
"Prepare to Fire"	Switch to RUN	[REDACTED]
"Start Firing Speed X"	Select Speed X Feed Gate OPEN	[REDACTED]
"Prepare to Stop Firing"	Grasp Remote Control	[REDACTED]
"Stop Firing"	Feed Gate CLOSE Check Gate Closed	[REDACTED]
	Check Drive Stopped	[REDACTED]
"Secure Machine"	Switch to STOP	[REDACTED]

Operational Events

Purge Sequence

- After gate closed, the drive motor runs to purge remaining three spheres.
- Three revolutions.
- Increase speed to shorten purge time.

B. Purge Sequence

1. [REDACTED]
2. Two revolutions are required, but the machine runs for three revolutions just in case.
3. To shorten purge time, operator can increase speed.

Operational Events

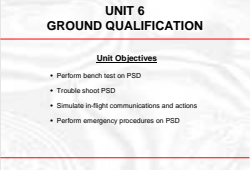
Anti-Jam Sequence

- Controller detects jam if the motor should be turning, but it is not.
- Motor reverses direction at slow speed for a fraction of a second to allow the jam to clear.
- "MOTOR FAULT" indicator on the main control panel illuminates.
- The "FAULT" indicator on the remote control flashes.
- Motor resumes forward operation at the selected speed.
- Fault indicators extinguish.

C. Anti-Jam Sequence

1. Controller can detect a jam when the motor should be turning, but it is not.
2. When a jam is detected, the motor reverses direction at slow speed for a fraction of a second to allow the jam to clear.
3. The "MOTOR FAULT" indicator on the main control panel illuminates
4. The "FAULT" indicator on the remote control illuminates.
5. The motor then resumes operation in the forward direction at the selected speed.
6. The fault indicators extinguish.

Interagency Aerial Ignition Guide
 Red Dragon PSD Cross Training (12-01-07)
 UNIT 3: GROUND QUALIFICATION

ITEM	DESCRIPTION
UNIT 3: GROUND QUALIFICATION	
Unit Objectives 	<ol style="list-style-type: none"> 1. Perform bench test on PSD 2. Simulate in-flight communications and actions. 3. Perform emergency procedures on PSD. 4. Trouble shoot the PSD.
Instructor Note	<p>The purpose of the ground qualification is to confirm that trainees are safe to operate the Red Dragon in the aircraft. Under no circumstances will a trainee be allowed to operate the machine in the aircraft before passing the ground qualification.</p> <p>A ratio of 5 trainees and 1 Red Dragon PSD per instructor is recommended.</p>
Class Time	1-3 hours outside
Materials, Equipment, & Handouts	<p>Materials: 1. <i>Interagency Aerial Ignition Guide (IAIG)</i> 2. <i>Red Dragon Operations Manual</i></p> <p>Equipment: 1. Red Dragon PSD 2. Red Dragon Spheres 4. Ethylene glycol 5. Power source (24-volt converter) 6. Water 7. Metal bucket 3. Tool kit 8. Spare parts 9. Chair or seat 10. Harness(es), tethers, and carabiners</p> <p>Handouts: None</p>
Instructor Note	<p>This phase of the training requires the activation of ignited spheres that will create several safety hazards to training personnel and adjoining property if not properly conducted.</p>

Interagency Aerial Ignition Guide
Red Dragon PSD Cross Training (12-01-07)
UNIT 3: GROUND QUALIFICATION

	<p>I. Bench Testing</p> <p>A. Selection of Bench Testing Site</p> <ol style="list-style-type: none">1. The training site must be outdoors and clear of buildings, vehicles, aircraft, and flammable materials.2. Adequate fire extinguishers and water sources must be available.3. During this session, spheres should not be dropped in the water. If moisture is allowed to come in contact with an injected live sphere, the sphere may be propelled erratically long distances endangering personnel and property.4. The wind direction must be considered so that the operator and trainees will stay clear of the smoke.5. During bench testing operations, designated individuals will remove activated spheres from the test area.6. The test platform needs to be stable to allow for the proper installation of the PSD. (i.e., PSD box, heavy duty picnic table, or bench).
	<p>B. Test Procedure</p> <ol style="list-style-type: none">1. Remove the base adapter and hopper assembly and set aside.2. Mount the Red Dragon securely on a suitable table or bench.3. Connect the bench test power cord to the Red Dragon dispenser. Connect the other end of the power cord to the optional 28VDC power supply or to two 12VDC batteries wired in series to produce 24VDC.4. Ensure water drain valves is closed. Check / fill the water tank. A safety interlock, indicated by a light on the main body control panel, will inhibit system operation if the water tank is not sufficiently filled with water.5. Ensure glycol drain valves is closed. Check / fill the glycol tank with undiluted and unused ethylene glycol (anti-freeze).

Interagency Aerial Ignition Guide
Red Dragon PSD Cross Training (12-01-07)
UNIT 3: GROUND QUALIFICATION

	<ol style="list-style-type: none">6. Remove the two pump assemblies from the injection head by loosening the captive screws in the side panel. Prime each pump assembly by squeezing and releasing the pump arm until glycol squirts from the injection needle. Replace the pump assemblies.7. Place an open-top metal container under the injection head outlet.8. Attach the tethered remote control to the control panel on the main body.9. Press the main circuit breaker on the front panel to the reset position.10. Switch the "RUN/STOP" switch on the main control panel to "RUN".11. Set the "SPEED" switch on the tethered remote control to "1."12. Place two spheres into each of the cavities of the gate assembly.13. Press and release the "FEED GATE" switch on the tethered remote control to the "OPEN" position.14. When the second sphere exits the machine, begin timing the ignition delay. The injected spheres should ignite within 25-30 seconds depending on temperature. Only three of the four spheres will ignite as the first sphere is not injected15. Press the "FEED GATE" switch on the tethered remote control to "CLOSE."16. Switch the "RUN/STOP" switch on the main control panel to "STOP."
Instructor Note	At the end of this exercise, the instructor should demonstrate the effect of loose potassium permanganate coming in contact with glycol and how water is effective in extinguishing the chemical.

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 Red Dragon PSD Cross Training (12-01-07)
 UNIT 3: GROUND QUALIFICATION

	<p>II. Normal Operation</p> <p>The instructor will establish a trainee rotation and test each trainee on the correct actions and responses to the firing commands.</p>
<p>Instructor Note</p>	<p>The trainees shall wear flight helmet, and flight gloves to simulate flight conditions.</p> <p>Test each trainee in front of the group. The repetition of hearing the commands and seeing the actions will help reinforce them to all the trainees.</p>
	<p>A. Prepare the PSD.</p> <ol style="list-style-type: none"> 1. Remove both glycol pump assemblies from the injection head. 2. Install the hopper assembly and fill with spheres. <p>B. Review the firing commands and actions with the trainees.</p> <p>C. Test each trainee with the following command / action sequence.</p> <ol style="list-style-type: none"> 1. Give command “Prepare to Fire” <ol style="list-style-type: none"> a. Trainee sets switch to “RUN” b. Trainee replies “Ready to Fire” 2. Give command “Start Firing Speed 4” <ol style="list-style-type: none"> a. Trainee sets speed to “4” b. Trainee presses Feed Gate Open. c. Trainee replies “Firing Speed 4” 3. Give command “Prepare to Stop Firing” <ol style="list-style-type: none"> a. Trainee replies “Ready to Stop” 4. Give command “Stop Firing” <ol style="list-style-type: none"> a. Trainee pressed Feed Gate Close. b. Trainee checks that gate has closed. c. Trainee replies “Gates Closed” d. Trainee waits for drive motor to stop. e. Trainee replies “Machine Cleared” 5. Give command “Secure Machine” <ol style="list-style-type: none"> a. Trainee sets switch to “STOP” b. Trainee replies “Machine Secured”

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 Red Dragon PSD Cross Training (12-01-07)
 UNIT 3: GROUND QUALIFICATION

	<p>III. Emergency Procedures</p> <p>The instructor will establish a trainee rotation and test each trainee on the correct actions for various emergency situations.</p> <p>Although there are two types of machine malfunctions that can leave a live sphere in the machine and will cause a fire inside the machine, the emergency corrective procedure is the same.</p>
Instructor Note	<p>The trainees shall wear flight helmet, and flight gloves to simulate flight conditions.</p>
	<p>A. Review the emergency procedures with the trainees</p> <ol style="list-style-type: none"> 1. Power Failure 2. Sphere Jam 3. Fire in PSD 4. PSD Jettison <p>B. Test each trainee with the following procedure.</p> <ol style="list-style-type: none"> 1. Use normal firing commands to get into firing sequence. 2. Give commands to open and close the feed gates and change speeds to keep the operator distracted. 3. Create malfunctions at random by turning off the power supply to simulate power failure or sphere jam. 4. You must emphasize to the trainees that if the manual assist stops turning, the operator must initiate emergency procedures to clear the machine.
Instructor Note	<p>During this exercise, the instructor should become aware of the trainees' abilities to react to stressful conditions and to operate the machine.</p> <p>Any trainee who can't satisfactorily perform shall not be allowed to operate the machine in the aircraft.</p>
Instructor Note	<p>It is very difficult to manipulate the machine so the trainee cannot clear the machine using the manual hand wheel. The instructor must ask each trainee to demonstrate the correct procedure to follow if the manual hand wheel fails to clear the machine.</p>

Interagency Aerial Ignition Guide
Red Dragon PSD Cross Training (12-01-07)
UNIT 3: GROUND QUALIFICATION

IV. Troubleshooting

A. No power to the PSD. ("POWER" indicator not illuminated)

1. Check that the PSD main circuit breaker is not tripped.
2. Check that the power cord is properly attached to the launcher.
3. Check that the power cord is properly attached to the aircraft outlet.
4. Check that the aircraft circuit breaker is not tripped.

B. Hopper motor does not start ("RUN/STOP" in "RUN" position)

1. Check that the PSD has external power. If not see A
2. Check that the "LOW WATER" indicator is not illuminated.
3. Check that the hopper is seated correctly on the gate assembly.
4. Remove the hopper and check that the agitator mechanism is not jammed.

C. The drive motor does not start when feed gate is open.

1. Check that the "RUN/STOP" is in the "RUN" position.
2. Check the "MOTOR FAULT" indicator to determine if a sphere jam has occurred.
3. Check that the tethered remote control is connected properly.

D. Feed Gates won't Open

1. Check that the tethered remote control is connected properly.
2. Remove the hopper and gate assembly and check for obstructions in the gate assembly.

E. The spheres do not flow when the drive is operational.

1. Check that the feed gate is in the open position.
2. Check that no jam has occurred in the hopper outlet.
3. Remove the hopper and gate assembly and check for obstructions in the feed gate and injection head.

Interagency Aerial Ignition Guide
Red Dragon PSD Cross Training (12-01-07)
UNIT 3: GROUND QUALIFICATION

F. Plastic spheres do not ignite.

1. Check the glycol level in the tank.
2. Check that injection needles are not plugged.
3. Squeeze and release pump arm to check that pump is primed.

G. The water system does not function.

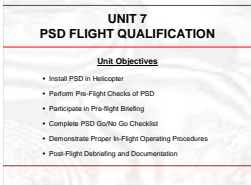
1. Check the water level in the tank.
2. Check the water pump by removing the water lines from the water nozzles and activating the pump switch.
3. Check that the water nozzles are not blocked.
4. Check for frozen lines when working in cold temperatures.

H. Leakage of glycol.

1. Check that the glycol drain valve is closed.
2. Check all glycol lines and fittings for leakage.

Note: Any spilled glycol must be cleaned up thoroughly.

Interagency Aerial Ignition Guide
 Red Dragon PSD Cross Training (12-01-07)
 UNIT 4: PSD FLIGHT QUALIFICATION

ITEM	DESCRIPTION
UNIT 4: PSD FLIGHT QUALIFICATION	
<p>Unit Objectives</p> 	<ol style="list-style-type: none"> 1. Successfully install Red Dragon PSD in the Helicopter 2. Perform preflight checks on Red Dragon PSD. 3. Participate in the preflight briefing with pilot, burn boss/ignition specialist, helibase manager, and operator; and complete PSD Air Operations/Safety Go/No Go Checklist. 4. Demonstrate proper operating procedures of Red Dragon PSD while in flight.
Class Time	<p>Suggested time will vary due to class size. We will use the classroom and field for this unit. The instructor needs to consider the logistics for the field operations: travel time, lunch, water, etc.</p>
Materials, Equipment, & Handouts	<p>Materials:</p> <ol style="list-style-type: none"> 1. <i>Interagency Aerial Ignition Guide (IAIG)</i> 2. <i>Red Dragon Operations Manual</i> <p>Equipment:</p> <ol style="list-style-type: none"> 1. Personal protective equipment 2. Red Dragon PSD 3. Helicopter 4. PSD operator safety harness 5. Fire shelters 6. Ethylene glycol 7. Water 8. Spheres 9. Metal bucket Helicopter support kit 10. Shovel 12. Pulaski 13. Tri-max or fire protection group (optional) <p>Handouts:</p> <ol style="list-style-type: none"> 1. PSD Operations Checklist
	<p>I. Preparation of Red Dragon PSD</p> <p>The Red Dragon PSD must be readied for installation outside the safety circle of the aircraft.</p> <ol style="list-style-type: none"> A. Ensure glycol tank drain is closed. Fill the glycol tank at least 25 feet from the aircraft. B. Ensure water drain tank is closed. Fill the water tank.

Interagency Aerial Ignition Guide
Red Dragon PSD Cross Training (12-01-07)
UNIT 4: PSD FLIGHT QUALIFICATION

	<p>II. Preparation of Aircraft</p> <ul style="list-style-type: none">A. Remove the appropriate door/doors from the aircraft.B. Remove all loose cushions and other loose materials.C. Use tape or other means to protect aircraft paint finish. Consult pilot.D. Locate and ensure proper electrical fittings.
	<p>III. Installation</p> <ul style="list-style-type: none">A. If installing in a Bell 206 series aircraft, install the base adapter into the aircraft.B. Install Red Dragon in the doorway.C. Attach the outlet chute.D. Attach belly strap:<ul style="list-style-type: none">1. Clips on “Y” end attach to PSD frame beside outlet chute.2. Pass strap under the fuselage, making sure it clears all wiring and accessories attached to the bottom of the aircraft.3. Return through the opposite door.4. Fasten to adjuster buckle on Red Dragon handle.5. Cinch tight and secure loose ends.E. Attach remote control to connection on front panel of PSD.F. Connect power supply cord to aircraft power supply.G. Connect power supply cord to PSD and secure breakaway connection with velcro straps.H. Reset the main circuit breaker and check that the POWER indicator on the main control panel illuminates. If the breaker trips immediately, check wiring polarity.

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 Red Dragon PSD Cross Training (12-01-07)
 UNIT 4: PSD FLIGHT QUALIFICATION

	<p>IV. Preflight Briefing</p> <p>A. The pilot, ignition specialist, and PSD operator must be present at the pre-mission aircraft briefing</p> <p>B. This briefing should address:</p> <ol style="list-style-type: none"> 1. Safety / Aerial Hazards 2. Weight and Balance 3. In-flight Commands 4. Emergency Procedures 5. Frequency Management 6. Available Flight Time 7. Aircrew Responsibilities 8. PSD Go / No Go checklist. <p>C. The pilot and/or mechanic must inspect and approve of the PSD installation.</p>
<p>Instructor Note</p>	<p>Pass out the PSD Operations Checklist and review.</p>
<p>Instructor Note</p>	<p>Specific crash procedures and crash seating positions must be discussed in the preflight briefing for aircraft being used</p>
	<p>V. Preflight Check</p> <p>A. Reset main circuit breaker.</p> <ol style="list-style-type: none"> 1. Check POWER indicator on main control panel illuminated. 2. Check PWR indicator on remote control illuminated. 3. Check LOW WATER indicator on main control panel not illuminated. <p>B. Switch RUN/STOP to RUN position.</p> <ol style="list-style-type: none"> 1. Check hopper agitator motor starts 2. Check indicator above RUN/STOP switch illuminates 3. Check RUN indicator on remote control illuminates. <p>C. Press FEED GATE switch to OPEN position.</p> <ol style="list-style-type: none"> 1. Check feed gate opens. 2. Check injection drive motor starts 3. Check RUN indicator on remote control flashes. 4. Check LED display on main control panel is counting spheres.

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Red Dragon PSD Cross Training (12-01-07)
UNIT 4: PSD FLIGHT QUALIFICATION

- D. Adjust the SPEED control from 1 to 7
 - 1. Check injection drive motor speed changes.
- E. Press FEED GATE switch CLOSE position.
 - 1. Check feed gates close immediately.
 - 2. Check injection drive motor purges machine and stops.
 - 3. Check RUN indicator on remote control stops flashing.
 - 4. Check LED display on main control panel stops counting spheres.
- F. Press the COUNT switch to the RESET position and hold for two seconds.
 - 1. Check that sphere count resets to zero.
 - 2. Switch RUN/STOP to STOP position.
 - 3. Check hopper agitator motor stops
 - 4. Check indicator above RUN/STOP switch extinguishes.
 - 5. Check RUN indicator on remote control extinguishes.
- G. Remove the hopper. Remove the Gate Assembly. Press and hold the "WATER" switch on the main control panel.
 - 1. Check that pump injects water into both chambers.
 - 2. Check that indicator on main control panel illuminates.
- H. Check that a one gallon container of water is available.
- I. Check that a sharp knife is within reach of the PSD operator.
- J. Check that PSD harness is secure and attached to helicopter hard points and seatbelt is on and buckled.
- K. Check that additional spheres carried within the aircraft are properly secured.
- L. Check one fire shelter per occupant of the aircraft.
- M. Check the intercom and air-to-ground communications.

Interagency Aerial Ignition Guide
Red Dragon PSD Cross Training (12-01-07)
UNIT 4: PSD FLIGHT QUALIFICATION

	<p>VI. In-Flight Operations</p> <ul style="list-style-type: none">A. Dry run over the burn area proceduresB. Check that the burn area is clear of personnel.C. Identify burn area boundaries.D. Ensure communication with ground personnel.E. Make practice run of the first firing sequence.F. Coordinate machine speed and sphere spacing to be used on the first run with burn boss/ignition specialist.G. Identify helispots and emergency landing areas.H. Notify ground personnel that ignition will commence.
	<p>VII. Ignition Operation</p> <ul style="list-style-type: none">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) understand where the firing is to be done. This includes the starting points, ending points, and desired placement and spacing.B. The maximum recommended speed should be 50 mph. Slow aircraft speed to planned application speed when the firing operation is in progress. Optimum speed is 25 to 35 mph.C. The firing boss gives direction to the pilot once the firing run has begun and during the dry run to ensure correct placement of the injected spheres.D. Recommended flight operations are between 300' AGL and 500'AGL. Some firing operations may be above 500' AGL, but never below 300' AGL.E. Occupants of the helicopter shall be limited to the pilot, PSD operator, and burn boss/ignition specialist or instructor if essential to the mission.F. When the helicopter with the PSD leaves the burn area (crosses a fire control line) the RUN/STOP switch must be in the STOP position.

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Red Dragon PSD Operator Test

- 1. Approximately how many spheres does the hopper hold?**
 - a. 250
 - b. 450
 - c. 950

- 2. What is the operational weight of the Red Dragon PSD with full fluids and hopper full?**
 - a. 50 lb
 - b. 70 lb
 - c. 100 lb

- 3. The emergency water pump will operate even when there is no external power source?**
 - a. true
 - b. false

- 4. The hopper motor and drive motor will operate when there is no water in the water tank?**
 - a. true
 - b. false

- 5. How many speeds does the Red Dragon PSD have?**

- 6. What type of anti-freeze mixture is normally used?**
 - a. 90 - 100% Propylene Glycol
 - b. 90 - 100% Ethylene Glycol
 - c. 50 - 60% Ethylene Glycol

- 7. Fill in the appropriate commands C and responses R.**

Firing Boss Commands	PSD Operator Responses
“Prepare to Fire”	_____
“Start Firing Speed X”	_____
“Prepare to Stop Firing”	_____
“Stop Firing”	_____ and _____
“Secure Machine”	_____

Interagency Aerial Ignition Guide
Red Dragon PSD Cross Training (12-01-07)
Red Dragon PSD Operator Test

8. After the feed gates close, how many purge revolutions does the handwheel turn ?

- a. one
- b. two
- c. three
- d. four

9. The glycol pumps require calibration during the bench test?

- a. true
- b. false

10. What are the first three actions to be taken if a power failure occurs?

- a. _____
- b. _____
- c. _____

11. What are the first two actions to be taken if a fire occurs in the machine?

- a. _____
- b. _____

12. What type of lubricant is used on the injection head components?

Interagency Aerial Ignition Guide
Red Dragon PSD Cross Training (12-01-07)
Red Dragon PSD Operator Test Answer Key

1. **Approximately how many spheres does the hopper hold?**
 - a. 250
 - b. 450
 - c. 950**

2. **What is the operational weight of the Red Dragon PSD with full fluids and hopper full?**
 - a. 50 lb
 - b. 70 lb**
 - c. 100 lb

3. **The emergency water pump will operate even when there is no external power source?**
 - a. true**
 - b. false

4. **The hopper motor and drive motor will operate when there is no water in the water tank?**
 - a. true
 - b. false**

5. **How many speeds does the Red Dragon PSD have?**

7

6. **What type of anti-freeze mixture is normally used?**
 - a. 90 - 100% Propylene Glycol
 - b. 90 - 100% Ethylene Glycol**
 - c. 50 - 60% Ethylene Glycol

7. **Fill in the appropriate commands C and responses R.**

Firing Boss Commands	PSD Operator Responses
“Prepare to Fire”	Ready to Fire
“Start Firing Speed X”	Firing Speed X
“Prepare to Stop Firing”	Ready to Stop Firing
“Stop Firing”	Gates Close and Machine Cleared
“Secure Machine”	Machine Secured

Interagency Aerial Ignition Guide
Red Dragon PSD Cross Training (12-01-07)
Red Dragon PSD Operator Test Answer Key

8. After the feed gates close, how many purge revolutions does the handwheel turn ?

- a. one
- b. two
- c. three**
- d. four

9. The glycol pumps require calibration during the bench test?

- a. true
- b. false**

10. What are the first three actions to be taken if a power failure occurs?

- a. Notify the pilot**
- b. Close the feed gate manually.**
- c. Clear the machine with the manual hand wheel**

11. What are the first two actions to be taken if a fire occurs in the machine?

- a. Notify the pilot**
- b. Press the emergency water switch**

12. What type of lubricant is used on the injection head components?

- None**