

SX-7 Starsun Searchlight System Setup and Operation Manual



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1.0 INTRODUCTION TO THE SX-7 STARSUN

1.1 Description and Features

The SX-7 Starsun Searchlight System (called the SX-7 Starsun or simply the Searchlight from this point forward in the manual) is a versatile, mobile, high intensity light source. It can be mounted on fixed wing aircraft, helicopters, and water craft. When properly installed and operated, it can flood an area with light from a safe distance.

- The Searchlight uses an air cooled, 700-Watt high-intensity xenon arc Lamp. It emits light that is the same color as daylight, starts rapidly, and can be operated continuously or started and stopped to meet operational requirements.
- The Gimbal assembly that supports the Searchlight enables users to aim the Searchlight beam at various positions with respect to Azimuth (horizontal directions) and Elevation (vertical directions).
- The SX-7 Starsun responds to directional commands from a hand-held Control Box.
- Performance Specifications are outlined in the *Performance Specifications* section of this manual.

1.2 Applications

The SX-7 Starsun is particularly useful for nighttime reconnaissance when installed on fixed wing aircraft and water craft. Applications include law enforcement; search and rescue; assessment of emergency-landing and staging areas; surveillance of critical installations, borders, and coastlines; nighttime photography using color film designed for daytime use; and military operations. The SX-7 Starsun also is useful for applications that are not described in this manual. Please contact Spectrolab Customer Service for more information.

1.3 About This Manual

This manual provides the following information about the SX-7 Starsun:

- Product Safety
- Component Information
- Set up and Operation
- Instructions to perform inspections

1.4 Read, Obey, and Keep Instructions

To ensure the safety of people and equipment, it is important to read and obey all instructions and safety warnings contained in this document and posted on the equipment before you attempt to operate, maintain, or troubleshoot the SX-7 Starsun. Keep this document for reference.

The SX-7 Starburst Searchlight is intended for use only by professional, qualified personnel. Attempting installation, use or maintenance of the searchlight system without the appropriate expertise, tools, training and equipment, could cause serious bodily injury to personnel and/or damage to the searchlight.



1.5 Installer Responsibility

It is the responsibility of SX-7 Starsun installer to ensure the integrity and safety of the installation, configuration, and integration with the aircraft or other operational platform.

1.6 Disclaimer

The information in this document is current as of the publication date. The manufacturer reserves the right to make changes to this document and products associated with it at any time without notice.

2.0 SAFETY

2.1 Product Safety

SX-7 Starsun poses the following hazards that can cause serious personal injury or damage to nearby property, including the aircraft:

- The Searchlight generates high voltages that can cause electrical shock.
- The Searchlight generates high temperatures that can cause a serious burn to a victim or start a fire.
- The Searchlight generates a high-intensity light that can damage eyes or start a fire.
- The Searchlight has a pressurized xenon-arc gas arc Lamp that poses an explosion hazard.

Obey the safety precautions in this section and the precautions displayed in each section at all times. Although the SX-7 Starsun is designed and manufactured to provide years of safe operation, be responsible for using this product properly and safely. Also, be responsible for training others to use and maintain this product safely. Do not take chances; contact Spectrolab for any questions.

2.1.1 High-Voltage Electrical Shock

The SX-7 Starsun generates voltages in the range of 125 to 150 volts DC and up to 25,000 volts AC. These voltages are present in both the Searchlight and Junction Box during the start cycle. To reduce the risk of serious injury from electrical shock:

- Never work alone when working on exposed electrical components.
- During close up inspection activities, remove the Control Box or its cable, or disconnect the Searchlight cable (power) to prevent the Searchlight from being turned on accidentally.
- High voltages normally discharge a few seconds after the start cycle ends. Under certain malfunction or fault conditions, however, they may remain in the 25,000 VAC range.

2.1.2 Lamp Explosion Hazard

The Lamp contains xenon gas under pressure. Since the gas inside the Lamp is pressurized, the Lamp can explode without warning, especially when it is hot. If it explodes, it will project quartz particles in every direction. Authorized personnel should always handle the Searchlight and Lamp with caution, and ensure the safety of others.

- Never operate the Searchlight with the front window or rear cover removed.
- The Searchlight must be cooled to ambient temperature prior to any maintenance.
- In order to handle the Lamp or work on the Searchlight head with the front lens removed, wear protective clothing that includes a face shield, a long sleeve heavy (leather) jacket, and gloves.
- Never leave an exposed xenon Lamp unattended.

2.1.3 High-Temperature, High-Intensity Light

The light from the SX-7 Starsun is very powerful; the intense beam can cause serious eye injury, and the high temperatures pose a fire hazard. The Searchlight beam is hazardous to people and certain materials at close range, particularly at distances within 10 feet of the Searchlight. At a 10-foot distance, the beam intensity can be 100 times as powerful as direct sunlight, and its reflection can be more intense.

- Do not look into the Searchlight beam, and never shine the light at anyone within 125 feet of the Searchlight.
- At distances of less than 10 feet, flammable materials (such as human hair, clothing, wiping rags, paper, cardboard, wood boxes, electrical insulation, and most plastics) can be set on fire.
- During preflight tests on the ground, make sure that the beam is directed away from nearby people and flammable materials. Make sure to tell people not to look at or to walk through the Searchlight beam.
- For Searchlight adjustments that require visual observation of the light beam, always wear dark glasses that are equivalent to welders' glasses, shade 3.
- To avoid temporary blindness from reflected light, never operate the Searchlight in dense fog or while the aircraft is flying in clouds.

2.1.4 Required Protective Equipment and Clothing

The gas pressure inside the Lamp is a potential explosion hazard. Use the following safety equipment and wear the following protective clothing when exposed to a bare Lamp (for example, when working around the Searchlight head with the front lens removed from the Searchlight):

- Dark green safety glasses (Welding Safety Glasses, Shade 3.0), such as the Uvex Genesis (S3207) to be worn while the Lamp is on.
- Clear safety glasses and/or face shield, such as the Aerosite/Uvex Highflyer 9177 by American Optical or Uvex.
- Cut resistant safety gloves (Wells Lamont P/N 31417)
- A long sleeve, heavy leather jacket
- A non-flammable target at which to aim the light beam during adjustments (do not use wood, cardboard, plastic, cloth, or paper as a target); there are two acceptable target types:

Source: Spectrolab, Inc.

- A piece of sheet metal that is 0.032" to 0.125" (0.7 mm to 3 mm) thick and approximately 3 feet (1 m) across painted with a high temperature resistant black (or dark brown) paint on one side and white (or light colored) high temperature resistant paint on the other side. The high temperature resistant paint should be resistant to 500° F (260° C). Barbecue or automotive exhaust manifold paint works well. The target should be well supported by a stand that is non-flammable. During use, it will become very hot and should not be handled until it has cooled. A fan can be used to cool the target.
- A woven aluminum air handling filter (the washable type used to catch cooking grease in over-the-grill venting systems.) If the filter is painted black, it can be an effective fireproof Lamp target. Its large surface area helps to keep it cool. A fan can help cool the target.

2.1.5 Trained Operators and Maintenance Personnel

Only trained staff should operate the Searchlight. Furthermore, all installation, maintenance, troubleshooting, and repairs should be performed only by experienced technicians who have skill and knowledge about aircraft airframes and electrical systems.

- Since the SX-7 Starsun is subject to vibration in its normal operating environment, the hardware used for system attachment requires positive locking features such as locknuts and lock wire.
- The SX-7 Starsun contains parts that users can maintain and replace; however, there are no factory-approved processes for rebuilding any worn parts; they must be replaced. For any questions regarding non-repairable parts, please contact Spectrolab Customer Service at 800-936-4888.

2.1.6 Handling Precautions

Do not lift the SX-7 Starsun using locations that are not designed to bear the weight or strain of being lifted.

- During inspection, cleaning, and maintenance; do not grasp the Gimbal motors or the connector interfaces on the Gimbal or Searchlight to lift it. Instead, use the Searchlight housing, and lift the Gimbal by the yoke itself.
- When maintaining exposed electrical components, never work alone.
- The Gimbal can cause possible injury during operation:
 - Do not place fingers inside the Gimbal's area of motion when the power is on. The moving parts can trap loose clothing and cause personal injury.
 - To avoid injuries, keep people and loose fitting clothing away from the equipment during operation.

2.1.7 Installation Location Safety Considerations

The following should be taken into consideration during the installation:

MOUNTING LOCATION:

- During operation, the Searchlight's high-intensity light beam can cause heat damage to exposed surfaces, especially if the light is aimed at a surface for long periods of time.
 - Provide for heat dissipation from the Searchlight beam during operation.
 - Do not install the Searchlight in locations that allow the light beam to be aimed at nearby temperature sensitive surfaces without taking appropriate steps to

Source: Spectrolab, Inc.

-
- mitigate possible damage. The light absorbed by dark colored surfaces can cause them to reach combustion temperatures under some conditions.
- If the Searchlight is installed on an aircraft that is equipped with floats, the Mechanical Stops for Azimuth and Elevation may have to be adjusted. Adjust the Stops to limit the movement of the Searchlight to prevent it from shining directly at the floats. The Searchlight beam can melt a hole in floats at close range.
 - Prevent the Searchlight from being aimed in ways that adversely affect the aircraft crew.
 - Do not expose fuel or other volatile substances to the Searchlight beam.
 - Azimuth Stop Blocks should be set so as to avoid the searchlight beam from shining directly on the aircraft.
- Mount the system using a qualified mounting bracket and verify all safety cables are installed.
 - Verify the distribution of weight and balance with reference aircraft center of gravity.
 - It is recommended to mount the system at a horizontal position (without an angle) to prevent lookup or lookdown limitations.
 - It is recommended to mount the system along the same horizontal plane as a “linked” camera or imaging system for optimal performance and to prevent pointing errors.

ELECTRICAL

- The SX-7 system is designed to operate with a supply voltage of 27.5 ± 1.5 volts.
- To maintain optimal performance, cable lengths should be kept as direct and short as possible.
- Starting the Lamp demands a relatively large amount of electrical power. It is recommended that the Lamp is operated when the aircraft engine is at full RPM during flight or an APU during ground tests.
- Install a circuit breaker (for the SX-7 Starsun) that is accessible to the aircraft crew.
- Make sure that the Searchlight does not interfere with aircraft instrumentation or radios.
- Make sure that the Searchlight does not overload the aircraft’s electrical system when all other anticipated electrical systems are operating.

GROUND CLEARANCE

- For aircraft with minimal ground clearance, raise the light to horizontal position prior to landing to prevent damage. The SX-7 has a minimum ground clearance requirement of 16.5 inches.

FIRE PRECAUTIONS

- The Searchlight has focusing capability and therefore has a focal point (which is the hottest spot) which is variable and can be as close as 3 feet to the front of the searchlight.
- Avoid operation of the searchlight below 10 feet AGL as it can ignite flammable material or dry vegetation at the focal point.
- Never point the searchlight to any part of the aircraft

2.2 Safety Messages Used in this Manual

This manual contains important safety messages that are identifiable by their appearance. These safety messages identify hazards and contain information to help you avoid personal injury or damage to the Searchlight, aircraft, or other property. There are three types of safety message used in this manual.

- *Danger* notices indicate a hazardous situation that will result in serious injury if not avoided. A danger message has the following appearance:



- *Warning* notices indicate a hazardous situation that could result in serious injury if not avoided. A warning message has the following appearance:



- *Caution* notices indicate a hazardous situation that could result in minor or moderate injury if not avoided. A caution message has the following appearance:



3.0 SX-7 STARSUN SYSTEM OVERVIEW

3.1 Components

SX-7 Starsun Standard Equipment	
<p>Searchlight</p> 	<p>Gimbal</p> 
<p>Junction Box</p> 	<p>Control Box</p> 

3.2 Connections

The SX-7 Starsun system includes a Control Box, Junction Box, Gimbal, Searchlight, and associated cables. In Figure 1, the basic connections between the main components of the SX-7 Starsun system are illustrated. It identifies the components, the connectors on each component (J1 on the Junction Box for example), and the cables attached to each connector. The Junction Box links most of the SX-7 Starsun components. This section of the manual addresses the following connections:

- Control Box to the Junction Box
- Junction Box to the Gimbal Assembly and Searchlight
- Junction Box to the Power Input

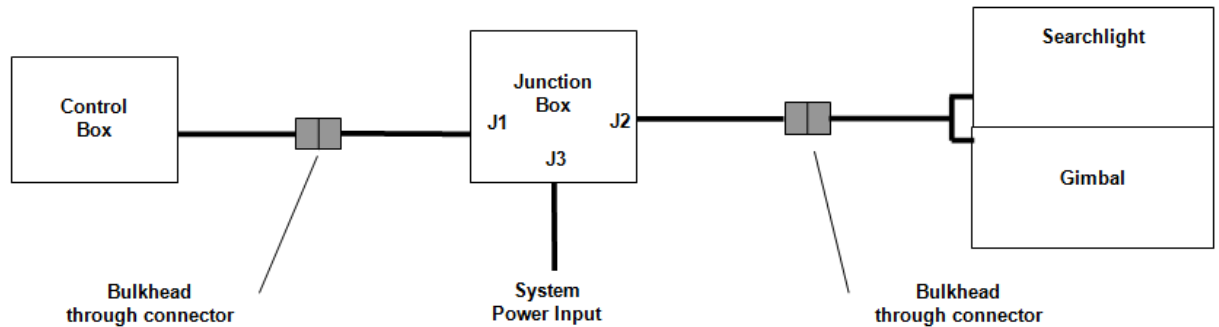


Figure 1 Overview of SX-7 System

3.2.1 Junction Box to Control Box

In the area where the Control Box will be used to operate the Searchlight, connect one end of the control cable to the connector on the base of the Control Box and the other end to the bulkhead through connector.

On the other side of the bulkhead, connect one end of the straight control cable to the bulkhead through connector. Connect the other end of the cable to the J1 connector on the Junction Box.

3.2.2 Junction Box to Gimbal Assembly and Searchlight

In the area where the Junction Box is installed, connect one end of the Junction Box to bulkhead cable to the J2 connector on the Junction Box. The other end of the cable is the bulkhead through connector leading to the exterior of the vehicle, where the Gimbal assembly is installed.

On the exterior of the aircraft:

- Connect one end of the External Split cable to the bulkhead through connector. On the other end, connect one end of the cable to the connector on the Gimbal.
- Connect the Searchlight end of the cable to the connector on the Searchlight.

3.2.3 Junction Box to Input Power

Make sure that the Control Box On switch is set to the Off position.

Connect one end of the power cable to the J3 connector on the Junction Box. Connect the other end of the power cable to the power source.

3.2.4 Cabling

The SX-7 Starsun relies on various cables for power and communication. These cables use bulkhead through connectors to support installation on a variety of vehicles.

- Coiled Control Cable
- Internal, Straight Control Cable
- Main Power Cable
- Junction Box to Bulkhead Cable
- External, Split Cable

4.0 GIMBAL ASSEMBLY

The Gimbal assembly illustrated in Figure 2 has a U-shaped yoke (Gimbal Arm) made of high-strength aluminum. When fully assembled, it serves the following functions:

- Mechanically supports the Searchlight and the attachment to the aircraft.
- Provides the electrical and communication link between the Searchlight and Junction Box.
- Contains gears, electronic equipment, and separate DC motors that adjust the Searchlight's Azimuth and Elevation positions. Consequently, the Gimbal assembly enables the Searchlight to be pointed in various directions.

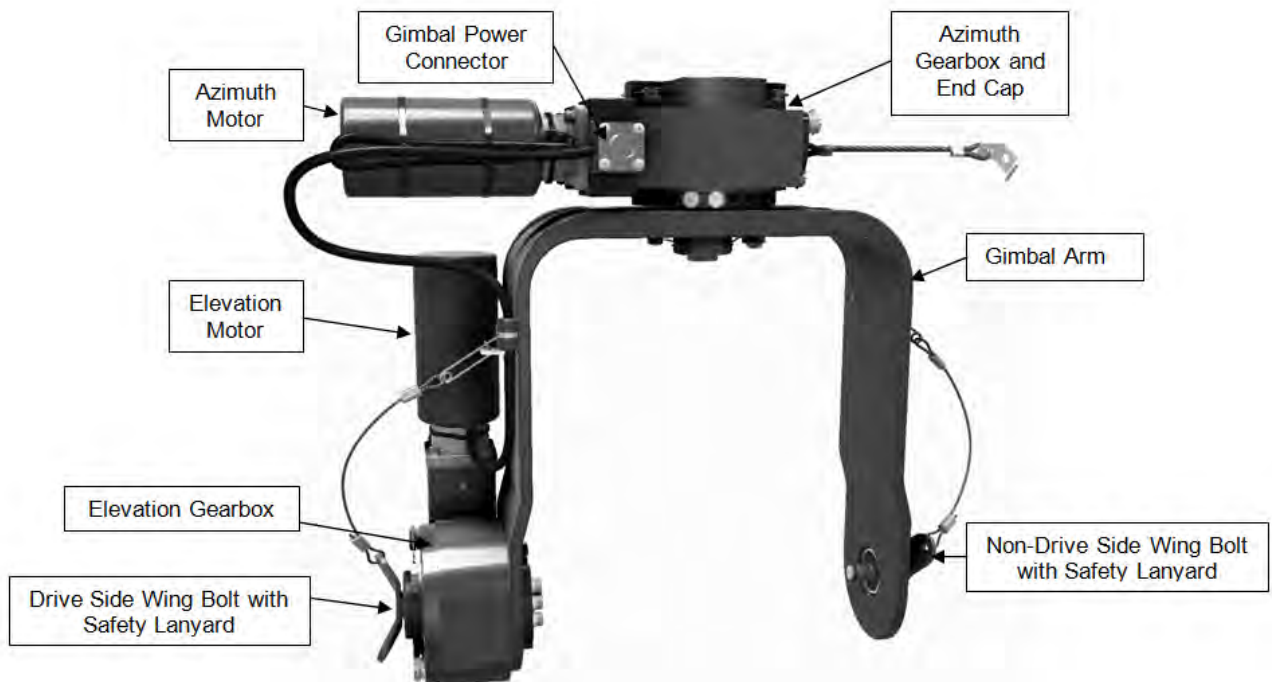


Figure 2 Gimbal Assembly (Standard)

4.1 Gimbal Motor and Gearbox

The maximum drive speed the Azimuth and Elevation motors are up to 40° per second.

4.1.1 Azimuth and Elevation Gearbox Clutches

The pressure-sensitive Joystick on the Control Box controls the position of the Searchlight for the Azimuth and Elevation axes. Clutches in the Gearboxes will slip when the light has reached its mechanical limit of travel in the event the operator continues to press the Joystick.

4.2 Elevation Attachment and Movement

- The Elevation Gearbox and Motor are mounted on one side of the Gimbal Arm, also called the drive side. Wing bolts pass through each side of the Gimbal Arm into the

Searchlight's mounting bosses; one through the Elevation Gearbox (drive side) and the other into the opposite side (non-drive side).

On the drive side of the Gimbal Arm:

- A square drive output shaft on the Elevation Gearbox slips into a mating socket in the Searchlight's Elevation Stop illustrated in Figure 3, and this transmits the output power from the Gearbox directly to the Searchlight.
- Elevation Mechanical Stop Blocks illustrated in Figure 4 are mounted on the inside of the Gimbal Arm (drive side) and come into contact with the Searchlight's Elevation Stop.
 - The Elevation Stop limits Searchlight movement and prevents it from pointing in detrimental directions. The Elevation Stop is adjustable and described in the *Adjusting the Elevation Mechanical Stops* section of this manual.

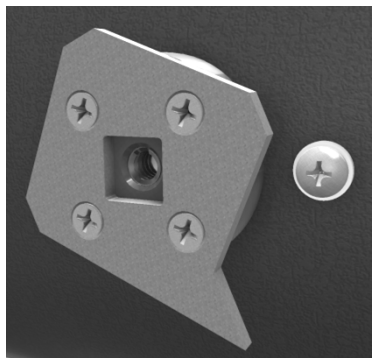


Figure 3 Searchlight Elevation Stop

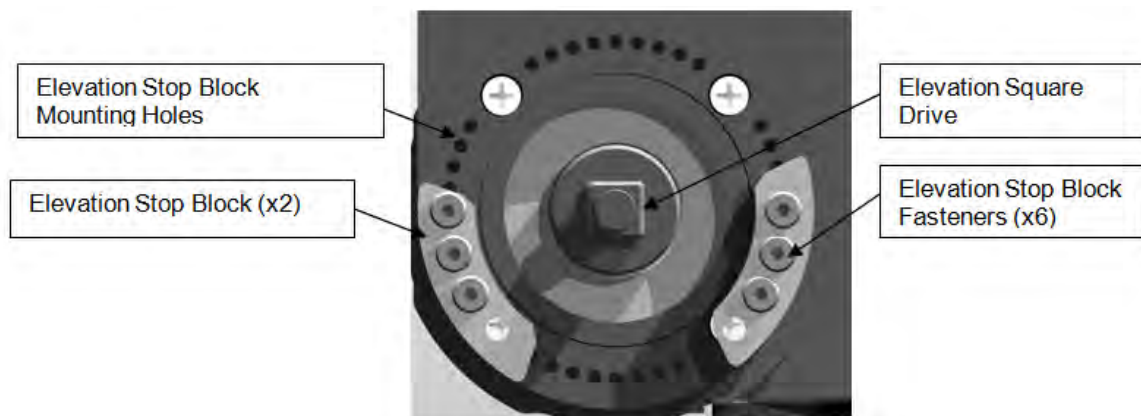


Figure 4 Elevation Stop Blocks

4.2.1 Adjusting the Elevation Stop Blocks

The Gimbal has two Elevation Mechanical Stop Blocks, one to limit the lookup angle and the other to limit lookdown angle of the Searchlight. The Stops are adjustable in 2° increments. The Stop Blocks may be adjusted for the required elevation travel range. In addition to being moved, the Stop Blocks can be trimmed on the slotted end of the Stop

Block for more precise travel limit requirements. Adjustments may vary for configuration of the Searchlight and will depend on the installer to determine the settings.

Tools Required:

7/64" hex tool

To adjust the Stop Blocks:

- Note the current position of the Blocks
- Loosen and remove all the Block fasteners (6-32 socket head screws) in Figure 5.
- Adjust each Block as required.
- Tighten all mounting bolts to 10 inch-pounds.

Note: At least two fasteners must be installed on the Blocks since the position of the Block may not allow for three fasteners.

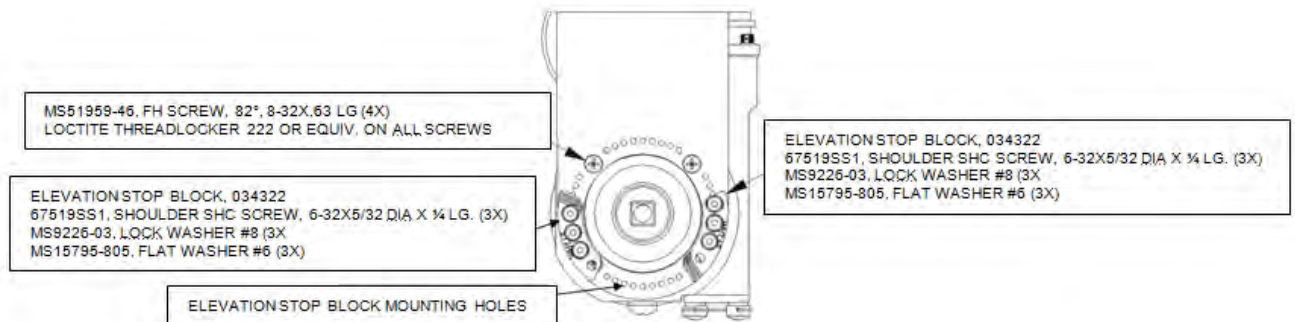


Figure 5 Elevation Stop Block Adjustment

4.3 Wing Bolt Safety Cable

There are two Wing Bolt Assemblies with Safety Cables and Safety Clips attached as shown in Figure 6. One attaches to the Elevation Gearbox and the other to the non-drive side of the Gimbal. The Wing Bolt Safety Cable Clip latches to a bracket on the side of the Gimbal and prevents the Wing Bolt from rotating and loosening.

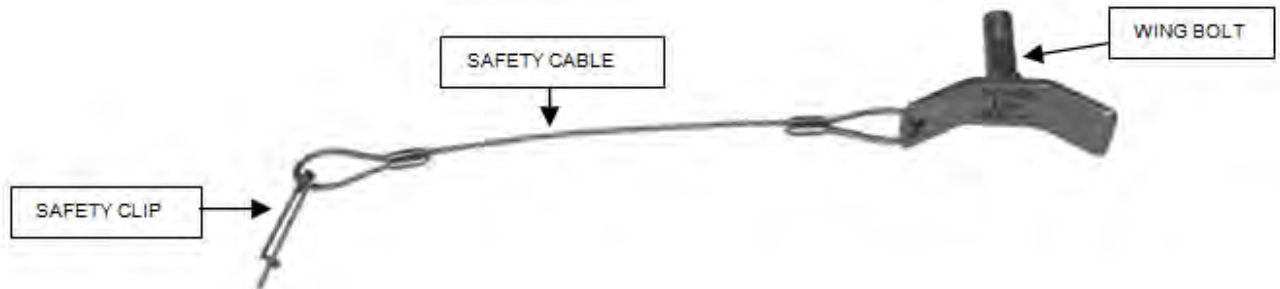


Figure 6 Wing Bolt Assembly

4.4 Azimuth Attachment and Movement

The Azimuth Gearbox and motor are mounted at the top of the Gimbal Arm (where it attaches to the aircraft).

- The Azimuth Gearbox has a shaft that secures the Searchlight to the aircraft mounting bracket through four mounting bolts. This shaft supports the entire weight and aerodynamic load of the Searchlight and Gimbal assembly.

4.4.1 Azimuth Mechanical Stops

Azimuth movement is limited when a Stop Block attached the Azimuth Gearbox Adapter Ring with two Shoulder Bolts makes contact with a high-strength stationary Shoulder Bolt on the Gimbal Arm as illustrated in Figure 7. A maximum of two adjustable Stop Blocks can be installed to achieve the required Azimuth movement range.



Figure 7 Azimuth Stop Block

4.4.1.1 Adjusting the Azimuth Stop Blocks

To adjust the Stop Blocks:

- Loosen the shoulder screws with a hex tool.
- Once the screws are loosened and removed, the Stop can be positioned as required.
- Fasten to the following torque values:
 - 8-32 Stop Block Shoulder Bolt should be 20 inch-pounds (± 2).
 - $\frac{1}{4}$ "-20 Stationary Shoulder Bolt should be 78 inch-pounds (± 2).

In addition, regularly inspect the condition of the Stop Block shoulder bolts and the stationary precision shoulder bolt. Replace them if necessary.

Azimuth motion also is limited by the length of the cabling. If it is long enough, the Searchlight cabling enables the Searchlight to rotate a maximum of 170° to the left and 170° to the right of the center position with respect to the Gimbal (this assumes that the Searchlight/Gimbal are pointed directly forward in relation to the aircraft). The maximum potential movement of the Searchlight will be compromised if the cable becomes twisted around or hampered by the Gimbal components.

4.5 Gearbox Safety Cable

The Gearbox Safety Cable shown in Figure 8 is recommended to be installed between the Gearbox body and the aircraft mounting bracket or aircraft hard point. This safety cable secures the entire Gimbal in the event the mounting bracket bolts or the end cap bolts were to loosen or fail. Figure 9 shows the one end of the Safety Cable attached to the Azimuth Gearbox.



Figure 8 Gearbox Safety Cable



Figure 9 Safety Cable Attached to Gearbox

5.0 SEARCHLIGHT

The Searchlight assembly illustrated in Figure 10 consists of a metal cylindrical housing that consists of the xenon-arc Lamp, Chassis with electrical components, Front Window Assembly, Focus Mechanism, Rear Cover and optics that are described in more detail in this section and shown in Figure 11 and Figure 12. The SX-7 Searchlight assembly is compatible with the SX-5 series Gimbals; however some components differ from some the SX-5.

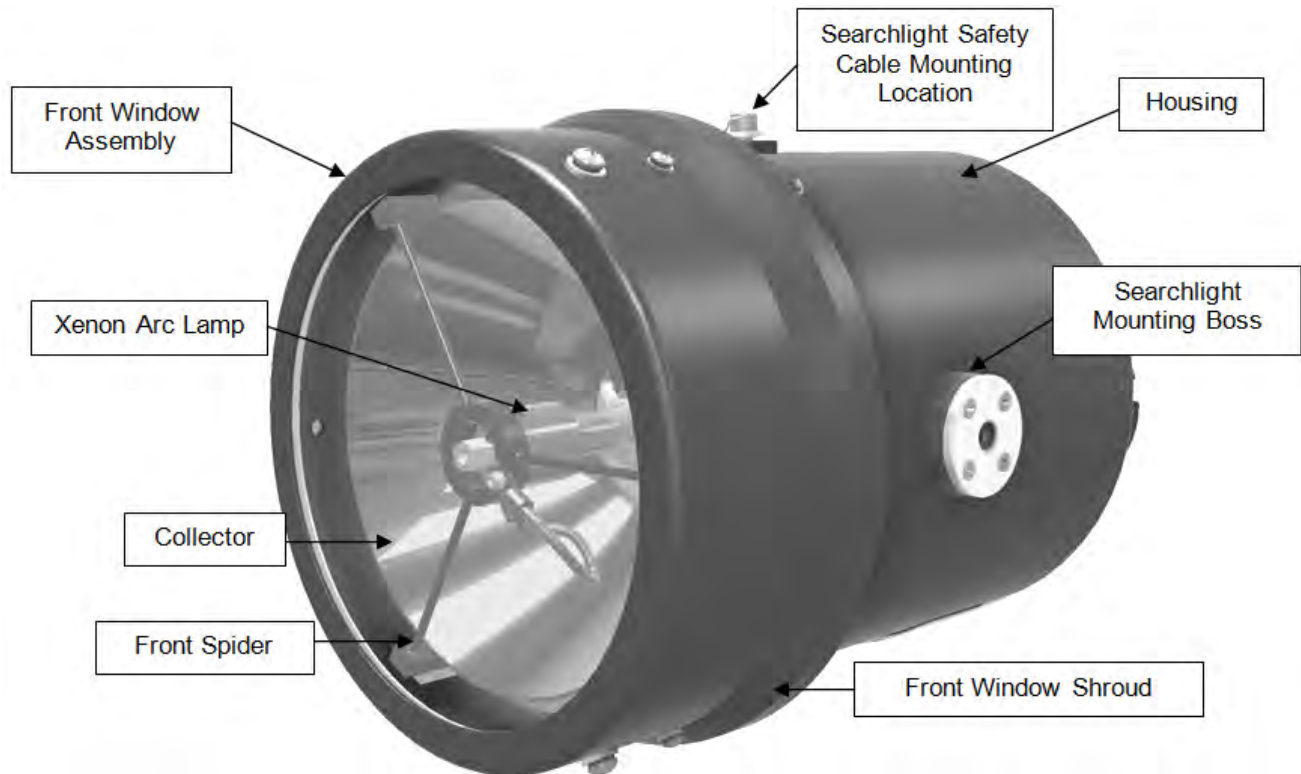


Figure 10 Searchlight Assembly

5.1 Searchlight Components

Xenon Arc Lamp - A high-intensity xenon arc Lamp or simply the Lamp, where light is produced by an electric arc that forms between the tips of two tungsten electrodes called the anode (positive electrode) and cathode (negative electrode):

- The two tungsten electrodes are permanently sealed in a quartz envelope that contains xenon gas under approximately 30 to 75 pounds of pressure per square inch at normal ambient temperatures of 60° to 90° F. In use, however, the xenon gas reaches 3000° F, and the temperature surrounding the bulb ranges between 800 and 2100° F. Consequently, pressure inside the bulb can rise to 300 psi.
- The Lamp must be handled with great caution. Accidental breakage will result in an explosion of quartz particles because of the pressurized xenon gas within the bulb.

Source: Spectrolab, Inc.

-
- During normal, continuous operation, the Searchlight draws the specified 28 volts and 35 amperes. During the first minute or two of operation, however, it may draw 50 amps. This decreases to 35 or less as the Lamp warms up and stabilizes. Most aircraft electrical systems can support these loads without difficulty. On occasion, non-essential equipment must be de-energized during Searchlight startup, but this equipment can be turned back on after 2 or 3 minutes. The operator can determine if this is necessary by observing the aircraft load meter to make sure that it does not exceed the limits set by the aircraft or equipment manufacturer.

Optics

- Collector/Reflector - The Lamp and parabolic reflector form a precision optical system. The majority of the light produced by the xenon Lamp comes from a small point near the cathode (small electrode) which can be accurately collected and focused by the reflector. It is this property of the xenon arc Lamp which allows the tight focus, and extremely high beam intensity of the SX-7.

Searchlight Chassis

- Chassis (includes the reflector and all interior components between the reflector and the rear cover inside the Searchlight housing, including electronics such as the starting circuit for the Lamp).
- Focus Mechanism - A bi-directional focus mechanism allows the operator to focus selectively without having to cycle to reach the desired beam width. The operator can adjust the beam width with the Control Box.
 - A focus mechanism and motor to adjust the position of the reflector with respect to the bulb:
 - When the reflector is moved to the rear of the Searchlight, the beam increases in diameter.
 - The reflector can be moved up to change the diameter of the beam from a minimum of 2° to a maximum of 10°.

Front Window Assembly

- Glass - An impact resistant, ¼" thick, Pyrex glass front window that can withstand mechanical stress, high temperatures, and thermal shock
- Baffle - A light baffle (between the Front Window Shroud and the Searchlight Housing) that keeps light from shining out of the housing toward the operator or aircraft, which could interfere with the vision of personnel in the aircraft. Also, it allows for heat generated by the Lamp to exit the Searchlight.

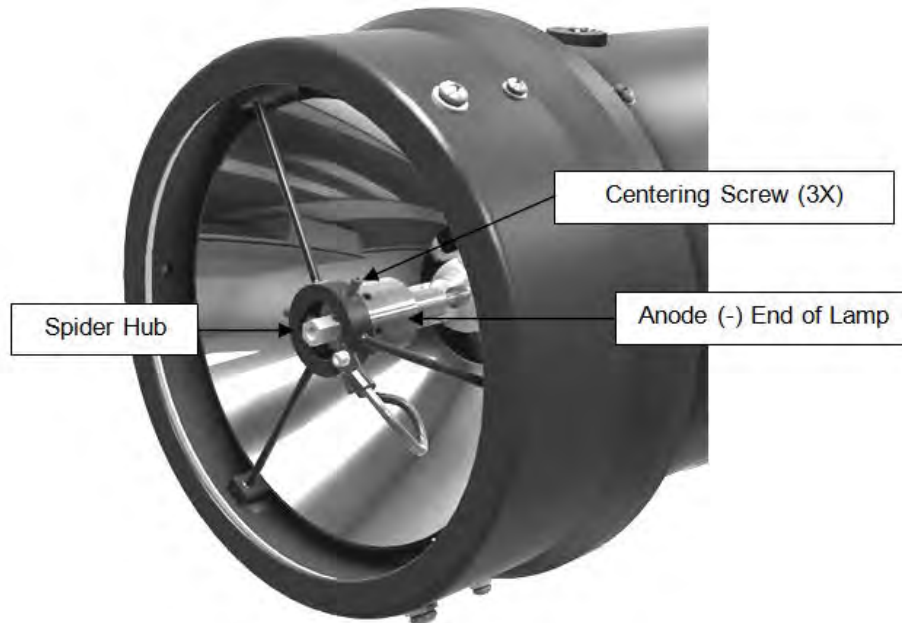


Figure 11 Searchlight Front Spider

- Lamp Electrical Connection - The Lamp's electrical connection is through the Front Spider. The Lamp's Anode (+) end of is supported and electrically connected by an attached copper pin which inserts into a stationary receptacle at the rear center of the Searchlight. The Cathode (-) end of the Lamp is supported by the centering adjustment screws on the hub of the Front Spider.

Rear Cover

- Cooling Blower - A Cooling Blower on the Rear Cover of the Searchlight Assembly provides airflow to the Lamp to prevent overheating. The airflow generated by the Cooling Blower also prevents moisture from accumulating inside the Searchlight.
- Lamp Hour Meter - This component measures Lamp ON time in hours and 10ths of an hour and will assist in determining Lamp life and operation time. Electronics and a sensor track when the operator has ignited the Lamp.

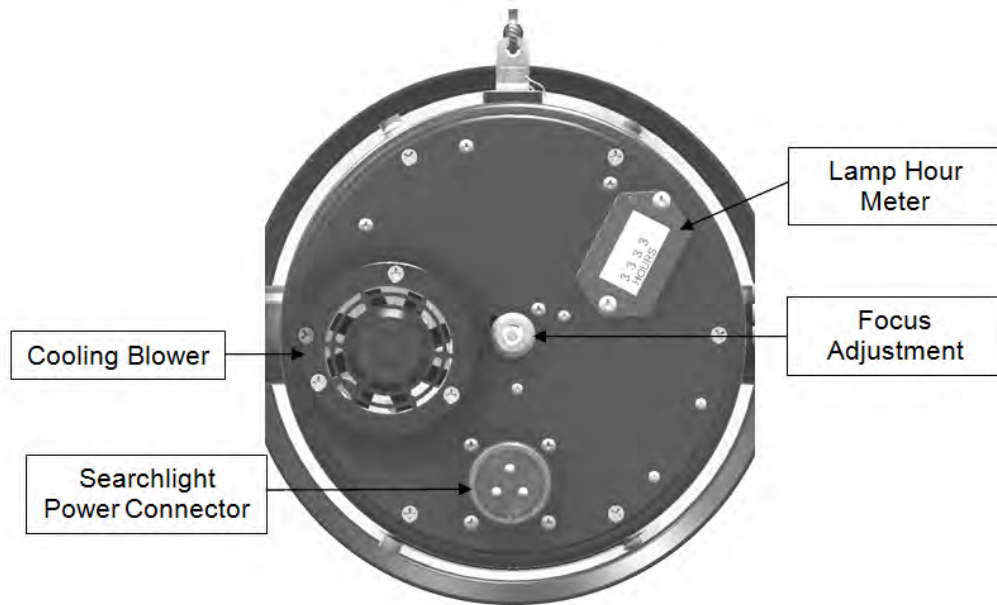


Figure 12 Rear Cover

5.2 Searchlight Beam Intensity

The SX-7 Searchlight has a nominal light intensity of 20-25 million candlepower at a beam diameter of 2° (narrow). Figure 13 shows the beam intensity at various distances when the focus is set to the narrow beam of 2°.

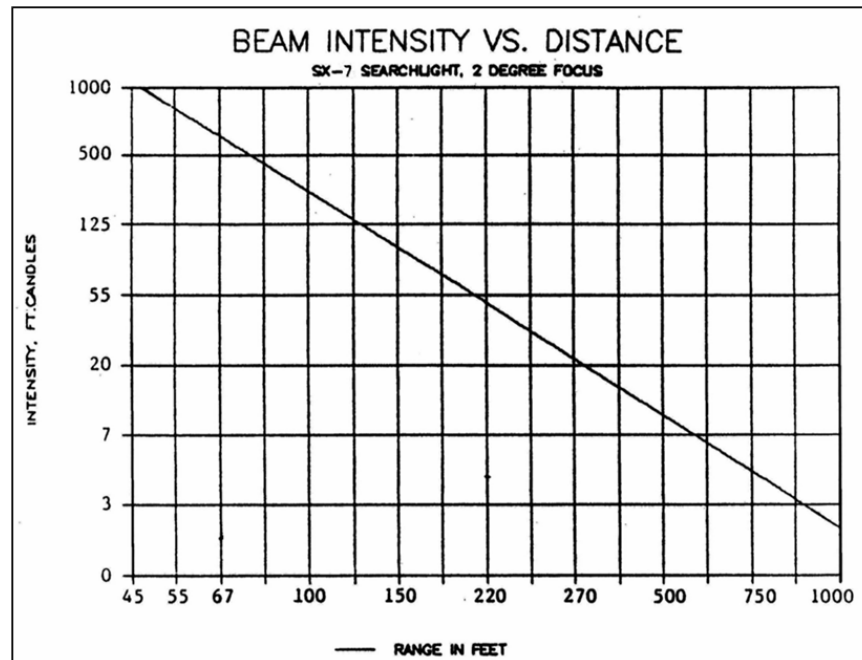


Figure 13 Beam Intensity vs. Distance

5.3 Searchlight Safety Cable

The Searchlight safety cable shown in Figure 14 is included with the Searchlight Assembly. However, this cable will need to be attached to the Gimbal Gearbox shaft. The searchlight safety cable is installed between the searchlight and the Gimbal. One end of the safety cable is bolted to a boss at the top center of the searchlight and the other end attaches to the underside of the Gimbal. This safety cable prevents the Searchlight from falling from the aircraft in the event the Wing Bolts became loose or failed. The instructions to attach this safety cable are in this section.



Figure 14 Searchlight Safety Cable



Figure 15 Searchlight and Gimbal

Safety Cable Installation required Hardware includes:

- 1- Socket Head Screw P/N NAS1351-3H12P
 - 1- Lock Washer P/N MS35338-138
 - 1- Flat Washer P/N NAS620C10L
 - 1- Lock Wire
 - 1- Fillister Screw, P/N MS35276-59
- Loctite 222 for fillister screw, as required

Source: Spectrolab, Inc.

Anti-Seize Compound, as required

Instructions to install the Searchlight Safety Cable:

- Apply Anti Seize to Hex Screw threads.
- Attach Safety Cable to Gimbal Azimuth Shaft with the recommended hardware
- Torque bolt to 28-30 inch-pounds.

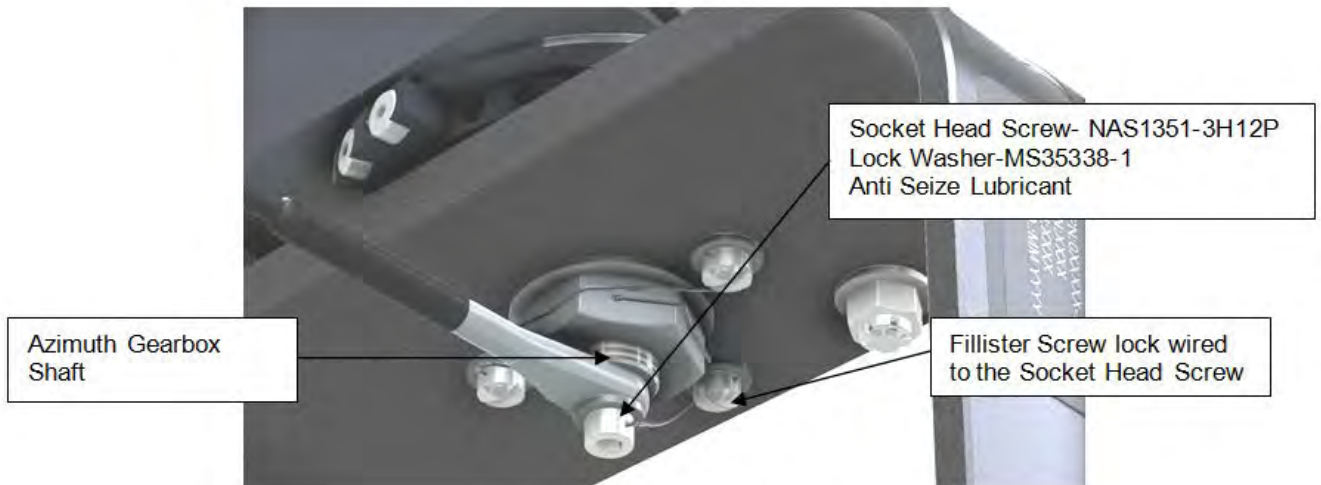


Figure 16 Searchlight Safety Cable attached to the Gimbal Azimuth Shaft

- Apply Loctite Threadlocker (222) to Fillister Screw (MS35276-59), add a Flat Washer (NAS620C10L) and fasten into the tapped hole on Gimbal Arm shown in Figure 16.
- Lock wire Fillister screw and Safety Cable Bolt per NASM 33540.

6.0 CONTROL BOX

The Searchlight responds to pointing commands from a Control Box shown in Figure 17. It can be attached anywhere in the craft or fastened to the operator's clothing.

The Control Box has the following controls:

- System Switch to enable system power
- Lamp Switch to start the Lamp (up position) and extinguish (down position)
- A Bi-direction (up and down) focus button allows for beam width adjustments.
- A pressure-sensitive Joystick controls the Searchlight Up/Down (Elevation) and Left/Right (Azimuth) positioning.



Figure 17 Standard SX-7 Control Box

7.0 JUNCTION BOX

The Junction Box shown in Figure 18 links all of the SX-7 Starsun components, and it provides the following functions:

- Central distribution location for control signals and power.
- Contains Circuit Breakers, support components, connectors and circuitry responsible for starting the Lamp.

7.1 Connectors

Its three connectors include:

- J1 - Control Box
- J2 – Searchlight/Gimbal
- J3 – Input Power







Figure 18 SX-7 Junction Box

7.2 Mounting Location

The Junction Box requires secure mounting in any orientation in a relatively dry location. It is recommended that the Circuit Breakers be accessible and visible.

8.0 OPERATION

	<p>⚠ WARNING</p> <p>UV Light Hazard.</p> <p>Avoid looking directly at light.</p>	<p>WARNING!</p> <p>Xenon-arc Searchlights produce a high intensity light beam during operation.</p> <p>If the beam is directed into the eyes at close range, may cause eye injury damage.</p> <p>The ultraviolet rich beam can cause severe sunburn to unprotected skin.</p> <p>The beam also can set on fire nearby combustible objects, including clothing and hair.</p>
	<p>⚠ WARNING</p> <p>Risk of eye injury.</p> <p>Wear eye protection.</p>	<p>To reduce the risk of serious injury or fire:</p> <ul style="list-style-type: none"> • Never look directly into Searchlight during operation. • Do not expose people to light beam. • Never walk through the light beam.
	<p>⚠ WARNING</p> <p>RISK OF SKIN DAMAGE DUE TO UV RADIATION</p> <p>WEAR PROTECTIVE CLOTHING</p>	<ul style="list-style-type: none"> • Alert all nearby people that the Searchlight will be operating. • Always wear protective eyewear when looking at objects illuminated by nearby Searchlight.
	<p>⚠ WARNING</p> <p>BURN AND FIRE HAZARD</p> <p>* HIGH DENSITY LIGHT BEAM FROM SEARCHLIGHT CAN BURN & START FIRES</p>	<ul style="list-style-type: none"> • Before starting Searchlight, make sure it points down and not toward any objects that may be damaged by light beam. • Keep all flammable objects away from the light beam. • Reference the safety section of this manual for safe distances of objects and people while light is illuminated.

During close-up inspection and cleaning activities, the Searchlight must not be turned on. Remove the Control Box or its cable, or disconnect the Searchlight cable so the light cannot be turned on accidentally during the inspection.

8.1 Preflight Inspection

Maintenance personnel should conduct a routine check of the SX-7 Starsun to keep it ready for use.

- The inspection should be conducted daily if the aircraft is used frequently (more than once each day).
- An inspection should be conducted before each flight if these flights are infrequent (do not take place daily).
- Observe the all safety precautions mentioned in the *Safety* section.

8.1.1 Visual Inspection

The inspection should include the following tasks:

- Make sure that the Searchlight housing, mounting locations and safety cables are dry, mechanically sound, clean of dust and dirt, and not worn or damaged.
 - Inspect the Elevation drive boss welds and nearby housing. Look for signs of cracking in the paint and metal.
 - Inspect the boss weld and nearby housing for the safety cable attachment. Look for signs of cracking in both the paint and metal.
 - Inspect the safety cables that attach the Searchlight to the Gimbal and the Azimuth Gearbox housing to the aircraft.
 - Verify there is not excessive movement when applying hand-pressure in up, down, left, and right directions. The Gimbal should maintain its position and should not rotate under moderate hand pressure.

Inspect optics:

- Make sure that the Front Window, Reflector, and Lamp are clean and not obstructed by dirt or moisture.
 - Inspect the window under moderate to strong light such as daylight. Both the inside and outside of the glass should be free of dirt, oil, moisture, water stains, insects, chips and pits, scratches and cracks. If you see significant amounts of dirt on the inside or outside surface of the glass, it must be cleaned.
 - The adhesive bond attaching the glass to the metal frame should have elasticity and be intact all around the circumference of the window; if it is loose, it must be re-bonded.
 - Inspect the Reflector for dust or discoloration in an area with sufficient light or with a bright portable light such as a flashlight. Look for easily visible dirt or dust, insects or spider webs, leaves and grass, and bits of paper and plastic.
 - Inspect the arc Lamp (bulb) for dirt and leaves, insects and spider webs, cracks in the quartz envelope, and loosening of either of the electrodes.

Inspect cables:

- Make sure that the cable connections are tight and cables are not showing any signs of cracking, fraying, or any other type of damage.

Inspect Circuit Breakers:

- Make sure that the Circuit Breakers in the Junction Box are pushed in.

Inspect the fan:

- Make sure that the Cooling Blower is clean and not obstructed by dirt or moisture.

-
- Check the condition of the Cooling Blower screen at the back of the Searchlight housing.

8.1.2 Functional Tests

These tests verify critical system functions required for the mission and sustain reliability.

- The functional tests should be conducted daily if the aircraft is used frequently (more than once each day).
- The functional tests should be conducted before each flight if these flights are infrequent (do not take place daily).
- It is recommended to power up system prior to flight if system use will be required.
- Place the Control Box Start switch in the On position.

Verify Fan Operation:

- Make sure that the Cooling Blower functions properly. Listen to the sound of the Searchlight cooling fan during operation; it should sound smooth and even. This test can be performed using battery power on aircraft installations.

Lamp and Focus Function:

- All personnel should remain behind the Searchlight's glass window and never look directly into front of the Searchlight.
- During Lamp operation, wear dark glasses equal to or darker than welder's shade 3 glasses to protect your eyes.
- The test operator's hands must remain out of the beam.
- Searchlight must be mounted on the aircraft or a bench test set; Searchlight cable must be connected to Searchlight.
- Point the Searchlight at a target that is 10 meters (33 feet) away. The target should be dark or medium dark in color, completely non-flammable, and heat resistant at temperatures up to 500° F (260° C).
- Hold the Lamp switch in the On position until the Lamp ignites. Then release the switch. Allow it to run for a few minutes to stabilize.
- Press the focus switch in both directions to verify the Searchlight can focus from wide to narrow and back. Observe the beam on the target as you run through the focus range. It should change focus and be round at all times.
- Turn off Lamp, and allow it to cool properly by allowing the Cooling Blower to run for 5-10 minutes after the Lamp is extinguished.

Gimbal Movement:

To verify full Gimbal movement, the system should be on.

- Ensure the Gimbal responds to inputs from the Joystick switch for up, down, left, and right directions.

Once all the function tests have been completed and passed, the system is ready for use.

8.2 Operational Sequence

To operate the Searchlight, perform the following steps in the order they are listed.

- Place the System switch in the On position to turn on the system power.
- Use the Up/ Down/Left/Right directional control to point the Searchlight away from the cockpit area before starting the Searchlight in flight. This avoids exposing the pilot to excessive glare. In addition, check the Gimbal movement and the operation of the focus control.
- Place the Lamp switch in the On position, and hold it in this position until the Lamp ignites. This usually requires 3 to 5 seconds. Release the switch immediately after the Lamp starts.

NOTICE

Holding the switch in the start position after the Lamp turns on or during a prolonged series of “strokes” will cause premature failure of some starting circuit components and the xenon gas Lamp.

- Adjust the Up/ Down/Left/Right directional control as desired to aim the Searchlight.
- Adjust the Searchlight focus by pressing the Focus switch up or down until the desired beam width is obtained.
- Practice using the Searchlight at various altitudes below 3000 feet AGL.
- If the aircraft has minimal ground clearance or if the Searchlight is mounted on the nose of the aircraft, make sure to raise the light to a horizontal position before landing.

Before landing the craft:

- Extinguish the Lamp by pressing the Lamp switch in the Off position. Allow the Lamp to properly cool as described in the *Proper Cooling Procedure* section.
- When the Searchlight has finished cooling, place the System switch in the Off position.
- Position the Searchlight to provide enough clearance to land the craft.

8.3 Maximizing and Assessing Lamp Performance

8.3.1 Maximizing Lamp Life

The Lamps are designed to operate for 1,000 hours under ideal conditions. According to the manufacturer, ideal means 1 hour of operation or more after startup. This period of operation is considered ideal because the Lamp’s electrodes require 20 continuous minutes of operation to “re-form” (smooth out the erosion and pitting that occur during the startup cycle). If re-forming does not take place, the erosion becomes progressively worse and causes premature bulb failure, which is indicated by failure to start.

A continuous period of operation that exceeds 20 minutes after startup may not be possible for various reasons. Consequently, it is important to schedule a “maintenance” period of Lamp on operation on a regular basis. This Lamp on maintenance period of operation should exceed 20 minutes.

8.3.2 Proper Cooling Procedure

To provide proper cooling for the Lamp in your Searchlight, it is imperative to allow the fan to run for 5-10 minutes after the Lamp is extinguished.

8.3.3 Assessing the Need for Lamp Replacement

A decision to replace a Lamp should take into consideration all factors, including overall system performance. The following characteristics can help to determine the need to replace a Lamp:

- “Hard” Lamp starts (the Lamp requires more than 3 or 4 seconds to turn on)
- Multiple flashes and “hard” Lamp starts before actual startup (the Lamp is near the end of its service life)
- Development of a brownish tint on the inside surface of the bulb
- A cracked or otherwise compromised bulb (leads to escape of the xenon gas)

9.0 CUSTOMER SERVICE

If you have a question about this manual or need assistance with an SX-7 Starsun, please contact Spectrolab Customer Service at 800-936-4888 or by email at DL-SYLCustomerservice@west.boeing.com .

10.0 SPECIFICATIONS

Illumination Characteristics	
Lamp type/Lamp life	1600 watt xenon short-arc / 1,000-hour, 2-year maximum life
Peak beam intensity	20 to 25 million candlepower
Beam width	Adjustable, from 2° (search mode) to 20° (flood mode)
Focus control	Remote control
Electrical Requirements	
Input voltage	28 volts nominal (26.5-29.0 VDC)
Input current	55 to 67 amps nominal (85 amps maximum)
Start time	3 to 5 seconds (typical)
Recycle time	None required
Compatibility	Compatible with most standard aircraft type DC generators; fixed wing applications and accessory power converters available (not from Spectrolab) for operation from other primary power sources from 117-480 VAC, 50-400 Hz; may be operated from batteries or ground power unit
Cooling	Internal cooling fan with filtered air intake
Application Characteristics	
Typical range	3200 ft (1 km)
Useful target ID range	1 mile (1.6 km)
Peak luminance at 1 km	32 lux (2.9 ft-cd)
Beam diameter at 10% of peak luminance	230 ft @3200 ft (70 m @ 1 km)
Weight	55-64 lbs (25-30 kg) depending upon hardware and cable lengths

11.0 GLOSSARY AND ACRONYMS

This glossary lists terms, acronyms, and symbols that appear in the manual.

μf	microfarad, a unit of capacitance equal to one millionth of a farad
AGL	above ground level
anode	positive (+) electrode at the rear end of the xenon gas Lamp (it is larger than the cathode)
APU	auxiliary power unit
azimuth	horizontal (compass) directions with respect to the Gimbal's mounting plane
backlash	a sudden violent movement or reaction against pressure (the original pressure can be either forward or backward or side to side, and the backlash movement is in the direction opposite to the original movement)
bulb (Lamp)	Xenon gas arc Lamp located in the Searchlight
cathode	negative (-) electrode at the front end of the xenon gas Lamp (it is smaller than the anode)
chassis	includes the structural and electronic components inside of the rear portion of Searchlight housing (including the starting circuits, fan mechanisms, optics (the reflector), and focus mechanism
circuit breaker	switch that interrupts electrical current under abnormal conditions
collector	reflector
CB	circuit breaker
Control Box	Hand held control unit consisting of switches and status indicators; it enables the operator to control the SX-7 Starsun
duty cycle	the fraction of time that a system is actually employed in performing its function; the ratio of "on" time to "off" time during the operation of a component
DVOM	digital volt-ohm meter
electrode	electrical conductors that create the intense light in the xenon arc Lamp (see anode and cathode)
elevation	vertical directions (up and down) with respect to the Gimbal's mounting plane
EMI	electromagnetic interference
ESD	electrostatic sensitive device (a component that requires special handling because it is sensitive to electrostatic discharge)
FMS	Flight Manual Supplement
focus	control that narrows or widens the light beam
galling	the joining or sticking together of two metal parts as a result of friction

	between them
Gimbal	also referred to as a “pan-tilt” mount, a mechanical structure that supports the Searchlight head and enables pointing of the light; it includes mechanical supports, motors, gears, and electronic equipment; serves as an interface between the Searchlight head and Junction Box
IAS	indicated air speed
IPA	isopropyl alcohol (electronic grade)
Junction Box	also referred to as a “J-Box,” serves as a connection point between cables connecting other system components
kn	knot
Lamp (bulb)	xenon gas arc Lamp located in the Searchlight
Lamp adapters	attached to both ends of the xenon gas Lamp, these removable fixtures hold the Lamp in position
lead dress	cable tie
mechanical stop	located inside the Gimbal mechanism, a mechanical stop limits the range of movement (Azimuth and elevation) to prevent the Searchlight beam from being aimed in detrimental directions; mechanical stops include adjustment stop blocks and fixed stop blocks (for elevation) and hard stops (for azimuth)
MEK	methyl ethyl ketone; a solvent used to remove silicone adhesive
MTBF	mean time between failure
OD	outside diameter
PC	printed circuit
PCB	printed circuit board
PN	part number
pot, potting, potted	to encapsulate or embed (to pot); encapsulating or embedding (potting); encapsulated or embedded (potted); for example, wires are embedded in RTV in many of the connections
psi	pounds per square inch
reflector	collector
RFI	radio frequency interference
rpm	revolutions per minute
RTV	Room temperature vulcanizing; the curing of rubbery compounds at room temperature caused by the linking of polymer molecules
Searchlight	consists of a housing and front glass window (or lens) containing a high intensity xenon arc Lamp, optical system, cooling fan, and electronics
slave system	directional controller or other device that controls the Searchlight to enable synchronized positioning between this device and the Searchlight, enabling them to track and slave together

Source: Spectrolab, Inc.

slew rate	the speed of the Gimbal movement
SN	serial number
spider	there are two spiders: (1) a front spider and (2) a rear spider
strobe	the Lamp flashes
Swaged end fitting	an end fitting onto which a metal fitting is cold-pressed to the cable to attach it
SX-7 Starsun Searchlight System	system consisting of the Searchlight, Gimbal, Junction Box, Control Box, and associated cables
SX-7 Starsun	shortened form of SX-7 Starsun Searchlight System
VAC	volts alternating current
VDC	volts direct current
Worm	the driving gear in the Gearbox
worm gear	the gear shaft that is driven by the worm in the Gearbox

12.0 PERFORMANCE SPECIFICATIONS

ILLUMINATION CHARACTERISTICS:

Lamp Type	700 Watt Xenon Short-Arc Lamp
Beam Intensity	20-25 Million candlepower (Peak)
Beam Width	2° (narrow) 10° (wide)
Beam Focus	Continuous Bi-Directional

APPLICATION INFORMATION

Typical Range	3280 ft (1km)
Peak Illuminance	~32 Lux (2.9 ft-cd) @ 1km
Diameter at 10% of Peak Illuminance:	143 @ 1640 ft

Adaptable to helicopters, fixed wing aircraft, maritime and ground-based applications

Azimuth Rotation	345° maximum
Elevation Range	+15° (above horizontal) to -90° ± 1° (below horizontal)
Elevation Slew Rate	40°/sec maximum
Azimuth Slew Rate	40°/sec maximum

ELECTRICAL REQUIREMENTS AND CHARACTERISTICS

Input Voltage	28 Volts DC Nominal
Input Current	35 Amps Nominal (50 Amps max)
Start Time	3-5 seconds typical

MECHANICAL CHARACTERISTICS:

Control Box

Dimensions:	(2.25"W x 5.125"L x 2.75" H)
Weight:	10 oz.

Junction Box

Dimensions:	(6.25"W x 8.5"L x 5.25" H)
Weight:	6.3 lbs.

Searchlight

Dimensions:	8.0" Diameter, 11.25" L
Weight:	10 lbs.

Gimbal (U Shaped Yoke)

Dimensions:	5"W x 12"L x 12"H
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System Weight:

Cable Weight:	10-25lbs. (Based on cable lengths)
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Adjustable Hard Stops in Azimuth and Elevation

Azimuth, 24 Positions (15° increments)

Elevation, 10 Positions (7.5° increments)

Optional Accessories

SpectroLink Linking System

ENVIRONMENTAL CHARACTERISTICS

Temperature Normal operating conditions: +70 °C to -40 °C

Survival Range: +90 °C to -55 °C

Humidity Up to 100% non-condensing

EQUIPMENT LIFE EXPECTANCY

Searchlight The life expectancy of the searchlight is based on a combination of flight hours, operation hours, adherence to manufacturer's maintenance schedule, and environmental conditions, since every assembly that comprises the searchlight system can be overhauled, a maximum limit is not established.

OVERHAUL PERIOD

SX-7 System Periodic maintenance and pre-flight inspection is required at regular intervals. Periodic Maintenance guidelines generally coincide with routine aircraft inspections as described in section 6 of this manual. Overhaul is dependent upon operational conditions and usually expected between 7,500 and 10,000 flight hours. Some life limited components may require replacement prior to overhaul.


SHELF LIFE

SX-7 System Has unlimited shelf life with proper storage.
- Exception: Xenon Lamp has a one-year shelf life

MTBF

SX-7 System Greater than 600 hours with proper maintenance.

13.0 PREFLIGHT INSPECTION CARD

 A BOEING COMPANY
SX-7 Starsun Searchlight System
Preflight Checklist
Visual Inspections
Verify:
✓ Searchlight mounting tight and secured
✓ Safety Lanyards are attached on Wing Bolts
✓ Safety Cables
○ Searchlight to Gimbal
○ Gimbal Arm to Aircraft
✓ Searchlight/Gimbal is without excessive side to side or up and down movement
✓ Cable connections are without abrasion or damage
✓ Fasteners are without corrosion or damage
✓ Front window is clean and without damage
✓ Cooling Blower is free of interference or blockage that may prevent adequate airflow.
Functional Tests
System Operations
Verify:
✓ Lamp Start/Extinguish
✓ Focus
✓ Fan
✓ Gimbal Movement