

WHAT PILOTS CAN DO TO DETECT CORROSION DURING PREFLIGHT

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Corrosion is often thought of as a maintenance concern, but pilots are a critical line of defense in spotting it early.

Rotorcraft and fixed-wing aircraft alike face exposure to humid, salty and corrosive environments. And while corrosion may seem like a slow-moving threat, when it's left undetected, it can lead to sudden and dangerous structural failures. Enhancing preflight inspections with corrosion awareness can prevent serious issues down the line.

Pilots can take several practical steps during their daily walk-arounds and preflight checks to detect early signs of corrosion and report them before they become hazardous. With the right mindset and a few

simple tools, pilots can significantly contribute to airworthiness and safety.

Know the Vulnerable Areas

Pilots should familiarize themselves with the corrosion-prone areas specific to their aircraft type. These typically include landing gear components, control hinges, riveted seams, fasteners, rotor hubs, blade roots and exhaust areas. Any place that traps moisture, collects salt or endures friction between moving parts is a potential trouble spot.

Look for Visual Clues. Even without opening panels, many surface indicators of corrosion are visible during a walk-around. Common signs include flaking or bubbling

paint, white or gray powdery deposits, dull metal surfaces, and small pinholes or pitting. Blistered paint may suggest filiform corrosion lurking beneath. Rust-like streaks or residue on or around bolts and seams are also red flags.

Use a Flashlight and Mirror. Equipping your preflight kit with a small flashlight and telescoping mirror can make a big difference. These tools help examine undercarriages, gear well interiors or areas behind tightly packed components where corrosion might be hidden. Good lighting and the right angle can reveal details missed in ambient conditions.

Inspect for Moisture and Drainage. Moisture is the primary fuel for corrosion. Pilots should check for standing water, clogged drain holes or excessive condensation during preflight. Any sign that water is not draining properly should be noted and reported.

Know Your Environment, Report What You See

Pilots operating near the coast, over saltwater or in humid tropical climates must assume elevated corrosion risk. Daily rinses, frequent washdowns and increased

UNDERSTANDING CORROSION

Corrosion is the gradual deterioration of metal due to chemical or electrochemical reactions. In the rotorcraft industry, corrosion can occur both internally and externally, often undetected until it leads to structural compromise. Most helicopters operate in high-risk environments—humid, coastal or over freshwater—where corrosion is almost inevitable if not proactively managed. Corrosive agents like salt, moisture and oxygen initiate electrochemical reactions that attack the integrity of metal components. Helicopter structures, typically composed of alloys like magnesium and aluminum, are particularly vulnerable because the metals are chemically active and prone to losing electrons.

— Chris Matt, MRO Technical Sales, PHI Aviation

CORROSION INSPECTION: EVERYONE'S RESPONSIBILITY

An integrated approach to corrosion inspection involves:

- **Visual Inspection:** Conducted after cleaning, using flashlights, mirrors and borescopes for hard-to-reach areas.
- **NDT (Non-Destructive Testing):** Applied when visual evidence is inconclusive or parts are hidden. Only trained and certified personnel should perform NDT.

Once detected, corrosion must be addressed immediately to prevent progression.

Treatment methods fall into two categories:

- **Mechanical Removal:** Includes hand sanding or using mechanical tools with aluminum-safe abrasives. This is the most common method and is effective for moderate to severe corrosion.
- **Chemical Removal:** Reserved for light corrosion in contained areas, ensuring chemicals don't seep into surrounding components.

Corrosion prevention starts at the design level but must be maintained throughout an aircraft's service life. Best practices include:

- **Protective Coatings:** Using sacrificial (e.g., zinc, cadmium) or non-sacrificial (e.g., hard plating) finishes to shield metals.
- **Cleaning Regimens:** Routine exterior and interior cleaning to remove salt and moisture.
- **Proper Storage:** Using dehumidifiers and climate-controlled environments to limit moisture during aircraft downtime.
- **Environmental Awareness:** Frequent inspections and preservation actions in high-humidity and coastal operations.
- **Training & Culture:** Ensuring all team members recognize corrosion and act proactively. — Chris Matt, MRO Technical Sales, PHI Aviation

inspection intervals may be required. If the aircraft operates in multiple environments, pilots should know which areas demand the most vigilance.

Even if a suspicious area doesn't look like a major concern, report it. Maintenance personnel can inspect it more thoroughly. Early reporting leads to early treatment—often allowing a part to be cleaned, resealed, or repainted instead of replaced. Reporting is a core part of aircraft preservation and safety culture.

Manufacturers often release service bulletins or corrosion control guides identifying specific concerns or updates. Pilots should be familiar with these and coordinate with maintenance when new risks are outlined. Maintenance manuals and regulatory guides like FAA AC 43-4B can also provide useful context.

Many operators now include corrosion awareness in pilot recurrent training. Learning how corrosion presents in real-world examples, through photos and case studies, helps develop an intuitive eye for abnormalities. Pilots who understand the science behind corrosion are more effective in preventing it.

Corrosion: The Big Picture

Pilots are not expected to perform the same level of inspection as maintenance technicians, but they are in a unique position to notice emerging problems first. With a few extra steps in a preflight walk-around—focused attention, using a flashlight, deploying a mirror—pilots can catch the earliest signs of corrosion and protect their aircraft, mission and lives.

Incorporating corrosion awareness into every flight operation doesn't just improve safety, it contributes to the longevity and readiness of the airborne public safety fleet. Pilots who are alert, informed and proactive are a valuable part of the corrosion control strategy.



RECOGNIZING CORROSION TYPES

- **General Surface Corrosion.** Appears as dull etching or roughness caused by exposure to moisture and atmospheric agents.
- **Pitting Corrosion.** Highly localized and dangerous; appears as small pits or holes and may penetrate deeply into the structure.
- **Fretting Corrosion.** Develops between vibrating, load-bearing surfaces and shows as dark paste or powder.
- **Filiform Corrosion.** Found under paint coatings in humid environments, often appearing as thread-like blisters.
- **Crevice Corrosion.** Forms in joints and seams where stagnant moisture creates differential oxygen levels.
- **Galvanic Corrosion.** Occurs when dissimilar metals come into contact in the presence of an electrolyte.
- **Intergranular Corrosion.** Internal attack at grain boundaries, often invisible on the surface.
- **Stress Corrosion Cracking.** Fast-growing cracks in high-stress areas of strong alloys, typically from poor assembly or incorrect part fitment. — Chris Matt, MRO Technical Sales, PHI Aviation