



Tech topic

# Controlling rust and wear in piston engines

Identifying the right lubricant to protect and extend engine life

## Did you know?

Because they typically contain more effective rust inhibitors, multi-grade oils combat rust better, even though they are thinner at ambient temperatures than monograde oils.

## Introduction

Controlling wear and rust is an important concern for owners of piston-engine aircraft. Typically, piston-engine aircraft are used intermittently, and when they sit idle, condensation can collect in the engine, causing rust. The result can be increased engine wear and failure to reach time between overhaul (TBO).

## The role of lubrication

Wear in aviation piston engines is often an invisible phenomenon to the aircraft owner. Mechanics can measure the wear in various engine components, but only at TBO when the engine is normally torn down. The alternative is for an aircraft owner to pay for a premature teardown in order to measure engine wear.

For these reasons, identifying the appropriate lubrication antidote is an important issue, involving real-time wear and tear, and real out-of-pocket expenses.

## Controlling rust

Oil prevents rust by forming a barrier between water that can condense in an engine and metal parts. However, over time, the moisture will diffuse through the oil layer, touching the metal and promoting galvanic corrosion or rust. More effective oils maintain this barrier to moisture longer.

**ExxonMobil**

# Controlling rust and wear in piston engines

## Monograde versus multi-grade oils

Aviation oils are sold in various viscosity grades, referring to the oil's thickness or resistance to flow. A monograde, or single grade, meets the requirements of one viscosity grade. A multi-grade oil meets the requirement of a summer and a winter viscosity grade and is used for wider temperature ranges.

Among other advantages, multi-grade oils provide better cold-start protection and a stronger lubricant film at typical operating temperatures. Exxon Aviation Oil Elite™ 20W-50 is a multi-grade oil; it is also a semi-synthetic — which means that it is a blend of synthetic and mineral-based oil, combining the best qualities of both.

As part of an additive package, multi-grade aviation oils usually contain rust inhibitors. These are chemicals added to the oil by the manufacturer to enhance the oil's ability to prevent rust. But not all rust inhibitor combinations are created equal. The challenge is how to evaluate the relative effectiveness of different brands in preventing rust.

---

## Did you know?

Periodic reviews of the composition of used oil can provide reliable comparisons on how different brands protect against wear.

---

## Using modified humidity cabinet rust tests to measure oil effectiveness



To test the effectiveness of aviation oils against rust, technicians can conduct a testing protocol with equipment used in the Standard Test Method for Rust Protection by Metal Preservatives in Humidity Cabinet (ASTM D 1748).

Humidity cabinet testing protocols have a long track record and are dependable and accurate. In conventional humidity cabinet test protocols, surfaces of steel panels are prepared and soaked in oil according to a standardized preparation procedure and exposed to humidity in the humidity cabinet. Instead of using steel panels, technicians in this latest examination of aviation oils modified the procedure to test engine parts actually found in the crankcase. The idea was to make the test as real world as possible.

In contrast to what many pilots and mechanics had predicted, the monograde oils tested were not especially effective in preventing rust. As a class, multi-grade oils performed substantially better. And the best performance among the multi-grades was Exxon Aviation Oil Elite engine oil.

As photos from the modified humidity cabinet test show, when it comes to rust protection, there are significant differences between brands of aviation oil. Those differences, as pilots who have switched to Exxon Aviation Oil Elite engine oil have already discovered, can translate to better performance, both in the air and — increasingly important — on the ground during extended idle time between flights.

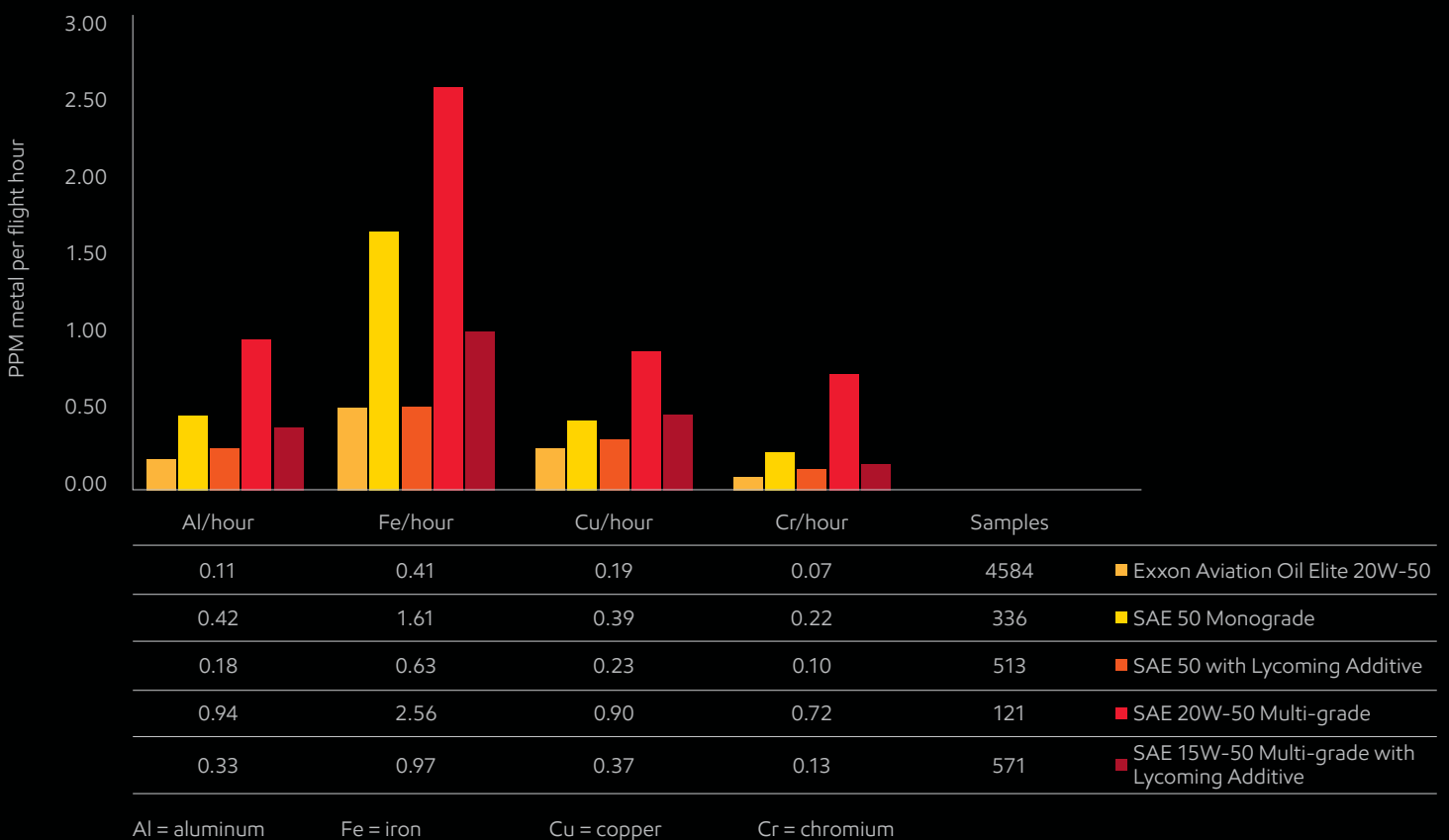
# Controlling rust and wear in piston engines

## Controlling wear

Engine wear is often difficult to measure without a costly engine teardown. Oil analysis is one way to get a fast and inexpensive engine check, so an aircraft owner doesn't have to speculate. Periodic reviews of the composition of used oil also provide reliable comparisons on how different brands protect against wear. According to an evaluation by ExxonMobil of used oil samples provided by an independent lab, one brand — Exxon Aviation Oil Elite™ 20W-50 — is extremely effective in preventing wear in aircraft piston engines.

## Oil analysis test results tell a story

Comparison of wear metals accumulation rate for used ashless dispersant piston engine oils

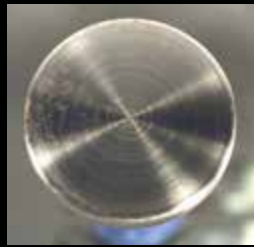


In its evaluation, ExxonMobil looked at several hundred real-world aircraft oil samples from a third-party lab. Wear metal analysis results were first grouped by product and averaged. Since oil changes happen at different oil-drain intervals, ExxonMobil went one step further to divide each wear metal measurement by the number of flight hours on that particular oil sample. The chart above tells the story best: In a statistically significant study, Exxon Aviation Oil Elite engine oil provided excellent protection against wear.

# Controlling rust and wear in piston engines

Put to the test, multi-grade oils fared better in repelling rust on these Textron Lycoming tappets than did monograde oils, and of the multi-grades, Exxon Aviation Oil Elite™ 20W-50 engine oil performed best.

Contrary to popular belief, monograde oils are not as effective as multi-grade oils in combating rust. Because they typically contain more effective rust inhibitors, multi-grade oils provide a second layer of protection against water penetration.



Exxon Aviation Oil Elite



Commercial AD Monograde (SAE 50)

Even with the addition of the Lycoming Additive, monograde oils do not offer the rust protection of Exxon Aviation Oil Elite engine oil.



Exxon Aviation Oil Elite



Commercial AD Monograde with Lycoming Additive (SAE 50)

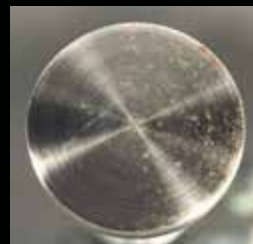


Commercial AD Monograde claiming to meet the Lycoming antiwear-antiscuff additive requirement (SAE 50)

When it comes to rust protection, there are significant differences between brands of aviation oil. As a class, multi-grades performed substantially better than monogrades. The best performance among the multi-grades tested was Exxon Aviation Oil Elite engine oil.



Exxon Aviation Oil Elite



Competitive Semi-Synthetic 15W-50



Competitive Mineral 20W-50

## For more information

Please contact your ExxonMobil aviation sales representative.