

# Observing the **significance and benefits of oil performance** in reducing engine coking in **CFM56-5B engines**

Customer	Juneyao Airlines
Location	Shanghai, China
Industry	Commercial airline
Website	<a href="http://www.juneyaoair.com/en">www.juneyaoair.com/en</a>
Customer evaluation	Engine disassembly and inspection took place at repair and overhaul facility. Engine has more than 30,000 hours and 15,000 cycles using Eastman Turbo Oil 2197™.
Highlights	<ul style="list-style-type: none"> <li>• Using Eastman turbo oil since EIS in December 2006</li> <li>• 30,312:51 hours</li> <li>• 15,080 cycles</li> </ul>
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## The challenge

Demonstrating the significance and benefits of oil performance in reducing engine coking in CFM56-5B engines

## The solution

Eastman Turbo Oil 2197™ has proven to reduce or completely eliminate coking in bearing compartments and especially the #5 bearing supply tube on all models of the CFM56 engine, thereby improving maintenance efficiencies and decreasing related costs.

Eastman Aviation Solutions participated in an oil systems review of a Juneyao Airlines CFM56-5B in which Eastman Turbo Oil 2197 has been used exclusively since the engine's entry into service in December 2006. The engine accumulated 30,312 hours and 15,080 cycles since new and was removed for scheduled performance restoration and core section life-limited parts (LLP) replacement.

Considering the extraordinarily high time on the engine and its 2:1 hour/cycle ratio usage, the engine oil system was exceptionally clean and free of oil-derived deposits.

## The inspection

Juneyao Airlines is based in Shanghai and has operating hubs at Hongqiao and Pudong International Airports. It operates mainly in domestic transport of passengers and cargo and mail, business, and tourist charter. Since its inception in 2006, Juneyao has acquired 35 brand-new Airbus A320 aircraft. Juneyao is an approved international flight operator with flights covering more than 50 cities and has also opened international (regional) flights to Chiangmai, Phuket, and more.

Juneyao Airlines elected to perform the oil systems review on a CFM56-5B4/P engine from an A320-200 aircraft. The engine was removed and sent to General Electric's Strother, Kansas, repair and overhaul facility for disassembly, inspection, and overhaul.

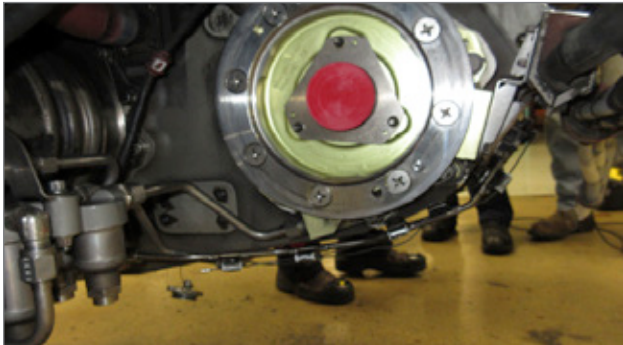
This review pictorially captures and documents, using photographs and borescope, the overall condition of the exposed lubricating system of an engine operated exclusively with Eastman Turbo Oil 2197 since new.

## The procedure and technical observations

During the engine disassembly process, there was minimal entry to #3 bearing; however, the visible portions, including the bearings, races, and compartments were very clean.

### Accessory gearbox (AGB)

All line-replaceable units (LRUs) were removed from the AGB with the exception of the fuel control unit (FCU), and the exposed drive pads showed no evidence of oil leakage.



ATS drive pad



IDG drive pad



EDP drive pad

The inspection did not call for opening the AGB. All AGB carbon seal assemblies were still installed and, subsequently, were not available for inspection. Records confirmed that all AGB carbon seal locations were upgraded and conform to SB 72-0660. It is significant that the original carbon seals had exceeded the standard 8,000 hours for category 2 compliant engines, in some cases by several times the normal limit, without any oil leakage prior to replacement with upgraded seal assemblies.

The following table shows replacement date, hours since new, and cycles since new for each seal assembly with an upgraded assembly that conforms to SB 72-0660.

Position	Date of replacement	ENG TSN when replaced	ENG CSN when replaced
IDG	2010-12-31	12622	6779
ATS	2010-12-31	12622	6779
IDG	2013-02-07	20455	10548
FCU	2014-07-11	25857	12997
EDP	2015-04-21	29016	14381

### TRF #5 supply tube

The supply tube inspection was documented through a borescope video that is available for review. Despite 30,312 hours and 15,080 cycles on the engine, the supply tube borescope showed a very minor buildup of deposits in this pressure tube and only a small amount of varnishing. The tube was estimated to be at least 98% open.

Typically the #5 oil supply tube suffers coking predominately in the area around the elbow and locating flange due to heat conduction from the TRF.



Supply tube view from the locating flange area towards the elbow transition



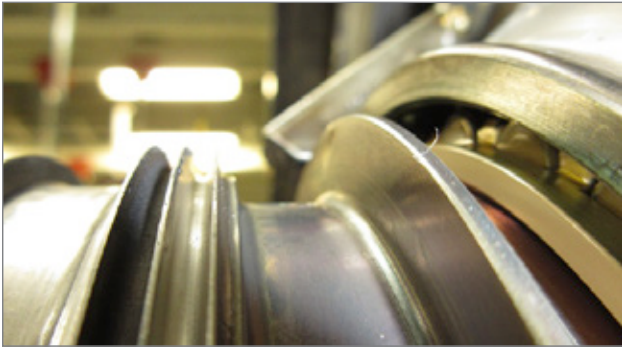
Metal clean scavenge tube

## Bearings and compartments

The inspectors had minimal access to bearing #3; however, what was exposed was very clean, as evidenced in the following images.



Bearing #3

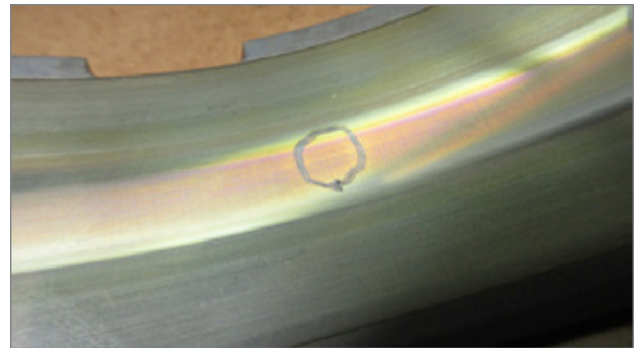


Bearing #3

Overall, the bearings, races, and compartments were very clean. Some of the bearings, however, did show some imperfections. For example, the #4 bearing's outer-race inner diameter showed some pitting that will require extra work.



Bearing #4



Bearing #4 outer-race ID

In contrast, the #5 bearing's outer-race inner diameter showed no signs of damage during the inspection when seen by the naked eye.



Bearing #5



Bearing #5 outer-race ID



Rear sump

## Conclusion

This inspection data further support the proven performance of Eastman Turbo Oil 2197. All inspected portions of the engine oil system were exceptionally clean and free of oil-derived deposits. Even though some of the tubes were unable to be fully accessed, the exposed parts of those tubes appeared clean and still in excellent condition. The results are substantiated by the images provided by both borescope and visual inspection, further supporting that Turbo Oil 2197 has a direct correlation with reducing engine coking compared to other turbine engine oils.

For the entire duration on wing, this specific engine exhibited normal oil consumption and no elevated oil temperature or oil pressures during operation. This engine exhibits the exceptional degree of cleanliness and overall excellent oil performance that can be expected with Turbo Oil 2197. There is also substantial evidence of reduced levels of coking as a result of sustained use of Turbo Oil 2197 displayed in many other engines, including the CFM56-7B model.



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