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WAITING TO UNFOLD

The Farnborough Airshow will provide an insight into the future of commercial aviation

AHEAD OF THE PACK

Airlines continue to innovate to meet changing customer needs

RENEWED APPEAL

Singapore Airlines has hit the bullseye with its new cabin offerings

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POWERING UP

CFM56 engine MRO will take off in the next decade

► Atul Chandra

CFM International's CFM56 engine family is nearing the end of an outstanding production run, but with more than 27,000 CFM56 engines operational today, it is set to trigger off an MRO boom as more than 60 percent of the engines have never had a shop visit. Since the first engine entered service in 1982, the CFM56 family has gone on to become the world's largest selling aircraft engine with over 32,000 orders across all variants. The CFM56 was developed by a 50-50 venture between General Electric (GE) and France's Safran Aircraft Engines (erstwhile) Snecma Moteurs. The five different CFM56 engine models cover a the thrust range from 18,500 to 34,000 lbf, powering Airbus A320s, first generation A340-200/-300s and both the standard and next-generation Boeing 737s. Air France was the launch customer for the A320 with CFM56-5A (1988), A340 with CFM56-5C (1993) and A320 powered by CFM56-5B (1994). The CFM56-7B engine entered revenue service in 1997 and powers more than 6,700 Boeing Next-Generation 737s worldwide, with approximately 14,000 CFM56-7B engines in operation.

While CFM56-7B engines have accumulated more than 350 million flight hours, the CFM56 high bypass turbofan engine family crossed 800 million engine flight hours in June 2016 and is expected to reach one billion flight hours by 2020.

Future Growth

Record single-aisle airline orders meant that CFM had to quickly transition from CFM56 engine production to a ramp-up of the new LEAP engine manufacture on a scale the industry has never seen before. CFM56 engine production is now dropping and the highest number of engines produced in a year by CFM was 1,665 in 2016, this dropped to 1,444 engines delivered last year. Only 100 CFM56 engines are slated for manufacture in 2020. CFM has said that it will continue to build CFM56 spare engines until 2020 and produce spare parts until around the year 2045.

Even as CFM56-5B and -7B engine production slows down with the ramp-up of production of the LEAP engine models, the installed base of CFM56 engines will generate a substantial increase in MRO activities in terms of number of engine shop visits in the coming years.

As per figures provided by CFM, at the end of 2015, 50 percent of the CFM56-5B and -7B fleet in service was less than 10 years old , and more than 60 percent of the engines have never had a shop visit.

The average time on wing for current production CFM56 engines before a first shop visit is approximately 30,000 hours, with the current fleet record at 50,000 hours. Unlike previous generation commercial aircraft engines, the CFM56 has enjoyed unsurpassed longevity



allowing engines to remain onwing far longer than originally anticipated. Between now and 2021 a great many of these engines will need

to start their shop visits. As a result, there will be a significant increase in overhaul and MRO related activities for CFM56 engines well into the next decade. CFM's decision to allow a wide variety of Maintenance Repair and Overhaul (MRO) players for the CFM56 has meant that there are an estimated 42 facilities available worldwide that offer overhaul services for the engine. While the number of CFM56-5B and CFM56-7B engines in operation will continue to increase till 2020, the overhaul market for the older CFM56-3 is now declining.



MTU Maintenance

MTU Maintenance is the world's largest independent engine MRO provider and eleven percent of all shop visits worldwide were performed at MTU in 2015. The company has been undertaking CFM56 engine work since 2000, with overhaul work taken up at MTU Maintenance Canada (CFM56-2, CFM56-3), MTU Maintenance Zhuhai (CFM56-3, CFM56-5B, CFM56-7B) and MTU Maintenance Hannover (CFM56-7B). MTU Maintenance undertakes approximately 175 CFM56 engine family shop visits annually at these locations and is the number one inde-

pendent services provider for the popular -3/-5B/-7B variants with a market share of nine percent in 2017. 2/3 of the MTU Maintenance group's overall shop visits are on this engine and MTU Maintenance Zhuhai is one of the very few shops in Asia with the ability to overhaul CFM56-7BE engines.

MTU Maintenance Zhuhai, a 50/50 joint venture between MTU Aero Engines and China Southern Air Holding Company was set up in 2001 and is now China's leading engine MRO shop and is nearing 2,000 shop visits for V2500-A5 and CFM56-3, -5B and -7B MRO services. MTU Maintenance Zhuhai extended its facility by 5,900 square meters in late 2012, bringing its total area to almost 40,000 square meters. As a result, the shop's overall capacity was boosted by 50 percent from 200 to 300 shop visits per year. MTU Maintenance Zhuhai performed 280 shop visits in 2017.

Lufthansa Technik

CFM56 engine overhaul has been done at Lufthansa Technik since 1985 and more than 2,500 engines (covering every version), having passed through its shops. As a certified maintenance, design and production organization, Lufthansa Technik develops its own repair methods and has been working extensively on thermodynamic modelling of the engines, to understand exactly which components are relevant to the EGT margin. Lufthansa Technik has invested a lot with a view to reducing the variation in EGT margin, especially in relation to the CFM56-5C engine which has allowed it to predict the effects of individual measures on EGT margin much more accurately.



The MRO giant continues to improve on its offerings and the latest innovation unveiled by the company in April was an automated inspection procedure for engine components developed in-house. AutoInspect is a robot-based procedure that performs digital crack inspections on engine components with the help of high-end sensors. The optical measurement procedure not only improves crack detection but also further increases process reliability. "Thanks to the AutoInspect procedure, we now have repair-relevant information available in digital form for all com-

ponents throughout their product life cycle. This makes our engine component repairs even more efficient and thus also benefits our customers,” says Michael Ernst, AutoInspect Project Manager at Lufthansa Technik. The newly developed inspection procedure is being rolled out for other combustor components in engines of the CFM56 and CF34 families. The company’s Engine Condition Monitoring (ECM) offering also provides engineers with an accurate picture of a CFM56 engine allowing analysis of key parameters enabling problems to be anticipated early on and work scopes to be planned precisely well in advance. At the same time ECM trends also enable recommendations to be made for line maintenance, for example, for a water wash. Lufthansa Technik is also a part of the LEAP-1A engine MRO network and the first LEAP-1A engine shop visit is expected in Hamburg in early 2019. “We are proud to join the CFM MRO network and extend our



existing, very successful partnership and collaboration beyond the CFM56 family. The LEAP engine represents the next generation of aircraft engines with state-of-the-art technology. We are pleased to provide state-of-the-art MRO services to our customers worldwide and committed to continue delivering sustainable value and cost savings for airlines and lessors and their LEAP engines,” says Bernhard Krueger-Sprengel, Vice President Engine Services at Lufthansa Technik.



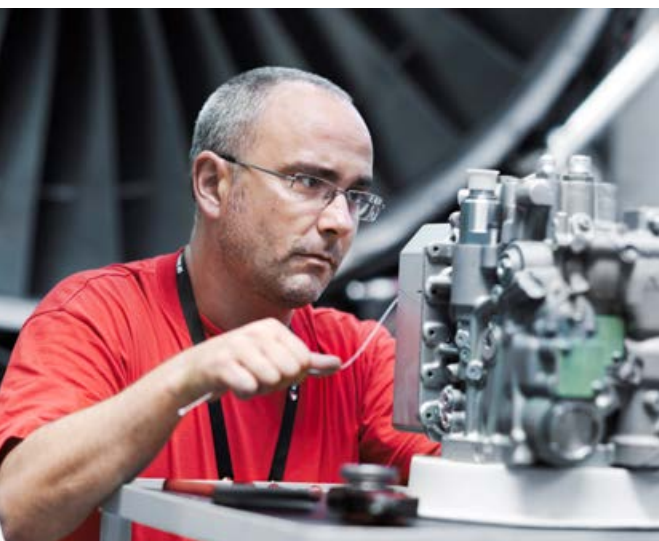
SR Technics

MRO service provider, SR Technics had a busy 2017 and its biggest business, Engine Services, which has a yearly capacity of approximately 200 shop visits at the engine facility in Zurich Switzerland was running at full capacity, servicing CFM56 and Pratt & Whitney PW4000 engines. As of July 2017, SR Technics Engine Services had delivered over 4,300 CFM and Pratt & Whitney engines. The company is now gearing for the growth in CFM56 engine overhaul and MRO and is working to increase the capacity of its Zurich facility and in April announced that it would add 100 new positions in Engine Services. SR Technics latest contract for CFM56 engine MRO was to extend the engine maintenance partnership with Ural Airlines in December 2017. The new contract is valid for another six years and covers the airline’s CFM56-5B fleet. Work is set to begin in the second quarter of 2018. All work will be done at the SR Technics facilities in Zurich. “SR Technics’ expertise, high-quality services and efficient approach for our CFM56-5B fleet is much appreciated and we are pleased to expand our Engine Service business further,” said Andrey Melnikov, Head of Budget Planning and Material Support at Ural Airlines at the time of announcing the contract. The Swiss MRO firm also has a three-year CFM56-5B thrust reversers contract with easyJet till June 2020.

AerFin Ltd (UK) and SR Technics also offer a Total Engine Solutions programme called Beyond.Fleet.Services which was launched in July last year, after the successful delivery of the first CFM56-5C4 engine to Philippine Airlines. AerFin and SR Technics jointly undertake the engine MRO requirements for the Philippine carrier’s fleet of A340-300s. SR Technics handles the maintenance and repair services for the CFM56-5C engines as well as component-related support. AerFin Ltd will be responsible



for the finance and leasing schemes, as well as the provisioning of CFM56-5C4 engines and spares in cooperation with SR Technics. “We are very pleased to be partnering with AerFin to supporting our long-standing customer Philippine Airlines. Beyond.Fleet. Services is an integrated solution designed to provide tailored support at each stage of aircraft maturity helping Philippine Airlines in optimizing their operational costs and fleet lifespan,” said SR Technics COO Jean-Marc Lenz..



Aero Norway

Norway-based engine MRO provider Aero Norway has been supporting CFM56-3, CFM56-5B and CFM56-7B engines for 26 years and

is bullish on MRO demand for repair and maintenance services for these engines. “At Aero Norway the focus is always on delivering the best service and industry-recognised EGT margins and we are globally acknowledged as a leader in CFM56 engine repairs. To best serve our customers - MROs, independent engine owners and leasing companies, we have taken steps to underpin the business in three fundamental ways: financial support to deliver working capital; sourcing of repair partners



“Aero Norway’s unequivocal pursuit of industry-recognised EGT margins reduces costs and improves reliability - the greater the EGT margin achieved, the healthier the engine. So from a commercial perspective Aero Norway’s customers’ engines will last longer on wing, and the engine components, especially in the hot section, will remain in better condition,”

Aero Norway CEO, Glenford Marston

that can complement the flexibility of workscope that we, as an independent organisation, strive to offer; and the development of highly trained apprentices to ensure continuity of our engineering skill sets for the next 20 years and more,” says CEO, Glenford Marston.

Aero Norway’s engine MRO for the CFM56 series has been underpinned by what the company says is industry leading Exhaust Gas Temperature (EGT) margins (up to 15 percent higher than industry standard). “Aero Norway’s success can be attributed 100 percent to the spirit and precision of the dedicated technicians and engineers. Their unequivocal pursuit of industry-recognised EGT margins reduces costs and improves reliability - the greater the EGT margin achieved, the healthier the engine. So from a commercial perspective Aero Norway’s customers’ engines will last longer on wing, and the engine components, especially in the hot section, will remain in better condition,” Marston says. ■