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Cost-effective Spare Engine Solutions

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Managing the Availability of Spare Engines

Experts recommending strategies in times of shortages

By David Dundas

In the post-pandemic period, the commercial aviation sector of the aerospace industry has recovered quicker than many had predicted or expected. One of the consequences is that the manufacturing sector, especially the production of new aircraft and engines, has not recovered to the same degree, primarily through a lack of qualified engineers.

Thus carriers, especially those with larger fleets of aircraft, have been forced to look to alter and adapt previous strategies to keep their aircraft operational, and one area that has become key to any strategy has been that of spare engines. We decided to approach a dozen key companies involved in the MRO aspect of aircraft engines to discover what cost-effective solutions were being offered where spare engines were concerned.

Is the industry facing a shortage of spare engines?

During the COVID crisis airlines tried to preserve cash by delaying engine shop visits. The recovery of the industry has created a peak in the number of shop visits and consequently a high demand for spare engines. We asked whether the industry currently faces a shortage in the availability of spare engines?

Oliver James, VP Trading at AerFin comments: "Significant delays in new aircraft deliveries have forced airlines to operate older aircraft longer, creating additional spare engine requirements that were not initially anticipated.

> ***"Significant delays in new aircraft deliveries have forced airlines to operate older aircraft longer."***
>
> *Oliver James, VP Trading, AerFin*

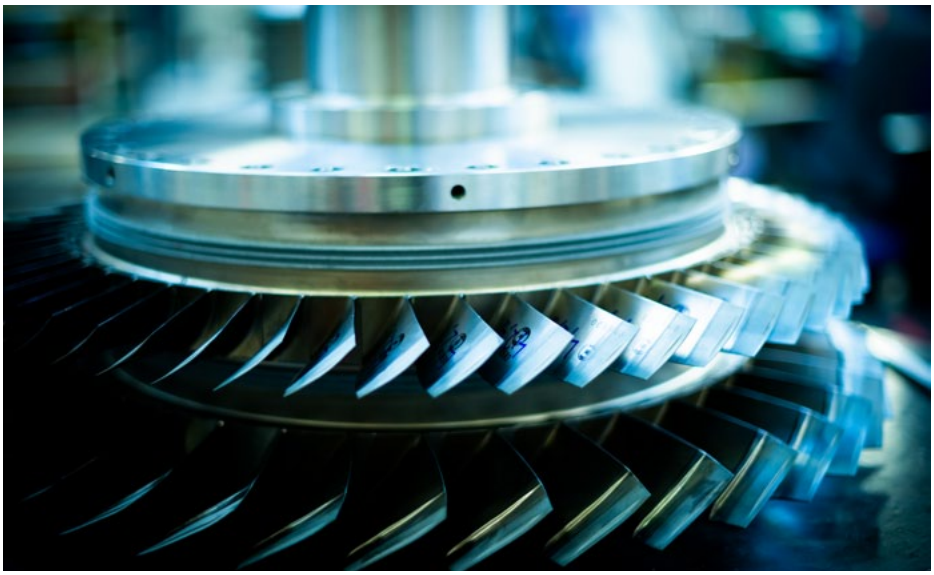
Oliver James, VP Trading, AerFin

Simultaneously, MRO capacity issues, due to labour and material shortages, have resulted in longer turnaround times for engine maintenance, further increasing the demand for spare engines. As a result, certain engine types are now experiencing demand that exceeds supply."

Anca Mihalache, Managing Director at AERO CARE feels that finding certain engine types for lease has become very challenging, advising that "During the pandemic times, and even after, most airlines and lessors did their upmost to avoid shop visits in order to maintain availability of cash. But this is only sustainable for so long, and we have now reached a point where these shop visits are desperately needed for airlines to be able to continue flying this summer."

Evren Akca, Global Account Manager at Aero Norway says, succinctly, that: "the industry is currently experiencing a shortage of spare engines due to the increased demand for shop visits after the recovery period. The backlog from delayed maintenance has led to a higher need for spare engines, creating a supply challenge," while Andres Jimenez - Vice President Materials and Operations at Aero Engine Solutions feels that: "Shop visits are taking longer than usual due to MRO's capacity problems, backlog, and staff retention. These issues create a domino effect that impacts both assets and materials' availability world-wide."

Anca Mihalache, Managing Director, AERO CARE



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Interestingly, Wasim Akhtar, Director of Engines at AJW feels that: "the current shortage of useable serviceable engines will stay with us at least for the next 18-24 months while the OEMs get to grips with their issues on the new-technology engines and associated aircraft," while John McKirdy, CCO at Kellstrom Aerospace Group, Inc. is of a like mind: "The industry continues to cooperate to find solutions to a global problem that has the potential to last for the next two to three years as availability for new engines improves and turnaround time, available materials improve, and maintenance is overlaid by the increasing demand by the flying public and cargo operations." Also in agreement is John McCarthy, Director of VAS Europe, VAS Aero Services who notes that: "We believed airlines were going to reduce some of the impact from delayed maintenance by exiting or retiring the aircraft with the alignment of new deliveries. The fact that we face delayed deliveries with narrow-body aircraft creates additional pressure to operate aging fleets longer, resulting in a higher demand for engine and material availability. The situation is more severe than expected and we expect it will continue through 2025."

Bruce Ansell, Technical Manager Engine Division, APOC Aviation points out that: "There is an acute shortage of most engines variants in the single-aisle sector. 7B's have been taken up by operators to hold as spares, the extended shop visit (SV) times are playing havoc with fleet maintenance planning, and airlines are keeping these spare engines to cover any shortage in availability. Plus, the return to service of Next Gen B737s has also resulted in further demand."

Toma Matutyte CEO at Locatory.com, part of Avia Solutions Group, bluntly identifies the main cause of a lack of spare engines – "travel recovery has triggered a wave of overdue engine repairs," adding that: "The engine shortage has pushed some airlines into a precarious situation. A lot of carriers have been forced to

> ***"During the pandemic times, and even after, most airlines and lessors did their upmost to avoid shop visits in order to maintain availability of cash."***
>
> *Anca Mihalache, Managing Director, AERO CARE*

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reduce their flight schedules to create a buffer and minimize cancellations. This might improve on-time performance, but it comes at the cost of reduced travel options for passengers."

Gunnar Már Sigurfinnsson - President of GA Telesis Engine Services Oy points out that "airlines became more conservative due to uncertainty in investments in general, among others renewing their fleet, that increased the use of older generations, and we definitely see a shortage of, for example, the CFM56/7b – as they are in use more than probably planned a couple of years ago." However, Fabrizio Laurenti, Head of Leasing, MTU Maintenance Lease Services feels that demand varies across engine types, commenting that: "In general, we see high, scarcity-related demand for lease engines in most of the platforms that we support: mainly, for CFM56-7B, V2500 (both Select and pre-Select), GE90-110/115B and CF34-10E engines. The CF6-80C2 is back to pre-COVID stability and demand has slightly softened recently. There is still soft demand for the CFM56-5B but this is likely to pick up with the coming summer. The lease demand for the PW2000 is almost at a standstill."

David Blackburn, Senior Vice President, StandardAero identifies manpower shortages as being at the root of the engine shortage problem: "The aerospace sector is still experiencing a lack of skilled technicians, mechanics and aviation-specific asset managers due to the retirement wave experienced during 2020-21, and this has also led to labour and used serviceable material (USM) USM problems, coupled with delays associated with engine and component repairs. This has left our industry with a noticeable shortage of available/serviceable engines and components to support the current demand in the engine marketplace."

How do airlines cover their spare engine needs?

We then wanted to know how airlines should cover their spare engine needs based on operational requirements and financial aspects.

Toma Matutyte came up with several viable options, including: "And it now seems that engine pooling, where airlines with similar engines share a pool managed by a third party, is gaining more and more popularity. This approach has worked perfectly well for smaller airlines, as it reduced individual investment and spread out the risk. Today, it is becoming more popular with operators of all kinds. Power-by-the-hour agreements are still popular, as both small and larger airlines are willing to let the manufacturer take care of the spares and guarantee availability. It's a good way to avoid upfront costs, but those usage fees can add up over time."

Gunnar Már Sigurfinnsson advises that: "The airlines are more frequently fully utilising the engines, and they do that by being creative on engine work scoping to extend the green time of the engines. Modular replacement is an example of how engine owners fully utilise the life of an engine which otherwise would be partly lost," while John McKirdy states that "the more effective an airline can be in on-wing troubleshooting of deteriorating

© CFM56-7B at DFW

Fabrizio Laurenti, Head of Leasing, MTU Maintenance Lease Services

> ***"We can support airlines opting for a lower level of spares to invest in other strategic initiatives and get their engine only where and when actually needed."***
>
> *Fabrizio Laurenti, Head of Leasing, MTU Maintenance Lease Services*

and problematic engines and enacting a preventive maintenance plan, the longer these engines can perform on wing and generate much-needed lift hours." He points out that: "Supporting effective on-wing troubleshooting, the Vortex Aviation organization within Kellstrom supports airlines on wing on site and in our four shops in Europe and in the US in effective hospital shop and on-wing maintenance troubleshooting. These experts are dispatched to the aircraft to solve engine problems and minimize aircraft and engine downtime and direct maintenance costs by using the latest technology, equipment, and tooling to keep an airline's engines flying.

Fabrizio Laurenti makes it clear that the question "depends entirely on an airline's commercial goals and on relevant engine fleet age, although the going industry standard is to reserve ten percent of an engine fleet as spares. With the provisions of MTU Maintenance Lease Services, which include engine exchanges, short-term leasing as well as long-term leasing through our network partners, we can support airlines opting for a lower level of spares to invest in other strategic initiatives and get their engine only where and when actually needed."

David Blackburn feels that "Airlines should focus on bolstering their serviceable spare engine programs by strategically planning on reliable and economical engine maintenance and repairs, in both the short and long term. As such, airlines should ensure that they are supported by MRO providers which proactively invest in engine modules and serviceable material, in order to anticipate and meet the needs of operators," pointing out that: " StandardAero, for example, is constantly and actively purchasing available engine assets in the marketplace in order to 'feed' our overhaul facilities with high-quality parts at least 2-3 years in advance, focusing on well-traced and well-maintained powerplants and material."

John McCarthy recommends airlines follow four key steps: "Engine planning should be scoped up to five years ahead to secure future engine shop slots. Plan critical hard-to-get material such as Life Limited Parts in advance with your USM provider and shop. Plan spare engine availability by incorporating a mix of owned, short- and long-term lease, and access to guaranteed engine availability on demand. Utilise a carefully integrated long-term operational approach with tailored support and financial solutions with a mix of exchange and lease engines, as this can provide an airline with complete security of supply."

Anca Mihalache is very pragmatic: "Green time leases are rarely an option at the moment and fresh-from-shop engines are very sought after, making it difficult to source spare engines. At AERO CARE, we advise our airline customers that forward planning is the most important element in ensuring their spare engine needs are met. But planning requirements nowadays are different from planning pre-COVID, now it needs to be done many months, if not years, in advance." Evren Akca is similarly succinct: "Airlines should implement a robust planning system for shop visit scheduling and collaborate with flexible MRO providers that can support urgent needs, a factor we understand the importance of at Aero Norway. This strategic planning helps balance operational requirements with financial limitations, ensuring spare engine availability when needed."

Evren Akca, Global Account Manager, Aero Norway

> ***"Airlines should implement a robust planning system for shop visit scheduling and collaborate with flexible MRO providers that can support urgent needs."***
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> ***"The leasing and aftermarket sectors should work together to create and manage an asset/lease portfolio for operators and MROs that don't have the infrastructure or knowledge in place."***
>
> *Andres Jimenez, Vice President Materials and Operations, Aero Engine Solutions*

Andres Jimenez, Vice President Materials, Aero Engine Solutions

Andres Jimenez feels that: "The leasing and aftermarket sectors should work together to create and manage an asset/lease portfolio for operators and MROs that don't have the infrastructure or knowledge in place to deal with the maintenance, risk and extended lead times involved in the process," while Wasim Akhtar makes it clear that: "Airlines need to look at their future schedules, current fleet, current engine removal plan, and the availability of spare engines already accessible to them and use that information to decide on what inventory is needed."

Bruce Ansell gives a broader view of the options available: "From an operational viewpoint it is usual to have a pooling agreement, however in times of high demand an alternative solution should be planned for, either by airlines holding their own spare engines, or having additional agreements with lessors to support them. Financially, few operators are content to keep spare engines on their balance sheet, with many going down the sale-and-leaseback path, this way they can plan the amortised costs over the lease period. Most lessors now offer short-term leasing

© MTU Maintenance Lease Services

to cover SV requirements, whilst this type of lease may have elevated rates, it can be preferable to retaining an engine over a longer period when it may not be fully utilised."

What spare engine solutions are available?

We then asked our contributors to advise us as to what solutions they could provide to mitigate the spare engine problem.

According to John McKirdy, "At Kellstrom Aerospace, we support the global fleet with green-time engine leasing availability or outright sale on the CFM56, V2500, CF6-80, and PW4000. In addition, we support module replacement hospital shop strategies through a combination of available spare modules and the support of our Vortex Aviation Engine MRO specialising in quick and cost-effective module swaps reducing downtime and minimizing costly exposure to heavy maintenance workscope creep. While partnering with our airline and MRO customers, we advance plan the acquisition and repair of critical time sensitive and expensive engine components and LLPs based on build goals, eliminating delays on material availability."

Fabrizio Laurenti explains: "MTU Maintenance's leasing arm, based in Amsterdam, has a global team of leasing experts and asset managers which specialises in placing engines with airlines and other operators, and spare engine support forms part of the core of our SERVICEPlus provision. Depending on the existing spare engine level of an airline, we offer short-term leases, engine pooling and a number of stand-by arrangements to optimize their reserves. Alternatively, we can facilitate long-term leases via our partner network.

"If the operator has no spares, they have two options. Either they opt for a short-term lease, which runs for a defined period of time, with all-around support for the duration of the lease, including during maintenance events. Alternatively, they can choose a long-term option with flexible cost structures, cost-effective constant thrust and buy and lease-back options in cooperation with our industry partners.

"For operators with a minimum level of spares, a stand-by arrangement would make sense as a short-term solution, which guarantees availability of dedicated engines at the agreed confidence level, located at preferred facilities. The long-term solution at this spare engine level is engine pooling that gives direct access to MTU's engines which are strategically located across the globe and can be delivered within 48 hours.

"For those with adequate spares levels, engine pooling is also a good long-term solution, whereas in the short-term, the operator may want to take advantage of our remarketing service. Surplus engines are always a good source of extra revenue, either through lease-outs as a green-time engine or by selling the engine outright to MTU if it is being retired from active revenue service. Alternatively, we can tear the engine down and repair remarketable parts through our MRO network and sell the serviceable material on consignment. Our spare engine support is very flexible, and we work closely together with our customers to create the best possible solution for them."

David Blackburn summarises PTS Aviation's contribution: "Through PTS Aviation, LLC, a StandardAero Company, we can offer full serviceable time-continued assets for sale or for lease, along with serviceable fan, core, and low-pressure turbine (LPT) major module assemblies for customer exchange and/or outright sales."

John McCarthy explains: "For over 45 years VAS has built a proven track record of supporting airlines and lessors, so we are confident in our ability to provide solutions for spare engine needs.

"For all the popular narrow- and wide-body applications we offer Used Serviceable Material (USM) to support

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the material supply into both the airlines and the engine MRO's. We also have long-term agreements in place that have proven their value over 20-plus years. We offer lease engines and maintain a stock of serviceable engines for immediate and long-term lease.

"We can offset shop visits, where appropriate, by providing an engine immediately and taking the removed engine in exchange. We work to ensure that this process is seamless by forming a deal team with the technical, legal and operational people working with the airline to complete the process.

"We partner with airlines and lessors and map out integrated immediate, short-term and long-term engine solutions. Where lessors or airlines are phasing out aircraft (not just Airbus aircraft), we tailor the solution to the phase out schedule optimizing spend and cash for lessors and lessees. This is where we leverage VAS' innovation and experience to provide unique and effective solutions to engine needs."

According to Oliver James, "For the past ten years AerFin has been providing tailored services to airlines and asset owners in the mid- to end-of-life space. We offer flexible services for those customers seeking immediate solutions for their spare engines. The company can either buy, maintain, store or lease manage the asset depending on the investor's long-term plans.

"Our strong technical/asset management background coupled with our engine MRO facility, gives us the ability to store, maintain, technically assess, and repair engines in-house. This means we are not as reliant on third-party MROs at a time when engine shop capacity is limited. This ultimately means we can turn engines quicker between leases, thus generate revenue quicker to investors. The company typically focuses on shorter-term leases from Six (6) to Twenty-Four (24) months. Recent years have seen a diversification of our product lines which now include but which are not limited to the CFM56, V2500, PW4000, CF6 and Trent 700."

Anca Mihalache advises that: "At AERO CARE we specialise in green-time leasing, and part-out when an engine becomes unserviceable. But we also offer lease management services for narrow-body engines. Another area we focus on is the supply of USM parts, where we work hard to support the industry by supplying components with as short-as-possible lead times, which in turn enables MRO shops to supply lessors with engines faster."

Where Aero Norway is concerned, Evren Akca advises: "We can facilitate connections with lessors we partner with to provide spare engines. Depending on the programme's structure, we can explore various tailored solutions to meet specific customer needs."

Andres Jimenez explains that Aero Engine Solutions: "focuses on the supply of commercial aircraft parts, components, and accessories through the sourcing and disassembly of whole aircraft. In addition, our expertise covers engine leasing and logistics support. Our customers include many of the world's leading airlines, MROs, aircraft leasing organisations, and financial institutions. We currently have a lease pool of around 15 assets (both engines and modules) at any given time, to supply to our customers and meet their requirements to keep their aircraft flying."

Wasim Akhtar points out that "AJW offers a broad range of reliable engine services across a range of engine types,

Wasim Akhtar, Director of Engines, AJW

> **"AJW offers a broad range of reliable engine services across a range of engine types, including the leasing and repair of Airbus and Boeing aircraft engines."**
>
> *Wasim Akhtar, Director of Engines, AJW*

Bruce Ansell, Technical Manager Engine Division, APOC

> **"Being a part-out company as well as a lessor, APOC is able to offer green-time engines at very competitive rates."**
>
> *Bruce Ansell, Technical Manager Engine Division, APOC Aviation*

including the leasing and repair of Airbus and Boeing aircraft engines. We are an award-winning independent specialist in the supply and repair of aircraft spare parts and pride ourselves on our customer service and flexibility to support the customers' needs, helping to reduce their operational costs and improve efficiency."

At APOC, Bruce Ansell explains that the company: "works in the narrow-body sector, specialising in mature CFM56-7B, 5B, 5A, and V2500 engines. Being a part-out company as well as a lessor, APOC is able to offer green-time engines at very competitive rates. We are also purchasing further mid-life engines to support our customers; these are available for longer lease terms, or for installation on one of our airframes."

Toma Matutyte advises that: "While we don't directly sell or lease engines ourselves, we still act as a quite important facilitator in the spare engine marketplace. Think of us as a high-tech swap meet for the aviation industry, but on a global scale.

"The strong point of Locatory.com is that we connect all the key players – engine and parts traders, maintenance service providers, airlines, or lessors – on a single, user-friendly platform. This creates a dynamic environment where airlines and other operators facing a spare engine shortage can quickly find solutions. They can browse listings from a vast network of verified traders, with a high likelihood of finding a suitable solution at a competitive price.

"Now, you mentioned the current challenges in the engine parts and spare engine market – shortages, disruptions, you name it. Locatory.com is specifically designed to address those very issues. By being a proactive and market-sensitive platform, we offer a solution that's more relevant than ever. Besides, Locatory.com empowers airlines to navigate the current challenges in the spare engine market. It's a win-win for everyone involved – airlines find the parts they need faster and at better prices, and vendors gain access to a wider customer base."

Gunnar Már Sigurfinnsson briefly explains that: "GA Telesis has its own leasing operation within the company, LIFT, and we cooperate with them in case we need spare engines for our customers."

CFM56-5B

> ***"... being creative with the work scope to increase utilization of all LLP in the engine, by doing that they extend the lifetime and that creates less need of engines..."***
>
> *Gunnar Már Sigurfinnsson, President GA Telesis Engine Services Oy*

Gunnar Már Sigurfinnsson, President GA Telesis Engine Services Oy

Is smart shop visit planning a solution?

We wanted to know how our contributors felt about the benefits of smart shop visit planning and if this would help to eliminate the shortages in spare engine availability.

Evren Akca at Aero Norway is quite clear: "Effective shop visit planning involves staggering maintenance schedules, comprehensive material planning, and securing critical parts such as key airfoils and LLPs well in advance. Through this careful approach at Aero Norway, we are able to optimize maintenance schedules and turnaround times, ensuring a steady supply of spare engines and reducing the risk of shortages," while Andres Jimenez at Aero Engine Solutions feels that: "Many airlines and MROs across the world are not set up to hold stock of engines and materials for their requirements. Instead, they plan for when they need it in hopes of availability, which is not the case sometimes depending on the asset, timeframe, and type of request."

Wasim Akhtar at AJW feels the following is a solution: "Smart shop visit planning and implementing a proactive approach to inventory management are key for any airline if it wants to continue its operations without any engine-driven AOGs, delays, cancellations, or similar issues. It will offer insight into possible repair costs, allowing the airline to proactively search or earmark USM as per their build goals. If the airline has its own spares, it could proactively invest in upgrading or modifying these to the latest standard requirements to contain the high TAT issues currently being faced at different components MROs. In addition, the airline could liaise with the relevant MROs to lock induction slots and WS discussions."

Bruce Ansell at APOC advises: "Regular boroscope inspections and monitoring of the available flight data provides a great indication of what work is going to be required, and what parts will be needed. The early purchasing, or reservation of these parts is critical to SV planning, as too often SV's are delayed due to component shortage. By working with their MRO, operators can plan for those 'unpleasant surprises' which can cause so much trouble," while GA Telesis' Gunnar Már Sigurfinnsson reminds us: "That is as we said before, being creative with the work scope to increase utilization of all LLP in the engine, by doing that they extend the lifetime and that creates less need of engines. This is what we do at our SPAH operation in Helsinki and Wilmington, we help engine owners to fully utilise all LLP in their engines. We see more interest from the owner side utilising the SPAH service."

Locatory.com's Toma Matutyte comments: "By planning shop visits as smart as they can, airlines are able to identify engines that are nearing overhaul or service intervals. This gives them a window of opportunity. And here we see that it is precisely one of situations where marketplaces like ours play their crucial role. In such situations airlines can scour Locatory.com for the specific parts or engines they need, which gives them the ability to secure them well before the actual maintenance visit. That is extremely important as we all know how such benefits can go beyond just avoiding a parts scramble. Smart shop visit planning is also a shield against much dreaded AOG situations, which is every airline's financial nightmare."

Toma Matutyte, CEO Locatory.com

> ***"By planning shop visits as smart as they can, airlines are able to identify engines that are nearing overhaul or service intervals. This gives them a window of opportunity."***
>
> *Toma Matutyte, CEO Locatory.com*

At MTU Maintenance, Fabrizio Laurenti points out: "we work closely with customers to garner as much technical information as possible about each and every engine and can create a tailor-made maintenance strategy with our in-house developed engine fleet management software CORTEX. That requires factoring in a number of variables: age and make-up of the fleet, the environments in which it operates, maintenance history, expected changes to the fleet and others. Having access to that kind of information and feeding it into CORTEX allows us to generate precise, individual MRO scenarios for a customer, give them the ideal timing for a shop visit and optimize the maintenance costs over the lifetime of the engines."

David Blackburn at Standard Aero believes: "Airlines should continually and constantly review on-wing engine condition monitoring (ECM) performance data, including exhaust gas temperature margin (EGTM) degradation, oil consumption, fuel-flow and rotor-speed data in order to help determine on-wing longevity and proper planning for future spares support. Airlines should also work with engine MROs in advance in order to ensure they have the right material available at the right time for each individual shop visit, at cost-effective prices."

John McCarthy at VAS Aero Services suggests you should: "plan heavy removal and shop visit inputs in the off season if possible. Boost spare engine availability in advance of a sustained removal and shop visit schedule. Trust your trend data and planning systems. Schedule engine removals with some space for the unexpected across the fleet. We have seen some very tired engines being offered with four cycles remaining and narrow EGT margins. We don't recommend living life that close to a problem that could impact flight operations."

Anca Mihalache at AERO CARE believes it makes perfect sense for carriers: "to extend the life of an engine by conducting a repair on wing or through a hospital shop visit, where possible. With relation to performance restoration, the power plant departments will know far in advance when the time for a heavy shop visit is approaching. This allows them to make provisions for this event in good time, planning with both with the MRO and their purchasing department to source the required parts. If we are talking about LLP replacement, that's also pretty straightforward – as a general rule – the better planned it is, the cheaper it is to source the LLPs."

Avoiding "Zero Spare" situations

Obviously a "zero spare" situation is far from ideal for a carrier, so we next wanted to know what remedies or respondents could suggest to avoid this situation happening.

John McKirdy advises: "Having a strong maintenance planning and engineering organization and partnering with a balanced approach within the leasing community, an

John McKirdy, CCO Kellstrom Aerospace Group, Inc.

> ***"Having a strong maintenance planning and engineering organization and partnering with a balanced approach within the leasing community, an airline can significantly improve its spare engine asset availability..."***
>
> *John McKirdy, CCO at Kellstrom Aerospace Group, Inc.*

airline can significantly improve its spare engine asset availability while minimizing costs set aside for risk management," while Fabrizio Laurenti points out that: "At MTU Maintenance Lease Services, we are able to deliver a lease engine in less than 24 hours from the time of the request. That means the airline is able to react to an unscheduled event as if it had a spare available at its facilities, even when considering the time required to remove the unserviceable engine."

David Blackburn suggests that: "Airlines can maximise their likelihood of avoiding engine "zero spare" situations through proper fleet performance monitoring, engine/material planning, engine workscoping and engine shop visit forecasting," while John McCarthy comments that: "VAS recommends a multi-action approach, including a combination of on-lease engines, lease options, and owned engines. The number of available spares varies with the cyclical nature of the shop visits. Essentially the total number of engines available should cover in-shop engines, scheduled and unscheduled shop visits, and include a buffer to cover the unexpected. With this approach the capital commitment and cost are balanced and tailored to the current need."

Oliver James makes it clear that spare engine requirement will depend on the type and age of existing equipment, adding that: "Effective engine management goes a long way towards mitigating zero-spare situations. Owning engines has become increasing more expensive in recent years, making it harder for airlines to own them outright. In some cases, engine leasing is a smart option for engine management; airlines not only save on the upfront purchase cost but benefit from increased operational flexibility."

Anca Mihalache feels that this is not a major problem for large carriers but is definitely a headache for smaller carriers. She points out that: "There are various lessors and MROs who offer short-term leases, and this can be a big help for airlines. However, when there are no engines available (as is the situation right now with a couple of narrow-body engine types), it is not an easy situation to navigate. So again, it really comes down to good planning and extending engine life where possible, with support of the technical department."

Evren Akca advises that: "To avoid "zero spare" situations, airlines should engage in proactive material sourcing, ensuring timely procurement and working closely with MRO providers for flexible support. Regular monitoring and forecasting of engine maintenance needs are essential to avoid unexpected shortages," while Andres Jimenez feels that this is not a situation that can be totally avoided: "There are different things an airline can do – some of which we have discussed in previous questions, but it will not eliminate the issue, in my opinion. This is a very dynamic industry, and we can only plan so much based on market forecast and industry trends."

Wasim Akhtar has a simple solution to the problem for carriers: "An airline could opt to approach a company like AJW who offers bespoke engine management and associated services. We provide several engine leasing options which can guarantee avoiding a "zero-spare" situation for the airline as our vast inventory always ensures spare engine availability." Meanwhile, Bruce Ansell has concerns when an AD is issued which affects one engine variant: "Airlines need to work with the OEM or their preferred lessor to ensure they always have

David Blackburn, Senior Vice President, Standard Aero

> ***"Airlines can maximise their likelihood of avoiding engine "zero spare" situations through proper fleet performance monitoring, engine/material planning, engine workscoping and engine shop visit forecasting."***
>
> *David Blackburn, Senior Vice President, StandardAero*

access to available engines, or they need to retain sufficient numbers of spare engines themselves. The troublesome part is when an AD affects all engines of one particular variant, and every engine is required to enter the shop for inspection and repair. A dual-variant aircraft fleet helps to overcome this usually, as different engines are required for each variant."

Toma Matutyte believes that being proactive as opposed to reactive can make a huge difference: "By knowing their upcoming maintenance needs early, airlines can proactively search our marketplace to potentially secure used engines or parts before their aircraft is grounded. Needless to say, it is about getting ahead of the curve, not scrambling at the last minute when a crucial engine component needs replacing."

Gunnar Már Sigurfinnsson highlights a couple of issues: "All airlines try to maximize the utilization of the fleet, so they try to operate the fleet with as few engines as they can to save cost, though not in a way that lack of an engine will ground the aircraft. All airlines try to have as few engines as they estimate they can get away with, to save cost. That can create a problem and then airlines try to lease in engines from lessors or engine owners to bridge the gap."

Exchange or repair an engine?

Finally, we arrive at the most challenging situation, and that is recognising the point where it becomes more financially viable to exchange an older-generation engine rather than repair it.

AerFin's Oliver James feels that: "This decision really comes down to where the engine is in its life cycle. It's common for airlines and investors to avoid making large-scale repairs to their engines. Under this scenario investors can look to exchange older engines for younger, more capable engines. This not only has major economic benefits but also avoids the repair process altogether where lead times are unknown and repair costs are not certain." Anca Mihalache at AERO CARE sees exchanging engines becoming a more popular option: "This is a growing trend and not only from an airline perspective, but lessors are also increasingly looking to exchange engines. It is a sellers' market and as a buyer you have a better chance of being considered if you can offer an engine in exchange. This gives shops the opportunity of more work during the low season, over the summer for example, and also more availability of spare engines to offer airlines. This in turn makes them a more attractive partner for shop visits, as airlines will often choose a shop that can offer them an engine to lease for the duration of the maintenance period."

Aero Norway's Evren Akca urges caution when it comes to exchanging engines: "Exchanging engines can be a short-term solution but comes with risks. Airlines are familiar with the engine maintenance history for the engines in their fleet, while exchange engines might have unforeseen issues,

> ***"The advantage is having an engine available immediately. VAS Aero Services can also deliver an exchange ready-to-install engine to the airline in advance of the engine change..."***
>
> *John McCarthy, Director VAS Europe, VAS Aero Services*

leading to unscheduled removals that can significantly impact operations," while Aero Engine Solutions' Andres Jimenez is another proponent of proactivity: "Airlines are being very proactive in changing the way they operate, but it is not easy to change their business model. Fleet size, destinations, staff, training, licenses, etc., are some of the things that prevent an airline from switching to a new-gen aircraft fleet. Legacy engines are still being repaired and operated by many airlines and continue to generate growth in many aspects of the industry."

AJW's Wasim Akhtar feels that where the engine is in its lifecycle is key: "Investing millions in repairs may lack viability when the engine's remaining lifespan is limited. This is when it becomes pivotal to accurately determine the engine's lifecycle stage when making the choice between repair and replacement. Exchanging engines instead of repairing older-generation engine types has its advantages. Firstly, it helps avoid costly engine shop visits, saving the operator both time and money. Secondly, the exchange service provides a guaranteed cost advantage compared to traditional repair shop visits. Additionally, airlines benefit from AJWs specific engine data review, ensuring they receive engines with sufficient life and performance to meet operational demands."

Bruce Ansell at APOC acknowledges that while airlines have been exchanging engines rather than repairing the older-generation ones: "as the supply of available engines is drying up, we are seeing more airlines now putting these older assets into the shop to maximise the remaining life in each engine. Other operators are investing heavily and installing new OEM-supplied components, due to lack of good USM available. The airlines are currently facing some hard times, with new aircraft being grounded, or delivery being delayed, resulting in older aircraft having to be retained and extensive maintenance being required to keep these older aircraft and engines in operation."

At Locatory.com, Toma Matutyte feels there has to be a balancing act between an airline's financial budget and the current market climate, adding that: "finding a suitable used engine of the desired generation can be a treasure hunt. So, which path is the smarter one? Airlines with a healthy bank account and a strong market for used engines might lean towards exchanging for a newer, potentially more fuel-efficient model. Yet, it is as a long-term investment – lower fuel costs and fewer maintenance headaches down the line. On the other hand, airlines with tighter budgets might prioritise repairs in a sluggish used-engine market. It can be a more cost-effective option in the short term, but those maintenance expenses could creep up over time."

Gunnar Már Sigurfinnsson at GA Telesis is concerned about problems with new-generation engines and takes a more cautious approach: "We believe that every asset should be fully utilized before it is taken out for newer generations. That will maximise the investment and is also a strategy that is environmentally friendly. We have also seen lot of issues with new-generation engines, meaning that the older engines are very much in demand, as for example the CFM56/7B engine."

Fabrizio Laurenti at MTU advises that the answer depends on the airline's future plans for its engine fleet, though at MTU: "When a shop visit for an old-generation engine is performed and the airline is not able to exploit the full post-maintenance life (residual green time) before the respective fleet is phased out, we can add the engine into our lease pool and remarket it to our customer base, thus allowing the airline to extract the remaining life of the engine even after the fleet is phased out."

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David Blackburn at Standard Aero strongly recommends a shop visit cost analysis before any decision is made: "A thorough shop visit cost analysis, coupled with a complete evaluation of engine and component availability in the current marketplace, should be performed each and every time before making a 'shop visit vs. engine exchange' decision. Airlines should be prepared with a strong and knowledgeable financial modelling team which will determine the best path forward when it comes to providing continuous, reliable and uninterrupted engine utilisation and operation."

To end with, John McCarthy at VAS Aero Services is very much in favour of engine exchanges, saying that: "The advantage is having an engine available immediately. VAS Aero Services can also deliver an exchange ready-to-install engine to the airline in advance of the engine change ensuring a seamless engine change."

It is clear there is no 'one size fits all' solution to the challenges airlines face with regard to spare engines. Much depends on the size of the airline and an MRO budget, but from the section of answers provided by leading engine MRO specialists above, it is clear that there is a solution available for the majority of spare engine requirements.