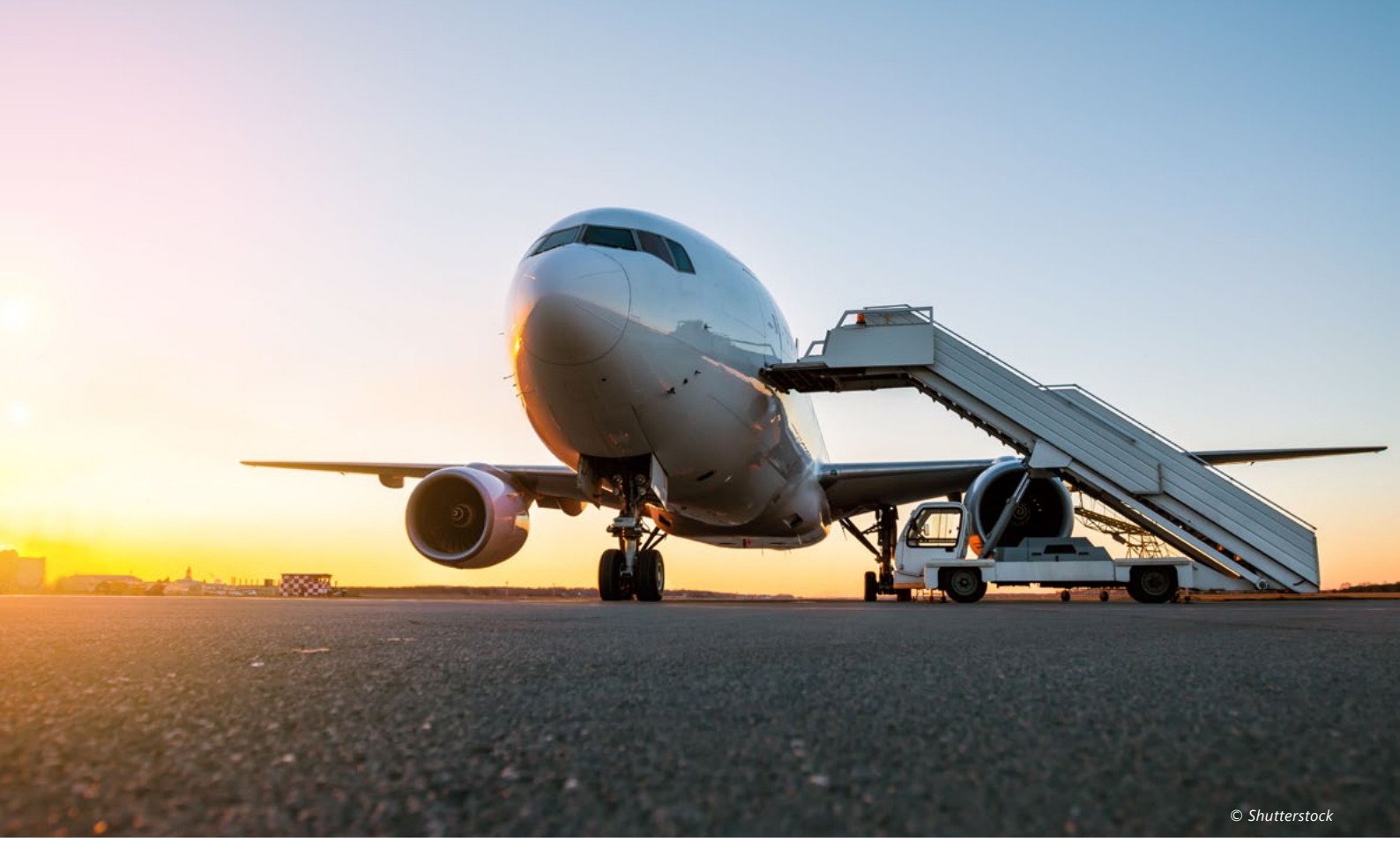
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Unplanned Events

Positioning of Critical Parts to Reduce the Impact of AOGs

By David Dundas

An unplanned aircraft on the ground (AOG) event causes a whole raft of problems for both carriers and MRO operators. For the carrier, there is the immediate financial cost in terms of having a grounded aircraft and depending on the estimated time to repair the fault(s), rearranging alternative aircraft as substitutes. For the MRO, the pressure is on to get the aircraft back in the air as swift and efficient service leads to renewal of maintenance contracts in a competitive environment. We wanted to learn more about the positioning of critical parts by MROs to mitigate the impact of an AOG incident, and we approached six of the industry's established operators to get their perspective on the challenges faced.

From your experience, what are the most common causes of Aircraft on Ground (AOG) situations related to parts availability?

Mark Shimizu, SVP EMEA at AerFin cuts to the chase with a clear indication that the most common causes of AOG situations stem from insufficient coverage of operationally critical parts in the right locations. He explains further: "Operators need dependable access to a broad network of inventory, whether through owned stock, leased solutions, or pool provider support. At AerFin, we deliver tailored services that give operators immediate access to the critical inventory they need, wherever they need it. Our goal is simple: to keep our customers flying by minimising the risk of AOG events worldwide." At FI Technics, Victor Bulanov, the company's Head of Sales and Customer Support Unit goes a bit deeper, suggesting that AOG situations arise from three primary causes that require specific crisis management strategies. He tells us that "Component failures constitute the first major cause, ranging from complex

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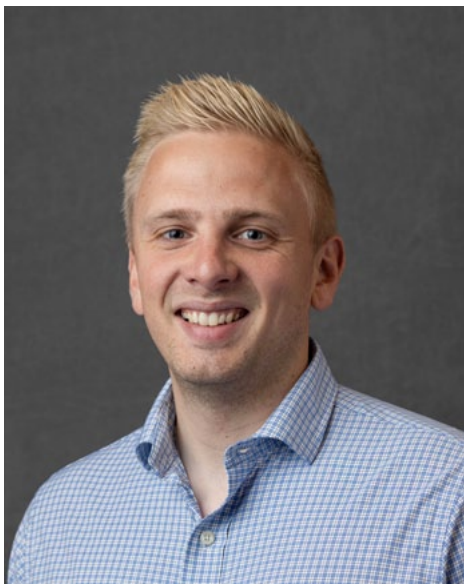
systems to individual sensors. These failures occur through both anticipated wear patterns and unexpected events, including premature deterioration, manufacturing defects, and external incidents such as bird strikes. When critical "no-go" components involving essential flight system components malfunction, immediate action becomes essential to maintain airworthiness. Supply chain complexities represent the second major cause, encompassing interconnected operational challenges. Extended OEM lead times and shop backlogs create critical component shortages across aircraft platforms. Manufacturing constraints affect both raw materials and subcomponent availability, while freight capacity limitations and stringent customs protocols delay time-sensitive shipments. These supply chain disruptions significantly impact piece parts procurement, causing repair times to exceed standard maintenance windows. The third significant cause involves geographical and logistical challenges. Airlines face mismatches between parts storage locations and failure points, complicated by limited freight options and customs barriers. Economic constraints prevent comprehensive inventory positioning, while strict quality requirements limit qualified supplier options at remote stations."

Jordan Greenberg, Senior Component Trader at Setna iO provides us with a concise opinion, suggesting that: "Typically, what we see when it comes to true AOGs are a lot of smaller piece parts that are easily replaceable during routine service. Seals, brackets, O-rings, etc.. Now, this can vary if we widen our idea of what an AOG is, if you are grounded at the gate waiting to taxi to the runway, normally something like this noticed on initial checks and you are waiting for it to be fixed, generally quickly." Inaccurate planning and poor order management are significant causes of AOG, often stemming from the use of static data rather than real-time information about the expected arrival time of parts. Additionally, a lack of consistent follow-up with suppliers to confirm shipment and delivery status can result in parts not arriving on time, directly contributing to an AOG event, Erkki Brakmann, CEO and Co-Founder of SkySelect, Inc. advises. He goes further to say that: "Manual processes for managing routine orders can create significant backlogs. When a large volume of orders is handled manually, it becomes difficult to track and prioritise them effectively. This inefficiency can lead to delays in receiving even standard parts, which can quickly escalate into an AOG situation. Automating these processes can streamline the supply chain and reduce the risk of delays."

Over at VAS Aero Services, Michael DeMicco, Sr. Vice President of Sales and Material Management considers there to be a variety of factors that "can contribute to extended AOG times, including supply-chain-induced shortages and delays, erroneous inventory data and inaccurate forecasting. The impact is especially severe on components with long lead times or that are no longer in production. Minimising the effect of the availability of parts on AOG times requires a proactive inventory management system that anticipates these situations and a close relationship with a responsive supply partner who possesses visibility into parts and components across the global aftermarket. A partner who can work with you to locate, stage and deliver parts whenever and wherever you need them."

How does an AOG due to parts shortage typically impact airline operations — both operationally and financially?

Craig Skilton, VP Components at APOC Aviation looks at the problem from a supplier's perspective, noting that APOC always appreciates the potential impact than an AOG can have to on airline customer and this is always in the forefront of their minds when trying to rectify situations. He adds that: "Typically, cost and reliability would



Craig Skilton, Vice President - Components, APOC Aviation

be the first two priorities when sourcing a part. In these situations, however, these priorities are quickly replaced by availability and location. An AOG will not only impact an airline's commercial operations, but also their reputation, given that aircraft will not leave when it needs to. Because of this, airlines will know that the cost of an AOG will far outweigh the cost of the part itself. Therefore, it is common to pay a premium for a required part, as well as an additional fees to get it quicker, such as the fastest transport to specific locations at specific times." Jordan Greenberg equates an AOG incident almost having a virtual ripple effect, as he explains: "An airline grounding and flight cancellation due to an AOG is detrimental to an airline. These companies are working on very slim margins and, as we saw in Covid and afterwards. Small disruptions can cause lasting issues. cancelling one flight causes a domino effect where it can take up to 5 or 10 routes to catch up to their initially planned route. Expanding on this idea, it leaves a negative taste with their customers which can cause customers to move to other similar options."

AOG situations immediately trigger crisis management protocols with cascading operational and financial consequences. Operationally, airlines enter crisis mode, simultaneously managing flight cancellations, passenger rebooking, and cargo rerouting. This creates a complex web of disruptions affecting crew duty times, maintenance scheduling, and network connectivity. Airlines must rapidly evaluate multiple solutions - from replacement aircraft deployment to network schedule adjustments - while working every available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channel to restore service, suggests Viktor Bulanov. He expands on this by noting that: "The financial impact compounds hourly through multiple cost streams. Beyond direct revenue losses from the grounded aircraft, airlines face substantial premium charges for urgent logistics, last-minute parts sourcing, and mandatory passenger compensation under various regulations. Remote station AOGs particularly escalate costs through complex logistics requirements and limited support options, often doubling standard procurement expenses."

Both Michael Demicco and Erkki Brakmann are of a like mind in relation to the consequences of an AOG event. An AOG caused by parts' shortages significantly disrupts airline operations and impacts finances. AOG down-time triggers flight delays and cancellations, logistical complications with crews and passengers, and adds costs through compensation, expedited shipments, and labour. Grounded aircraft result in lost revenue, while penalties for poor on-time performance and reputational damage can diminish future earnings. DeMicco makes it abundantly clear when he tells us that: "The potential impact of extended AOG times underscores the importance of proactive supply chain management, close collaboration with parts supply and logistics partners, and inventory strategies to minimise operational disruptions and financial losses related to AOG events," while Erkki Brakmann feels that: "AOG situations directly impact airlines' operational efficiency and financial stability, and can also have long-term negative effects on their reputation. To avoid these issues, airlines must find a balance between having sufficient spare parts and managing the high costs associated with maintaining an inventory."

To round off this section, Mark Shimizu has provided a comprehensive overview of the impact of an AOG event. "Any prolonged AOG situation is very serious for an airline. Operationally it can lead to flight delays and cancellations as the essential maintenance can't be carried out due to lack of available material. This increased maintenance downtime can affect the customer experience and ultimately confidence in the brand. Financially there are direct costs associated with expediting the shipping of material, additional labour and potential compensation to customers. This situation has been exacerbated by the global supply chain challenges that the industry has been experiencing for the last few years. While there are early signs recovery, persistent shortages of piece parts continue to disrupt repair timelines, extending turnaround times and creating operational challenges across the industry. Operators often have to invest in larger volumes of critical parts across multiple locations. These shortages not only disrupt operations but also drive up the market value of parts, creating additional financial strain. The result is delayed schedules, increased costs and operational inefficiencies — all of which highlight the need for a trusted partner with ready-to-deploy inventory."

What role does demand forecasting play in preventing parts-related AOGs?

Demand forecasting serves as the primary tool in transforming AOG response from

reactive to proactive. By analysing usage patterns, reliability data, and maintenance schedules, airlines can identify potential failures before they ground aircraft. This predictive approach is particularly crucial for "no-go" items and high-failure-rate components where immediate availability is essential for maintaining operations. Viktor Bulanov explains: "FL Technics implements this preventive approach by analysing parts performance data. We track failure patterns across our global customer base to identify and pre-position critical components where they're most likely to be needed. This data-driven approach shapes our inventory decisions for A320, Boeing 737, and Embraer fleets, ensuring parts availability before AOG situations occur. Our forecasting methodology translates into tangible operational benefits through optimised supply chain efficiency. We analyse customer-specific consumption patterns to maintain appropriate stock levels across our global network, focusing particularly on emergency-critical parts. This proactive positioning, combined with pooling arrangements and exchange programmes, significantly reduces AOG risk while optimising inventory investment. The result is a shift from emergency response to planned availability, particularly for components with historically high failure rates or extended lead times."

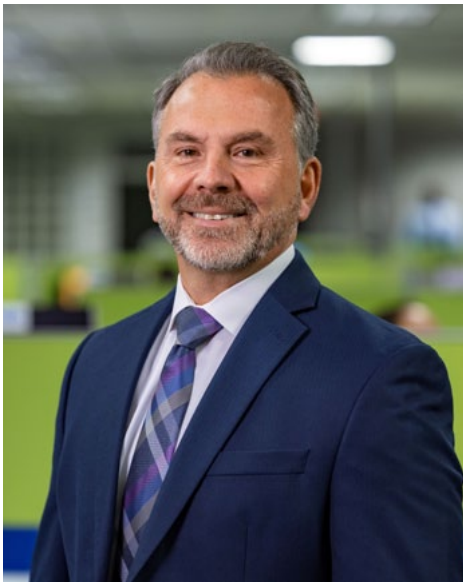
The Material Planning division is obviously a key cog in the operations when it comes to avoiding AOGs. Jordan Greenberg suggests that: "A well balanced and properly allocated forecast will drastically reduce not only the occurrence, but also the severity of AOGs. Knowing within a reasonable margin of error how many of a certain part is going to be used daily/weekly/monthly will give airlines a clean look at what parts could potentially cause on AOG and clear line of sight to what they need." Over at SkySelect, Erkki Brakmann has helped us by identifying three key areas where forecasting is next to impossible: "Unknown or First-Time Use Materials: When a new or unexpected part is required for the first time, forecasting can be challenging and may not yield accurate results. In such cases, data from the manufacturer (RSPL) can be helpful. This data can assist in making forecasts or, at the very least, in mitigating the risks associated with high-impact parts. Issues at Remote Stations: When a part is required at a remote station, even with an accurate forecast, it may not be financially or practically sensible to send the part there. Financially, this could be due to a low "local forecast" for demand, and practically, it might be because there aren't enough personnel available to handle the task. In such cases, it may be more efficient for the team to take the part with them instead. Supplier Issues: As mentioned above, while forecasting can inform decisions about suppliers, it cannot address a supplier's internal problems that cause delivery delays."

"Demand forecasting is essential for preventing parts-related AOG events. Without solid forecasting, organisations risk overstocking some items and understocking essential ones, increasing AOG risk and operational costs. Thus, analysing historical data, LLP schedules, maintenance cycles and failure trends helps operators anticipate parts needs, resulting in accurate inventory planning and management." Michael Demicco further tells us: "At VAS, we work with customer partners on maintaining a detailed inventory profile, one than anticipates parts replacement, and a right-sized level of inventory." Accurate forecasting is vital to reducing the risk of AOGs, but as Mark Shimizu explains, it must be dynamic. "Forecasts need to be constantly updated with real-time variables, such as turnaround times, live fair market values, upcoming maintenance events, variations in utilisation, inventory levels, consumption trends, and vendor performance." He then adds that: "At AerFin, we work closely with our customers to ensure their forecasts remain agile and informed, helping them anticipate challenges and secure the right inventory ahead of time."

To conclude, Craig Skilton senses that we are entering a time where technology, especially analytical orientated solutions around predictive maintenance, can help mitigate the risk around high-failure-rate components before they lead to AOG situations. "Rather than simply having awareness of high-failure-rate components, those companies, like APOC, that effectively leverage modern technology can benefit through detailed trend analysis and statistical models that correlate failure events. Those inputs can be translated into fully optimised stock levels, ensuring that airlines maintain the right stock based on actual usage and predicted failures. The output of which, can be provided to suppliers ahead of time, enabling the sourcing event to be focused on finding the best price, rather than price being pushed down the priority list when an AOG comes along," he informs us.

AOG often requires the immediate availability of spare parts at a remote location. Within an airline operation, who is now in the driving seat to make the parts available?

The most important way this industry can collaborate is with transparency, i.e., if airlines give their vendors, MROs, and OEMs a view into what is most troublesome for their sourcing team and the most common and preventable causes of AOGs. Consequently, as Jordan Greenberg suggests, "We can all work together to



Michael DeMicco, Senior Vice President Sales & Material Management, VAS Aero Services

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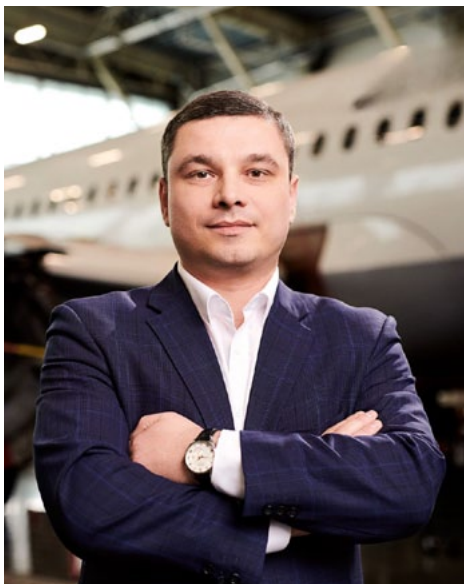

Viktor Bulanov, Head of Sales and Customer Support Unit, FL Technics

> ***"Our role as an integrator focuses on creating tangible benefits through resource optimization. We manage pooling agreements and exchange programs that have demonstrated success in reducing AOG response times by sharing resources across partners."***
>
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make sure these parts are always ready to go for the end user. This goes both ways, listing the correct condition and parts that are ready to go on ILS, Partsbase, and any other platform can create the clarity needed for airlines. At Setna we update our ILS listing every morning to correctly show all of our available inventory." MROs, OEMs, and airlines need to move beyond isolated planning and engage in a collaborative demand forecasting process. For example, airlines could share their upcoming maintenance plans, operational data, and demand forecasts. This transparency enables OEMs to more accurately predict component wear and tear, while MROs can anticipate the need for specific repairs and parts. As SkySelect's Erkki Brakmann also suggests: "Securing access to critical parts, especially those with long lead times or a high risk of stock-outs, requires innovative contractual arrangements that balance cost and reliability. These arrangements often come at a higher expense, as OEMs may charge a premium of 5-20% above market rates to mitigate risk. However, this trade-off can provide airlines with greater peace of mind, knowing that critical parts are readily available."

"Sharing real-time data on inventory and maintenance schedules and history increases transparency and supports proactive planning. Forecasting based on historical and predictive data helps streamline parts procurement," Michael DeMicco advises, adding that: "And long-term supplier partnerships are critical for securing priority access to essential components. VAS works closely with customers to analyse parts needs and develop solutions that encompass everything from forward staging of critical parts to asset pooling arrangements to exchange programmes. The key for us is early involvement in the strategic planning process to assure a responsive and resilient inventory management programme." Mark Shimizu at AerFin is of a similar mind when stating that: "Collaboration is most effective when there's transparency and early communication. By sharing advanced notifications of upcoming events — such as potential part shortages or maintenance peaks — MROs and OEMs can help operators and suppliers prepare proactively. Providers with strong teardown pipelines, like AerFin, play a key role in creating flexible, collaborative solutions that ensure operators have the parts they need without delay." Meanwhile, at APOC Aviation, Craig Skilton believes that: "The onus initially is on the airline's supply chain team to give visibility around what parts are needed in those critical locations, even outside of contract situations, suppliers are generally receptive to place stock in remote warehouses. For suppliers like APOC, if there is known and repeat demand, then the cost of moving stock remotely can be offset by the customer requirements they know they will soon be servicing. Without that demand visibility, then suppliers will be more comfortable holding stock at the main hubs to support the wider customer demographic."

Ultimately, effective collaboration between MROs, OEMs, and airlines requires transforming traditional transactional relationships into long-term strategic partnerships. By sharing maintenance forecasts, inventory data, and usage patterns, stakeholders can prepare for demands before they become urgent. This partnership approach extends to sharing specialized tools and test equipment, reducing individual investment needs while maximising resource utilization. As Viktor Bulanov expands: "FL Technics enables these partnerships through practical collaboration tools and established industry relationships. Our platform processes over 50,000 parts requests monthly, connecting 1,000+ suppliers with airlines and repair stations. We combine this extensive network with flexible tool sharing options and joint planning initiatives, helping partners reduce capital investments while maintaining operational readiness. Our role as an integrator focuses on creating tangible benefits through resource optimisation. We manage pooling agreements and exchange programs that have demonstrated success in reducing AOG response times by sharing resources across partners. This collaborative approach, supported by our established relationships with OEMs and repair stations, creates measurable efficiency improvements while reducing individual stakeholder costs."

How should airlines prepare for the event that a critical part is missing at a remote long-haul destination?

This has to be the most challenging scenario and a nightmare for many MROs, although it is clear there are mitigating options and effective solutions to the problem. "Airlines should proactively establish partnerships in various destinations to ensure access to critical parts. This includes participating in airline inventory pools, where member airlines share access to a collective stock of parts and materials," suggests Erkki Brakmann, adding that: "To go beyond their default set of suppliers, airlines should invest in a tool that provides market insights. This technology allows them to search for and locate parts in real-time, identifying available stock at the closest destination. This capability is crucial for identifying alternative sources when a primary supplier is unable to deliver, enabling a more agile and responsive supply chain." He concludes that: "Good preparation depends on planning and forecasting based on real-time market availability. Rather than relying on static or

historical data, airlines should use real-time inventory tracking to optimise their stock level. This means stocking critical parts not just at home bases but also at strategic, long-haul destinations where they are most likely to be needed." It's all about readiness, being in position to respond when an emergency arises according to Michael DeMicco. "Assuring critical parts availability entails a variety of strategies: inventory pooling programmes for shared access to key components, establishing loan or exchange agreements with partner airlines and local MROs, and working closely with a supply and logistics partner, like VAS, who can expedite shipments and forward-position high-failure parts at strategic locations, based on mutually determined demand data. Contingency planning ensures an operator can respond quickly and efficiently to parts shortages, even when far from their home base," he further advises.

Mark Shimizu feels that there are several strategies which could be adopted to mitigate risk. "Holding inventory at remote destinations isn't always the most efficient use of capital, but International Airlines Technical Pooling offers a cost-effective safety net by sharing resources between airlines. Another effective approach is to work with suppliers who operate a truly global footprint. AerFin holds substantial inventory across four strategically located facilities — Gatwick, Newport, Miami, and Singapore — giving airlines immediate access to the parts they need, backed by local support from our teams," he suggests.

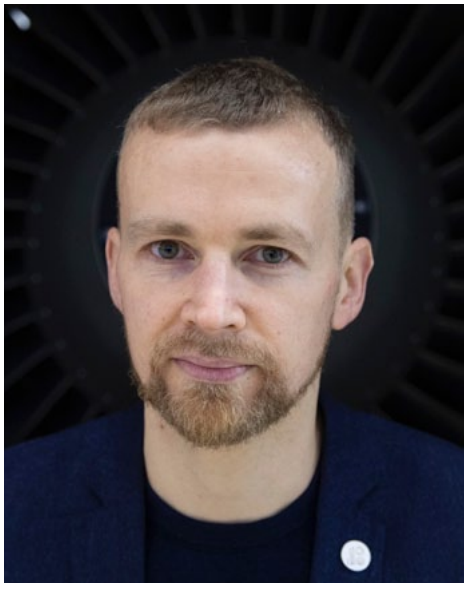
Remote station AOG preparation demands comprehensive advance planning and tested response procedures. Airlines must identify critical network points, validate local support capabilities, and establish contingency plans before emergencies arise. This preparation includes testing customs clearance processes, confirming handler capabilities, and establishing multiple transport options for each route. Viktor Bulanov tells us that "FL Technics supports airlines through proven fast-reaction processes at major long-haul destinations. Our network combines warehouses and technical stations across Europe, Asia-Pacific, Americas, and the Middle East with established local partnerships. We maintain ready-response arrangements with customs authorities and handlers, regularly testing these processes to ensure reliability when urgent clearance is needed. Our 24/7 AOG desk coordinates multiple response options simultaneously, from dedicated onboard couriers to expedited air freight. We maintain alternative routing plans and backup transport modes for each major route, enabling quick shifts between solutions if initial options face delays. This multi-layered approach, supported by local partnerships and tested procedures, consistently delivers parts to remote stations within critical response windows."

Jordan Greenberg is happy to share the strategy adopted by Seta iO, telling us that: "... we have strategic locations to lessen the lift on operators in need of parts all over the world. Now there are still locations that exist where many distributors may not have stock, but a concentrated pool of vendors that have reach, globally, is critical to getting the best service and quickest action to AOGs. Outside of that an airline inventory pool or partnership with airlines that run similar routes can be effective in joint action with quality vendors."

Should airlines keep critical, high-failure-rate components on board the aircraft as a flight kit or operate a warehouse at remote destinations?

The choice between flight kits and remote warehousing represents a critical balance of operational insurance versus cost efficiency. Flight kits function as immediate insurance for critical, lightweight components but add fuel burn costs and require regular updates. Like any insurance policy, the key is determining the right coverage level - carrying only those items whose immediate availability justifies their weight penalty and inventory costs.

Viktor Bulanov at FL Technics informs us that the company's experience: "... shows the most efficient solution combines minimal onboard inventory with strong regional support networks. Small, frequently needed components like specific sensors or avionics cards may justify onboard carriage, while larger items are better accessed through regional warehouses and pools. This approach considers both usage frequency and local support infrastructure, ensuring critical parts remain accessible without unnecessary weight or inventory burden." He then adds that "We support airlines in optimizing this balance through regional hub networks and pooling arrangements. Our analysis of component usage patterns, weight impacts, and carrying costs helps determine which parts belong onboard versus in regional stock. This strategy has proven particularly effective for remote operations, where the right mix of onboard spares and regional pool access provides cost-effective insurance against AOG situations." In turn, Michael DeMicco suggests that: "The best approach is probably a mix of flight kits, remote warehousing and collaboration with a global parts supply and logistics partner. Onboard flight kits for high-failure, lightweight components can minimise downtime at remote destinations, but there are weight and space limitations. On the other hand, setting up a warehouse at a busy remote location carries with it added expense. Partnering with a parts supply and logistics partner, such as VAS, with global reach provides flexibility and coverage while minimising risk and expense."



Erkki Brakmann, CEO & Co-founder, SkySelect, Inc.

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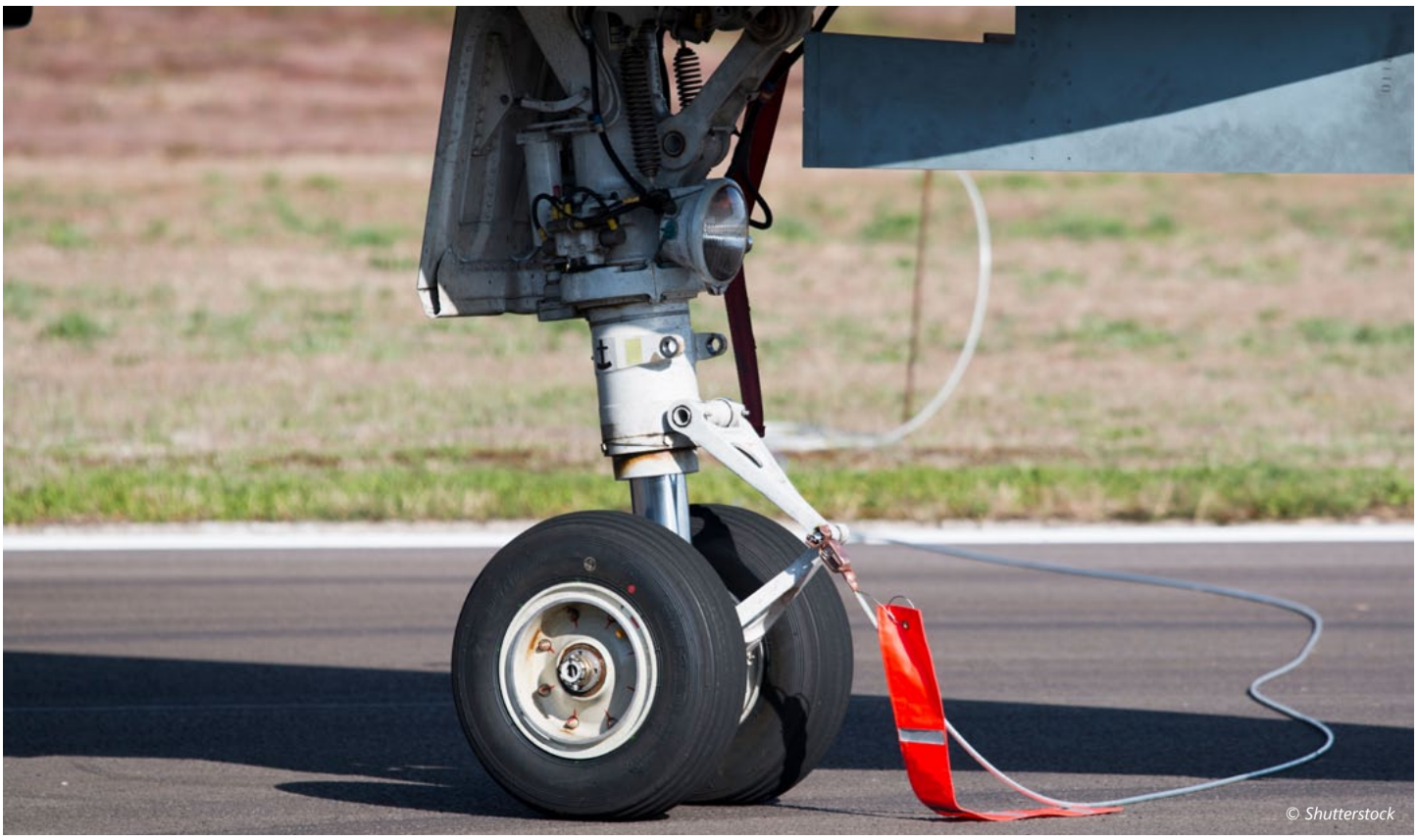
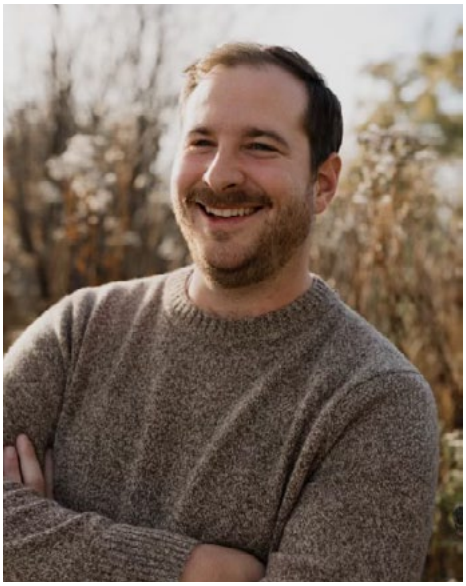


In accord with Bulanov and DeMicco, Mark Shimizu suggests that: "Flight kits and remote warehouses can provide some assurance, but they are often capital-intensive solutions. A more efficient approach is to work with a supplier that offers extensive global coverage and rapid response capabilities. AerFin's network allows operators to avoid tying up capital in flight kits or remote stock, while still having confidence that critical parts are accessible whenever and wherever they're needed." Clearly Viktor Bulanov feels that the solution to this problem is a careful balancing act between availability and cost. As he explains:



Jordan Greenberg, Senior Component Trader, Setna iO

"The idea of keeping extra weight on every flight as assurance would scare most every airline executive I believe. When thinking about opening up a warehouse there is more than just the cost of the warehouse or the cost of the parts to consider. Overhead cost of employees, keeping the parts in proper storage temperature and the necessary maintenance of parts over time, if some of these parts are safety related then there is normally an expiration date or recertify date adding even more complexity and cost. Keeping these parts or kits in their main warehouse or with consignment would be the most effective way to have constant access and monitoring without too much added cost."

It seems that there is no single operative solution and that a mix of options will always be the best way to mitigate for problems directly related to arts' availability. As Jordan Greenberg tells us: "Airlines must weigh the continuous cost of carrying a flight kit against the high but infrequent cost of a flight cancellation. The on-board flight kit strategy provides immediate access to critical, high-failure-rate components, saving millions in recovery costs for non-deferrable failures. However, it incurs a constant fuel cost from the added weight. The remote warehouse strategy avoids this continuous cost but risks significant delays and expenses if a part is needed immediately at a remote location. The best solution is a hybrid model, using flight kits for small, critical parts and remote warehouses for heavy or deferrable components, based on a detailed cost-benefit analysis of each part and route. Another factor to consider is whether the crew at the remote destination is capable of installing the component or executing the task. If not, then the best strategy may be to always keep it with the engineer, typically at the base station."

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