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End-of-Life Management for Commercial Aircraft

Engineering the Future
The KUNZ Approach

Wheels and Brakes Solutions
AMETEK MRO and Werner Aero Interview

Maintenance Mythbusters
OEM Parts Are the Only Safe Option

End-of-Life Management for Commercial Aircraft

How we handle aircraft that reach the end of their economically viable life has changed considerably over the last 20 years

By David Dundas

It is quite remarkable to think that only 20 years ago we were only 'recycling' roughly 50% of a commercial aircraft when it reached the end of its operational life. Many of us have memories of row upon row of abandoned aircraft parked up in some remote desert location, while the alternative back then was simply to strip out the most basic parts and then confine the rest to landfill. So, what has changed today where anything up to 90% by weight of a retiring aircraft can be reused or repurposed and, just as important, what is happening in terms of end-of-life management of these aircraft?

There have been several changes to the 'operational environment' where retiring aircraft are concerned, with a major turning point occurring with the birth of modern aviation recycling just after the turn of the millennium. In 2005, Airbus launched the PAMELA project (Process for Advanced Management of End-of-Life Aircraft), demonstrating for the first time that up to 85% of an older plane's weight could be recovered. Concurrently, the Aircraft Fleet Recycling Association (AFRA) was established in 2006 to regulate and elevate industry standards. The second major change was the emergence of Used Serviceable Material (USM) as a viable alternative to Original Equipment Manufacturer (OEM) parts which provided an even greater incentive to recover as much of an aircraft during the teardown process. Beyond this, when it comes to engines, today you can expect more than 99% of, say, a CFM56 engine's parts and materials to be recycled or recovered at the end of its operational lifespan.

The third change to the operational environment has been the emergence and continuation of supply chain problems that began with the onset of the COVID-19 pandemic. This problem has become so great that it not only relates to OEM parts but also USM as well. The fourth change has been in relation to aircraft supplies rather than the supply chain itself. Both Airbus and Boeing have encountered problems which have led to severe delays in the production of their most popular narrow-body jets. While Airbus is struggling with delivery delays of much needed Pratt & Whitney engines, Boeing is only just getting production back on track after two fatal 737 MAX crashes and an in-flight door plug blowout.

As a consequence of the last two changes, a virtual dichotomy has developed concerning when aircraft reach the end of their life. Logically, with a shortage of new planes coming off the production line, carriers are being forced to delay renewing their fleets and OEMs are now required to keep these older aircraft operational. The problem is that older aircraft require more replacement parts than new aircraft, and the supply chain is put under extra pressure, especially as those older aircraft would have been earmarked for teardown and the parts used for replenishing the supply chain. At the other end of the scale, the shortage of engines for certain models plus the strong demand for USM has seen aircraft as young as two years old reaching the end of their commercial life and being bought for teardown.

With such drastic changes all round, end-of-life management of aircraft has, unsurprisingly, also changed considerably over the last twenty years, and particularly after the pandemic. We wanted to catch up with several MRO-connected companies to get their take on a few of the most pertinent aspects of today's management practices and decision drivers.

What factors determine whether an aircraft is parted out, stored, or sold as a whole asset?

There is no question that there are a whole range of factors that didn't exist five years ago, let alone 20 years ago, so we were curious to see which were currently key.

James Bennett, Chief Commercial Officer at AerFin Ltd cuts straight to the chase as he advises that the decision ultimately comes down to value. "Asset owners, lessors and managers assess whether an aircraft will generate greater returns through continued operation, storage for future use, or disassembly and sale of its individual components. A range of factors influence this assessment, including the aircraft's age, maintenance status, engine condition, remaining life on key components, lease prospects and overall market demand for the aircraft type. If there is a strong operator market and the aircraft's value in service exceeds its teardown value, selling or leasing the aircraft as a whole is often the preferred option. Storage may be chosen when market conditions are temporarily weak but future demand is expected to recover. This preserves flexibility while allowing owners to wait for a more favourable market environment. Parting out becomes attractive when the combined value of engines, landing gear, APUs and other serviceable components exceeds the value that could be achieved through a sale or lease. In these cases, detailed teardown modelling is used to compare potential recovery values against future revenue opportunities. At AerFin, these decisions are supported by real-time market intelligence, component demand forecasting and extensive aftermarket trading data to identify the optimal asset strategy," he tells us.

Daniel Tautges, SVP Component Control

David Strockbine, Vice President, Assets & Leasing at Aero Engine Solutions is of a similar mind to James Bennett, though he looks at the situation from a slightly different angle, suggesting that: "The primary factor in determining whether an aircraft or engine should be parted out, stored, or sold as a whole asset is whether the cost to return it to service exceeds its current market value as an operational asset. Beyond that initial assessment, the decision becomes more specific to the asset owner's objectives and market conditions. Owners and lessors must evaluate factors such as current demand for used serviceable material (USM), lease return timing, maintenance status, engine condition, and projected residual values. Ultimately, the goal is to maximise the end-of-life value of the asset. Depending on market dynamics and the condition of the aircraft or engine, that value may be best realised through teardown and parts recovery, strategic storage, or sale as a complete asset." However, for Lindsay Cooper, Director of Asset Management at AJW Group, age is the primary driver as she informs us that as aircraft mature, operating and maintenance costs often become too expensive to maintain relative to their revenue generation. She continues: "This drives older airframes toward teardown and part-out scenarios, where their residual value is maximised through component recovery. We place an emphasis on maintenance history and structural integrity. Well maintained aircraft with solid airframes generally produce components in superior condition, which translates directly to higher market value. Quality components from the right aircraft types can command premium pricing and support airlines opting for USM rather than new components. A further consideration is the current market demand for specific components, regulatory compliance requirements, lease agreement terms, and manufacturer characteristics. Economic factors like fuel prices and passenger demand influence these decisions. Equally important are practical things such as proximity to teardown facilities and access to skilled technicians, these may make or break the feasibility of a project. AJW actively pursues newer-generation aircraft to meet our customers' evolving needs. Our competitive advantage lies in our expertise in asset evaluation and our efficient removal and repair processes. This allows us to maximise value recovery while ensuring components meet the exacting standards our airline customers demand. There are other variables involved that determine the economies of a part-out decision, as has occurred on Pratt & Whitney-powered NEOs and a small number of B787s."

For Daniel Tautges, SVP at Component Control, "The decision is primarily driven by market demand, aircraft age, maintenance status, engine condition, and residual asset value. If an aircraft remains economically viable and there is demand from operators, selling it as a whole asset often generates the highest return. Storage may be chosen when market conditions are temporarily unfavourable or when operators anticipate future demand for the aircraft type. Part-out becomes attractive when the combined value of individual components exceeds the aircraft's market value as a complete asset. Aircraft nearing retirement often contains engines, landing gear, avionics, and rotable components that remain highly desirable in the aftermarket. Teardown decisions are increasingly supported by data-driven analysis of component demand, repair costs, and projected aftermarket pricing. Changes in the aircraft leasing business have also increased the opportunity for greater visibility and profit in aircraft lifecycle management." Similar to Daniel Tautges, Eoin Doherty, VP Pricing at EirTrade Aviation looks upon age as a key factor, primarily when an aircraft is of an age to be nearing the end of its operational

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life. Interestingly, he goes on to say that "Specifically with engines, once the Life Limited Parts (LLPs) reach low life and there is no desire to complete LLP replacements during shop visits, engines are typically torn down, depending on the asset type and the market demand for whole assets. Fleet retirements can also speed up part-out decisions as certain aircraft become phased out of airline fleets. Alternatively, companies may choose to 'flip' whole assets: if there is strong market demand and it is possible, engines can be rebuilt and reinstalled onto another aircraft or put back on lease. This will happen if the value of a 'flip' outweighs the value of trading the parts after teardown."

Greg Creekmore, Regional Sales Manager – Americas at Inventory Locator Service has identified three key factors that he feels are the principal determinants - economics, market demand, and projected return on the asset. He then expands on this: "If an aircraft still has strong operator demand and lease potential, selling it whole is usually the best option. If the greatest value is in the engines, landing gear, avionics, and components, teardown becomes more profitable. Tools like the ILS Asset Analyzer help owners evaluate market demand, component values, and teardown yields using IPC-based analytics down to the piece-part level. Storage is typically a timing strategy when owners expect market conditions or asset values to improve." Kensuke Nakamura, SVP, Business Development at Werner Aero LLC is concise and clear in his thinking, and like many others, implies that there is no single deciding factor. "It depends on various factors, for example, such as aircraft condition, market demand, and stance of aircraft owners, etc. Aircraft condition – maintenance is recently provided and extended, or it will expire soon. Market demand – which demand of flyable aircraft or used serviceable parts would be stronger then. Stance of aircraft owners – they needs to sell right away, they can monitor the market and wait, and they can consider utilising some of removed parts in a better way," he suggests.

Valentina Pilshchikova, Engines & Parts Trading Sales Manager at Vallair provides a comprehensive overview of the challenge suggesting that it is "fundamentally an economic analysis," based on such factors as market demand, aircraft condition, aircraft age, technical factors, and overall asset value. She then advises that: "The decision to part out is simple: if the value of the parts is higher than the value of the aircraft as a complete asset, parting it out is the preferred course of action. It is straightforward when you consider that the market value for an engine may be twice its base value due to supply chain disruptions and technical issues. In recent years, Vallair has observed that relatively young aircraft with strong engines are being torn down because of this. For example, A320neo aircraft equipped with GTF engines, the lease value of which can be higher than the value of the entire aircraft in some cases. For lessors, the decision to part out can be accelerated by maintenance costs. In many cases, aircraft owners would rather reap financial rewards instantly rather than invest in engine overhauls or airframe work. In other words, they prefer to keep cash in the bank, not cash in metal. Some lessors have already informed us of their intention to sell airframes for teardown. It will be interesting to see how many Spirit aircraft may ultimately be parted out. Storage becomes an attractive option when current demand is weak, or when the market makes it financially difficult to sell. Owners may wish to store an aircraft and depreciate the asset slowly, rather than sell it at a low price and realise the loss immediately. These owners would then reap the rewards of retaining their assets when the market improves and they can resume operation of the aircraft or sell it at a more favourable price. If part out is about maximising returns by keeping cash in the bank, then storage is about minimising losses by keeping cash in assets. Lastly, sale of whole assets may be chosen by lessors when they are faced with costly transitions for mature, third-lease aircraft. In such cases, owners will once again prefer to monetise their assets quickly in a favourable market. Considering the current worldwide market situation, the decision is mainly driven by which option provides the fastest and best commercial return."

Which aircraft components typically retain the highest value at end of life?

While there is a very logical element to this question, what we will be interested to discover is how supply chain problems may have altered the value of components and whether this is a fluid situation. Perhaps it is not possible to identify specific components, but more a specific type of component. "In general, components with life-limited characteristics retain the highest and most predictable value at end of life. These include parts with defined cyclic or hour-based limits, as well as components subject to repair cycle restrictions, such as limits on the number of times a part can undergo specific repair processes. High-value assets commonly include engines, LLPs (life-limited parts), APUs, and landing gear components, as demand

David Strockbine, Vice President, Assets & Leasing, Aero Engine Solutions

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for these items remains consistently strong within the aftermarket and MRO sectors. The value of these components is largely driven by their remaining usable life, traceability, repairability, and continued relevance within active fleets" says David Strockbine. Lindsay Cooper on the other hand seems to be leaning more to the fluid side of things, telling us that: "The value of components is heavily influenced by supply and demand. When demand for specific aircraft materials or components is high and the supply is limited, prices tend to soar. Conversely, in times of reduced demand and ample supply, prices may decline. The intrinsic value of certain components also plays a role; items like engines or avionics systems often command higher prices due to their complexity and essential role in aircraft operation. However, as mentioned, market conditions, economic fluctuations, and external factors such as fuel prices all influence pricing. In general, though, items such as engines and landing gear, APUs, thrust reversers, integrated drive generators (IDGs), Air Data Inertial Reference Units (ADIRUs), and avionics systems tend to hold the highest value at end of life."

As is becoming more apparent, engines seem to be top of the list, with Daniel Tautges and Kensuke Nakamura in accord with many others. Tautges suggests that "...engine assemblies and individual engine modules can account for a significant portion of total asset recovery value," but acknowledges that there are other assets including "...APUs, landing gear systems, avionics, flight control components, and certain high-demand rotable parts.

James Bennett, Chief Commercial Officer, AerFin

Components with extensive traceability records, recent overhauls, or remaining service life and aircraft in-service rates tend to command premium pricing. Market demand also plays a major role, particularly for components supporting aircraft types that remain in active service globally." According to Nakamura, "Engines account for most of the value of retiring aircraft. But, other than engines, components with the highest value can be APUs, landing gears or nacelles, subject to aircraft type, market demand and the maintenance condition of such components." However, Eoin Doherty also recommends we look beyond engines on an aircraft for high-value components such as: "landing gears, APUs and the avionics. On certain aircraft types, nacelles (thrust reversers, inlet cowls, etc.) can also hold a vast amount of value. For landing gear, driving factors of price tend to be the number of overhaul intervals or cycles operated. For APUs, the main driver is usually life remaining on the LLPs." Meanwhile, Greg Creekmore suggests that engines are typically the largest value driver, acknowledging, like Eoin Doherty, that " ...APUs, landing gear, avionics, and other high-demand rotables generally retain the strongest aftermarket value. Components with high replacement costs, long repair cycles, or limited availability tend to perform best in the USM market. Serviceable material supporting active fleets is especially valuable because airlines and MROs rely on it to reduce maintenance costs and avoid long OEM lead times. Ultimately, the parts that retain value are the ones operators consistently need to keep aircraft flying economically and efficiently."

While acknowledging that engine parts retain highest value, Valentina Pilshchikova notes that: "not all engines retain the same value." She is then quite blunt when she makes it very clear that: "When an OEM tightly controls the repair market, the end-of-life residual value of the engine (which should normally represent up to 80% of the aircraft's value) can be significantly impacted. I will not name and shame monopolistic aftermarket OEMs, but I will praise the fair and wise approach of CFM and GE Aerospace. They have an open aftermarket network, which allows them to overcome the teething issues of new engine programmes more effectively and ensures product longevity by preserving asset value at the end of life. It also enables more competitive maintenance and repair costs compared to a fully controlled environment, which remains the business model of some competitors." To round this section off, while in agreement with everyone else in terms of engines and nacelles, landing gear assemblies, etc., James Bennett makes a very prudent comment, pointing out that: "Value retention is heavily influenced by fleet size, aircraft popularity and operator demand. Components from in-production aircraft with large active fleets generally maintain stronger values than those from older or less widely used platforms. Ongoing trading activity across the aftermarket provides valuable insight into which assets continue to demonstrate the strongest liquidity and demand throughout their lifecycle."

How do operators and lessors maximise returns from used serviceable material (USM)?

Here Lindsay Cooper give us a clear insight into what happens at AJW Group, placing emphasis on the fact that "... maximising USM returns requires a disciplined, data-driven approach from the outset." She continues: "Our teams begin with a rigorous initial appraisal to establish the aircraft's baseline value, calculating remaining green time, and conducting a thorough condition assessment. This foundation is critical. From there, we develop a detailed harvest list, leveraging both historical performance data and current repair costs alongside fair market value (FMV) analysis. This allows us to

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build a comprehensive business case and project a realistic return on investment before we commit our resources. What many don't appreciate is the importance of a complete aircraft and records audit. We meticulously establish the full maintenance history because this directly impacts aftermarket resale value. Components with documented, clean maintenance records can deliver a high return in the secondary market. It's not just about what a part is, it's about proving what it's been through. When it comes to disassembly, our process is thorough. We begin with external components, then systematically progress through internal systems, avionics, and high-value equipment. We cross-reference every component against its associated paperwork and maintenance documentation. This traceability is invaluable as it substantiates airworthiness, supports regulatory compliance, and ultimately commands better pricing from operators and MROs seeking certified material." Beyond this, Daniel Tautges makes an interesting point in that "Successful USM strategies begin with comprehensive asset planning before an aircraft is retired." He then further explains: "Operators and lessors maximise returns by identifying high-demand components, ensuring complete maintenance records, and carefully managing removal, inspection, and certification processes. Technology plays an increasingly important role in this process. Modern aviation ERP systems such as Quantum Control help organisations maintain traceability, manage inventory lifecycles, monitor repair costs, and gain visibility into component demand across their operations. Having accurate data readily available enables companies to make informed decisions about whether to repair, stock, exchange, or sell a component. Ultimately, maximising USM value requires balancing component repair costs, market demand, certification requirements, and inventory holding periods while maintaining full regulatory compliance and asset traceability."

Eoin Doherty sees the ability to sell on OEM in 'installation-ready' condition as vital when looking to maximise the value of parts. "In order to get maximum value from line components after teardown, components are sent to a repair facility to be repaired or overhauled. The seller can then provide material that is ready to be installed on another aircraft or engine, which allows them to sell at higher prices, especially during critical and AOG requirements. In addition to this, it is important to have high-quality technical documentation supporting this material. Poor paperwork can often have pricing implications, especially on life-limited parts," he cautions. Beyond this, Greg Creekmore identifies four important factors when looking to maximise returns on USM, namely "...strong documentation, an effective repair strategy, timing, and market visibility." He backs this up by stating that "Components with complete traceability, clean maintenance records, and solid repair history consistently achieve higher values and sell faster in the aftermarket. Repair decisions are also critical. In many cases, investing in the right repair or overhaul can significantly increase a component's resale value and expand the buyer pool. Understanding real-time market demand is equally important so operators and lessors can prioritise high-value inventory. Platforms like ILS play a major role by providing market intelligence on pricing, availability, and demand trends while giving sellers global exposure to airlines, MROs, OEMs, and distributors actively sourcing material. That visibility helps improve inventory turns and maximise overall USM returns."

Beyond maintaining pristine back-to-birth traceability, Valentina Pilshchikova places further emphasis on operators to "...balance maintenance reserves and LLP residual life. On CFM engines, LLPs with cycle remaining (CR) above 8,000 cycles will have excellent remarketing potential compared to LLPs with only 4,000 cycles remaining. The market becomes extremely narrow with lower-cycle LLPs, as it makes little sense to build an engine capable of running 10,000 cycles with a limiting LLP stack of only 4,000 cycles. In such a case, you effectively waste 6,000 cycles of the engine's economic and performance life. Beyond these fundamentals, maximising returns from USM is primarily about inventory management. At Vallair, our Material Management & Trading department focuses on identifying high-demand parts and optimising stock levels accordingly. Over the long term, selling serviceable parts individually from aircraft teardowns often generates higher value than selling the entire aircraft. The key is getting the timing right: parts must be available for immediate delivery when demand and pricing are at their peak."

David Strockbine makes it very clear that: "To maximise returns from used serviceable material (USM), operators and lessors must ensure they are utilising the most effective end-of-life monetisation strategies available. This requires a strong understanding of market demand, asset condition, repair economics, and timing. He adds that: "Organisations can manage this internally or partner with industry specialists such as Aero Engine Solutions (AES), which supports operators and lessors through tailored end-of-life monetisation and consignment programmes. At AES, we have spent the past decade developing strategic relationships across the supply chain, including MROs, operators, lessors, and aftermarket buyers. These partnerships enable us to optimise asset disposition strategies and maximise value recovery for our customers." To conclude this section, James Bennett puts it very succinctly:

Valentina Pilshchikova,
Engines & Parts Trading Sales Manager, Vallair

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"Operators and lessors can maximise value from the USM market in two key ways: by reducing maintenance and transition costs, and by generating revenue from surplus assets and aircraft." He then goes on to say that: "Airlines and lessors are increasingly using USM as a cost-effective alternative to new OEM parts without compromising safety, reliability or regulatory compliance. Serviceable components are inspected, certified and returned to service at a significantly lower cost than new material, often delivering savings of between 30 and 70 percent. Beyond the lower acquisition cost, USM can help reduce inventory investment, mitigate supply chain disruptions and minimise aircraft-on-ground time by providing faster access to replacement components. This is particularly valuable for mature fleets, where new parts may be expensive, subject to long lead times or no longer be readily available. Repair exchange programmes can provide additional savings. In these arrangements, an operator receives a serviceable replacement component immediately and, provided the removed unit can be successfully repaired, only pays the repair cost and an exchange fee. This helps maintain operational continuity while reducing maintenance expenditure. Operators and lessors can also generate value by selling surplus aircraft, engines and spare parts into the USM market. As aircraft approach the end of their operational life, selling assets to specialist aftermarket companies such as AerFin can often unlock greater value than continued storage or operation. Maximising returns depends heavily on the quality of the accompanying records. Complete traceability, accurate maintenance documentation and robust airworthiness records all enhance marketability and can significantly increase the value achieved when material is sold. By combining strong asset management practices with an understanding of market demand, operators and lessors can optimise both the cost-saving and revenue-generating opportunities offered by the USM market."

Engine removed from aircraft
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Eoin Doherty, Vice President of Pricing, EirTrade Aviation Ireland Ltd

What role do engines, APUs and landing gear play in overall asset recovery economics?

The recurring theme from contributors here is that engines, APUs, and landing gear are recoverable assets with the highest value. As Daniel Tautges at Component Control says: "In many teardown projects, engines alone may represent the largest portion of recoverable value due to their high replacement costs and ongoing demand for serviceable modules and piece parts. Landing gear assemblies are similarly valuable because they undergo regular overhaul cycles and can remain economically repairable for extended periods. APUs often provide attractive recovery opportunities due to their widespread use and relatively consistent aftermarket demand. The condition, maintenance history, and remaining life of these assets significantly influence whether a retirement project achieves its expected financial return." EirTrade's Eoin Doherty and Greg Creekmore at Inventory Locator Service concur with Tautges, particularly in relation to landing gear. "Landing gear, especially, can have huge value in the USM market if freshly overhauled. Engine LLPs also have substantial value, depending on the asset type and life remaining. Modules can be repaired and sold whole or completely torn down and LLPs sold individually. This can hold significant value, and shortages will typically drive the price higher in the aftermarket," Doherty shares with us. Similarly, Creekmore comments: "Engines, APUs, and landing gear are the primary drivers of aircraft asset recovery value and often determine whether a teardown is financially viable. Engines

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typically represent the largest share of recoverable value due to remaining LLP life, maintenance status, overhaul economics, and strong global demand across active fleets." He then underlines that: "In many cases, the engines alone can justify the teardown," before concluding: "APUs and landing gear also generate significant recovery value because of their high replacement costs and steady aftermarket demand. Operators and MROs frequently seek serviceable or repaired units to avoid expensive new equipment purchases and long OEM lead times. Together, these high-value assemblies form the foundation of most teardown business cases and largely determine the profitability of the asset recovery process."

Valentina Pilshchikova at Vallair feels that engines, APUs, and landing gear "... can represent 80-85% of the total value of the asset," adding that: "their condition, remaining life, and demand have a direct impact on overall recovery economics." Beyond engines, at AerFin Ltd James Bennett also agrees that "Landing gear and APUs provide additional high-value recovery opportunities, supported by mature overhaul, repair and exchange markets. Together, these assets can account for a substantial proportion of an aircraft's recoverable value, while the remaining airframe components contribute further incremental returns." He then adds: "At AerFin, detailed valuation and recovery modelling of these assets plays a central role in acquisition, leasing and teardown investment decisions, helping ensure that each asset is managed to deliver the strongest possible outcome."

David Strockbine at Aero Engine Solutions is slightly more conservative than Valentina Pilshchikova. While acknowledging like everyone else that engines, APUs, and landing gear are typically the most significant value drivers in the overall end-of-life monetization of an aircraft, he feels that: "...these assets can account for approximately 50% to 70% of the total recoverable value, with engines representing the largest share." He then goes on to say that: "Engine value is influenced by factors such as remaining life on LLPs, maintenance status, market demand, and engine variant applicability across active fleets. Similarly, APUs and landing gear assemblies can generate substantial value due to their high replacement and overhaul costs. As a result, the condition and marketability of these major assemblies often play a decisive role in determining the overall recovery strategy for an aircraft asset." Lindsay Cooper then explains that for AJW, the focus isn't solely on dismantling aircraft. Instead, she makes it very clear that where engines, APUs and landing gear are concerned, "... the discipline lies in managing all three simultaneously, understanding not just their individual value, but how they interact across market cycles." She goes further: "Timing is critical. So is technical insight, particularly around maintenance condition, documentation, and traceability. Effective asset recovery isn't about dismantling aircraft; it's about unlocking value. Engines, landing gear, and APUs are the levers we pull but it's the strategy behind how and when we pull them that differentiates a transactional teardown from a truly optimised recovery programme."

How do MRO capabilities influence the decision to repair versus scrap a component?

As with many areas involving MRO and spare parts, there is no one-size-fits-all solution to many challenges, and whether to repair or scrap a recovered component depends on a number of individual factors. In the opinion of Eoin Doherty and Valentina Pilshchikova, market demand is the principal driver. As Doherty puts it: "Repair decisions are driven by the demand for components as well as the cost to repair or overhaul these units. In order to get maximum value, high-demand material is commonly sent to the repair shop to be tagged. Once those parts undergo their inspections, they will sometimes be deemed outside of limits, damaged or unrepairable. This would usually drive the decision to scrap the part depending on the findings from the repair vendor. In some cases, parts can be sent to alternative shops for DER (Designated Engineering Representative) repairs, depending on the demand for these types of parts." For Pilshchikova: "The first consideration is market demand. If a part is slow-moving, it may be preferable to keep it in 'repairable' condition and only repair it on demand. Another approach is to maintain one serviceable set ready for immediate use while holding the others in "as removed condition" or scrapping them if the market is oversupplied. If the MRO team can restore the component safely, quickly, and cost-effectively, the part is given a second life. If not, it retires gracefully. The decision ultimately comes down to balancing cost, turnaround time, and technical feasibility."

From a different perspective, the key factor for Greg Creekmore is very straightforward as, in his opinion: "The decision is based on repair cost, turnaround time, material availability, and the projected market value after repair. If a component can be repaired economically and there is strong aftermarket demand, repairing it usually provides a better return than scrapping it. If repair costs exceed the component's market value or turnaround times are too long, scrapping may be the better option. ILS helps operators, lessors, and MROs make these decisions by providing real-time

> **"ILS helps operators, lessors, and MROs make these decisions by providing real-time market pricing, inventory availability, and demand data for repaired material across the global aftermarket."**
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> *Greg Creekmore, Regional Sales Manager – Americas, Inventory Locator Service*

Greg Creekmore, Regional Sales Manager – Americas, Inventory Locator Service

market pricing, inventory availability, and demand data for repaired material across the global aftermarket." James Bennett expands further: "A part that has limited value in an unserviceable condition may become highly marketable once repaired, recertified and returned to the supply chain. When assessing repair opportunities, asset managers evaluate repair costs, turnaround times, the likelihood of a successful repair, expected post-repair value and current market demand. These factors are weighed against the value that could be achieved by selling the component in its current condition or scrapping it altogether. Access to approved repair schemes, engineering expertise, OEM support and experienced MRO partners can significantly improve recovery outcomes. In many cases, these capabilities allow components that might otherwise be discarded to be restored as commercially viable inventory, extending their useful life and generating additional value."

David Strockbine makes several valid points, in particular noting that the capability of the MRO operator can also affect the decision whether to repair or scrap a part. "While all MROs operate in accordance with OEM inspection and repair criteria, some facilities offer more advanced or strategic repair solutions that can significantly improve repair economics," he says, continuing: "In recent years, OEMs such as CFM have supported asset owners and MRO providers by allowing more targeted and 'surgical' inspection and repair approaches during engine maintenance events. These strategies can help reduce unnecessary maintenance costs while preserving component value. Selecting an MRO with strong technical capabilities and flexible work scope management can therefore have a direct impact on reducing repair expenses and extending component life. Ultimately, repair-versus-scrap decisions must align with the component's intended operational mission and the economic viability of returning it to service." Lindsay Cooper and Daniel Tautges are also of a like mind, with Cooper noting from a personal perspective the difference having in-house capabilities can make on the decision-making process. As she tells us: "Where an organisation has in-house repair capability, engineering approvals, and test infrastructure, as AJW has with its MRO facility AJW Technique, it can often repair components at a lower cost and with greater control over turnaround time. This shifts the decision in favour of repair, allowing recovery of assets that others might consider uneconomic. On the other hand, reliance on external shops introduces higher costs, longer lead times, and less certainty, which then may push the decision toward scrapping the component. Depth of the MRO's capability also matters. Advanced diagnostics, DER repairs, and access to part pools can unlock value from components that would otherwise be written off. AJW Technique's strong MRO capability supports the Group's operations and directly expands our pool of recoverable USM." Tautges echoes Cooper as he points out that: "Organisations with in-house repair capabilities, specialised tooling, technical expertise, and established repair approvals may be able to restore components at a lower cost and achieve higher resale values. Equally important is access to operational and financial data. MRO software platforms such as Quantum Control provide visibility into repair history, labour costs, material consumption, inventory availability, and component profitability. This information allows organisations to make more informed decisions regarding repair versus replacement and helps identify when a component may no longer be economically viable. The ability to accurately assess repair costs, expected resale value, turnaround times, and market demand is critical in determining the most economically advantageous outcome."

Kensuke Nakamura, SVP, Business Development, Werner Aero LLC

At what point does a component become "beyond economical repair" (BER)?

Opinions on this aspect are all remarkably similar, in that the crossover point is where, as Greg Creekmore puts it: "...the cost to repair, overhaul, or recertify the part exceeds its realistic market value or expected return after repair. While the component may still be technically repairable, the economics no longer support the investment." He adds that: "BER decisions are based on factors such as repair cost, turnaround time, remaining service life, replacement availability, and current market demand. Companies often use historical data and market intelligence tools like ILS to evaluate pricing, inventory availability, and demand for replacement material. This helps operators, lessors, and MROs compare repair costs against actual aftermarket values and make more informed BER decisions." Kensuke Nakamura at Werner Aero LLC gives a slightly deeper insight, telling us that: "we should consider the repair cost, repair slot availability at the MRO, and repair turnaround time (TAT). Repair costs have been increasing recently, and I would say that 70% is one criterion for BER. When the repair cost reaches 70% of the replacement acquisition cost in the market, it becomes difficult for the repaired component to generate profit." Similarly, James Bennett looks at the

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Retired aircraft © Shutterstock

problem in greater depth, suggesting that: "A component is generally considered beyond economical repair when the cost, complexity and risk of returning it to service exceed the value that can reasonably be recovered once the repair is complete. This assessment takes into account a range of factors, including repair and overhaul costs, material replacement requirements, remaining useful life, market demand, the availability of alternative serviceable units and any uncertainty around the repair process itself. For example, if a component requires a repair costing US$50,000 but is only expected to achieve a market value of US$30,000 once repaired, it would typically be classified as BER. However, this threshold is not fixed. During periods of supply chain constraint or material shortages, aftermarket values can rise significantly, making previously uneconomic repairs commercially viable once again. As a result, BER is often a dynamic commercial assessment rather than a purely technical determination, influenced by both market conditions and the availability of repair solutions."

David Strockbine confirms that the determination to repair or discard USM Is determined based on such parameters as repair costs, material availability, turnaround time, remaining service life, and current market pricing for serviceable or overhauled units. He then points out that "One advantage of working with AES is our broad market access and inventory availability. In situations where serviceable or overhauled units are limited, AES can often provide an 'as removed' (AR) replacement unit and manage the inspection process to determine whether it can be restored more economically than the original component. This approach helps customers minimise maintenance costs while maximising asset recovery value." Daniel Tautges adds further valuable insight into the BER debate when he comments that: "As aftermarket values fluctuate, a component considered BER today may become economically repairable in the future if supply shortages or market conditions change. For this reason, BER evaluations increasingly rely on real-time operational and operational market data"

Eoin Doherty also highlights that if there is a shortage of a particular component which then drives the price upwards, it becomes more unlikely for a part to be deemed BER, he adds useful further insight when remarking that there are, however, "...some components which tend to have expensive repair costings due to the need for replacement subcomponents within the part itself. If these subcomponents are expensive to source, it becomes more difficult to repair the unit without it being deemed BER," while to conclude, both Lindsay Cooper and Valentina Pilshchikova sum up BER in respective nutshells. According to Cooper: "BER is less a fixed point and more a commercial judgement, balancing technical feasibility against realisable market value at a given moment," though Pilshchikova sees it as: "... fundamentally, a straightforward economic analysis."

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