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October / November 2015

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**Saving the Bottom Line:**

# DER Repair Alternatives

By Charlotte Adams

*High material cost savings compared to the use of new parts, higher repair rate, a longer durability of the parts and better performance are some of the benefits of DER repairs like the one shown here, according to MTU Maintenance experts. MTU image.*

Operators have an array of choices when it comes to deciding what to do about worn or damaged parts. Among the options are buying a new part from an original equipment manufacturer (OEM), having the part repaired by an OEM-affiliated repair station, buying a new Parts Manufacturer Approval (PMA) component from a non-OEM source, and obtaining a designated engineering representative (DER)-approved repair. The choice depends on factors such as the age of the aircraft, the part's warranty status, the cost of the various options, and the likely turnaround times for part delivery or repair approval. DER repair suppliers include MROs, PMA parts suppliers, and OEMs at various levels of the food chain.

## If a part can be repaired,

the DER route may be the most cost-effective way to go, particularly if the airplane is out of warranty and the part is complex, costly, and difficult to obtain in a timely manner. A DER repair is a repair process and configuration that has met all the specifications for development, performance, reliability, and safety, and has been validated and certified by an FAA-authorized DER, explains John McKirdy, vice president, commercial aerospace global accounts, for Chromalloy, a supplier of new parts and DER repairs for aircraft engine components. Within the ranks of DERs the repair specification-DERs (RS-DERs) provide additional flexibility, as they can both evaluate how to do a repair and approve the repair.

The FAA has approved only a small number of independent RS-DERs (between 32 and 70), says Dominick DaCosta, chief operating officer of the Delegated Engineering Service Group, an independent DER consultant firm. The number depends on how they are counted. For example, one DER can have more than one RS-DER delegation disciplines such as, Chart A [Structures], Chart B [Powerplant], Chart C1 [Mech Systems], and Chart E, [Engines], making the count appear somewhat higher if those individuals are counted more than once. These private individuals designated by the FAA are in essence review agents for the agency, he says. The very restricted number of RS-DERs is unfortunate because these designees "are really more needed than anything else we've got because so many field approvals could be subject to RS-DER work," says Jason Dickstein, president of the Washington Aviation Group law firm.

RS-DERs focus on major repairs, as minor repairs of very limited scope can be performed by a repair station in coordination with its local FAA Flight Standards office. But the RS-DER has to run any major repair to an engine, wing, or landing gear through the FAA, says Sarah MacLeod, executive director of the Aeronautical Repair



Complex mechanical assemblies, such as this 737 flap carriage, lend themselves to refurbishment using DER repairs, according to Able Aerospace. Able photo.

Station Association (ARSA). This is explained in the FAA's "DER Handbook," Order 8110.37E, DaCosta says. Normally, the RS-DER must coordinate with the Flight Standards District Office (FSDO) that oversees the applicant, DaCosta says, referring to Section 4-13 (e) of this Order. So even if a project falls within the RS-DER's authority, the FSDO who oversees the applicant repair facility must be aware of and be able to monitor that applicant's new activities.

DER repairs have to conform to the same airworthiness standards as new OEM parts or OEM manual repairs in order to maintain the same level of safety, says Dan Rose,



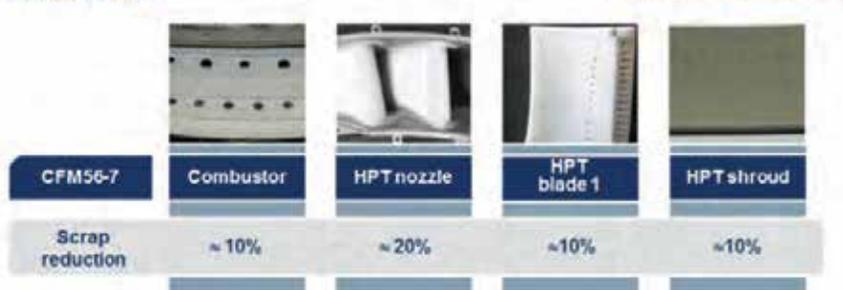
Dan Rose  
Chief Engineer,  
Able Aerospace



Dominick DaCosta, COO  
Delegated Engineering  
Service Group

The image above shows a high pressure turbine blade uncoated, coated and with the MTUPlus Erosion-Resistant Coating, a repair designed in house at MTU.

### MTUPlus repair – Benefits Example CFM56-7



#### Savings potential (per engine, operational life: two runs / shop visits)

- **Shop visits:** - up to \$350,000 material scrap savings combining MTUPlus Repairs  
- repair price reduction savings
- **Between shop visits\*:** up to \$100,000 SFC savings

Notes: Results based on an STC study compared to alternative repair sources. Individual results may vary due to individual thrust and environmental conditions.

### MTUPlus repairs – Benefits Example V2500-A5



#### Savings potential (per engine, operational life: two runs / shop visits)

- **Shop visits:** - Over \$800,000 material scrap savings combining MTUPlus Repairs  
- repair price reduction savings minus investment in ERCcoat<sup>TM</sup>
- **Between shop visits\*:** up to \$280,000 SFC savings

Results based on an STC study. Individual results may vary due to individual thrust and environmental conditions.

These two charts show the cost advantages of MTUPlus repairs versus the use of new material over the operational life of the engine if it comes in for two regular shop visits. The first calculation is made for a V2500-A5, including the proprietary repairs we have available, the second one is calculated for a CFM56-7B engine. MTU images.

chief engineer for Able Aerospace, a leading developer of PMA parts and sister company to Able Engineering, an MRO that applies DER-approved repair processes. The minimum requirement is to restore a part to its original function and level of safety, he says. Able's PMA and engineering arms support each other in DER activities.

DER repairs are most common in the engine area because these assemblies are high-cycle and under great service stress, DaCosta says. Auxiliary power units (APUs) would be next, along with landing gears, which are used all the time and subject to repetitive buffeting and loads.

Many DER repairs also involve airframes. The cost of the material – usually steel, titanium, or aluminum — may be lower than the cost of material for some engine parts but, if the piece is big, a repair to it will involve a lot of stress calculations. So the cost of developing the repair design for an airframe part may be relatively high.

The cost savings associated with PMA parts and DER repairs, vs. new OEM parts, are significant. A PMA part costs around 60 percent of a new OEM part, while a DER repair may be 15 to 40 percent of the OEM part cost, Rose explains. DaCosta also cites 40 percent cost savings. "Nobody's going to do DER repairs unless they get at least 40 percent cost savings," he says. Working with DERs and RS-DERs also frees operators from OEM control, DaCosta says.

DER turnaround time is another typical advantage. DER approvals are "a whole lot faster and more cost-effective than going to an OEM to do something," says Jocy Prochaska, business manager for DER Associates, a consulting DER firm. Some structure issues can turn in a day she says, referring to the analysis and approval of the data—the paperwork supporting a repair process. DER Associates works with a wide range of fixed- and rotary-wing aircraft. The company has worked with planes with everything from bullet holes to softball-sized hail damage, she recalls.

Whereas a new OEM part might take three to six months to be delivered, a DER repair for the part can be implemented in 30 to 45 days, Rose says. Able Engineering's current "toolbox" includes more than 10,000 DER repair approvals accomplished over the last 25 years. Rose estimates that over the last five years Able DER repairs have saved its customers some \$400 million as compared with what it would have cost to buy new OEM parts.

### Running the Gamut

DER repairs cover the whole gamut of aviation, including fixed-wing and rotary-



Pastor Lopez, CEO of PEMCO World Air Services

wing aircraft and engines, airframes, and components. Good opportunities for DER repairs include high-value parts that may have wear or light surface corrosion, Rose says. Others include complex mechanical assemblies, such as flap carriages, that lend themselves to refurbishment. Life-limited engine parts would be a less favorable opportunity for DER repairs, he says, because sometimes the OEM is really better positioned to evaluate these issues. Lower-value parts

and consumables like brake pads or polymer seals represent better opportunities for PMA solutions.

DER repairs can involve highly complex tasks. Pastor Lopez, CEO of PEMCO World Air Services, recalls work on a legacy carrier's 757 with damage to a vertical stabilizer rear spar door panel. PEMCO contacted Boeing with a proposed repair, but the repair was denied and Boeing recommended ordering a new door panel, he says. The new door panel had a 90-day lead time and cost \$16,000.

PEMCO elected to request a SMAL (Spares Material Authorization Letter) which approves the one-time manufacture of an OEM part in accordance with production drawings. The production drawing for this door panel called out a special chemical milling procedure to remove minor amounts of unnecessary material for weight savings purposes, Lopez says. "PEMCO could not accomplish this particular process during the fabrication process, so we elected to fabricate the part per a production drawing, using a solid constant thickness aluminum sheet."

An FAA DER reviewed and approved this change through a form 8110-3, Lopez says. This repair saved the operator approximately \$13,000 and 80 days of out-of-service downtime. In PEMCO's experience DER repairs are most cost-effective for airframe maintenance and in many instances for component maintenance, he says.

As an example of its portfolio, Able Engineering has DER repair approvals on 747 flap carriages, the mechanical assemblies that are used to raise and lower the flaps on the wings. The older 747s – the classics and even the 747-400s – are essentially out of production, Rose says, "so you probably couldn't even buy an OEM flap carriage [for them] today." OEMs tend to focus their resources on delivering new aircraft, so they try to work with networks of maintenance providers to come up with solutions, including DER repairs, he says. Able, for example, works with Boeing to help the OEM's customers on this issue, he says. OEMs also buy Able Aerospace PMA parts if they don't have the appropriate components on the shelf. Able Engineering also does FAA-approved DER repairs on 737 flap carriages.

### Bearings

Bearings are also a good DER opportunity. Timken manufactures new bearings, but the company also overhauls used bearings from various OEMs. When Timken Aerospace Bearing Repair receives a bearing for overhaul, it performs an extensive inspection process (both visual and dimensional), cleans up the raceways, replaces the rolling elements, and re-plates the retainers. This overhaul process is accomplished via an FAA-approved DER repair procedure or under a blanket FAA approval called C747, explains Greg Diem, sales specialist.

Timken's turnaround time for bearing overhaul is approximately 15 days, whereas the time to manufacture a brand-new bearing can be over a year, Diem says. Of course there are distribution networks that can deliver new parts in much less time, but a repaired bearing typically costs 50 percent or less than a new one. If a new bearing costs \$1,000, it typically costs about \$500 to get it overhauled, he says.

An overhauled bearing's reliability is equal to that of new manufactured parts, Diem says. "Some of our customers, who have done their own analysis, ... have mentioned [that] the overhauled bearing runs quieter in operation than [a] new bearing," he says.

### Engines

DER repairs are also very cost-effective in the engine arena, as apart from the cost of fuel, engine maintenance is typically an operator's largest expense. Two leading providers of DER engine repairs are Chromalloy and MTU Maintenance, a unit of the engine manufacturer, MTU Aero Engines. Chromalloy, which also supplies new engine parts to major OEMs, generates about 200 new repairs per year. MTU Maintenance provides FAA- and EASA-approved high-tech repairs that meet the most stringent standards with its MTUPLUS line of services, according to the company.

DER Repairs can range from equivalent OEM book repairs to advanced repairs that often go beyond the basic book repairs found in the engine manual to provide enhanced value in terms of lower maintenance cost and enhanced performance, Chromalloy's McKirdy says. Chromalloy DER repairs are offered for gas turbine engine components and are available throughout each module of the engine. The company has "a robust pipeline driven by customer demand," he says.

Although Chromalloy does not perform DER repairs on life-limited engine parts, its DER repairs are all for the hot section or gas path of the engine. DER repairs provide operators with significant cost savings and in many cases with increased reliability and enhanced engine performance, McKirdy says.

Chromalloy performs DER repairs on parts, such as blades, vanes, shrouds, segments, combustors, honeycomb, and cases, he says. Company DER activity covers engine models, including: legacy engine platforms, such as the JT8D, CMF56-3, JT9D, and CF6-50; mature engine platforms, such as the PP2000, PW4000, CF6-80, CFM56-5C, and V2500; and emerging/new engine platforms, such as the CF34-8/-10, CFM56-5B/-7, and the V2500 Select.

The concept of repair vs. replace is logical, proven, and supported by FAA approvals, McKirdy says. "We have teamed with operators on specific solutions that have reduced overall expense while improving on-wing time by as much as 20 percent - that's meaningful to any operator." In addition to DER repairs, the company provides OEM book repairs, OEM-licensed repairs, and repair support directly to the OEMs, "helping them manage their cost on contract maintenance programs." Chromalloy partners with OEMs on authorized repairs and works directly with MROs and operators.



DER Associates, a consulting DER firm, says it has worked with a wide range of fixed- and rotary-wing aircraft, repairing planes with everything from bullet holes to softball-sized hail damage, like the one shown here. DER Associates image.



DER repairs to CRTs can substantially benefit operators of older aircraft. Thomas Global images.

## Keeping CRTs Flying

Another area that lends itself to DER repairs is the cathode ray tube (CRT)-based displays found in older aircraft. Keeping these displays in good condition is a big concern for operators, says Andrew Hutchinson, president, USA, for Thomas Global Systems. The company supports major airframe manufacturers, using DER repairs of flight deck CRT displays. A recent presentation at MRO Network described the company as “the last man standing for CRT support.”

CRTs have a life of about five years, Hutchinson explains. A CRT needs repair after that time, including a new tube, but certain components can be reused. Thomas Global Systems provides both line replaceable unit (LRU) overhaul and CRT subassembly repair, Hutchinson says. “In most scenarios a unit will arrive in the shop with the display light output being dull or the image burnt into the screen.” In these cases the company will remove the CRT subassembly from the LRU assembly and break down the CRT subassembly into its core components, replace the CRT with a brand-new one, and reassemble the subassembly with all the retained components, he explains.

### MTU Maintenance

MTU Maintenance’s DER repairs come under its MTUPlus services line. “The advantages ... for our customers are manifold,” says Frank Haberkamp, vice president repair services for MTU Maintenance. These repairs, developed in-house, greatly “increase the cost-effectiveness of a maintenance work scope as opposed to replacement [with] new parts,” he says. “The techniques we use give expensive engine components a second, third, or even fourth lease on life.”

Apart from high material cost savings compared to the use of new parts, these repairs provide customers “a higher repair rate, longer durability of the parts, and better engine performance,” Haberkamp says. He cites the example of a new V2500 HPT blade 1, which costs nearly \$10,000 on the market. “With our MTUPlus Tip Protection repair, the blade can be salvaged for only slightly over \$1,000.” MTU Maintenance develops repairs for engines such as the V2500-A5 and the CFM56-7B.

“The subassembly will then be electrically set up, tested, run in, and then assembled back into the LRU, which will then go through a full CMM [component maintenance manual] release process, ensuring all of the other circuit card assemblies/ components are functional and airworthy.” The LRU is then released with an 8130/Form 1, he says.

Customers who have the internal capability to overhaul the LRU only send the company the CRT subassembly. In these cases the CRT assembly is released with an 8130/Form 1. The company provides LRU overhaul capability on a range of Bombardier, Fokker, ATR, Boeing, and BAE aircraft as well as on the Sikorsky S-76 and various corporate aircraft platforms. It provides CRT support for all the CRT-based products listed on its Web site, [www.thomas-global.com](http://www.thomas-global.com). Hutchinson envisions the CRT repair business lasting until the mid-2020s. The company has secured a supply of replacement CRTs through lifetime buys.

Thomas Global Systems also offers plug-and-play LCD upgrade solutions for aircraft, including the Boeing 757 and 767, SAAB 340, Embraer EMB-120 Brasilia, Beechcraft King Air, Dassault Falcon, Gulfstream, Hawker, and Learjet, he says.

DER repairs can be alternatives for existing OEM repair solutions that may be economically or technically unattractive, he says. DER repairs, moreover, can be the only available repair solution, if the OEM decides not to offer one. “Generally speaking, our DER repairs provide an alternative with a better outcome as compared to the standard repair. This can be in terms of costs, operational performance, materials used, etc.”

MTU Maintenance, along with other players in the repair market, believes there is room for growth in the DER repair sector. Part of MTU’s independent MRO offerings includes a service called MTUPlus New Engines Solutions. This is aimed at customers who are operating engines such as the V2500 or the CFM56 and provides alternative services which lower their operational costs significantly, Haberkamp says. The service combines individual work scoping with MTUPlus repairs, which results in extended part life, improved HPC/HPT efficiency, lower specific fuel consumption, and longer on-wing times, he says. **AM**