



Happy landings

Wheels and brakes require the most removals.
Photo: Flybe Aviation Services

The increasing fleet size globally and evolving new technologies are driving growth in the aircraft wheels and brakes market. **Keith Mwanalushi** looks closer at this growing sector.

Industry reports indicate that the aircraft brake system market is projected to grow from US\$6.08 billion in 2017 to US\$8.42 billion by 2022, at a CAGR of 6.71% during the forecast period.

Carbon brakes are set to account for the bulk of the demand – “This can also be seen at Magnetic MRO, where the majority of brake systems that go through our workshop are carbon brakes,” observes Raili Mägi Workshop Manager at Magnetic MRO.

Richard Jowett, AerFin VP Purchasing and Programmes has similar views saying the industry is seeing an evolution from steel brakes, to carbon which has increased life on wing and reduced removals, weight and therefore gaining fuel savings. Another trend is electrical braking systems on the 787 which is the latest technology. “Carbon brakes are more able to control the heat and wear created by landings and thus longer life. Jowett refers.

Lufthansa Technik’s wheel and brakes have its core business on the European market due to the logistical challenges for which it has developed bespoke solutions. “With our new factory in Frankfurt East, Lufthansa Technik has set itself up to expand its market leader position while sustaining future growth,” says Sven Duve, Senior Director

Closed Loop Fulfilment Aircraft Component Services.

The sheer number of travellers, a shift towards more fuel efficient, environmentally friendly and larger capacity aircraft are driving the necessity for a change in the way brakes are designed, produced and perform.

Hans Laudon, VP General Manager of Wheels and Brakes at Honeywell Aerospace says customers are looking for brakes that function with longer maintenance intervals and ultimately help to reduce aircraft operating costs and greenhouse gas emissions. “Honeywell’s advancements in brake design and Carbenix friction materials is meeting this demand while deployed across a wide breadth of platforms, including the world’s largest airliner, the Airbus A380,” he says.

Based on component, the brakes segment of the aircraft brake system market is projected to grow at the highest CAGR during 2017 to 2022 according to industry projections. The growth of this segment can be attributed to the high demand for carbon brakes and technological advances in braking systems, such as electric braking.

Wheels and brakes require the most removals and this will supposedly present some challenges to aircraft operators, especially with regards to maintenance.



Wheels and brakes need a lot of attention as they are crucial to landings.
Photo: Direct Maintenance

"Wheels and brakes need a lot of attention as they are crucial to landings," states Mägi from Magnetic MRO. "They need to be maintained at a specific interval and also according to regulatory rules like all other components." She adds that environmental conditions such as a wet, sandy or snowy runways, climate as well as human factors all play a big role in the state of wheels and brakes and how often they should be maintained.

Duve says removals and its causes are inherently different to that of a normal component, and make the operation more prone to its effects. "This means that operators need to plan wheel or brake changes within the allotted maintenance ground times such as a night stop."

The wheels aspect of the business is highly seasonal. During the peak summer months the increased temperatures result in higher wear of the tyres alongside the increased cycles operated by the aircraft, Duve notes. Inversely, the winter period, subsequently drives high stock levels. "Both of the above require the operator to allocate his stock in an optimum way giving maximum stock availability throughout his flying programme.

"As an MRO you need to ensure that the output and supply and availability is given, which are only possible through a stable output and high reliability of your facilities. Flexibility in staffing is also key as these factors enable you to act quickly to any changes in both the market, operator or weather conditions, while being economic on the approach," Duve explains.

Jeffrey Becker, Director, CRO and Manufacturing Services, Airborne Maintenance and Engineering Services, Inc. (AMES) adds that the problem mostly comes with predatory pricing from the brake OEM's. "Over the last several years they have increased the prices for brake replacement parts while reducing the price for brake repairs and overhauls sent to their facilities. This makes it more difficult for operators as they are basically forced to ship brakes to OEM repair and overhaul facilities only."

Laudon from Honeywell Aerospace feels the most common maintenance removals are to service the wheels by changing to a fresh tire tread. Honeywell has also led the development of boltless wheels through its advanced fighters such as F18, F22 and F35 such that new air transport designs can reliably benefit from less parts to streamline wheel maintenance.

In addition, Laudon says brake Landings-per-Overhaul (LPO) life needs to be predictable and maximised in order to reduce brake overhaul intervals. "Honeywell continuously works to improve carbon brake life performance with advanced carbon process technology, design for heat management, and leading anti-oxidant systems."

Jowett, from AerFin feels that actually, the wheels and brakes are amongst the most predictive components on the aircraft to forecast removals and therefore easier to negotiate support contracts if not supported by internal workshop capability and also to calculate level of inventory to purchase.

"Wheels are dictated to by the expected life of the tyre and operational environment, most tyre manufacturers have a pretty good idea on performance and can provide a guaranteed landing expected on nose and main," Jowett states.

With brakes, he says as you can measure wear pin or have the a/c provide wear pin reading (787) you can calculate and forecast removals fairly accurately. "We do this on the TUI fleet.

"Being able to calculate removals allows you to understand how many tyres you are likely to need, how many brake removals so you can negotiate with an MRO provider based on fairly accurate data and the MRO can calculate a rate for services based on this data, other airframe components are on condition so more unpredictable in number of removals expected, plus there's +1000 PN's to consider."

With regards to the trends in landing gear technologies Nick Filce, AerFin Director-Regional Sales and MRO notices that technology is constantly evolving with the manufacturers striving to achieve reduced weight and life cycle costs whilst maintaining high performance and an extended life. "The development of high strength materials, active damping systems, increased use of composite material and moving away from hydraulic to electrical actuation systems help achieve these goals and will also assist in moving towards a 'on condition' based maintenance.

"From the manufacturers, this inevitably filters down to companies such as AerFin supporting the equipment since our material and logistical requirements change to meet the differing demands on wheel, brake and component removals," he says.

Mägi stresses on the need to keep up with operators' needs: MRO responsiveness and adaptability to change with demand.

"This is obviously not only tied to landing gear technologies," she indicates. However, as brakes and wheels are components with significant maintenance requirements, she adds that the MROs need to be able to adapt to change rapidly and adopt a "what-operators-need-we-train-staff-mentality" to provide service to as wide a variety of operators' wheel and brake assemblies. "Magnetic MRO



Railii Mägi Workshop Manager at Magnetic MRO

Workshop has adapted this responsive mentality, and also knowledge to offer different capabilities for wheel and brake assemblies exactly where customer's needs lie," Mägi affirms.

Honeywell is able to use value analytics based on aircraft operational and component wear data to identify ways to operate the aircraft more efficiently while providing feedback to further improve landing gear, wheel and brake design models. The connected system of components also reduces workload in routine dispatch checks such as tire pressure and condition and remaining brake life (wear pin) and to proactively share monitoring data to predict maintenance requirements by identifying component health and associated fleet operating trends.

"These advances are providing new insights that allow Honeywell to collaborate with airlines and MRO's to reduce troubleshooting time and maintenance costs, reduce fuel-related operating costs and improve overall aircraft availability," Laudon stipulates.

In addition, he adds that RFID technologies have been developed to levels of robustness to reliably enhance asset tracking and management of spare components that improves spares logistics accuracy, reduces inventories and speeds up repair turnaround times – therefore saving the airline money and time while making flying safer and more efficient for the passenger.

Larry Montreuil, VP Asset Management and Business Development at Werner Aero Services says airlines are increasingly relying on used surplus material (USM) to lower maintenance costs. He mentions the most economic source of USM is from aircraft teardowns. Werner Aero Services, a specialist in the acquisition and disassembly of end of life aircraft is a leading provider of USM to airlines, MROs and other suppliers. "The material we harvest from these aircraft is refurbished through our network of high quality repair agencies for use to support direct sale or pooling programmes for operators."

Wheels and brakes like all aircraft components are subject to strict regulatory regimes, as will all components that can be made serviceable, they are subject to following the CMM (component maintenance manuals) issued by the OEM and any work is released under EASA or FAA or CAAC or combinations etc. depending on the operators requirement and regulatory regime. Jowett says: "Wheels can have tyre changes up to four to five occasions and then on the next visit an OH, brakes can have similar intervals or be OH on each shop visit, dictated by the CMM or increased frequency introduced by the operator."



Duve says removals and its causes are inherently different to that of a normal component.
Photo: LufthansaTechnik

Duve from Lufthansa Technik indicates that wheels and brake components are subject to the same requirements as any other aircraft component and part, which is key for the safety of the product and its usage. "For wheels and brakes a pressure test and visual inspection form the basis



Magnetic MRO offers different capabilities for wheel and brake assemblies

of this, and are maintained in the history of this individual component."

"Certification should be always very stringent as it is the last document that will be released for the specific component after repair," continues Mägi. "Moreover, if a component is released with a certificate it is certain that it can be used in the way that it is supposed to. Before certificate release various tests should proceed depending on the condition of the component and customer needs. At Magnetic MRO we release certificates only when all is clear with the component concerned and it passes all tests."

Laudon notes that components are tested to demonstrate that they can meet stringent requirements under the most extreme conditions with factors of safety beyond typical aircraft service levels.

"Each level of the wheel and braking system are tested from individual component parts, to sub-assemblies and to full integrated assembly to ensure that aircraft qualification requirements are met with consistency when subjected to various unique conditions," says Laudon.

He further states this qualification testing includes laboratory testing through to full aircraft flight-testing of components to determine performance. "One of the most demanding qualification tests is the simulation of a rejected take-off whereby the braking system is subject to the energies of take-off abort with engines in full thrust." The testing qualification of wheels and brakes play a particularly vital role as they take the brunt of landing a 575 metric tonne aircraft in various conditions.

Certainly, airframe OEMs and regulatory agencies will define these extreme conditions to include all possible environmental and operating conditions that the aircraft may experience. "Hundreds of thousands of braking cycles and tens of thousands of miles of wheel testing are used to certify that these essential components are up to the task with repeatable performance," Laudon concludes.