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UK Aerospace Maintenance, Repair,
Overhaul & Logistics Industry Analysis

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RESEARCH

The views expressed in this report are the authors' and do not necessarily reflect those of the Department for Business, Innovation and Skills.

Contents

Preface.....	6
Executive Summary	7
1. Introduction.....	10
Key Research Questions.....	10
Methodology and Structure of Report.....	11
2. The MRO and Logistics Industry	12
MRO Capability Classification	14
Airframe Class MRO Activities	15
Aircraft Engine MRO Activities	17
MRO Organisation Types.....	18
The Cost of MRO Services.....	20
MRO Regulatory Framework.....	21
3. UK MROL Sector Analysis	25
4. Number and Type of UK MROL Companies.....	29
Location of UK MROL Organisations.....	29
Segmentation of Approved MRO Organisations by Company Size	33
Summary of Findings	41
5. UK MROL Sector Revenues	43
6. UK MROL Sector Employment.....	45
Licensed Aircraft MRO Engineers	46
7. Segmentation by Type of MRO Organisation.....	49
Segmentation and Location of Airline and Operator MROs	50
Segmentation and Location of OEM MROs.....	51
Segmentation and Location of Independent MROs	52
8. MRO Sector Feedback.....	54
Market Feedback Summary	54
UK MRO Skills: Summary from Focus Groups	55
9. Opportunities for UK MROL Industry Growth and Competitiveness.....	57
References	58

Appendices	60
Methodology used to determine the MRO Sector Size and Scale	60
Information provided by Companies House.....	63
Office of National Statistics - Annual Business Survey	65
Factors that can influence the MROL Sector	67
Full Companies – MRO Employment and Revenues.....	71
Questionnaire.....	74

Figures

Figure 1: MROL - ONS Related Industry Statistics	7
Figure 2: Typical breakdown of total operating cost for a commercial aircraft operator	20
Figure 3: Aircraft maintenance cost breakdown.....	21
Figure 4: Structure of the EU Regulations Relating to Civil Air Transport.....	22
Figure 5: UK MROL Organisations	27
Figure 6: Location Map of All MROL Companies.....	30
Figure 7: Location Map of Large MROL Companies.....	31
Figure 8: Number of MoD and EASA Approved MRO Organisation Types	32
Figure 9: Locations of EASA Part 145 MRO Companies.....	37
Figure 10: Location of MoD (MAA) MAOS Part 145 MRO Companies	38
Figure 11: Locations of Part 147 Training Organisations	40
Figure 12: Locations of Logistics Companies	41
Figure 13: UK MROL Sector Revenues Methodology	44
Figure 14: UK MROL Sector Employment	45
Figure 15: Continuous Aircraft Airworthiness Engineer Privileges	47
Figure 16: MRO Organisation Type Segmentation	49
Figure 17: Location map of Airline and Air Transport MROs.....	51
Figure 18: Location Map of OEM MROs.....	52
Figure 19: Location Map of Independent MROs	53
Figure 20: MRO Sector Analysis Methodology	62

Tables

Table 1: Classification of ONS SIC 33.160 Companies	27
Table 2: Classification of Companies not included in ONS SIC 33.160	27
Table 3: Total number of UK MRO Sector Companies by size	29
Table 4: List of MRO Services by MRO Type	33
Table 5: UK EASA Part 145 MRO Companies	33
Table 6: UK MoD MAA Part 145 MRO Companies	33
Table 7: UK EASA Part 147 Training Organisations.....	33
Table 8: UK MRO Logistics Companies.....	34
Table 9: Breakdown of UK Part 145 Approved Companies by Capabilities or Class.....	34
Table 10: Breakdown of EASA Part 145 MRO Services by Capability or Class.....	36
Table 11: Breakdown of UK MOD MAOS Part 145 Size	37
Table 12: Breakdown of MAOS Part 145 Approved Companies by Class	38
Table 13: Breakdown of MAOS Part 145 MRO Services by Class.....	39
Table 14: Breakdown of UK Part 147 Training Companies	39
Table 15: Breakdown of UK MROL Logistics Companies by Size	40
Table 16: Total UK MRO Sector Revenues.....	44
Table 17: UK MRO Sector Revenues by Company Size	44
Table 18: UK MRO Sector Employees by Company Size	45
Table 19: Total Number of Employees in the UK MROL Sector	46
Table 20: Type of MROL Organisations.....	50
Table 21: Airline and Operator MROL Size	50
Table 22: Airline and Operator MROLs Employment.....	50
Table 23: Airline and Operator MROLs Revenues	50
Table 24: OEM MROLs Size	51
Table 25: OEM MROLs Employment.....	51
Table 26: OEM MROs Revenues.....	52
Table 27: Number of Independent MROLs.....	52
Table 28: Independent MRO Employment	53
Table 29: Independent MRO Revenues.....	53
Table 30: Description of Companies House Classification of Companies.....	63
Table 31: Detailed ONS Annual Business Survey Statistics for SIC Code 33.160.....	65
Table 32: ONS Aerospace Manufacturing, Aircraft Maintenance and Air Transport Statistics.....	66
Table 33: MRO Employment and Revenues (Full Accounts) not in ONS SIC 33.160	71

Preface

As Chair of the ADS MROL I welcome the publication of this report and the insight it provides to a significant industry sector.

The report confirms that the MROL sector is a major contributor to the UK economy in terms of industrial activity and economic output, with the involvement of an estimated 57,000 employees, a turnover of £15 billion, and the participation of over 1,300 companies. While a significant element of this is through the support activities of Original Equipment Manufacturers, there is an appreciable independent contribution in a wide range of service provision. Both sides of the sector have exciting growth opportunities and are subject to the challenges of new technologies and changing market dynamics.

The sector is complex and dynamic, and UK organisations demonstrate significant world class capability. The fact that it is a high value added, and both knowledge and service lead, enables the development of global opportunities that are platform agnostic. This capability which has not always been widely recognised should help industry develop internationally through the delivery of innovative support solutions to platform operators in technologically advanced areas.

The analysis within the report highlights the scale of the sector and further develops the understanding of it. Hopefully this will help inform the ongoing Aerospace Growth Partnership and the Defence Growth Partnership activities.

The ADS MROL Network has independently identified a number of key drivers for the future evolution of the sector which align well with the findings of this report. The areas, identified below, offer real challenges for the industry, but also provide significant opportunities for innovation, development and growth, in a global marketplace.

- Improved market data for the MROL sector
- Composite Non Destructive Testing and Repair
- Aircraft data management for improved prognostics and maintenance service provision
- UK industry strategy for aircraft end-of-life management
- Skills development in support service delivery and management
- Engagement at the top of the aerospace supply chain, with Airline/Operator organisations

This BIS report captures the industry feedback and highlights the need for a greater consideration of the service opportunities of the aerospace industry. It will broaden the understanding of the importance of a key element of the product life cycle, promote a dialogue as to how the UK can expand its scale and international presence, and hopefully develop the engagement with the platform operators upon whom we depend. The study supplements the annual UKTI Global Aerospace Outlook, providing the opportunity for cross fertilisation of the analyses which will in turn better inform all stakeholders.

Tim Rice - Chair of the ADS Maintenance Repair Overhaul and Logistics Network

Executive Summary

The purpose of this research was to develop a better understanding of the size, nature and scale of the UK MRO and Logistic Aerospace sub-sector and the growth opportunities associated with it.

The UK has a 17 percent global market share in aerospace industry revenues, which is the largest in Europe and second only to the US in worldwide terms. In terms of MROL we find that there are over 1,300 companies supporting the UK Maintenance, Repair, Overhaul and Logistics (MROL) sector. Together these companies have a turnover of around £15 billion, and they employ around 57,000 people in the UK.

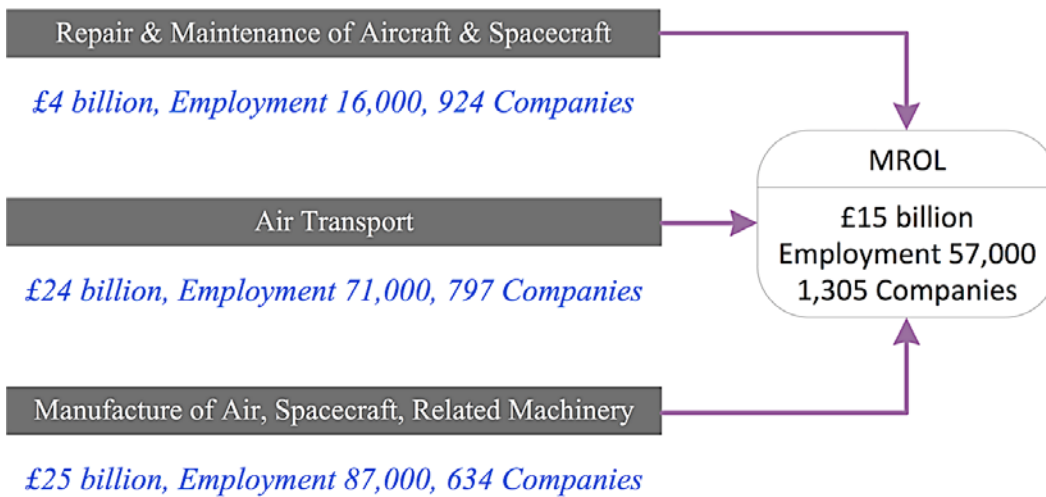


Figure 1: MROL - ONS Related Industry Statistics¹

Original Equipment Manufacturers (OEMs) provide a significant MRO contribution to the UK with 68 percent of the MROL revenues and employment. They are predominantly large companies.

A significant proportion of the 1,305 MROL organisations are small companies who comprise seventy-two percent (72 percent) of the total MRO organisation population. Eleven percent (11 percent) of the MRO companies have not submitted any financial reports to either HMRC or Companies House. We infer that these companies can therefore be considered as new entrants to the sector. Latest figures from the UK Civil Aviation Authority state that there are over 32,000 EASA/CAA licenced MRO engineers.

Independent MROs have no affiliation with an OEM, air transport operator or airline and they contribute 22 percent to the MROL sector. In this case approximately 40 percent of the Independent MROs are SMEs. The airline or air transport operator owned MROs contribute the least with only 10 percent of the MROL sector. SMEs in this group provide a minor contribution.

¹ In this report we are only counting part of the air transport and manufacture of air categories.

In Europe and the U.S. maintenance costs are falling whilst in Asia, labour rates are moving in the opposite direction, a trend that has affected the MRO market in 2014 and appears to be continuing beyond. With labour rates offering a more level playing field, the UK MROL industry has an opportunity to compete effectively by leveraging competitive differentiators such as:

- Highly qualified workforce
- Superior workmanship quality
- Spare part security and integrity
- Advanced tooling and sophistication in processing composite materials
- Utilisation in electronic aircraft health diagnostics – remotely in flight and in situ.
- Growing investment in R&D and Innovation
- Cabin refurbishment and Inflight Entertainment (IFE) Expertise

The key challenge for UK MRO sectors is to prepare and position attractively for the more technology intensive aircraft, for example:

- Increased use of composites and advanced materials – the Airbus A350XWB and Boeing 787 aircraft typically have a composite material content reaching 50 percent by aircraft weight.
- Increased use of electrical power as opposed to hydraulics and pneumatics, in aircraft such as the Boeing 787
- Introduction of health monitoring, diagnostic and prognostic technologies – e.g. Rolls Royce use real-time Engine Health Monitoring to track the health of engines worldwide.
- Enhanced cabin environment and interiors, such as cabin lighting, noise reduction, improved air quality, in-flight connectivity, cabin Wi-Fi, and inflight entertainment systems on the A380 and B787.

These trends represent both a threat and an opportunity for the UK MROL industry. Due to these and other technology advances, the modern airframes, engines and systems are becoming less man-hour intensive but are requiring new test equipment and processes with the associated investment and capital expenditure.

National policy and regulatory intervention can play an important role in the competitiveness, ability to invest and growth potential of the UK MROL industry, whether it is enabling investment into facilities, technological innovation, facilitating local or regional clusters or further promoting a dedicated vocational or apprenticeship track that is visible, available, and recognised for delivering the skills the MROL industry needs.

Conclusions:

- There is some consensus that the UK MROL sector is highly regarded throughout the world for: the quality of its work; its aerospace heritage; having a highly skilled, knowledgeable and flexible work force; and the presence of an effective regulator with good excellent regulatory compliance.

- The majority of the larger MROs endorse the need for on-going training through apprenticeship schemes
- In an international market place, the UK MROL sector is thought to have a particular strength in the provision of high value, sophisticated and advanced MROL services. Building on this capability, the UK MROL industry has the potential to make a significant contribution to the UK Government's intention to double UK exports to £1 trillion by 2020.

1. Introduction

This report was commissioned by BIS to provide a better understanding of the size, nature and scale of the UK MRO and Logistic Aerospace sub-sector and the growth opportunities associated with it. This report assesses and describes the size, scale and characteristics of the MROL sub-sector, its contribution to the UK economy, as well as future growth opportunities.

This report takes a rigorous bottom-up approach to overcome the prevalent lack of accurate quantitative and qualitative data for the MROL sub-sector, particularly with respect to independent and operator-owned MROL providers.

The Aerospace Industrial Strategy – Lifting Off: Implementing the Strategic Vision for UK Aerospace, published in 2011 recognised that MROL is a key capability in the UK and an area where demand is likely to grow. The UK Aerospace Growth Partnership (AGP)² has already made commitments to support R&D activity in areas of MROL, which relate to aerospace design, engineering and manufacturing. Additionally, it identifies specific skills requirements for the MROL community. The report specifically mentions that Maintenance, Repair and Overhaul (MRO) is an area where demand is likely to grow and is a key capability in the UK aerospace sector with services including:

- Composite materials in-service support repair and disposal.
- Integrated health management technologies - data and information management,
- Aircraft and equipment recycling and deployment
- Availability of skilled and licensed personnel

Key Research Questions

The purpose of this report is to provide a rigorous, in-depth study of MROL activity in the UK, including its geographic distribution, its contribution to the UK economy and future growth opportunities. The report also provides an evidence base which the MROL community may use to refresh its original national strategy, published in 2010, and for government to consider appropriate future support for this sub-sector.

In doing so it seeks to address the following key questions:

1. What is the size and scale of the aerospace MROL sub-sector in the UK (by value, employment, numbers of providers)?
2. How does the sector break down by category (airline-owned, OEM-owned, independent).
3. What is the spatial distribution of companies and where are the significant geographic clusters located?

² www.theagp.aero

4. What are the significant economic opportunities for the sector in the short and medium terms?
5. What are the barriers to growth for the sector in the short and medium term?

Methodology and Structure of Report

The research focused on obtaining, collating and analysing information and opinions from the following sources to establish the size and MROL industry players. As MROL is a key activity to ensure a safe and effective air transport system, many organisations do not provide MRO services exclusively but as a supplement to normal business activity. The research relies on the expert judgement and industry knowledge of the researchers in assessing data from the various sources listed below to meet the project objectives.

1. The UK Office of National Statistics
2. The UK Civil Aviation Authority
3. Ministry of Defence
4. UK Companies House
5. Extensive Desk Research
6. Meetings with MRO Industry representatives.
7. Questionnaire sent to MRO providers licensed by the CAA.

The report focuses initially on the quantitative characteristics to provide an indication of the size and scale of the whole sector, followed by a qualitative review of the market findings based on research, market discussions and feedback from a questionnaire.

The report is structured by providing an initial overview of the whole MRO industry that includes both the civil and military aviation sectors. It covers the regulatory structure and provides a breakdown of how the sector is segmented by capability, ownership and characteristic of the operator. It includes the MoD, airlines, and corporate or business aviation as well as the specialist operators.

This is followed by a section providing a methodology on the quantitative analysis to determine the size, scale and segmentation of the UK MROL industry.

Section 4 provides the size and scale of the MROL sector and a breakdown of the organisations that release airworthy aircraft into service. Sections 5 and 6 provide the total UK MROL sector revenue and employment levels along with a breakdown by type and size of company.

Section 7 provides a sector break down by category (airline-owned, OEM-owned, independent) and includes a further breakdown into the size and value of the SMEs and large companies.

Section 8 summarises the results from the questionnaire and meetings held with several MROL companies and interest groups.

Finally Section 9 considers the opportunities for government.

2. The MRO and Logistics Industry

Aircraft maintenance, repair and overhaul (MRO) is an integral and essential part of the whole aircraft lifecycle. MRO covers both scheduled maintenance to keep the aircraft airworthy on an ongoing basis as well as unscheduled or unplanned maintenance due to damage, component and engine failures, mandatory modifications, and upgrades to the cabin interior, systems and other components.

The Maintenance, Repair, Overhaul and Logistics (MROL) sector refers to organisations involved with the maintenance, repair and overhaul of aircraft and associated systems and components and continues throughout the life of an aircraft from its initial entry into service through to its ultimate disposal.

The MROL sector services or activities include the following activities:

- Maintenance that relates to the process of preserving a complete aircraft in an airworthy condition.
- Repair or replacement of damaged items that do not function properly.
- Overhaul that relates to reconditioning a system that has deteriorated due to worn out parts or degradation in performance or strength to their original characteristics.
- Logistics that relates to the resale of serviceable and airworthy components, engines, aircraft parts and structures, such as flaps and engine cowlings. Logistics organisations carry all these items as serviceable parts and supply them at a premium price as and when they are needed by the operator operating anywhere in the world. This service relieves some operators of the cost and logistics of carrying an extensive parts inventory in stores, which may never be used.

Operators demand that their aircraft are either fully utilised in commercial service to maximise revenues, or be available at short notice for use when required by the military or business aviation operators. This places a lot of pressure on aircraft maintenance and support organisations to be efficient, minimise costs and prevent unexpected aircraft unavailability. This is set against a background of the high cost of keeping spares, complying with the regulations, employing suitably skilled staff, maintaining a high residual aircraft value, and gaining access and time on the aircraft to carry out any maintenance or support activities both at the home base and at destinations served by the fleet.

While having the common objective of keeping aircraft airworthy and operational the MRO activities are tailored to suit the specific requirement of each individual type of operator, which are discussed in greater detail below:

- **Airlines, air transport and cargo operators** operate schedules that require high levels of utilisation, service availability and minimum cost. Because of their high utilisation and capital costs, they require a significant amount of MRO support and are the largest MRO revenue generators of the whole MRO sector. They operate large fleets of aircraft and many of them are on lease, which requires that they are

maintained to a high level to maximise their value, according to the requirements of the lessor, who own the aircraft.

They require MRO support throughout their operating network. Line maintenance and minor maintenance and repairs may be required at remote destinations. More significant maintenance and repair activity would necessitate deferring the maintenance by either flying the aircraft back to its main operating base or, in the event of the aircraft becoming un-airworthy, making arrangements for the necessary MRO work to be carried out on site. This could require a team of engineers and spares being flown out to the aircraft or relying on local resources from other airlines or operators.

- **Corporate, VIP or business aviation operators** require the availability of their aircraft to fly to diverse destinations at short notice. These aircraft are typically owned by companies or high net worth individuals. This sector operates expensive and the most sophisticated aircraft, systems and engines and while they do not fly as much as the airlines their contribution to the MRO is important.
- **Helicopter operators**, unlike the airlines, operate locally within a relatively small area of operation such as the North Sea. They are not capable of flying the long distances that are typical of airliners and other fixed wing aircraft. Thus, they require full MRO capabilities to be established on-site at the remote operating base where they are based. The location of such MRO facilities is therefore driven by where helicopter operators are contracted to operate. Helicopter MRO is typically more labour intensive than fixed wing MROs, due to their higher mechanical complexity, and the harsher operating environment. Light or small helicopters typically operate within 150 miles of an MRO. Heavy or large helicopters, such as those used on the North Sea operate within 300 to 400 miles of an MRO.
- **Military aircraft operators** require high service availability and reliability of very complex and expensive aircraft ranging from helicopters, transport aircraft, fighters, drones (UAVs) and special mission aircraft. These aircraft operate in harsh and hostile environments. Their MRO activities are carried out at their home base as well as in operational areas such as the MoD's former Camp Bastion base in Afghanistan. While they do not fly as much as the air transport aircraft, their contribution to the MRO sector is significant.
- **Special Mission operators** that include air ambulance, police helicopters, research aircraft and surveillance operators also require MRO support. This sector is relatively small in terms of the overall MRO industry and its MRO sector contribution is typically included in either the Military or Air transport sector MRO activities (e.g. The UK Meteorological Office, FAAM (Facility for Airborne Atmospheric Measurements) operate a BAe 146 aircraft owned by BAe Systems).
- **General Aviation operators** include leisure operators of privately owned light aircraft, who also require MRO support. This sector is also relatively insignificant in terms of the overall MRO industry and has not been specifically included in this study. This sector is not as intensive as the aircraft transport sector, where aircraft may typically fly less than 600 hours per annum as opposed to airline long-haul, airline short-haul, and North Sea helicopters flying typically 4,500hours, 3,000 hours

and 1,500 hours per annum respectively. Also general aviation aircraft cost significantly less than an airline aircraft (a Boeing 787 costs US\$120 million³ compared to a top range general aviation single engine turboprop Pilatus PC12 costing US\$ 4.5 million and a single piston engine Cessna Skyline light aircraft costing \$0.5 million⁴). This means that their MRO costs for the general aviation sector are significantly lower.

MRO Capability Classification

To carry out MRO work on aircraft, requires what is called 'Part 145 Approval' or its equivalent that is provided by the national aviation authority in which an aircraft is registered. In the UK, both the Civil Aviation Authority under the authority of the European Aviation Safety Agency (EASA) and the MoD Military Aviation Authority (MAA) approve Part 145⁵ maintenance organisations to carry out MRO work on UK civil and military registered aircraft respectively. These Part 145 approved maintenance organisations are classified according to their capabilities or specialities according to their approval Class and Rating.

The approval Class is based on the aircraft major subsystem is classified as ⁶:

1. Aircraft (Airframe)
2. Engines
3. Components
4. Specialised (Non Destructive Testing or Evaluation, welding etc.)

This means that Part 145 organisations specialise in the type of MRO services they provide according to their Part 145 approval Class and Rating. In most cases the approval Class also includes a specific list of engine models or aircraft types that the MRO may support. Several MROs have several approvals classes to cover various type of MRO capabilities such as 'Aircraft' and 'Components'.

Within each approval Class the scope of approval is further subdivided down into various categories identified as a Rating. For example Aircraft Rating A1 refers to Aeroplanes whose take-off weight or mass exceeds 5,700 kg. Similarly, Rating A3 covers helicopters, Rating B1 Turbine Engines, and Rating C5 for Components refers to aircraft electrical power and lights.

Each independent approval Class or capability has to satisfy the following MRO objectives:

1. To ensure the inherent safety and reliability levels of the aircraft are maintained.
2. To restore the inherent aircraft safety and reliability when deterioration has occurred.

³ Aviation Week and Space Technology, 5 March 2015.

⁴ Business and Commercial Aviation, May 2013.

⁵ The MAA approve military Part 145 organisations under Maintenance Approved Organisation Scheme (MAOS) and refer to their organisation as MAOS Part 145 approved.

⁶ The capabilities of EASA MRO activities are defined according to EU Commission Regulation 12/2010 (5 February 2010)

3. To obtain the necessary information for design improvements of those items whose inherent reliability proves to be inadequate.
4. To maintain these goals at a minimum total cost, while maximising aircraft service availability (i.e. minimise the time an aircraft is taken out of service).
5. Minimising unplanned or unscheduled maintenance, which would disrupt operations and create logistic and resource problems if such maintenance has to take place away from the operator's base.

MRO service providers whose class includes Airframe and Engine require EASA licensed engineers to release aircraft into service. The engineers carry the full responsibility of ensuring the airworthiness of aircraft before and during flight. Component MROs do not require licensed engineers as they release systems and components into service by virtue of their organisation approval with the EASA through the CAA and operating an approved quality management system.

Airframe Class MRO Activities

MRO typically covers routine or pre-planned maintenance which is typically scheduled according the numbers of hours flown since the last maintenance activity, the number of cycles (number of take-offs and landings) or the age of the aircraft.

MRO activities are categorized as follows:

1. Line or ramp maintenance
2. Base or heavy maintenance
3. Unscheduled Maintenance and Aircraft Recovery
4. Integrated fleet management
5. Other services

Line maintenance

Line Maintenance⁷ covers any maintenance that is carried out before flight to ensure that the aircraft is fit for the intended flight. The aircraft is visually inspected and its aircraft logbook is checked for entries relating to system problems, failures or other maintenance requirements identified by the flight crew. It is normally carried out overnight or during down time during the day, when the aircraft is not flying, and averages 2 man-hours. Line maintenance may include troubleshooting, defect rectification and component replacement with use of external test equipment if required. Component replacement may include components such as engines and propellers.

⁷ According to EASA - AMC 145.A.10 Scope definition.

It can also include:

- Scheduled maintenance and/or checks including visual inspections that will detect obvious unsatisfactory conditions/discrepancies but do not require extensive in depth inspection. It may also include internal structure, systems and powerplant items, which are visible through quick opening access panels/doors.
- Minor repairs and modifications, which do not require extensive disassembly and can be accomplished by simple means.

Base Maintenance

Base or Heavy Maintenance is normally carried out in a hanger and covers a range of checks and MRO activities. Every operator has different maintenance schedules and procedures that relate to their specific operations.

Base or Heavy maintenance for airlines and other air transport operators has a range of 'lettered' checks from a simple A-check through to a comprehensive D-Check. The type of check required depends on the number of hours the aircraft has flown since its last check, the age of the aircraft, and the number of cycles (take-offs and landings) carried out. These checks are labour intensive and require taking the aircraft out of service resulting in lost revenues and aircraft availability.

These 'letter checks' typically include:

0 A-Check

This check is carried out approximately every 80 to 100 aircraft flight hours, which is every 7 to 9 days. It needs about 10 to 20 man-hours and is usually performed overnight while the aircraft is at the gate or in a hangar.

1 B-Check

The B-check is a more thorough maintenance check and is normally carried out every two months (approximately 500 to 600 aircraft flying hours). This maintenance is carried out in a hangar and requires approximately 100 to 300 man-hours depending upon the size and complexity of the aircraft.

2 C-Check

The C-Check is very thorough and comprehensive. Virtually the entire aircraft goes through an exhaustive series of checks, inspections and overhaul work. The C-Checks typically occur every two years and require 10,000 to 30,000 man-hours, depending on the aircraft type and take two to four weeks to complete.

3 D-Check

This check is the most comprehensive and occurs approximately every 6 years. It is a check that, more or less, takes the entire airplane apart for inspection and overhaul. Such a check can usually demand up to 50,000 man-hours and it can generally take up to 2 months to complete, depending on the aircraft and the number of technicians involved. It must be performed at a suitable maintenance base.

There is a recent trend to include some D-Check work in each C-Check and try and eliminate the D-Check, to improve the availability of the aircraft for commercial service.

D-checks would normally be carried out at a heavy maintenance and engineering facility such as at British Airway's Engineering in Cardiff and Monarch Engineering at Luton.

Unscheduled Maintenance and Aircraft Recovery

Unscheduled MRO activities may occur away from the home base. If the unscheduled unserviceability is due to a critical component, system or an engine the operator may declare the aircraft as AOG (Aircraft on Ground), which places a high priority on the supplier to expedite the shipment of a replacement part, which would be exchanged onsite by an approved organisation or technician. Repair to damaged aircraft may require a specialist team to travel to the damaged aircraft and carry out the repair locally on-site or decommission and scrap the aircraft.

Integrated fleet management

Integrated fleet management is an umbrella MRO service where the operator hands over responsibility for the fleet airworthiness to the MRO. The MRO can act in partnership with the operator and influence the timing and availability of serviceable aircraft.

Other services

This includes providing added services like operator maintenance planning and specific campaign-based services across the fleet, like painting aircraft to support specific events like the Olympics, to upgrading the cabin and in-flight entertainment systems. Cabin and IFE system upgrades are currently very popular and will provide significant MRO revenues in the near and medium term.

Aircraft Engine MRO Activities

Modern aircraft engines are among the most reliable systems installed on aircraft. Typically they are kept operating on the aircraft up to a specified hour limit, as long as they are operating within predefined operating parameters or conditions such as vibration levels, fuel flows and temperatures etc. Advances in engine trend monitoring, means that these parameters are monitored continuously throughout the flight to ensure the engine's safe operation and to predict when maintenance is required in advance of any problems or failures occurring. Besides visual inspections, technicians monitor the internal condition using boroscopes and oil sample spectrographs. This helps keep costs down and minimises unnecessary maintenance particularly when engine MRO is the most expensive of all the MRO activities.

Engine Maintenance is carried out either while mounted on the aircraft wing (on-wing services) or at an approved maintenance facility (off-wing). It includes the MRO of the aircraft engines as well as APUs (Auxiliary Power Units), which are small gas turbine engines installed on the aircraft that provide electrical power and compressed air to the aircraft whilst on the ground, without the need of using the main engines or an external ground power unit. APUs are also required to provide on-board power in the case of an all-engine out condition - although a rare occurrence, an APU was instrumental in US Airways

Flight 1549's Airbus A320 ditching into the Hudson River when both engines stopped working.

Component MRO Activities

Component MRO activities are typically carried out by the manufacturer or organisation that are approved to carry out maintenance work on a particular component. Since components are interchangeable unserviceable components can be exchanged with serviceable items. Components that undergo MRO are released with a certificate of airworthiness and can either be installed on an aircraft or kept in storage as spare items for later use.

Specialised MRO

These organisations provide specialist services that support the airframe, engine and component MROs. They can include welding, non-destructive evaluation (NDE), non-destructive test (NDT), specialist manufacturing of parts, X-ray and other testing services.

MRO Organisation Types

The aftermarket or MRO organisations are categorised according to their relationship with the aircraft operator and manufacturer.

They can be provided by the:

1. Original equipment manufacturers (OEM), who provide MRO services.
2. Aircraft operators or Airlines, who carry out the MRO themselves;
3. Independent MRO service providers who provide MRO service independently of the OEM or aircraft operator.
4. Related companies that support the MROs

Original Equipment Manufacturer (OEM) MRO Organisations

Some equipment manufacturers or OEMs provide aftermarket product support as a value added service throughout the product life cycle for the engines, systems or components they manufacture and supply. This characteristic is more prevalent in the engine and component product support markets than in the airframe manufacturing sector. OEMs that provide MRO services include GE Aviation, that supplies aircraft systems and engines, as well as Rolls-Royce that manufactures and supports aircraft engines.

Aircraft Operator Or Airline MRO Organisations

Most airlines and other air transport operators provide their own MRO services particularly for line maintenance. The larger operators also provide heavy maintenance services. Some of these, such as British Airways Engineering and Monarch Engineering support both their own airlines MRO activities but also resell their MRO services and capabilities to other airlines.

Independent MRO Organisations

These organisations are independent of either the OEM or the airline and contract out their services to operators. They include MROs that can carry out heavy maintenance such as Marshall of Cambridge Aerospace who support a lot of the heavy maintenance on helicopters and transport aircraft for the MoD. They are very dependent on receiving maintenance data and IP from the OEMs, to be able to provide MRO services. They are increasingly being challenged by the OEMs desire to capture the aftermarket revenues by not releasing maintenance and IP information that is necessary to provide MRO services, to the Independents. The revenue stream of Independent UK MROs contains an increasingly larger proportion generated by support of legacy aircraft, engines and components, where there is intense competition to secure MRO contract work.

MRO Related Organisations

As stated earlier, a Part 145 approved company is authorised to release an aircraft as being serviceable after any work is carried out on it. Many of these EASA, MAA (Military Aviation Authority) MAOS (Maintenance Approved Organisation Scheme) Part 145 organisations rely on other companies to supply spares and service, replace or repair components or other subsystems. These suppliers have neither MAA MAOS Part 145 nor EASA Part 145 approvals themselves, but go through an approval process, managed by the Part 145 organisation to become their approved suppliers on the basis they meet certain criteria such as using an aviation accredited Quality Management System such as EN-ISO 9001 or EN-9110. These MRO related companies contribute to the MRO sector activity, as they are part of the whole MRO service supply chain.

They include the following companies:

1. Component and Systems suppliers of non-aviation specific products such as medical equipment for air ambulance operators.
2. Approved suppliers to the Part 145 organisations. These include specialist component manufacturers, suppliers, agents, distributors, dealers of aircraft approved systems and components as well as contractors, design engineers and MRO licensed engineers. These organisations are typically assessed by the Part 145 organisations and the MoD in accordance with their quality management system. If they meet the criteria they become approved suppliers to the MRO.
3. Non-approved companies employing licensed aircraft engineers and other support personnel, which are contracted out to the MRO Sector.
4. Manufacturers, who are approved suppliers to the Part 145 MROs, who operate a suitable Quality Management System such as AS9100, which is a widely accredited quality management system standard for the aerospace industry.
5. Companies who provide MRO services to smaller general aviation (light aircraft) that exclude business or corporate aircraft.

The Cost of MRO Services

MRO costs are a significant proportion of the total aircraft cost of ownership and MRO services can span more than 30 years for a particular aircraft. The typical value of MRO and the aftermarket support is estimated to be 80 percent of the total aircraft life cycle cost. As an example, the Boeing 747-400 aircraft entered service in late 1989. This aircraft is currently still in service with British Airways and Virgin Atlantic (26 years later). Throughout its service life the aircraft goes through several scheduled maintenance cycles, repairs, upgrades, replacement and overhaul of engines, systems, aircraft structures and other components.

British Airways, for example, depreciate their aircraft to periods of between 18 and 25 years⁸. Their engines are depreciated to periods that range between 26 and 78 months (just over 2 to 6.5 years), and their cabin interior modifications are depreciated over 5 years. The implications are that an aircraft will go through several engine replacements or overhauls and several cabin interior refits, in addition to the routine MRO activities that are necessary to keep the airframe and systems airworthy on a day to day basis.

The typical cost breakdown for a commercial aircraft operator⁹ is provided in Figure 2 below. Maintenance typically accounts for 13 percent of the total operating cost and it is only 25 percent lower than the airlines fuel cost, which demonstrates the significance of MRO in the total operator cost structure.

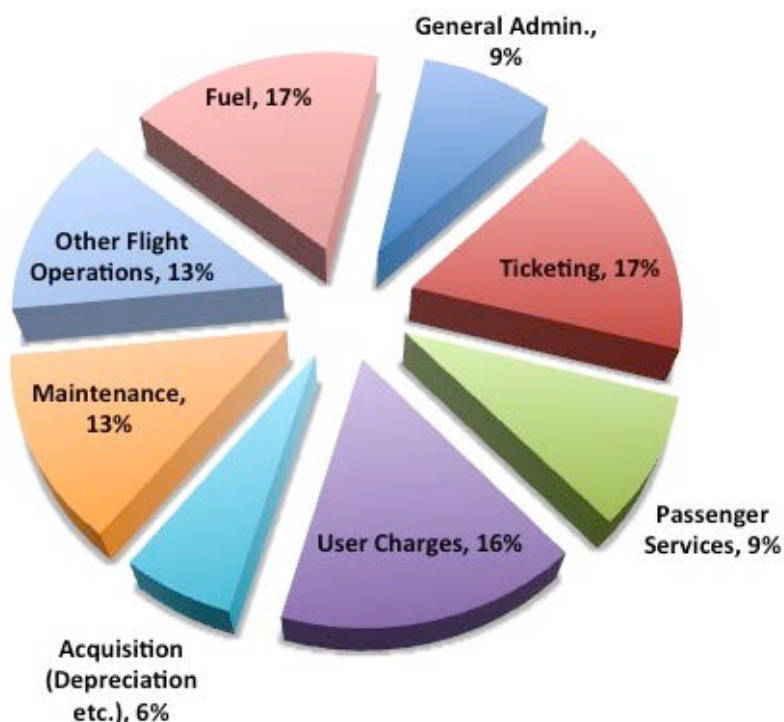


Figure 2: Typical breakdown of total operating cost for a commercial aircraft operator

⁸ British Airways PLC, Annual Report and Accounts for period ended 31 December 2013.

⁹ Commercial Aircraft Projects, Managing the development of highly complex product, Dr. Hans-Henrich Altfeld (Airbus), Ashgate Publishing Limited, 2011, Page 386.

Aircraft MRO costs include the direct cost of engine and airframe cost as well as a maintenance burden. Maintenance burden is a catchall category including airline overhead, cost of acquiring, maintaining equipment and tools, building, facilities and other indirect costs. As Figure 3 below highlights, the airframe, engine and maintenance costs are of a similar proportion¹⁰. In other words, the cost of MRO for engines is similar to the MRO cost for the airframe. The maintenance burden comprises 40 percent of the total MRO costs implying that the infrastructure and investment necessary to support MRO activities is significant.

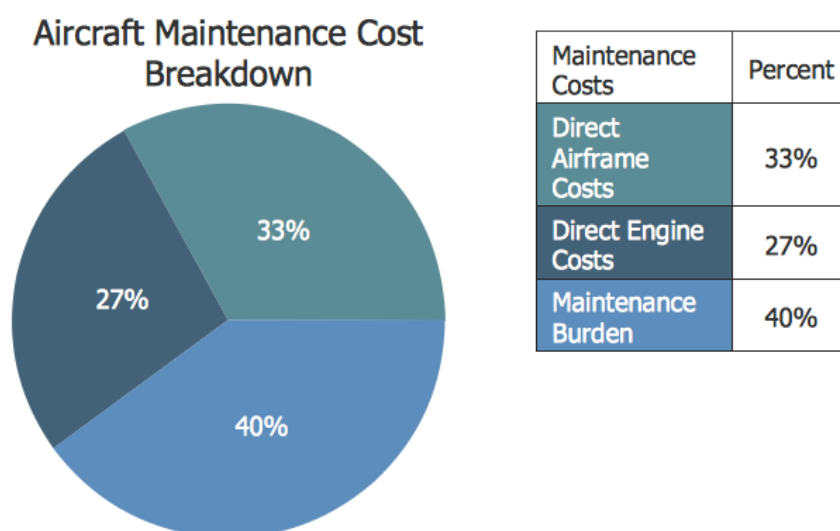


Figure 3: Aircraft maintenance cost breakdown

MRO Regulatory Framework

The MRO sector is heavily regulated. The civil aviation market is regulated across the world by the International Civil Aviation Organization (ICAO), which provides overall guidance on all the aspects of the global civil transport market. The military sector is different. MRO activities are regulated by each nation's military. They do rely on information and requirements from the aircraft manufacturer and OEMs. Because the civil sector has extensive and successful MRO experience, and OEMs supply both civil and military products, many military organisations follow, to a large extent, some of the civilian regulations and procedures.

Civil Air Transport

The International Civil Aviation Organization (ICAO) was founded in 1947 to foster the planning and development of civilian international air transport with several objectives that include:

1. Ensure the safe and orderly growth of international civil air transportation,

¹⁰ Rand Project Air Force – Prepared for the USAF, The maintenance Costs of Aging Aircraft, 2006

2. Encourage the arts of aircraft design and operation for peaceful purposes,
3. Promote the safety of flight in international air navigation.

The European Aviation Safety Agency, EASA, is the European Union Authority in aviation safety. The main activities of the organisation include the strategy and safety management, the certification of aviation products and the oversight of approved organisations and EU Member States.

The EASA member states include the 27 Countries of the EU plus Switzerland, Lichtenstein, Norway and Iceland.

Civilian MRO Regulatory Compliance in the UK

The responsibility for ensuring that the objectives listed above are met is assigned to the State of aircraft registration. In the case of the United Kingdom this responsibility for all UK registered aircraft is assigned to the UK Civil Aviation Authority (CAA), which in turn operates under the European Aviation Safety Agency (EASA) regulations.

EASA REGULATORY STRUCTURE

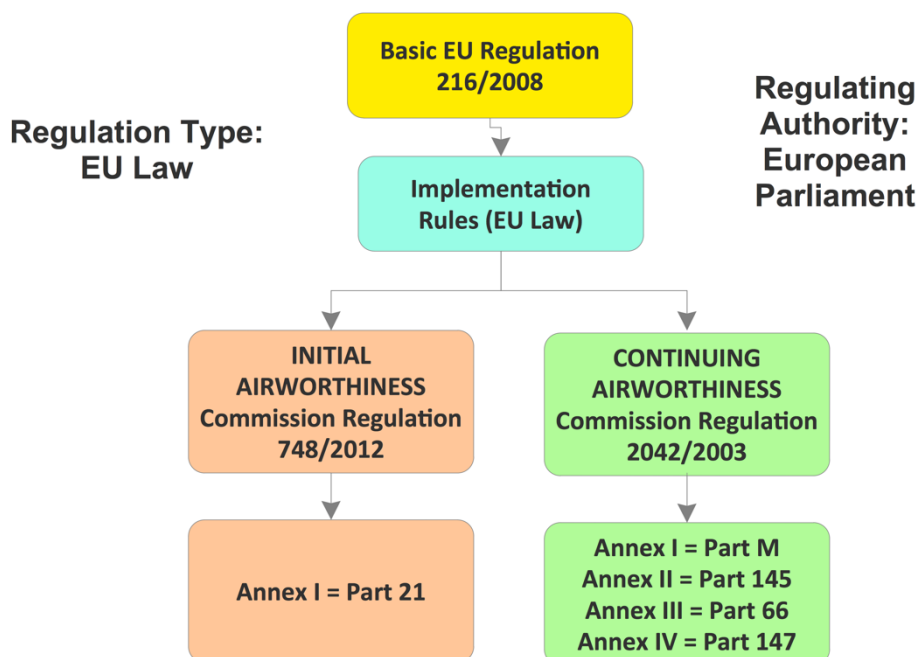


Figure 4: Structure of the EU Regulations Relating to Civil Air Transport

As part of the EASA Continuing Airworthiness Regulations that relate to the operation of civilian aircraft under the jurisdiction of the European Union, the maintenance of large aircraft, aircraft used for commercial air transport and components intended for fitment thereto, is to be carried out by an EASA Part-145 approved maintenance organisation, as

defined in the EU Commission Regulation 2042/2003¹¹. Only EASA Part 145 organisations can release aircraft as airworthy and legally allow them to enter into service.

MRO for Other Jurisdictions or Regulatory Authorities

Many MROs, both within and outside the EU obtain additional approvals to provide MRO Services on aircraft registered outside of their national jurisdiction to expand their customer base and target markets. They may seek and obtain approvals from EASA (for EU registered aircraft), the US FAA (Federal Aviation Agency) and other jurisdictions, such as Canada, China, Brazil etc. For instance, in the Middle East, Qatar follows the EASA rules and procedures, while Saudi Arabia has aligned itself with the US FAA regulations. The FAA and EASA Approvals are recognised by most nations and form the basis for many national regulations and approvals.

As an example, Monarch Aircraft Engineering, who supports their own airlines, also resells MRO services to other operators. They have maintenance approvals for Bermuda, Canada, South Africa, UAE, Ukraine, the United Kingdom (EU) and the United States of America.

As another example, ATC Lasham in the UK, is an independent MRO providing MRO services to Boeing 737, 757 727 and the Airbus A320 range of aircraft, has approvals with the UK CAA (EASA), the USA FAA, Aruba Department of Civil Aviation, (DCA), Bermuda DCA, Cayman CAA, Nigeria CAA, Republique du Niger DAC, Saudi Arabia, and the South African CAA. These approvals provide ATC Lasham with access to markets in these countries.

Continued Airworthiness and Maintenance (CAMO)

Flight safety begins with the design of the aircraft. The responsibility for setting the maintenance requirements and procedures resides with the original equipment manufacturer, which holds the design approval for the airframe, engine, system or component.

This means not only that the structures, systems, flight performance, flight qualities, and so on must comply with the applicable airworthiness requirements, but they also need to provide instructions for maintenance of the aircraft and for repairs during its operational life.

The holder of a design approval for an aircraft, aircraft engine, or propeller, is required to furnish at least one set of complete Instructions for Continued Airworthiness. The instructions must include:

1. Airplane Maintenance Manual, covering a description of all the systems, engines and appliances, basic control and operation information and servicing information.
2. Maintenance Instructions, covering troubleshooting, removing and replacing parts and products, testing procedures etc.

¹¹ Initial Airworthiness relate to the airworthiness design standards, to which aircraft must comply. It also refers to the Design Organisation Approval (DOA - Part 21J) and Production Organisation Approval (POA – Part 21G)

Military Air Transport MRO

Military air transport is regulated by the State itself and there is no global military aviation regulatory authority. In the UK this responsibility lies with the Military Aviation Authority (MAA) as part of the Ministry of Defence. Typically the MAA follows the regulations and procedures as those used in the civil air transport sector. In the case of the UK, the MAA has provided Maintenance Approved Organization Scheme (MAOS) Part 145 Approval to several UK organisations. The MAA Part 145 Organisations can release a MoD aircraft into service after a MRO activity.

The UK has initiated an initiative to harmonise military airworthiness standards and protocols across the EU, through the participation of twenty-six participating EU Member States of the European Defence Agency who, on 10 November 2008, agreed to the formation of the Military Airworthiness Authorities (MAWA) Forum. This initiative will bring significant cost savings and efficiencies to EU military aviation¹². Over the medium to long term this harmonisation may open opportunities for military approved maintenance organisations to extend their MRO services across national borders.

¹² The following document refers:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/408646/Aerospace-Harmonising_Military_Airworthiness_-_Feb_2015.pdf

3. UK MROL Sector Analysis

The objective of determining the UK MROL sector size, scale and segmentation is based on MROL providers meeting the following criteria:

1. There is evidence that they provide aerospace MROL and related services.
2. They are legal entities.
3. They are registered with the United Kingdom Companies House.
4. They are actively trading (i.e. they are neither dormant nor dissolved).
5. They operate within the UK.

This study has relied on public domain data and does not include information such as the cost of employment numbers for MROL services within the UK Ministry of Defence.

The study approach consisted fundamentally of deriving a ‘bottom up’ consolidated sector value based on annual company financial turnover and the number of employees.

Where companies’ primary activity was not MRO services, an assumed proportion approach was used to estimate the MRO proportion on the total turnover value for each Company.

For example, an airline provides MRO activities to support its main activity, which is the air transportation of goods and services. In this case it was assumed that the MRO proportion was ten percent (10 percent) of the turnover, based on previous research¹³, and the researchers’ own industry experience¹⁴.

Similarly for a helicopter operator, we assumed that the MRO value was twenty-five percent (25 percent) of the turnover based on information provided in Reference 1 on page 58. We believe that this percentage is both realistic and conservative.

In the case of aviation component, system, and avionics OEMs, the authors assumed that ten percent (10 percent) of their turnover was related to the MRO of their products. We believe that this is a conservative estimate as it includes the MRO of old legacy systems, which have to be maintained serviceable to enable the continued airworthiness of aircraft in service.

The UK MROL industry sector industry organisations are summarised in Figure 5 below. Based on the five criteria listed above, the sources listed below were used to compile a list of UK MROL companies along with their company details.

¹³ Commercial Aircraft Projects, Managing the development of highly complex product, Hans-Heinrich Altfeld, 2011, page 386 [Maintenance for airline aircraft = 13 percent of total operating cost]

¹⁴ Hans Karlsen CEng, MBA, BSc(Eng), FRAeS and Rainer J. Koll MBA, MSc, FRAeS, who have extensive aviation industry experience in airline operations, aircraft and system design, production, sales and domestic and international aftermarket support.

The sources on information included:

1. Companies that have an EASA Part 145 approval issued by the UK CAA based on a list published on the CAA website dated 7 October 2014. The data includes a list of all Part 145 approved companies along with their address and capabilities in terms of approval class and rating.
2. Companies that are MAOS Part 145 approved issued by the MoD Military Aviation Authority as listed on the MAA website in October 2014. The data includes a list of all Part 145 approved companies along with their address and capabilities in terms of approval class and rating.
3. Companies that are listed as Part 147 Training organisations, who specifically train licensed aircraft engineers and technicians, based on a list published by the UK CAA, dated 7 October 2014. The data includes a list of all Part 14t approved training companies along with their address.
4. Companies who are involved with the purchase and resale of approved aircraft parts and components, and do not carry out any direct engine, aircraft or component MRO activities. These companies are defined as Logistics companies and have been identified based on industry knowledge. The compiled data includes the companies along with their address and contact details.
5. Companies who are registered with Companies House and whose Nature of Business is classified according to SIC Code 33160 based on the Annual Business Survey, 2013 Provisional Results, provided by the UK Office of National Statistics (ONS), dated 13/11/2014 at the request of Stellar.¹⁵

The latest statistical Information published by the Office of National Statistics for SIC code 33.160 (Repair and maintenance of aircraft and spacecraft) is summarised in Table 31 on page 66. The data includes a list of all companies with SIC 33.160, along with their account type and address details¹⁶. The data also includes the combined total revenues and employment numbers for all the companies in the SIC category. Individual company revenues and staff numbers is not available from the ONS data.

The above data was consolidated into a single list of MROL companies and duplicates were removed where individual companies were included in more than one of the five sources. The analysis also excluded dormant companies. The methodology used is discussed in greater detail on page 61.

The data from sources 1 to 4 above did not include the account type categories as defined by Companies House (e.g. small, medium, large, or type not available). This information was obtained by extracting the data from Companies House manually for each company and including this information with the final list of companies.

¹⁵ Organisations registered with the UK Companies House under the international Standard Industry Classification (SIC) code 33.160 includes “the repair and maintenance of aircraft and spacecraft. It includes repair and maintenance of aircraft and aircraft engines. It excludes the factory overhaul and rebuilding of aircraft.” Since the repair of spacecraft in the UK is minimal or non-existent, because of ITAR etc., and since the UK re-usable spacecraft or spaceplane sector is currently nascent, it is assumed that in the UK, SIC Code 33.160 refers to the repair and maintenance of aircraft only.

¹⁶ This information is available from Companies House for each individual UK company



Figure 5: UK MROL Organisations

The details of the total number of MROL sector companies are summarised in Table 1, Table 2 and Table 3 below. The total number of Companies in this ONS SIC category is 974, and the total annual turnover for these companies for 2013, as provided by the ONS category summary is £3,975 million, and the total employment number is 16,000¹⁷ (See Table 31 and Table 32).

The ONS statistics includes 807 Small Companies, which is a significant proportion of the total number of Small companies in the total UK MROL sector as listed in Table 3 (i.e. a total of 960 Small Companies).¹⁸

Table 1: Classification of ONS SIC 33.160 Companies

Type not available	137	14%
Small	807	83%
Medium	0	0%
Large	30	3%
Total	974	100%

Table 2: Classification of Companies not included in ONS SIC 33.160

Type not available	3	1%
Small	153	46%
Medium	10	3%
Large	165	50%
Total	331	100%

The companies who are not included in ONS SIC 33.160 and are included in the Table above are companies whose primary nature of business is classified according to another

¹⁷ These values are from the ONS survey

¹⁸ Companies House definitions of firm size: Small = less than 50 employees, Medium = 50 to 249 employees, and Large = 250+ employees.

SIC code. These companies do however provide MRO services by virtue of their Part 145 maintenance approval status with either or both EASA and the MAA. An example would be Bristow Helicopters Limited, whose nature of business is SIC 51102 (non-scheduled passenger air transport).

The total MROL sector size was estimated by combining the ONS SIC 33.160 total revenue and the total number of employees with the revenue and employment information derived from Companies House for each large and medium sized company with the estimated values for the small companies.

The total number of MRO companies is therefore the summation of the values in Table 1 and Table 2 above and these total numbers are presented in Table 3 below.

A list of the most recent Financial Statements for the large and medium sized MRO companies that were downloaded from Companies House is included on page 71.

4. Number and Type of UK MROL Companies

There are 1,305 companies actively trading and involved with the provision of MROL services in the UK. The total number of companies is segmented further by their category and size, as listed by the most recent filing of their company accounts that was submitted to Companies House. They include:

- 195 large companies that comprise 15 percent of the total population of 1305; they account for the most significant portion of the MRO activities
- 970 SMEs comprising 75 percent of the total MROL company population (966 Small plus 10 Medium sized)
- 140 companies (11 percent) with Companies House Classification “Type not available” that have not submitted any financial report to Companies House. These are considered as start-up companies.

Table 3: Total number of UK MRO Sector Companies by size

Type not available (Start-ups)	140	11%
Small	960	74%
Medium	10	1%
Large	195	15%
Total	1,305	100%

Location of UK MROL Organisations

The location of all the 1,305 companies based on the registered address are depicted in Figure 6 below. The majority of the companies are located in the southern half of the UK with clusters in Scotland located along a line running from Glasgow to Edinburgh as well as Aberdeen and Inverness along the north east coastline, supporting the UK’s North Sea oil industry operations. In Northern Ireland they are clustered around Belfast and Londonderry. In England there are main clusters around Newcastle upon Tyne, Blackpool, Liverpool and Manchester. Further south they are mainly clustered around Cheltenham, Cardiff and Bristol, Bournemouth, Southampton, Brighton and around London.

The locations used in the maps throughout this document are based on either the company address post code registered with Companies House or in the case where companies have a Part 145 or Part 147 approval, the location is based on the address post code registered with the UK CAA or MoD MAA.

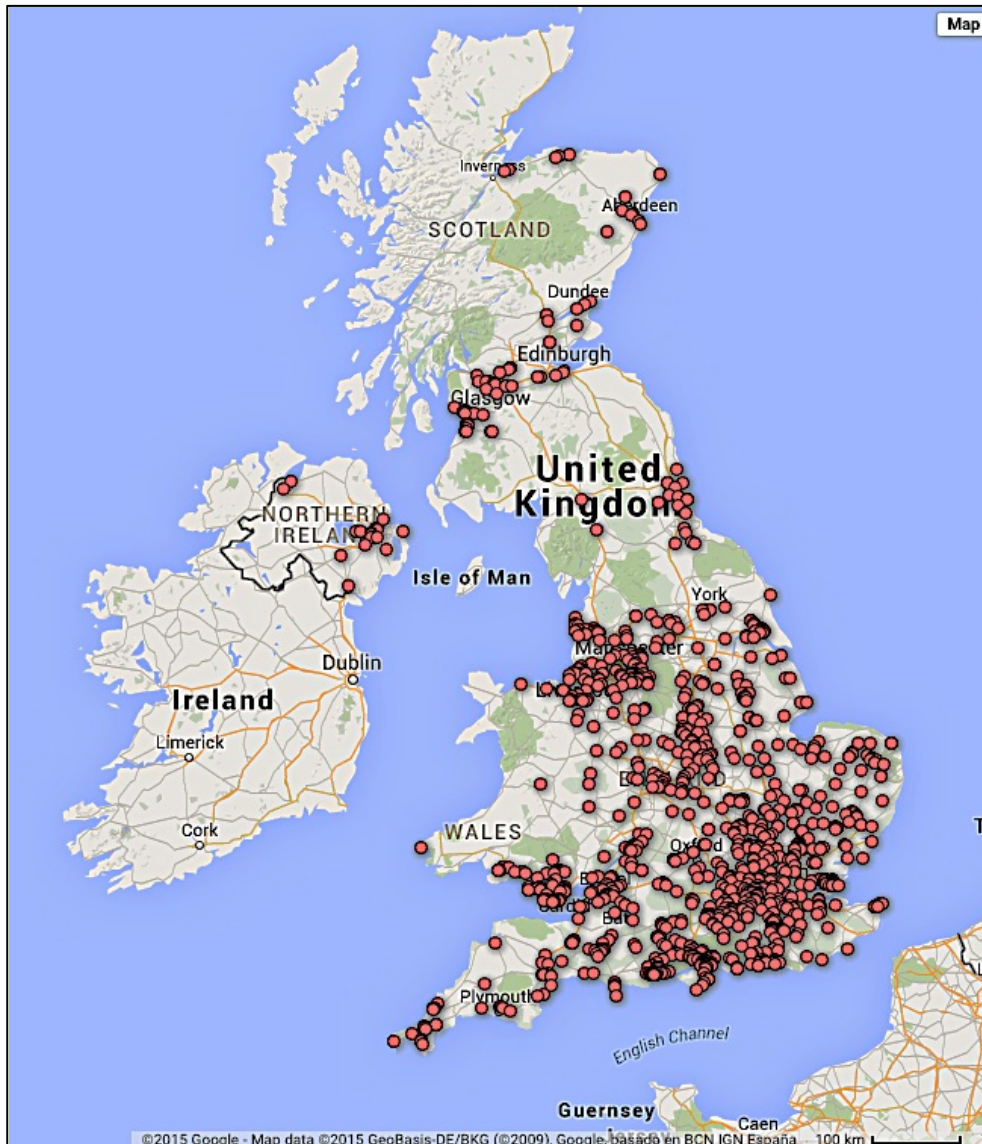


Figure 6: Location Map of All MROL Companies¹⁹

The SMEs appear to be located in the same areas as the large Companies as shown in Figure 7. It is clear that MROs are located in areas where there is a lot of aviation activity as well as in areas where there may be a cost or other incentive to establish a MRO facility.

¹⁹ Clarification can be found in section 4

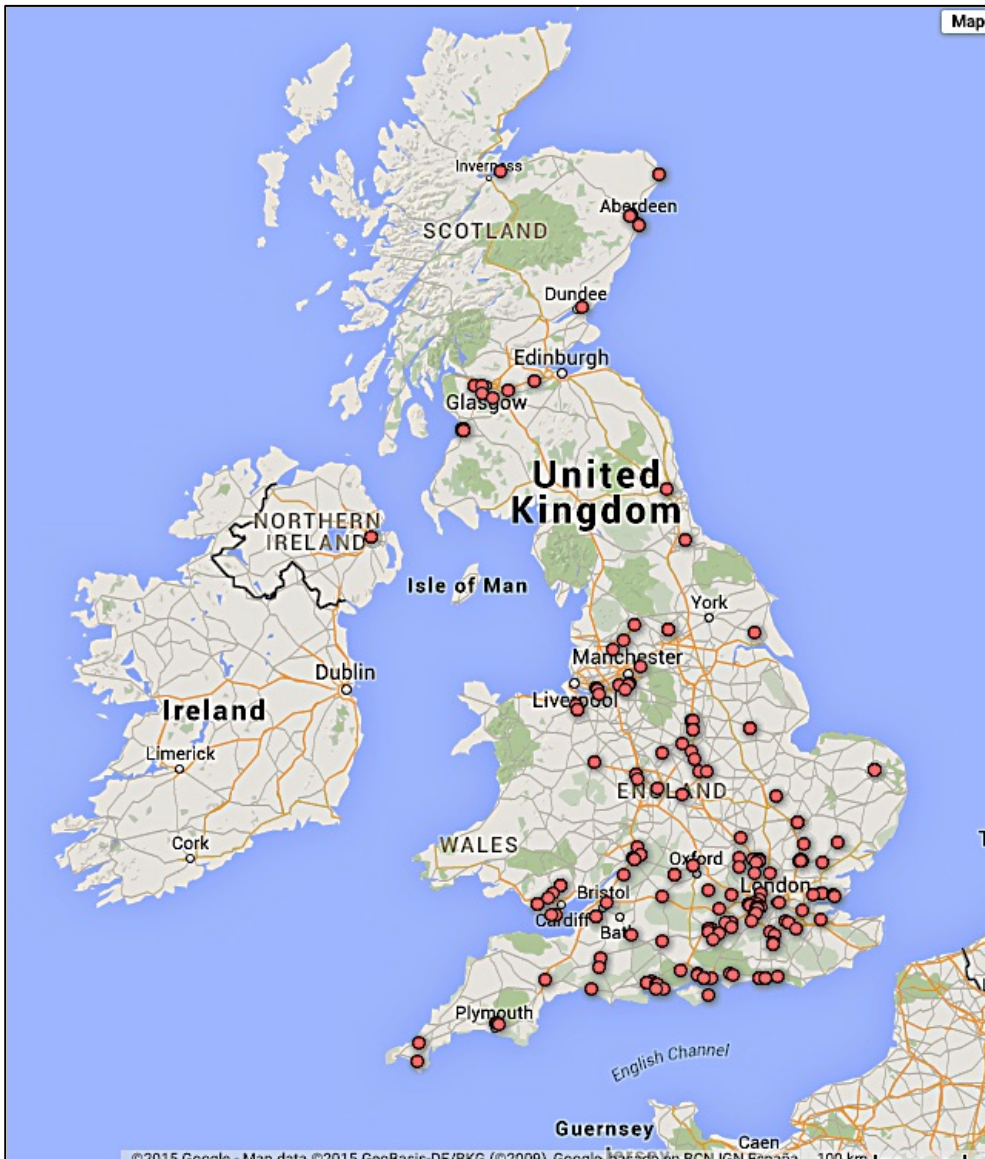


Figure 7: Location Map of Large MROL Companies

MRO Sector Segmentation by MRO Approval Type

The analysis segmented the companies according to their capability or their MRO approval. Part 145 approved organisations have the authority to release or certify an aircraft as being airworthy and can therefore release or authorise the aircraft fly or operate legally. In the UK the civilian aircraft certification is carried out by the UK CAA under the authority of EASA. The UK MoD approvals are controlled by the MoD under the Military Aviation Authority (MAA) Maintenance Approved Organisation Scheme (MOAS) scheme. Part 147 approved training organisations are authorised to train aircraft engineers to carry out maintenance activities. Companies that do not have any EASA or MAA approvals cannot release and aircraft into service. They are however actively involved with providing product and services to the approved organisations (see page 18).

Some companies have several approvals covering the civilian EASA Part 145, the military MAA MAOS Part 145 as well as the civilian EASA Part 147 training organisations. The

majority of the companies are EASA Part 145 approved, followed by EASA Part 147 training organisation and then the military MAA MAOS Part 145 companies.

The Venn diagram below shows the number of companies that have more than one MRO approval as shown in the overlap areas. For example, FR Aviation or Cobham Aviation Services is the only organisation that is MAOS Part 145, EASA Part 145 and EASA Part 147 approved.

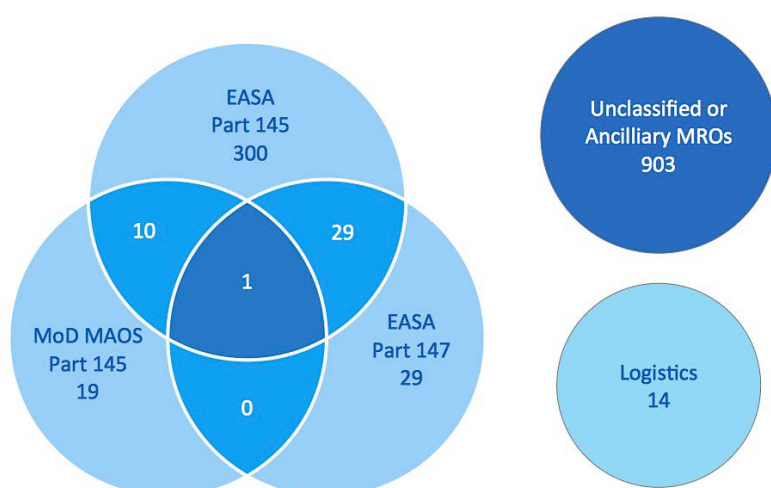


Figure 8: Number of MoD and EASA Approved MRO Organisation Types²⁰

As stated earlier Part 145 companies have the legal authorisation to release or sign-off an aircraft or system (component) as being airworthy and approved for flight. When looking at the total population, 31 percent of the UK MROL companies have some form of MRO approval. The civilian EASA Part 145 approved companies form the most significant proportion of approvals, with 26 percent of the total MRO population. This is a reflection on the high level of civilian MRO activity in the UK.

As shown in **Table** , there are 903 companies (i.e. 69 percent of the total MROL population) who have no formal MRO approval. These are defined as MRO related or ancillary companies as defined on page 18. They provide ancillary MRO services and are included because of their SIC Industry Classification (i.e. their SIC business classification under which the company is registered as 'Repair and Maintenance of aircraft and spacecraft'). These companies should be familiar with the aerospace industry airworthiness requirements and could play a role in a growing MRO Sector.

²⁰ The number of EASA Part 145 only companies includes 1 company that is also a logistic company, resulting in a total of 299 plus 1 companies (i.e. 300 Companies).

Table 4: List of MRO Services by MRO Type

EASA MRO Part 145	299	23%
MAOS Part 145	19	1%
MAOS & EASA MRO Part 145	10	1%
EASA Part 145 & Part 147	29	2%
EASA & MAOS Part 145 & Part 147	1	0%
EASA Part 147 Training	29	2%
Logistics and EASA Part 145	1	0%
Logistics	14	1%
Unclassified	903	69%
Total	1,305	100%

Segmentation of Approved MRO Organisations by Company Size

Table through to **Table** below provide the total numbers of companies, segmented by company size for each type of MRO classification. SMEs, with 53 percent of the total, represent most significant proportion of EASA Part 145 organisations. SMEs also have a significant portion of Part 147 Training and Logistics companies. SMEs have a very minor portion of the military MAA MAOS Part 145 companies, which is a reflection that the most of the MAA Part 145 MRO activities are on military aircraft that is carried out by large companies or prime contractors.

Table 5: UK EASA Part 145 MRO Companies

Type not available	4	1%
SME	179	53%
Large	157	46%
Total	340	100%

Table 6: UK MoD MAA Part 145 MRO Companies

SME	3	10%
Large	27	90%
Total	30	100%

Table 7: UK EASA Part 147 Training Organisations

Type not available	3	5%
SME	19	33%
Large	35	61%
Total	57	100%

Table 8: UK MRO Logistics Companies

SME	11	73%
Large	4	27%
Total	15	100%

Segmentation and Location of EASA Part 145 Companies

Table provides a breakdown of all EASA Part 145 approvals according to their approval class as discussed on page 14. Some companies have several or multiple approvals as a consequence of having numerous operating locations and supporting different aircraft type, engines and components. The total numbers in the Table below refer to the number of approvals by Class that are issued and not the no. of companies.

Table 9: Breakdown of UK Part 145 Approved Companies by Capabilities or Class

Aircraft / Airframe	149	25%
Engines	91	15%
Components	318	52%
Specialised Services	50	8%

Over half the companies (52 percent) provide MROL services of components, followed by Airframe MRO at 25 percent and Engine MRO services at 15 percent. Specialised Services, such as non-destructive testing and testing comprises less than 10 percent of the total UK MRO capabilities.

Table below provides a breakdown of the Part 145 Organisations according to their MRO classes the support (i.e. Airframe, Engine, Component, Specialised or any combination thereof). As stated earlier the total number exceeds the total number of EASA Part 145 actual companies because several of the larger companies have several EASA Part 145 approvals.

In the Table below, for example, there are seven organisations that are approved for Part 145 Airframe, Engine, Component and Specialised services. Similarly there are 41 organisations that only provide airframe MRO capabilities.

Table 10: Breakdown of EASA Part 145 MRO Services by Capability or Class as provided by the UK Civil Aviation Authority (October 2014)

Aircraft / Airframe	Engines	Components	Specialised Services	TOTAL	%
YES	YES	YES	YES	7	2%
YES	YES	YES		46	12%
YES	YES			7	2%
YES		YES	YES	6	2%
YES		YES		41	11%
YES			YES	1	0%
YES				41	11%
	YES	YES	YES	14	4%
	YES	YES		9	2%
	YES			8	2%
		YES	YES	15	4%
			YES	7	2%
		YES		180	47%
149	91	318	50		
TOTAL MRO CLASS BREAKDOWN				382	100%

Most of EASA Part 145 approved companies are in the southern part of the UK with another cluster in Scotland between Glasgow and Edinburgh as well as the North East coastline of Scotland where helicopters service the North Sea operations. There are only a few companies in Northern Ireland.

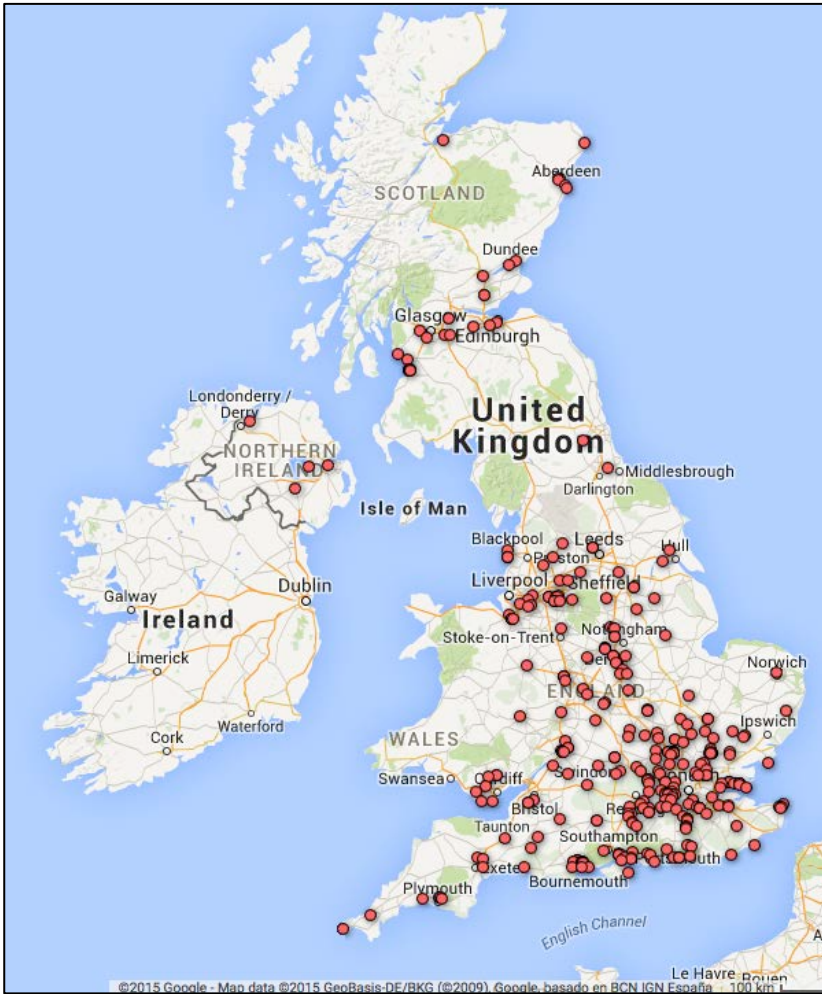


Figure 9: Locations of EASA Part 145 MRO Companies

Segmentation and Location of MAA MAOS Part 145 Companies

As indicated in Table below all the MoD MAOS Part 145 companies fall into the 'large' category. There are no SMEs. Their geographical location is shown in Figure 10. Although there are only a small number of companies in this sector, most are located in England and only one company is located in Scotland. There are no companies in Northern Ireland.

Table 11: Breakdown of UK MOD MAOS Part 145 Size

SME	0	0%
Large	30	100%
Total	30	100%



Figure 10: Location of MoD (MAA) MAOS Part 145 MRO Companies

Table 12 and Table 13 below provide a breakdown of the MoD MAOS Part 145 Approval Class. The majority support aircraft or airframe MRO services followed by Components and Engines.

Table 12: Breakdown of MAOS Part 145 Approved Companies by Class

Aircraft / Airframe	23	38%
Engines	12	20%
Components	20	33%
Specialised Services	5	9%

Table 13: Breakdown of MAOS Part 145 MRO Services by Class

Aircraft / Airframe	Engines	Components	Specialised Services	TOTAL	%
YES	YES	YES	YES	2	1%
YES	YES	YES		5	1%
YES	YES			-	0%
YES		YES	YES	2	1%
YES		YES		8	2%
YES			YES	1	0%
YES				5	1%
	YES	YES	YES	-	0%
	YES	YES		1	0%
	YES			4	1%
		YES	YES	-	0%
			YES	-	0%
		YES		2	1%
23	12	20	5		
TOTAL MoD MRO CLASS BREAKDOWN				30	100%

Segmentation and Location of MRO Part 147 Training Companies

The EASA Part 147 training companies are predominantly Large Companies or Organisations such as Universities or technical colleges. They are mainly located in England with a few organisations located in Scotland.

Table 3: Breakdown of UK Part 147 Training Companies

Type not available	3	5%
SME	19	33%
Large	35	61%
Total	57	100%

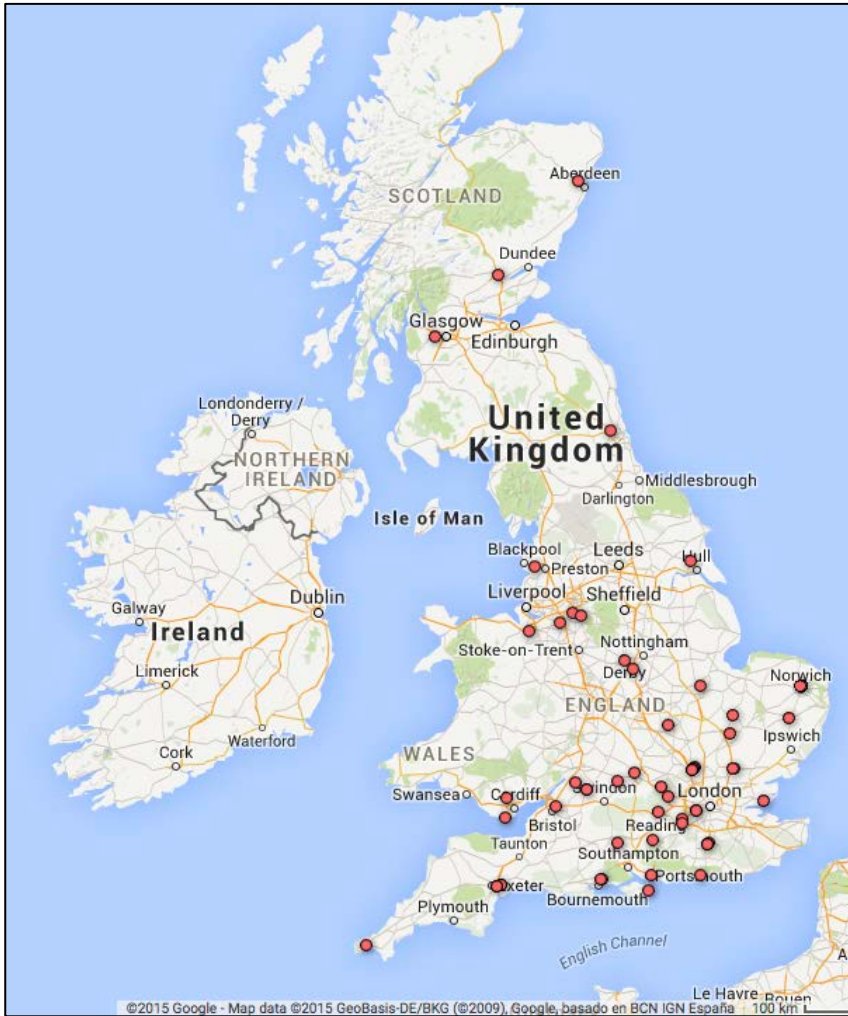


Figure 11: Locations of Part 147 Training Organisations

Segmentation and Location of MRO Logistics Companies

The MROL logistics companies have no approval status according to the CAA or EASA. There are only a few companies and they are spread across the UK. In the author's opinion, they do not play a significant role in the overall UK MROL sector in terms of revenue generation or employment.

Table 4: Breakdown of UK MROL Logistics Companies by Size

SME	11	73%
Large	4	27%
Total	15	100%



Figure 12: Locations of Logistics Companies

Summary of Findings

1. There are 1,305 MRO companies in the UK. Almost 70 percent of the companies do not have any formal EASA or MAA Approvals and these companies would provide support services and be suppliers to the Part 145 companies as defined on page 18. They cannot release and aircraft, engine or component as airworthy or approved for flight.
2. SMEs form a large proportion with 53 percent of the number of EASA Part 145 approved companies. There are no SMEs with MoD MAA MAOS approvals.
3. The majority of MROL companies are located in England. The other clusters include Cardiff, Wales, Belfast in Northern Ireland and in Scotland between Glasgow and Edinburgh as well as in Aberdeen and Inverness where MROs support the helicopters serving the north sea oil industry,
4. EASA Part145 companies' form the mainstay of the MRO services in the UK with 340 companies that have the necessary EASA Part 145 approval.

5. There are a significant number of SMEs (970 companies or 75 percent of the MROL companies), most of which (i.e. 82 percent) do not have any formal EASA or MAA (MoD) MRO approval. They would therefore provide ancillary or support services to the Part 145 MROs.
6. In the author's opinion a large proportion of SMEs would be familiar with the MRO regulatory requirements and could be encouraged to become approved by either EASA, through the UK CAA, or by the MoD MAA to help grow the UK MRO sector. Further research is needed in order to understand the barriers that may be preventing this.
7. It was surprising that there were only 30 MoD MAOS Part 145 approved companies. Given that the MoD has initiated a drive to harmonise airworthiness and MRO standards across 27 countries of the EU, there could be an opportunity for the UK to grow the UK military MRO sector to capture some of the EU military MRO market from other countries once the harmonisation has sufficiently matured.

5. UK MROL Sector Revenues

This research estimates that the UK MRO & Logistical sector comprises 1,305 companies. These companies generate approximately £15 billion in annual revenues and employ over 57,000 personnel. This study has relied on public domain information and has not included the inherent value of MRO services within the UK Ministry of Defence itself.

MROL revenues and employment levels are heavily weighted towards the large engine and defence manufacturers. Their MRO revenues and employment levels are estimated to be just over £8 billion employing an estimated 21,000 employees. The biggest revenue and employment level are derived from the engine manufacturers followed by the defence sector.

The airlines by virtue of their size, the number of aircraft they operate and the intensity in which they are flown also contribute significantly to the MRO sector. The combined airline, cargo and helicopter air transport operator MRO value is worth about £1,370 billion.

Most of the airlines and air transport operators carry out the MRO work themselves and there is a trend to do this within the UK to minimise costs and maximise utilisation. Even the heavy labour intensive work associated with D-Checks is being replaced with several enhanced C-checks (i.e. the traditional C-check work plus a portion of the D-check). This MRO work is increasingly being carried out in the UK as opposed to flying the aircraft out to regions such as Asia.

The ONS Annual Business Survey for SIC 33.160 (Repair and maintenance of aircraft and spacecraft) excludes data for 153 small companies from the total MROL population (i.e. 960 small MROL companies minus 807 small companies registered with SIC 33.160). The ONS statistics includes the annual turnover for the 807 small companies. As the turnover for small companies is not available from Companies House, this analysis had to consider the turnover uncertainty of the 153 small companies that are not included in the ONS list of companies:

For the purpose of determining an estimated turnover value for these 153 small companies, we assumed average annual turnover of £1 million per company, which results in an estimated value of £153 million.

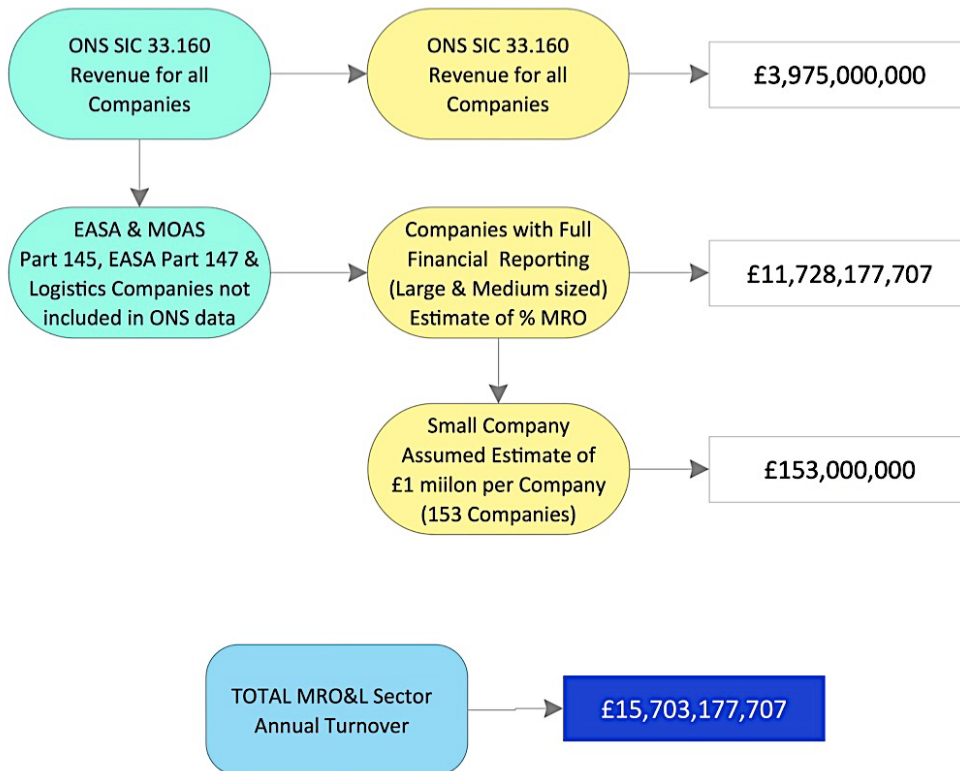
We believe that this is a conservative estimate. An alternative estimation method might be to deduct the large and medium sized company revenues from the sector revenue total and attribute the remaining revenue and staff totals to the 807 small companies in the ONS data. This would give an average revenue of £2.6 million per small company. Hence the estimate of £1 million revenues per each small company, that was not included in the ONS list of companies, is considered to be conservative.

The total estimated value (annual industry sector revenue) of the UK MROL and aircraft aftermarket services industry, based on annual turnover is summarised in

Table 5 below, provides the derivation method of the annual industry sector revenues.

Table 5: Total UK MRO Sector Revenues

Source	Revenue
ONS SIC 33.160 Turnover	£3,975,000,000
Small Company Turnover (Non-ONS)	£153,000,000
Full Company Turnover (Non-ONS)	£11,728,177,707
TOTAL MROL Turnover	£15,703,177,707

**Figure 13: UK MROL Sector Revenues Methodology**

Even if the entire total estimated revenue from the small companies that are not included in the ONS data is excluded, the total estimated MROL sector revenue would still exceed £15 billion. Hence the revenue uncertainty associated with Non-ONS small companies has been deemed as acceptable.

As shown in Table 6 below, large companies contribute approximately £13.6 billion in annual revenues comprising 87 percent of the total annual revenues generated. SMEs only contribute just over £2 billion or 13 percent of the total MROL sector revenues.

Table 6: UK MRO Sector Revenues by Company Size

Company Type	Revenue
SMEs (ONS + Non-ONS)	£2,059,428,195
Large	£13,643,749,512
TOTAL MROL Turnover	£15,703,177,707

6. UK MROL Sector Employment

As with revenue, MROL employment levels are heavily weighted towards the large engine and defence manufacturers. Their MRO employment levels are estimated to be 21,000 employees.

This section provides an overview of the total number of employees and the derivation method of these values.

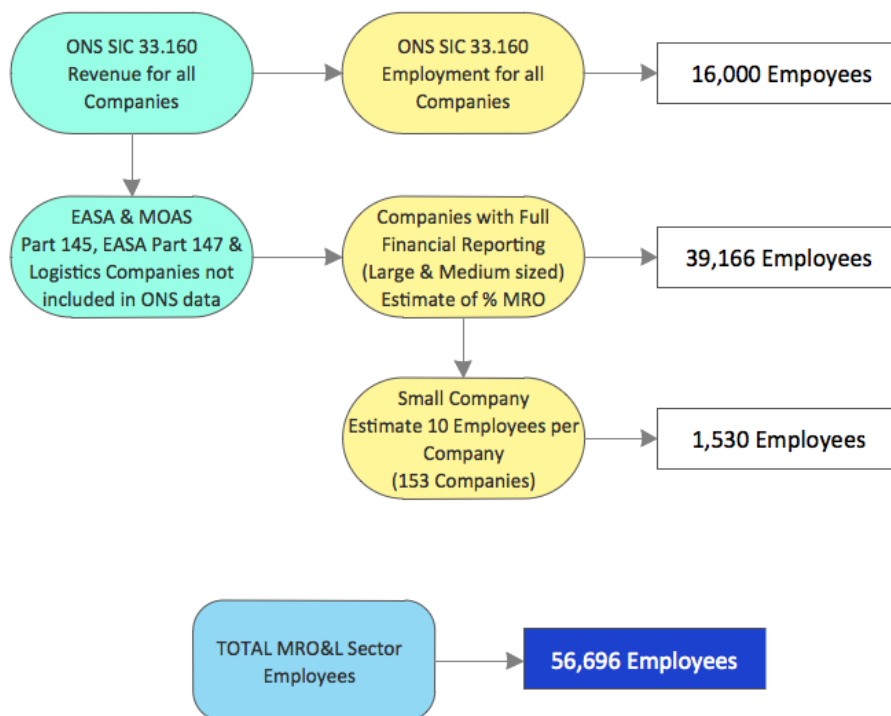


Figure 14: UK MROL Sector Employment

As shown in Table below, large companies employ approximately 47,000 staff, which is a significant proportion of the total MRO employment level, comprising 87 percent of the total number of MRO staff employed.

Table 18: UK MRO Sector Employees by Company Size

Company Type	Employees
SME	9,270
Large	47,426
TOTAL MROL Employment	56,696

We derived the total MROL sector employment figure from the ONS Statistics plus the employment data for those companies that are not included in the ONS data. The ONS Annual Business Survey for 2013, for SIC Code 33160 states that there were 16,000 employees in this category in 2013.

Table 19: Total Number of Employees in the UK MROL Sector

Source	Employees
ONS SIC 33.160 Employees	16,000
Small Company Employees (Non-ONS)	1,530
Full Company Employees (Non-ONS)	39,166
TOTAL MROL Employment	56,696

The individual company staff number data for Small Companies is not available from Companies House, so the author's assumed an average number of 10 employees per small company for those companies not included in the ONS data. This results in 1,530 employees for 153 Small Companies. This assumption was further validated when the author deducted the staff levels for the large companies - as determined from the actual financial statements - from the total 16,000 staff for the total ONS figure, and averaged this remaining balance over 807 companies. This resulted in an average of 9 staff per small company. Thus the decision was made to accept an average figure of 10 staff per small company.

Large companies do report their annual average number of employees in their financial statements. The total number of employees was extracted from the latest individual company financial statements. Since the primary activity of most of these companies is not exclusively MROL related, the author applied the same proportions or percentages as those used to determine the annual financial turnover to derive the total number of employees in the UK MROL sector.

In other instances where companies did not provide data on the number of employees specifically involved in MRO or aftermarket services, Stellar made a conservative estimate of the number of employees.

As shown in Table above, large companies employ approximately 47,000 staff comprising 84 percent of the total number of UK MROL industry employees.

Licensed Aircraft MRO Engineers

The EU Commission Regulation 2043/2003 governs the continuous airworthiness approval of civilian aircraft. Annex III of the regulation covers Part 66, which regulates the licensing of aircraft maintenance engineers.

Part 66 came into force in October 2012 covering all aircraft over 5,700 kg MTOW (Maximum Take Off Weight) and has simplified the licensing process of licensed aircraft maintenance engineers. These include:

1. Category A covers basic line maintenance and simple defect rectification.
2. Category B1 covers structural, electrical and engine.

3. Category B2 covers avionic and electrical systems
4. Category C is a new category for a licensed engineer who is ultimately responsible for the aircraft release to service.

The categories are described in greater detail below:

A **Category A Part-66 Aircraft Maintenance Licence** permits the holder to issue certificates of release to service, following minor scheduled line maintenance and simple defect rectification within the limits of tasks specifically endorsed on the authorisation. The certification privileges are restricted to work that the Licence holder has personally performed in a Part-145 organisation.

A **Category B1 Part-66 Aircraft Maintenance Licence** permits the holder to issue certificates of release to service following maintenance, including aircraft structure, power plant and mechanical and electrical systems. Replacement of avionic line replaceable units, requiring simple tests to prove their serviceability, is also included in the privileges. Category B1 automatically includes the appropriate A sub category.

A **Category B2 Part-66 Aircraft Maintenance Licence** permits the holder to issue certificates of release to service following maintenance on avionics and electrical systems.

A **Category C Part-66 Aircraft Maintenance Licence** permits the holder to issue certificates of release to service following maintenance on aircraft. The privileges apply to the aircraft in its entirety in a Part 145 organisation.

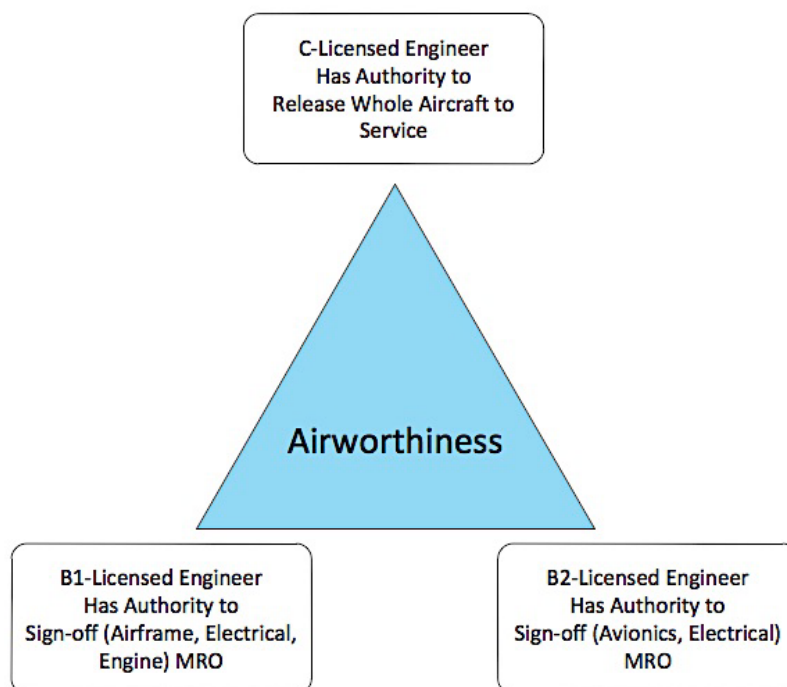


Figure 15: Continuous Aircraft Airworthiness Engineer Privileges

The CAA issues a lifetime Part 66 EASA Rating. The operator is responsible for type training and a re-currency rating every two years. EASA Licences remain valid so long as the annual fee is paid to the CAA.

The numbers of EASA licensed engineers registered with the UK CAA as of the 15th of December 2014, by category, are:

- 6,204 - Category C engineers
- 11,674 - Category A engineers
- 10,818 - Category B1 engineers
- 3,443 - Category B2 engineers

This means that there are 32,139 EASA MRO engineers that are licensed by the UK CAA. These numbers do not reflect the true number of licensed engineers actually working on the aircraft as many of these engineers work outside of the UK Market and others retain their Licensed Engineer status as they take on other roles, such as in management, within organisations.

Foreign engineers that are licensed either by EASA, either through a non-UK EASA member state, or through another foreign aviation authority, may work in the UK provided it is through a UK EASA Part 145 approved organisation. The number of these foreign licensed engineers has not been made available and is not included in this study.

7. Segmentation by Type of MRO Organisation

MROL organisations can be categorised as airline or operator MROs, Independent MRO organisations, or OEM (original equipment manufacturers) MRO organisations which provide MRO Services, e.g. Rolls-Royce. Figure 16 below summarises the breakdown of the type of MRO organisation. OEMs providing MRO services are the biggest sector comprising £10.7 billion or 68 percent of the MRO revenues and employing over 31,000 employees. This is followed by the Independent MROs, with revenues and employment levels of £3.5 billion and 18,700 employees respectively. SMEs play an insignificant role in the OEM MRO services. SMEs fall mostly in the Independent MRO sector.

The results highlight the dominance of the OEMs in UK MROL services. The role of the airline and operator MROs are fairly small when compared to the OEMs and Independents. The results are provided in greater detail below along with the UK geographic location of each of the MRO groups or organisation types.

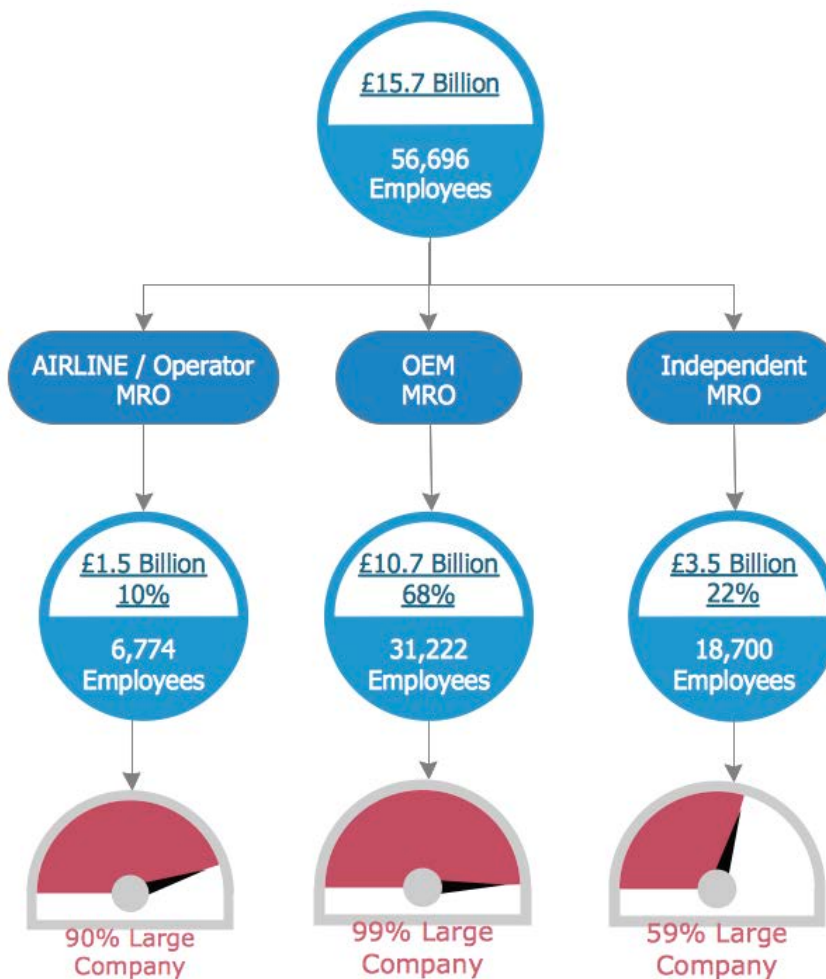


Figure 16: MRO Organisation Type Segmentation

Based on the 1,305 MROL organisations in the United Kingdom only 39 (3 percent) are owned by the airlines and other air transport operators, 84 companies (6 percent) are owned or directly affiliated with the Original Equipment Manufacturers (OEMs) and the balance of 1,182 organisations or (90 percent) are independent organisations. The independent organisations include the logistics and company that have no formal MRO approval. The independent MROLs have to compete amongst each other to provide MROL services to rest of the air transport market as well as provide support services to the Aircraft Operator and OEM owned MROLs.

Table 20: Type of MROL Organisations

Aircraft and Operator MROs	39	3%
OEM MROs	84	6%
Independent MROs	1,182	90%
Total MROs	1,305	100%

Segmentation and Location of Airline and Operator MROs

The following three Tables highlight that most of the airline and operator MROs are large companies comprising 87 percent of the total number of companies. Large companies have 99 percent of the total employment and generate 99 percent of the revenues. As the map in Figure 17 below shows the companies are located at the airline's or operator's airport out of which they operate.

Table 21: Airline and Operator MROL Size

Type Not Available	0	0%
SME	5	13%
Large	34	87%
Total	39	100%

Table 22: Airline and Operator MROLs Employment

Airline and Operator MROs	Employees
SME	54
Large	6,720
Total Employment	6,774

Table 23: Airline and Operator MROLs Revenues

Airline and Operator MROs	Revenues
SME	£6,393,064
Large	£1,534,699,058
Total Revenue	£1,541,092,122

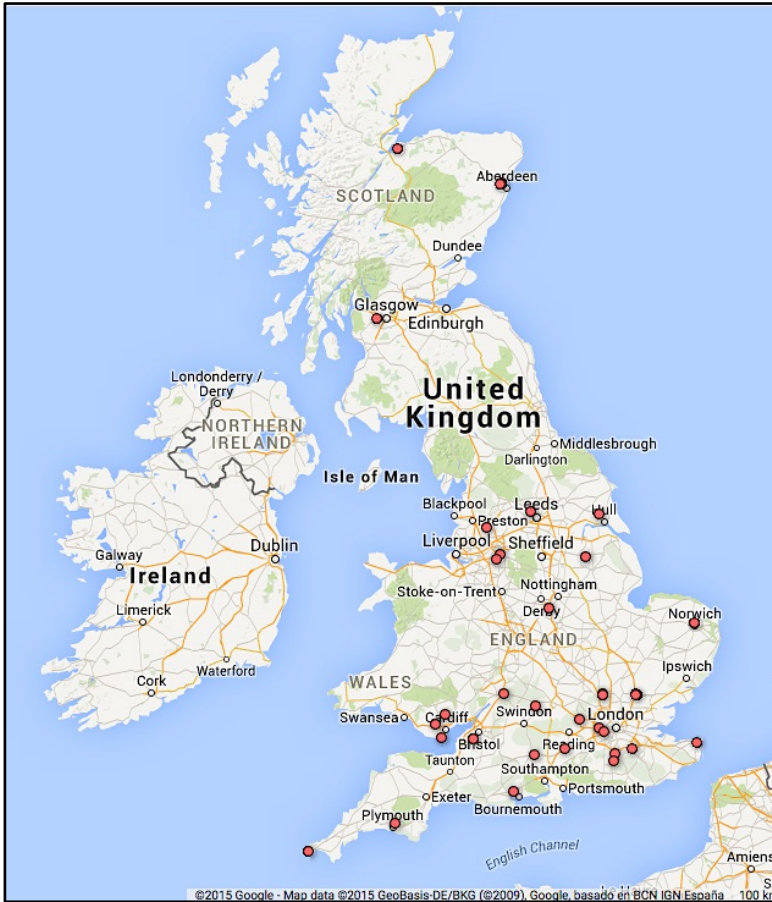


Figure 17: Location map of Airline and Air Transport MROs

Segmentation and Location of OEM MROs

The following three Tables highlight that, as in the case of the airline and aircraft operators MROs, OEM MROs are predominantly large representing 90 percent of the total companies. Large companies employ over 99 percent of the total employees and generate over 99 percent on the revenues. As the map in Figure 18 shows, these OEM MROs are mainly located in the southern half of the UK.

Table 24: OEM MROs Size

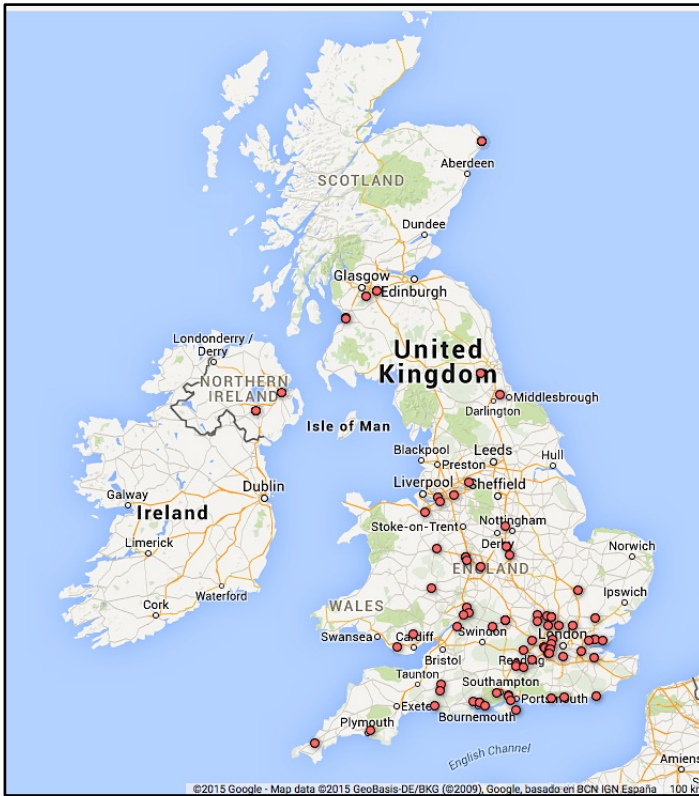
SME	8	10%
Large	76	90%
Total	84	6%

Table 25: OEM MROs Employment

OEM MRO Company Type	Employees
SME	92
Large	31,130
Total Employment	31,222

Table 7: OEM MROs Revenues

OEM MRO Company Type	Revenues
SME	£11,381,721
Large	£10,662,520,667
Total Revenue	£10,673,902,388

**Figure 18: Location Map of OEM MROs**

Segmentation and Location of Independent MROs

In the case of the Independent MROs, there is a complete shift in the proportions when compared to the OEM MROs and the airline and operator MROs. In the case of the Independent MROs, most of the companies (81 percent) are SMEs. In addition, the SME and large Independent MROs are almost equally split when looking at the employment levels and revenues generated. As the map in Figure 19 shows, most of the Independent MROs are located in the southern half of the UK.

Table 8: Number of Independent MROs

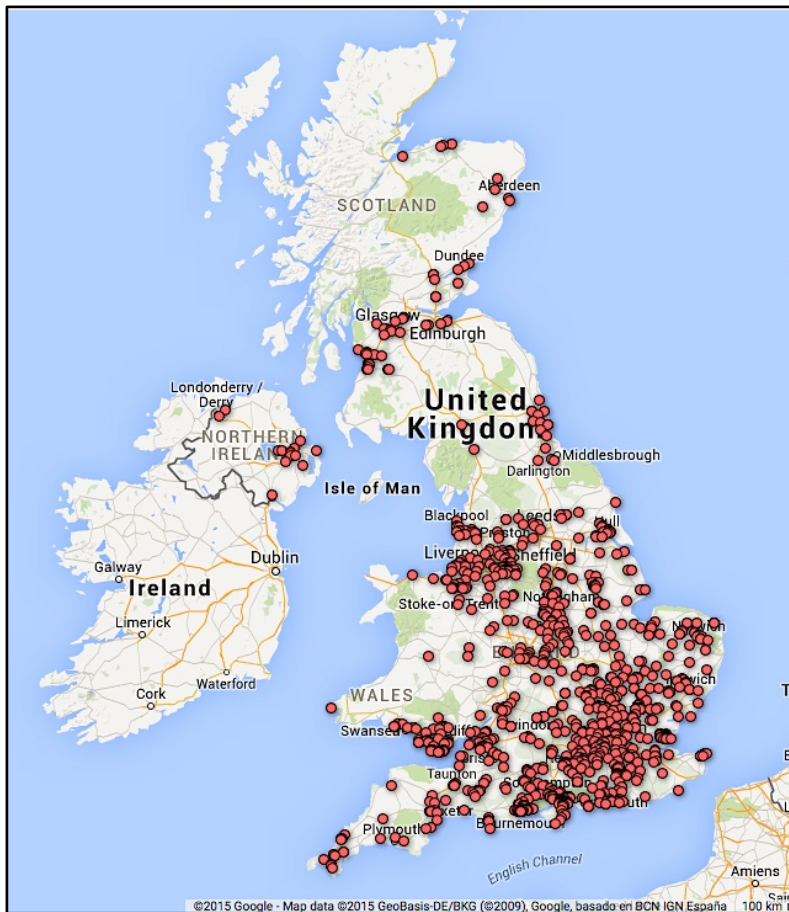
Type Not Available	138	12%
SME	959	81%
Large	85	7%
Total	1,182	100%

Table 28: Independent MRO Employment

Independent MRO Company Type	Employees
SME	8,833
Large	9,867
Total Employment	18,700

Table 29: Independent MRO Revenues

Independent MRO Company Type	Revenues
SME	£1,446,529,787
Large	£2,041,653,410
Total Revenue	£3,488,165,197


Figure 19: Location Map of Independent MROs

8. MRO Sector Feedback

In order to gain insight from industry, a questionnaire was sent to CAA EASA Part 145 approved organisations and to the members of the ADS MRO Specialist Group. In all fourteen responses were received. The researchers also spoke to eight key contacts within the industry. The responses received are compiled in a qualitative format below; from a technical perspective, these cannot be considered to be representative of the industry as whole and therefore should be treated with some caution.

Market Feedback Summary

Market opportunities

There appeared to be some consensus that the UK MROL sector is highly regarded throughout the world for: the quality of its work; its aerospace heritage; having a highly skilled, knowledgeable and flexible work force; and the presence of an effective regulator with good excellent regulatory compliance.

Respondents felt that the UK should not compete in markets where the labour rates are low, but focus on services where there is a high added value. Lower labour rates are not considered as the overriding driver for UK MROL services. While cost is important, the main MROL drivers appear to be quality and consistency of service, security, location and turnaround or turn times.

In terms of future prospects for the industry, several respondents identified what they felt to be a clear opportunity associated with the evolution of the MROL industry. The complexity and sophistication of activities conducted within the industry was felt to be intensifying – and doing so at an increasing rate. This is being driven by the need for increased aircraft serviceability, combined with MROL productivity and efficiency improvements through composite material technologies, data analytics and integrated logistics support.

Performance based contracts

Some respondents identified a trend whereby the air transport industry is evolving more towards performance based contracts and the desire to work through a single 'Tier 1' MRO for all MRO activities. The Tier 1 MRO would subcontract MRO services to engine, airframe and component MROs. The focus is to pay fixed MRO rates to ensure aircraft availability.

Awareness of business support services

A number of responses indicated that there appears to be gaps in the knowledge of UK MROL industry participants regarding the availability of publicly-funded investment support, export support and access to finance interventions.

Short term skills needs

The responses received do not seem to raise an immediate skills shortage and the majority of the larger MROs have realised the need for on-going training through apprenticeship schemes. It takes up to seven years to train a licensed engineer; implying that the industry needs to plan for long lead times in their resource requirements; and the MRO industry needs to ensure it can attract apprentices to go through a long term training programme.

However, respondents identified a need for harmonisation and standardisation of apprenticeship training schemes across the UK. Going forward, the skill requirements will need to be managed by MROs to take into account both retirements in skilled technicians and advances in technology. Some respondents recognised that weaker perceptions of the MRO industry (relative to OEMs) may represent a barrier to attracting skilled labour.

UK MRO Skills: Summary from Focus Groups

The following insights on skills were obtained through focus group discussions with the CAA and MRO companies.

1. The MoD requires civilian licensed engineers for their civilian aircraft to sign off aircraft when it flies in a military role (whilst staying on a civilian register). The military aircraft release to service in a military role is not recognised by the CAA. Aircraft that are not on a civilian register are not listed from CAA's point of view and cannot be returned to civil operations without a complete civil recertification.
2. Combined with UK Government incentives for companies that offer apprenticeships, the increase in UK university fees have influenced the growth in engineering apprenticeships and their attractiveness.
3. The focus groups reported that they believed industry is reluctant to invest in training of apprenticeships due to cost and the risk of training staff that leave subsequent to completion of the training and move on to their competitors. This view is in contrast to the respondents view collected via a survey. A degree of internal industry-driven rivalry and competition for licensed engineers has become apparent.
4. The focus groups reported a shortage of B2 avionics engineers. Indications are that they can command a gross salary of up to £80,000.
5. The MoD has traditionally been a good source of skilled engineers who could supply the civilian market demand. Some respondents perceived that the quality and the numbers of military technicians are significantly down from earlier years. For instance, military aircraft engineer training at RAF Halton, which used to be a significant trained personnel supplier, has been shut down.
6. Technical training still falls under two broad classifications: Apprenticeships have the benefit of guaranteed employment, and 'Trainees' who undergo training have no such guarantee.

7. The Middle East used to attract UK licensed engineers, but this market is now predominately being supplied by licensed engineers from Asia (Pakistan) etc. This is due to lower labour costs from Asia. The exit of skilled licensed engineers from the UK is not perceived as a major threat by UK organisations including operators.
8. Indications are that the UK is able to retain its skilled personnel in general, due to more attractive salaries.
9. Focus groups felt that there was a continued need to attract skilled personnel to the MRO industry. Some respondents indicated a desire for a industry to develop a shared strategy for achieving this.
10. Companies providing Component Class (C series Part 145 Approval) MRO services, such as OEMs, do not need to have any EASA Part 66 licensed engineers. They release components to service under the 'Certificate of Release' governed by the component overhaul manual and the organisation Quality Assurance Manual.
11. A significant number of UK EASA/CAA engineers work outside of the UK. In addition licensed engineers who have moved up the management chain have retained their licensed engineer status, despite not working on front line MRO activities. These facts may distort the total MRO licensed engineer population working directly on aircraft in the UK MRO sector.

9. Opportunities for UK MROL Industry Growth and Competitiveness

This report applies a mixed methodology in order to understand the size, scale and nature of the UK MROL sector. The analysis demonstrates that the UK MROL industry makes a significant contribution to the UK economy; the industry is estimated to account for £15bn of turnover annually and around 57,000 jobs across over 1,300 companies.

The analysis also illustrates the broad spatial footprint of the sector, with a presence across the breadth of England and the Devolved Administrations. This highlights the potential for growth within the sector to contribute to spatial rebalancing objectives. The report also shows some evidence of local MRO clusters that have established around large companies or physical infrastructure, particularly airports.

Changes in the international and the UK domestic MROL markets mean an increase in both competition and opportunities. The UK MROL industry presents opportunities for growth through technological innovation; for example data analytics, robotics and advanced materials have been identified as significant growth drivers and have the potential to become positive transformation drivers for aircraft maintenance and repair.

In an international market place, the UK MROL sector is thought to have a particular strength in the provision of high value, sophisticated and advanced MROL services. Building on this capability, the UK MROL industry has the potential to make a significant contribution to the UK Government's intention to double UK exports to £1 trillion by 2020.

The analysis of firms currently operating within the UK MROL sector highlights a long tail of small and medium-sized firms that are not "approved" organisations. There is potential for these companies to increase their contribution to the MROL sub-sector as well as to the UK economy by attaining such approvals.

The future growth and competitiveness of the UK MROL industry will be contingent upon effective investment by MROL businesses into facilities, equipment, technological innovation and skills. In order to achieve growth ambitions, there may be an opportunity for greater collaboration between players within the MROL industry, particularly in terms of innovation, training and perception of the sector. As part of this, there may be scope for a dialogue between the industry and Government to understand whether there is a specific role for public intervention in furthering the growth ambitions of the industry.

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Appendices

Methodology used to determine the MRO Sector Size and Scale

The methodology for capturing data and determining the MRO sector size, scale includes the following steps:

1. Obtain lists of all the company names, addresses, capabilities and size as determined by Companies House and, where possible, the most recent annual revenues and average employment levels, as shown in **Figure 20** from various sources that include Companies House, the Office of National Statistics (ONS), the Civil Aviation Authority (CAA) and the Ministry of Defence (MoD).
2. Identify the organisations listed in the ONS data list, according to SIC 33.160 classification and note the total revenues and total number of employees or employment levels for these companies.
3. Consolidate these lists into a single list comprising all the MROL organisations.
4. Identify duplicate company or organisations, whose data is duplicated.
5. Identify those organisations that are not listed in the ONS data. Exclude all the dormant companies and segment these remaining organisations according to whether they are SMEs, Start-ups (i.e. their type is unknown as they have not filled any accounts with companies house) and large companies, who are responsible for full disclosure of financial information through their financial statements.
6. Download the most recent financial statements from the Companies House 'Webcheck' service for the large companies. Then follow these steps:
 - a. Extract the most recent annual turnover and average staff employment levels from each Company's Financial Statement.
 - b. Estimate the net percentage of MROL involvement for each large company (i.e. those large companies not included in ONS data), based on the 'Nature of business activity' and using Stellar's own judgment, based on its extensive industry experience and discussions with MROLs.
 - c. The proportion of MROL- generated revenue typically ranges from between five and fifteen percent for aircraft engine and aircraft component Original Equipment Manufacturers (OEMs), ten percent for airlines and other operators of fixed wing aircraft and twenty five percent for helicopter operators. Stellar assumed one hundred percent for full MROL service providers. Stellar acted on the side of caution where there was no clear indication of the MROL-business-related revenue percentage. In such circumstances a zero percent MROL-related contribution was assumed for the organisation (e.g. in Serco's case).
 - d. Apply these percentages to all applicable large organisations to determine the net MROL-related revenue and net MROL employment levels or staff numbers. A summary of the MROL Revenue and Employment levels for each of these companies is provided in **Table** on page 71.

- e. Add all the net MROL Revenues and Employment levels to determine the total values for these large companies.
7. Estimate the total revenues for the SMEs not included in the ONS data.
8. Determine the total MROL sector size by adding:
 - a. The total annual revenues and employment level for the ONS SIC 33.160 companies
 - b. The total revenues and employment levels for the large companies that are not included in the ONS list of companies
 - c. The total estimated revenue and employment levels for Small companies not included in the ONS list.
9. Identify the category of the MROL companies according to their ownership or relationship in the MROL supply chain. These are:
 - a. Airline or aircraft operator owned.
 - b. OEM or manufacturer owned.
 - c. Independent from either the OEM, airline or aircraft operator.
 - d. Segment and analyse the companies according to their category.
10. Segment and analyse the MROL companies according to their regulatory approval status, which includes one or a combination of the following capabilities.
 - a. EASA/CAA Part 145 MRO.
 - b. MoD MAOS Part 145 MRO.
 - c. EASA/CAA Part 147 Training.
 - d. Logistics (supplier and movement of approved aircraft parts and components).
11. Segment and analyse the MROL companies according to their capability, which includes one or a combination of the following capabilities or speciality.
 - a. Aircraft or airframe MROL.
 - b. Engine MROL.
 - c. Component MROL.
 - d. Specialised Services such as non-destructive testing etc.

Table on page 71 summarises the estimated MRO employment levels and annual revenues, based on the most recent accounts filed with Companies House along with the estimated MRO content expressed as a percentage of the total revenue and employment numbers.

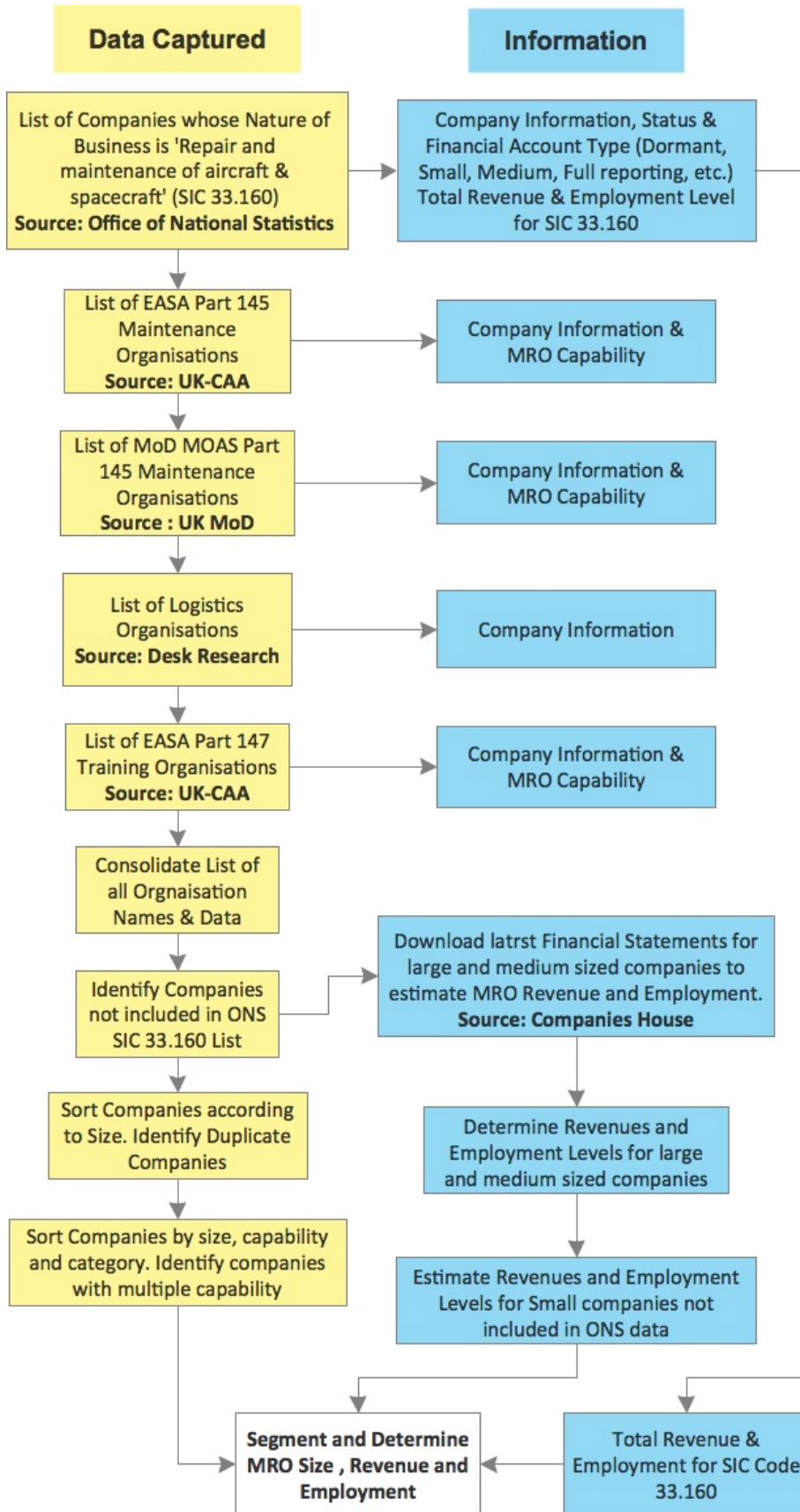


Figure 20: MRO Sector Analysis Methodology

Information provided by Companies House

In accordance with Companies Act 2006, the size of UK registered companies are classified according to the categories in the Table below:

Table 30: Description of Companies House Classification of Companies

Classification	Description
No Accounts Filed (Type not known)	These companies have not submitted any accounts to Companies House and their Type in terms of being Small, Medium or requiring Full reporting are not known. It can be assumed that these companies are new companies or start-ups and have been registered within the last 21 months (i.e. first anniversary (12 months of operation) plus 9 months to file first accounts).
Small	These are classified as Small Companies with Companies House, and comply with at least two of the following conditions: The annual turnover must be £6.5 million or less. The balance sheet must be £3.26 million or less. The average number of employees must be 50 or fewer. This category includes companies classified as 'Total Exemption Full' and 'Audit Exemption Subsidiaries' as they are exempt from having to be audited. They not only submit abbreviated accounts, which does not include annual financial turnover or staff levels.
Medium	These are classified as Medium Companies with Companies House with at least two of the following conditions: The annual turnover must be £25.9 million or less. The balance sheet must be £12.9 million or less. The average number of employees must be 250 or fewer. Their accounts require auditing and include an income statement and include the total annual turnover and average staff numbers during the reporting period.
Large	These are classified as Companies having to submit full accounts to Companies House and they are not classified as Small or Medium. Their accounts require auditing and include an income statement and include the total annual turnover and average staff numbers during the reporting period.
Dormant	These Companies are no longer trading and have been excluded from the total MRO sector analysis.
Foreign	These Companies have their registered office located outside of the UK and may file accounts in a foreign currency.

Limitations on Small Company Financial Reporting

Small Companies are exempt from an annual audit and they can choose to disclose less information on their financial statements than medium or large sized companies. They don't have to include the full balance sheet, profit and loss account or director's report normally required for medium and large sized companies. They must include an abbreviated balance sheet and notes explaining in more detail the make-up of the figures in the balance sheet.

The impact of this limited disclosure is that the annual financial turnover or staff number for small companies is not available from either Companies House or from the Office of National Statistics. The impact of this limitation is that the revenues and employment levels

have to be estimated and an assessment has to be made on the overall impact of the lack of this information on the overall sector size.

Financial and Employment Information of Large and Medium Companies

These Companies are audited and are required to disclose their full financial accounts that include a full balance sheet, a profit and loss account or income statement, the associated notes, declarations and average staff numbers.

Their income statements do not need to provide a detailed breakdown of their financial turnover. As a result, while a Company such as an airline is Part 145 approved, its MRO activity is only a portion of its total MRO value. In these instances, an estimate of MRO value and staff numbers of the company was made by taking a proportion, or reasonable percentage of the total reported revenue and staff numbers or employment levels.

The most recent turnover for Companies classified as either Large or Medium sized companies that were not included in the ONS Annual Business Survey were obtained from the latest Financial Statements filed with Companies House.

These Financial Statements included a Full Profit and Loss statement as well as the Balance Sheet. The reporting requirements do not require the breakdown of the financial data or turnover by service (e.g. MRO services). In most cases, companies, whose primary activity was not MRO services, the company did not provide a separate value for MRO services. Stellar therefore went through the financial statements and made a conservative judgement on the MRO proportion on the total turnover value for each Company.

For example, an airline provides MRO activities to support its main activity, which is the air transportation of goods and services. In this case Stellar assumed that the MRO proportion was ten percent (10 percent) of the turnover. This percentage is conservative and was based on information provided in Reference 2 on page 58, along with author's industry experience.

Similarly for a helicopter operator, Stellar assumed that the MRO value was twenty-five percent (25 percent) of the turnover based on information provided in Reference 1 on page 58. This percentage in the author's opinion is both realistic and conservative.

In the case of aviation component, system, and avionic OEMs, that ten percent (10 percent) of their turnover was related to the MRO of their products. In the author's opinion this is a conservative estimate as it includes the MRO of old legacy systems, which have to be maintained serviceable to enable the continued airworthiness of aircraft in service.

In other instances where companies did not provide a financial turnover statement on their specific MROL or aftermarket services, a conservative estimate of the MROL or aftermarket business value was used.

Office of National Statistics - Annual Business Survey

Table 31: Detailed ONS Annual Business Survey Statistics for SIC Code 33.160

Year	Number of enterprises	Total turnover	Approximate gross value added at basic prices (aGVA)	Total purchases of goods, materials and services	Total employment – point in time ¹	Total employment – average during the year ¹	Total employment costs	Total net capital expenditure	Total capital expenditure - acquisitions	Total capital expenditure - disposals	Total stocks and work in progress – value at end of year	Total stocks and work in progress – value at beginning of year	Total stocks and work in progress – increase during year
	Number	£ million	£ million	£ million	Thousand	Thousand	£ million	£ million	£ million	£ million	£ million	£ million	£ million
2008	238	3,412	995	2,486	25	25	694	*	*	24	567	498	68
2009	345	3,399	1,433	1,967	18	16	640	101	104	3	467	470	-4
2010	458	3,252	1,420	1,887	*	*	504	-34	50	84	413	358	55
2011	582	3,372	1,380	1,973	14	14	579	39	41	3	373	390	-18
2012	753	3,621	1,737	1,959	16	16	658	39	49	10	555	480	75
2013	924	3,975	2,101	1,892	15	16	612	*	*	7	524	507	17

Source: Annual Business Survey (ABS)

The following symbols and abbreviations are used throughout the ABS releases;

- * Information suppressed to avoid disclosure
- ... not available
- nil or less than half the level of rounding

The sum of constituent items in tables may not always agree exactly with the totals shown due to rounding.

Notes:

1. Total employment – point in time and Total employment – average during the year are from the Business Register and Employment Survey (BRES). Caution should be taken when combining financial data from the ABS with employment data from BRES due to differences in methodology.

2. Gross Value Added (GVA) measures the contribution to the economy of each individual producer, industry or sector in the United Kingdom. It is used in the estimation of Gross Domestic Product (GDP)

3. The ABS has included results for the Insurance and Reinsurance in its UK National releases since 2008.

Data for this industry has remained experimental since its first release while ongoing quality assurance of the developing time series has taken place. This quality assurance has led the figures to be revised substantially in recent years with a resulting break in the series between 2009 and 2010.

Due to ongoing volatility in the data for 2012, and following discussions with key users, results for Insurance and Reinsurance have been removed from ABS releases while a more detailed quality assessment is undertaken. This does not affect other industries.

While the experimental results for Insurance and Reinsurance will not appear in ABS from reference year 2012, the data will be available on request, but users should take into account the issue concerning quality.

A review of the questionnaire for Insurance and Reinsurance businesses will be undertaken alongside continued validation of returns to the survey, with the aim of reintroducing them to the ABS publications when the quality of the data has improved. Updates on progress will be available on the ABS page.

Aerospace Manufacturing, Aircraft Maintenance and Air Transport Statistics

Table 32: ONS Aerospace Manufacturing, Aircraft Maintenance and Air Transport Statistics

Standard Industrial Classification (Revised 2007)	Description	Year	Number of enterprises	Total turnover	Approximate gross value added at basic prices (aGVA)	Total purchases of goods, materials and services	Total employment – point in time ¹	Total employment – average during the year ¹
			Number	£ million	£ million	£ million	Thousand	Thousand
33.16	Repair and maintenance of aircraft and spacecraft	2008	238	3,412	995	2,486	25	25
		2009	346	3,399	1,433	1,967	18	16
		2010	458	3,252	1,420	1,887	*	*
		2011	582	3,372	1,380	1,973	14	14
		2012	753	3,621	1,737	1,959	16	16
		2013	924	3,975	2,101	1,892	15	16
51	Air transport	2008	980	21,841	5,373	15,403	93	93
		2009	1,045	20,458	5,034	14,470	81	72
		2010	929	20,854	6,608	13,416	73	74
		2011	859	21,954	5,721	15,820	77	75
		2012	854	22,511	5,210	16,919	82	75
		2013	797	24,018	5,994	17,582	78	71
30.3	Manufacture of air and spacecraft and related machinery	2008	379	17,628	7,038	11,000	87	87
		2009	440	20,103	6,636	13,644	*	*
		2010	489	20,472	5,828	14,610	*	*
		2011	495	21,509	7,245	14,345	*	*
		2012	562	22,321	7,263	15,673	*	*
		2013	634	24,749	9,422	15,592	89	87

Factors that can influence the MROL Sector

The following list provides an initial structured breakdown and summary of the factors that Stellar has identified as factors that can influence the UK MROL sector.

1. MRO Business Structure

- Degree of Vertical Integration
 - OEM
 - Independents
 - Operator
- Segmentation
 - Capabilities and Size
 - Part 145, Part 147, MAOS Part 145.
 - Aircraft Types
 - Older Generation Aircraft (Single Aisle / Wide body / Rotary / Other)
 - New Generation (Single Aisle / Wide body / Rotary / Other)
 - Type of Customer
 - Military
 - Airline
 - Corporate
 - Other (Aerial Work)
- Capacity
 - Skills
 - Excess capacity management
 - Investment in MRO equipment and facilities
- Business Viability and Risk
 - Over reliance on a single or few customers
 - Ability to accommodate changes in demand (increase and decrease)
 - Profitability (ability to accommodate business cycle changes)
 - OEM dominance versus OEM collaboration and mutual trust
 - Supply Chain weaknesses and strengths
 - R&D, investment, training
- Competitive Advantage
 - IP and propriety processes and skills
 - Relationships
 - Leadership / Management strength and weaknesses
 - Stage of business life cycle
 - Ability to provide bespoke services
 - Ability to change and evolve

2. Impact of New Aircraft Technology on MRO future

- Composite Aircraft (Repairs, Non-destructive Evaluation (NDE))
- Advanced Materials
- MORE Electrical Aircraft
- Cabin technology (seats, IFEC, Wi-Fi etc.)
- Airline differentiation itself through technology and services
- Bespoke passenger services

3. MRO Logistics

- Movement of spares and parts
- Import, export, customs barriers
- AOG movement of parts and spares globally
- UK transportation infrastructure (Road, Rail, Sea)
- Movement of aircraft to and from MRO facilities
- Quality Assurance, documentation, and handling of goods harmonisation of requirements between suppliers and customers. Many customers, including OEMs have unique additional requirements to ensure airworthiness compliance in addition to the standard EASA Form 1 and FAA Form 8130 release certificates, which result in added costs.

4. MRO Resources

- Major requirement for qualified technicians
- Change in technician training from aircraft powerplant, airframe and avionics centric skills to integrated total system skills.
- Need and advantage of paperless documentation control
- Need for MROs to invest in systems and training to accommodate new technologies
- High EU Labour rates closing gap with Asia (China)
- Preparation for the future
- Graduate training

5. Airworthiness and Regulatory Considerations

- EASA - reduction in the lucrative Type Certification, which provides a lot of EASA funding – risk of increase in MRO, STC related costs
- EASA competitive advantage over FAA – more ICAO States following EASA
- Compliance with regulatory requirements of other CAAs
- Paperless documentation (included above)
- Harmonisation of regulatory requirements between major CAAs
 - EASA
 - FAA in the USA.
 - Interstate Aviation Committee (IAC)
 - National Civil Aviation Agency also known as ANAC, (Brazil)
 - Transport Canada.
 - Directorate General of Civil Aviation (India)
 - Civil Aviation Administration of China (CAAC)
 - MAOS

- Streamlining of MRO requirements between operators and MROs - addressing the question why does each airline need to develop its own MRO procedures and are frequent audits necessary.
- FAA changes - FAA now requiring reporting of each fault – increased workload
- Impact of ICAO Annex 19 (SMS) and its implementation.

6. Political / Economics Implications (Positive and Negative)

- Support of Government
- UK Legal environment – IP protection, litigation, contract
- UK Corporate Governance and Compliance
- Taxation, financial reporting, capital allowances
- EU Regulations
- Impact of EC Regulation 261/2004 (common rules on compensation and assistance to passengers in the event of denied boarding, flight cancellations, or long delays of flights)
- Fuel Price decrease or increase
- Cost of Capital – availability of debt finance
- Terrorism, Disease
- Strong Security, Intelligence and Law Enforcement
- Availability of finance
- Currency fluctuations
- Product warranty (e.g. EU – 2 years on consumer products)
- EU evolution and impact of UK leaving EU

7. MRO Relationships

- Engine OEMs vertical integration along the product support MRO chain
- Relationships with OEMs and Airlines increasing
- Independent MROs have an opportunity to collaborate with OEMs
- Management, Monitoring and Approval of Suppliers
- Harmonisation of different Quality Assurance requirements between OEM and suppliers (e.g. Cobham supplying Eurocopter and AgustaWestland).

8. MRO Process

- Logistics and Movement of Goods
- Investment in assets and facilities (MRO related)
- MRO IT Systems
- Digital Documentation (Legislation)
- New MRO skills and protocols
- Streamlining EASA procedures
- Exception, system failure reporting using In-flight connectivity (IFC) data-link off aircraft to MRO
- MRO Planning for maximum Return on Investment (e.g. Engine life phased in with airframe end-of-service life)

9. Global Industry Considerations

- Opportunities for Growth
- Single Aisle
- Cabin Seat technology
- Connectivity
- Capturing business from outside UK (providing MRO services in other areas, jurisdiction)
- Leasing Companies
- Global trends (traffic growth, new aircraft, skills, resources)
- Evolve to target new MRO services to support new generation aircraft.

10. Threats / Barriers / Inhibitors to growth and sustainability

- Capacity limitations
- Skills, capabilities,
- Investment in facilities, plant and machinery required to support MRO growth
- Investment in MRO sector
- OEM requirements on SMEs
- Global labour rates differences
- Increased product reliability, resulting in reduced MRO work
- Entry of cheaper and 'disposable' COTS equipment (cheaper to scrap than repair) – e.g. use of iPads instead of Electric Flight Bags for cockpit

Full Companies – MRO Employment and Revenues

The Table below summarises the companies providing full accounts to Companies House, which have not been included in the ONS SIC 33.160 category and are considered as non-SMEs. It includes the estimated MROL employment and revenue or turnover values.

Table 33: MRO Employment and Revenues (Full Accounts) not in ONS SIC 33.160

Class	Name	MRO Employees Non-ONS	Employees Non-ONS	MRO Revenue Non-ONS	Revenue Total Non-ONS	MRO % of Total Revenue
Part 145	Roll-Royce PLC	11,694	21,500	£3,620,000,000	£6,655,000,000	54%
Part 145	GE Aircraft Engine Services Limited	1,336	1,336	£1,671,829,439	£1,671,829,439	100%
MOAS Part 145	Rolls-Royce Defence	3,630	7,800	£1,206,000,000	£2,591,000,000	47%
Part 145	BAE Systems (Operations) limited	3,732	18,664	£1,197,600,000	£5,988,000,000	20%
Part 145	Easyjet Airline Company limited	784	7,844	£430,200,000	£4,302,000,000	10%
Part 145	GE Caledonian Limited (Formerly Aviall)	799	799	£359,922,762	£359,922,762	100%
Part 145	Marshall of Cambridge Aerospace Limited	1,444	1,444	£239,159,000	£239,159,000	100%
Part 145	Virgin Atlantic Airways Limited	834	8,341	£223,390,000	£2,233,900,000	10%
Part 145	Thomson Airways Limited	379	3,797	£192,300,000	£1,923,000,000	10%
MOAS Part 145	Boeing Defence UK Limited	631	631	£174,541,217	£174,541,217	100%
Part 145	Marshall Aviation Services Limited	238	238	£165,660,000	£165,660,000	100%
Part 145	Selex ES Limited	448	4,486	£91,057,200	£910,572,000	10%
Part 145	Zodiac Seats UK Limited	540	1,080	£87,663,000	£175,326,000	50%
Part 145	Babcock Aerospace Limited	1,573	1,573	£81,907,000	£81,907,000	100%
Part 145	GE Aviation Systems Limited	450	3,002	£79,507,564	£530,050,427	15%
Part 145	GKN Aerospace Services Limited	385	3,850	£70,725,600	£707,256,000	10%
Part 145	H & S Aviation Limited	337	337	£65,889,000	£65,889,000	100%
Part 145	Bristow Helicopters Limited	211	845	£63,130,877	£252,523,509	25%
Part 145	Flybe Limited	218	2,185	£62,050,000	£620,500,000	10%
Logistics	Aerotron Limited	60	60	£60,252,127	£60,252,127	100%
Part 145	Short Brothers PLC	87	873	£57,700,000	£577,000,000	10%
Part 145	Jet2.Com Limited	227	2,274	£55,615,600	£556,156,000	10%
Part 145	Rohr Aero Services Limited	270	270	£48,086,282	£48,086,282	100%
Part 145	ATC (Lasham) Limited	421	421	£48,009,669	£48,009,669	100%
Part 145	Harrods Aviation Limited	214	214	£47,721,000	£47,721,000	100%
Logistics	Saywell International Limited	74	74	£45,957,724	£45,957,724	100%
Part 145	CHC Scotia Limited	121	484	£44,426,250	£177,705,000	25%
Part 145	Spirit Aerosystems (Europe) Limited	95	952	£44,360,300	£443,603,000	10%
Part 145	B/E Aerospace (UK) Limited	135	1,351	£43,902,000	£439,020,000	10%
Part 145	Thomas Cook Aircraft Engineering Limited	441	441	£39,599,000	£39,599,000	100%
Part 145	Raytheon Systems Limited	124	1,240	£38,632,000	£386,320,000	10%
Part 145	Honeywell Control Systems Limited	184	1,843	£35,834,800	£358,348,000	10%
Part 145	Inflite Engineering Services Limited	401	401	£33,775,429	£33,775,429	100%
Part 145	Airline Services Limited	465	621	£33,050,382	£44,067,176	75%
Part 145	KLM UK Engineering Limited	390	390	£32,467,435	£32,467,435	100%
Part 145	Goodrich Aerospace UK Limited	52	52	£31,393,000	£31,393,000	100%
Part 145	Doncasters Aerospace Limited	238	477	£31,253,000	£62,506,000	50%
Part 145	DHL Air Limited	33	335	£30,468,000	£304,680,000	10%
Part 145	Gulfstream Aerospace Limited	186	186	£29,391,000	£29,391,000	100%
Part 145	Bond Offshore Helicopters Limited	96	386	£28,632,750	£114,531,000	25%
Part 145	Goodrich Actuation Systems Limited	141	1,414	£28,000,000	£280,000,000	10%
Part 145	SKF (UK) Limited	100	1,000	£25,461,700	£254,617,000	10%
Part 145	AEM Limited	217	217	£25,262,000	£25,262,000	100%
Part 145	Air Tanker Services	225	225	£23,254,000	£23,254,000	100%
Part 145	Meggitt Aerospace Limited	147	1,478	£22,381,700	£223,817,000	100%
Part 145	FB Heliservices Limited	155	621	£20,539,250	£82,157,000	25%
Part 145	Zodiac Aerospace UK Limited	35	35	£19,822,545	£19,822,545	100%
Part 145	Praxair Surface Technologies Limited	168	337	£19,793,500	£39,587,000	50%
Part 145	Dunlop Aircraft Tyres Limited	175	350	£19,710,000	£39,420,000	50%
Part 145	Goodrich Control Systems PLC	60	600	£18,830,000	£188,300,000	10%
Part 145	Ultra Electronics Limited	112	2,257	£18,637,050	£372,741,000	5%
Part 145	Nordam Europe Limited	142	285	£18,457,807	£36,915,613	50%
Part 145	Serco Limited	299	29,987	£17,849,000	£1,784,900,000	1%
Part 145	Thales UK Limited	83	1,664	£17,308,300	£346,166,000	5%
Part 145	Meggitt (UK) Limited	79	796	£16,566,000	£165,660,000	10%
Part 145	Eaton Limited	99	992	£16,372,900	£163,729,000	10%
Part 145	MEL Aviation Limited	157	157	£15,974,944	£15,974,944	100%

Class	Name	MRO Employees Non-ONS	Employees Non-ONS	MRO Revenue Non-ONS	Revenue Total Non-ONS	MRO % of Total Revenue
Logistics	ACLAS Global Limited	-		£15,622,883	£15,622,883	100%
Part 145	BA Cityflyer Limited	37	375	£14,904,800	£149,048,000	10%
Part 145	TAG Farnborough Engineering Limited	111	111	£13,429,301	£13,429,301	100%
Part 145	Flight Refuelling Limited (FR AVIATION)	-		£13,027,500	£130,275,000	10%
Part 145	Pall Europe Limited	73	737	£12,265,800	£122,658,000	10%
Part 145	Safran Power UK Limited	52	529	£11,508,300	£115,083,000	10%
Part 145	Honeywell UK Limited	101	203	£11,129,500	£22,259,000	50%
Logistics	Air and Ground Aviation Limited.	60	60	£11,125,315	£11,125,315	100%
Part 145	Prestwick Aircraft Maintenance Limited	226	226	£11,068,676	£11,068,676	100%
Part 145	MOOG Wolverhampton Limited	42	424	£10,899,600	£108,996,000	10%
Part 145	HS Marston Aerospace Limited	80	320	£9,547,000	£38,188,000	25%
Part 145	Pratt & Whitney Canada (UK) Limited	22	22	£9,151,666	£9,151,666	100%
Part 145	TES Parts Limited	-	-	£9,111,700	£91,117,000	10%
Part 145	Kaman Composites - UK Limited	122	245	£9,025,500	£18,051,000	50%
Part 145	CHEP Aerospace Solutions (UK) Limited	91	91	£8,901,517	£8,901,517	100%
Part 145	Chromalloy United Kingdom Limited	120	241	£8,789,500	£17,579,000	50%
Part 145	Druck limited	65	657	£8,785,200	£87,852,000	10%
Part 145	Bond Air Services Limited	43	174	£8,781,500	£35,126,000	25%
Part 145	Loganair Limited	56	562	£8,753,200	£87,532,000	10%
Part 145	Darchem Engineering Limited	86	865	£8,351,400	£83,514,000	10%
Part 145	CSE Bournemouth Limited	53	53	£8,193,000	£8,193,000	100%
Part 145	Muirhead Aerospace limited	35	70	£8,192,000	£16,384,000	50%
Part 145	Adams Aviation Supply Company Limited	28	56	£7,907,511	£15,815,022	50%
Part 145	Global Supply Systems Limited	12	125	£7,745,008	£77,450,080	10%
Part 145	Penny & Giles Controls Limited	51	515	£7,649,800	£76,498,000	10%
Part 145	Chelton Limited	28	280	£7,167,400	£71,674,000	10%
Part 145	Titan Airways Limited	7	70	£7,158,616	£71,586,156	10%
Part 145	Rosemount Aerospace Limited	28	115	£7,028,250	£28,113,000	25%
Part 145	Storm Aviation Limited	52	52	£6,884,995	£6,884,995	100%
Part 145	Claverham Limited	20	205	£6,597,400	£65,974,000	10%
Part 145	Moog Controls Limited	46	461	£6,244,400	£62,444,000	10%
Part 145	AIM Aviation (Henshalls) Limited	31	311	£6,176,600	£61,766,000	10%
Part 145	Airbase Interiors Limited	96	96	£6,161,315	£6,161,315	100%
Part 145	Ipeco Holdings Limited	64	647	£5,829,300	£58,293,000	10%
Part 145	British Midland Regional Limited	39	392	£5,523,400	£55,234,000	10%
Part 145	Wood Group Gas Turbine Services Limited	-		£5,040,000	£5,040,000	100%
Part 145	AIM Aviation (Jecco) Limited	32	325	£4,843,000	£48,430,000	10%
Part 145	Teledyne Limited	23	234	£4,421,862	£44,218,621	10%
Part 145	Ontic Engineering & Manufacturing UK Limited	11	114	£4,253,397	£42,533,968	10%
Part 145	Smiths (Harlow) Aerospace Limited	44	88	£4,175,234	£8,350,468	50%
MOAS Part 145	Airbus Military (UK) Limited	-		£4,026,653	£4,026,653	100%
Part 145	Turbine Motor Works Limited	17	17	£3,931,351	£3,931,351	100%
Part 145	Rotor Blades Limited	9	9	£3,905,000	£3,905,000	100%
Part 145	PLM Dollar Group Limited	21	87	£3,876,401	£15,505,605	25%
Part 145	British International Helicopter Services Limited	27	111	£3,863,041	£15,452,163	25%
Part 145	Survitec Service & Distribution Limited	32	324	£3,797,300	£37,973,000	10%
Part 145	Delavan Limited	25	50	£3,737,409	£7,474,818	50%
Part 145	JETS (Biggin Hill) Limited	-		£3,574,047	£3,574,047	100%
Part 145	Amsafe Bridport Limited	18	187	£3,484,100	£34,848,000	10%
Part 145	Air Contractors Engineering Limited New Name: Aclas Tecchnics Limited	18	18	£3,471,425	£3,471,425	100%
Part 145	Aerospace Tooling Limited	39	78	£3,350,148	£6,700,295	50%
Part 145	Police Aviation Services Limited	38	153	£3,331,000	£13,324,000	25%
Part 145	Bostonair Limited Subsidiary of Bostonair Group	44	44	£3,279,439	£3,279,439	100%
Part 145	Material Measurements Limited	35	70	£2,944,000	£5,888,000	50%
Part 145	Cobham Advanced Composites Limited	18	184	£2,850,900	£28,509,000	10%
Part 145	Kidde Graviner Limited	10	109	£2,759,800	£27,598,000	10%
Part 145	Thompson Aero Seating Limited	11	119	£2,693,540	£26,935,404	10%
Part 145	Zenith Aviation Limited (Perfect Aviation UK Limited)	-		£2,638,411	£5,276,822	50%

Class	Name	MRO Employees Non-ONS	Employees Non-ONS	MRO Revenue Non-ONS	Revenue Total Non-ONS	MRO % of Total Revenue
Part 145	Satair UK Limited	6	13	£2,630,587	£5,261,173	50%
Part 145	Multiflight Limited	18	75	£2,510,514	£10,042,055	25%
Part 145	Page Aerospace Limited	16	169	£2,393,400	£23,934,000	10%
Part 145	Heli Air Limited	14	56	£2,393,064	£9,572,254	25%
Part 145	Ferranti Technologies Limited	15	156	£2,357,800	£23,578,000	10%
Part 145	Gardner Aerospace - Basildon Limited	18	180	£2,228,900	£22,289,000	10%
Part 145	Timken UK Limited	17	176	£2,161,021	£21,610,214	10%
Part 145	Racal Acoustics limited	12	124	£1,900,700	£19,007,000	10%
Part 145	Survival One Limited	16	169	£1,678,762	£16,787,619	10%
Part 145	Rizon Jet UK Limited	20	41	£1,550,290	£3,100,580	50%
Part 145	Goodwood Road Racing Company Limited (PLC)	111	222	£1,470,462	£2,940,923	50%
Part 145	EDO MBM Technology Limited	9	91	£1,466,800	£14,668,000	10%
Part 145	Aerospace Surface Treatments Limited	-		£1,431,106	£1,431,106	100%
Part 145	AIM Composites Limited	18	182	£1,371,600	£13,716,000	10%
Part 145	25 Repair Centre Limited	9	9	£1,128,628	£1,128,628	100%
Part 145	NDT Services Limited	12	122	£1,033,800	£10,338,000	10%
Part 145	Castle Air Limited	-		£1,019,948	£10,199,476	10%
Part 145	South Western Helicopters Limited	3	12	£1,007,750	£4,031,000	25%
General	Miscellaneous Small Company Data Filing Full Accounts	32		£6,274,464		
TOTAL		39,166		£11,728,177,707		

Questionnaire

The following Questionnaire was sent to MRO Part 145 Organisations and ADS MRO Sector Members.

UK MRO&L Survey for the UK Department for Business, Innovation & Skills

1. Introduction

We have been contracted by the UK Department for Innovation and Skills to carry out a survey of the UK MRO & Logistics market.

The MRO and Logistics sector is set to be a high growth industry that will face challenges on accommodating the large growth in new aircraft, new technologies and the increasing demand for skilled maintenance personnel.

The purpose of this research which is funded by the UK Department for Business, Innovation & Skills (UK-BIS) is to: “provide an in depth understanding of the size and scale of the MRO&L: sub-sector and the growth opportunities associated with it. The outcomes of the research are expected to inform future BIOS policy and to provide a robust evidence base for both government and industry with respect to identifying and exploiting areas of growth potential.”

Your support in answering the questions below will help develop a strategy that will help both your organisation and the UK MRO&L sector grow and provide a coherent strategy to support the sectors growth and profitability.

Your survey results will help highlight the importance of this sector to the UK economy and help identify the threats and global opportunities that will in turn determine a national strategy to counter the threats and position the UK to exploit global MRO&L opportunities.

The questionnaire should take a maximum of 20 minutes to complete.

Please contact me if you have any questions. My contact details are:

Hans Karlsen
Vice President and Senior Advisor
Stellar Solutions Aerospace Limited
Mobile 077 937 64231
Email: hkarlsen@stellaraerospace.co.uk

2. Your company

1. Your Size of Organisation

- ☐ Large
- ☐ Medium (less than £25.9 million Annual Turnover)
- ☐ Small (less than £6.3 Million Annual Turnover)
- ☐ Other (please specify)

2. What is your type of organisation?

- ☐ Independent MRO
- ☐ OEM providing MRO service
- ☐ Airline or Aircraft Operator owned
- ☐ Education
- ☐ Government, Military
- ☐ Aircraft Leasing
- ☐ Management Consulting and Advisory services
- ☐ Independent consulting

Other (please specify)

3. What MRO&L services do you provide?

- ☐ Field/ Line/ Base MRO
- ☐ Engine Overhaul and Repair
- ☐ Component or Systems MRO
- ☐ Airframe Overhaul and Repair
- ☐ Logistics and Supply Chain Management
- ☐ Design & Approvals (minor modifications, STCs etc.)
- ☐ Training
- ☐ MRO R&D

Other (please specify)

4. Which areas are your target market?

- ☐ UK
- ☐ EU
- ☐ Middle East
- ☐ Asia
- ☐ South America
- ☐ North America
- ☐ Africa
- ☐ Oceania
- Other (please specify)

5. List the categories that best describes the customers that you serve.

- ☐ Civil
- ☐ Military
- ☐ General Aviation Including Business Aviation
- ☐ OEM or OEM Owned
- ☐ Aircraft Operator or Airline Owned
- ☐ Independent
- ☐ Aviation Training
- ☐ Supply of MRO&L related Manpower
- Other (please specify)

6. How many customers do you mainly rely on for your MRO services?

- ☐ Confidential
- ☐ 1
- ☐ 2 to 5
- ☐ More than 5
- Other (please specify)

3. Strategic Value of the UK MRO&L Sector

7. What is the impact of the following MRO industry trends and drivers that may affect or help grow your business in the next 5 to 10 years?

	Significant	Minor	No Impact
MRO opportunity from new high growth markets.	☐	☐	☐
High growth in new single aisle aircraft deliveries.	☐	☐	☐
MRO of new technologies (MRO of composites, advanced systems, etc.).	☐	☐	☐
MRO Competition mainly from Asia and North America.	☐	☐	☐
New MRO Market entrants (ie. New companies entering MRO&L sector).	☐	☐	☐
Cabin interior upgrades and refurbishments.	☐	☐	☐
Upgrades and installation of in-flight entertainment, connectivity and systems complying with future ATM requirements.	☐	☐	☐
MRO Regulatory changes (EASA, FAA and others.)	☐	☐	☐
Aircraft leasing companies influencing who provides MRO services	☐	☐	☐
Low cost carriers entering aircraft leasing market, who would influence MRO suppliers or carry out MRO themselves.	☐	☐	☐
OEMs controlling IP as a means of securing OEM MRO aftermarket provision	☐	☐	☐
Engine OEMs moving into or increasing presence in aftermarket service provision.	☐	☐	☐
Airframe OEMs moving into or increasing presence in aftermarket service provision.	☐	☐	☐
Component and System OEMs moving into or increasing presence in aftermarket service provision.	☐	☐	☐
Harmonisation of MRO standards and protocols between airlines.	☐	☐	☐
Harmonisation of MRO standards and protocols between MROs.	☐	☐	☐
Leasing companies and aircraft sales organisations influencing standards harmonisation.	☐	☐	☐
Digitisation and standardisation of MRO records.	☐	☐	☐
OEM threat to decline in Independent MROs.	☐	☐	☐
Independent MROs having to rely more on legacy airframe and engine MRO.	☐	☐	☐
Increased opportunity to secure MRO services from high growth in single aisle aircraft market.	☐	☐	☐
Increased opportunity to secure MRO services from wide-body market (eg. B747, A380, B777, A250 etc.).	☐	☐	☐
Other (please specify)			

8. How well is the UK placed to take advantage of these drivers that will influence the MRO&L industry?

	Dominant Position	Strong Position	Weak	Something needs to be done	N/A
High Growth Aviation Markets (e.g. Asia etc.)	☐	☐	☐	☐	☐
Growth in single aisle aircraft deliveries	☐	☐	☐	☐	☐
MRO of New Technology (Composites, Lithium Batteries etc.)	☐	☐	☐	☐	☐
Global MRO Competition.	☐	☐	☐	☐	☐
New MRO Market Entrants	☐	☐	☐	☐	☐
Influencing MRO Regulatory Issues (EASA, FAA & Rest of World).	☐	☐	☐	☐	☐
Cabin interior upgrades or refurbishments.	☐	☐	☐	☐	☐
Upgrades and installation of in-flight entertainment, connectivity and systems	☐	☐	☐	☐	☐
MRO of Aircraft coming out of lease from different regulatory jurisdictions	☐	☐	☐	☐	☐
Harmonisation of MRO standards and protocols.	☐	☐	☐	☐	☐
Influencing digitisation of MRO records.	☐	☐	☐	☐	☐
Ability to support OEM aftermarket expansion.	☐	☐	☐	☐	☐

9. What do think are the main inhibitors or barriers (if any) to growing the UK MRO&L sector?

10. What do you think are the main global competitive threats that the UK will face if nothing is done to offset them?

11. What do you think are the main opportunities that the UK MRO&L sector should exploit?

12. The UK MRO&L sector has not grown significantly over the past 5 years. What could be done to “kick-start” this growth?

13. Considering the UK MRO&L sector, what strengths does the UK have in relation to the rest of the world? Please list as many as possible.

UK MRO&L strengths

- 1.
- 2.
- 3.
- 4.
- 5.

14. Considering the UK MRO&L sector, what weaknesses does the UK have in relation to the rest of the world? Please list as many as possible.

UK MRO&L weaknesses

- 1.
- 2.
- 3.
- 4.
- 5.

15. Considering the Global MRO&L Industry sector, what opportunities are there that the UK should target to become a leader in MRO&L Services? Please list as many as possible.

Global MRO&L Opportunities

- 1.
- 2.
- 3.
- 4.
- 5.

16. Considering the Global MRO&L Industry sector, what threats are there that could adversely affect the UK MRO&L sector? Please list as many as possible.

Global MRO&L Threats

- 1.
- 2.
- 3.
- 4.
- 5.

17. With the trend of the OEMs moving into the aftermarket and MRO sector, do you have any thoughts on how the independent MROs could respond to this threat?

4. Skilled Labour to Support the UK MRO&L Sector Growth and Aspirations

The MRO&L industry will have significant growth with the forecast high growth in new single aisle aircraft, particularly in Asia. This would require a significant increase in the number of licensed engineers and technicians to support the Global MRO market.

18. In relation to your organisation:

	Yes	No	N/A
Are you facing a shortage in staff?	☐	☐	☐
Please provide any additional comments			
Do you carry out in-house training?	☐	☐	☐
Please provide any additional comments			
Is the lack of training support adversely affecting you?	☐	☐	☐
Please provide any additional comments			
Will you need to retrain your staff to support new technologies?	☐	☐	☐
Please provide any additional comments			
Do you anticipate a problem with recruiting skilled staff in 5 years time?	☐	☐	☐
Please provide any additional comments			
Is the MRO&L sector facing competition for skilled staff from the airlines and OEMs?	☐	☐	☐
Please provide any additional comments			

19. In relation to the MRO&L Skills and their impact on the UK MRO&L Sector, please indicate your views on the following:

	Severe	High Negative	Moderate Impact	Low No impact	N/A
Availability of Skilled UK based MRO technicians in next 5 years	☐	☐	☐	☐	☐
Availability of Skill UK based MRO technicians in next 10 to 15 years	☐	☐	☐	☐	☐
Technician training to meet future technology	☐	☐	☐	☐	☐
Threat of Technicians leaving UK	☐	☐	☐	☐	☐
Increased labour costs in next 5 years	☐	☐	☐	☐	☐
Increased labour costs in next 10 to 15 years	☐	☐	☐	☐	☐
Ability to attract skilled workers	☐	☐	☐	☐	☐
Other comments (please specify)					

20. Do you have any views on how the UK Government can help meet the demand for licensed and skilled technicians and engineers?

21. Is there anything other industry bodies such as ADS and the CAA could do to alleviate skills shortages?

5. Factors Critical to MRO&L Industry Future

22. What factors are critical to help position the UK as a Global MRO&L Leader? Please rank them in order of importance with 1 being the most important and 4 being the least important.

- 1-4. Availability of skilled technicians ☐ N/A
- 1-4. Making Finance available to invest ☐ N/A
- 1-4. Investment in MRO R&D for future technologies ☐ N/A
- 1-4. Government Support to promote UK MRO&L capabilities globally ☐ N/A

23. What do you feel are the factors that are critical for the UK MRO&L industries' medium to long term future success.

- Primary factor [Click here to enter text.](#)
- Secondary [Click here to enter text.](#)
- Tertiary [Click here to enter text.](#)
- Other [Click here to enter text.](#)
- Other [Click here to enter text.](#)
- Other [Click here to enter text.](#)
- Other [Click here to enter text.](#)

24. How well is the UK positioned to take advantage of new technologies and the associated after sales support?

	Global Leader	Strong	Average	Weak	N/A
Composite repairs	☐	☐	☐	☐	☐
Integrated systems	☐	☐	☐	☐	☐
Engines	☐	☐	☐	☐	☐
Electrical Power Generation	☐	☐	☐	☐	☐
In-Flight Entertainment	☐	☐	☐	☐	☐
In-Flight Connectivity	☐	☐	☐	☐	☐
Cabin Interiors	☐	☐	☐	☐	☐
Additional comments					

25. Do you have any views on the UK remaining within the EU? What impact would there be on the MRO&L sector if the UK left the EU? Please leave a blank if you have no specific views.

6. Thank you for completing the survey

26. Are you aware of the services and resources, such as finance, that the UK Department for Business, Innovation & Skills and UKTI make available to help your business succeed?

☐ Yes

☐ No

☐ Aware of some information

Please provide any additional comments

27. Are there any additional factors that the UK Department for Business, Innovation & Skills should consider to help the UK MRO&L industry sector?

28. Are you happy to share your contact details and your answers to the survey with UK-BIS?

☐ Yes

☐ No

Other (please specify)

29. Please provide your Name and Contact details.

Name

Company

Email Address

Phone Number



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