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Flying through servicing and maintenance

Ever since the first powered aircraft flight by Wilber and Orville Wright in 1903 there has been a need to gain access to various components on an aircraft in order inspect, service, maintain and repair. In the early days it would have been steps and ladders with little concern for falls from height. However, as time progressed, the safety of those working at height has become increasingly important, as has the speed and efficiency of the work.

The advent of larger aircraft carrying more and more passengers has increased the impact of a serious or fatal incident. As a result, the focus on doing anything and everything possible to avoid such incidents and keep passengers safe has grown exponentially, to the point where aviation is probably the most demanding and safety orientated of all industries.

The sector was regulated quite early on in its history, initially introduced during the mid to late 1920s - a period which saw more than 90 fatal commercial airline crashes in just three years. 1929 is the worst year on record with an accident rate of one death for every million miles flown. Based on the current numbers flying this would equate to about 7,000 fatal incidents a year!

It was the USA and most notably the Air Commerce Act of 1926 - under the Aeronautics Branch of the United States Department of Commerce - which required pilots and aircraft to be examined and licensed, for accidents to be properly investigated and the establishment of safety rules and navigation aids.

Hand in hand with the regulations came increasingly stringent safety requirements along with service and maintenance schedules which helped reduce the number of incidents dramatically. More than 100 years after the first flight - between 2002 and 2011 - the number of fatal accidents had fallen to 0.6 per one million flights globally or 0.4 per million hours flown.

From the early days, passenger numbers grew steadily. Between 1930 and 1938 the number of people using airplanes for travel jumped from 6,000 to 1.3 million. By 1970 the total was 310 million, however this figure had rocketed to 4.5 billion in 2019 and is expected to more than double to about 10 billion by 2040! (Climate/covid restrictions allowing).

Commercial aviation is big business and keeping aircraft fully operational is absolutely critical for airlines to maximise revenues. In 2019 it is estimated that revenues totalled about $841 billion generating profits of around $45 billion. Keeping aircraft in the air has meant the ability to satisfy safety and maintenance requirements in as short a time as possible, which in turn has led to the development of improved methods of working at height. These developments have enhanced speed and safety both for the highly trained aircraft engineers but also protecting the aircraft fuselages and engines from damage. As a result, access equipment specifically designed for the sector has expanded and grown to incorporate the latest technologies.

A Manitou articulated boom providing quick and safe access to carry out inspection work

A set of steps was all that was needed to check the propeller in the early days

There were so many accidents in the early days that the sector became regulated quite early on in its history

In the late 1920s there were more than 90 fatal commercial airline crashes

Access all areas

Until the introduction of aerial work platforms, the access methods used to service and maintain aircraft had remained pretty much the same for more than three quarters of a century - in fact many of the principles remain much the same today for the larger maintenance/ service tasks!

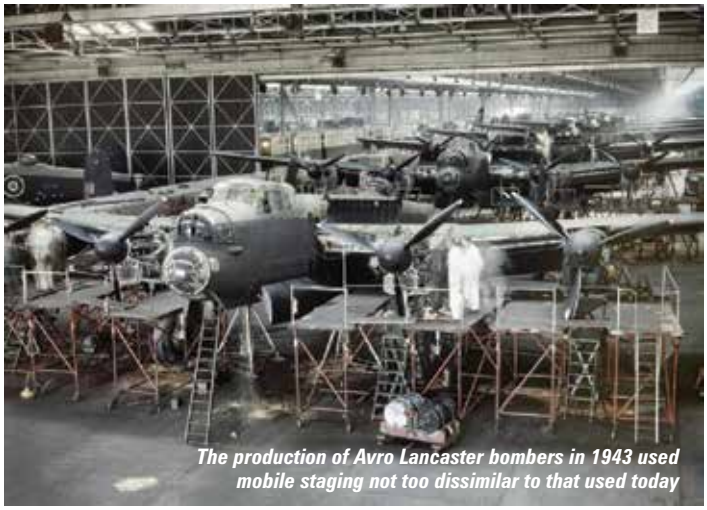
If you walk into any hanger today - security permitting - you will see a mixture of aerial work platforms including fairly standard scissor and boom lifts, as well as steps and purpose-built staging, often designed for a specific aircraft type.

Pictures from the 1920s and 1940s show a range of ladders, towers and staging in use, even on the largest planes. For smaller aircraft today these methods remain relatively unchanged. However, the increase in the size of long haul commercial aircraft mean that the larger jets have tail sections around 20 metres above ground level making ladders impractical. This is an area where aerial work platforms have transformed the work at height, particularly for the smaller service, maintenance and

This was not always the case. At one time most work platforms were equipped with what was referred to as 'on/off' or 'bang bang' controllers. While these were accepted on construction sites and for general tasks, the fact that they could be difficult to operate smoothly and control the function speed, made them unpopular or even impractical for working close to an aircraft, given that all but the gentlest contact can cost a fortune to repair when the full cost of repairs, retesting and most importantly downtime are taken into account. Simple padding and buffers helped but were not an ideal solution.

Over the years however, aerial lift manufacturers have developed and improved their hydraulic systems and controls and today super-smooth proportional control drive and lift functions are prerequisite, making them ideal for the fine

A JLG 740 AJ being used to access the top of a wing


The production of Avro Lancaster bombers in 1943 used mobile staging not too dissimilar to that used today


A Genie mast boom being used for aircraft inspection

manoeuvring required to place a platform close up to and alongside an aircraft.

Many, if not most, manufacturers now also offer optional aviation packages.

For example, Genie offers the Aviation Scissor Lift - the Genie GS-2646 AV - which includes a Padded Aircraft Protection Rail, front entry gate and powered 1.52 metre powered roll out extension deck. It also offers an Aircraft Protection Pack for its booms designed to protect the aircraft and other sensitive work surfaces from damage. It features a foam padding to cover the top and lateral auxiliary platform rails plus a padded proximity sensing rail beneath the platform.

Foam padding on the basket gives added protection should it come into contact with any part of the aircraft

What has changed over the past 15 years or so are the numerous mechanical and electronic warning systems - some using a similar technology to car reversing sensors - that alert the operator when the basket or platform is in close proximity to an object/aircraft.

Maintenance schedules

In normal circumstances commercial aircraft do not make money when they are not flying, so turnaround times for the maintenance and inspection programmes are critical, given that an aircraft sitting on the tarmac or in a hangar costs tens of thousands a day.

Access solutions for these essential maintenance/servicing tasks come in many forms depending on the duties, the type of aircraft and facilities available. Airlines and other commercial operators of large or turbine powered aircraft follow a continuous inspection programme approved by airworthiness authorities such as the Federal Aviation Administration (FAA) in the United States, the Transport Canada Civil Aviation Directorate (TCCA), or the European Aviation Safety Agency (EASA). Each airline operator prepares a Continuous

A Skyjack 6826RT scissor lift being used to help carry out cleaning duties

Airworthiness Maintenance Programme (CAMP) under its Operations Specifications which includes both routine and detailed inspections.

ABC check system

Airlines and authorities casually refer to the detailed inspections as 'checks' commonly referred to as A, B, C and D (or variations on the theme). A and B are easier checks while C and D are considerably more onerous. Aircraft operators may perform some work at their own facilities, but often the more in-depth checks take place at maintenance, repair and overhaul (MRO) company sites.

The A check is performed every 400 to 600 flight hours, takes a minimum of 10 hours to complete and is usually performed in an airport hangar. The B check takes place every six to eight months taking about 160 to180 man-hours depending on the aircraft and is usually completed within one to three days.

For example, a common jet such as the Boeing 737 has it's A check performed at 600 hours and is completed overnight taking between eight and 10 hours and then the plane is straight back into operational duties. Under this time pressure it is imperative that engineers gain access to all areas of the aircraft in a quick and safe manner.

Boom lift are ideal to access maintenance items in the tail section of a larger commercial jet

During this inspection the tail of the aircraft needs to be checked for damage as well as checking out flying surfaces and navigational lighting. A 46ft boom lift is ideal for this operation and also gives access to the top of the fuselage where other checks are carried out. Access to the fuselage windows and doors are other important areas that need to be inspected, this can be carried out with a selection of small self-propelled scissor lifts. When the checks are completed and the aircraft is signed off, it can then leave the hangar to get back to flying in the morning. This work will normally be covered by one 46ft boom and four to five 26ft scissor lifts and is an example where the correct access equipment can offer quick and safe turnaround times.

The C check is carried out every 20 to 24 months or as defined by the manufacturer. This is much more extensive than the B check requiring a large majority of the aircraft's components to be inspected resulting in the aircraft being out of service for between one and two weeks. It also requires more space than A and B checks and is therefore usually carried out in a hangar at a maintenance base. The C check can take up to 6,000 man hours to complete.

Some authorities use a 3C or Intermediate Layover (IL) check which typically includes light structural maintenance including checks for corrosion on specific high load parts of the airframe. The 3C check may also be used as the opportunity for cabin upgrades such as new seats, entertainment systems and carpeting etc. This shortens the time the aircraft is out of service by performing two distinct tasks simultaneously. As component reliability has improved, some MROs now spread the workload across several C checks or may incorporate this 3C check into D checks.

The D check - also known as a 'heavy maintenance visit' (HMV) - is by far the most comprehensive and demanding check for an airplane. It occurs about every six to ten years and includes taking the entire airplane apart for inspection and overhaul - even removing the paint for a complete inspection of the fuselage's metal skin. Such a check can generally take up to 50,000 man-hours and two months to complete depending on the number of technicians involved. It also requires the most space of all maintenance checks and must be performed at a suitable maintenance base. The requirements and the tremendous effort involved in this check make it by far the most expensive, with total costs for a single D check upwards of $1 million.


The D check may even involve removing all the paint for a complete inspection of the fuselage's metal skin

Because of the nature and the cost of a D check, most airlines - especially those with a large fleet - plan them years in advance. On average, a commercial aircraft undergoes two or three D checks before being retired. Often, older aircraft being phased out of a particular airline's fleet are either stored or scrapped upon reaching their next D check due to the high costs involved in comparison to the aircraft's value.

The current Covid pandemic has greatly impacted the commercial aviation sector with aircraft fleets grounded overnight. With planes not flying the need to maintain them - particularly the more onerous C and D checks - have effectively stopped. However, as more planes are taking to the skies, these checks will again have to be carried out again and there may well be a good deal of 'catch up' involved.

Access all areas

Line maintenance is also carried out by engineering crews based at out stations at all airports. Work can take place in either the ramp area where passengers disembark, or the apron area where aircraft is parked up. In most cases a quick turnaround is needed.

The ramp can be some distance from the apron - two to three miles at some airports - so most airline maintenance crews use truck mounted boom lifts for access to the tail. Truck mounted access platforms offer the flexibility to cover both and can quickly and easily travel the distances between. In reality there is little to inspect apart from a light on the top and the bulb needs checking and changed if necessary, which on a Boeing 747s tail, for example, is about 20 metres high.

Truck mounted scissor lifts are mostly used to gain access to the APU area - a small Axillary Power Unit fitted in the rear tail cone area of the aircraft. Engineers also need to access the navigational lights fitted to the horizontal wing tips, again bulbs may need to be changed.


A helicopter docking station


Mobile staging is used when carrying out more in-depth maintenance and repairs


A variable height docking system

Pictures courtesy of Planet Platforms

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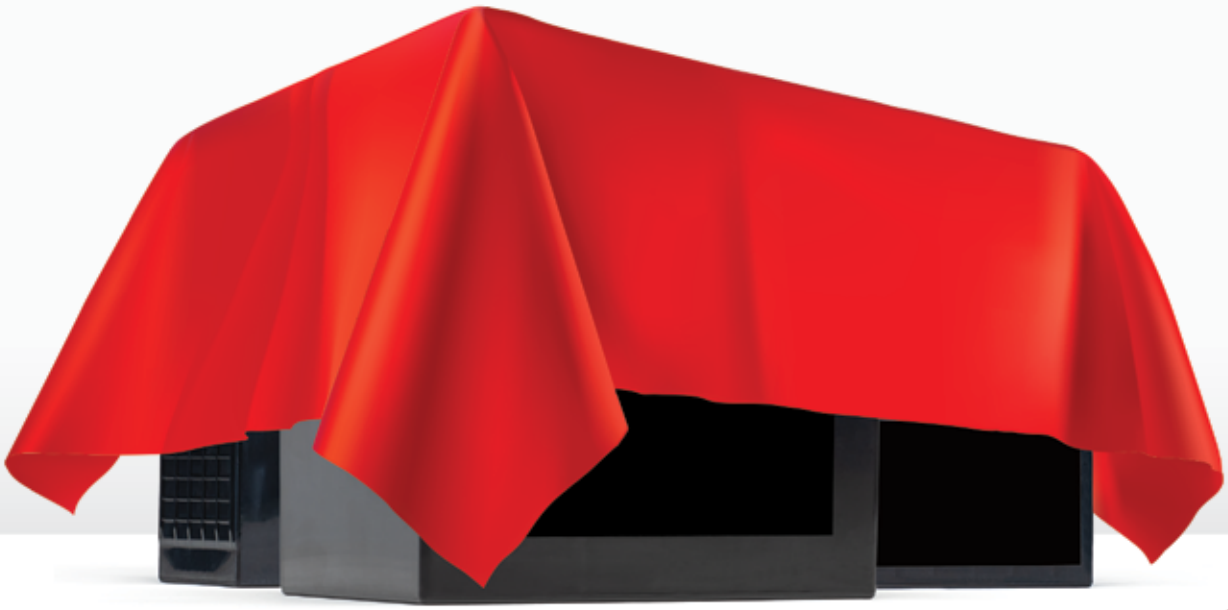

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Planet Platforms AIRdeck engine access

Longer maintenance solutions

The aircraft maintenance described so far has been for quick turnaround A and B check situations and self-propelled access platforms play a major part in getting this work done. However, when an aircraft needs longer and more in-depth maintenance such as C and D checks, then the aircraft can be parked up in one position in some cases for up to six weeks in the case of a Boeing 747 D check. For many of these procedures a specialist designed aircraft docking is the preferred solution - some are fixed and some mobile. The design of fixed docking is very much dependent on the design of the hangar. In some cases, the nose goes in first and in others the nose is at the rear.

These bespoke systems provide a more efficient and safer method of carrying out regular maintenance or repairs both for commercial aircraft and helicopters. A few years ago, Planet Platforms supplied helicopter maintenance platforms to the 10 UK search and rescue bases (SAR) operated by the Bristows Group.

The equipment helps maintain its fleet of S-92 helicopters which replaced the popular yellow Sea King helicopters. More recently it has supplied two complete aircraft docking systems - including a Taildock - to Airbus Military UK (AMUK) for the maintenance of the Royal Air Force's fleet of A400M military transport aircraft.

Many of the major airlines which run their own maintenance facilities tend to put their aircraft nose in first so that they can park the nose into a fixed access nose dock combined with a mezzanine floor. This area also houses the engineers' work stations. The nose access dock stretches back far enough to access the forward cabin access doors allowing seats and galley items to be removed from the aircraft. The seats can be stored on the mezzanine floor or taken away to the workshops allowing the work to be carried out on one level saving the engineers valuable time from walking up and down stairs to different levels.

Newer hangar designs can feature a tapered roof at the nose end with the normal height at the rear at the hangar door for the tail access. The tapered design reduces construction costs and heating what would be empty space. This system works especially well if the hangar is dedicated to one aircraft type. In a number of cases the tail docking is suspended from the roof and can slide in and out to allow the aircraft to exit the hangar. Access via staging to the fuselage and wings can either be of a fixed or mobile design.

Planet Platforms supplied this staging for the New Heights in Flight Training

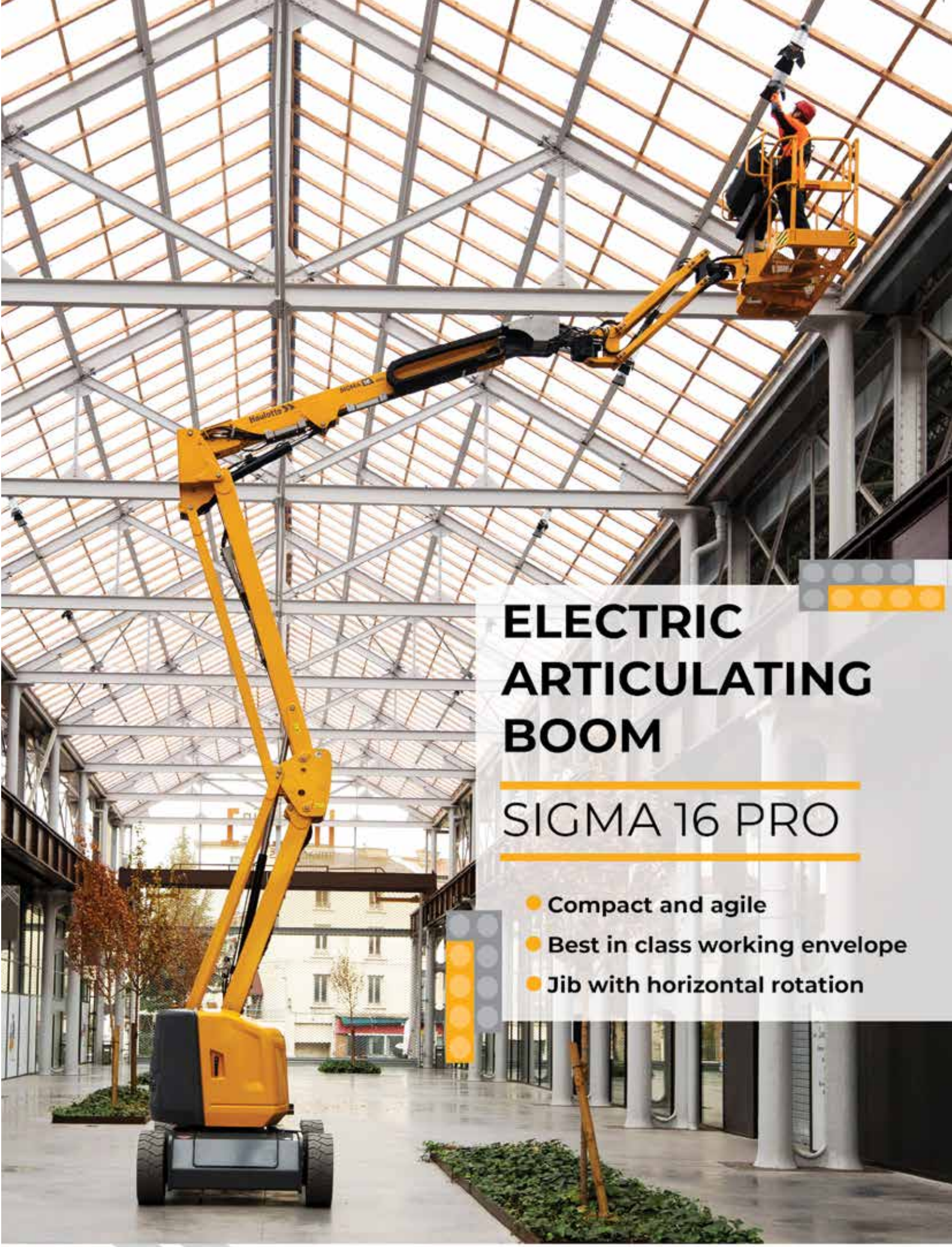
When an aircraft is positioned in the docking system it may have to be raised up and down using hydraulic jacks to allow for the undercarriage to be removed or operated and tested in the static position. In this case all the aircraft staging needs to be adjustable in height. This is where self-propelled scissor lifts have an advantage due to their variable platform heights.

There are many aircraft maintenance companies around the world which offer engineering services and act as a type of service and repair garage. Many airlines are happy to subcontract their maintenance to these companies such as AFI BMI E&M. The company is a world-leading MRO - Maintenance Repair & Overhaul - provider with about 200 customers offering services including comprehensive technical support, inline maintenance, engine overhaul and aerostructure maintenance. It employs 14,000 and covers about 2,800 aircraft around the world.

Line Maintenance

One powered access company that is supplying equipment to the major airlines and MRO companies in the Middle East is Rapid Access - part of the Loxam group - as it's equipment is well suited to multiple line maintenance duties such as component replacement, structural and special assessments or repairs and exterior washing.

"Our clients are tasked with maintaining high despatch reliability and reduced delay and our range of mobile powered access solutions are perfect for achieving their KPIs. We provide a range of ready to operate diesel or hybrid machines, including large deck scissors with high payloads and truck mounted articulated booms ideal for reaching stabilisers or fuselage mounted services such as inflight Wi-Fi. All our products can be fitted with particulate filters, fire suppression, stop/start technology, handrail protection and our SkySentry device. We supply bespoke products perfectly suited to the requirements of quick turnaround maintenance and with the use of our SkySentry product, it is simple



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Rapid Access operates throughout the MIddle East

to locate and identify machines that are unused and deploy these in a quick and timely manner to any area of operation."

The company also says it can provide machines for use in paint hangars, specifically engineered with zero emissions and an explosion-proof build. Its electric, explosion-proof scissor lifts provide a simple and reliable solution for most stripping and painting requirements and offer flexibility across multiple aircraft types. They are also perfect for large and small format decal applications, with extendable work decks and easy manoeuvrability for exact positioning.

Rapid Access also claims to be the first company to offer customers in the Middle East a virtual simulator courses with the ability to model a range of scenarios.

The benefit is not only improved retention of technical information and enhanced operator confidence and ability, but also a reduction in total practical hours in familiarisation and refresher training. Its virtual classroom lessons can be tailored to individual or organisational requirements and are available for short or long term delivery.

MROs

These specialist companies can work on many different types of aircraft from a private jet the size of a Gulfstream G5 up to a wide body Boeing 747 or Airbus A380. Their access requirements need to be flexible and include a mixture of adjustable mobile docking and self-propelled scissor and boom lifts. Self-propelled or push around platforms also give an additional advantage of taking up less space in what can be a crowded hangar.

An area that can be difficult to access is the main undercarriage bay. This is a cavernous area on most wide bodied aircraft and can also be slippery due to the number of hydraulic valves situated in its upper ceiling. It is also open to the elements when landing or taking off. Mobile staging has been traditionally used, but again it must be adjustable if the aircraft is in the jacked up position.

An Airbus 320 surrounded by a nose access dock - note the engineer on the roof is secure being tied in to an overhead fall protection system


A helicopter maintenance docking station from Planet Platforms

Because of the design of the bay, outreach is also needed. Access manufacturers often work with the major aircraft manufacturer to supply specially modified equipment such as mast booms to gain access to this area of the aircraft. Push around platforms are also used in both the front nose wheel bay and main undercarriage bay areas.

The stage is set

Access staging plays a major part in aircraft access particularly during the more in-depth maintenance/ inspection tasks. Staging was originally manufactured from steel but is now often made from aluminium, reducing overall weight and therefore making it easier to move around a hangar. Steel is obviously heavier and tends to be used when fixed docking positions are needed. There are a number of companies who specialise in this area such as Planet Platforms and Semmco.

Safety when operating around aircraft with access equipment is paramount, both for the operator and the aircraft particularly as the hangar environment can be a busy and congested area during maintenance checks.

While self-propelled aerial lifts are now featuring ultra-smooth proportional controls they can be safely operated alongside or over an aircraft, although many airlines look for more protection, just in case. Most manufacturers or specialist distributors are able to provide an aircraft specification self-propelled lift as well as various options and levels of protection from simple buffer material around the platform to systems that cut all functions when part of the machine is too close to aircraft components. These can range from the mechanical 'cats whiskers' to sophisticated radar type sensors.

Whatever the access system used, getting it right is a lot less expensive to specify than the repair bill for a damaged commercial jet!


Scissor lifts used on a test engine install