

DOSSIER

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# SAFETY AS A TOP PRIORITY

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In aviation, the goal is to run operations with minimal risks. This article discusses how Management, Repair and Overhaul (MRO) activities ensure the safety of planes and ultimately that of passengers, and how risk management is integrated into Safety Management Systems.

by **Mário Lobato de Faria** · TAP Air Portugal

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**Mário Lobato de Faria** is 55, married with two children and has a degree in mechanical engineering (thermodynamics), from the IST, Lisbon. He started his career in 1988 as an engineer with Profabril, responsible for mechanical equipment, and in January 1989 joined TAP as an engines and fuel systems engineer, where he stayed until 1993. In October 1993 Mário was asked by Portugália to manage its engineering services and in 1995 he became maintenance and engineering director. In July 2006 he was invited by the shareholder Embraer to join OGMA as vice president of industrial operations and following a company restructuring, Mário became vice president of the MRO unit. An approach by TAP's CEO saw Mário return to the company in March 2014 as executive vice president of maintenance and engineering. He is now Executive Vice President of TAP Engineering and Maintenance.

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2017 was the safest year in world aviation since 1946 and ever since we started keeping records on aviation accidents and incidents, considering both the number of events and the victim total.

SOURCE: AVIATION SAFETY NETWORK



*“We need some blindness when we take risks”*  
Bill Gates.

As managers, we never tire of hearing testimonies about the link between success and a desire to take risks.

In reality, risk is inherent in everyday life and all human activities. However, in aviation and particularly when undertaking Maintenance, Repair & Overhaul (MRO), the goal is to run operations without risks or with acceptable risks.

In light of the potential for disastrous consequences, the operational culture must be one of risk aversion. This means a thorough and consistent approach to risk management; from identifying the risks and measures to remove and mitigate them to creating indicators that allow us to monitor the success of the actions implemented.

Because safety is the top priority for all aviation activities, this risk management process is integrated into a Safety Management System (SMS).

### **AIRCRAFT MAINTENANCE PROGRAMME (AMP)**

The maintenance of aircraft, engines and components is necessary, not only to ensure the safety of people and cargo, but also for economic reasons, as in the long-term they are not disposable goods.

The AMP is the key reference point for MRO activities; it is a document approved by the aeronautical authorities and produced by operators following aircraft manufacturers' guidelines. Known as MSG3 it defines which tasks must be fulfilled and how.

In reality, this wasn't always the case. Until the advent of jet aviation, it was the mechanics themselves who empirically developed aircraft maintenance programmes. Later on, during the development of the B747 project, Boeing felt the need to produce something more robust.

Today, maintenance activities analyse all of the plane's systems, taking into account the safety, operational and economic risks and their consequences, whether visible to the crew or not. This means all maintenance activities connected with aircraft, engines and

components are nothing more than the careful risk management of the planes' systems, operating or at rest. Maintenance intervals are measured in hours of flight time, cycles (one taking-off and one landing constitutes one cycle) and calendar days. Experience and probability models determine these parameters.

## SAFETY MANAGEMENT SYSTEM (SMS)

Safety management is the systematic management of risks associated with MRO activities to ensure the highest levels of protection. SMS in any airline or MRO organization is one of the responsibilities of senior management who must publish a safety policy and manage it as an integral part of the business.

It is important the SMS follows quality management protocols and is considered by differing management levels as an essential strategic tool, as for example, an accident or near accident may have serious financial consequences.

If a culture of safety exists at all levels within an organisation, it will strongly influence its working practices.

The SMS should be both proactive and reactive, providing via processes and procedures, mechanisms to predict, prevent and mitigate the effect of safety hazards. Implementation success is closely linked to three pillars: corporate safety compliance, a safety-focused organisational structure and effective monitoring systems.

The requirements of corporate safety compliance are:

- a. The publication of the differing management safety responsibilities and main stakeholders
- b. A definition of the requirements of the safety person in charge
- c. An ability to demonstrate the management team promotes a positive safety culture throughout the organization
- d. Evidence that safety is top priority in all business policies, principles and practices
- e. A commitment to a process of independent safety monitoring, not dependent upon managerial strategies
- f. Regular analysis to improve safety plans
- g. Formal processes for safety analysis

A safety-focused organisational structure has the following features:

- a. Specific procedures for the recruitment, integration, training and development of employees
- b. Management and employee safety awareness training
- c. Early monitoring procedures and corrective actions for equipment, system or service safety failures
- d. Means to monitor and record safety standards
- e. Effective management of resources to correctly identify safety threats and to analyse and control risks
- f. Change management strategies
- g. Processes that enable employees to voluntarily report safety-related issues to line managers for solving and monitoring actions taken
- h. Regular exercises to test the effectiveness of emergency response plans
- i. Safety impact assessments on trade policies

Effective monitoring systems should:

- a. Analyse and monitor flight records in order to assess performance and detect any unreported safety issues
- b. Collate and document all safety reports
- c. Focus on safety audits results and problems as they arise
- d. Publish the results of internal safety investigation processes and any respective corrective actions
- e. Share safety data when evaluating organisational performance and include structural changes within the risk management process

Finally, a robust SMS must have in place processes to consistently promote safety and evaluate the results achieved, adopt the best industrial practices and use an independent body to periodically review their effectiveness.

For the aerospace industry and its MRO activities, risk management is an essential safety tool and key contributor to business success. Such is the level of attention it requires and in recognition of the importance of the processes and technology involved, and its economic impact, SMS was given ISO 9110 accreditation in 2016. -

In 1922, the first southern Atlantic journey took place. Portuguese aviators Gago Coutinho and Sacadura Cabral flew a plane from Lisbon, Portugal, to Rio de Janeiro, Brazil.

SOURCE: MARINHA PORTUGUESA



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# ARE YOU STRAPPED IN?

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Risk management, compliance and safety intelligence are intrinsically linked with aviation insurance. Find out how these crucial elements work together to keep **AIG** ahead of the underwriting market.

by **Mark Sperring** · AIG

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**Mark Sperring** started his Aviation Insurance career at Ace Global Markets in 2001 before quickly moving on to the Aviation Underwriting team in Lloyd's. From there he saw a wide range of business from airlines, GA, aerospace and war. In 2006 Mark was part of the team that formed QBE's Aviation Syndicate where he specialised in Airports and Products and drove a market leading facility which showed QBE's leadership skills. Mark joined AIG Europe as UK Head of Airports and Products with a particular emphasis in improving the Aerospace portfolio, which particular emphasis on growing the product offering and service proposition.

The aviation insurance industry demonstrated profitability over the years spanning the early part of this decade, driven from the 09/11 rating environment. Behind this was the airline industry's sterling safety record, which had been driven by a combination of technological and managerial improvements across the globe. The high cost of oil had boosted the introduction of a new generation of fuel-efficient aircraft, while a proactive and systematic analysis of safety trends had dramatically improved risk mitigation within airlines – 2012 was so far, according to IATA, the best year in the history of aviation safety with one accident every five million flights. However, 2013 was the year that marked a turning point, as market conditions started to deteriorate. This was not because of an exceptional increase in major loss events, but following years of continuous reductions, premiums had just become too low in the face of any loss against attritional claims and with the backdrop of marketplace commoditisation. With market mutualisation a distant memory and an increase in insurer capacity, prices continued to drop. Looking forward, exposures will inevitably continue to rise with increased hull values, especially with the introduction of difficult and expensive to repair composite materials. Recent industry analysis suggests that although we are seeing fewer major events due to the overall improving technology in the industry, the per-hull cost of repair for a composite airliner versus similar structural damage to an alloy

aircraft is four to six times greater. This data is based on a relatively short time span (three years), given the relative infancy of composite fleets, but the potential impact to an insurer is clear. Other factors that are likely to change the claims picture are the emergence of a more litigious judicial system, characterised by a rise in class actions and an increase in the size of liability settlements, as well as a sharp increase in the number of flights and passenger movements. The Boeing 2017 Market Outlook predicts passenger numbers to increase by 4.7% per year over the next 20 years (based on revenue passenger kilometres (RPK)). This growth will be supported by an additional 40,000 new aircraft deliveries through to 2036. At the same time, consolidation amongst airlines will tend to reduce premiums further. In the absence of evasive action, the market is heading for a crash.

## AVOIDING A COLLISION

Albert Einstein is sometimes quoted saying: *The definition of insanity is doing the same thing over and over again and expecting a different result.* Put bluntly, that is what the aviation insurance industry has been doing. But there are signs that this insanity is about to come to an end. There is no magic recipe for turnaround, but risk selection and adherence to underwriting discipline will most probably be key factors of success in both the insurance and reinsurance markets. Insurers will have to learn to say "no" again, and look to protect their bottom line with underwriting

discipline. In addition, cost control will inevitably increase as margins reduce. This needs to be done while paying close attention to service, as insurers need to recognise that clients now have a wider choice of options when deciding on the signing of their policies as insurance is effectively a service industry. To avoid the further commoditisation of their product, insurers will have to move the discussion with clients away from one which is focused solely on price to emphasise the other benefits they can offer, such as superior claims handling, client risk solutions, industry expertise and underwriting excellence. Innovation will also represent a key to success. The aviation industry has seen spectacular technical and commercial progress over the years. Insurance must embrace that trend.

## MOVING THE NEEDLE

A number of insurers have already made significant investments in order to differentiate their offering to the market and provide more holistic solutions, as they position themselves to aviation insurance buyers as strategic partners in managing their operational risks. Some insurers, such as AIG, now offer safety consulting and data services in partnership with specialist risk management consultants who provide a full range of innovative, state-of-the-art loss control tools. With the regulatory environment constantly changing, compliance is a key issue. In addition, robust risk management programmes need to be adopted by all clients whatever their size of business. Buyers should expect a comprehensive onsite audit to verify that their operation complies with the International Standard for Business Aviation (IS-BAO) protocols toward their certification. This would include a gap analysis of their systems, policies, processes and procedures, either onsite or remotely. Other important tools include safety intelligence reports and pilot and aircraft safety surveys. Insurers can offer access to the largest, most up-to-date database of charter operators, pilots and aircraft, allowing airlines to create due-diligence reports for every flight against their company's safety

standard, with gap analyses used for actuarial study. Underwriters themselves need to stay on top of market developments, a responsibility made easier by various market publications and social media channels covering the aviation industry in more detail than ever. The onus is also on clients to ensure their employees are aware of these market developments. Insurers can also provide customised safety and risk management training courses for employees at every level of the organisation on a variety of leading-edge safety topics. Simply put, it is probable that those insurers who are not prepared to adapt

and who simply wait for a hypothetical market turn are likely to face turbulent times. The focus has to be on sustainability and thus profitability rather than top line growth. In the same way that the aviation industry has made constant and successful efforts to improve safety to an unprecedented level, so insurers must pay them the compliment of showing the same dedication, underwriting discipline and imagination. •



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# FROM SPACE TO THE GROUNDS

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Compared with other main markets the Aviation Insurance market is relatively small but as soon as there is an aircraft accident it very often becomes big headline news. There are not many classes of insurance where this happens in quite the same way.

by **Nick Redgrove** · Ed Broking

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**Nick Redgrove** is the Managing Director of the Ed Aerospace team. He joined Lloyd's of London in 1981 and started his broking career with Bristow Syndicate. He moved to a small Reinsurance Broker called Harrington Austin in 1983 and was appointed Aviation Director in 1987. In 1990 Nick joined Fenchurch which then merged with Lowndes Lambert to become Lambert Fenchurch and then merged with Heaths to become Heath Lambert. In 2002 Nick was asked to start up an Aerospace department at Cooper Gay (now Ed Broking) to where he remains. Nick is responsible for the broking and client servicing of many of our major clients which include Airports, Airlines, Aircraft Manufacturers and Aircraft Leasing Companies

Although airline companies and aircraft manufacturers purchase sizable third party liability limits in-case an accident occurs, safety and regulation is paramount within the industry. Whilst it is not entirely natural for human beings to be sitting in a missile shaped object moving at 500mph up at 40,000 feet it is an extremely safe way to travel, especially when you consider you are 7.5 miles above *terra firma*. In fact, in Aviation terms 2017 was one of the safest years on record with no jet airline passenger fatalities.

As with many product lines, aviation keeps evolving, aircraft are safer, larger, can fly further, while being quieter and more fuel efficient than their predecessors. For passenger airlines the experience on board is also more refined for passenger comfort.

## ANYTHING THAT FLIES

The perception of aviation insurance is "anything that flies" but there are many coverages that fall within aviation liability insurance including products, premises and hangarkeepers liability, maintenance, repair and overhaul, airport liability, air traffic control liability, service providers airside including refuellers, refiners, fuel storage, baggage & cargo handlers, aircraft cleaners, construction companies working at airports, down

to logistics companies delivering goods airside at an airport.

Banking and finance companies that are involved in aircraft leasing is another exposure that you may not realise comes under aviation coverage. Although the aircraft are generally insured by the operator/lessee for hull, liability and war risk per the lease agreement, it is in the best interest of the lessor to seek contingent hull and liability coverage for their asset, this policy would also cover possessed aircraft for hull, war risk and third party liability that have been returned from lease.

A policyholder may not own or operate an aircraft but they may have aviation exposure elsewhere and that their general liability policy could exclude the coverage. A prime example is an insured that manufactures a component (sheet metal or fasteners for example) that is used in the automobile industry but somewhere in the supply chain may end up also being used within the aircraft industry. A full breakdown of parts sold to customers and the end product is vital to understand the risks of your insured.

## KEEPING PACE WITH THE RATE OF CHANGE

Of course with every new aviation product that enters the public domain we also need to ensure that the insurance industry is ready for the exposure of the new product.

The more information we can provide to the underwriter the better understanding they will have to determine the exposure.

One area which is seeing a great deal of research and development is Unmanned Aerial Vehicles (UAV); the various civil aviation authorities have a busy time regulating UAV use.

Are there many people that would fly on an aircraft that does not have a pilot? Well, commercial aircraft do fly automated but personally if I'm on a plane I have more peace of mind if a pilot is sat in the cockpit as backup! However, I can see cargo being flown

autonomously in the near future. Fuel efficiency and protecting the environment from emissions and also noise pollution are also a major research and development directive for manufacturers as well as being an important topic for aircraft operators /owners.

## RECOGNISING WHERE A RISK EXISTS

Sometimes it isn't obvious that a client has an aviation exposure. As I have illustrated above there doesn't actually have to be an aeroplane involved. It's important to understand what the policyholder's end product or service will do or where it will end up. And of course, it is always a good idea to speak to a broker with aviation or aerospace expertise to help work through the risk exposure. -

## A BREAKDOWN OF AVIATION/AEROSPACE COVERAGES

### Airlines

- . Aircraft 'all risks' hull
- . Comprehensive airline liability
- . Aircraft hull war risks
- . Excess war (AVN52) liability
- . Deductible buy back insurance
- . Loss of use
- . Personal accident / loss of license
- . Mechanical breakdown

### Products Liability

- . Prime airframe manufacturers
- . Major engine manufacturers
- . Sub-airframe manufacturers
- . Component part manufacturers
- . Electronics / avionics
- . Maintenance, repair and overhaul (MRO)

### Coverages

- . Product liability
- . Grounding liability
- . Airport premises liability
- . Hangarkeepers liability
- . Working parties liability
- . Excess war (AVN52) liability
- . Products recall
- . Manufacturers hull risks

### Space

- . Pre-launch
- . Launch and in orbit
- . Space third party liability

### General Aviation & Executive Jets

- . Aircraft 'all risks' hull
- . Aviation liability
- . Aircraft hull war risks
- . Excess war (AVN52) liability
- . Deductible buy back insurance
- . Personal accident / loss of license
- . Mechanical breakdown

### Helicopters

- . Aircraft 'all risks' hull
- . Aircraft liability
- . Aircraft hull war risks
- . Excess war (AVN52) liability
- . Deductible buy back insurance
- . Personal accident / loss of license

### Airports & Ground Service Operations

- . Airports
- . Air traffic control
- . Refuellers / refiners
- . Service providers
- . Products liability
- . Airport premises liability
- . Hangarkeepers liability
- . Excess war (AVN52) liability
- . Airport contractors

### Banks, Finance Houses, Aircraft Leasing Companies

- . Contingent aircraft hull
- . Contingent aircraft liability
- . Repossessed aircraft hull and liability
- . Aircraft hull war risks
- . Political risks
- . Residual value insurance
- . Excess war (AVN52) liability

### Remotely Piloted Aircraft Systems / Unmanned Aerial Systems

- . Aircraft 'all risks' hull
- . Third party liability
- . Manufacturers hull risks

# AVIATION CLAIMS

## LOCATION, LOCATION, LOCATION

Using a case study, this article demonstrates the importance of a specialized broking team when handling an aviation claim.

by **Steven Eagle** · Ed Broking



**Steven Eagle** heads up Ed's Aerospace Claims team in London and he has been with the company since 2008. Steven has over 40 years experience of handling claims in a variety of Senior Management roles with major Lloyd's brokers. He also represents Ed Broking on the Aviation Claims Sub-Committee of LIIBA (London and International Insurance Brokers Association).

The Concorde, the one aircraft that could fly faster than the Earth rotates, operated without incident for 24 years. The only fatal accident it was involved in occurred in the year 2000, at the Charles de Gaulle airport in Paris, because another airplane leaked oil onto the tarmac.

SOURCE: FEDERAL AVIATION ADMINISTRATION

When you mention aircraft, many people have a mental picture of bright, shiny, passenger jets, landing at modern, well equipped, airports in prime locations, like New York, Dubai, or London.

This is a great image and would reflect some of the larger aviation risks, but aviation insurance is an incredibly diverse sector and many insureds operate a vast variety of aircraft types to numerous destinations with complex jurisdictions that can complicate matters, when claims occur.

Here are brief details of a claim and the real issues that arose:

A few years ago, in a North African country, an aircraft was chartered to carry a group of prominent politicians on a tour of villages in a remote region. Unfortunately, whilst carrying out the tour, the aircraft took off in poor weather and crashed into a mountain top, totally destroying the aircraft and killing everybody on board.

As the London brokers, we arranged hull, liability and crew personal accident coverage, on a full reinsurance basis, for the local insurance company. The reinsurance was subject to a claims control clause, that gave reinsurers full control over the instruction of experts and subsequent claims agreements and settlements.

A prompt advice was given to the reinsurers and they instructed the London office of a major international adjuster.





As the country where the incident occurred was the subject of sanctions, there were immediate problems for the adjuster, in obtaining the necessary visas and arranging travel to the region. In the end, this took around three weeks and the visas were only obtained with the assistance of the local insurance company, who had excellent connections in the government of the country.

Unfortunately, by the time the adjuster arrived, the official investigation had been completed and the remote site had been abandoned. The adjuster was advised that this was because of local insurgent activity, so sensibly decided to remain in the capital and meet with the insured and members of the local Civil Aviation Authority investigation team, instead.

From the discussions, it was possible to confirm that the aircraft had crashed due to probable pilot error and this allowed the adjuster to report and recommend a hull total loss settlement.

The London underwriter quickly agreed the claim and a release was obtained to allow the claim to be collected.

Whilst every collection is subject to sanction checks, this particular claim was being paid to a sensitive area, so particular care had to be taken by all involved, the underwriter, adjuster and us as brokers, to confirm the status of the insured and the loss payees. When the checks were finalised to everyone's satisfaction, the collection was completed and a payment sent to the appropriate parties.

Moving on from the hull claim, the adjuster then focussed on the passenger liability and the crew personal accident, which would be handled by their specialist liability team. With fixed benefits, any crew death claims under personal accident coverages are normally simple to collect, just requiring death certificates, the identification of beneficiaries and then the collection. Unfortunately, in this instance, the deceased crew were

not from the country, so there was extensive liaison with their embassy and it was a protracted process, before settlements could be arranged. In the meantime, claims were being presented from the families of the deceased passengers and the adjuster's investigation was in progress, with the first priority being to seek legal advice on any legislation that was applicable to air travel, in this location.

As this was an internal flight, the adjuster found that there was local legislation, that provided a fixed level of compensation, equivalent to around EUR 26,000.00, at the current exchange rates. Accordingly, when the adjuster responded to representatives of the passengers, they offered this figure.

Surprisingly, the offer was rejected and the lawyer who was acting for the claimants, started legal proceedings.

In response and with underwriter's agreement, the adjuster contacted a local lawyer, who was instructed to



respond to the complaint. It was hoped that the process would be simple, but this did not prove to be the case, as the plaintiff lawyer contended that the limitation act had not been legally issued. The defence lawyer argued back, that if this was the case, then earlier legislation existed, which provided even lower limits (around 20% of the amount mentioned above).

At this point, the plaintiff lawyer, somehow, discovered that the crew benefits had been settled at EUR 60,000.00 and demanded a similar payment for each of the deceased passengers. Matters took a turn for the worse and court accepted the plaintiff arguments and agreed that this should be the settlement figure.

Somewhat bemused by the decision, the defence lawyer filed an immediate appeal and further hearings were arranged, to review the matter. It was believed that the defence was still strong, so the appeal was viewed with a degree of optimism.

Again, there was a surprise, as the first appeal was rejected and the lower court decision was ratified, so a further appeal was filed and the matter was taken up to the next level.

It still seemed that there was no basis of law for this award and it was hoped that more senior judges would recognise this fact, but this was to no avail.

The defence team's frustration increased, as the claimant's lawyer moved to enforce the awards and sought to freeze the assets of the Insured and the Ceding Company, to compel settlement.

Unfortunately, it became clear that the decision of the court would not be changed, so urgent meetings were held to try and find an appropriate resolution to avert the financial orders against the Insured and the Ceding Company.

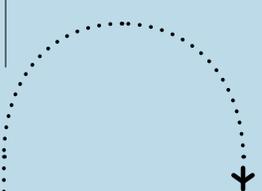
Luckily, the lead underwriter was highly experienced in handling claims from this region and agreed that it was time to increase the offer and negotiate a resolution, rather than keep launching appeals. Conference calls took place, involving the local insurer, reinsurers,

the adjuster and us, which resulted in reinsurers granting an authority to try and settle the matter. The figure was below the court award, but was made on the basis that underwriters could continue to appeal and it would take several years to go through the higher courts.

After much discussion, between the local lawyers, the negotiated figure was finally accepted and the collection process began. In this instance, around three hundred individuals were named as beneficiaries, so protracted sanction checks were required, before the claim was finally collected and distributed to the appropriate people.

In comparison to many western jurisdictions, the final settlements were relatively low, but this case was an interesting example of how the interpretation of local law is sometimes not as clear cut as you would hope. The insured, ceding company, adjuster and defence lawyers, did a great job defending the claims and they might, reasonably, have hoped for a better outcome. Fortunately, we had reinsurers that understood the region and were prepared to support the insured and the local insurer, by paying "above the odds", to conclude the matter.

As brokers, we are aware that local courts can be unpredictable, so even with the best defence lawyers, results might not go as planned. In that situation, it is good to have supportive reinsurers, with a realistic view of the jurisdiction. -



Alberto Santos Dumont, Brazilian inventor and airman, designed, built and flew the first gasoline-engine airships having won the Deutsch de la Meurthe prize in 1901 for a flight that rounded the Eiffel Tower.

SOURCE: SMITHSONIAN OFFICE OF EDUCATION

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# ENVIRONMENTAL AVIATION RISK

## A SERIOUS BUSINESS

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On a cold and windy day 115 years ago this December, Orville and Wilbur Wright made the first successful flight of a self-propelled, heavier-than-air aircraft. That momentous day in Kitty Hawk, North Carolina, spawned an industry that is now worth hundreds of billions of dollars a year. It has changed the way we not only travel but also how think about the world.

by **Stephen Andrews** · Aspen Insurance

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**Stephen Andrews** is Head of International Environmental at Aspen Insurance. He has responsibility for Aspen Insurance's portfolio of environmental accounts across Europe and the London Market. Stephen has over 25 years of global environmental experience including insurance, as well as within industry as an environmental specialist, regulatory consultant and chemical engineer. Prior to joining Aspen, Stephen worked

in New York, London and Paris and focused on the development of international environmental liabilities, international specialty products, growth strategies and underwriting. He sat on the Insurance Europe environmental task force regarding the Environmental Liability Directive. Stephen holds a Bachelor of Engineering degree, Chemical Engineering, from Stevens Institute of Technology, in Hoboken, USA.

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Cyber attacks on the aviation industry have become a serious concern. As increasingly complex and integrated information systems are adopted by the aviation sector, the threat of vulnerability to cyberattack increases. It has been estimated that the aviation sector faces over one thousand attempted cyber attacks each month.

SOURCE: CLYDE & CO NEWSLETTER, JULY 2017

From that first landing on sand after a 12-second flight, aviation has become one of the world's biggest and most important industries, with associated sectors from safety, refuelling, inflight entertainment and refreshments, to air traffic control and baggage handling. The link between aviation and pollution liability was late being made, with environmental impairment liability insurance not being introduced until the late 1970s. But there are many factors that those involved in aviation-associated sectors must bear in mind today.

Environmental risk exposures for companies (and their risk managers) continue to increase due to changes in legislation and an increase in social awareness and public pressure. In addition, there is anecdotal evidence of an increase in consistency in enforcement in many markets of new environmental regulation. Overall, we see two main pillars that drive the discussion of environmental risk and increase the value of specialized environmental insurance programs.

1. Increase in frequency of claims – as new regulations emerge and take hold, coupled with public awareness and consistency in enforcement, we see a future of increased claims activity. Although one could question the pace of this increase, it would be hard to argue that there would be an actual global decrease in claims activities for companies that fail to manage their environmental exposures properly.
2. Increase in claims complexity/cost – our experience illustrates that as time goes forward, claim complexity increases. This is primarily as a result of the implementation of new regulations, globally, and the increased number of stakeholders involved when a pollution incident or environmental damage event takes place.

So overall with a trend in increasing claims frequency coupled with an increase in claims complexity, we can see that the demand for education around environmental exposures and available environmental insurance coverage will continue on its growth path.

## **POLLUTION FROM AVIATION SECTOR AND POLLUTION FROM 'FIXED BASE OPERATIONS'**

When looking at the aviation sector, we need to question what are the prevailing environmental exposures? Are airport owners and operators exposed to environmental risks? Is there insurance protection in general liability policies? Pollution can be introduced into the environment from many sources in the aviation sector. For instance, those introduced over a widespread area such as aircraft emissions and vehicle traffic in and around an airport. There are also those resulting from more specific activities at an airport (a 'Fixed-Based Operator'), for example:

- . Fueling operations
- . Fuel storage and hydrant systems
- . Operation of aircraft
- . Aircraft and ground service equipment maintenance
- . Firefighting training areas
- . De-icing activities
- . Terminal operations including waste management

These can all be exacerbated by construction and expansion activities including the acquisition of additional land. Costs arising out of pollution events can include:

- . Third-party bodily injury claims
- . Third-party property damage
- . Investigation, clean-up and remediation costs
- . Oversight and monitoring costs
- . Legal defense costs
- . Loss of use and business interruption expense costs
- . Natural resources and environmental damage claims

## **REAL EXAMPLES TELL THE STORY OF RISK**

### **Construction work**

In the case of a contractor working at an airfield, 36,000 gallons of fuel leaked into the ground rather than being delivered to aircraft. An investigation found part of a drilling machine stuck into the fuel pipe. Even after mitigation measures, the pipe still continued to leak. The incident raised questions around underground hazards, and the role of site owners and contractors.

### **Fuel Distribution**

A London based company which supplied and distributed fuel at an airport severely polluted groundwater with at least 139,000 litres of fuel, at a rate of seven litres a second. The leak was inadvertently discovered during an investigation into an unrelated incident. The fuel is likely to be recovered at 80 litres a week, or slower, at a cost of around £1m.

### **De-icing**

An airport executive was fined for polluting a river by irregular release of de-icing compounds from activities on a runway. Contamination of 85 times the acceptable level were found after a control process to avoid spills broke down. The airport was warned after a previous event approximately a year earlier and the incident was noticed due to monitoring controls.

### **Fire fighting**

A Port Authority recently detected contaminated soil and groundwater at one of their Airports, which has been traced back over 50 years. They entered into a voluntary clean-up agreement primarily focused on chemical compounds PFOS (perfluorooctane sulfonate) and PFOA (perfluorooctanoic acid). An investigation into the extent of the contamination is ongoing. PFOS and PFOA have been classified as a potential threat to health, wildlife and the environment. There is concern that these could contaminate drinking water. The chemicals do not readily breakdown, so airports should be prudent about their existence, even if their use has been phased out many years ago. It is likely the contamination stems from fire training as far back as the 1960s, when foams that contain PFOS and PFOA had been used to extinguish fires.

### **Ground transportation**

Late last year, a ground transportation company at a major UK airport was fined when staff poured waste material directly into a river, rather than taking it to a regulated disposal site. While it may seem quite difficult to trace the cause of pollution, environmental regulators have the technology and skills to identify the sources of contamination.

## GENERAL LIABILITY AND AVIATION INSURANCE MARKETS

Environmental coverage in “traditional” property and casualty policies is certainly inconsistent across global markets. Additionally, the coverage is typically not comprehensive with regards to relevant environmental exposures.

In some cases, there is no pollution coverage except if caused by hostile fire, and often then just limited only to third-party bodily injury and third-party property damage – not including any first party clean-up coverage.

Some extensions provide coverage for named perils such as fire, windstorm, lightning, explosion, or collision, but are still limited only to third-party bodily injury and third-party property damage. Broader forms can grant some type of sudden and accidental (“S&A”) coverage with strict requirements for discovery and reporting periods, but again often limited only to third-party bodily injury and third-party property damage.

More specifically in the aviation insurance market, one can often see the application of a restrictive AVN 46B (Noise and Pollution and Other Perils Exclusion Clause) wording. This states that the policy does not apply to claims directly or indirectly occasioned by, happening through or in consequence of pollution and contamination of any kind whatsoever unless caused by or resulting in a crash fire explosion or collision or a recorded in-flight emergency causing abnormal aircraft operation.

Regardless of coverage in a “traditional” property and casualty policy, there are still significant exclusions and exceptions such as gradual releases, first party coverage, regulatory liability, waste disposal or natural resource and biodiversity damage.

In some cases there may be coverage “buy backs” for some elements of statutory environmental liability and even natural resource and environmental damage claims, but usually with low sub-limits and irrespective of the operation’s true exposure.

## SPECIALIST ENVIRONMENTAL MARKETS

The specialist environmental market’s products on the other hand are designed around a broad range of environmental liabilities and impairment risk. Specialist environmental underwriters, often with environmental consulting and engineering backgrounds, have the expertise to understand and provide coverages for some of the more complex elements. Coverage can include:

- . Gradual and S&A pollution
- . Clean-up costs
- . Natural resources/biodiversity damage
- . Business interruption expense
- . Third-party bodily injury and property damage
- . Legal costs
- . Transportation
- . Non-owned waste disposal site liability
- . Underground storage tank liability
- . Pre-existing conditions

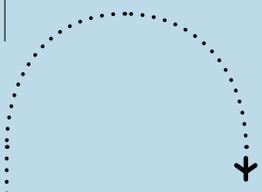
Policies can be tailored to the owner and/ or the fixed based operator’s liability but also to contractors’ coverage for liability arising due to claims resulting from exacerbation of existing pollution or other release caused by construction, development or remediation activities.

There are a number of actions that can be taken including ensuring that pollution and environmental risk are evaluated properly, including historical contamination at the site.

It is also important to review if the risk management practices used to manage environmental risk are adequate.

Risk transfer and indemnification language in vendor FBO (Federal Business Opportunity) contracts should also be reviewed for adequacy and consideration should be given to mandating insurance requirements for vendors and contractors. It is also recommended that there is a review on the reliance on airport sovereign and governmental immunity.

It is always good practice to review current insurance coverage for gaps and consider the availability of specialist environmental insurance. •



The greatest aircraft ever built was the Graf Zeppelin II (LZ-130) airship, which boasted an impressive 245-meter length and a 41.2m radius.

SOURCE: GUINNESS WORLD OF RECORDS



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# THE ERA OF DRONES

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Three years ago, drone operators considered that the lack of availability of appropriate insurance was a major problem hampering the development of their business. Today, this concern is gone but major changes are ahead of us. A scan from the past to the future helps understanding how this evolution happens.

by **Jean Fournier** · Global Aerospace

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**Jean Fournier** is Managing Director of the French branch of Global Aerospace.

Prior to joining Global in 2009, Jean was a Managing Director at Marsh where he spent 19 years, including 10 years as Head of the French Aviation and Space team and 3 years in charge of Innovation. Earlier in his career, he worked at Airbus on military and space programmes.

Jean is a graduate engineer from Arts et Metiers, and holds a Master degree from Stanford University and a DESS in Finance from Sorbonne University.

Jean is a member of the board of UVS International.



## FLYING DRONES ARE AIRCRAFT

A debate took place in the early days to figure out if the flying component of Unmanned Aircraft Systems (UAS) – i.e. the drone – was indeed an aircraft. Light devices designed for leisure were presented as toys or flying robots to avoid the application of aviation regulations.

The clarification took place when administrations stated that whatever the weight and the use, a flying device is an aircraft subject to the related regulations.

Simultaneously, it was recognized that the pace at which the sector grows, requires a considerable change to the way these regulations account for new devices. Where the sky accommodates hundreds of thousand aircraft of all kind worldwide with well-established traffic regulation procedures, the challenge is to accept millions of drones without impacting flight safety.

2017, the safest year ever for airline passengers, recorded no fatality on jet aircraft for more than 4 billion passengers transported, and 2 fatal accidents of small turbo-prop aircraft resulting in 13 lives lost.

How to manage the growth of a promising activity in an economic sector where professionals have contributed to reach such a high level of safety, is the challenge that the Civil Aviation Authorities (CAA) currently face.

## SEGMENTING THE MARKET

The CAAs recognize the need to limit the application of prescriptive regulations currently used for manned aviation to drones that are designed to be integrated into the existing traffic. More flexible rules should apply to light drones that are flown in a segregated environment, namely below the minimum altitude below which manned aviation should not fly except for take-off and landings.

A distinction should also be made between drones operations. Professional use over cities should be subject to greater constraints than occasional use for leisure within Visual Line Of Sight (VLOS) in non-populated areas.

Hence the concept of Specific Operation Risk Assessment (SORA) that the Joint Aviation Authorities on Unmanned

Systems (JARUS) published in summer 2017<sup>1</sup>. This document recommends a risk assessment methodology to establish a sufficient level of confidence that a specific operation can be conducted safely.

These evolutions are major changes for the aviation community. The transition period needs to be managed as time is needed to accept the new environment.

## THE ADAPTATION OF THE INSURANCE SECTOR

Insurance companies support these efforts with a balanced approach aiming at facilitating the experiment of new applications, while disseminating the safety culture of manned aviation to new comers to this field.

The first step in the European Union was to make clear that Regulation (EC) 785/2004 applies to drones that are recognised as aircraft.

For aircraft with a Maximum Take Off Mass (MTOM) below 500 kg, the insurance in respect of liability for damages caused to third parties shall be no less than 750 000 SDRs<sup>2</sup> corresponding to approximately 900 000 EUR. This limit of insurance can be provided by any liability insurer. Amongst the short list of exemptions, the one concerning model aircraft with an MTOM of less than 20 kg was controversial. The debate is hopefully now closed on three grounds: Flying without third party liability insurance is inconsistent with the safety culture that the authorities want to implement; this culture is based on responsible behaviour.

A restrictive application of this exemption limited it to aircraft flown in model aircraft associations or clubs, which promote flight safety and provide insurance when you become a member. A wider reading of the exemption extended it to aircraft used for recreational purposes; insurers providing private liability insurance can insure such flights of light drones (MTOM below 2 kg – 95% of the existing fleet) as long as they remain within VLOS. This is done through private liability insurance, which penetration should be increased in many European countries.

Most professional uses of light drones can also be covered by general liability insurers. With the support of reinsurers,

they consider that the risk is not higher than the ones they already cover in a factory or a construction site. To the contrary, their use usually decreases the exposure of workers to hazardous situations.

Aviation insurers, with specialised professionals and limited resources, focus on more specific operations, such as long range mapping or flights over cities. These operations should be carried out by entities that are flight safety savvy, a point that aviation insurers check before underwriting the risk. This comprehensive and adapted insurance approach is disseminated by the European Commission through the DroneRules.eu<sup>3</sup> project.

## WHAT IS NEXT?

The change in mindset is happening. Now that drones designed to transport passengers have flown in China or in Dubai, voices are heard from individuals saying that they are willing to use them. The aviation community (airlines, air forces, airports) recognizes the potential of these aircraft and want to cooperate to speed up their deployment.

In such positive environment, capability to detect and avoid other aircraft remains critical. This concern – common to autonomous car manufacturers – should foster the efforts of tech firms in this area.

Aviation insurers will stay tuned to facilitate these changes while continuously promoting flight safety. This is our commitment at Global Aerospace worldwide. -

<sup>1</sup> [https://rpas-regulations.com/wp-content/uploads/2017/07/170626\\_JARUS\\_Specific-Operations-Risk-Assessment\\_SORA\\_v1.0.pdf](https://rpas-regulations.com/wp-content/uploads/2017/07/170626_JARUS_Specific-Operations-Risk-Assessment_SORA_v1.0.pdf)

<sup>2</sup> Special Drawing Rights: [http://www.imf.org/external/np/fin/data/rms\\_sdrv.aspx](http://www.imf.org/external/np/fin/data/rms_sdrv.aspx)

<sup>3</sup> <http://dronerules.eu/en/>

# WHAT'S NEXT?

## TRENDS, EMERGING RISK AND OPPORTUNITIES FOR AVIATION AND SPACE INSURANCE

by **Anna Bordon** · Lloyd's



**Anna Bordon** is an Executive in the Innovation team at Lloyd's where she supports horizon scanning and the delivery of the thought leadership reports. Subjects covered recently include: stranded assets (the transition to low carbon economy), the exploration of aggregation modelling methods for liability risks and the application of counterfactual risk analysis in the insurance industry. Prior to joining Lloyd's Anna was a Policy and Research Officer for the Principle for Responsible Investment Initiative where she worked on the integration of environmental, social and governance (ESG) factors in financial decisions. Previously she held roles at the Chatham House and the Financial Times. Anna holds a BA in Languages, Economics and Legal Institutions in Eastern Asia from Università Ca' Foscari and Beijing Language University. In 2012 she obtained an MSc in International Management for China from the School of Oriental and African Studies (SOAS) followed by an MSc in Energy Management from ESCP Europe Business School.

Lloyd's has always had a reputation for innovation and is a pioneer when it comes to insuring aviation and space activities.

The first-ever aviation insurance policy was written by Lloyd's in 1911 and although it stopped writing policies a year later after bad weather caused a series of crashes, in 1919, far-sighted underwriter Cuthbert Heath started the British Aviation Insurance Association.

In 1965 the first space satellite insurance was placed, covering physical damage to the Intelsat 1 on pre-launch, and from 1974-1982 the market underwrote other satellites for up to US\$100 million each. In 1984, Lloyd's launched a successful salvage mission to reclaim two rogue satellites, sending a shuttle and five astronauts into orbit.

With expertise earned over centuries, Lloyd's is the foundation of the insurance industry and the future of it. Led by expert underwriters and brokers who cover more than 200 territories and countries, the Lloyd's market develops the essential, complex and critical insurance needed to underwrite human progress. Lloyd's can develop tailor-made policies for every customer in every sector and it covers more than 60 lines of insurance and reinsurance including space and aviation.

London underwrites 60% of the global aviation market. In 2016 aviation accounted for more than US\$1.2 billion in gross written premium for the Lloyd's market, with space contributing US\$200 million gross written premium to the total. Multiple syndicates at Lloyd's underwrite space and aviation,

demonstrating strong underwriting discipline and sophisticated pricing modelling techniques. Currently Lloyd's maintains one aviation and four space realistic disaster scenarios to stress test both individual syndicates and the market as a whole.

The first-ever aviation insurance policy was written by Lloyd's in 1911.

SOURCE: LLOYD'S WEBSITE





## AVIATION AND SPACE

The world's airlines carry more than three billion passengers a year and 50 million tonnes of freight. These services generate 9.9 million direct jobs within the air transport industry and support 2.7 trillion (3.5%) of the world's gross domestic product (GDP). Globally, the UK has the third largest aviation network after the US and China.

In 2015 the space sector accounted for US\$330 billion globally, with the US space sector worth US\$43 billion and the UK space sector worth US\$18 billion. The UK Government's stated goal is to grow the space business to US\$53 billion by 2030.

### Trends

#### **Aviation**

Low-cost carriers and ultra-low-cost carriers are still gaining market share from the dominant full-service carriers. In the US, a wave of consolidation has resulted in 80% of US domestic travel being controlled by four major carriers. They are, in order of passenger traffic, American Airlines, Southwest Airlines, Delta Air Lines and United Airlines. Emerging markets are also driving aviation growth. This year, passenger traffic in China's domestic aviation market grew by 15.1% year-on-year, beating India's 14.6% growth, according to data from the International Air Transport Association (IATA).

As China's air passenger market is set to triple over the next 20 years, China will continue to invest in airports, airlines and aircraft in order to develop a modern and sustainable aviation industry. Development is happening so quickly that Li Xiaxiang, head of the Civil Aviation Administration of China, recently said: "We are still unable to catch up with demand for airport construction."

Boeing and Airbus have forecasted China will replace the US as the most valuable market in the world for passenger jet deliveries by about 2030. Recently, Airbus struck a deal to increase the number of planes it makes in China. China is also slowly developing a national commercial aircraft



manufacturing sector. The Commercial Aircraft Corporation of China estimates that Chinese airlines will need 8,575 new planes worth US\$1.21 trillion over the next 20 years as strong travel growth continues.

As aviation is one of the most energy and carbon-intensive forms of transport, whether measured per passenger km or per hour travelling the ongoing growth in travel and freight has put the spotlight on its environmental impacts. Direct emissions from aviation account for about 6% of total UK emissions in 2014, 3% of the EU's total greenhouse gas emissions and more than 2% of global emissions. The aim is to reduce aviation's CO2 emissions and then stabilise them at 2020 levels (carbon-neutral growth) using aircraft and operational efficiency, alternative fuels as well as emission trading and offsetting schemes (e.g. the EU Emissions Trading System and ICAO's CORSIA scheme).

Overall a megatrend for the entire aviation industry is connectivity. In-

-flight connectivity is changing from being a luxury to a necessity as Wi-Fi becomes more in demand than in-flight meals and in-flight entertainment. Connected airports, encompassing smart landing (which alerts pilots if aircrafts are approaching the runway too high, too fast or are improperly configured for landing), lighting control (which enables control and monitoring within one series circuit), advanced visual docking guidance system to optimise gate operations, mobile devices to navigate the airports and face recognition systems will transform how airports respond to passengers and aircrafts needs.

**Space**

In the space sector, new areas of business include emerging space programmes in Africa and South America, and emerging private space companies and start-ups active in a variety of services such as human spaceflight, mining lunar and asteroids resources, suborbital and orbital launch services of small payload and

nanosatellite launches. For example, in December 2017 China launched Algeria's first communication satellite, Nigeria has successfully launched five satellites from foreign territories in less than a decade and in May 2017 engineers in Ghana converted an old telecommunications dish into the continent's first functioning radio telescope outside South Africa.

Rapid technological developments in satellite construction and launch infrastructure have enabled the increasing use of nano/micro satellites (1 to 100kg). According to SpaceWorks's forecast: "2017 will be a record year for nano/microsatellite launches, with 182 satellites expected to launch, representing an 80% increase from 2016. The full market potential for the industry remains high, but this year predicts only 10% growth year over year in the future." Launch delays are the major contributing factor to reduced market growth. In 2016, the US dominated the management of nano/micro satellite launches (63%), with China second

(13%). Between 2009 and 2016, the commercial sector accounted for 40% of nano/microsatellites, forecasted to rise to 70% by 2019. That leaves governments with 10% and academic with the rest.

This next generation of satellites is supporting another area of business: monitoring. The UK Space Agency has awarded a \$19 million contract for a new satellite monitoring programme, which aims to protect 300 million hectares of tropical rainforests across the globe. Advanced use of earth observation data from satellites, aerial surveys, ground sensors and other sources will support decisions and actions for disaster response and security. For example, the NASA Disaster Applications programme was able to create a Damage Proxy Map depicting areas of southwestern Florida, including Key West and Naples, that were damaged by Hurricane Irma (Category 4 at landfall in Florida). The London Market Association's claims committee and Lloyd's have agreed to support and fund the satellite imagery service provided by McKenzie Intelligence Services. The service attracted the broad support of the Lloyd's market, with 44 out of a possible 59 managing agents having signed up by the time the hurricanes struck.

Looking ahead, the race to Mars is also fuelling the development of methane-burning rocket engines and competition between SpaceX and BlueOrigin. The Google Lunar XPRIZE, sponsored by Google, has ignited global participation of privately funded spaceflight teams with five teams left in the competition. Overall, the idea of low cost access to space and NASA's support for private spaceflight has paved the way for private sector investments. In 2016, 40 initiatives received US\$1.5 billion in funding, down from 46 and US\$2.3billion in 2015. In December 2017, NASA announced its investment in concept developments for the next decade: a return mission to sample a comet and a drone-like helicopter that would explore potential landing sites on Saturn's largest moon, Titan.

#### **Brexit**

Under the 7<sup>th</sup> Framework Programme for Research and the Horizon 2020 Framework Programme for Research and Innovation (2014-2020), EU funding to UK entities amounts to US\$270 million

for aeronautics and US\$161 million for space (January 2017 data and exchange rate). A further US\$66 million in loans has been allocated to the UK aerospace industry under the Europe's programme for small and medium-sized enterprises (COSME).

Brexit might have significant impacts for both aviation and space, but at the moment its exact effects are uncertain.

In terms of space, the UK wants to stay involved in the EU Copernicus, Galileo and EGNOS programmes, but questions remain as to what extent UK space companies will retain access to the EU single market.

According to IATA, the regulatory impacts will depend on the nature of the future Brexit agreement and access to the European Single Aviation Market. IATA has modelled three different scenarios and even in the case of a "hard" Brexit the UK passenger market is expected to be 45.5% larger in 2035 than it was in 2015 (a "soft" Brexit would result in 55.2% change).

Nevertheless the UK and the EU would benefit from ongoing collaboration.

### **THE CHANGING RISK LANDSCAPE**

What future risks and opportunities the trends discussed above will bring for space and aviation?

The following is an overview of these, looking at three main categories: natural environment, technology, and society and security.

#### **Natural environment**

##### **Climate change and solar weather**

As discussed earlier, increasing CO<sub>2</sub> levels are a concern from a sustainability perspective, but climate change could also affect aviation by increasing clean-air turbulence, cause injuries, delays, higher fuel consumption and increased emissions on transatlantic routes by the middle of this century.

Like weather on the earth, space weather comes in different forms and

The first space satellite insurance is placed, covering physical damage to the Intelsat 1 on pre-launch, and from 1974-1982 the market will underwrite others for up to \$100m each. In 1984, Lloyd's launches a successful salvage mission to reclaim two rogue satellites, sending a shuttle and five astronauts into orbit.

SOURCE: LLOYD'S WEBSITE



different strengths. Solar flares, coronal mass ejections and geomagnetic storms could potentially create huge disturbances in the transport, aviation and power sectors by interfering with ground technology, GPS systems for navigation and satellites. The risks posed by space weather are now also magnified through what some commentators have called “creeping dependency”, which means the growth of interconnected systems that business and other activities rely on.

Another issue is asset stranding. The world has a budget of estimated carbon dioxide it can emit while still limiting the rise of temperatures over 2C above pre-industrial levels. To stay within the budget countries will have to pursue further emission reductions. This means that some fossil fuels will be phased out of the economy and assets such as airplanes that still require them, will gradually lose value or become obsolete – becoming “stranded”. This is why alternative, low-carbon jet fuels will play a key role in meeting the aviation industry’s target of carbon neutral growth starting in 2020. Electric planes will also play a role, for example EasyJet has recently partnered with Wright Electric to develop battery-powered planes for its short-haul flights such as London to Amsterdam or Paris.

### **Space mining**

Asteroid mining is another opportunity in the space sector. Asteroid resources include materials such as sulphur, platinum, cobalt, ferrous metals and organic carbon. For example, according to Asterank, a scientific and economic database that provides information for more than 600,000 asteroids, Asteroid 162173 Ryugu would be the most cost effective to mine with an estimated value of US\$82 billion and an estimated profit of US\$30 billion.

Deep Space Industries and Planetary Resources are first movers and have already identified attractive asteroids.

Despite large potential profits, in 2012 a Keck Institute for Space Studies (KISS) study calculated that the cost for a future mission to identify and return a 500-tonne asteroid to low earth orbit would be US\$2.6 billion.

Similar to traditional mining, materials, technical mining skills, a licence to operate and financing will play a crucial role in making commercial exploitation of asteroidal resources a reality in the coming years.

In regards to regulations, the US and Luxembourg are at the forefront of developing the regulations for asteroid exploration and exploitation.

In 2015 the Commercial Space Launch Competitiveness Act was approved in the US with the aim to “facilitate a pro-growth environment for the developing commercial space industry by encouraging private sector investment and creating more stable and predictable regulatory conditions, and for other purposes.” It granted US citizens rights to own, use, transfer and sell mined space resources without granting exclusive ownership over the celestial bodies in compliance with international treaties such as the Outer Space Treaty.

Since July 2017, Luxembourg has provided space law expertise and it is the first European country to adopt legislation regulating the ownership of resources acquired in space by commercial companies.

### **Technology**

#### **Cyber threats and business interruption**

In July 2015 the Prudential Regulation Authority (PRA) at the Bank of England published a policy statement, which mentioned that casualty (direct and facultative), marine, aviation and transport lines are potentially significantly exposed to “silent” cyber losses (i.e. cyber exposures in insurance policies that may not implicitly include or exclude cyber risks). With aviation companies relying on IT systems that are crucial for ground and flight operations, cyber risks pose a major threat as they can cause breaches and disruption, and can directly impact services, reputation and financial performance.

For example, a technology failure at British Airways (BA) led to delays, airport congestion and flight cancellations for thousands of customers at London

airports in May 2017. BA cited “a major IT system failure that caused severe disruption to flight operations worldwide” originated by a power supply issue that led to an estimated US\$102 million loss.

The year before, following a power control malfunction, critical systems and network equipment failed to switch over to Delta’s backup systems. This incident issue highlighted the airline’s reliance on ageing technology and the interconnected nature of its systems, and led to almost 1,000 flights being cancelled and delays of almost 3,000 others worldwide. The airline was quick to deny a cyber-attack was the cause. In the same year Southwest Airlines grounded more than 2,000 flights due to what it described as a technical glitch with a router.

Cyber-attacks and cyber security are rapidly developing issues and in 2014, the Aviation Information Sharing and Analysis Center was created in the US to act as the focal point for security information sharing across the aviation sector. Two years later the European Centre for Cyber Security in Aviation was created by the European Aviation Safety Agency.

#### **The Internet of Things**

When looking at the Internet of Things (IoT) there are projects to improve every aspect of aviation: passenger experience, baggage handling, equipment monitoring, and improving fuel efficiency.

Virgin Atlantic’s Boeing 787 uses IoT sensors to gain real-time data for a number of things from performance to maintenance (for example, detecting if the performance of a jet engine mid-air is not up to standards and sending a message to airport engineers to be ready when the plane lands). The kind of data collected by this sort of system would help to boost engine efficiency, reduce travel times and cut fuel costs. Companies such as Rolls Royce and General Electric use IoT technology to monitor the performance of jet engines.

In 2015, Lufthansa Airlines launched the RIMOWA electronic tag, which enables travelers to check in their luggage from the comfort of their home from their



smartphone via Bluetooth and hand in their luggage at a check-in station upon arrival at the airport. Helsinki Airport uses sensors in its terminal to track passengers through their smartphones in order to help prevent queues and tailbacks and also be able to send notifications to passengers using their locations.

As aircraft, ground facilities and other critical infrastructures are vulnerable to cyber-attacks, the risk could increase with connectivity. However, as systems become more interconnected, more up-to-date data becomes available and loss prevention services are developed. This is an opportunity to better understand risks and trends as well as planning mitigation and information sharing frameworks.

**Drones**

Drones are now used for a range of activities including military, agriculture, public services, wildlife protection and research. The sector is expanding rapidly with global expenditure set to double to US\$91 billion over the next decade. In the future drones could be used to deliver parcels, move freight and carry people singly or in swarms.

They could be solar-powered to pollinate crops as the number of honey bees declines.

In 2015 a Lloyd’s report identified three key areas that must be developed for the effective provision of insurance for drone operations:

- . Regulation, through the implementation of a robust, internationally-harmonious framework
- . Safety, through the continued development of training and licensing schemes, and further enhancements in ‘sense and avoid’ technology
- . Security, through the application of sufficient cyber security measures

As it’s a relatively new risk, claims history for drone insurance is sparse. In the case of drones, which have come close to causing civil aviation disasters, a downward counterfactual work would be insightful.

A downward counterfactual analysis, as explored in Lloyd’s report Reimagining history published in 2017, is a different way of exploring past losses or near-misses by treating the past as one possible version of many that could

have occurred if various influencing factors had been different. In the case of a drone flying within 20 meters of a plane on the approach to Heathrow, a post event analysis could take into consideration the proximity to the plane as a severity measure and statistics of near misses as an estimation of likelihood of a collision. This would help to understand potential total economic loss and insurable losses from a catastrophic event on a scale of the one that almost took place.

Drones UK regulation is also changing. In July 2017 the UK Government announced measures to place new responsibilities on drones weighing more than 250g - such as mandatory registration of the individual owner and safety awareness tests. Finally, as mentioned in Lloyd’s 2017 report “The rise of the drone insurance market”, insurers might consider whether they can incorporate drones into their own business model to collect quickly large amounts of data to price risks and process claims. This means that insurers might invest in drones with a view to generate cost savings, reduce risk and provide a better service to clients.



### **Flying cars**

Flying cars have been a popular theme in science fiction and every day, millions of hours are wasted on the road worldwide. In 2014 America's drivers wasted 6.9 billion hours stuck in traffic. Projects such as Uber Elevate that look into vertical takeoff and landing aircraft are currently being developed. At the moment there are several market feasibility barriers including battery, air traffic control, safety, cost, noise, emissions and pilot training.

### **Space manufacturing**

Material from asteroids could be processed directly and terrestrial manufacturing techniques could be shifted into orbit. Moving factories into space could reduce the need to open new ones on earth but transport costs might offset any emissions reductions unless powered by sustainable energy. In 2014, a 3-D printer was installed on the International Space Station (ISS) and it validated the process for printing in orbit, critical to making longer journeys to Mars for example.

### **Society and security**

#### **Terrorism**

Recent attacks and threats to flights and airports - the three coordinated suicide attacks targeting Brussels' Airport and Zaventem and Maalbeek metro stations in 2016, and the arrest of Jaber al-Bakr, 22, from Syria, who was allegedly planning to blow himself up at a German airport, for example - demonstrate how aviation and potentially space might continue to be targets of future attacks with consequent psychological and economic effects.

Another trend is the use of new technologies such as drones and terrorists' tactical and technological knowledge and experience accumulated in conflict zones. In November 2017 the US National Terrorism Advisory System stated that "some terrorist groups overseas are using battlefield experiences to pursue new technologies and tactics, such as unmanned aerial systems and chemical agents that could be used outside the conflict zones. Additionally, terrorists continue

Currently, the world's longest flight is Qatar Airways route between Doha and Auckland, New Zealand. The 9,032 mile trip takes nearly 17 hours and is flown by four rotating pilots.

SOURCE: FLYING TIME AVIATION



to target commercial aviation and air cargo, including with concealed explosives”.

### Space tourism

Space tourism has been developing since the 1990s, but significant uptake is yet to be seen. In 2001 Dennis Tito became the first to visit the International Space Station (ISS) through Space Adventures where he stayed for seven days, becoming the first “fee-paying” space tourist for US\$20 million. Virgin Galactic, founded by Richard Branson (Virgin Group), Blue Origin founded by Jeff Bezos (Amazon) and Space X founded by Elon Musk (Tesla and SolarCity) are all developing reusable suborbital launch systems specifically to enable space tourism.

SpaceX has recently been approached to fly two private citizens on a trip around the Moon in 2018, while for US\$250,000 Virgin Galactic offers a two and a half hour flight after three days’ training.

Moreover, the idea of developing a commercial lunar depot to provide anchorage for significant lunar business development (hotels, for example) was confirmed by Bigelow Aerospace and United Launch Alliance in 2017.

## CONCLUSIONS

From creating an aviation space consortium to insuring against airlines defaulting on loans for new aircraft to paying claims for tens of millions of dollars for a spaceship test flight programme accident, the London market and Lloyd’s are already deeply involved in insuring aviation and space developments. London in particular is the epicenter for space and aviation activities given the presence of infrastructure and expertise to support these sectors.

However, as this article shows, these sectors are entering a new age as risks mature and evolve. This represents a substantial opportunity for insurers in a number of business lines.

For example, business interruption products to insure airlines against large events (such as volcanic ash clouds, severe winter storms) that lead to

losses due to cancellation and re-routing costs are being developed. The increasing use of nano/micro satellites could generate more pre-launch and launch insurance opportunities. Drone deliveries, self-driving flying taxis, and Mars travel are also in the pipeline, and insurance will be a crucial component in their viability and success.

The challenge for insurers if they want to maximise these opportunities is to ensure their products keep pace and remain aligned with their customers’ insurance needs. They will need to make sure they have enough capacity to take on these new risks and to do so, ensure their models are up to date and fit for purpose. New approaches to modelling losses that have not yet occurred might be needed for space-related business, such as business interruption and environmental liability for space mining missions, personal accident and third-party liability for space tourism and space-specific travel insurance (including repatriation!).

How this all develops in reality is unknown but one thing is for certain, insurance will be a key part of any future that unfolds. Those insurers who start to think today about what is coming over the horizon tomorrow will be those best placed to take advantage of the many new business opportunities that soon will surely be speeding into view. •

Editor’s Note: Footnotes included in the article are available in our digital edition @mdsinsure.com/en/fullcover/

Only 5% of the world’s population has ever flown on an airplane. However, at the same time a small minority of the world’s population fly very regularly.

SOURCE: BAA TRAINING

