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Cyber security in civil aviation

Deepika Jeyakodi*

‘Absence of Evidence is not the Evidence of Absence’

Introduction

Scenes from the movie Die Hard, where the safety and security of aircraft are compromised using computers, and even eventually turning the aircraft into weapons, can no more be dismissed off as mere fiction. Even as the aviation industry grows in leaps and bounds, with improvement and innovation in design, technology, and efficiency, its fragility can be witnessed in the sphere of cyber security.

Cyber attacks are a global issue and there are unlimited ways to attack an aircraft’s integrity considering its increased dependence on information and communication technology. Such dependence, directed towards reducing human interference and errors, may jeopardize safety, security, and efficiency. Perpetrators use the cyberspace as a new tactic and weapon against their targets. The anonymity, difficulty in assigning responsibility, inexpensiveness, quick attack time, and limited counter-attack mechanisms are few of the contributing factors that make cyber-attacks an effortless opportunity for miscreants, and a potentially catastrophic threat for aviation industry stakeholders as well as beneficiaries.

In general, a legal and regulatory framework for cyber standards, security and enforcement is still in its nascent stages. While so, the situation demands that cyber security issues, in a critical infrastructure¹ such as aviation, need to be resolved.

Cyber Vulnerability of Aviation

In aviation, there are multiple points of attack for cyber terrorists/hackers; from the manufacture of aircraft and its equipment, to any stage of their operation. ‘Cyber terrorism, whether conducted by individuals, corporations or States, could target the electronic systems of companies, which design and develop hardware and software used in airports, air traffic control systems; It could target industries involved in the construction of aircraft and components whether they be used for civil or military purposes’².

Airplanes are sophisticated systems of engineering. It comprises of a complex network of components that essentially comprise of, but are not limited to a base system, communication links, sensors, and avionics. Ground control systems, air navigation service providers, and more communication links complement this. Just as any other computer, these components and communication links are prone to cyber-attacks that include but are not limited to hacking, jamming, and spoofing.

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'This interconnectedness can potentially provide unauthorized remote access to aircraft avionics systems'³; and this is particularly applicable to newer planes such as the Boeing 787 Dreamliner and long-haul Airbus models such as the A350 and A380. An attack may be on the entire system or targeted at individual components, or it could be a manipulation of systems to carry out physical attacks.

Earlier, in 2015, United Airlines had grounded all its flights in the US, reportedly after bogus flight plans appeared in its system. A few weeks later, Polish airline LOT encountered a cyber-attack that affected their ground operation systems. As a result they were not able to create flight plans and outbound flights from Warsaw are not able to depart.

At the DerbyCon 2013, a white-hat (ethical hacker), demonstrated that with equipment worth \$2000, ghost planes could be introduced into an Air Traffic Controller's screen to cause chaos, since there was no verification process to determine where messages were relayed from and no authentication process is involved. In the same year, another hacker, Hugo Teso, demonstrated how to gain remote access into the cockpit system, gain control and remotely programme flights from the ground using a simple application and off-the-shelf electronic equipment, at a security conference in Amsterdam. This demonstration urged not only governmental organizations but also several IT Security Analysts to investigate the vulnerability of aircraft to cyber-attacks. Several incidents have also demonstrated that Global Positioning System (GPS) has been subject to intentional and unintentional targeting and disruption by both state and non-state actors. The 2011 capture of a drone by Iran is still one of the most controversial cyber incidents, wherein it was alleged that an RQ 170 Sentinel was brought down by the Iranian Armed Forces' electronic warfare unit. Following this incident there were several estimations on the possibility of cyber hijack of aircraft. Subsequently, in July 2012, Todd Humphreys, demonstrated in his 'Statement on the Vulnerability of Civil Unmanned Aerial Vehicles and Other Systems to Civil GPS Spoofing'⁴, the ability to hijack an Unmanned Aerial Vehicle (UAV) by GPS Spoofing. This was established by remotely tricking the aircraft, from a distance of a half mile away, into a commanded dive that was only aborted 10 feet above the ground to prevent it from crashing, using equipment that costed less than US \$2000. Much earlier, in 2009, Newark Liberty International Airport experienced sporadic outages of the GPS Ground-based Augmentation System used for precision approach landing. The ground station 300 feet away experienced signal interference every day at about the same time. The Federal Aviation Authority (FAA), discovered the cause of the outage was a GPS jammer being used by a truck driver to avoid being tracked by his employer⁵. Reliance on open civilian GPS is a matter for concern, as the aviation industry is seeing a marked shift from the use of traditional radar based identification and guidance systems, to one that is based on satellite navigation and automation. For example, U.S's NextGen Automatic Dependent Surveillance-Broadcast (ADS-B).

By 2020, ADS-B, a surveillance technology will be replacing radar as the primary means of tracking aircraft and will be a compulsory requirement on the majority of aircraft. Being a data infrastructure, it will provide traffic and weather information, offering better communication between the aircraft and air traffic control. However, till date, the ADS-B system remains unprotected and vulnerable to cyber-attacks. Communications between aircraft and air traffic controllers remain unencrypted and unsecured, making it open for attacks that can disrupt air traffic. It remains vulnerable to jamming and spoofing of information.

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The disappearance of the MH370 flight had also raised questions on the possibility of cyber-hijacking as the possibility of all transponders being switched off to relay location signals despite having state-of-the-art communication and reporting system was doubted by several cyber experts. This was triggered by Boeing's request earlier in 2014 to the FAA to incorporate changes to its aircraft designs citing security reasons, as there was a possibility of its in-flight entertainment systems being connected to other critical systems of the aircraft⁶.

The above examples are merely the tip of the iceberg. At every stage, with every new information and communication technology innovation in this industry, the other side would be waiting to test the vulnerabilities and possibly launch attacks. Apart from potential damage to property and life, the chaos and resulting economic losses, there also exists an angle of psychological threat, whereby such cyber interference may play havoc on the integrity of air transport as it did post the 9/11 attacks, instilling some sort of reluctance to air travel.

Legal and Regulatory Framework

Aviation is a unique critical national infrastructure that requires the application of higher standards of security to fortify their systems from cyber-attacks, than those that are applied to general electronic infrastructure. Having said that, it should be acknowledged, that laws in relation to cyber-security, have not matured yet. Nevertheless, it is not a lawless 'Wild West' scenario. Efforts have already been initiated and are evolving at the international, regional and national levels to address concerns.

Firstly, of particular relevance are the efforts taken by the International Civil Aviation Organization (ICAO). In the early 1970s, ICAO published a Security Manual to assist its Member States to take measures for the prevention of unlawful interference, minimize its effects, and established standards by adopting Annex 17 of the Chicago Convention, thereby establishing a security culture. However, the threat posed by cyber security was left unaddressed until recent times.

Adopted as a part of the Aviation Security Plan of Action by the ICAO Assembly Resolution A33-1 in October 2001, the Universal Security Audit Programme, commenced the auditing of access controls and related security lapses in ICT systems. This was the first step forward in identifying the potential risks in cyber security. Over the years, the ICAO has effectively strengthened existing 'Standards and Recommended Practices' (SARPs) and evolved new recommended practices in respect of Air Traffic Network Security too, for example, the amendments made in respect of Annexes 6 and 11 of the Chicago Convention regarding the use of standardized equipment, message handling etc.,.

The Internet Engineering Task Force (IETF) responsible for aircraft mobile standards routing, the Internet Corporation for Assigned Names and Numbers (ICANN) responsible for internet infrastructure, the FAA and EUROCONTROL collaborated in 2008 with ICAO to discuss about the impact of Boeing's in-flight online internet connectivity service, 'Connexion', on global internet routing. Discussions left it clear that aircraft internet service, including the new next generation air traffic management networks, could be highly disruptive to the global Internet. No formal agreements resulted, though, it was suggested that aviation needed to isolate the Internet from disruptions caused by their global aircraft network movements⁷.

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It is projected that in a decade over 30,000 aircrafts will occupy our skies and each of these aircraft would be using its own internet bases with each nation owning and controlling their network operations instead of the ideal single network operator. According to the Report on Cyber Security in Civil Aviation, 2012 by the Centre for Protection of National Infrastructure, UK, ICAO seems to assume that since telecommunication is a national subject, each State determines what passes through its territory and the responsibility for any default in security will vest with that State. In a world where traffic, data, voice, video, etc is transmitted via internet, this attitude is untenable in the long term. Ideally ICAO could define a “closed/isolated” network architecture that would both make their aviation network operation easier to manage and isolate the Internet, although for now this seems like a long shot.

In 2009, at the behest of the European Civil Aviation Conference, the Aviation Security Panel along with the Working Group on New and Emerging Threats, looked into the challenges posed by cyber security; Its report came out with several recommendations, which include but are not limited to the evaluation of cyber-risks and incorporation of ‘unpredictability’ into SARPs. Based on the proposals of the Committee on Unlawful Interference, followed by the ICAO Assembly Resolution A36-20 in 2010, the 12th Amendment, and based on the Aviation Security Panel’s recommendations, the 14th Amendment, to Annex 17 were made applicable from July 2011 and November 2014 respectively. Chapter 4 of Annex 17 now deals with cyber threats. It recommends that:

‘Each Contracting State must develop measures in order to protect information and communication technology systems used for civil aviation purposes from interference that may jeopardize the safety of civil aviation.’

Although this provision is in the nature of a recommendation, the imperative need to address the concerns relating to cyber security may compel the States to take efforts in this direction. The ICAO is working on new safety standards for 2018 on large unmanned aircraft that can fly across borders; Early 2015, saw the agency mulling whether to take the unusual step of helping countries draft domestic rules for integrating drones into regular airspace. As UAVs are more prone to cyber-attacks, it is widely expected that cyber security issues would be considered in depth. If so, general aviation would also benefit from such developments.

Further, The Convention on the Suppression of Unlawful Acts Relating to International Civil Aviation, popularly the Beijing Convention, 2010, which is yet to come into force, is hailed by cyber security experts as the first step forward in securing the aviation industry. The treaties adopted in Beijing further criminalize the act of using civil aircraft as a weapon, and of using dangerous materials to attack aircraft or other targets on the ground⁸. It is in this Convention that the problem of cyber threats is implicitly addressed. Article 1(d) therein, provides that an offence is committed when a person destroys or damages air navigation facilities or interferes with their operation, if any such act is likely to endanger the safety of aircraft in flight. This undoubtedly refers, inter alia to cyber terrorism, but strangely links the offence exclusively to the safety of aircraft in flight. If therefore as a result of an act of cyber terrorism, a taxing aircraft collides with an aircraft, which has opened its doors for disembarkation, but the passengers are still on board awaiting disembarkation, that act would not be considered an offence in terms of the passengers in the process of disembarkation.

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In other words, the offender would not be committing an offence either against the second aircraft or its disembarking passengers⁹. Further, as per Article 1(e), an offence is also said to be committed where a person communicates information, which that person knows to be false, thereby endangering the safety of an aircraft in flight. This can be applied to situations where personas are engaged in interrupting air navigation services. However, the term “safety in flight” may restrict the scope of this provision if such communication is made when the doors are open or when the aircraft is not actually in flight. Moreover, the limited scope of this Convention to attacks on air navigation facilities, an interference with their operations, and/or communicating false information, excludes a wide variety of attacks. The above notwithstanding, the Beijing Treaty of 2010 is a step forward in the right direction with the threat of cyber terrorism looming, affecting the peace of nations¹⁰.

Secondly, the efforts of various international and regional organizations, which contain elements that would apply to aviation, may be used as building blocks for the development of laws and regulations to address cyber-security issues in aviation. The United Nations Manual on the Prevention and Control of Computer Related Crime, and the 2001 United Nations Resolution on Combating the Criminal Misuse of Information Technologies which stress on the establishment of a law enforcement mechanism to tackle the problems that may arise from technology, are a culmination of the efforts taken by various international and regional organizations such as the United Nations, Council of Europe, Interpol, the OAS, the ECAC and OECD. The 2001 Cybercrime Convention was formulated in anticipation of situations where cyber technology may be used to commit criminal acts. Articles 3, 4, and 5 therein recommend States Parties to adopt legislative or other measures to counter illegal interception of transmission of computer data, data interception and exchange interception, respectively. This along with Article 7 on alteration of data and forgery, require States to establish interceptions and alterations as criminal offences under its domestic law. Following this, various strategies, cooperative agreements and frameworks have been developed and adopted by the EU, ASEAN, the Asia-Pacific Economic Cooperation, the International Telecommunications Union, the Economic Community of West African States etc.,. A recent development in regulating cyber activities in the international arena is the Draft United Nations Treaty on an International Criminal Court or Tribunal for Cyberspace, which could pave the way for a strong and unified law enforcement mechanism for cybercrimes. These laws would principally deal with the after-math of a cyber-attack on aviation. Although it would be appropriate to harden the aviation infrastructure from attacks, this second level measure will be paramount in acting as a deterrent to potential perpetrators.

Thirdly, of considerable importance are the national laws that some countries have adopted in line with the Cybercrime Convention; although their effectiveness is questionable. While there are many provisions that address jurisdiction, economic activity, privacy, content etc., those relating to cyber security and its breach are either inadequate or non-existent at best. Additionally, the enforcement provisions are often poorly designed and the punishment is far disproportionate to the resultant economic loss. This can be attributed to the lack of understanding and consequent poverty in defining cybercrimes specifically regarding hacking, unlawful interference, data alteration etc. For example, in Brazil¹¹ its law addresses only manipulation of data by authorized public servants, consequently, there is no mention about external actors; only manipulation of data by authorized public servants, consequently, there is no mention about external actors; In India¹² the term ‘hacking’ is defined, yet, the punishment for the

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same is 3 years imprisonment and/or a fine equivalent to 1000 Euros; In China¹³ the punishment for interference with computer systems is punishable with imprisonment for 7 years; Korea¹⁴ is comparatively, the country with the strongest cyber laws, where any damage to Critical Information Infrastructure, would attract a 10 year imprisonment and a fine of 100 million Korean currency. Similar provisions can be found in the national legislations of USA¹⁵ and UK¹⁶. Increasing reports on cyber incidents may probably force or at least urge these States to revisit their national cyber laws, in order to acclimatize them to changing demands.

Fourthly, apart from the above mentioned laws, there exist guidelines and ‘good practices’ that are frequently prescribed by various bodies within the aviation industry. In a way, these efforts from within the industry can be termed as self-regulation mechanisms. IATA’s Aviation Cyber Security Toolkit launched in October 2014 to identify, assess and mitigate, cyber risks in aviation IT infrastructure, ECAC’s guidance material for member states on cyber security control measures, studies by the EUROCONTROL at the various stages of Single European Sky ATM Research (SESAR) programme, are a few examples. The U.K’s Centre for Protection of National Infrastructure, the U.S.’ National Institute of Standards and Technology, and several other national and regional organizations are drawing attention to the issue and calling for a coordinated response. The organization that is leading its way into cyber-security research is the Federal Aviation Authority. In February 2015, a notice of assignment was made to the Aviation Rule making and Advisory committee to make recommendations on Aircraft Systems Information Security/ Protection (ASISP). Moreover, it is also advancing on Airborne Radio Standards Development and prescription of airworthiness standards for ICT components in aviation. Besides, it is also collaborating with the U.S. Homeland Security in applying the Cyber Security Assessment and Risk Management Approach ‘CARMA’ to Aviation Sector. The initiatives taken by the FAA may act as an archetype for future laws and regulations governing aviation cyber-security.

Finally, several independent cyber security analysts, University IT labs, manufacturers, and ethical hackers are actively involved in conducting research, identifying exploits and vulnerabilities, and recommending guidelines to various stakeholders in the industry. For instance, the System-Aware Secure Sentinel was developed by Georgia Institute of Technology and Virginia Tech, USA, in which the new system detects “illogical behavior” compared to how the aircraft normally operates, before initiating warnings. Aforesaid practices will go a long way in testing the waters, subsequently resulting in the establishment of unified aviation cyber security architecture.

Overall, there is promise for the future, nonetheless, the law needs to catch up with the rise of the cyber-dependent systems to efficiently regulate and protect various stakeholders and beneficiaries.

Suggestions

It is clear that terrorizations to aviation infrastructure from cyber-attacks are real and imminent. It is required to develop a hybrid system that amalgamates elements of the aviation and IT industry to create a suitable environment for safe and secure operation.

The first step in this direction would be to see the complete picture by understanding, identifying and accepting the existence of cyber threats and risks.

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The full implications of the increased connectivity and dependency on ICT need to be understood in light of evolving cyber threats¹⁷. The States need to foresee that even a single incident of cyber-attacks may cause enormous damage. Keeping in mind the unique nature of cyberspace and the activities therein, even if separate laws to address cyber-attacks are not made, incorporation of corresponding provisions must be made into their local criminal laws so that they are well-equipped to deal with such circumstances if and when they arise. A separate 'Cyber Security Architecture' for aviation can be devised by establishing common standards in order to keep the structure closed and thereby subject to strict regulation and control. Further, a cyber security culture must be established through formulation and strong implementation of SARPs; This could be effectively carried out by encouraging co-ordination and co-operation between States as well as industry players and establishing a cyber-security incident reporting and response system. Components, data communication systems, especially COTS, have to be hardened against cyber-attacks. Manufacturers should ensure that a minimum standard in security is applied. Adopting a prescriptive approach, as suggested by Stefan Kaiser¹⁸, airworthiness standards may be applied to the aviation IT components for their reliable and stable use. Not prescribing such a standard fearing an adverse economy would have dangerous consequences as '...the quality standards commonly practiced in the information technology industry do not suffice airworthiness standards'¹⁹. Automatic re-programming, kill switches etc., should be incorporated in systems as a fall back measure when it is under said attack. A cyber-attack can be intercepted only in a manner that is similar to the one employed by hackers; by blocking signals, or hacking to assume control. Training of personnel at various levels in various capacities to meet the challenges posed by cyber threats is necessary, in order to launch response attacks to secure networks, the aircraft, and/or third parties. This can be achieved by taking inputs from cyber experts including those who test vulnerabilities as third party actors. A certification examination for operators must also test the operators' cyber-security knowledge.

The need of the hour is an assessment of the 'spectrum of threats, not simply the worst one imaginable, in order to properly understand and coherently deal with the risks to people, institutions, and the economy'²⁰.

Conclusion

'As a key critical infrastructure and an essential link to commerce and passenger transportation, the global aviation industry will remain a target for adversaries seeking to make a statement or cause substantial loss to life and financial bearing. Like many emerging threats, cyber attacks still loom in the periphery, bordering on the 'not yet realized,' and are seen more as a stylized fiction than an actual possibility'²¹. Technological advancement, dependence thereon, current economic pressures to reduce labour, increase automation etc., should not act as an impediment to the security of the aviation industry. The development of a cyber-security framework is urgent. The only way forward to tackle this new and emerging threat is to find a global solution. Every day, in the field of aviation, some innovation is made, more so when it comes to the part of information and communication technology. The key to ensuring its security would be to keep up with the developments thereby being in a position to confront the threats rather than evoking responsive action after its occurrence.

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¹The loss or compromise of which would have a major detrimental impact on the availability or integrity of essential services, leading to severe economic or social consequences or to loss of life, <http://www.cpni.gov.uk/about/cni/#sthash.up2EiCNN.dpuf>

²Abeyratne Ruwantissa, 'Cyber Terrorism and Aviation—National and International Responses', *Journal of Transportation Security*, 2011, Vol.4 (4), at pp.342.

³FAA Needs a More Comprehensive Approach to Address Cybersecurity As Agency Transitions to NextGen,' Report of the U.S. Government Accountability Office, GAO-15-370, <http://www.gao.gov/assets/670/669627.pdf>

⁴Submitted to the Subcommittee on Oversight, Investigations, and Management of the House Committee on Homeland Security.

⁵Emilio Iasiello, 'Aviation and Cyber Security: Getting Ahead of the Threat', *Aerospace America*, July-August 2013 at pp. 24.

⁶Dr. Sally Leivesley, British anti-terrorist expert and former Home Office Scientific Adviser, News Report to *The Express*, March 14, 2014.

⁷Terry L. Davis, about 'Aviation Network' at <http://www.ietf.org/mail-archive/web/cin/current/msg00005.html>

⁸Abeyratne Ruwantissa, 'The Beijing Convention of 2010 On The Suppression of Unlawful Acts Relating To International Civil Aviation—An Interpretative Study', *Journal of Transportation Security*, 2011, Vol.4 (2), at pp.132.

⁹Supra, note 8 at pp.137.

¹⁰Supra, note 8 at pp.138.

¹¹Law no. 9983 of July 7, 2000, Insertion of fake data into systems of information Article 313-A / Non-authorized modification or alteration of systems of information Article 313-B.

¹²Information Technology Act, 2000.

¹³'Regulations on Safeguarding Computer Information Systems', Feb. 1996 / Criminal Law of the People's Republic of China Articles 285, 286, 287.

¹⁴Act On Promotion of Information and Communications Network Utilization and Information Protection, etc. Chapter VI Stability of the Information and Communications Network/ Information Infrastructure Protection Act.

¹⁵Homeland Security Act of 2002, USAPATRIOT Act of 2001 etc.,

¹⁶Regulation of Investigatory Powers Act (RIPA) of 2000, Computer Misuse Act of 1990, The Anti-Terrorism, Crime and Security Act of 2001 etc.,

¹⁷'A Framework for Aviation Cyber Security', AIAA Decision Paper, August 2013.

¹⁸'RPAS/UAS: A Challenge For International, European And National Air Law', Workshop of EASA and Institute of Air and Space Law, University of Cologne, 23-24 May 2013.

¹⁹Stefan Kaiser, 'UAVs and Their Integration into Non-segregated Airspace' (2011) 36 *Air and Space Law*, Issue 2, pp. 161-172.

²⁰John Mueller, Mark G. Stewart 'Terror, Security, and Money', Oxford, 2011, pg.16.

²¹Supra, note 5 at pg.25.

Recent Legal Issues in International Civil Aviation Organisation (ICAO). Step back or forward?

Małgorzata Polkowska *

Introduction

This article updates the recent discussions during the Legal Committee session of ICAO (36th) in Montreal. It's based on the report prepared by ICAO Secretariat on this matter¹. This article raises the issues about the present and future directions of legal activities of ICAO.

ICAO Legal Committee has been established at the first session of the ICAO Assembly in 1947. Its mandate is to advise the Council and the Assembly of ICAO in the field of legal issues and prepare draft international conventions and their protocols in the field of Aviation law. The Committee consists of all Member States of ICAO and each Member State has one vote. According to its constitution, the Committee is composed of experts in law seconded by Member States. The Committee meetings may also be attended by organizations invited by the ICAO Council².

The 36th Session of the Legal Committee

The 36th Session of the Committee took place in Montreal from 30 November to 3 December 2015. During this short meeting (in comparison to the previous much longer sessions) with only few working papers (including reports, flimsy and information paper) prepared, an international community discussed about the current legal issues and the priorities.

The meeting was attended by 61 Member States and 9 international organizations represented (such as: IATA, EUROCONTROL, IFALPA) by 134 representatives and observers.

Unruly passengers

The first document of the Legal Committee session referred to the Acts or Offences of concern to the international aviation community not covered by existing air law instruments³.

The working paper on this matter recalled that when the ICAO Diplomatic Conference adopted on 4 April 2014 the Protocol to Amend the Convention on Offences and Certain Other Acts Committed on Board Aircraft (Montreal Protocol of 2014)⁴, it also adopted a Resolution which urges the Council of ICAO to request the Secretary General to update ICAO Circular 288 (Guidance Material on the Legal Aspects of Unruly/Disruptive Passengers)⁵ to include a more detailed list of offences and other acts, as well as to make

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consequential changes to the Circular arising from the adoption of the Protocol.

According to this resolution, a Task Force on Legal Aspects of Unruly Passengers was established, which held its first meeting in September 2015. The Chairperson of the Task Force (Author of this Article) provided to the Legal Committee a progress report of its work. The Task Force decided to maintain the list of offences in the Circular as it is, as the list is sufficiently comprehensive to cover the unruly behaviour of passengers that takes place on a daily basis. The Task Force also established three drafting groups respectively led by Singapore, Kenya and Finland for different chapters in the new guidance material.

Many delegations praised the work of the Task Force. Whether a draft Assembly Resolution on the subject of unruly passengers could be presented in 2016 would depend upon the completion of the work. One delegation requested that the guidance material would take into account of the fact that the Tokyo Convention of 1963⁶ would remain in effect for those parties that have not ratified the Montreal Protocol of 2014. Another delegation suggested that the guidance material should not only cover the acts on board aircraft in flight but should also cover certain acts on the ground, giving an example where the passengers refused to leave the aircraft after landing. The Secretariat explained that the provisions of Montreal Protocol of 2014 apply when the external door of an aircraft is closed. When the door is open, the acts on board aircraft are subject to the national law of the State of the airport where the aircraft lands. The Chairman summarized the discussion, and the Committee agreed, by stating that the Task Force should be congratulated for its work, and encouraged to complete its task. The next meeting of the Task Force has been planned in March 2016.

Conflict of Interest

The next point of the discussion of the committee was the document on the conflict of interest⁷. The Secretariat reported on the results of the online survey on conflicts of interest in civil aviation to which 43 States responded. It was established from the survey that most States that responded have in place a framework dealing with conflicts of interest (COI) which they consider to be effective. Furthermore, the paper concluded that it was useful for all States to have such a framework given the prevalence of COI situations in the civil aviation activities of States. It was recommended to develop and present an Assembly Resolution to promote awareness of potential conflicts of interest in civil aviation and the need for States to take measures to avoid or mitigate risks from COIs to aviation safety and security. The United States, while introducing its own paper⁸, stated that its main purpose was to communicate interest in continuing the work on conflicts of interest. Scenarios such as civil aviation administrations (CAAs) with an oversight body upon which industry representatives sat or CAAs making public statements indicating their mission to support or improve the economic situation of national carriers were cited as posing possible risks to independent regulation. Provision such as disclosure requirements and recusal from regulatory decisions were cited as examples of mitigating measures that could be put in place.

All delegations (including the US) that took the floor supported the proposal to develop and present an Assembly Resolution and many delegations expressed their willingness to contribute or sponsor such a Resolution.

*AVIATION***Article 83 bis**

Another point of discussion of the Legal Committee was the safety aspects related to liberalization and art. 83 bis of the Chicago Convention⁹ presented by the Secretariat. The paper recalled that at its 35th Session the Legal Committee recommended that a Task Force be formed; this was endorsed by the Council. The Article 83 bis Task Force was consequently established in September 2014, the deliverables of which were: recommendations for revisions to ICAO Circular 295 and identification of options to be considered by ICAO as alternatives to the current registration system, possibly web-based. The Task Force delivered recommendations to the Secretariat for the publication of a Manual to update Circular 295, as well as five recommendations to the Legal Committee. It was indicated that a consolidated draft text of the Manual should be ready around April 2016 for review by the Task Force Members and approval of the Secretary General by the end of Summer 2016. The publication is expected in Fall 2016. The Recommendations to the Committee were introduced by the Chair of the Task Force. As regards the proposed amendment to the applicable Council's Rules to allow swift registration and publication of Article 83 bis agreements through an interactive web-based system, he indicated that it was believed that the Secretariat and the Council could consider whether there would be efficiencies to extend such on-line registration system to other aeronautical agreements and arrangements; this point was supported by some delegations.

In the ensuing discussions, there was general support and appreciation expressed for the work accomplished by the Task Force and its very productive outcome. The ICAO Secretariat was encouraged to familiarize States with the guidance in the new Manual once published, on the occasion of the forthcoming 39th Session of the Assembly or during other meetings as appropriate.

Remotely Piloted Aircraft Systems (RPAS)

The next agenda item of the Legal Committee was a discussion of legal issues related to unmanned aircraft. The Secretariat presented a document to the committee on an overview of existing international air law instruments in the responsibility for the use of RPAS- Study of legal issues relating to remotely piloted aircraft¹⁰. The study noted that remotely piloted aircraft (RPA) are simply one type of unmanned aircraft, and all unmanned (pilotless) aircraft, whether remotely piloted, fully autonomous, or combinations thereof, are subject to the provisions of the Chicago Convention and its Annexes. The overall conclusion of the study was that although the propagation of RPAS will likely expose a new evidentiary landscape relating to how the international regime for liability would be applied to RPAS operations and operators, the regime in its current state is legally adequate to accommodate RPAS technology. The Secretariat study was lauded as excellent by several members of the Committee, and generally characterized as thorough and comprehensive. Nevertheless, the vast majority of delegates expressed their unqualified support for the report's analysis and conclusions, while also expressing their appreciation for the presentations made by the Secretariat.

The Secretariat's presentation of the paper was then followed by another Secretariat presentation on the technical work of ICAO related to RPAS, including the ICAO RPAS Seminar, which took place in March 2015. The participants were also briefed on the work of the ICAO RPAS panel. The third and fourth meeting of the RPAS panel were planned to take place accordingly in December 2015 and March 2016.

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Upon conclusion of a number of questions and answers on the technical work of ICAO as regards RPAS, a question was raised on insurance requirements. Moreover it was pointed out that they are areas that still need to be identified: e.g. registration process, cross border operations, operations over the open sea, as well as the possible change of control of remotely piloted aircraft in international flights. The Committee agreed that the item on RPAS should be backed up by detailed information from the Member States on national jurisdictions for comparative purposes and to identify other possible issues in the field of international operations which the national legal system could not cover.

The Committee's overall satisfaction with the work of the Secretariat notwithstanding, a number of delegates noted that legal aspects of RPAS operations other than liability still might need to be addressed and so favoured maintaining the "Study of Legal Issues Relating to Remotely Piloted Aircraft" as an item on the Work Programme of the Committee. One delegate further averred that though its State already had in place all-encompassing national regulations on RPAS, including extensive provisions addressing even very small craft commonly referred to as "drones", they were interested in the views of other States and favoured a questionnaire to collect information on the national regulations of other States.

The proposal for a questionnaire (which will be prepared and send by ICAO Secretariat during the first quarter of 2016) was supported by a significant number of other delegates, several of whom advocated it be used as a means to identify the specific international legal problems that RPAS integration was presenting for States. One delegation also stressed the importance of ensuring the Committee's future work on RPAS takes into account technical developments and industry needs through coordination with the RPAS Panel.

CNS/ATM

The next short point discussed by the Committee was the issue related to the systems CNS/ATM¹¹ including Global Navigation Satellite System (GNSS) and to establish an international legal framework in this area. The committee was informed by the Secretariat in the field concerned and decided on the need to continue to monitor this issue and take the necessary activity in the development of this point.

Promotion of ICAO legal instruments

Within the next point of the agenda of the Legal Committee: promotion of the ratification of international legal instruments and the status of ratification of international air law instruments have been discussed². During this point the Committee agreed on a paramount role of international legal conferences aimed at promoting their ratification. After 35th Legal Committee several international conferences and seminars have been held. Among others the International Conference on Air Law, which was held in Warsaw in 2014 to commemorate the 85th Anniversary of signing of the Warsaw Convention.

AVIATION

Under this point one delegation presented a document to amend the Transit Agreement from 1944¹³, taking into account the changes of the past 70 years in reducing sovereignty over the airspace by the United Nations Convention on the Law of the Sea (1982)¹⁴ and the so-called Outer Space Treaty¹⁵, as well as air transport policy towards an open skies aimed to use the shortest available routes. The document stressed also the need to continue the ICAO calling for universal ratification of the Transit Agreement, as noted by the Committee.

State and civil aircraft

Next point of the Committee's work was to determine the status of civil/state aircraft. Under this point the lively discussion has been observed. Poland on behalf of 10 Central European Rotation Group-CERG countries¹⁶ presented the Working Paper¹⁷ which recalled the 1993 ICAO Secretariat Study on Civil/State Aircraft and stated that there are three specific objectives related to civil/state aircraft or possible unusual (mixed) character of aircraft in flights operated in international air navigation, namely: (a) the definition of Civil/State aircraft; (b) “[establish] more precise qualifications for civil, state, or mixed character of aircraft and flights operated for unusual purposes”; and (c) “ensure the recognition of the relevant rules by the International Aviation community for determining the aircraft status for each flight or flight series (who is competent to take such decision, how such determination has to be identified and notified to the parties concerned if flight planning rules are not sufficient).”

The Legal Committee was invited to express its opinion on the possibility of achieving the above-described objectives without amending the Convention. The United States presented its own Working Paper¹⁸, which questioned the desirability of the objectives outlined in CERG paper, and recalled that the Chicago Convention is, by the terms of Article 3a, “not applicable to state aircraft.” Further noting the previous difficulty to arrive at a consensus definition of “state aircraft”, as well as the fact that “the Legal and External Relations Bureau (LEB/ICAO) is severely stretched to carry out its support for the several items on the Work Programme that the Organization considers to be more important”, the paper recommended that the agenda item “Determination of the Status of an Aircraft - Civil/State” remain on the Committee’s Work Programme at its current priority level.

The Committee was therefore asked to express an opinion on the possible achievement of objectives without changing the Chicago Convention. The document was supported by a large number of delegations. A number of delegations supported the necessity to clarify the definition of “state aircraft” contained in Art. 3 b of the Chicago Convention and establish criteria to facilitate the determination of the status of the aircraft flying as a civilian or state. The majority of States also supported the Polish proposal to find a solution without changing the Chicago Convention and to address this issue through possible revision of its Annexes.

The lack of uniform practice in classifying civil/state aircraft had created certain difficulties. For instance, aircraft used to carry detainees were considered by some States as civil aircraft, but they were in fact State aircraft which should not enter into territory of another State without the explicit consent of the latter.

AVIATION

Accordingly, they favoured the establishment of a working group or task force to advance the work on these matters. Another group of delegations recognized the challenges that the current classification of “civil/state aircraft” presents, but in consideration of LEB’s limited resources, favored retaining the item on the agenda of the Legal Committee for continued work during its 37th Session.

During the discussions the delegations indicated that the lack of uniform practice in determining the status of the aircraft might cause a number of legal problems. One member gave the example of the use of aircraft to transport of convicts that have been recognized as civil aircraft, while their character could be presumed as state status of the flight and there need to obtain consent for entry into another country. Some delegations suggested the creation of a task force that could identify the legal issues and ways of addressing them. Several delegations also proposed the creation of a questionnaire, which would first identify the problems of individual countries with the existing legal regime and, subsequently, to determine the following activities of the committee. Poland supported both proposals.

The majority of interventions, however, expressed support for the idea of sending out a survey or questionnaire to Member States, as a means of ascertaining their positions and practices. Such survey or questionnaire would be most useful for determining what specific challenges States have due to the current legal regime relative to civil/state aircraft. After an interesting and exhaustive discussion, the Committee has decided to prepare a questionnaire and send it to the Member States in the Summer of 2016.

The Chairman, in summarizing the discussion, took note of the sense of some delegates that the Chicago Convention’s definition of “state aircraft” has become outdated, insofar as some types of aircraft/flights no longer fit exactly into the categories of military, police, or custom services. Some problems were also encountered by airports and air navigation service providers in trying to ascertain the civil/state status of an aircraft in order to collect relevant charges. However, he noted that there had been a number of delegates calling for the development of specific criteria for determining the status of an aircraft/flight as civil/state when, in fact, the 1993 ICAO Secretariat Study on Civil/State Aircraft already provides this. With this said, the Chairman enumerated four areas of consensus among the members of the Committee: (1) safety and security requirements impacting civil aviation are preeminent; (2) there is no need to amend Article 3 a) and b) of the Chicago Convention; (3) the “Determination of the Status of an Aircraft - Civil/State” should remain on the Committee’s Work Programme; and (4) the 1993 Secretariat Study is excellent and should serve as the basis for of the Committee’s review and continued work on this issue.

The Chairman further specified two matters with respect to which there was no consensus, namely: (1) the need for or desirability of an official ICAO interpretation of Article 3 b); and (2) the need for or desirability of amendments to the Annexes of the Convention to address the matter. In conclusion, the Chairman suggested that the creation of a working group or task force, while not totally excluded, was premature prior to the results of LEB’s review of the 1993 Study that had been directed by the Council.

AVIATION

He further proposed that considering LEB's limited resources, the Committee generally agreed that a questionnaire inquiring about the practical problems caused by the classification of "civil/state aircraft" should be sent out before LEB's review of the 1993 Study is undertaken to aid in narrowing the scope of the review. He invited the countries to help ICAO Secretariat with preparing adequate questions for the questionnaire.

Suborbital flights

Then, the ICAO Secretariat presented a document on commercial suborbital flights and provided the Committee with recent developments in the field of space law and the challenges faced by the airline industry that may arise with the development of suborbital space flights. The document informed about the creation of a joint sub-learning group between ICAO and UNOOSA¹⁹ to compile the existing regulations for space transport. In order to broaden knowledge on the regulation of space activities, including suborbital flights the ICAO and UNOOSA jointly organized from 18 to 20 March 2015 the Aerospace seminar. During the seminar approximately 300 participants from worldwide (coming from different international and European institutions, agencies, industry and academia's) attempted to resolve the pending question if legal framework for these flights should be governed by air law or space law. A second joint seminar of ICAO and UNOOSA will be held in Abu Dhabi in March 2016 and its main purpose is to increase the awareness of Member States on legal challenges and gather best practices on its operations in this growing sector.

Some delegation supported the initiative contained in the document and the need to continue discussions on the future regulation of sub-orbital and commercial space flights. ICAO should be thus proactive in this matter, mostly in the discussion about the air navigation safety, so that's why some initiatives referring to additional amendments into ICAO safety plans such as GASP²⁰ and GANP²¹ are ongoing.

After short discussion it was agreed that the legal aspects relating to commercial flights would not be at this stage placed on the agenda of the Committee because of the need to observe the directions of development of this new sector and then implement adequate actions concerning development the legal solutions. Among the delegations there was no unanimously need to carry out additional legal work by the Secretariat at this stage.

General Work Programme and Legal Commission Agenda

The Committee then reconsidered its General Working Programme²² and the order of priority of individual items on the plan taking into account the progress of work on each items and the results of previous discussions. Prioritization of the agenda has been changed according to previous discussion in the Legal Committee, so few items were reconsidered to change the priority, e.g. item related to RPAS has been changed from priority No. 4 to No. 1, and item related to the determination of status of civil/state aircraft have been increased from level 7 to point 5.

The Committee then considered the Agenda of the ICAO Legal Commission²³ which meeting will be held at the 39th ICAO Assembly in September 2016.

AVIATION

The Committee also approved amendments to the Rules of Procedures of the ICAO Legal Committee, adding the Chinese language to the official languages of the Committee and changing the procedure for succession of Vice-Chairmen of the Committee in the event of vacancy. The Committee also determined that the most appropriate date to convene the 37th Session of the ICAO Legal Committee would be 2017, while the final decision on specific date was left for the decision of the Council of ICAO.

Any Other Business (AOB) and Conflict -Risk Zones

As part of the AOB item, the Brazilian delegation presented a document²⁴ concerning the interpretation of Article 12 of the Chicago Convention submitted during the session. After a discussion on the document and expressing support by several delegations, the Chairman of the Committee noted that due to the late submit of the document, delegations were not able to develop embodied positions on the matter. The Committee decided that due to raised interest, the issue should remain in attention of appropriate ICAO bodies for detailed analysis²⁵.

The last document presented at the 36th Session of the ICAO Legal Committee under AOB was presented by the delegation of the Netherlands²⁶, which included the recommendations of the final report of the Dutch Safety Board after the downing of the Malaysia Airlines (flight MH-17). The document also contained the results of the work of the Special Group on the review of international legal instruments in terms of their application to Conflict Zones.

The Special Group to Review the Application of ICAO Treaties Relating to Conflict Zones was established and met from 13 to 14 July 2015. The Group concluded, that at this stage, it had not identified any need to amend the Chicago Convention, while not excluding that such revisions might be necessary in future. The Council endorsed the conclusions of the Group and agreed to bring them to the attention of the Legal Committee for information purposes. WP/8-1 referred to the Final Report on the investigation of MH17, released by the Dutch Safety Board on 13 October 2015. The Report called for stricter definition of States responsibilities related to the safety of their airspace and referred to the need to amend the Chicago Convention and its annexes.

The Netherlands stated that as the Final Report was released after the conclusions of the Special Group mentioned above, the Legal Committee is requested to take into consideration in its deliberations whether reconsideration of these conclusions is necessary. A number of delegations supported Netherland's position, and proposed to include the matter discussed therein in the General Work Programme of the Legal Committee. One delegation deplored the loss of 298 lives and emphasized the need to prevent its recurrence. It recalled that while the Council referred the conclusions of the Special Group to this Committee for information purposes, one should be mindful of other decisions of the Council to remain seized of the matters relating to MH17 and take a series of measures to improve the safety of civil aviation.

Another delegation referred to its earlier proposal to the Council to consider a possible amendment to the Chicago Convention in order to eliminate or minimize risks in conflict zones for civil aviation. It urged the international community to act before a new tragedy happens with more loss of life.

AVIATION

One delegation specifically mentioned the need to amend Article 9 of the Chicago Convention in order to close the gap concerning the obligation to close airspace over conflict zones. A number of other delegations offered sincere condolences for the tragedy of MH-17 and expressed strong concern for aviation safety. They mentioned that holistic work has been carried out or is under way in ICAO, including the establishment of web repository for conflict zones, amendments to Annexes to the Chicago Convention, and the development or revision of guidance material. As the Council had already endorsed the conclusions of the Special Group, a number of delegations indicated it would be premature to include in the work programme the item relating to amendment to the Chicago Convention, before the work carried out in other areas is completed. One delegation referred to the difficulty for an island State to close its airspace, as it would bloc its access to the outside world.

It was also noted that the recommendation of the Dutch Safety Board concerning States responsibilities were addressed to the Member States of ICAO, and States might take their own initiative to propose an amendment to the Chicago Convention if they deem necessary, without the involvement of the Legal Committee. One delegation, referring to the ICAO web repository, informed the Committee that there were 67 messages in the repository involving 14 States, among which 11 had lodged protests. This demonstrated the need for improvement of the system. The Chairman noted the high interest of delegations for this sensitive legal, political, and technical matter.

The Group decided among others, that there is currently no need to change the Chicago Convention, but possible changes might be required in the future. The Dutch delegation stressed out that the final report was published a few months after the end of the work of the group and because of this fact the Committee might put into consideration the possible need to re-examine the outcomes of the work of the group. Many delegations proposed to include the issue of conflict-risk zones to the overall work program of the Legal Committee. One delegation indicated that the Special Group during its meeting could not take into account the recommendations included in the future report of the Dutch Safety Board, therefore, re-convening of the Special Group might be considered. At the end the chairman of the Committee summarizing the discussions determined that due to the on-going work in ICAO on changes of SARPs, the Committee may inform the Council of its availability in terms of assistance on the issues of conflict risk zones, but also has determined that at this point there is no need for this point to be included in the General Work Programme of the ICAO Legal Committee²⁷.

Conclusion

The 36th Legal Committee session showed how international community is involved in legal tasks of creating the path for future work of ICAO. There are no treaties to be amended, no new international convention is created. The Committee was reported by Secretariat on on-going legal activities (e.g. unruly passengers, article 83 bis, conflicts of interest, conflict zones) upon its acceptance to continue the Secretariat work.

AVIATION

This session of the ICAO Legal Committee with few issues on board shows that the agenda for the next year Assembly Legal Commission will not be overwhelmed. It's up to the states to decide which areas are important enough to be discussed (e.g. conflict zones). It's worth to be recognized that not the Legal Committee, but the Council of ICAO according to the Chicago Convention is responsible for creating the policy of this Organization. Legal experts should follow their role as advisors to the Council and Assembly in legal domain.

Hopefully, there is still area of manoeuvre for ICAO Legal Committee to be innovative by providing advice on the legal subjects of the great importance to states in practice on such issues as: determining the state and civil aircraft or RPAS or conflict zones. The lively discussion among the legal professionals during the Session on those issues has been observed. Let's hope that the legal experts will be more engaged in action by creating the ICAO image as more proactive than reactive in legal field in the future in particular areas of interests (e.g. sub-orbital flights). The ICAO Legal Committee advisory role should be thus strengthened.

¹LC/36 International Civil Aviation Organization Legal Committee, 36th Session, Montreal 30 November-3 December 2015 Report

²www.icao.org; www.ulc.gov.pl

³LC/36-WP/2-1

⁴http://www.icao.int/Meetings/AirLaw/Documents/Protocole_mu.pdf

⁵Cir 288 LE/1 June 2002

⁶ICAO Doc. 8364

⁷LC/36-WP/2-2

⁸LC/36-WP/2-7

⁹LC/36-WP/2-3

¹⁰LC/36-WP/2-4

¹¹LC/36-WP/2-5 Consideration, with regard to CNS/ATM systems including global navigation satellite systems (GNSS), and Doc 75100 International Air Services Transit Agreement, 1944 the regional multinational organisms, of the establishment of a legal framework

¹²LC/36-WP/2-5

¹³Doc 7500 International Air Services Transit Agreement, 1944

¹⁴<http://www.un.org>

¹⁵Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 1967

¹⁶Except from Poland CERG (Central European Rotation Group) consists of: Bulgaria, Czech Republic, Cyprus, Greece, Hungary, Lithuania, Romania, Slovakia and Slovenia.

¹⁷LC/36-WP/2-6

¹⁸LC/36-WP/2-8

¹⁹UNOOSA- Office for Outer Space Affairs

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²⁰GASP- Global Air Safety Plan

²¹GANP- Global Air Navigation Plan

²²LC/36-WP/3-1 and LC/36-WP/3-2

²³LC/36-WP/4-1

²⁴LC/36-WP/8-2

²⁵LC/35-WP/5-1

²⁶LC/36-WP/8-1

²⁷LC /36 International Civil Aviation Organization Legal Committee, 36th Session, Montreal 30 November-3 December 2015 report

LC/36-WP/2-1

LC/36-WP/2-2

LC/36-WP/2-7

LC/36-WP/2-3

LC/36-WP/2-4

LC/36-WP/2-5

LC/36-WP/2-6

LC/36-WP/2-8

LC/36-WP/3-1

LC/36-WP/3-2

LC/36-WP/4-1

LC/36-WP/8-2

LC/35-WP/5-1

LC/36-WP/8-1

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2222 (XXI). Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer

Space, including the Moon and Other Celestial Bodies

UNOOSA- Office for Outer Space Affairs

GASP- Global Air Safety Plan

GANP- Global Air Navigation Plan

Human Space Activities and Space Tourism

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Introduction

Human space activities and space tourism include the development and operations of orbital infrastructures aimed at preparing long term manned activities into space. They include the development and operations of space stations and transportation vehicles designed to carry humans in these infrastructure and possibly beyond for scientific and technological development, exploration and tourism. Activities may include short to long-term manned missions into deep space and other planets, which preliminary destinations being identified the Moon, Mars and asteroids.

Human space activities programmes are typically called human/manned space flight programmes whereas space tourism has only recently emerged. These programmes have particular specificities compared to other programmes due to inclusion of humans, which significantly increase the risk adverse nature of the programmes. They require high levels of investments and constant commitment from the countries involved due to long-term implementation time frame of ten to twenty years. Thus, are usually developed by the world's leading space faring nations. However, in recent years rapidly developing space nations have been making significant investments and progress. Additionally, even though historically human space activities have been activities of national governments, in recent years, as the maturity of the space sector has been increasing, the commercial engagement is increasing. In particular, governments have been outsourcing cargo and crew operations, commercial space tourism activities, and commercial ventures for business operations on the Moon or Mars have emerged.

Over the past two decades, human spaceflight has been receiving a constant stream of funding between \$8 to 9\$ billion per year. After a pick funding of \$11.8 billion in 2010, there has been a decrease reflecting the termination of NASA's space shuttle programme. The spending has been focused on ISS assembly and transportation. Despite international efforts of cooperation, NASA's human spaceflight programme accounts for about 74% of the total world investments and represents 40% of its total budget. Apart from NASA, there are in eight more space agencies that have reported dedicated human space flight budgets. These include the leading agencies ESA, JAXA and Roscosmos and countries like Canada, China, India, Basil, Malaysia and South Korea.

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SPACE

ESA over the past five years has been gradually moved its spending towards ISS utilisation. ESA has in the ISS the Columbus Laboratory and until recently been providing the cargo ship Automated Transfer Vehicle (ATV). After the last ATV in 2015, ESA for the period 2017-2020 will provide the service module of NASA's new Orion Multipurpose Crew Vehicle (MPCV) as an in-kind contribution in exchange for ESAs share in ISS operating costs. National programmes in Europe are limited primarily to Germany and Italy. JAXA has increased its funding with focus on the operations of the JEM Laboratory and the H-II Transfer Vehicle (HTV). Roscosmos have increased significantly their funding with a five-year GAGR of 25% and this trend is expected to continue till 2020 following plans to have six modules at the ISS and to develop new space transport vehicle and launcher. Canada's budget has been declining, however, human space flight still represents about 12% of CSA budget with focus on ISS utilisation. China's human space flight programme is one of its largest one and is experiencing significant growth. It is considered defence expenditure as it is managed by the People's Liberation Army (PLA). Since 2008 it has more than doubled reflecting Chinas ambitions in the area. India has also increased its budget significantly from an initial 1\$ million in 2007 to 5\$ million in 2012. The focus is preparatory studies, development of critical infrastructure associated to a proposed mission. Emerging space national like Brazil, Malaysia and South Korea have been engaging in human space activities though bilateral cooperation with NASA and Roscosmos.

Space Stations

The current destination of human space activities are space stations. The International Space Station (ISS) is the largest international cooperation in space establishing an orbiting microgravity research laboratory. It is operated by five international partners, USA, Russia, Japan, Canada and ESA with 11 participating countries. The ISS has suffered significant delays and budget overruns with a total cost of about 150\$ billion over a 30 year time frame. The operations of ISS have been confirmed by its partners at least until 2020 and currently there are discussions for extending its life.

After the completion of the ISS, mission priorities have shifted to the ISS utilisation with related expenditure set to significantly increase. The USA forecast foresees a 9% increase in 2017 after the transfer of the management of the USA ISS research to a non-profit organisation. The ESA exploitation budget is expected to be proportionally in line with that of the NASA. In order to provide additional support for the utilisation and reduce costs, a number of countries have advocated opening up the ISS to other countries to participate such as India, China and South Korea. However, as the USA is prohibited from using funds to cooperate with China. On the other hand ESA plans to broaden its usage right to all Member States of the European Union.

There are two post 2020 scenarios for the ISS. The first one is to deorbit the station re-entering it to the Earths atmosphere and the second one is to extend the life of the ISS for longer period possibly till 2028. However, post-ISS discussion about the next generation of space stations are also undergoing. Russia and China are discussing independent basis and USA looking into commercial operations. ESA currently has no clear position beyond 2020. Supporting exploration beyond Low Earth Orbit (LEO) is also under discussion by most countries with targets such as Moon, near-Earth asteroids, Mars and beyond.

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Russia plans to develop the Orbital Manned Assembly and Experiment Complex (OPSEK) around 2030. OPSEK's main goal is to support in manned deep space exploration. As an intermediate step in case the ISS is deorbited by 2020, Russia plans to launch six modules to the ISS by 2018. The Russian space segment could be reconfigured into an autonomous orbital complex that would function until OPSEK is completed.

The Chinese manned space programme is targeting the construction of a 60-ton manned space station consisting of three pressurised modules to be launched by Long March 5 around 2020-2022. The development of this station will draw upon the experience gained by the Tiangong programme and the Shenzhou spacecraft programme. The Tiangong-1 was launched in September 2011 and is a module of 3.35 meters in diameter and has an approximately mass of 8,500 kg with one docking station. The unmanned Shenzhou-8 was successfully launched and docked to Tiangong in 2011. In 2012 and 2013, manned Shenzhou 9 and 10 missions were launched. The Tiangong 2/3 precursors to the manned space station are expected to cost about \$7 billion until 2017¹.

India has conducted a feasibility study report on Indian Human Space Programme. In this study a number of key technologies required for human space mission have been identified and a number of related new technology programmes for systems like crew module, service module, launch escape system, environmental control and life support system, and avionics systems have been initiated².

The commercial company Bigelow Aerospace (BA) based in Nevada is developing expandable space habitat technology to support a variety of public and private activities including commercial space stations in LEO and human space flight beyond LEO. BA has launched two prototype spacecraft's Genesis I and II. They are also developing the Bigelow Expandable Activity Module (BEAM), a technology pathfinder for the ISS. Furthermore, BA has been working on fully expandable modules of different sizes.

Space Transportation

In Figure 1 a list of suborbital vehicles in operation or development are shown. Seventy-eight commercial cargo and crew launches are projected from 2014 to 2023³. The forecast is in line with the commercial crew and cargo resupply need of the ISS. The current ISS cargo and crew transportation services have been provided by Russia's progress, ESA's ATV (retired with last flight 2015), Japan's HTV, and for the USA, following the retirement of the space shuttle in 2011 by commercial operators. After the extension of the ISS, ESA will construct an ATV based service model to support the Orion Multi-Purpose Crew Vehicle of NASA. Japan's next generation of HTV-R would be a return cargo transportation system with capacity of 300kg or 1.6 ton. The first flight is foreseen in 2016 and 2018 depending on budget.

The USA decision to engage commercial operators has been realised by two-phase programmes: the Commercial Orbital Transportation Service (COTS) and the Commercial Resupply Services (CRS).

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The first phase under COTS programme marked the initial development and demonstration of commercial cargo space transportation capabilities. The aim has been to put in place commercial solutions for cargo transportation, which are currently operational. Under the COTS programme Space X developed the Falcon 9 launch vehicle and the Dragon spacecraft. Orbital Science Corporation developed the Cygnus spacecraft and the medium-class Antares launch vehicle. In September 2013 Cygnus became fully operational and berthed with the ISS, highlighting the end of the COTS programme. The second phase of the commercialization programme, CRS resulted in awarding in 2008 two contracts to Space X and Orbital for providing twelve and eight flights to the ISS respectively. In October 2012, operational flights began to the ISS with the successful launch of SpaceX's dragon and in January 2014, Orbital resupply missions also started. The budget line for commercial cargo under the NASA exploration directorate has not been phased out as it is now operational and funding is coming through ISS Crew and Cargo Transportation budget line. In 2010 NASA in order to further stimulate the commercial development of crew transport capability, initiated the Commercial Crew Development (CCDev) with focus on development of commercial space transportation concepts and enabling capabilities. After CCDev completed in 2011 the CCDev2 followed to further advance commercial crew transportation system concepts, maturing the design and development of system elements such as launch vehicles and spacecraft's. Under this Blue Origin, Boeing, Sierra Nevada Corporation, Space X, ULA, Alliance Tech Systems (ATK) and Excalibur Almaz have been receiving contracts and funds⁴.

Blue Origin a USA company is pursuing development of a crewed suborbital transportation system called New Shepard and an orbital crewed system containing of a Reusable Orbital Vehicle (SV) launched aboard a two-stage Orbital Launch Vehicle (OLV). The SV will be designed to carry seven people. The first stage of the reusable OLV will be powered by a cluster of BE-3 liquid rocket engines, which were successfully tested in 2013. The company has not yet releases a test launch schedule.

Excalibur Almaz, Limited (EAL) an Isle of Man company uses elements of the Almaz Soviet military space programme for its developments. The system under development includes four three-persons reusable vehicles (RRV) one of which will be equipped as an unmanned microgravity laboratory and two Salyut-type Almaz orbital space stations that can stay on-orbit autonomously for one week and dock with the ISS. EAL has received an unfunded activity for commercial crew transportation as part of its CCDev2 programme, which was successfully completed. The baseline will be Atlas V for launch if NASA decided to use it. In 2012 the company announced plans to carry passengers to and from lunar orbit for 155\$ million per ticket. Test flights of Almaz were expected in 2014 and first commercial flight in 2015. However, no launch contracts have been announced. EALs key partners are NPO Mashinostroyenia (original developer of Almaz), Airbus Group, and Japan Manned Space Systems Corporation.

Golden Spike Company, offers human expeditions to the surface of the Moon by 2019. The company has contracted Northrop Grumman for the design of a new lunar lander with a two-manned crew capability. The first lunar mission will start at 1.4 billion. The president of the company is Science Alan Stern, former NASA associate administrator.

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Inspiration Mars Foundation targeted a privately funded crew Mars flyby mission originally for 2018, which in 2014 was shifted to 2021. The project aims to take advantage of the planetary alignment to facilitate a flyby Mars in 501 days. The foundation plans to use NASA's Space Launch System (SLS) to send a dual use upper stage (DUUS) and a modified Cygnus module into LEO. SLS and DUUS are currently under development by NASA while Cygnus module will be provided by Orbital Science Corporation. A second launch using an Atlas V or Delta UV will send a crew of two aboard NASA's Orion spacecraft. The Foundation is chaired by Dennis Tito who will fund the mission development for the first two years, while additional fundraising is taking place.

Space Adventures, is a broker of space tourism and expeditions. In 2011 had indicated it was in the late planning stages for a three-person expedition to circumnavigate the moon. The crew would include one Roscosmos cosmonaut and a two paying individuals. Two separate launches are included, a Proton-M carrying a Block-DM lunar transfer stage and a Soyuz with two crewmembers. The price of the seats is rumoured at 150\$ million.

Suborbital Reusable Vehicles								
Vehicle	Operator	Company HQ	Launch Site	Year Launch Operations begin	Seats	Price	Time in Microgravity	Flight Duration
Lynx	XCOR Aerospace	USA	Mojave Air and Space Port - Midland International Airport	2015	Pilot: 1 - Participant: 1	\$ 95,000 per seat	N.A.	N.A.
New Shepard	Blue Origin	USA	Van Horn, Texas	N.A.	Participants 3	N.A.	N.A.	N.A.
Space Loft	UP Aerospace	USA	Spaceport America	2006	N.A.	N.A.	4 minutes	13 minutes
SpaceShip Two	Virgin Galactic	USA	Spaceport America	2015-2016	Pilot: 2 - Participants: 6	\$ 250,000 per seat	5 minutes	120 minutes
Xaero	Masten Space Systems	USA	Mojave Air and Space Port - Midland International Airport	N.A.				5 to 6 minutes
Xombie	Masten Space Systems	USA	Mojave Air and Space Port	2009	N.A.	N.A.	0	< 5 minutes
Other suborbital vehicles in development								
Sub-orbital spacecraft	Booster Space Industries	Spain	N.A.	2016-2017	Pilots: 2 - Participants: 8	N.A.	4 minutes	N.A.
Tycho Brache	Copenhagen Suborbitals	Denmark	N.A.	2015	1	N.A.	N.A.	N.A.
P-18	Garvey Spacecraft Corp.	USA	N.A.	N.A.	N.A.	N.A.	N.A.	N/A
SOAR	S3, Swiss Space Systems	Switzerland	N/A	2017	N/A	TBD	N/A	
Mcls	Whittinghill Aerospace	USA	N/A	TBD	N/A	N/A	N/A	N/A

Figure 1: Suborbital vehicles in operation or development, 2013⁵

SPACE

Spaceports⁶

Space activities cannot take place without ground facilities and spaceports. Spaceports are facilities that are used to launch vehicles and their payloads into space. Today there twelve spaceports exist and a number are under development. The recent emergence of new spaceports is an indicator of the re-emerging field of human spaceflight. By the end of 2013, the number of projects under development and discussion are have almost doubled the population of spaceports. Figure 2 provides an overview of operational and under development spaceports.

The majority of operational and under development spaceports are in the United States. The USA has currently five operation spaceports that are capable for supporting orbital launches. From the spaceports under development the USA hosts eight out of the thirteen new projects, which are currently being developed or discussed. This development is also heavily spurred by private investors that are responsible for almost half of the new projects. The shift to private investors also seems to be a result of the long term US space strategy that emphasizes the need for a robust and competitive commercial space sector. Likewise, the new spaceports in Russia and China show the ambitions of both countries. While Russia, after a years of delay, began constructing Vostochny Cosmodrome, China started the work on a new launch pad at the Wenchang Satellite Launch Centre on the southern Chinese island of Hainan.

Both spaceports will allow for heavier next generation launchers (Angara; Long March 5,6,7), and the Vostochny Cosmodrome gives Russia greater independence from Kazakhstan and Baikonur for sensitive launches. It also represents a significant economic impetus to the low developed region of Far East Russia. In addition to the new Angara series, Vostochny Cosmodrome will also allow for crewed and non crewed Soyuz launches⁷. The new launch pad in Wenchang, China has been chosen with a similar objective to facilitate heavy launchers. The location will allow for naval transportation of heavy rockets, which would otherwise be limited by tunnels and bridges in train transportation. Wenchang will thus become the only launch option for the heavy-lift Long March 5, as well as Long March 6 and 7. Wenchang's proximity to the equator also allows for more efficient launches, as the earth rotation will be better used. The first launch is expected for 2015⁸.

In Europe several plans exist for new Spaceports, while the Kiruna Spaceport is Europe's first space port above the Arctic Circle and actively pursuing its development in making the step from sounding rockets to commercial space flight. The United Kingdom is deciding on the location to set up a spaceport. Six out of the eight potential locations are in Scotland. The UK deems the commercial spaceflight to become part of a crucial economic space sector that might create up to a 100.000 jobs⁹. This potential is also realised in other countries. Only recently, the Swiss company Swiss Space Systems (S3) announced that they would invest into a spaceport in Croatia from where they will offer zero gravity flights. The location was chosen after Croatia joined the European Union and the natural environment with flat fields and open skies, deems suitable for the S3. It would be the third project for S3¹⁰ that also aims at constructing a spaceport at Payerne Air Base in Switzerland and in Gran Canarias, Spain.

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Spaceport Name	Country	Location	Operator Type	Orbital	Number of Orbital Launches, 2013
Active					
1	Alcântara Launch Center	Brazil	Alcântara	Public	✓
2	Jiuquan Satellite Launch Center	China	Inner Mongolia Region	Public	✓ 7
3	Taiuquan Launch Center	China	Shanxi Province	Public	✓ 5
4	Xichang Launch Center	China	Sichuan Province	Public	✓ 3
5	Guiana Space Centre	Europe (ESA)	Kourou, French Guiana	Public	✓ 7
6	Esrange (Spaceport Sweden)	Europe (ESA)	Kiruna, Sweden	Public	
7	Satish Dhawan Space Centre	India	Sriharikota	Public	✓ 3
8	Semnan Launch Site	Iran	Semnan Province	Public	✓
9	Palmachim Air Force Base	Israel	Rishon LeZion	Public	✓
10	Tanegashima Space Center	Japan	Tanegashima Island	Public	✓ 2
11	Uchinoura Space Center	Japan	Uchinoura	Public	✓ 1
12	Odyssey Launch Platform	Multinational	Equatorial Pacific, South of Hawaii	Private	✓ 1
13	Tonghae Satellite Launching Ground	North Korea	Musudan-ri	Public	✓
14	Sohae Satellite Launching Station	North Korea	Cholsan	Public	✓
15	Baikonur Cosmodrome	Russia	Baikonur, Kazakhstan	Public	✓ 23
16	Dombrovskiy Missile Base	Russia	Yasny	Public	✓ 2
17	Plesetsk Cosmodrome	Russia	Plesetsk	Public	✓ 7
18	Naro Space Center	South Korea	Naro Island	Public	✓ 1
19	Cape Canaveral Air Force Station	United States	Cape Canaveral, Florida	Public	✓ 10
20	Kennedy Space Center	United States	Cape Canaveral, Florida	Public	✓
21	Vandenberg Air Force Base	United States	California	Public	✓ 5
22	Kodiak Launch Complex	United States	Southwest Alaska	Public	✓
23	Reagan Test Site	United States	Kwajalein Atoll, Marshall Islands	Public	✓
24	Spaceport America	United States	Truth or Consequences, New Mexico	Public	
25	Mojave Air and Space Port	United States	Mojave, California	Public	

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26	Wallops Flight Facility/Mid-Atlantic Regional Airport	United States	Eastern Virginia	Public	✓	4
In Development						
27	Wenchang	China	Hainan Island	Public	✓	
28	Carribbean Spaceport	Curaçao	Curaçao	Private		
29	Vostochny Cosmodrome	Russia	Svobodny region	Public	✓	
30	Blue Origin Launch Site	United States	Southern Texas	Private		
31	Oklahoma Spaceport	United States	Burns Flat, Oklahoma	Public		
32	XCOR Commercial Space Research and Development Center Headquarters	United States	Midland Texas	Private		
Proposed						
33	Spaceport Malaysia	Malaysia	Malacca	Private		
34	Spaceport Abu Dhabi	United Arab Emirates	Abu Dhabi	Private		
35	Ellington Field	United States	Houston, Texas	Public		
36	Front Range Airport	United States	Denver, Colorado	Public		
37	Cecil Field	United States	Jacksonville, Florida	Public		
38	Spaceport Hawaii	United States	Kapolei, Hawaii	Public		
39	Space Texas Launch Site	United States	Cameron County, Texas	Private	✓	

Figure 2: Spaceports in Operation or Development, 2013¹¹⁻¹²**Other Activities**

The commercial company Planetary Resources Inc. introduced its plans to mine near-Earth asteroids for raw materials. The company is focusing its initial efforts on telescopes designed to identify research source targets. It has entered in an agreement with Virgin Galactic to launch on its LaunchOne, which is still under development and executed to fly in 2016, several constellations of Arkyd-100 Series LEO space telescope. Prior to that is expected to launch with Virgin Galactic A3 or Arkid-3 cubesat a technology demonstration nanosatellite based on the triple CubeSat form factor for the planned Arkyd-100 asteroid prospecting astronomy satellites.

Human space flight in emerging countries

India's space programmes are driven by a decade profile and directions for 2025. The broad directions for the space programme for the next decade include also a human space flight programme. Indian Space Research Organisation has been working quietly in the background on the development of an astronaut-training program and an astronaut crew vehicle. However, there is no prospect of an imminent launch of an Indian astronaut by ISRO. While a human spaceflight mission will not be conducted before the year 2017, there are funds in the 12th five-year plan to continue with pre-project studies and to develop critical technologies associated with the proposed mission.

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The efforts on Indian human space flight activities mostly derived by the success of the Chinese spaceflight with astronauts. However India is not ready to go it alone and ISRO has not made any substantial progress in its human spaceflight program. A fundamental requirement for human spaceflight is a heavy launch system and ISRO does not have one. For human spaceflight, a launch vehicle needs to carry at least 5 tonnes to low Earth orbit. ISRO's highly reliable and extremely successful PSLV in its most enhanced configuration, PSLV-XL, can lift only about 3.8 tonnes to low Earth orbit and ISRO is trying to resolve this shortcoming in two steps. Despite of these efforts and good intentions, India still lacks an operational GLSV needed to launch a two-member crew to LEO and have them return safely to Earth. While India's GSLV-Mk II rocket was proposed to be used for the mission, it would be able to carry only two crewmembers. The GSLV-Mk III that is currently under development will have additional mass left for conducting scientific experiments in addition to hosting two crewmembers¹³⁻¹⁴.

For what concern Iran, its pursuit of human spaceflight was central in the last years and the same trend is expected for the upcoming years. In 16 December 2013, the country announced that it had successfully launched a monkey into suborbital space for the second time in 2013, sending it to a 120 km apogee altitude, with a safe return to Earth after a 15-minute ride aboard a Kavoshgar 5 rocket. Earlier in the year, controversy arose when archive photos were used by a news agency instead of photos of the first space monkey's return, creating doubt as to the accuracy of the claims by Iranian officials. Having reached a new milestone, launches of animals are expected to continue into 2014, helping scientists continue to develop space technology in the pursuit of sending a human to space by 2018.

International coordination platforms and legislations

There are a number of international platforms existing today for exchanging information on national space exploration policies and plans, as well as for coordinating related planning activities. The International Space Exploration Forum (ISEF) fosters political-level dialogue. The last meeting took place in January 2014 in Washington, and the next one is scheduled to take place in 2016/2017. The International Space Exploration Coordination Group (ISECG), is the space agencies' forum for advancing a common vision on the next steps for global space exploration. It has produced a Global Exploration Roadmap (GER) as a result of the joint work of 14 space agencies¹⁸. The Global Exploration Roadmap (GER) published in August 2013, reflects a common long-range human exploration strategy that covers three steps. The first focuses on the use of ISS for general research and exploration preparatory activities. The second step focuses on robotic missions to discover and prepare with focus on sample return and precursor opportunities. The third step includes human missions beyond Low-Earth Orbit (LEO) to explore near earth asteroid, extended duration crew missions and human to lunar surface as preparation for mission to deep space and Mars system in a sustainable manner. The International Mars Exploration Working Group (IMEWG) is a platform where space agencies advance the definition of a common international Design Reference Mission for returning samples from Mars. The United Nations Office for Outer Space Affairs (UNOOSA), promotes the engagement of emerging space faring nations in the future global space exploration endeavour.

SPACE

The USA regulations will play a significant role in the emergence of commercial sub-orbital activities and space tourism. It is considered to have one of the most innovative regulatory frameworks for commercial space travel, however differences in states influence where companies establish their operations. Currently the US law prohibits the Office of Commercial Space Transportation at the Federal Aviation Administration (FAA) from issuing regulations on manned space flight until October 2015 to encourage the development of space industry. The FAA will engage with industry participants until then without proposing burdensome regulations, but increasing calls were being made for industry to reach consensus on voluntary standards. The congress currently is setting up what is formally known as Spurring Private Aerospace Competitiveness and Entrepreneurship (SPACE) Act. The bill is a combination of four separate bills. One of them has been primarily an update of existing commercial launch law. One of its provisions extended existing third-party launch indemnification from the end of 2016 to 2023. The indemnification would allow federal government to cover any third-party damages from a commercial launch accident above a “maximum probable loss” level that the company holding launch licence is responsible for, up to a level of approximately \$3 Billion. The indemnification, which was put in place about twenty-five years ago, has never been invoked by any commercial company. Another provision of the SPACE Act would extend the “learning period” restricting the ability of the FAA to enact regulations regarding the safety of people flying on commercial spacecraft. Under the Commercial Act of 2004, the FAA can only enact such regulations in the event of a serious accident or unplanned event that posed the high risk of such an accident. The intent of the restriction was to allow industry to build up experience that could serve as the basis for later regulations. USA regulatory provisions over all directly in support of manned space flight and have become a factor for attracting commercial space business in USA states. Apart from the USA, Europe and AUE are investigating on opportunities for space tourism in industry.

Future trends

Human space activities in the past have exclusively been government activities, developing cutting edge technologies and engaging in international cooperation in particular through the ISS. The current ISS partners as well as others are looking at options in exploring beyond low-earth orbit. Implementation largely remains a national engagement with cooperation on a bilateral basis. Over the past years the involvement of commercial actors is indicating the maturity of the sector setting new grounds. The commercial potential for tourism has increased the number of involved commercial actors.

The Global Exploration Roadmap (GER) published in August 2013 by ISECG with the agreement of 14 space agencies¹⁹ covers three steps: a) the use of ISS for general research and exploration preparatory activities; b) robotic missions to discover and prepare with focus on sample return and precursor opportunities; c) human missions beyond Low-Earth Orbit (LEO) to explore near earth asteroid, extended duration crew missions and human to Lunar surface as preparation for mission to deep space and mars missions. The challenge for GER will be to identify pathways to a common approach for cooperation, while the preferences of the space agencies may considerably vary.

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ESA has recently published its space exploration strategy, outlining the long term planning for Europe in space exploration over the next ten years. The strategy outlines three main common mission goals: a) Exploitation of human-tended infrastructures in Low Earth Orbit (LEO) beyond 2020 for advancing research and enabling human exploration of deep space; b) Returning samples from the Moon and Mars; c) Extending human presence to the Moon and Mars in a step-wise approach²⁰.

NASA is laying the groundwork for exploring beyond LEO. In addition to the International Space Station enabling important learning related to long duration mission human health and performance, the heavy lift launcher Space Launch System (SLS) and the Orion crew vehicle are foundational capabilities under development for human missions beyond LEO. Initial Orion and SLS vehicles will enable near-term missions in the lunar vicinity and demonstrate capabilities and operations necessary for exploration missions further away from the relative safety of LEO. These missions also enable exploration of a near-Earth asteroid and the Moon, allowing the presence of the crew to engage the public in ways that further increase value to people on Earth. International and public-private partnerships will enable these early missions and ensure that human space exploration proceeds in a sustainable manner²¹.

Interdependence and bilateral cooperation between long standing partners remains the basis for the future. Examples of such partnerships that are expected to continue are between NASA, ESA and JAXA. Cooperation with emerging nations may not be immediately foreseeable due to funding and political instabilities. As China further develops its capabilities, the USA prohibition of interactions with China is put to a question regarding its sustainability. In contrast to the USA, Europe appears to be more willing to cooperate with China on space exploration. Russia and China have been increasing cooperation and this trend is expected to continue, as China needs a partner for technology development. However, Russian capabilities in space have drastically withered in the 20 years since the collapse of the Soviet Union, and the Russian space program lacks clear direction or goals. This partnership will be put in question the moment China fully develops its capabilities.

Figure 3 shows the historical government expenditures in manned spaceflight by region and provides a forecast till 2022. Human space flight is expected to recover from the global flat spending with a modest increase by a 5-year CAGR of 3.3 % between 2013 and 2017 due to the stable spending of the USA towards exploration system development, commercial crew development, and space operations and growing expenditure in the Russian Federation and China towards the development of next-generation transport systems and space stations. A historically high funding level over \$15 billion (€11.11 billion) is expected to be reached due to existing leading space programs and new players. Indian spending is expected to increase over \$500 million (€370.37 million) from 2018 to 2022 for the development of their first manned mission. It should be noted from the global spending the USA spending represented 90 % of the total in 2000 and is expected to drop to 60 % by the end of the decade. This is due to the interest of more countries in developing and maintaining human space- flight capabilities²².

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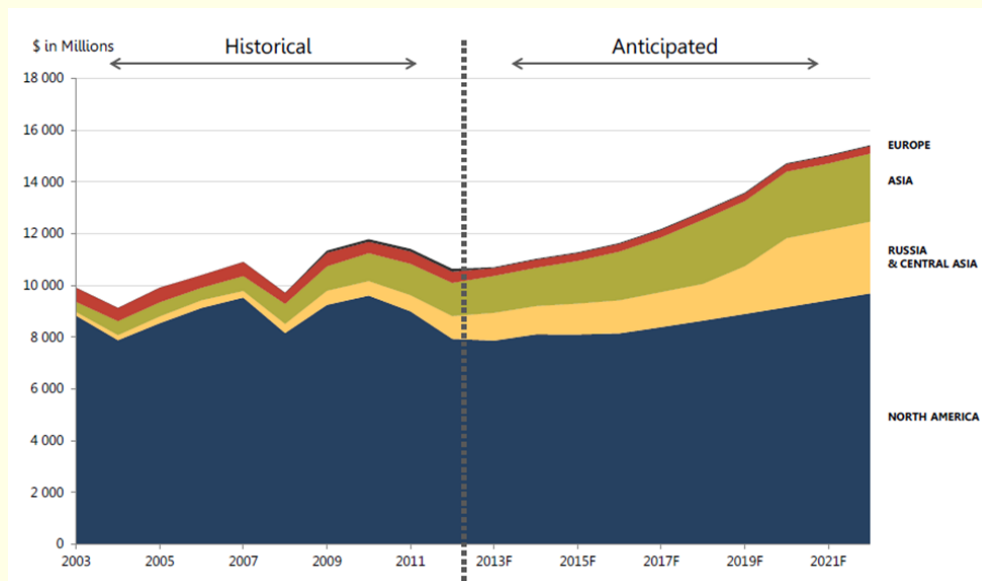


Figure 3: Forecast for government expenditures in manned spaceflight by region (2013-2022)

¹ Euroconsult (2013) *Government space markets: word prospects to 2022*. Euroconsult, Paris.

² p.937, Schrogl et al. (2015) *Handbook of Space Security. Policies Applications and Programmes*. Springer, New York.

³ p151, FAA (2015) *The Annual Compendium of Commercial Space Transportation: 2014*. Federal Aviation Administration. February 2015. USA

⁴ p153, FAA (2015) *The Annual Compendium of Commercial Space Transportation: 2014*. Federal Aviation Administration. February 2015. USA

⁵ FAA (2015) *The Annual Compendium of Commercial Space Transportation: 2014*. Federal Aviation Administration. February 2015. USA

⁶ Space Foundation. *The Space Report 2014*. Space Foundation, Colorado Spring, 2014, p.98.

⁷ Peter B. De Selding, "News from the 64th International Astronautical Congress Russia Plows Ahead with New Far East Cosmodrome", October 3, 2013, *Space News*, <http://www.spacenews.com/article/civil-space/37530news-from-the-64th-international-astronautical-congress-russia-plows-ahead> (accessed October 22, 2013)

⁸ "China's fourth space launch center to be used in two years", March 3, 2014, *news.xinhuanet.com*, http://news.xinhuanet.com/english/sci/2013-03/03/c_132204156.htm (accessed October 22, 2013).

⁹ Tom Porter, "Scottish Sites Shortlisted for First UK 'Spaceport'", July 13, 2014, *International Business Times*, <http://www.ibtimes.co.uk/scottish-sites-shortlisted-first-uk-spaceport-1456486> (accessed May 26, 2015).

¹⁰ Bloomberg, "Swiss Space Wants to Build EU60 Million Spaceport in Croatia", February 26, 2015, *swissinfo.ch*, <http://www.swissinfo.ch/eng/bloomberg/swiss-space-wants-to-build-eu60-million-spaceport-in-croatia/41293224> (accessed May 26, 2015)

¹¹⁻¹² Space Foundation. *The Space Report 2014*. Space Foundation, Colorado Spring, 2014, p.98. Definitions: a) Active: Orbital or suborbital launch attempts made; b) In Development: Infrastructure construction contracted, underway, or complete but no orbital or suborbital launch attempts made; c) Proposed: Official interest stated in project and/or marketing of capabilities but no license granted or construction began.

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¹³Radhakrishnan, K. "India Not to Undertake Human Space Flight Before 2017: ISRO." 17 Sept. 2012. *The Economic Times* 3 May 2014, http://articles.economicstimes.indiatimes.com/2012-09-17/news/33902713_1_cryogenic-engine-gslv-mk-iii-radhakrishnan-today

¹⁴Singh, G. "Prospects for the Indian human spaceflight program." *The Space Review*, 31 March 2014. <http://www.thespacereview.com/article/2481/1>

¹⁵Kramer, Miriam. "Iran Says It Launched a Second Monkey Into Space (Video)." 16 Dec. 2013. *Space.com*, 4 May 2014. <http://www.space.com/23979-iran-space-monkey-launch.html>

¹⁶"Let's Get the Facts Straight About Iran's Space Monkey." 3 Feb. 2013. *The Guardian* 4 May 2014. <http://www.theguardian.com/world/iranblog/2013/feb/03/iran-space-monkey>

¹⁷http://esamultimedia.esa.int/multimedia/publications/ESA_Space_Exploration_Strategy/offline/download.pdf

¹⁸ASI (Italy), BNSC (United Kingdom), CNES (France), CNSA (China), CSA (Canada), CSIRO (Australia), DLR (Germany), ESA (European Space Agency), ISRO (India), JAXA (Japan), KARI (Republic of Korea), NASA (United States of America), NSAU (Ukraine), Roscosmos (Russia).

¹⁹(Italy), BNSC (United Kingdom), CNES (France), CNSA (China), CSA (Canada), CSIRO (Australia), DLR (Germany), ESA (European Space Agency), ISRO (India), JAXA (Japan), KARI (Republic of Korea), NASA (United States of America), NSAU (Ukraine), Roscosmos (Russia).

²⁰http://esamultimedia.esa.int/multimedia/publications/ESA_Space_Exploration_Strategy/

²¹http://www.nasa.gov/sites/default/files/files/IAC-14-E3_2-Laurini.pdf

²²Euroconsult (2013) *Government space markets: world prospect to 2022*. Euroconsult, Paris.

The principles of non-discrimination and transparency in the awarding procedure of a State owned airport

Anna Masutti*

Yohan Saparamadu**

With the Ministerial Decree n. 104/2013 the Italian Ministry of Transport entrusted a private company based in Verona - Valerio Catullo S.p.a. - with the full management of Brescia Montichiari Airport. SACBO S.p.a., a private company already managing the civil airport of Bergamo, appealed the decree before the Lombardia Regional Administrative Court, demanding the cancellation of the decree. The Regional Court upheld SACBO's appeal. The matter was brought before the Court of second instance, the Council of State.

The Council of State raised doubts concerning the legitimacy of the Italian provisions before the European Court of Justice, pursuant to art. 267, par. 1, of the Treaty on the Functioning of the European Union. The doubts concerned art. 3 of law decree n. 96/2005, on the awarding procedures of State owned airports, which provides that the concession is issued by the Italian Civil Aviation Authority (ENAC) for a maximum period of 40 years following a public call for tender properly advertised according to European law. However the same law provision provides that no call for tender is necessary for the concessions already issued by ENAC before the entry into force of law decree n. 96/2005.

The Council of State was concerned about the compliance of the aforesaid law provision with the European law principles of non-discrimination and transparency, according to which such a concession has to be awarded following a public call for tender procedure.

According to Italian law, a company which has been entrusted with a total or partial management concession of an airport before the 8th of June 2005 (the date of entry into force of the law decree n. 96/2005) benefits of the direct awarding of the management concession without a tendering procedure. Such a provision may imply a breach of general principles of EU law, such as equal treatment, non-discrimination and proportionality, as:

- a) it prevents other companies, which may offer a better bid and service, from being awarded the concession;
- b) it prevents the public administration from gaining an expenditure saving and to find the best service operator.

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MISCELLANEOUS MATERIAL OF INTEREST

The above mentioned provision may imply a breach of the principle of fair competition (art. 101 TFEU) as such a long direct award of concession may result in a monopolistic management of a public service. Indeed the concession is not granted for substantive reasons, such as a better service or a competitive price, but it is granted for companies which have two requirements: (i) already being an airport service manager of a State owned airport, (ii) being one of the first companies requesting the concession.

Furthermore the concerned law provisions seem to be contrary to art. 49 TFEU, which prohibits restrictions on the freedom of establishment of nationals of a Member State in the territory of another Member State, and art. 56 TFEU, which prohibits restrictions on freedom to provide services within the Union in respect of nationals of a third country who provides services and who is established within the Union.

Given the above, a correct interpretation and application of EU principles should require that all the private economic operators established in EU would be granted equal chances to be awarded a concession issued by a public entity of a Member State.

In September 2015 The European Court of Justice received the documents of the proceedings in order to issue the preliminary ruling. Therefore we will soon find out whether the Italian Law complies with EU principles.

The EU Commission declares the failure of Italian authorities to consult interested parties for the distribution of traffic at the Milan airport system

Anna Masutti*

Last 17 December the European Commission declared that the measures provided by the Italian Government (in the Ministerial Decree No 395 of 1 October 2014 amending Decree No 15 of 3 March 2000) on the distribution of air traffic within the Milan airport system [the airports Milan Malpensa, Milan Linate and Orio al Serio (Bergamo)], did not comply with Article 19 of Regulation (EC) No 1008/2008. Therefore the Commission did not approve the new regulations.

The traffic distribution rules for the Milan airport system were implemented with the Decree of the Minister for Infrastructure and Transport of 3 March 2000 (so c. Bersani and Bersani 2 Decree) and the Commission declared the set of rules compatible with the Regulation (EEC) No 2408/92. This regulation has since been repealed and replaced by Regulation (EC) No 1008/2008. The objective of the Bersani Decree and Bersani 2 Decree was to ensure the full development potential of Milan Malpensa airport as an international hub, whilst at the same time describing Milan Linate airport as a facility for point to point services. To this end, the Bersani Decree and Bersani 2 Decree contained several provisions, in particular they imposed, at Milan Linate airport, limitations on the number of daily return services to EU airports identified on the basis of passenger traffic volume.

Recently the Lupi Decree (the Ministerial Decree No 395/2014) changes the Bersani Decree and the Bersani 2 Decree by removing any limitations on the number of daily return services to EU airports identified on the basis of passenger traffic volume imposed at Milan Linate airport. The other limitations imposed at Milan Linate airport (single aisle aircraft, point-to-point scheduled connections within the EU) remain in place. The Italian Government explained that the reason for this change was the need to abolish restrictions based on criteria that are now obsolete and no longer appropriate and to allow operators holding slots at Milan Linate airport to use them as efficiently as possible. This should contribute to make Italy's and Europe's airport systems more efficient both for business and passengers.

The Commission received comments from two interested parties and stated that the Italian authorities did consult all the interested parties prior to the adoption of the new Decree.

The interested party submitted to the EU commission several considerations and among them the fact that the Lupi Decree concerns a specific advantage to Etihad, Alitalia and its European Equity Partners as Alitalia holds the vast majority of slots and that the Lupi Decree has the potential to severely distort competition in favour of Alitalia.

The Commission, after having stated that the Lupi Decree constitutes a change to an existing traffic distribution rule within the meaning of Article 19 of Regulation (EC) No 1008/2008, underlined the fact that Italian authorities did not consult all the interested parties AND declared the new Italian Decree contrary to Article 19(2) of Regulation (EC) No 1008/2008.

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A New Aviation Strategy for Europe

Alessandra Laconi *

On the 7th December 2015, the European Commission published the awaited Aviation Strategy for Europe, a key initiative to focus on three core priorities: i) boost Europe's economy, (ii) strengthen its industrial base and (iii) reinforce its global leadership position.

Such a package is aimed at ensuring that the European aviation sector remains competitive, taking advantage of a fast changing and developing global economy, and representing a crucial field for economic growth, job generation and connectivity.

Evidently, a strong aviation sector would benefit all the involved subjects, from businesses to European citizens, by granting more global connections at lower prices.

The specific Commissions's goal is thus the provision of a comprehensive Strategy for the whole European aviation ecosystem, which could be realized through the following priorities:

a) *“Place the EU as a leading player in international aviation, whilst guaranteeing a level playing field”*: the analysed package focuses on a better integration of the EU aviation sector into the new fast-growing markets, promoting the signing of new external aviation agreements with key countries and regions in the world. As we can notice, this would improve market access, granting further business opportunities for European operators and ensuring transparent, fair and clear conditions. As a consequence of these agreements, more connections and better prices for passengers would be provided, and trade and tourism would be boosted.

Moreover, it must be pointed out that the examined Strategy represents a first attempt to face the concerns descending from the way Arabian Gulf carriers operate in Europe. The GCC region, and notably the UAE and Qatar, is among the most dynamic and fast growing aviation markets in the world, and its airlines also benefit from (i) highly liberal bilateral air services agreements and (ii) political choices by local governments to invest in aviation as a strategic economic sector. In this scenario, comprehensive aviation agreements between the EU and GCC States would be the right way forward to bridge the interests of both sides by creating conditions that will allow further market development and growth based on common rules and transparency. On the other side, we can suppose that Gulf carriers could perceive the recent Strategy as a potential curb to their expansion, since some of their European competitors accuse them of benefiting from unfair state subsidies.

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MISCELLANEOUS MATERIAL OF INTEREST

b) *“Tackle limits to growth in the air and on the ground”*: the growth of EU aviation must be able to address the capacity, efficiency and connectivity constraints. In fact, the fragmentation of the EU airspace and the capacity constraints cause high costs, so that the EU cannot avoid to plan for future air travel demand. These are the reasons why the new Strategy explicitly underlines the importance of completing the Single European Sky, preventing congestion and monitoring the connectivity flows to identify deficiencies.

c) *“Maintain high EU standards”* for safety, security, the environment, passenger rights and social issues. Important measures are proposed, with an update of the EU’s safety rules in order to grant high safety standards despite the growing of the air traffic. An effective and efficient regulatory framework would guarantee flexibility and competition at a global level. The Commission will analyse new manners to reduce the burden of security checks and costs, supporting new technology, improving the social dialogue and employment conditions in the aviation field.

d) *“Make progress on innovation, digital technologies and investments”*: in particular, the Commission underlines the necessity to unleash the full potential of drones, proposing a legal framework to ensure safety and legal certainty, focusing on privacy, data protection, security and the environment. In addition, investments into innovation and technology (including the Single European Sky ATM Research SESAR project) will maintain Europe’s leading role in international aviation.

It can be affirmed that, if fully implemented, the Strategy contained in the recent “Aviation Package” will contribute to safer, shorter and cheaper flights, improving connectivity and its direct consequences (like the enhancement of air services and employment). Moreover, the introduction of new technologies such as drones should have a positive effect on growth and jobs, requiring new skills and competences, but also adequate assessments of their risk level.

Therefore, the Commission brought forward crucial proposals and clearly acknowledged the strategic value of aviation in Europe, giving particular consideration to sustainability, a high topical issue with relation to the COP21 which recently took place in Paris.

The EU Passenger Name Records Directive

Anna Masutti*

Zsófia Török **

After this year's terrorist attacks in Paris, starting with the Charlie Hebdo shooting and the recent coordinated terrorist attacks in November, the EU decided to take a further step in the process of the adoption of the Passenger Name Record (PNR) Directive.

The Directive on the use of Passenger Name Record data for the prevention, detection, investigation and prosecution of terrorist offences and serious crime (PNR) is on the EU's agenda since 2011 when the original proposal was presented but was rejected by the Parliament's Civil Liberties, Justice and Home Affairs Committee (LIBE) in 2013. On 4 December 2015 the EU PNR Directive was approved by the Council and on 10 December 2015 LIBE endorsed the legislative proposal.

Until now, The UK and Ireland have opted in to this Directive. Denmark is not participating.

During the next period the legal text will be revised by lawyer-linguists. When the revision process ends, the Directive will be put to a vote by European Parliament in early 2016 followed by the approval of the EU Council. Member States will have two years to transpose the Directive in their national law from the day when the PNR Directive will enter into force.

PNR data is information provided by passengers and collected by air carriers during reservation and check-in procedures. PNR data contains the passenger's full name, telephone number, travel itinerary, seat number, baggage information and method of payment. The current proposal does not require airlines or passengers to provide any additional information.

The PNR Directive would apply for international flights and would require the systematic collection, retention and use of PNR data on air passengers entering the EU from, or leaving it for, a third country. According to EU officials, a common PNR data would be far more effective and efficient for airlines and will help authorities to identify terrorist suspects' travel patterns.

In the past, the PNR Directive received many criticisms because of its impact on privacy and fundamental rights. On one hand, it is true that once the Directive will come into force, passengers will be more supervised, but on the other hand, we must not forget the main scope of it, which is to fight terrorism and serious crimes by enforcing cooperation among the Member States. According to Etienne Schneider, Luxembourg Deputy Prime Minister, Minister of Internal Security and President of the Council, "The compromise agreed today will enable the EU to set up an effective PNR system which fully respects fundamental rights and freedoms".

*Tenured Professor of Air Law at the University of Bologna, Senior Partner LS Law Firm

**Law Student at Nicolae Titulescu University, Bucharest

MISCELLANEOUS MATERIAL OF INTEREST

According to the EU, the Directive includes a series of limitations in order to protect fundamental rights. These safeguards are referring to the transfer, processing and retention of PNR data, such as: the Directive prohibits the collection and use of sensitive data; PNR data can only be kept for a period of 5 years, and must be depersonalized after a period of 6 months so the data subject is no longer immediately identifiable; Member States are required to establish a passenger information unit to handle and protect the data and this unit must include a data protection officer; transfer of PNR data to third countries can only take place in very limited circumstances and on a case-by-case basis.

Due to the growing number of terrorist attacks, not only in the EU but also around the world, the EU officials must take urgent measures. The PNR data would help to counter terrorist offences and of certain types of serious transnational crimes. At the same time, questions about the possibility to breach privacy and infringe fundamental rights by a “mass data collection” remain open.

FORTHCOMING EVENTS

CONFERENCE ON INTERNATIONAL AVIATION LAW
& INSURANCE

Ninth Annual
McGill University/PEOPIL

Venue: The Hub - Edinburgh's Festival Centre Castlehill Edinburgh, Scotland

Date: 20 May, 2016

Time: 09.00 REGISTRATION

Organized by: The McGill University Institute of Air & Space Law & PEOPIL (Pan-European Organisation of Personal Injury Lawyers)

THIS EVENT BRINGS TOGETHER WORLD-LEADING AVIATION LIABILITY AND INSURANCE EXPERTS TO ADDRESS THE FOLLOWING TOPICS:

- RECENT DEVELOPMENTS IN AVIATION LIABILITY AND INSURANCE
- COMPARATIVE JURISPRUDENCE UNDER THE WARSAW SYSTEM AND THE MONTREAL CONVENTION OF 1999
- JURISDICTION & FORUM NON CONVENIENS
- LIABILITY OF AIRLINES, AIRPORTS, LESSORS, MANUFACTURERS, MAINTENANCE PROVIDERS & ANSPs
- CHALLENGES OF SETTLEMENT

8:00 – 9:00
REGISTRATION

9:00 – 10:15

Air Carrier Liability

- Recent Warsaw and Montreal Convention Interpretations
- Recoverable Damages
- Conflicts Between U.S. and European Courts
- The Challenges of Achieving Global Uniformity
- A Comparative Analysis of “Thorny” Issues under the Montreal Convention, including:

Liability for Pre-Impact Fright in a Death Cas

If there is no Article 33 Jurisdiction of the Passenger’s Claim against the Airline, will the Manufacturer’s Contribution Claim against the Airline also be barred by Article 33?

Airline Liability for Injuries to Passengers Resulting from the Actions of Other Passengers.

Comparative Fault and Multiple Defendants

FORTHCOMING EVENTS

Chair: Alan Reitzfeld - Holland & Knight, New York, USA

Speakers:

Simon Balls - Kennedys, London, UK

Robert F. Hedrick - Aviation Law Group PS, Seattle, USA

Anna Masutti - Lexjus Sinacta, Milan - Bologna, Italy

Joseph Wheeler - International Aerospace Law & Policy Group and Maurice Blackburn Lawyers, Brisbane, Australia

Refreshment Break

10:45 – 12:00

Jurisdiction & Venue

- Which forum is best for the plaintiffs/defendants?
- How to pick and choose among the venues of carriers, manufacturers, and others?
- Is the fifth jurisdiction of the Montreal Convention being used more often?
- Forum Non Conveniens - *West Caribbean Airways* & *Bashkirian* case updates
- What are the recent developments in *forum non conveniens*, and when does it work well, or work poorly?

Chair: Prof. Anna Konert - Lazarski University, and K&K Aviation Lawyers, Warsaw, Poland

Speakers:

Sophie Cochery - HMN & Partners, Paris, France

Stratis Georgilas - G-H Chambers, Athens, Greece

Rob Lawson QC - Quadrant Chambers, London, UK

Laura M. Safran, QC - DLA Piper, Calgary, Canada

12:00 – 13:00

Lunch

13:00 – 14:00

Products Liability

- Recoverable Damages
- The Conflict Between North American and European Courts
- TCAS, Autopilot and Automation
- Will we see more use of the Hague Convention on Products Liability?
- Is there Liability Exposure for Foul Cabin Air and Radiation?

Chair: Heather C. Devine - Gowling Lafleur Henderson LLP, Hamilton, Canada

Speakers:

Jean-Michel Fobe - Sybarius Advocats, Brussels, Belgium

Michael Scoville - Perkins Coie LLP, Seattle, USA

Philip Shepherd - XXIV Barristers' Chambers, London, UK

Éric Vallières - McMillan LLP, Montreal, Canada

FORTHCOMING EVENTS

14:00 - 15:00

Liability of Airports, ANSPs, Lessors and Maintenance Providers

- Latest and forecasted developments in the air navigation services (such as RPAS, remote towers and virtual infrastructures) and their impact on the liability of service providers
- The national liability regime (including case law) applicable to airport operators - a national perspective: Swiss law, and selected other European countries
- The performance of national public law tasks by airport operators
- The application of the national liability legislation to airport operators
- The contractual liability of the airport operator:

- vis-à-vis the public authority, as the airport land owner who granted the airport operator the concession contract (whether operated by a public or a private operator, the airport always remains a public asset that requires public service/general interest obligations)

- vis-à-vis its various contractual counterparts (including airlines, groundhandlers, retailers, security and safety providers, etc.)

- The lessor and manufacturer liability, latest developments

Chair: Axelle Cartier - Joint Aviation Authorities-Training Organisation (JAA-TO), Hoofddorp, The Netherlands

Speakers:

Isabelle Lelieur - VINCI Airports, Paris, France

Prof. Francis Schubert - Skyguide, Genève, Switzerland

Dr. Julien Subilia - AVIALEGAL, counsel, attorney-at-law, Lausanne, Switzerland

15:00 - 15:30

REFRESHMENT BREAK

15:30 - 17:00

Difficulties of Settlement & Emerging Insurance Issues

- The Challenges of State Liability: A look at KAL 007, Lockerbie, the September 11, 2001 U.S. terror attacks, MH 17 and Cuban Brothers to the Rescue
- Insurance for Acts of Terrorism and Conflict Zones
- A look at MH 370
- Difficulties Imposed by Sanctions and International Trade Controls
- The new Model AVN 1D
- Insuring UAVs (Unmanned Aerial Vehicles, or RPAS, Remotely Piloted Aircraft Systems)
- Cyber Security Issues

FORTHCOMING EVENTS

15:30 - 17:00

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Chair: Kinga Kolasa-Sokołowska - THB Polska, Warsaw, Poland

Panelists:

Mitch Baumeister - Baumeister & Samuels, P.C., New York, USA

Qian Chen -Jingtian Law Firm, Shenzhen, China

Andrew Harakas - Clyde & Co, New York, USA

Russell M. Mirabile -XL Catlin, New York, USA

Richard A. Powell - AIG, London, UK

18:00 - 19:30 **Gala Dinner**