10 June 2010

English only

Committee on the Peaceful Uses of Outer Space
Fifty-third session
Vienna, 9-18 June 2010

Request for observer status with the United Nations Committee on the Peaceful Uses of Outer Space: application of the International Association for the Advancement of Space Safety (IAASS)

Note by the Secretariat

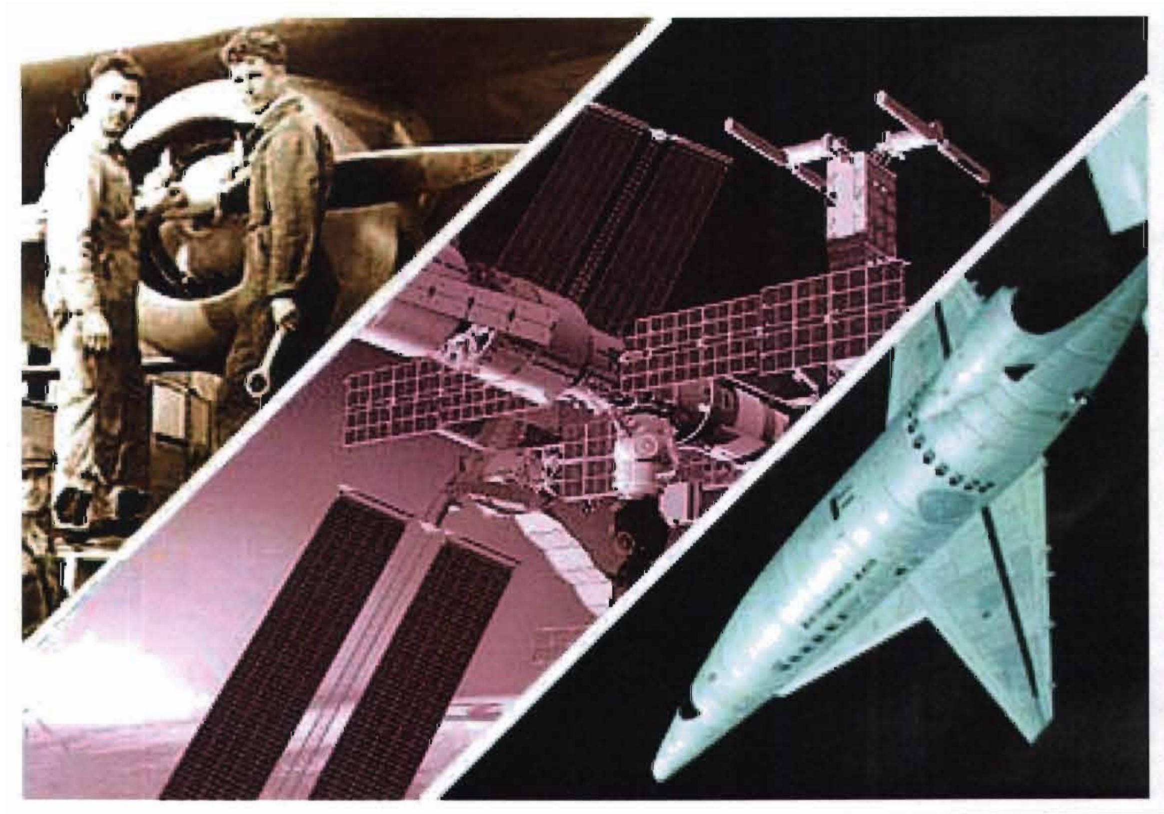
1. At its fifty-second session, in 2009, the Committee took note of the application of the International Association for the Advancement of Space Safety, a non-governmental organization, for permanent observer status with the Committee. The related correspondence and the statutes of that organization were before the Committee in conference room paper A/AC.105/2009/CRP.8. The Committee agreed to postpone its decision on the granting of permanent observer status to IAASS until the next session of the Committee, taking into account the need for further information (A/64/20, para. 312).

2. The present document contains further information provided to the Secretariat by IAASS.

IAASS

INTERNATIONAL ASSOCIATION FOR THE ADVANCEMENT OF SPACE SAFETY

Manifesto For Safe and Sustainable Outer Space



MANIFESTO FOR SAFE AND SUSTAINABLE OUTER SPACE

The International Association for the Advancement of Space Safety (IAASS) expresses serious concern about the safety and sustainability of civil and commercial space activities and calls upon all nations to actively cooperate with determination and goodwill to enhance access to and promote the safe use of outer space for the benefit of present and future human generations by committing to:

I) *Equally protect the citizens of all nations from the risks posed by launching, over-flying, and re-entering of space systems;*

II) *Develop, build and operate space systems in accordance with common ground and flight safety rules, procedures and standards based on the status of knowledge and the accumulated experience of all space-faring nations;*

III) *Establish international traffic control rules for launch, on-orbit and re-entry operations to prevent collisions or interference with other space systems and with air traffic;*

IV) *Protect the ground, air and space environments from chemical, radioactive and debris contamination related to space operations;*

V) *Ban intentional destruction of any on-orbit space system or other harmful activities that pose safety and environmental risks; and*

VI) *Establish mutual aid provisions for space mission emergencies.*

Background & Rationale

Space missions safety and sustainability risks

Safety of space missions refers to the safety of the general public (on ground, in air and at sea), launch range personnel, and humans on board. Space safety also encompasses the safeguard of valuable assets such as ground facilities (e.g., launch pads), space systems on orbit (e.g., space station, telecommunications satellites, etc.) and the safeguard of space, air and ground environment.

Since the beginning of human spaceflight 22 astronauts and cosmonauts have lost their lives, which is about 4% of the total number of people who have traveled to space. To date, there have been nearly 200 people killed by rocket explosions during ground processing, launch preparations and launch. And out of those accidents, 35 casualties were counted just at the beginning of the 21^{st} century.

In the last 10 years there have been at least six launches that were terminated by the launch range safety officer to prevent risk to the public. Several more cases of launchers which did not make to orbit and crushed back on Earth.

As matter of fact annual public risk criteria do not exist, and the actual distribution of annual risk imparted to the general public on Earth is completely unknown for the following reasons. First: only few space faring countries have published their launch and re-entries risk acceptance criteria and risk mitigation measures. Second: waivers for non compliances with launch/re-entry safety requirements, when granted, are treated as confidential. Third: risk assessments (when performed) are on a launch-by-launch (or re-entry-by-re-entry) basis with no consideration for previous launches/re-entries or planned launches/re-entries worldwide in the same year. There is no agency – national or international – that monitors and controls the cumulative risk imparted to over flown populations by launch and re-entry operations. A foreign city may be placed at risk by launches from multiple launch sites without the launching nations and interested parties performing any coordinated effort to assure that the risk levels are acceptable. Furthermore, debris generated during uncontrolled or off-nominal re-entries could cause casualties in the air (as well as at sea) which are generally not taken into account in the risk assessment models. The Shuttle Columbia accident posed a serious risk locally to civil aviation due to falling debris. The risk was estimated to be in the order of 1/1000 for commercial airlines and 1/100 for general aviation. (Afterwards new emergency procedures for the US airspace have been putted in place in coordination with the FAA).

Environmental accidents such as failures leading to dispersal of radioactive material also have occurred. As of September 2009, there have been 10 such cases, including the plutonium payload on board Apollo 13 lunar module jettisoned at re-entry, which ended up in the Pacific Ocean close to the coast of New Zealand, or the 68 pounds of uranium-235 from the Russian Cosmos

954 which were spread over Canada's Northwest Territories in 1978. The most recent accident of this kind was in 1996, when the Russian MARS96 disintegrated over Chile releasing its plutonium payload, which has never been found.

There have been also several instances of severe ground chemical contamination. A Russian launcher failure in September 2007 contaminated a vast swath of agricultural land with 200 metric tons of toxic fuel. Today, launchers release more ozone depleting substances in the stratosphere than the entire annual use of CFC-based medical inhalers once in use and now banned by the *Montreal Protocol*._

Another factor affecting safety and sustainability is debris left in space. Currently, there are about 800 operating satellites. However, there are over 17,000 tracked debris greater than 10 cm in size and millions of hazardous bits of debris too small to monitor. Orbital debris includes "dead" satellites, launcher upper stages, pieces of metal, blobs of liquid metal coolant that leaked from discarded space reactors, debris resulting from satellite explosions, optical lens covers, paint flakes, etc. Some of this material will remain in Earth orbit for hundreds or thousands of years and constitute a potential hazard for operational spacecraft because of the high relative velocities at impact.

Because there is no specific international legal obligation to ensure that spacecraft are disposed off properly, many spacecraft operators either abandon their failed satellites or just do not care to safely dispose them off at the end of the useful lives (e.g. by de-orbiting). The latest example of such danger is the accident that occurred on 10th February 2009 when a defunct Cosmos-2251 satellite and an active commercial Iridium-33 satellite collided in space at an altitude of about 800 kilometers.

Finally, the expanding human space-faring club (including China, next India and perhaps one day Europe and Japan), as well as the on-going developments in the field of commercial human spaceflight raise the issue of establishing international safety standards, and in particular systems interoperability standards, to allow mutual aid in case of emergencies during ascent/descent, on-orbit, and on extraterrestrial bodies.

Organizing Space: Space Exploitation vs. Space Exploration

Early space programs were conducted almost exclusively by few governments for military and civil purposes with little involvement by the private sector. Gradually, commercial uses of space began to develop as a global industry in particular in the field of satellite telecommunications first and launchers and global utilities later. Today, space can be considered divided in two functional regions: the region of space-exploitation and the region of space-exploration.

Exploitation means *making productive use*, while exploration *means, traveling (over new territory) for adventure, discovery or investigation.* Currently we can almost identify a physical borderline in space (because of debris dissemination) between the two regions to lay 200 km above the geostationary (geosynchronous) altitude. Thus, the region from the sea level to 36,200 kilometers in space is mainly of commercial and military strategic interest. However, it is getting increasingly crowded. On the other hand, the literally "boundless" region beyond 36,200 kilometers is currently for exclusive space exploration activities and thus mainly of scientific interest.

While the space exploration activities can be considered somehow covered by the existing space treaties, the safety of operations in the space exploitation region needs urgently to be regulated on international level. Just as international waters and airspace have traditionally been shared by government and commercial operators within an international regulatory framework, space exploitation operations are evolving in a similar fashion and have similar regulatory needs.

Military Space Exploitation

At the beginning of the space era, both the United States and the former Soviet Union developed and implemented programs that were more military in nature than civilian or scientific. The heritage of the current International Space Station and other civilian systems can be traced back to military programs. Space military programs were also precursors of all satellites applications from imagery to navigation, telecommunications and meteorology. The overhead reconnaissance by satellites was very soon accepted as legitimate means for confidence building and information exchange. By 1967, the year of coming into force of the Outer Space Treaty which established the principle of peaceful use of outer space, military satellites (e.g., for communications and navigation, detection of nuclear explosions in space, missile launchings and weather monitoring) were already an integral and irreplaceable part of the defense systems of both the US and the USSR. In the 1990s, space became a key component of military planning. The Persian Gulf War *Desert Storm* of 1991 was later described as the first 'space war'; since it was the first time that the full range of military space assets were used for actual fighting.

The interest of military use of space was and remains strong, and will become even stronger as national security will depend more and more on space based systems. Such strategic interest spurs of course debates and policies about assets protection and in turn "space superiority" and "space control". In this respect a debate is raging since several years about limiting space militarization to the current balance of applications and to forbid the deployment of space-based weapons.

In any case, military commands have an overall interest in transparent space operations as a way of preventing military incidents, and are becoming increasingly anxious about their capability to determine the nature (commercial or military) of satellites on-orbit as their population and miniaturization increase. They are even pondering the development of joint standards for station-keeping so that one military is not alarmed by a sudden maneuver of the other's satellite that was intended as station keeping, not as the beginning of an attack. It is therefore important to underline that an international civil regulatory framework for the space-exploitation-region would most probably be well acceptable to all (military) parties because of the above need for transparency and because of the common general interest in safeguarding the space environment.

Commercial Space Exploitation

From an economic standpoint, space commerce has been important for several years and space-derived annual revenue exceeded $251 billion in 2007. This is primarily due to the extensive expansion of traditional sector of telecommunication satellite services. New commercial fields are emerging such as space-based navigation systems (e.g. GPS of the U.S., GLONASS of Russia, Galileo of the EU, Beidou of China, Quasi-Zenith Satellite System of Japan, IRNSS of India, etc.), integrated global remote sensing and space-tourism. Navigation systems may soon become the second pillar of space commerce. But apart from the capability to generate revenue and profits, commercial space-based systems have a strategic importance as catalyst for further and faster economic and social progress on a global scale.

From a safety regulatory perspective, the most important development was in the field of commercial launch services. In the main market, the United States, space transportation was initially an area of government monopoly. In the early 1980's difficulties in meeting an increasing demand, the phasing out use of unmanned expendable launch vehicles (ELVs) and the failure of the Space Shuttle to both reduce cost and increase launch frequencies eventually created a substantial commercial transportation market in which the European commercial consortium Arianespace took a large share and provided a role model. Later, the fall of the Soviet Union allowed a number of Russian and Ukrainian companies to enter the launch services market sometimes in joint venture with their western counterparts. In addition, Japan, China and India also entered the commercial launch market, while South Korea and Brazil will join them soon.

In the field of space transportation a new industry appears to be emerging: space-tourism. Started with *SpaceShipOne* sub-orbital test flights in 2004, there are at the moment about 26 different concepts and vehicles under development of which 8 foresee horizontal take-off and landing capabilities. It should be noted that a large majority of suborbital vehicles under development are based on mature technologies and proven operations concepts which are about 40 years old. Here the challenges are costs reduction and safety improvement, although the former seem to be the real main driver and focus of the current design efforts, except for those aspects related to public safety which are mandated by law. The first commercial sub-orbital flights are expected to take place in 2010 and will be operated by the British company Virgin-Galactic. Concurrently, plans to realize new commercial spaceports worldwide are also very much in progress, most recently in Sweden, Singapore and Dubai. In perspective, sub-orbital space tourism may have little to do with space and much with Earth. Vehicles with sub-orbital flight capabilities have in fact the potential to be used for hypersonic point-to-point international travel, giving possibly rise (sooner than later) to "hypersonic-flight tourism".

For obvious reason of much higher complexity and cost, large scale orbital tourism developments are far behind. Orbital space tourism became reality in April 2001, through the use of Russian government vehicles and related infrastructure. Since then six space tourists have traveled on a Russian *Soyuz* spacecraft, which docked with the International Space Station (ISS). The 2006 saw a key milestone with the launch of an unmanned commercial demonstrator, the inflatable orbiting space station *Genesis I,* privately developed by Bigelow Inc. on quite solid bases of previous NASA research and patents. In 2007 the larger *Genesis II* launch followed.

Finally, NASA launched the demonstration phase of the *Commercial Orbital Transportation Services* program, with the final goal to contract with one or more space transport firms to deliver a given amount of cargo to the International Space Station each year. Eventually this may also include transportation and return of crew members and possibly private passengers.

Airspace and Space-Exploitation-Region Integration

The international airspace traffic control above oceans and high seas is very important not only for the safety of aviation global operations but also for the safety of space launch and re-entry operations. Major spaceports and launch sites are generally located close to the ocean coastline for the obvious safety reason of fast clearing inhabited areas. In some cases launches even take place directly from modified, self-propelled, ocean oil-drilling platforms to provide for the most direct route to orbit and maximum lift capacity. Spacecraft re-entry trajectories are selected as much as possible with similar criteria, and all controlled destructive re-entries are all aimed to the oceans.

States possess complete and exclusive sovereignty over their national airspace, which is defined as the atmospheric zone directly above their landmass and “territorial sea”, which extends 12 nautical miles from the coast. Beyond that line, the airspace is defined as “international airspace” and does not belong to any one country. The Convention on International Civil Aviation of 1944 (Chicago Convention) placed international airspace under the authority of the International Civil Aviation Organization (ICAO). The ICAO delegates responsibility for the provision of air traffic control services in this airspace to various countries based generally upon geographic proximity and the availability of the required resources. As aviation and space traffic continue to grow, ICAO has an increasing primary responsibility and duty of promoting innovative strategies to ensure the safety of the “integrated” air and space traffic in the international airspace, which is where those traffics mostly interact. But not only. For example, in future civil aviation will make more use of space-based systems for traffic management, approach and landing. Such systems are currently under development and make use of Global Navigation Satellite System (GNSS), like the American GPS, plus various precision augmentation systems, and position broadcasting capabilities. Also in the case of rockets launches there is a forthcoming transition from ground based radar to GPS applications of the safety (flight termination) system. Such system supports one of the most important safety responsibilities of the launch range safety officer to monitor the track of launch vehicles during flight and, in case of malfunction and risk for the public, to terminate the flight.

In the near future a number of critical aviation systems, from traffic control to high resolution weather forecasts and digital aviation communications will be based in space. This means that aviation safety will heavily depend upon the integrity and reliability of space based systems and services. Also certain advanced technologies will precipitate a merging of interests. For example, while it is notorious that terrestrial weather forecasts are essential also for space system safety during launch and re-entry, only recently has the aviation community become interested and indeed concerned about the dissemination of space weather forecasts and planning of related operational responses. Space weather is a collective term for radiation from a number of varying conditions on the sun plus galactic cosmic rays that have potential serious effects on electronic systems and on human beings. Solar radiation storms also known as Solar Proton Events (SPE) can increase the risk of errors and failures not only for orbiting satellites but also for safety critical aircraft electronic equipment such as flight engine management computers, in particular on polar routes. New technologies and progress with micro-electronics will in future further increase such failure risk because of their higher sensitivity to radiation.

Finally, the upcoming trend to operate hybrid systems (so called aero-spacecraft) from dual ground infrastructure (airport/spaceports) requires a well integrated international regulatory framework both for flightworthiness certification and ground operations.

A Manifesto for a New Space Safety Culture

As activities expand in the space-exploitation-region (i.e. up to 36,200 km) it is clear that a formalized and globally agreed framework of space safety standards and procedures is essential for assuring safety and long-term sustainability of space operations. The new regulatory framework should be guided by the six basic principles in the above-mentioned *Manifesto for Safe and Sustainable Space*.

Furthermore, a corresponding organizational set up (nationally and internationally) needs to be established. They could be brand new organizations or the extensions of existing ones. If we consider the US where space transportation safety regulatory responsibilities are already assigned to a specialized office of the aviation national authority (the FAA-AST), the extension of that office mandate to all commercial space operations up to and including geostationary orbits seems to be the most obvious step. Similarly extending the mandate of the corresponding international aviation organization (i.e., ICAO) instead of creating a new separate international space organization would bring about obvious advantages in terms of promptness, rationalization, synergies, efficiency and costs.

Note: International Association for the Advancement of Space Safety (IAASS)

The IAASS, legally established on 16 April 2004 in the Netherlands, is a non-profit professional organization dedicated to furthering international cooperation and scientific advancement in the field of space systems safety. The IAASS aims at promoting a New Safety Culture in space activities by acting to:

1. *Advance the science and application of space safety;*

2. *Improve the communication, dissemination of space safety knowledge and cooperation between interested groups and individuals;*

3. *Improve understanding and awareness of the space safety discipline;*

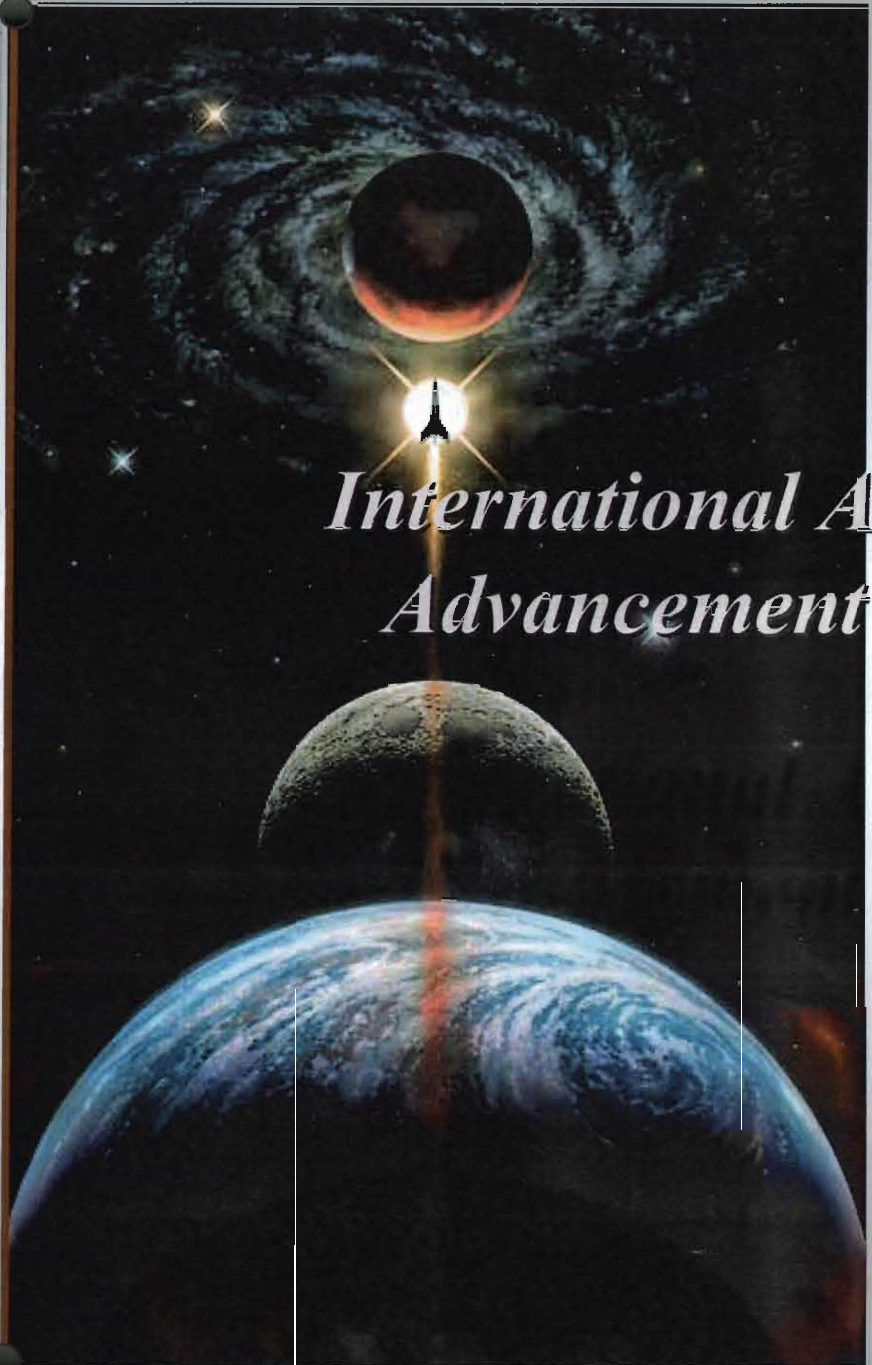
4. *Promote and improve the development of space safety professionals and standards; and*

5. *Advocate the establishment of safety laws, rules, and regulatory bodies at national and international levels for the safe civil/commercial use of space.*

The IAASS provides expertise, consultation and education on state of the art methods and processes that promote space safety. For more information, visit: http://www.iaass.org/.

IAASS

International Association for the Advancement of Space Safety



"Over the long run the safety of all human beings in the global commons of space is a responsibility that must be shared by all space-faring powers"

(G.Rodney, NASA Associated Administrator S&MA,40th IAF Congress, October 1989, Beijing – China)

www.iaass.org

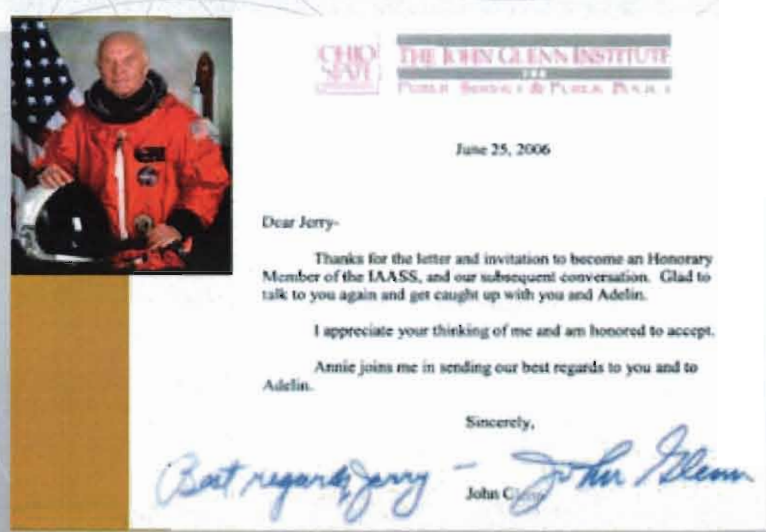
About Space Safety

- Safety of space missions refers to the safety of general public (on ground, in air and at sea), launch range personnel, and humans on board.
- Space safety also encompasses the safeguard of valuable assets on orbit (e.g. telecommunications satellites, global navigation systems, etc.), and the safeguard of space, air and ground environment.
- The risks related to space missions are often of international nature (e.g. launch and re-entry operations, on-orbit collisions, etc.)

Space Rockets Launch Sites

Introducing IAASS

- A non-profit organisation dedicated to furthering international cooperation and scientific advancement in the field of space systems safety
- Legally established 16 April 2004, The Netherlands
- Since October 2004 member of IAF (International Astronautical Federation)
- June 2006, former US Senator John Glenn and first American to orbit became Honorary Member


THE JOHN GLENN INSTITUTE

June 25, 2006

Dear Jerry-

Thanks for the letter and invitation to become an Honorary Member of the IAASS, and our subsequent conversation. Glad to talk to you again and get caught up with you and Adelin.

I appreciate your thinking of me and am honored to accept.

Annie joins me in sending our best regards to you and to Adelin.

Sincerely,

Best regards Jerry – John Glenn

John G

MISSION

Advancing space safety forms the foundation of our endeavour. Compared with the vastness of political, financial and intellectual resources that space programs require our forces are minute, truly a drop in the ocean. Nevertheless, we want to be that drop and indeed a catalyst drop. We are committed, through the knowledge and dedication of our members, to internationally advance space safety as parents are to their children, to help finally ensure that:

- **No accident shall ever happen because the risk was badly measured or willingly underestimated;**

- **No accident shall ever happen because the necessary knowledge was not made available to others;**

- **No accident shall ever happen because of lack of management commitment and attention;**

- **No accident shall ever happen because lack of personal accountability makes people negligent.**

Strategic Drivers

- ✓ Advancing safety is not only a moral duty but a key element to expand space programs and make them more economically viable.
- ✓ Space commercialization and international cooperation in civil space programs is the way ahead. It requires an international safety culture!
- ✓ The international dimension of public safety risk will become more and more evident (launch/re-entry risk, on-orbit collision risk, space debris, NPS use).
- ✓ Need for an integrated (airspace/outerspace) international regulations system to cover traffic and safety of aero-space operations (emerging suborbital space-planes, space-based safety critical services, etc.).
- ✓ Need for uniform international space safety standards to ensure fair competition in the global (space) market.

Association's Goals

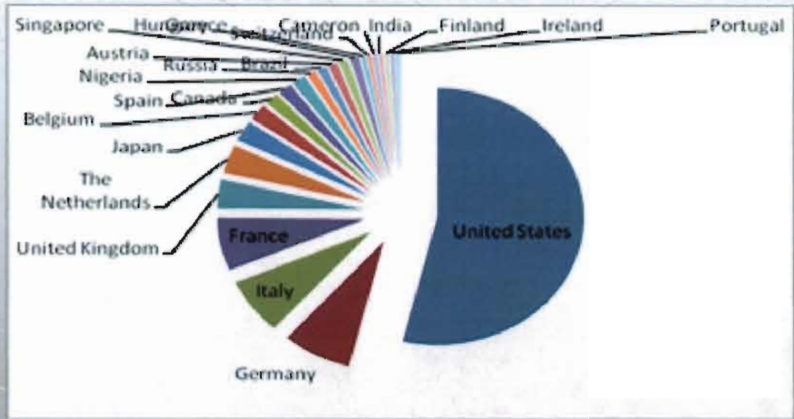
The IAASS aims to:

- ***Advance*** the science and application of space safety
- ***Improve*** the communication, dissemination of knowledge and cooperation between interested groups and individuals
- ***Improve*** understanding and awareness of the space safety discipline
- ***Promote*** and ***improve*** the development of space safety professionals and standards
- ***Advocate*** the establishment of safety laws, rules, and regulatory bodies at national and international levels for the civil/commercial use of space

Membership Policy

- The Association is based on the intellectual interaction of individual members who together shape the technical vision of the association, and make the association services available to stakeholders (on a non-profit basis)
- Corporate and institutional members of the Association have a sponsoring role and are the primary target of the association services
- Only individual members have voting rights

The association counts more than 200 professional members from 23 countries. 55% of the members are from industry, while the remaining 45% come from space agencies, governmental institutions and academia

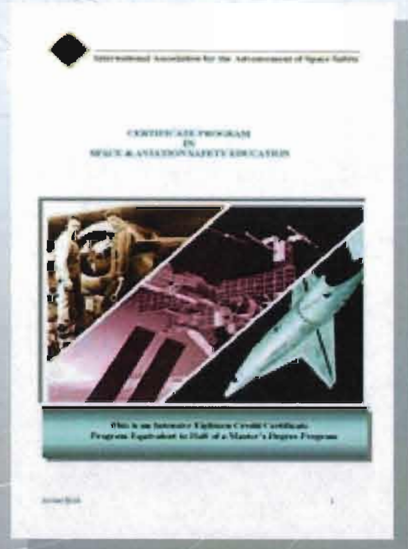


Which role for Academia?

- The Association is the ideal ground for academic world to meet and interact with industrial and institutional organisations.

- By attracting academic interest and involvement in space system safety research activities, the Association counts to effectively advance space safety to new levels and to establish space safety as an autonomous technical discipline.

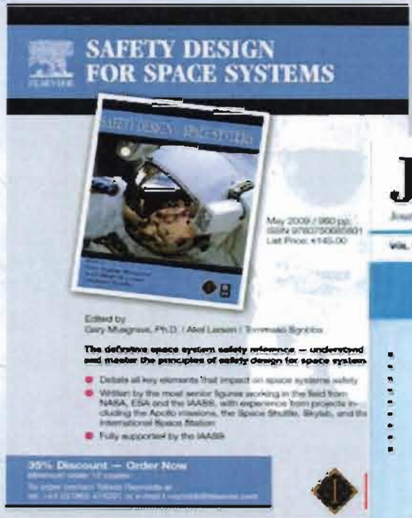
- The IAASS is developing a series of university textbooks and specific academic programs, such as Master in Aerospace Safety, safety courses at the International Space University (ISU) and PhD opportunities.



Primary Services

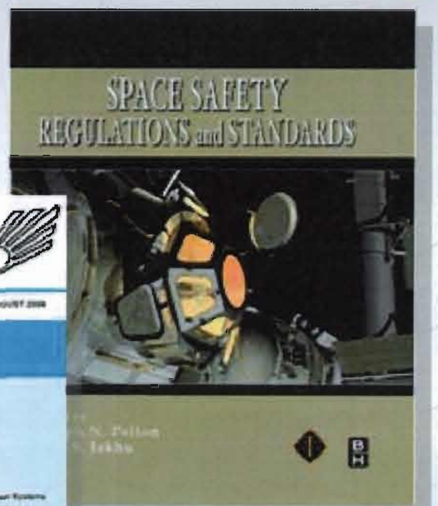
- Facilitate information exchange between members through networking, newsletters and website;
- Organisation of safety conferences and seminars;
- Establishment and maintenance of a world-class searchable database of published and electronic knowledge (on-line IAASS-Knowledge Management System operational since January 2006);
- Performance of independent research and studies (e.g., *An ICAO for Space?* to be published as part of the *Studies in Space Policy* series of the European Space Policy Institute);
- World-class space safety educational and training programme;
- Establish (or participate in) safety standardisation working groups;
- Scientific publications and university textbooks.

Publications (2009-2010)



March 2009

Special issue on Space Safety
edited by IAASS - December 2009



August 2010

Organisation

The ***IAASS Board*** is the policy governing body of the association. It is chaired by the ***IAASS President***, and may comprise up to 30 physical persons elected by the ***General Assembly*** . The IAASS Board includes also ***Regional Representatives*** which are elected by the regional members of IAASS (currently: Africa, China, Europe, India, Japan, North America, Russia and South America).

A section of the IAASS Board (i.e. the Standing Committees Chairmen) constitutes the ***IAASS Executive Committee***, which ensures the operations of the Association together with the ***Executive Director***, the ***Technical Director***, and the ***Secretary***

Organisation: Technical Committees

Professionals from agencies, industry and academia which satisfy criteria of expertise and excellence compose the seven IAASS Technical Committees:

- Technical Director – Ph. A. Menzel, EADS-Astrium
- Space Systems Safety – Prof. N. Leveson, Massachusetts Institute of Technology
- Space Transportation Safety - *Vacant*
- Space Exploration Safety – K. Mikula, Boeing
- Launch Range Safety – T. Pfitzer, APT-Research
- Re-entry and Space Debris – Dr. W. Ailor, The Aerospace Corporation
- Space-based Safety Critical Services - *Vacant*
- Space Safety Legal and Regulatory – Prof. R. Jakhu, McGill University
- Human Factors and Performance for Safety – D. Rogers, SAIC

Organisation: Standing Committees

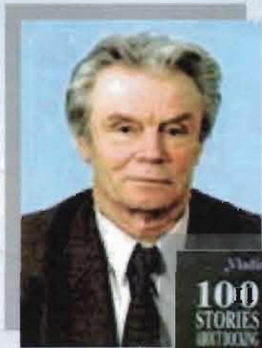
Any member of the Association can volunteer to fill vacancies in the Standing Committees:

- Information & Communication
- Sponsorship
- Membership
- Awards
- Professional Training
- Conference Planning
- Academic

" *Vladimir Syromiatnikov Safety-by-Design Award*"

- The *V. Syromyatnikov Safety-by-Design Award* is a means for IAASS to honour outstanding designers and engineers who have made major technical contribution toward systems safety

- Named in honour of Vladimir Syromiatnikov (1934-2006) the Russian designer of one of the most successful piece of space hardware, the docking system APAS. The APAS was used in the Apollo-Soyuz Test Project in 1975, successful in more than 200 dockings of Soviet/Russian, spacecraft, on the Shuttle and on the International Space Station



IAASS *V. Syromiatnikov Award* Winner 2010: Dr. Kyoichi Kuriki (Japan), received by Nobuo Takeuchi of JAXA

"Jerome Lederer – Space Safety Pioneer Award"

- A means for IAASS to honour professionals who made outstanding contribution or improvements to Space Safety
- Named in honour of J. Lederer (1902-2004), father of aviation safety who became Director of the NASA Office of Manned Spaceflight Safety following the tragic Apollo 1 fire

IAASS *J. Lederer Award Winner* 2010:
Dr. John Livingston (USA)

The Fifth IAASS Conference

The Fifth IAASS Conference *"A Safer Space for a Safer World"* will take place at the *Palais des Congres de Versailles*, France, in the period 18-20 October 2011