

Global Governance of Human Space Flight

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Questions

#1 - Should ICAO (or another international organization) exert jurisdiction over regulatory issues surrounding safety and navigation of emerging modes of transportation?

#2 - The definition and delimitation of outer space (vs airspace). Is there a present need to determine where and under what circumstances “space activities” begin, transition, and end with respect to space travel.

#3 - What is the current legal status of humans involved in spaceflight? Should all such persons be considered “astronauts” under the Rescue and Return Agreement?

The myth of “too early for regulations”



First rocket propelled airplane 70 years ago!



- Komet II -

During World War II, Allied bombing was crushing German industry. To counter this aerial attack, an intriguing counter weapon was developed: the point-defense interceptor.

- It could operate from fixed bases against high-value targets
- It could rapidly scramble to operating altitude

Komet I



First suborbital human spaceflights half century ago

- In 1961, Alan Shepard on a suborbital flight reached **187 km** of altitude on board the first Mercury man-rated rocket (Mercury Redstone 3, a rocket with a capsule on top).



- In 1963, NASA test pilot Joseph Walker reached an altitude of **108 km** in an X-15 aircraft, and returned to the runway from which he took off (attached to a B-52 mother ship).
- The commercial human suborbital space vehicles currently in development still basically follow such configurations, plus other two consisting into an airplane with either a rocket engine or jet engine and rocket engine.

*The misleading comparison with early
times of aviation*

State-of-art at beginning of aviation



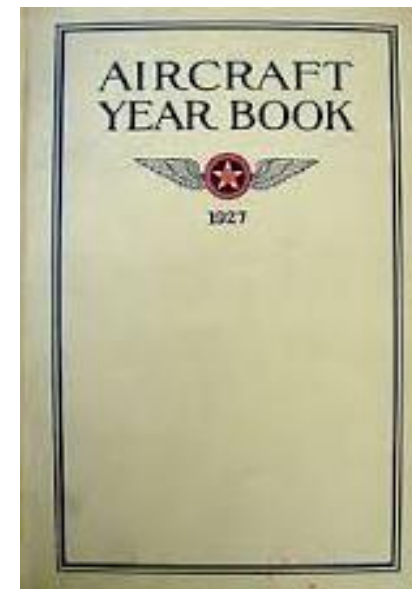
State-of-art at beginning of commercial human spaceflight



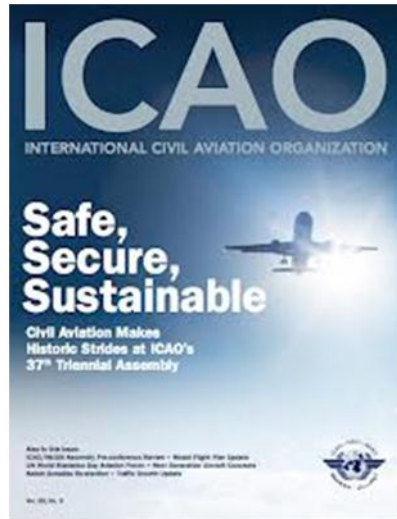
Those who cannot remember the past are condemned to repeat it

“Since the armistice (1918) when airplanes were first made generally available and came into hands skilled and unskilled, responsible and irresponsible, it may be conservatively estimated that more than 300 persons have been killed and 500 injured – many of them fatally – in flying accidents which could have been prevented had there been in existence and enforced a statute regulating the operation of commercial aircraft”

Aircraft Year Book - 1927



The ICAO Model



The IMO Model



The Safety Institute Model



A line or a zone?

Not a line but a zone separates airspace and outerspace

- Several “soft” boundaries between air and space have been defined:
 - **50 Km is the upper limit of atmospheric buoyancy (balloons);**
 - 80 Km is the threshold altitude that defines “astronauts” in the US;
 - **100 Km, also known as the “Karman Line”, is where aircraft aerodynamic controls become ineffective;**
 - 120 Km begins the re-entry threshold for space vehicles; and,
 - **160 Km is the lowest practical operating orbit for satellites and spacecraft.**



Back-up

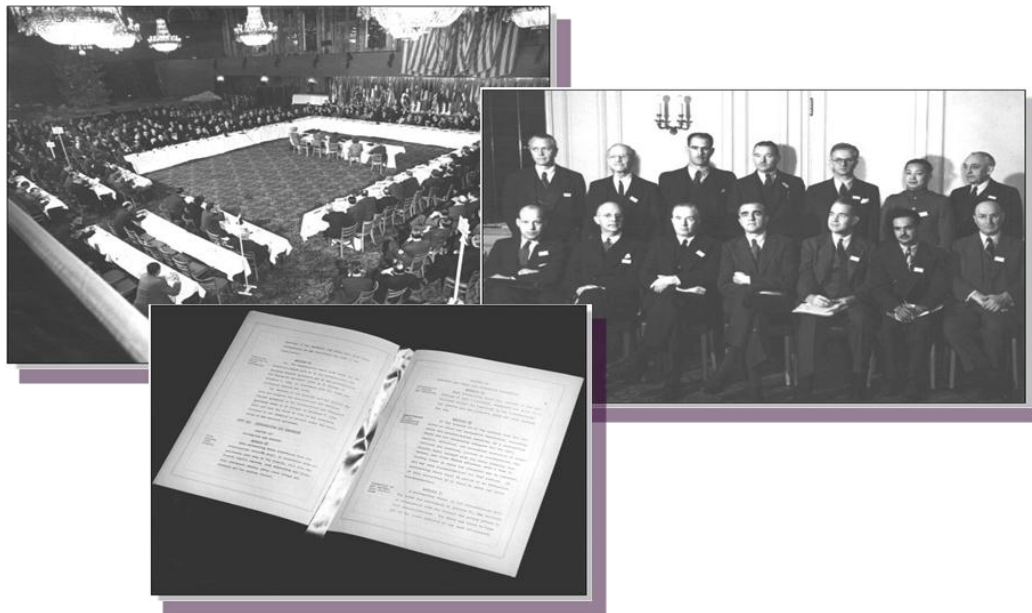
Back-up

The ICAO Model

The ICAO Model

The U.S. initiated in 1943 studies of post-war civil aviation, which confirmed that civil aviation had to be organized on an international scale to become a key element of the world economic development

At the end of 1944, the U.S. invited 55 states to attend an International Civil Aviation Conference in Chicago. The Convention on International Civil Aviation was signed on 7 December 1944. In 1947 ICAO became a specialized agency of UN.



The ICAO Model

The 96 articles of the Convention established the adoption of **International Standards and Recommended Practices (SARPs)** to secure the highest possible degree of uniformity in regulations and standards, procedures and organisation regarding civil aviation matters

The ICAO Convention does not generate any prerogative, right or obligation for individual nationals of the contracting States. Only national laws and regulations apply. [“Each contracting State undertakes to collaborate in securing the highest practicable degree of uniformity in regulations, standards, procedures, and organisation...”]

The ICAO Council can make recommendations for changes (to national rules) but “No contracting State shall be guilty of an infraction of this Convention if it fails to carry out these recommendations.”



The IMO Model

Taking a page from maritime practice



<http://www.thespacereview.com/article/2252/1>

Classification Societies.....it all started over a cup of coffee

- In the second half of 18th century, marine insurers, based at Lloyd's coffee house in London, developed a system and established a committee for the independent inspection of the hull and equipment of ships presented to them for insurance cover.
- The condition of each ship was “classified” on an annual basis according to the excellence of its construction and its perceived continuing soundness (or otherwise).
- In 1828 Bureau Veritas was established as classification society, followed by the Lloyd's Register of British and Foreign Shipping as a self-standing classification society, and by other societies (RINA, ABS, DNV, ClassNK, etc).



Classification Society activities

- ✓ Promotion of safety of life, property and the environment
- ✓ Develop technical standards (rules) for design and construction of ships
- ✓ Approve designs against their standards
- ✓ Conduct surveys during construction to satisfy the ship is built in accordance with the approved design and to the requirements of the Rules
- ✓ Acts as a Recognised Organization carrying out statutory surveys & certification as delegated by maritime administrations
- ✓ Regulations for in-service inspection and periodic survey during operation
- ✓ Research and development programs
- ✓ Support international organizations (IMO, ISO, IACS, etc.)

Involved in all stages throughout the life of a ship: design, construction and in-service. Assessment of changes resulting from modification, repair, degradation, etc.



International Maritime Organization (IMO)

As a specialized agency of the United Nations, IMO is the global standard-setting authority for the safety, security and environmental performance of international shipping.

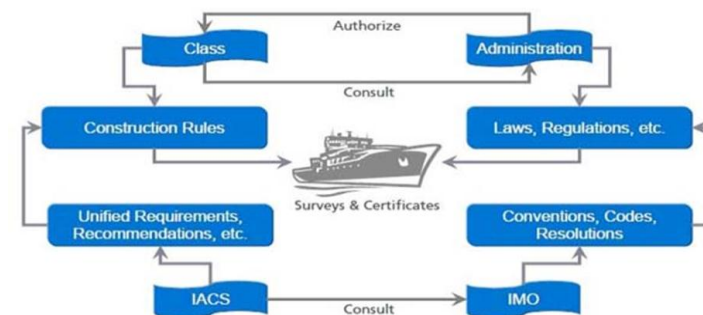
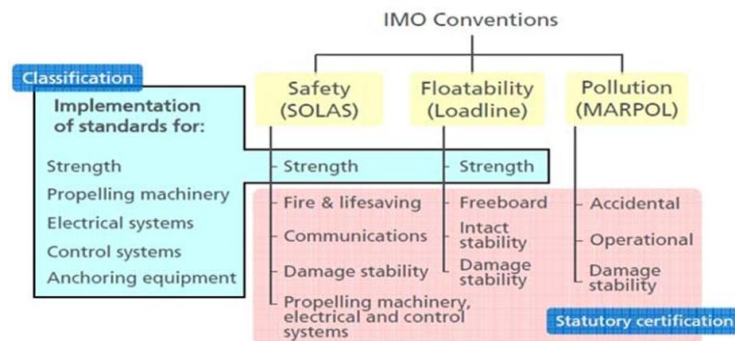
Its main role is to create a regulatory framework for the shipping industry that is fair and effective, universally adopted and universally implemented.

In other words, its role is to create a level playing-field so that ship operators cannot address their financial issues by simply cutting corners and compromising on safety, security and environmental performance. This approach also encourages innovation and efficiency.



Classification Society statutory role and interfaces

- Many national administrations have opted to take advantage of Classification Societies experience by signing formal delegation agreements with one or more of them (for example Canada signed with Germanischer Lloyd, American Bureau of Shipping, Bureau Veritas, Det Norske Veritas and Lloyd's Register).
- The rules published by Classification Societies, together with the requirements set down in the various International Conventions of the International Maritime Organisation (IMO) and the marine legislation of the flag states, form a comprehensive and coherent set of standards for design, construction and maintenance in operation of ships



The Safety Institute Approach

Taking a page from Formula 1 car racing industry



Formula 1 self-regulation

- In the first three decades of the Formula 1 World Championship, inaugurated in 1950, a racing driver's life expectancy was about two seasons. *“Driver raced, drivers died. In a world too familiar with the carnage of war it was accepted that total risk was something that went with the badge”* - (D. Tremayne, sport writer)
- Total risk was accepted by pilots, racing teams, and the public, but the deaths of Roland Ratzenberger and Ayrton Senna on live TV during the Imola Grand Prix of 1994 forced the car racing industry to look seriously at safety, or risk being banned forever.
- In the days after the Imola crashes the Fédération Internationale de l'Automobile (FIA) established the Safety Advisory Expert Group to identify innovative technologies to improve car and circuit safety, and mandated their implementation and certification testing. Thanks to such efforts, Formula 1 car racing evolved into a safe, self-regulated, multibillion dollar business funded by sponsorships and global television rights.



Lessons learned from deep water oil drilling

Deep water oil drilling is a high-tech industry. *“Everyone thought that exploring the deep sea would be as exciting as a trip into outer space. The reality, though, was different. Compared to conditions in the deep sea, flying to the moon looked easy”* (Klaus Wallmann, head of the Marine Geosystems Research Unit, Leibniz Institute of Marine Sciences, Kiel, Germany).



“The gas and oil industry must move towards developing a notion of safety as a collective responsibility. Industry should establish a “Safety Institute” ...this would be an industry created, self-policing entity, aimed at developing, adopting, and enforcing standards of excellence to ensure continuous improvement in safety and operational integrity offshore” (US Presidential Commission on Deepwater Horizon Disaster)