# Policies & Laws Governing Space Activities

**Space Policy and Law Course 2017**

*Sa'id Mosteshar*

***Professor of Space Policy and Law, Director of ISPL, FRAeS***

16 – 18 October 2017, London

LONDON INSTITUTE OF SPACE POLICY AND LAW

# Introduction

- Outline
  - Space Environment and Technology
  - International Policy and Institutions
  - Legal Regime and Applications
  - Commercial Space Activities and Management of Orbits and Spectrum
  - Military Use of Space and Space Weapons
  - Risks, Liability and Insurance
  - Space Security
  - Topical Current and Future Developments
  - Case Studies and Review

# Outer Space Definition

- Delimitation
  - No legal definition of airspace and outer space
    - sub-orbital tourism, re-usable space planes, private sector activities
  - Two approaches: Spatial - von Kármán Line, 100 kms [lift at > orbital velocity]
    Functional - altitude of aircraft wing lift and stable orbit
  - UN COPUOS LSC considering since 1961
    - 2017 Report: On 27 March 2017, the LSC reconvened its Working Group on the Definition and Delimitation of Outer Space . . . The WG convened to consider only matters relating to the definition and delimitation of outer space.
    - ICAO & UNOOSA Aerospace Symposium 2015-2017. A panel on ways to foster a better understanding on legal and regulatory mechanisms under international air law and international space law to ensure the safe and sustainable operation of civil aviation, suborbital operations, and space activities.

# Space Environment & Technology

Session 1

# Space Environment & Technology

**Space Policy and Law Course 2017**

***Characteristics of Space, Their Use and Space Objects***

*Professor Alan Smith*

***Mullard Space Science Laboratory, University College London***

16 October 2017, London

London Institute of Space Policy and Law

# Space Policy

Session 2

# SPACE POLICY REGIME

**Space Policy and Law Course 2017**

***Space Policy Principles, National and International Institutions***

*Professor Jean-Jacques Dordain*

***CNES; Former Director-General of European Space Agency; ISPL Adviser***

16 October 2017, London

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# Policy Formulation

- Nature of Policy
  - Identify political priorities
  - Devise programmes and actions to deliver desired outcome
  - US and USSR
  - EU and ESA
- Influences
  - Science, Social and Economic Development
  - Defence, Intelligence and National Security
- Policy *vs* Strategy
  - Policy is what is, or what is not done – implies a rule or guide
  - Strategy is the methodology used to accomplish a target prescribed by policy

# Options & Implementation

# Policy Objectives

- Motivation for Space Policy
  - Protect national interests (territorial, military, etc.)
  - Security (political, financial, personal - health, food)
    - Disaster Monitoring
    - Health
  - Economic growth & security
    - Weather Forecast
    - Agricultural Monitoring and Planning
    - Resource management
  - Technological development
    - Communication and Information technology
    - Scientific capacity
  - Education
  - National Prestige

# New Policy Factors

- Growing Focus on Space
  - Rapid Expansion of Activities
  - Increasing Numbers of Participants
    - Commercial Investors
    - Developing countries
  - Coordination on Sustainability and Security
  - Sharing Risks and Costs
- Earth Orbits:
  - Congested, Competed and Contested
  - Safety, Security and Sustainability

# Policy Institutions

- UN COPUOS
  - LSC and STSC
  - Groups of Experts
- Regional and National
  - European Commission
  - European Space Agency  ESA
  - Asia-Pacific Space Co-operation Organisation  APSCO
  - African Union
  - National Space Agencies  NASA, JAXA, UKSA
- IGOs with Specific Remit
  - Inmarsat, ArabSat and AfriSat

# Policy Challenges

- Treaty Adherence
  - Registration Convention
- Weapons Control
- Operator Diversity and Coordination
- Differential Needs
  - Applications for Developing Countries
  - Industrial Policy
- Public Support
  - Educate and Inform of Benefits
  - Government Sustained Funding and Investment

# CONSTRAINTS

- Role of WTO
  - General Agreement on Trade in Services 1995 GATS
  - Basic Telecoms Agreement 1997 BTA
- Arms Control
- European Union
  - Competition Laws
  - State Aid
  - ESA *juste retour*

# The Legal Regime

Session 3

# Legal Background

- Early activities by governments
  - Natural that public international laws govern
  - US and USSR could have had bilateral agreement
  - Need to involve other states since they are affected
  - Multi-lateral agreement through the UN
- *Ad hoc* COPUOS formed 1958, Permanent 1959
  - Members 18 to 24 members – now 84 [NZ]
  - STSC and LSC
- Cooperation
  - Apollo Soyuz Test Project docking 1975 – ISS Contribution


1952 Space Pioneer: Will man outgrow the Earth?

# Sources of Space Law

- International Law
  - Public International Law
  - Private International Law *or* Conflicts of Law
  - Commercial International Law
  - *cf* Municipal Law
- Sources
  - Treaties and Conventions
  - General international law - recognised principles of law ICJ Statute Art 38(1)
  - Judicial Decisions (secondary)
  - Teachings of Leading Scholars (secondary)
  - Multi-lateral Agreements

# UN Resolutions

1. Resolution 1962 (XVIII), Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space
    1. Established the main principles
        - Peaceful use
        - Benefit of all mankind with equality among States
        - Avoidance of harmful activities
        - State responsibility and liability
        - Non-appropriation
        - Cooperation
    2. Adopted 13 December 1963, later incorporated in OST 1967

# Space Treaty Operation

- To achieve international scope, Treaties binding on States
- OST articulates the general principles
- Other treaties and conventions more specific
- In some jurisdictions treaties are self implementing
- Municipal laws implement OST and apply to operators
  - Several countries have laws governing certain aspects

# UN Treaties

- Five international UN treaties:
  - **1967 Outer Space Treaty – Principles Treaty** [105]
  - 1968 Rescue Agreement [95]
  - **1972 Liability Convention** [94]
  - **1975 Registration Convention** [63]
  - 1979 Moon Agreement [17]
- Moon Agreement in force 1984
  - 17 ratifications. None of the major space active States. Excludes Brazil, China, France, India, Japan, Russia, UK and USA. Includes Australia, Austria, Belgium, Mexico and Netherlands

# Principles of Space Law

- Peaceful Use
  - States party to the OST are bound by its Preamble, with many references to peaceful use of outer space. Vienna Convention Art 18
  - Exclusively peaceful use of celestial bodies. OST Art IV
- Non-appropriation
  - *Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.* OST Art II
  - No State can claim any part of space or exclude others from access and use of space.
  - Freedom of over-flight and peaceful use.

# PRINCIPLES OF SPACE LAW

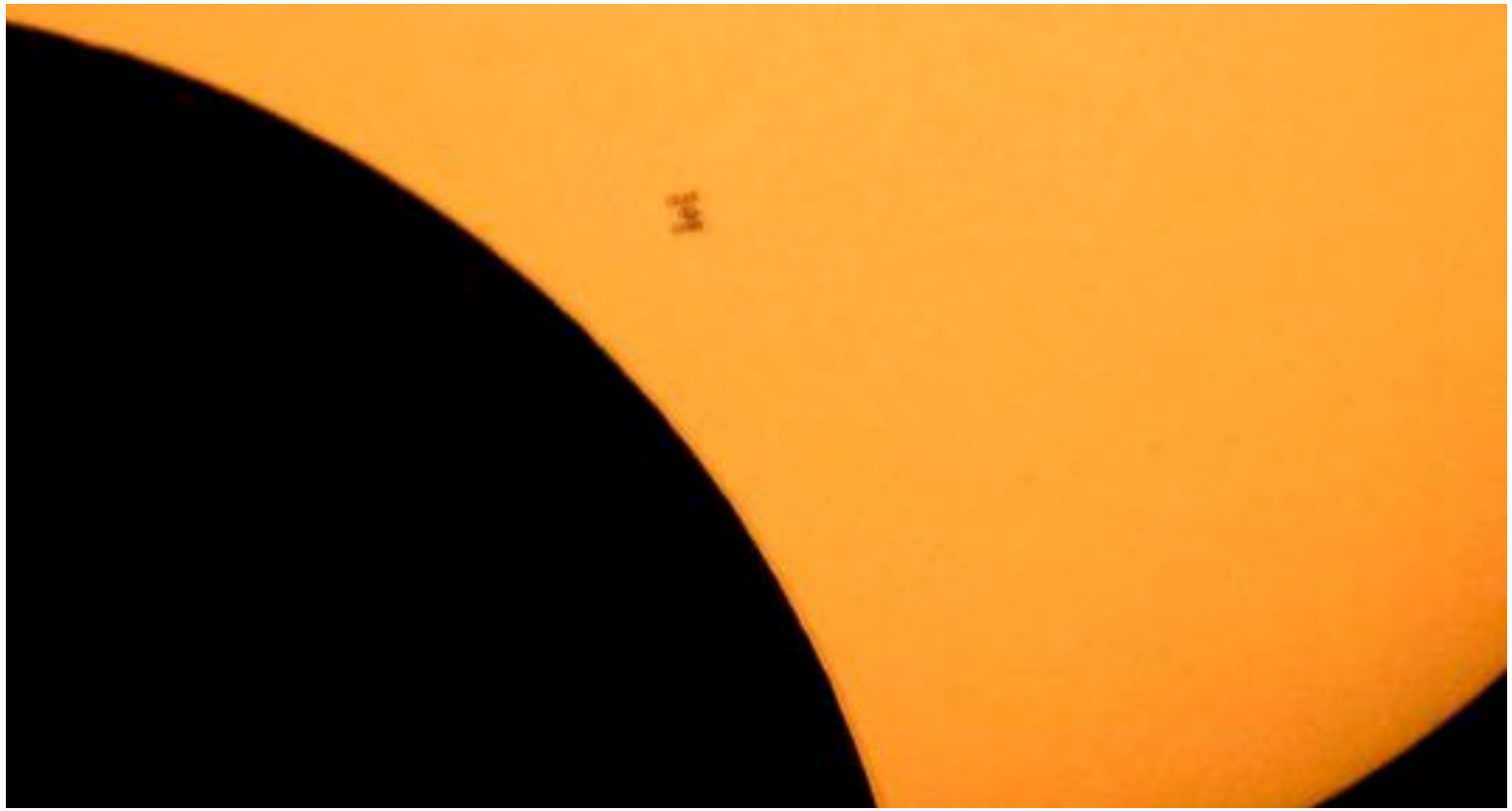
…Continued

- Common Interest and Cooperation
  - *Exploration and use of outer space, … shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, [without discrimination … on a basis of equality] and in accordance with international law and shall be the province of all mankind.*
  - *There shall be freedom of scientific investigation in outer space, … and States shall facilitate and encourage international cooperation in such investigation*. OST Art I
  - Opportunity to other States to observe; Report results OST Arts X-XII
  - See Apollo-Soyuz Test Project.

# Soyuz to ISS

NASA Image

# Solar Eclipse 21 Aug 2017



NASA Image

# Principles of Space Law

…Continued

- Access
  - All stations, installations, equipment and space vehicles on the Moon and other celestial bodies to be open to representatives of other States, subject to consultation and advance notice OST Art XII
- Non-Interference
  - Conduct activities with due regard to interests of other States
  - International consultations before any activity or experiment that would potentially cause harmful interference with activities of other States. OST Art IX
- Compliance with international law
  - Includes UN Charter. OST Art III

# PRINCIPLES OF SPACE LAW

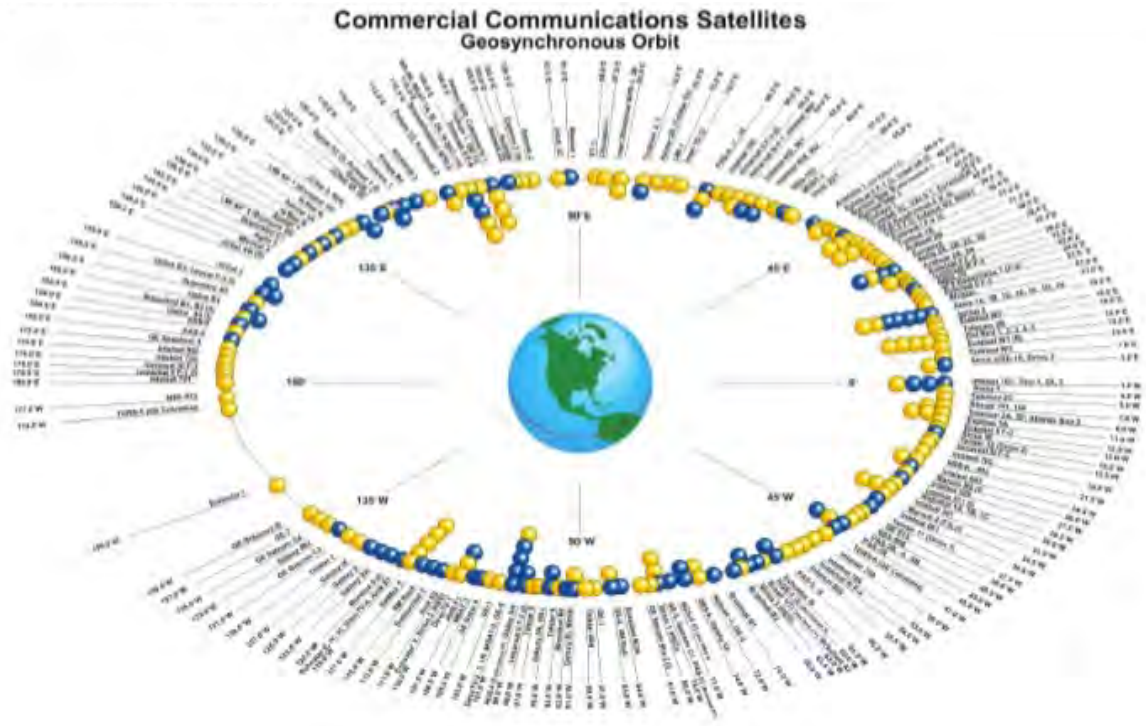
…Continued

- International Peace and Security
  - Measures taken by nations and international organizations, to ensure *mutual survival* and *safety*. OST Art III
  - Distinguish security of the unique space environment to be used safely and responsibly by all, including the physical and operational integrity of manmade assets in space and their ground stations, as well as security on Earth from threats originating in space-based assets
- Protection of Environment
  - Earth and Space. OST Art IX
- State Responsibility
  - States are responsible for their *national* space activities and must *authorise* and *supervise* private space ventures. OST Art VI

# PRINCIPLES OF SPACE LAW

…Continued

- Non-Interference and State Responsibility



# RESPONSIBILITY

- National Activity
  - States bear *responsibility* for *national activities* in outer space, whether carried on by *governmental* or *non-governmental* entities, and for assuring that national activities are carried out in conformity with the provisions in the present Treaty.
  - Activities of non-governmental entities require *authorization* and *continuing supervision* by the *appropriate* State. OST Art VI
- International Organisations
  - Responsibility for compliance with this Treaty by an international organization, carrying on space activities, shall be borne both by the international organization and by the States participating in such organization. OST Art XIII

# State Liability

- Responsibility Distinguished
  - OST Art VII creates liability for space activities distinct from Art VI.
  - Launching State internationally liable under Art VI even if not party to Liability Convention.
  - Liability Convention elaborates international liability.
- Definitions
  - "damage": loss of life or impairment of health; or loss of or damage to property of States or of persons, natural or juridical, or property of international intergovernmental organizations;
  - "launching" includes attempted launching; *Distinguish take-off*
  - "launching State": (i) A State which launches or procures the launching of a space object; (ii) A State from whose territory or facility a space object is launched. Liability Convention Art I

# JURISDICTION & CONTROL

- State of Registration
  - When a space object is launched into *Earth orbit or beyond*, the launching State shall register the space object by means of an entry in an appropriate registry which it shall maintain. Reg Conv Art II
- Jurisdiction
  - Jurisdiction and control of a space object vests in the registration State. OST Art VIII
  - The State can extend its laws to the space object and exercise control over it.
  - For examples see IGA and US IP laws
- Ownership
  - Not affected by presence in space or return to Earth. OST Art VIII

# Comparing Legal Regimes

- Air Law
  - National and international law regulating *civil* uses of airspace
  - Separate and Distinct - Aerospace Law
  - Airspace is under the sovereignty of subjacent states
  - Outer space governed as Province [Common Heritage] of Mankind
  - Aircraft safety and cross-border operation
  - Air-traffic control
- Air Space and Outer Space Boundary
  - COPUOS discussions
  - New space transportation systems

# Comparing Legal Regimes

…Continued

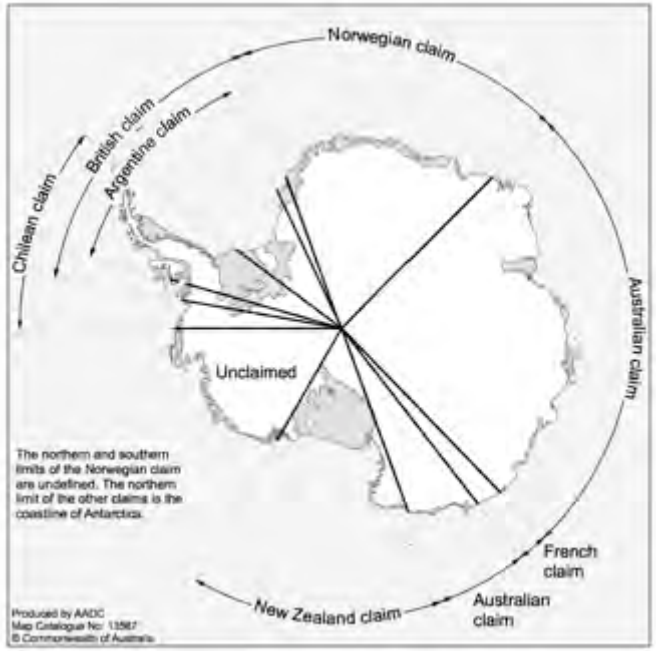
- Law of the Sea
  - Freedom of Access and Use
  - No Right of Appropriation or Sovereignty
  - Heritage of Mankind *cf* Province of all Mankind

- Differences
  - Right of Exploration and *Exploitation*
  - Resources Vested in Mankind as a Whole
  - *International Seabed Authority* Administers Resources

# Comparing Legal Regimes

…Continued

- Antarctica
  - Peaceful Purposes and Ban All Weapon Tests
  - No assertion or denial of a claim
  - No New Territorial Claims post 1961
  - Cooperation and Right of Inspection
  - Result of experiments freely available



# National Laws and Policies

- Discharging International Obligations
  - Licensing
  - Supervision
  - Liability
  - Telecommunication
- Implementing National Policy
  - Focus and terms of national laws vary
  - US most comprehensive
  - Administration of laws entrusted to different agencies, eg FAA-AST
    - Office of Commercial Space Transportation
- Relationship with International Law

# Developments of Legal Regime

- State monopoly
  - risky investment and security concerns
- Increased commercial element from 1980s
  - Telecom earliest private space service, articulated by Arthur C Clark in *Wireless World*, October 1945
  - Privatisation of Telecom, US breakup of AT&T
- Space Commercialisation Act and Private Launchers
- Upstream and Downstream
  - Infrastructure v. Applications

# National Laws

- Licensing and Authorisation
  - Some countries authorise each activity without licensing regime
  - Increasingly countries are adopting legislation and licensing schemes
  - Third party insurance and government indemnification – some limit
  - Spectrum assignment
- Typical Requirements
  - Notification of the launch date and location
  - Payload and orbital characteristics
  - Consistency with State international obligations
  - National security
  - State's liability for damages

# Space Applications

Session 4

# Applications

- Telecommunication
  - Spectrum management
  - Orbits
  - Content
- Remote Sensing – Earth Observation or EO
  - Sovereignty
  - Civilian and Military
  - Data
  - Privacy, Search and Warrants
  - NASA's Gravity Recovery and Climate Experiment (GRACE)
  - Distinguish tracking and telescope satellites
    - Canada Near Earth Object Surveillance Satellite (NEOSS)

# APPLICATIONS

…Continued

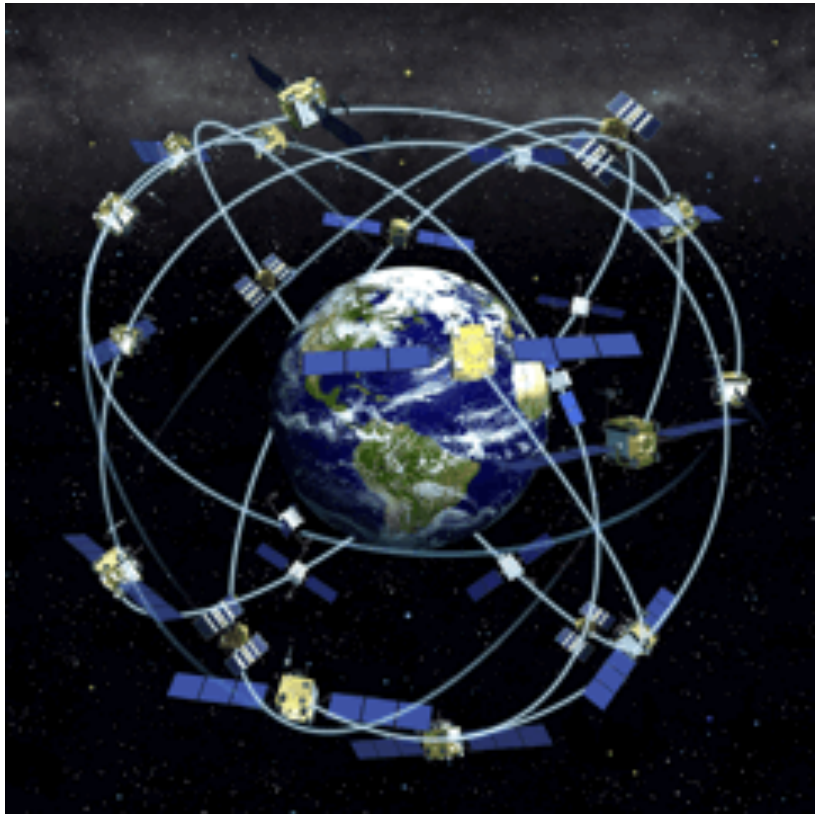
- Research
  - Non-commercial, mainly government and universities, and Commercial
  - Small Satellites

APPROXIMATE MAXIMUM WEIGHT

| Type | Pounds | Kg | NASA Kg |
|---|---|---|---|
| Mini-satellite (minisat) | 1,100 | 500 | ≥ 100 |
| Micro-satellite (microsat) | 220 | 100 | 10 – 100 |
| Nano-satellite (nanosat) | 22 | 10 | 1 – 10 |
| Pico-satellite (picosat) | 2.2 | 1 | 0.01 – 1 |
| Femto-satellite (femtosat) | 0.22 | 0.1 | 0.001 to 0.01 |

- Inexpensive and fast to construct and launch
- Universities and other educational and experimental
- Military use; Disaster relief
- PlanetLab
- Debris risk – life-span
- Spectrum - coordination

# Applications



GPS Constellation

# APPLICATIONS

…Continued

- Global Positioning System (GPS) and Global Navigation Satellite System (GNSS)
  - United States' NAVSTAR GPS and the Russian GLONASS are GNSSs. China is expanding BeiDou into the global Compass GNSS and the EU's developing Galileo.
  - Independence and interoperability – spectrum separation

- **Liability**
  - GPS free and operated by US military – State immunity
  - Galileo commercial element – Universally applied service terms
  - International agreement
- **Privacy**
  - Location is *personal information*

# APPLICATIONS

…Continued

- International Space Station ISS
  - Formed under IGA between Canada, ESA, Japan, Russia and USA 29 January 1998 – ESA representing 11 of its members, Belgium, Denmark, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, Switzerland and the United Kingdom.
  - Many MoUs govern specific arrangements and details.
  - Orbit at 330 to 410 kilometres
  - Spans 420 X 160 ft (128 X 49 m), including its solar arrays, area of U.S. football field, weighs nearly a million pounds (454 tons), not including visiting vehicles.
  - More liveable room than a conventional five-bedroom house, two bathrooms, a gymnasium and a 360-degree bay window.
  - Over 200 visitors

# APPLICATIONS

…Continued

- Space Transportation
  - ELVs
  - Private operators – SpaceX, X-Cor
  - Cargo delivery to ISS –SpaceX, May 2012
  - Personnel delivery to ISS – Soyuz
- Manned Space Travel
  - As of the end of October 2017 about 560 people from 37 countries; 3 sub-orbital; 24 beyond LEO; 12 walked on Moon
  - Sub-orbital "tourism" – *Jurisdiction and Control*, Reg Conv Art II
  - Regulatory approaches – Certification v Permit (Experimental)
  - Spaceports
  - Liability waiver
  - COSPAR Policy, and Guidelines for Mars missions

# UN Resolutions

- Remote Sensing Principles
  - Definitions
    - *Remote Sensing* Earth's surface from space using electromagnetic waves *emitted, reflected* or *refracted* by sensed object for *natural resource management*, *land use* and *environmental protection.*
    - *Remote Sensing Activities* Operation of system, data collection, processing, interpretation & disseminating processed data. Principle I
  - Benefit and interest of all countries; access to processed data. Principles II, XII
  - Remote Sensing Activities to respect *full and permanent sovereignty* of State and people over their *wealth* and *natural resources* and not to be detrimental to *legitimate rights and interests* of sensed State. Principle IV
  - Cooperation and participation - *equitable*. Principles V-VIII
  - Information about activities to UN and States affected. Principle IX
  - Protection of environment and from natural disasters. Principles X-XI

# International Disasters Charter

- Structure for cooperation between space agencies and space system operators – not an IGO
- Allows use of space facilities for the prediction and *management of disasters* arising from *natural* or *technological* causes
- Unified system for the acquisition and delivery of the data
- Provides mechanism for supply of data, information and other services, to States or communities influenced or threatened by disasters

# UN Resolutions

…Continued

2. Resolution 1884 (XVIII), calling on States not to place in Earth orbit or on celestial bodies any nuclear weapons or other weapons of mass destruction (adopted 17 October 1963)
   - OST Article IV, without prohibition on encouragement or participation in such activities; Resolution 1884 (XVIII), Para. 2(b).
3. Principles Governing Use by States of … Satellites for International Direct Television broadcasting (adopted10 December 1982 in Resolution 37/92).
   - Resolution 110 (II) 3 November 1947, condemned propaganda designed, likely to provoke or encourage threat to peace or act of aggression.

# UN Resolutions

…Continued

- International Direct TV Broadcasting
  - *Sovereign rights* of States and non-intervention.
  - Right to receive and impart information and ideas.
  - Promote free dissemination and exchange of information and knowledge.
  - Respect *political* and *cultural* integrity of States.
  - States bear responsibility.
  - State intending to establish service shall immediately notify and consult receiving State.
  - Observe ITU regulations.
  - Unavoidable overspill *exclusively* governed by ITU rules.

# COMMERCIAL SPACE

Session 5

# Commercial Activities

- Activities conducted by Government are not necessarily non-commercial
- OST recognised and provides for private space activities
- Range of Current Activities
  - Launch services, satellite communications, and remote sensing
  - Telecom earliest private space service; Privatisation of telecom, US breakup of AT&T in early 1980s; see Arthur C Clark in *Wireless World*, October 1945
  - *NewSpace* Those products and services not under contract to NASA
- Planned
  - Missions beyond Earth's orbit: Missions to the Moon, Mars & lunar habitat
  - On-orbit activities: Life extension, graveyard transfer, refuelling & service
  - Resource utilisation: Extraction of elements from asteroids and other bodies

# Impact of National Laws

- State responsibility *and* liability
- Obligation to *Authorise* and *Supervise*
- *Jurisdiction* and *Control*
- Licence conditions
  - Permitted activities
  - Insurance
  - End of life

# Human Flight

Re-entry of Apollo 8

27 December 1968

# Human Flight

Asked what he thought of man's attempt to reach the Moon,

Dr Albert Schweizer replied:

"Poor Moon"

1959 at Grünsbach in the Alsace

# HUMAN FLIGHT

- Space or Airspace
- Liability Waivers and Cross-waivers
  - *Informed* Consent
  - Municipal Law Requirements – NY, EU and UK
    - EU Directive 93/13/EEC; Unfair Terms in Consumer Contracts Regulations 1999, Reg 4
- Certification or Permit
- Federal Aviation Administration - AST in US
- UK Approach Developed by CAA
- European Aviation Safety Agency - EASA
  - Was developing European approach and regulation

# Property Rights

- Ownership of Property
  - *The Gods Must be Crazy*
  - Legal relationship between a person and property
  - Affected by law and other factors
  - At a minimum, owner's government will exclude others from the use or enjoyment of owner's possession without consent
- Ownership of Space Objects
  - Not affected by presence in space or return to Earth
  - Applies to objects constructed on a celestial body  OST Art VIII

# PROPERTY RIGHTS

…Continued

- Ownership of Space Resources
  - Jurisdiction  OST Arts II & VIII
  - Right to remove samples for experiment  Moon Agt Art 6(2)
- Non-corporeal Property
  - Nature
  - Jurisdiction and control
  - Priorities
- Salvage
  - Right against property saved – *in rem*
  - In Admiralty specific rights created by law
  - Action must be entirely voluntary

# US LEGISLATION

- Space Resource Exploration and Utilization [51 USC, Ch 513]
  - Asteroid resource.—The term "asteroid resource" means a space resource found on or within a single asteroid
  - Space resource.—
    - (A) IN GENERAL.—The term "space resource" means an abiotic resource ***in situ*** in outer space.
    - (B) INCLUSIONS.—The term "space resource" includes water and minerals
  - A United States citizen engaged in commercial recovery of an asteroid resource or a space resource under this chapter shall be entitled to any asteroid resource or space resource obtained, including to possess, ***own***, transport, use, and ***sell*** the asteroid resource or space resource obtained in accordance with applicable law, including the *international obligations of the United States*

# LUXEMBOURG LEGISLATION

- Luxembourg passed a space resources law, July 2017
  - Grants companies, including those operating out of the country, ownership of space resources they extract, similar to provisions in the Commercial Space Launch Competitiveness Act 2015.
  - Both the U.S. and Luxembourg laws grant ownership to resources only after they have been extracted, attempting to avoid potential conflicts with the Outer Space Treaty, which prohibits countries from appropriating any part of space or celestial bodies *by any means*.

# Spectrum and Orbit Management

Session 6

# SATELLITE COMMUNICATION

## Space Policy and Law Course 2017

*Orbit & Spectrum Management and the ITU - Challenges in 21st Century*

*Harmful Interference to Space Services*

*Regulation and Licensing of Small Satellites*

*Attila Matas*

***Satellite Orbit/Spectrum Consultant***

***Former Head of Space Publications & Registration, ITU***

17 October 2017, London

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# Military Use & Weapons

Session 7

# Military Use & Weapons

**Space Policy and Law Course 2017**

***Military and Other Uses of Space***

*Ralph Mark Dinsley ("Dinz")*

***Northern Space & Security; Squadron Leader, RAF (Rtd)***

17 October 2017, London

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# Military Use & Weapons

- Military Use and Personnel
- Weapons
  - Hague Code of Conduct against Ballistic Missile Proliferation HCoC
  - Missile Technology Control Regime – MTCR
  - Wassenaar Arrangement – Transparency, responsibility in conventional arms and dual-use technology transfers
- Drones

# Peaceful Use & Arms Control

- Meaning of Peaceful Use
  - Non-aggressive
  - Defence and international security
- Weapons
  - States undertake not to place in orbit around the Earth any objects carrying *nuclear weapons* or any other kinds of *weapons of mass destruction*, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.
  - All weapon tests and military manœuvres banned. OST Art IV
  - No general prohibition, eg lasers; see *Protocol on Blinding Laser Weapons*
  - Definition of weapon and Dual use – Cyber Security, Signal Jamming
  - Conference on Disarmament, PAROS (1982 Russia) and PPWT (2008 China)
  - Principles of Responsible Behavior in Outer Space (PORBOS) (2017 EU)

# Liability & Insurance

Session 8

# Liability & Insurance

**Space Policy and Law Course 2017**

***Risks and Liabilities***

*Nick Hughes*

***Partner, HollmanFenwick Willan; ISPL Faculty***

*Neil Stevens*

***Space Insurance Expert; ISPL Faculty***

17 October 2017, London

London Institute of Space Policy and Law

# Liability & Insurance

- Risks
  - Commercial
  - Policy and regulatory
  - Physical
- Insurable Risks and Insurance

  - Nick Hughes and Neil F Stevens

# Absolute and Fault Liability

- State Liability based on place of damage
  - A launching State shall be *absolutely* liable to pay compensation for damage caused by its *space object* on the *surface of the Earth* or to *aircraft in flight*. Liability Conv Art II
  - Where damage is caused *elsewhere than on the surface of the Earth* to a *space object* of one launching State or to *persons or property on board* such a space object by a space object of another launching State, the latter shall be *liable only if* the damage is due to its *fault* or the fault of persons for whom it is responsible. Liability Conv Art III
- Fault
  - *Fault* in international law is "any act or inaction that violates an obligation or duty."

# Operators' Liability

- Basis of Liability
  - Indemnification of Government
  - Licence Conditions
  - Domestic Law
    - Manufacturers' product liability
    - Tort
- Different Approaches
  - Full indemnity
  - Insurance limit
  - Other

# Operators' Liability

- UK Licensees
  - Indemnification of Government capped to €60 million in 2015
  - Third party insurance €60 million
  - Draft Spaceflight Bill
    - Licence conditions *may* limit indemnity
    - Minister – no indication of limit
- US, France, Australia and Others
  - Government bears excess of liability over operator's insurance
  - Not limited to State liability

# Space Security

Session 9

- Space hazards - Man made and natural
- Space Weather, Meteorites, Debris
- Debris Reduction and Elimination Measures
- Transparency and Confidence Building Measures

# SPACE SECURITY

**Space Policy and Law Course 2017**

***A Sustainable Space Environment***

*Professor Richard Crowther*

***Chief Engineer, UK Space Agency; ISPL Adviser***

17 October 2017, London

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# Background

- About 1,400 satellites; 80 Countries & organisations
- Civilian and Military systems providing
  - Earth Observation; Environmental Monitoring
  - Early Warning & Reconnaissance; Navigation
- Threats and Hazards
  - Debris; Space weather; Signal jamming and cyber attacks; ASAT
- Threats and Responses similar for all
- Dependence, ownership and sovereignty complicate
- Common strategy to improve resilience

# SUSTAINABILITY

- Debris Reduction
  - IADC Definition: Space debris are all man made objects including fragments and elements thereof, in Earth orbit or re-entering the atmosphere, that are *non functional*.
- IADC Debris Mitigation Guideline
  - Adopted by UN COPUOS LSC
- Active Debris Removal ADR
- Need for Space Situational Awareness SSA
  - Autonomous Satellites - Air University Report
- Confidence Building Measures and Transparency CBMT

# Current & Future Developments

Session 10

- Spaceflight and Spaceports
- Launch Systems
- Constellations and Small Satellites
- Focus on Applications

# Current & Future Developments

**Space Policy and Law Course 2017**

***Constellations, Launch Services and Spaceports***

*Professor Richard Crowther*
***Chief Engineer, UK Space Agency; ISPL Adviser***
*Andrew Ratcliffe*
***Head of Launch Systems, UK Space Agency***
17 October 2017, London

London Institute of Space Policy and Law

# Satellite Constellations

- Uniform design and construction
- Licensing
- Spectrum assignments
- Cube-Sats
  - Commonality of platform and delivery systems
  - Short construction and low cost
  - Simplified authorisation process and single fee

# Focus on Applications

- Economic and Industrial Policy
- Market size and Growth
- Foreign investment

# Case Studies

Session 11

# Review & Conclusion

Session 12

# Ambiguities or Problems

- Definitions Missing or Inadequate
  - *Outer Space*, *Space Object* and *Debris*
  - *National Activities* and *Launch*
  - Defence Articles for ITAR
- Equitable Sharing of Benefits
- Not clear about non-physical damage
- Military Use and Arms
- Cyber Security

# The Future

- Military Use and Weapons
  - Definitions of *peaceful use* and legitimacy of *self-defence*
  - Weapons and prospects for PAROS, PPWT, PORBOS
  - UN COPUOS, Conference on Disarmament and PPWT
- Space Resources
  - Commercial plans
  - US & Luxembourg Legislation; Bigelow Letter
- Sustainability of Orbits
  - Active Debris Removal, ADR
  - Transparency and Confidence Building Measures, TCBM
  - SDA; ProtoStar
- Small Satellites
  - Cost, Production speed and Regulation

# Where Next

NASA Image