Introducing A New Framework for Space Traffic Management (STM)

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STM FRAMEWORK: SGAC

This presentation will present a range of ideas and concerns from young students and professionals regarding the space environment. From those consultations and general recognition that additional means of prevention and identification is required a basic framework for establishing STM control will be introduced.

STM FRAMEWORK: GOALS

"To initiate a comprehensive system that would safe guard the resources of outer space and human explorations for future generations, as well as ensuring a safe space and earth environment for the innocent passage of traffic in accordance with Outer Space Treaty 1967 and international law."

STM FRAMEWORK: Purpose and Methodology

- **Purpose**

  To *provide a working mechanism for designating, identifying and routing as well as re-routing traffic accordingly.*

- **Methodology**

  To find coherent rules within existing international and national laws and regulations, which ensures international co-operation between civilian, commercial and military operators.

STM FRAMEWORK: Management

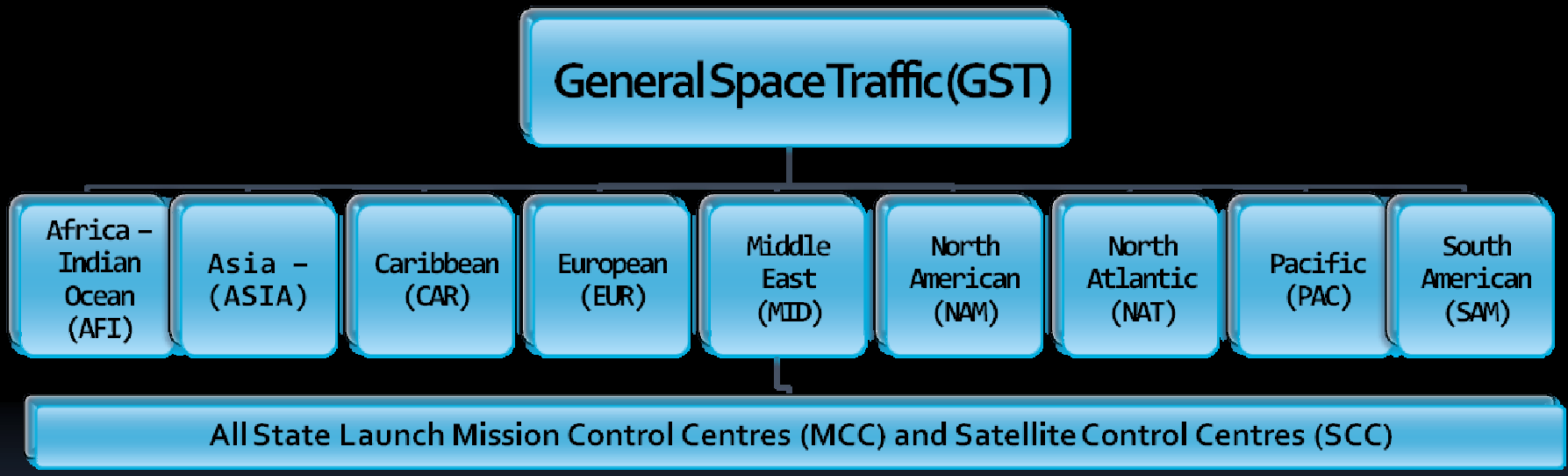
- Air Traffic Control
  - Operational Air Traffic
  - General Air Traffic
- Separate STM Services
  - Military Operational Space Traffic (MOST)
  - General Space traffic (GST)
    - CIVil Space Traffic (CIVST)
    - COmmercial Space Traffic (COST)

STM FRAMEWORK: The Network

- International Civil Aviation Organisation (ICAO)
  - Nine Air Navigation Regions
- International (regional) communication ground Telemetry, Tracking and Control (TT&C) network.
  - Mission Control Centres' – Launch Provider
  - Satellite Control Centres' – Owner/Operator
  - Nine regionally designated Centres

STM FRAMEWORK: The Network Composition

Mission - Telemetry, Tracking and Control (M-TTC) Centres



- Spaceflight Information Information Regions
- Designating Regional M-TT&C Centre
  - MCC - location of launch site/provider
  - SCC – location of the owner/operator
  - Transfer of Services

STM FRAMEWORK: MOST

- Military Agency – MOST
  - Identification Code

ICAO Annex 11	STM Framework
"To permit information relevant to the safe expeditious conduct of flights of civil aircraft to be promptly exchanged between air traffic services units and appropriate military units."	*"To permit information relevant to the safe expeditious conduct of GST to be promptly exchanged between regional M- TT&C Centres and appropriate military units."*
"Air Traffic Services units shall, either routinely or on request… provide appropriate military units with pertinent flight plan and other data concerning flights of civil aircraft."	*Regional MC-TT&C Centres shall, either routinely or on request… provide appropriate military units with pertinent SPACEFLIGHT plan and other data concerning GST."*

STM FRAMEWORK: Spaceflight Plan

- Spacecraftight Plan
  - Launch date and time
  - CIVST and COST identification
  - Launch Provider / Spaceport
  - Space Launch Vehicle / Spaceplane
  - Operator
  - Payloads
  - Designated Regional M-TT&C Center
  - Spacecraft Approach Sub-Orbital or Orbital Plan information e.g. Pre-launch Keplerian Elements (if applicable and is not MOST)
  - MOST Identification Code
  - Descending/Re-Entry information
  - Astronauts / passengers (human spaceflight mission)

STM FRAMEWORK: Space launch

- Space launch and Flexible Use of Airspace concept
- Space traffic includes space objects ascending and descending (including re-entry) between Initial Sub-Orbital/Orbital Launch Phase and Spacecraft Sub- Orbital/Orbital Approach Phase.
- Space object includes component parts of a space object as well as its launch vehicle and parts thereof (Liability Convention Article 1d)

STM FRAMEWORK: Space launch continued

- Sub-Orbital activity includes sounding rockets, weather balloons, Zero Gravity flights and Space Tourism.
- Initial Sub-Orbital/Orbital Launch Phase
  - Attempted launch
  - Spaceflight phases
  - International 'Transitional Airspaceway' to enable the continual movement of traffic
    - Mesophere 50km to 90/100km

STM FRAMEWORK: Space launch continued

- Spacecraft Sub-Orbital/Orbital Approach Phase
  - Spacecraft separation to Orbit Injection/insertion
  - Orbital manoeuvers' including re-orbiting
  - Transfer from Spacecraft Approach Phase to Final Graveyard Orbit (De-orbit).

STM FRAMEWORK: Services

Regional M-TT&C Centres	
Mission Control Services	Telemetry, Tracking and Control Services
Launch Clearance	Orbit screening
Re-entry Clearance	Orbital manoeuvers
Pre-launch safety assessment	Re-orbiting and de-orbiting

- Facilitating on-support - Advanced notifications not to be re-distributed outside of the STM inner network

STM FRAMEWORK: International Liability

- Outer Space Treaty 1967
  - Article VIII –jurisdiction and control
  - Article VI – international responsibility
  - Article VII – international liability
- Liability Convention 1972
  - Article I (d) – space object
  - Article III – Fault liability
    - The state/commercial operator that suffered the damage would have to prove the other state/commercial operator was at fault. No formal identification of component parts and difficult to prove jurisdiction and control under Article VIII of the OST.

STM FRAMEWORK: International Liability

- New international organisation
  - Inter-agencies representing each of the regional M-TT&C Centres
  - Develop Space Debris Liability and Arbitration System
    - Identification procedures
    - Compulsory insurance - Standard financial costing for minor, moderate to significant damage
- Objects not or never catalogued and in the absence of any legal fact to base ownership indemnification lies with insurance companies. National space laws.

USA: Space Situational Awareness

- Space Surveillance Network (SSN)
  - Air Force Space Command's Joint Space Operations Center Mountain (JSpOC-Mtn)
  - Space Shuttle
  - International Space Station
- Public Law Chapter 135, Title 10 United States Code §2274- satellite-tracking support to entities outside the US Government under a pilot program.

USA: Space Situational Awareness

- Commercial Foreign Entity Program (CFE)
  - Eligibility
  - Agreement
  - CFE Program initiated through space-track.org. Full Congressional pilot program yet to be implemented
  - Complete fee program includes launch support, conjunction assessment, end-of-life/re-entry support, and anomaly resolution support.
  - CFE extended to September 2009

STM FRAMEWORK: Conclusions

- SSN – data coverage issues and functionality as a continuous STM system. SSN is also subject to national laws and funding.

- Utilising all regional based sensors AFI ASIA; CAR; EUR; MID; NAM; NAT; PAC; SAM this would provide optimum coverage to enable an international communication ground based Mission-Telemetry, Tracking and Control (M-TT&C) network to be initialised under an international STM Framework.
  - ensure the safe, expeditious conduct of all space launches and satellite operations.

STM FRAMEWORK: Conclusions

- Space Debris Mitigation Guidelines issued by Inter-Agency Space Debris Coordination Committee (IADC).

- STM Framework natural development
  - Protocol to the Liability Convention; equivalent flexible use of airspace policy with regard to MOST and GST; transition between ATC and STM with an ultimate end goal single flexible use of the airspaceway.

STM FRAMEWORK: Conclusions

- The words of Chief Justice Earl Warren in an address delivered in February 1963 at the Georgia Institute of Technology still echo,
  - *"there is no reason why we cannot make legal research accomplish the same function as scientific research. This means that the law should no longer wait to be stirred by crises. The law should anticipate changing conditions. It should anticipate impending crisis. It should in other words look to the future, and as the future beckons humans into outer space, we must look there to for the rule of law"*

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SPACE GENERATION

the global space youth network

in support of the United Nations Programme on Space Applications

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