

# Overview

- Background and Authority
- What We Do Today
- Tomorrow's Challenges
- The Way Ahead
  - National Space Policy – Increased Emphasis on Commercial
  - National Designation of some form of On-orbit Authority
  - Regulating On-orbit Human Spaceflight and Debris Management
  - National and International Exploration of Space Traffic Management Concepts
- Conclusions



# Background

- The U.S. space program today has 3 sectors:
  - Civil
  - Military
  - **Commercial**
- The commercial sector was recognized in 1984 with the passage of the Commercial Space Launch Act, now codified in Title 51
- Regulatory oversight for the commercial sector was given to the Office of Commercial Space Transportation (AST), which was originally a staff office within the Department of Transportation.



# FAA Authority

- **Title 51 U.S. Code Subtitle V, Ch. 509**
  - **Protect** the public, property, and the national security and foreign policy interests of the U.S
  - Oversee and coordinate **commercial launch and reentry operations** including those with **crew and space flight participants**.
  - Issue **permits and licenses** and transfer licenses authorizing those operations.
  - **Promote economic growth** and entrepreneurial activity through the use of the space environment for peaceful purposes.
  - **Encourage the U.S. private** sector to provide launch vehicles, reentry vehicles and associated services.
  - **Facilitate the strengthening and expansion** of U.S. space transportation infrastructure.



# What types of activities is AST involved in?

- Launch Sites
  - Launch Pads
  - Purpose Built Spaceport
  - Dual-use Spaceport/Airport



# What types of activities is AST involved in?



- Launch
  - Land Launched
  - Sea Launched
  - Air Launched

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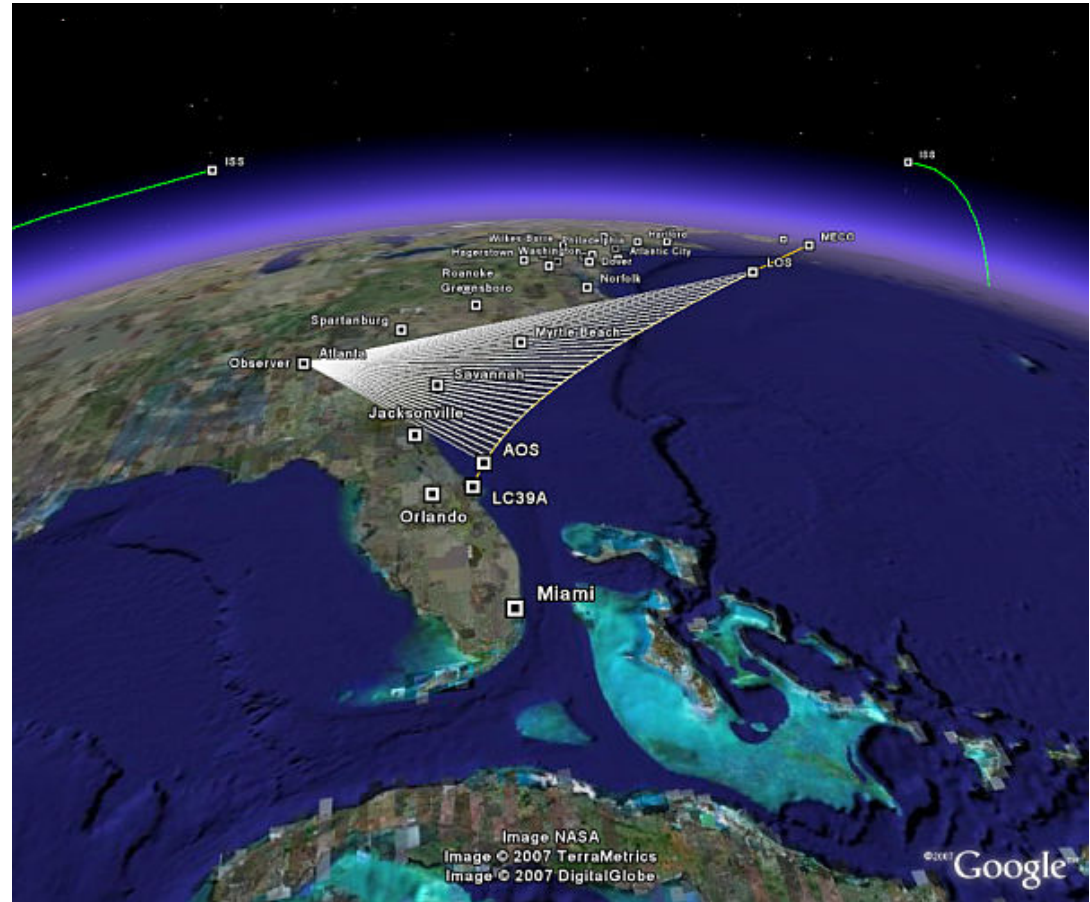


- Reentry
  - Sub-orbital Reuseable
  - Orbital
  - Intentional destructive reentry



# FAA Integrated Efforts

- As part of the license and permit evaluation process, **AST evaluates safety issues** of proposed launch and reentry operations and sites
- To ensure the **safety of the public and property**, safe launch and reentry requires operational deconfliction of
  - Space traffic
  - Air traffic
  - Sea traffic



Launch considerations from Cape Canaveral (Florida)

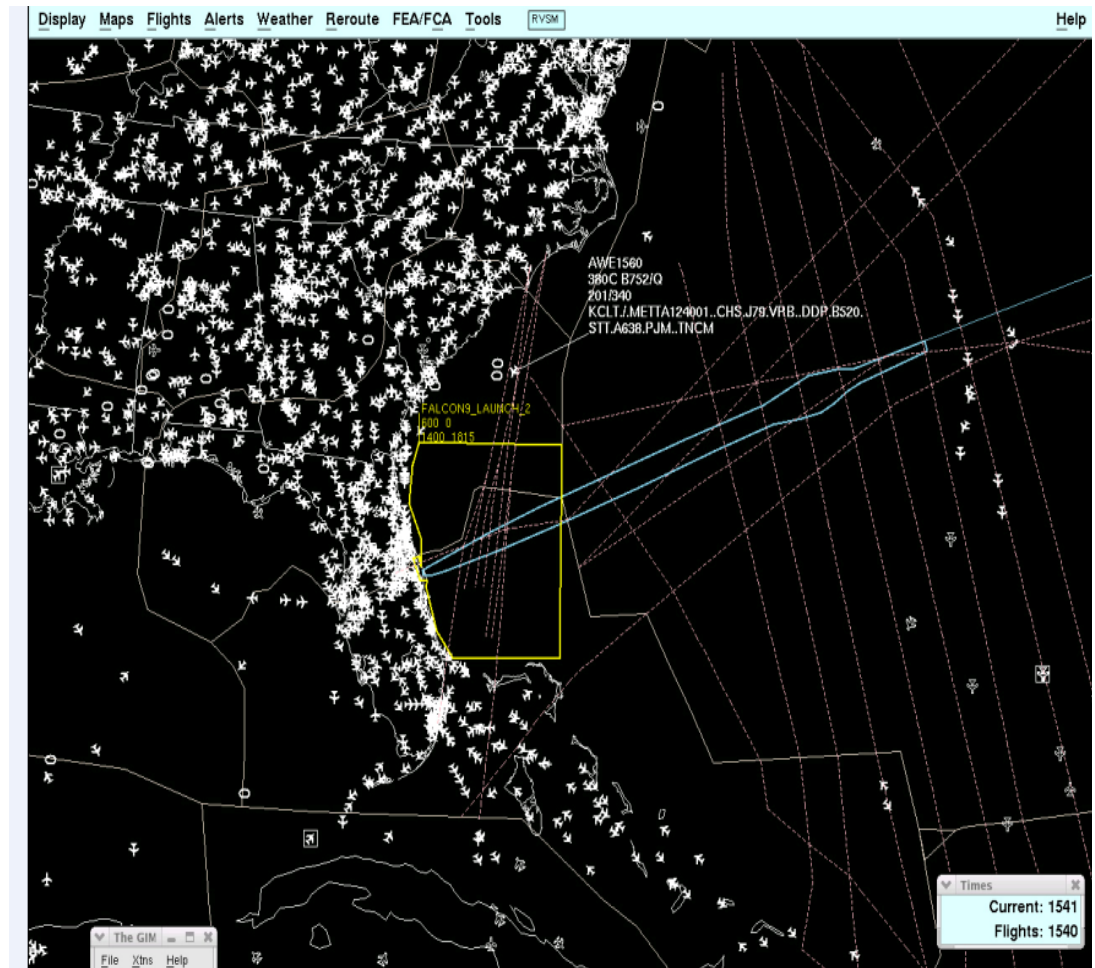
# FAA Integrated Efforts – *Launch*

For a licensed launch:

- AST performs flight safety analysis of a launch vehicle from a specific launch site
- ATO provides deconfliction of air traffic
- Other USG entities provide deconfliction of sea traffic, as well as launch and range support and collision avoidance

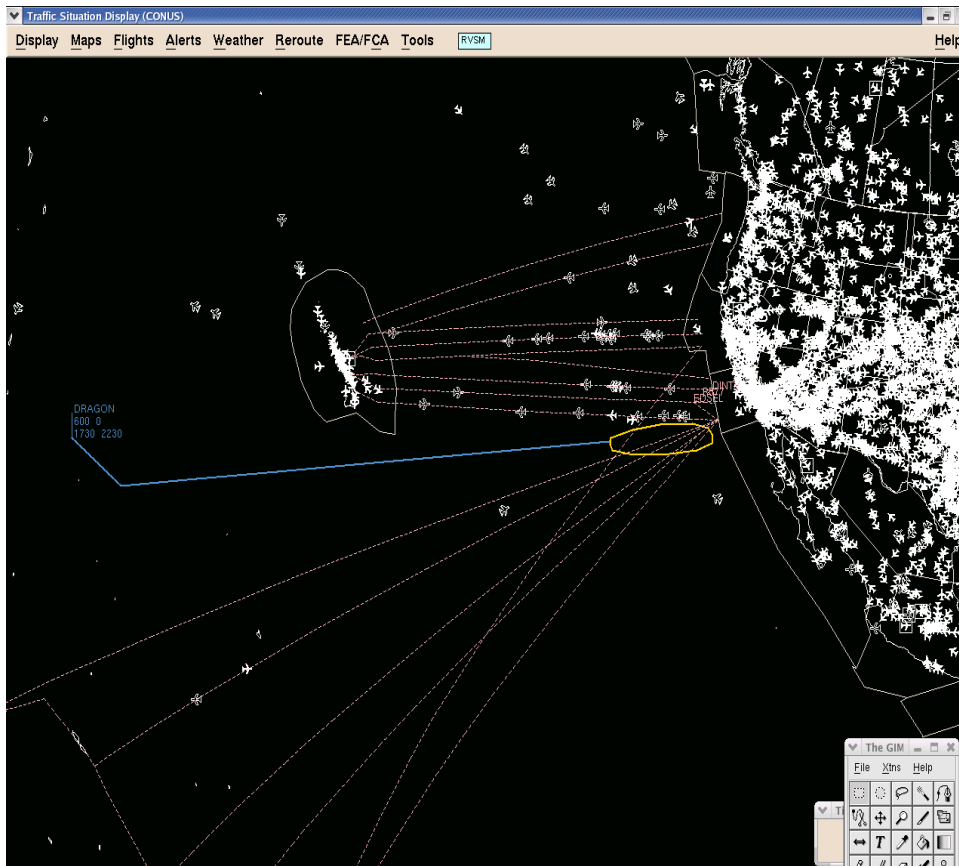
Example: East coast launch

- 3+ hour launch window
- Affected nearly 200 flights
- Ensured safety and effectively protected the environment





# FAA Integrated Efforts – *Reentry*



For a licensed reentry:

- AST performs hazard analysis of proposed reentry vehicle to a specific reentry area
- ATO provides deconfliction of air traffic
- Other USG entities provide deconfliction of sea traffic, as well as reentry support

Example: West coast reentry

- Analysis allowed for smaller hazard area
- Affected 41 flights
- Moved activity to less dense air routes
- Ensured safety and effectively protected the environment

# National Space Policy Goals

Leading Collaborative, Responsible,  
and Constructive Use of Space...

- **Energize Competitive Domestic Industries**
- **Expand International Cooperation**
- **Strengthen Stability in Space**
- **Increase Assurance and Resilience of Mission –Essential Functions**
- **Pursue Human and Robotic Initiatives**
- **Improve Space-based Earth and Solar Observation**



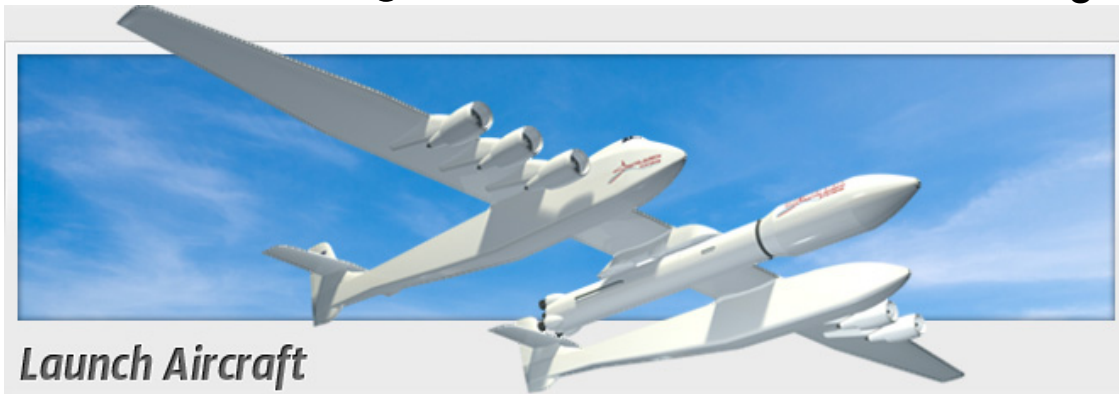
# Suborbital Reusable Launch Vehicles (RLVs) – Space Tourism



Blue Origin's PM-1



Virgin Galactic's WhiteKnightTwo  
and VSS Enterprise

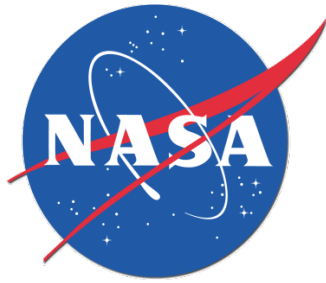


Launch Aircraft

Stratolaunch Systems



XCOR's Lynx



# **Orbital** Reusable Launch Vehicle activity – Commercial Orbital Transportation Services and Commercial Resupply Services Contract Award

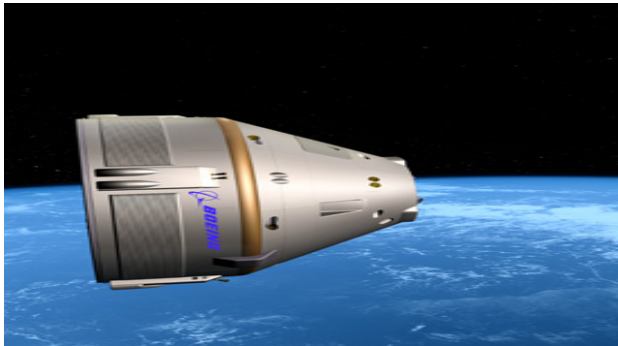


Michael McElligott  
CCMC  
January 19, 2012



Federal Aviation  
Administration

# ***Orbital* Reusable Launch Vehicle activity (cont.) – Commercial Crew Development Program (CCDEV)**



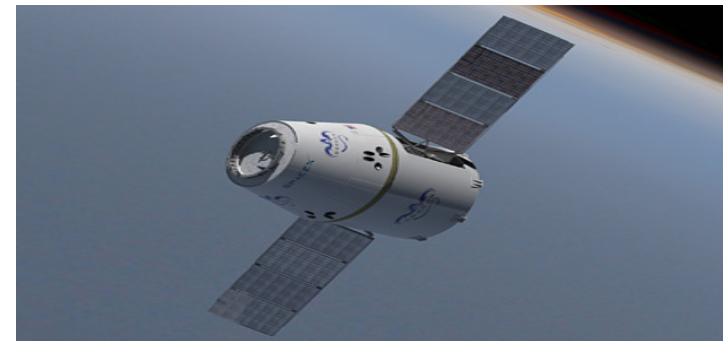
**Boeing's CST-100**



**Blue Origin Crew Transportation System**



**Sierra Nevada Corporation Dream Chaser**



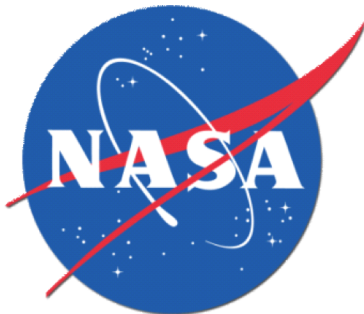
**Space-X Dragon Capsule**

# NASA and FAA Approach to Human Safety

- NASA and FAA approaches to human safety are based on their respective missions
- Different missions lead to different approaches



- Is the regulator for a new, broad and varied industry
- Is charged with allowing the industry to develop
- Is focused only on the safety of public and spacecraft occupants
- Mission success is launch customer's requirement
- Results in regulations that are more general and performance based



- Is a customer with a system level need (support ISS)
- This translates to detailed system requirements
- NASA has its own requirements for the safety of its crews
- Is willing and able to pay for top quality systems

# Emerging Issues

- National Reliance on Commercial Launch Providers
- Bifurcation of Commercial Launch Activity
  - Reuseable Launch Vehicles
    - Predominantly sub-orbital
    - “Space Tourism”
    - Scientific Research e.g., microgravity
  - Expendable Launch Vehicles
    - Predominantly Orbital Vehicles
    - Launching Commercial Satellites
    - Transporting Supplies and People to the International Space Station
    - Supporting Operation of Commercial Space Stations



# Emerging Issues

- Creates Divergent Medical and Space Weather Requirements
  - Sub-orbital Regime
    - Space Flight Participants: Probably one-time, short duration exposure
    - Crew: Repeated, short exposure over long period of time (airline pilot)
  - Orbital Regime
    - Longer duration and increased risk within space environment
    - Crew and passengers likely share same total risk
- Both scenarios stress accurate depiction of space Environment and improved modeling capabilities
- Information latency and full operational integration will be essential for safety of crew and spaceflight participants



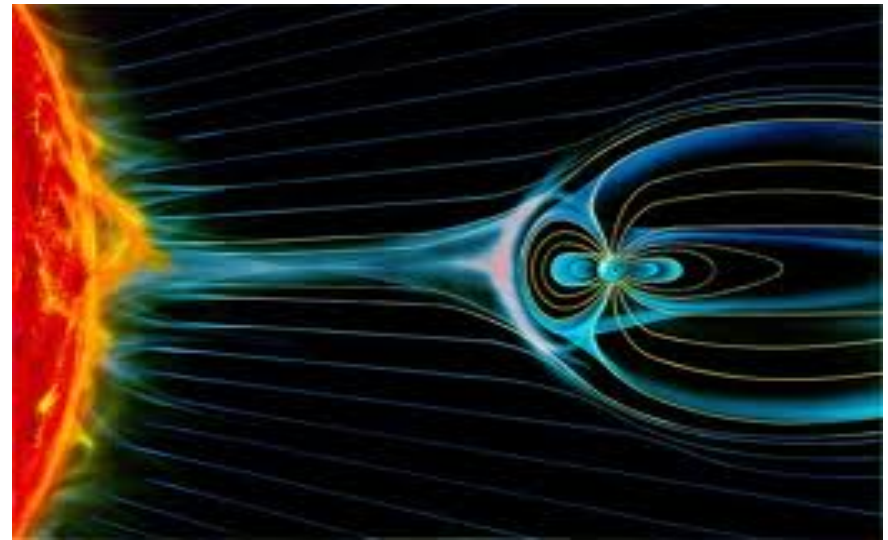
# FAA Space Weather Hazards and Risks

## Extremely serious consequences for human safety and mission assurance

- Crew and spaceflight participants could be exposed to extremely high doses of radiation
- Loss of safety critical communication with spacecraft could make response and evasive maneuvers more difficult
- Loss of spacecraft tracking could have safety implications

## Operational Effects:

- Degradation of spacecraft tracking and power systems
- Satellite disorientation and drag
- Interference with Satellite Communications, Radar, and High Frequency Radio Communications
- Loss of navigation, navigation errors or loss of signal
- Electrical upsets and damage to satellites or spacecraft



Coronal Mass Ejection - Earth Interface

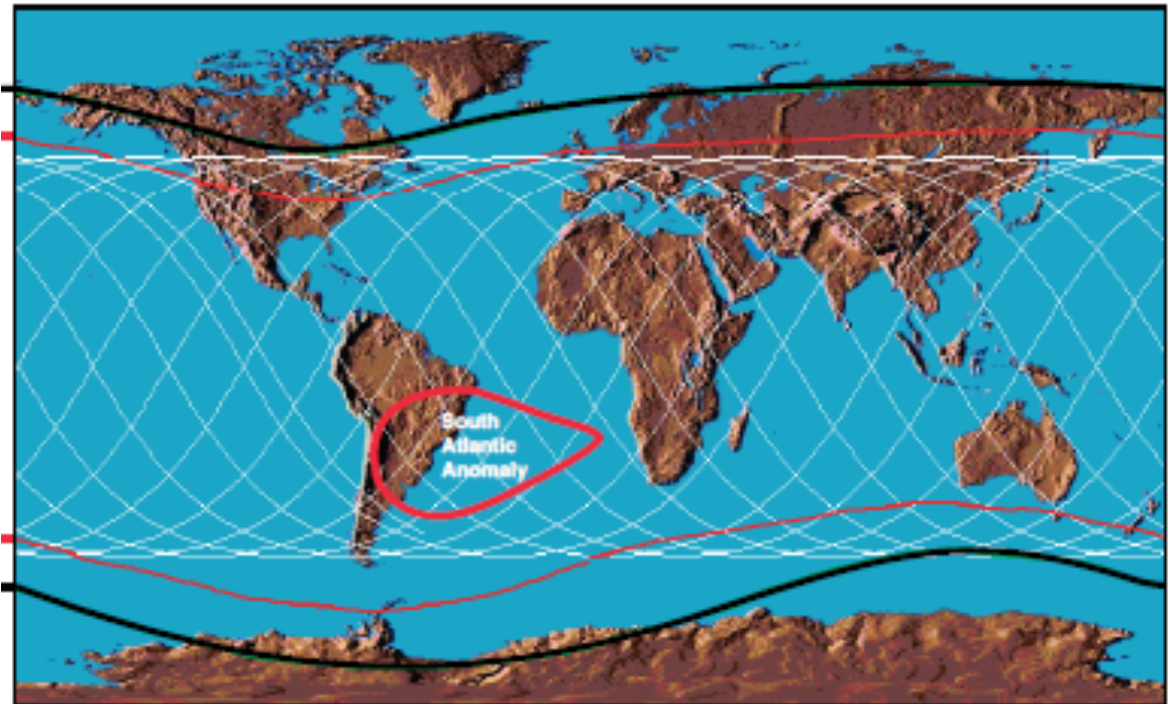
# Protecting the public w/Limited Authority

- AST has intensified its efforts to examine the public safety implications of sustained commercial space transportation operations on orbit, and to work cooperatively with other U.S. agencies to ensure the long term sustainability of space
- Per the 2010 National Space Policy, AST is working with other agencies to study and recommend options to reduce risk and enhance safe space launch operations including improved Space Situational Awareness and debris management
- AST is seeking to enhance Safety and Risk Standards for Human Spaceflight (on-orbit)
- In 2010 AST established an FAA Commercial Space Transportation Center of Excellence for Commercial space-related R&D



# Future Space Traffic Concerns

- Time/duration of transit through South Atlantic Anomaly
- Micrometeoroid/debris projection - Location/ time of impact
- Changes in orbital parameters
- Changes in energetic particle densities
- Time, duration, and location of communication disruptions
- Time, duration, and location of navigation errors



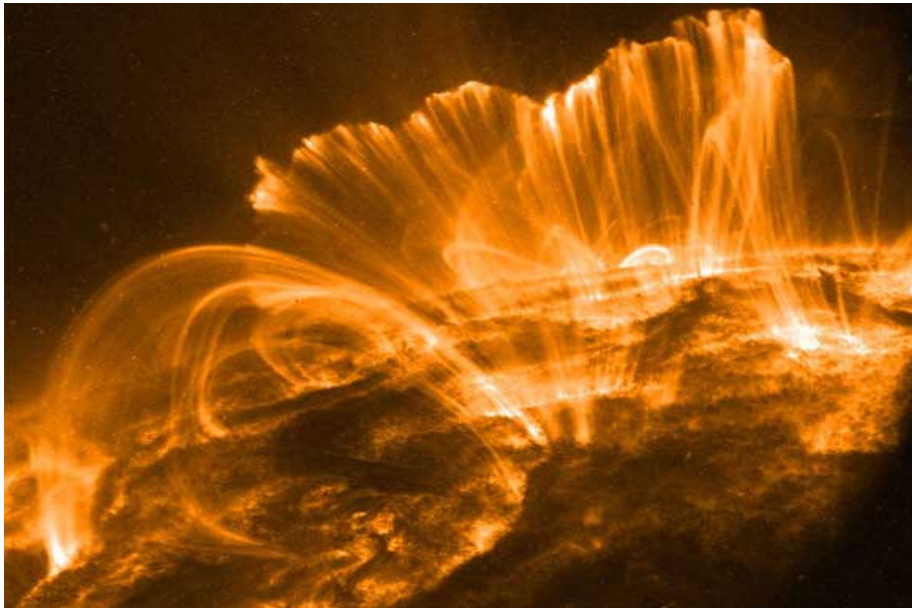
South Atlantic Anomaly

# Dual Approach to proposed Human Spaceflight regulations

- Two parts – process and core requirements
  - Process requirements require applicants to:
    - Use a system safety process for hazard analysis and risk assessment
    - Use human integration processes to manage capabilities and limitations
    - Validate and verify requirements
    - Maintain a “spaceworthy” system
  - Core safety requirements are minimum credible values for:
    - Cabin environment for human safety
    - Space system reliability
    - Human capabilities must match the tasks they are to perform



# Future FAA Space Weather Requirements



## Space weather needs for future commercial space activity

Nowcasts, forecasts and warnings of enhanced solar energetic particle events (along orbit) that could impact:

- Crew and spaceflight participants
- Safety Critical Electronics

Nowcasts, forecasts and warnings of ionospheric disturbances (along orbit) that could disrupt the spacecraft's (launch vehicle) communication and navigation systems

Nowcasts, forecasts and warnings of RSO's, or other space debris (along orbit)

Nowcasts, forecasts and warnings of trapped radiation from the South Atlantic Anomaly (SAA)

# Conclusions

- Development of a new segment of the aerospace industry -- Commercial Human Space Flight -- is well underway.
- Congress, through the Commercial Space Launch Amendments Act, has directed the FAA to “encourage, facilitate, and promote” this new activity in a way that continuously improves its safety.
  - Critical to safety is integration of comprehensive, relevant, timely space weather information
- The Office of Commercial Space Transportation is committed to doing our part to enable this exciting new part of the industry.





# Questions

