

# Emerging Issues for the FAA Office of Commercial Space Transportation



**Federal Aviation  
Administration**

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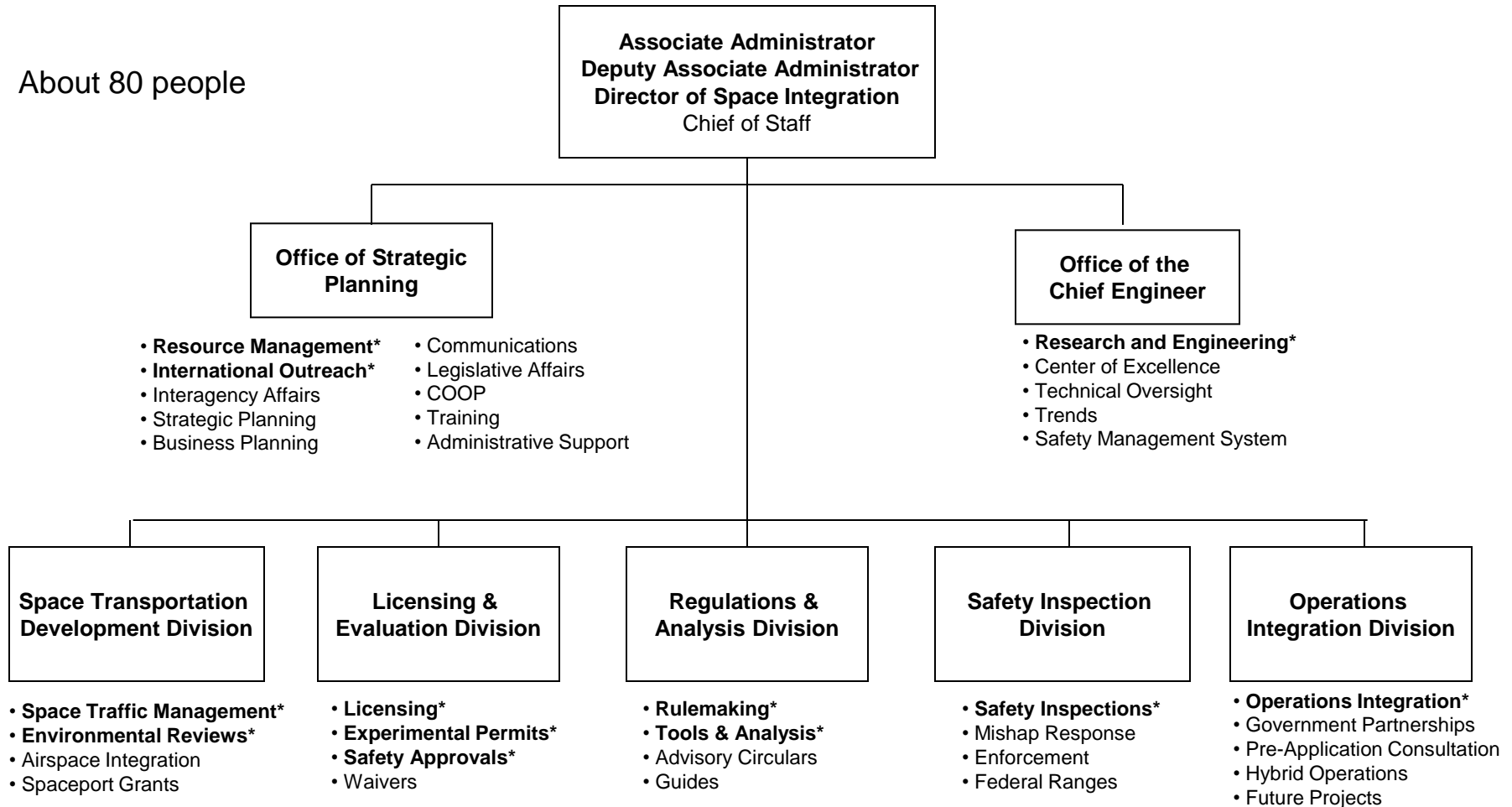
# Department of Transportation, Federal Aviation Administration- Statutory Authority

## 51 U. S. C. Chapter 509 (formerly the Commercial Space Launch Act of 1984, as amended)

- Authorizes the FAA\* to license commercial launch and reentry activities and the operation of launch and reentry sites as carried out by U.S. citizens or within the United States.
  - Directs the FAA to:
    - Exercise this responsibility consistent with **public** health and **safety**, safety of property, and the national security and foreign policy interests of the United States, and
    - Encourage, facilitate, and promote commercial space launches and reentries by the private sector.
- \* The Secretary of Transportation's licensing authority has been delegated to the Administrator of the FAA and further assigned to the Associate Administrator for Commercial Space Transportation (AST).

# AST Organization & Responsibilities

About 80 people

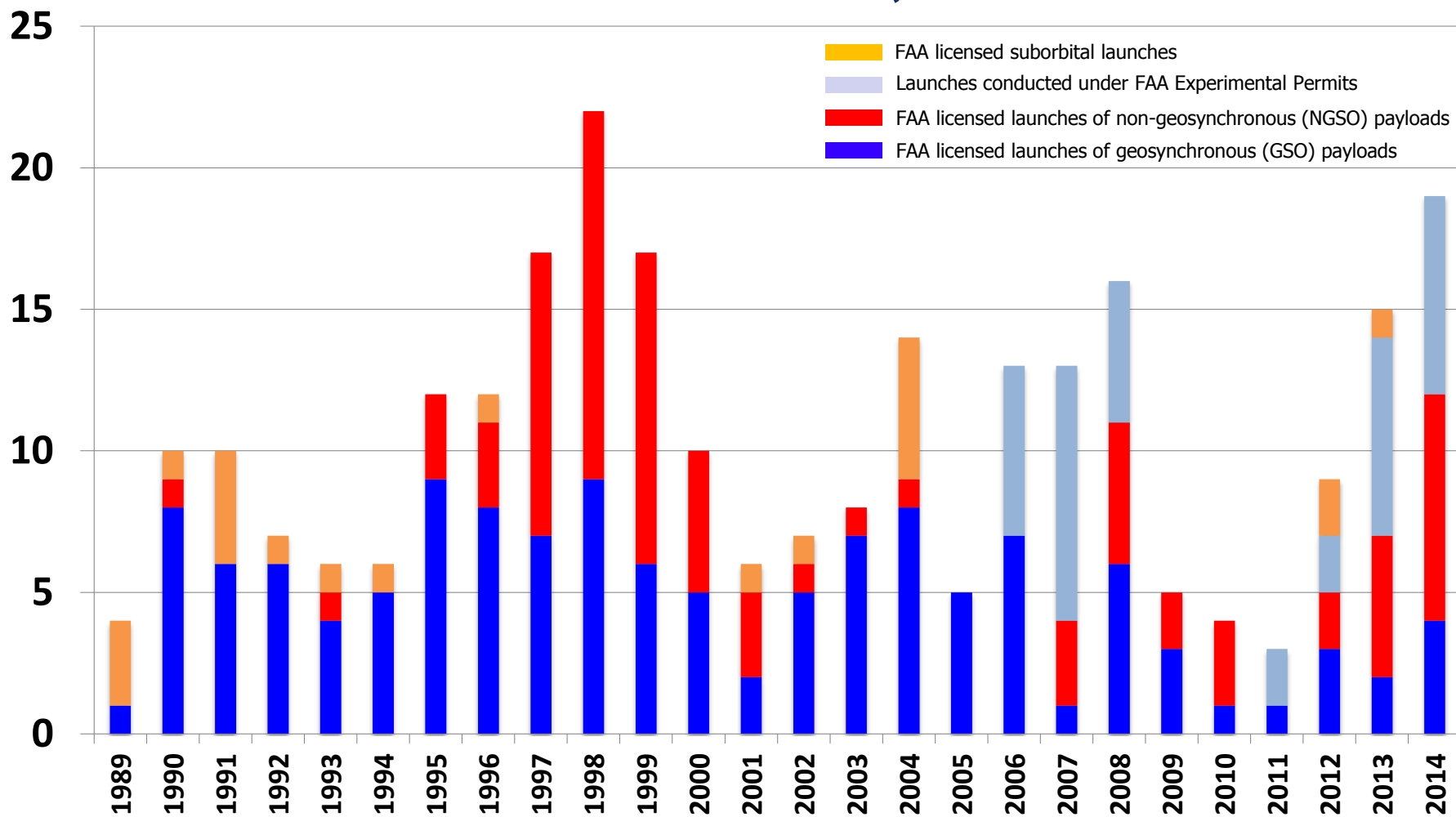


\* = Core Functions

January 2015



# FAA-Licensed Launches, 1989 - 2014



232 FAA-licensed launches, 1989 - 2014  
(129 GEO, 81 NGSO, 22 Suborbital)

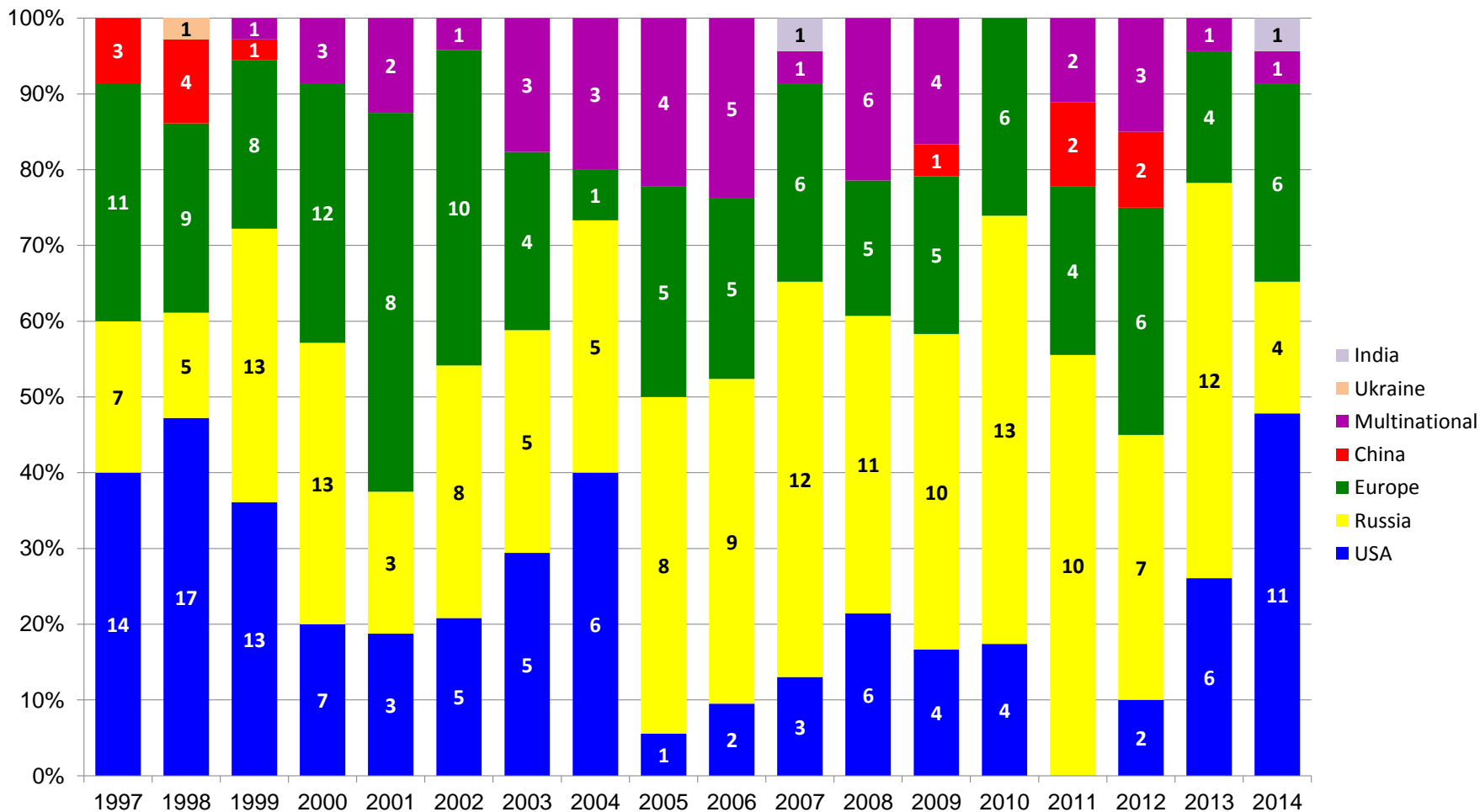
38 Permit launches 2006 - 2014  
(All Permits are suborbital)

Includes 39 licensed launches of payloads for DoD, NASA, and NOAA

Source: FAA January 2015



# Commercial Orbital Launches by Market Share, 1997 - 2014



Includes Geosynchronous Orbit and Non-geosynchronous orbits launches that are internationally competed, commercially sponsored, or FAA-licensed. Since 1989, DOT/FAA has licensed 39 launches of U.S. Government payloads  
 U.S. total includes U.S.-manufactured vehicles only. Multinational denotes Sea Launch.

Source: FAA January 2015



# Active and Future FAA Licenses for U.S. Launch Companies

## Expendable launch vehicles (ELV)

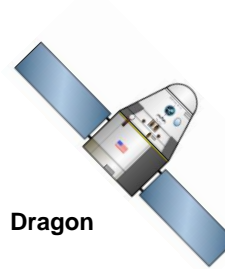
- Lockheed Martin – Atlas V
- Boeing –Delta II, Delta IV
- SpaceX – Falcon 1, Falcon 9
- Orbital Sciences Corporation – Pegasus XL, Taurus XL, Antares
- Sea Launch – Zenit 3SL (licensed to Energia Logistics Ltd)

## Reentry license

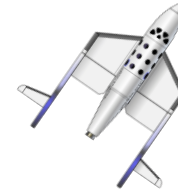
- SpaceX - Dragon

## Reusable Launch Vehicles (RLV)

- SpaceShipTwo, Lynx, STIG-B, others



Dragon



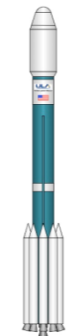
SpaceShipTwo



Lynx



Atlas V



Delta II



Delta IV



Falcon 1



Falcon 9



Pegasus XL



Taurus XL



Antares

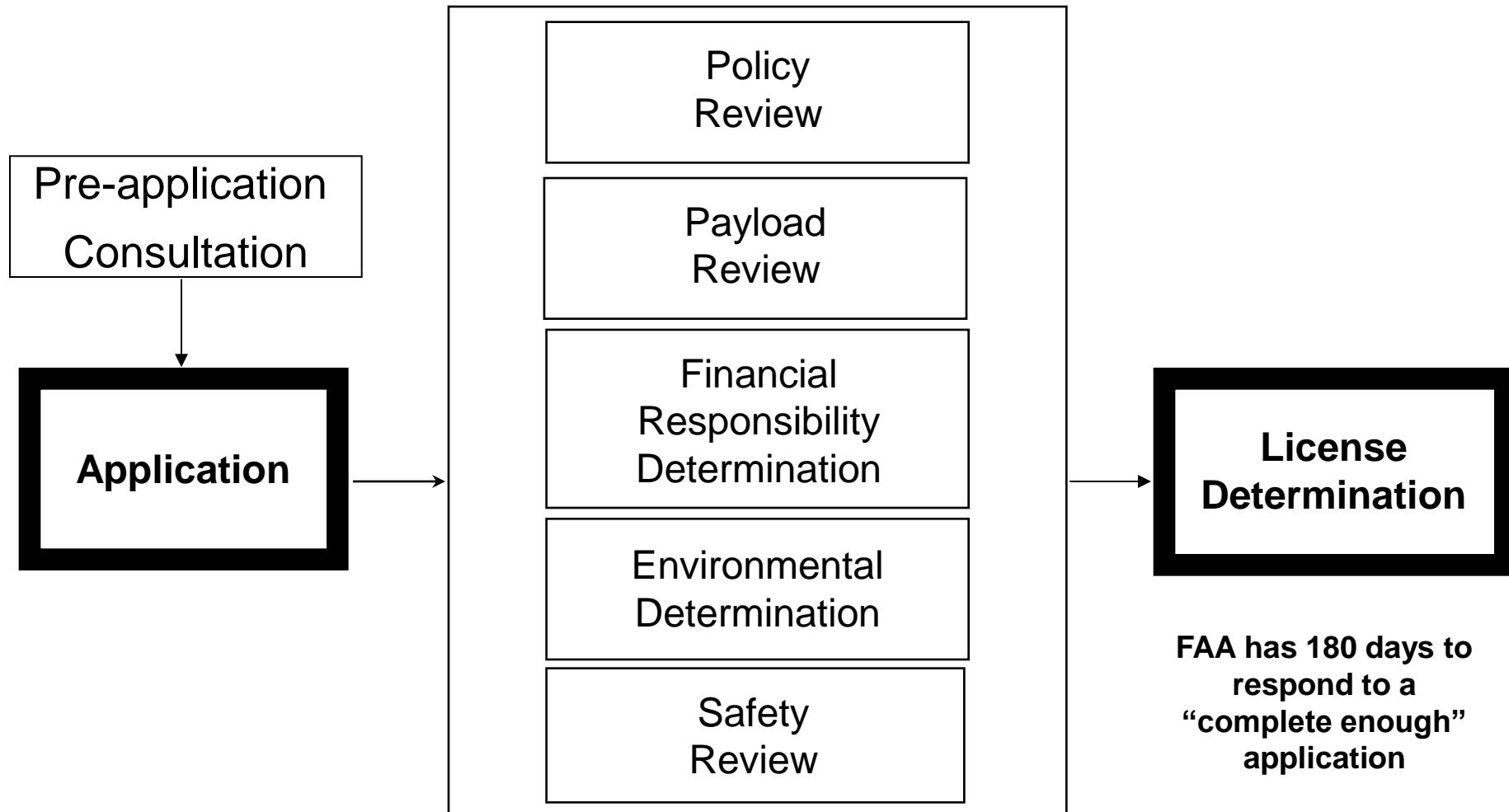


Zenit 3SL



STIG-B

# FAA Launch & Reentry Licensing Process Flow



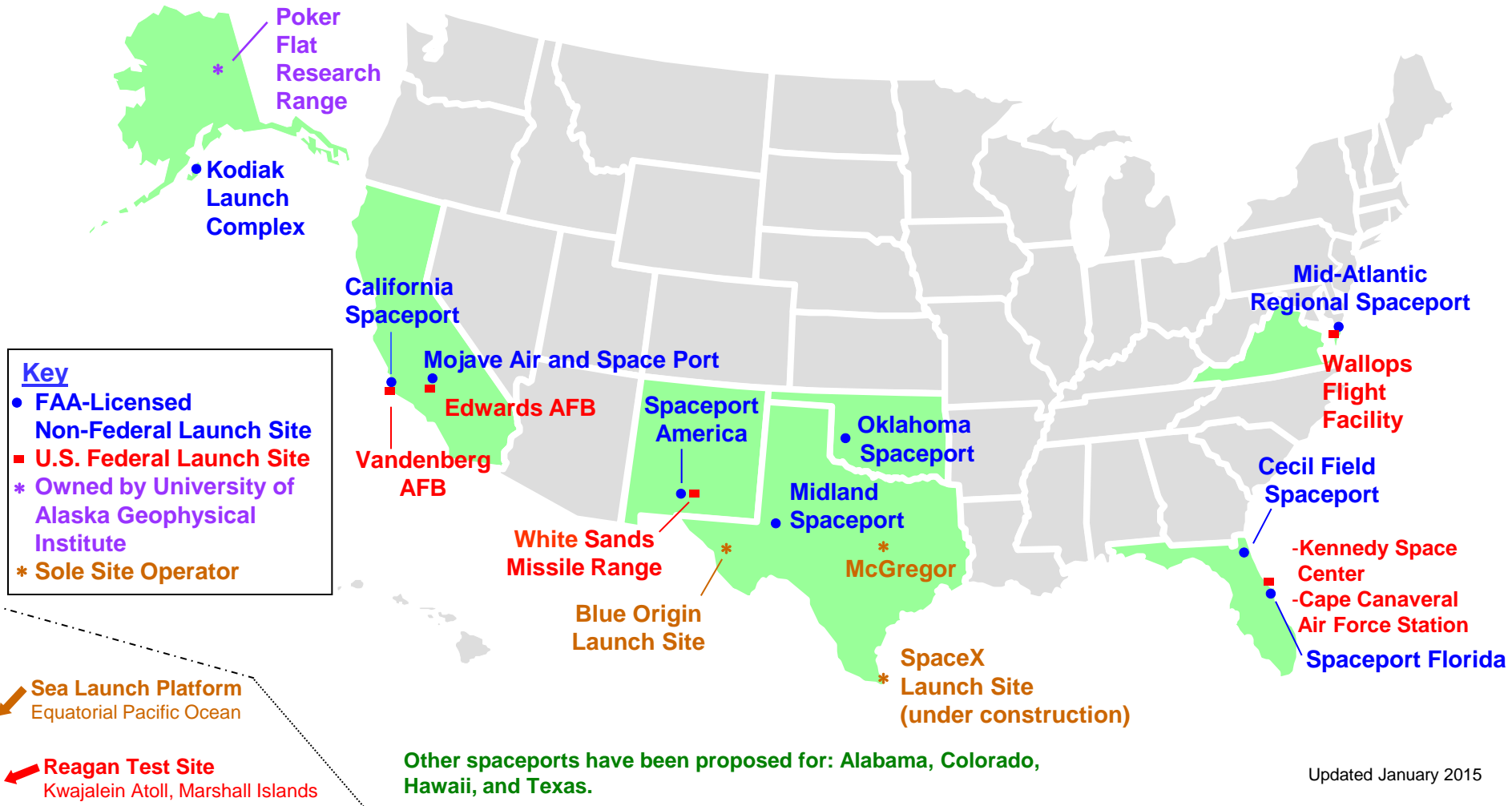
# Who Must Obtain A License

- **An entity must obtain a license:**
  - To ***launch*** a launch vehicle from the United States;
  - To ***operate*** a launch site within the United States;
  - To ***reenter*** a reentry vehicle in the United States; or
  - To ***operate a reentry site*** within the United States.
- **A U.S. citizen or an entity organized under the laws of the United States or any State must obtain a license:**
  - To launch a launch vehicle *outside* the United States;
  - To operate a launch site *outside* of the United States;
  - To reenter a reentry vehicle *outside* of the United States; or
  - To operate a reentry site *outside* of the United States.
- **FAA does not license launches or reentries “the Government carries out for the Government”**
  - NASA and the Department of Defense typically carry out their own launches.



# U.S. Spaceports

Commercial/Government/Private Active and Proposed Launch Sites



# Limits in Regulatory Authority

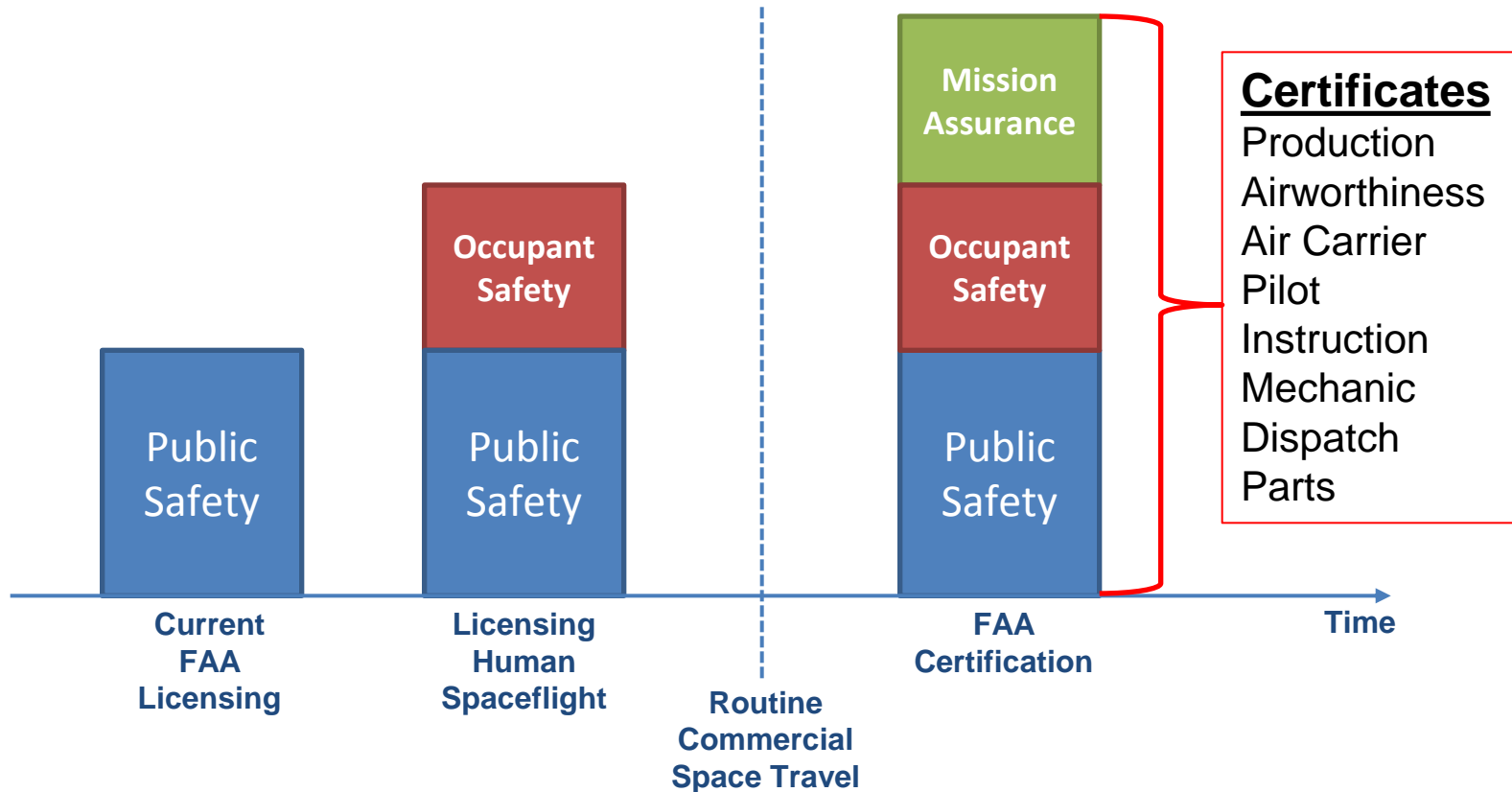
- **The U.S. Congress has only incrementally expanded DOT/FAA authority over commercial space transportation**
  - 1984 included launch authority
  - 1998 added reentry authority
  - 2004 added firm authority over commercial human space flight (CSLAA)
- **U.S. law contains limitations on FAA authority:**
  - The FAA can only regulate “to the extent necessary.”
    - The FAA does not certify space launch vehicles; it licenses the launch operation
      - Mission success is the responsibility of the commercial launch operator.
  - Included in the 2004 Commercial Space Launch Amendments Act (CSLAA): “...the regulatory standards governing human space flight must evolve as the industry matures so that regulations neither stifle technology development nor expose crew or space flight participants to avoidable risks as the public comes to expect greater safety for crew and space flight participants from the industry.”

# Licensing versus Certification

- Some countries and European Aviation Safety Agency are considering the establishment of a certification regime for new commercial human spaceflight vehicles
- The FAA believes it is too early to apply a certification regime to the commercial space transportation industry
- Commercial space vehicles that will carry people are new, and many different designs are being developed and evaluated for both suborbital and orbital flights
  - Some suborbital designs have vertical takeoff and landing, some involve horizontal takeoff and landing
  - Some have wings, others do not
  - Some are air-launched from a carrier aircraft
  - Some have powered landings, others glide back unpowered
- A certification regime may restrict design options
- Licensing allows more flexibility for innovation



# FAA/AST Regulatory Progression



# Recommended Practices for HSF

- In August 2014, FAA released “Recommended Practices for Human Space Flight Occupant Safety.”
- The FAA document provides a framework for development of industry consensus standards.
- The document can also serve as a starting point, should there be a need for the government to issue regulations at some point in the future.
- The FAA researched existing government and private sector requirements and standards, including those from:
  - NASA
  - European Space Agency
  - International Association for the Advancement of Space Safety
  - FAA
- The FAA’s primary source was requirements and guidance from NASA’s Commercial Crew Program.
- International interest
  - Countries seeking to attract U.S. operators to launch from or reenter into their territory may find the Recommended Practices document useful as a top-level description of regulatory philosophy.
  - It could also serve as a model for the development of domestic legislation and regulations for launches and reentries or for spaceport operations.
- Available at:  
[http://www.faa.gov/about/office\\_org/headquarters\\_offices/ast/media/Recommended\\_Practices\\_for\\_HSF\\_Occupant\\_Safety-Version\\_1-TC14-0037.pdf](http://www.faa.gov/about/office_org/headquarters_offices/ast/media/Recommended_Practices_for_HSF_Occupant_Safety-Version_1-TC14-0037.pdf)

# Air and Space Traffic

## Current Approach: Accommodation

- Generally, the FAA protects aircraft against potential hazards posed by launch and reentry vehicles using preemptive airspace closures (i.e., segregated airspace)
  - Relatively large, static volumes of airspace (i.e., aircraft hazard areas) are closed in advance of a launch, reentry, or amateur rocket operation to protect air traffic from hazards of vehicle failures, including falling debris
- Tactical and responsive approaches to airspace management are applied on a limited basis

## Future Approach: Integration

- Generally, launch and reentry vehicles and aircraft will share airspace
  - Air traffic management will focus on preventing collisions between vehicles and aircraft (i.e. separation) rather than collisions between aircraft and falling debris (i.e. segregation)
- Exceptions will be made for activities that have a relatively high likelihood of failing in a manner that produces falling debris or otherwise posing elevated risk to other National Airspace System (NAS) users
  - Examples include research and development, flight test, and planned hardware jettisons

# Expanding U.S. Commercial Capabilities

ELVs, Suborbital RLVs, Orbital Human Vehicles, Habitats



Virgin Galactic



Sierra Nevada Corp



Boeing



XCOR Aerospace



Masten Space Systems



Blue Origin



Orbital Sciences



Space X



Bigelow Aerospace



# Suborbital Commercial Human Space Flight



XCOR's Lynx vehicle under construction, December 2014



Virgin Galactic's WhiteKnightTwo and SpaceShipTwo



SS2, second vehicle under construction, January 2015

# Commercial Crew Program: FAA and NASA



SpaceX -Dragon



Boeing – CST 100

- Ensure public safety - FAA
- Ensure crew safety and mission assurance - NASA
- Eliminate duplicate and conflicting Government requirements imposed on commercial partner
- Take maximum advantage of both NASA and FAA knowledge and experience
- Enable FAA licensing of CCP launches/entries at earliest opportunity, while still meeting all other objectives
- Early Technical Interchange Meetings identified approximately 100 items to address
- MOU between FAA and NASA on the “Achievement of mutual goals in human space transportation” (June 2012)
  - Establishes Government intent to license ISS services missions
  - Advance both public safety and crew safety
  - Exchange knowledge and best practices
  - Roles of FAA and NASA
- FAA employees co-located at both KSC Program Office and JSC
- CCP employee on a one-year detail to FAA HQ to strengthen working relationships

# Emerging Issues

- **Mission License** – Add authority for in-space activity to current FAA launch and reentry authority
  - Industry is developing new capabilities for commercial spacecraft: satellite servicing, on-orbit habitats/space stations, asteroid mining, and Moon bases that don't necessarily fit oversight by other U.S. agencies
  - State Department has indicated the current U.S. regulatory framework appears to not be equipped to meet 1967 Outer Space Treaty obligations for some new proposed U.S. commercial activities. (Article 6, “*The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision...*”)
  - Objective of a Mission License would be to avoid collisions and avoid creation of orbital debris
- **Resources** – Budget increase for AST to handle diverse U.S. industry
  - About 30 “pre-application consultation” items: new vehicles, spaceports, safety approvals, and payload reviews
  - No longer just Expendable Launch Vehicles: Reusable Launch Vehicles (or reusable first stages), reentry vehicles (Dragon, Orion, Dream Chaser), NASA and DOD (Air Force, DARPA) activities that are commercially operated, spaceports and environmental reviews, field offices, limited Research & Development (FAA Centers of Excellence), and space traffic management.
  - FY 2016 budget request for \$18.1 million, 9% more than FY 2015
    - Add up to 25 more people in AST

# Emerging Issues (continued)

- **Hybrid and space flight support vehicles for training** - companies have proposed aircraft and other vehicles that could be used at FAA-licensed spaceports for training or other non-launch purposes. (SOARS Act bill in 2014.)
  - Experimental certificated aircraft cannot be operated for compensation or hire
  - Spaceports are open for business and there are safety benefits to training crew and space flight participants
- **Human Space Flight** – transition from the “Learning Period” to a non-burdensome regulatory regime
  - FAA is restricted from enacting new rulemaking to protect people onboard vehicles until October 2015– industry wants to extend deadline
  - “Recommended Practices for Human Space Flight Occupant Safety” released by FAA in 2014
  - FAA encourages industry to develop consensus standards
  - FAA proposes to work with U.S. industry to set up a regulatory framework with top level, performance-based requirements.

# International Relations

- FAA/AST began international outreach in 2008.
- Some countries are privatizing ELV operations, others are interested in building spaceports and developing laws, safety rules for new U.S. and international RLVs
- The 2010 U.S. National Space Policy states that: “Departments and agencies shall:... promote U.S. commercial space regulations and encourage interoperability with these regulations.”
- FAA/AST is a unique office– no other country has an equivalent office and few countries have laws or regulations for commercial space transportation
- Export policy: space launch vehicles remain on U.S. Munitions List
  - U.S. companies may have to operate their vehicles outside the U.S.
  - To date, no U.S. company has submitted an export application to the State Department regarding international launch/reentry operations for a reusable suborbital vehicle.
- If a U.S. company wants to launch a U.S.-operated commercial vehicle outside the United States, it would need an FAA launch license and if necessary, also comply with any foreign safety regulations.
  - Therefore, a memorandum of understanding may be useful between the FAA and the host country.

# FAA/AST International Goals and Policy Direction

- The FAA is promoting its commercial space transportation regulations for adoption by other countries
- The goals of AST's outreach are to:
  - 1) Assist U.S. industry activity outside the United States;
  - 2) Provide U.S. international leadership;
  - 3) Establish international relationships; and
  - 4) Prepare for future interoperability between countries.



# Licensing Operations, Not Certifying Vehicles

<u>U.S. Aviation</u>	<u>U.S. Commercial Space</u>
Mature industry	Established Expendable Launch Vehicle/satellite market but emerging suborbital and human space flight industry
<b>Daily average:</b> 28,000 commercial flights, 25,000 air taxi flights, 2,100 cargo flights, 27,000 general aviation flights ( <i>82,000 flights daily average</i> )	<b>Totals:</b> 234 licensed launches since 1989, 38 launches under experimental permit since 2006, and 8 licensed reentries since 2010 ( <i>280 regulated launch/reentries total</i> )
<b>Airports:</b> 542 certificated, 5155 public, 14,009 private	<b>Spaceports:</b> 9 licensed sites, 2 private sites
<b>Integrated certification framework</b> (design, production, airworthiness, air carrier, pilot, maintenance, training, etc.) – for safe operations that protect the public, passengers and crew	<b>Licensing and permitting of operations</b> – for the protection of public using a performance based framework
Passenger and crew expectation of occupant safety	Space flight participant and flight crew acknowledgment and acceptance of risk (Informed consent regime, 2004 law)
Operations at low altitude (within the National Airspace System (NAS))	Operations at high altitude above the NAS with the intent to exit and reenter Earth's atmosphere
Aviation is the safest mode of transportation	Space is inherently risky



# Non-binding Agreements



*Italy agreement signed March 12, 2014 by  
FAA Administrator Huerta and ENAC President Riggio*

- The FAA signed non-binding Memorandum of Cooperation (MOC) on commercial space transportation with:
  - Italy - ENAC (Italian Ente Nazionale per L'aviazione Civile; civil aviation authority) on March 12, 2014 in Washington, DC at the Italian embassy
  - United Kingdom - Department for Transport, Civil Aviation Authority, and UK Space Agency on July 15, 2014 at the Farnborough Airshow
- MOC text available at:  
[http://www.faa.gov/about/office\\_org/headquarters\\_offices/ast/programs/international\\_affairs](http://www.faa.gov/about/office_org/headquarters_offices/ast/programs/international_affairs)
- The parties agreed to exchange information on safety, standards, practices, and other activities related to commercial space transportation
  - Cooperate in development of Italy and UK regulations
  - Establish a Working Group
  - Potential to advance to a binding agreement
- FAA/AST exchanged similar non-binding Letters of Intent with Spain (2012) and Curacao (2012-2013).



# Contact

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**AST international website**  
[http://www.faa.gov/about/office\\_org/headquarters\\_offices/ast/programs/international\\_affairs/](http://www.faa.gov/about/office_org/headquarters_offices/ast/programs/international_affairs/)

**Regulations for Commercial Space Transportation**  
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