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Space Traffic Management Concepts Leveraging Existing Frameworks

Stephen K. Hunter
USAF, hunter.stephen.k@gmail.com

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Overview

In a recent US-sponsored international wargame event, in which the scenario was set 10 years in the future, a participant provided a scene-setting briefing to describe the US commercial and civil Space Traffic Management (STM) environment of 2026. He based his briefing on current US Government efforts to establish a STM concept combined with subject matter expert opinions on the most likely result of those efforts in the given time-frame. Initial responses from other wargame participants suggested that the concept presented had missed some aspect of what they believed STM should be in 2026. The participants' recommendations were consistent with discussions in other venues where broad misunderstandings of the US STM concept was usually caused by pre-conceived notions and organizational biases.

The presenter, in this situation, masterfully scoped his 2026 STM concept so that each organization's representatives eventually understood and accepted the concept as plausible. The pre-conceived notions of STM gave way to an understanding of what can be done with the resources likely to be available in the next ten years. The real-world 2026 US Civil and Commercial space operating environment will be influenced by administration changes, budgeting, and, the still present, stake-holder organizations' biases. Regardless of the final shape of the concept, however, some aspects are basic to a successful US STM capability and are already in motion. On-going legislative efforts will enable the Federal Aviation Administration's Office of Commercial Space Launch (FAA/AST) to share space-object positional data with non-governmental entities and eventually provide FAA/AST with the authority to produce regulations governing commercial US owner/operators. Collaborations with the US Departments of Defense and National Intelligence are underway so as to ensure appropriate sharing of information and responsibilities is addressed early. Commercial data providers are also in discussions with US government entities to address how they might contribute to a future STM concept.

Because creating a US STM concept is such a daunting task, it will be critical to use existing regulatory regimes, agreements, and organizations as a basis for striking the correct balance between ensuring operational safety and allowing for growth of an emerging industry. This approach will also encourage owner/operator and stakeholder acceptance of new regulations governing operations in space by building on familiar concepts that allow the FAA to describe existing analogies and allow industry participants to alleviate uncertainty in their planning processes. Additionally, because this approach has been used successfully in the maritime and air domains, it's more likely that once a US STM concept is ready to be shared with other nations, this "bottom up" approach will be implemented faster and more effectively than a "top-down" imposition of a global STM concept by allowing each sovereign entity involved to develop their own concepts consistent with agreed-upon standards and recommended procedures.

Organizational Bias

"It was impossible to get a conversation going; everybody was talking too much."
-- Yogi Berra[i]

There are at least ten entities with specific interests in the outcome of a US STM concept. Each organization is staffed by personnel who strive to ensure their organization is performing its mission in a manner that exceeds the expectations of senior US Government leaders as well as consumers of their respective products. During discussions regarding STM, each entity brings a very different perspective to the conversation and often, due to hurried schedules, each organization attempts to present their argument without the fully digesting the ideas present by the other organizations. These are often referred to as “hot mike” or “transmit only” meetings. In recent years, a more focused group with fewer participants in these meetings has resulted in more concise, and often actionable, outcomes. However, the organizations who are not represented have not given up on their interests in the STM outcome. They simply aren’t as focused on this issue and therefore aren’t providing the same level of input. It becomes incumbent on the participants currently developing the US STM capability to consider the concerns of these other entities while continuing to move forward toward an implementable capability. This is not an easy task as political and economic environmental changes directly impact each organization’s interests and their ideas morph to adapt and meet the changing expectations. In 2010, as a result of an Administration change, several of the primary US stakeholders were asked to describe their respective interests in a report that was provided to the US National Security Staff. Attachment 1 is a summary of that data which helps to provide current participants in STM development with a better understanding of why previous arguments appear inconsistent with the STM concept that is evolving today. Attachment 2 is a single-page summary of these data to further help understand where each organizations’ capabilities, authorities, and responsibilities start and end with respect to phases of space operations and spatial zones of those operations.

Further complicating this effort is the fact that in the years since the 2010 report was developed discussions regarding STM still suffer from the lack of standardized definitions and a clear mission statement. In order for this concept to move ahead there must be a clear understanding by all stake holders of what they stand to gain by overcoming their respective biases and specifically what it is that they are helping to develop.

What’s in a name

“If you don’t know where you’re goin’ you’ll end up someplace else.”
-- Yogi Berra[i]

Those words from decades ago ring true today in each and every STM discussion. In most instances, even when groups decide on specific definitions, individuals within the group have a different understanding of the definitions based on how they or their respective organizations define specific words within the definition itself. The Department of Defense uses the example of telling members of the Marines, Army, Navy, and Air Force to “secure” a building. The

Marine hears that they need to kick down the doors and clear the building of all inhabitants. The Army hears that they need to set up a perimeter and guard the building. The Navy hears they need to turn out all the lights and lock all the doors, and the Air Force hears they need to get a lease on a building with options to buy. This is why it is critical to develop definitions and mission statements agreeable to all stakeholders prior to moving toward regulatory inputs or expending manpower or resources toward a goal that might not fully mature due to a missed opportunity to agree on the meaning of a few words.

The most critical of these words is the name of the concept. "Space Traffic Management" is the most widely accepted term and describes what authors, academics, and government personnel from around the world have been working toward for decades. However, due to the lack of a common objective and difference in understanding of a few specific words, terms such as Space Traffic Control, Orbital Traffic Management, Space Situational Awareness Sharing, and others are routinely presented as the "correct" term. While each of these terms does describe a specific aspect of the STM concept, they do not fully encompass the overall goals and objectives that the US Government is currently moving toward.

The most widely accepted definition of STM was published in the 2006 IAA COSMIC study and reads:

> *…the set of technical and regulatory provisions for promoting safe access into outer space, operations in outer space and return from outer space to Earth free of physical or radio-frequency interference.*[ii]

This definition has been so widely used that in the 2016 revision of the IAA COSMIC study, the authors are expected to choose to retain the definition with no alternation. A critical aspect of this definition is that it helps to understand that "management" of space traffic doesn't always mean "controlling" space traffic. In the analogous aviation scenario the word "air traffic management" includes deliberate, long-term planning of routes, "hub and spoke" planning, airspeed considerations based on gate availability, and many other factors. The term "Air Traffic Control" pertains to specific phases of only certain flights in which aircraft are under positive control by an entity that provides "direction" to flight crews in order to ensure safety of all participating personnel as well as non-participating persons.

Another popular moniker has been a favorite of many NASA organizations. The term "orbital traffic management" disregards the coordination required to physically de-conflict suborbital objects as well as electromagnetic and administrative aspects of objects and their owner/operators. This name also is often associated with a definition that involves "movement" of space objects. The obvious flaw in this idea is what one considers "movement". For instance, geo-stationary objects aren't moving relative to the surface of the earth and could, in convenient cases, be considered *not* subject to any regulatory regime used in STM.

Further, many participants in the STM discussion suggest that Space Situational Awareness Sharing is the full description of what STM should do for the US Government. This misunderstanding leads, again, back to the lack of a clear mission statement and agreed-upon set of definitions. While Space Situational Awareness Sharing is a vital part of the STM

concept, it limits the concept to only the operational facets above the Karman line and negates the administrative and planning aspects. Most critical to the usefulness of the IAA definition, is the fact that it acknowledges that "management" begins in the earliest stages of space object development and that licensing and structural requirements are as critical to safety as owner/operator communications once on orbit.

In 2012, USSTRATCOM and FAA/AST coordinated a list of definitions and agreed on a common definition (the COSMIC study definition stated earlier). The definitions are in Attachment 3 to this document. While many of the personnel who developed these terms no longer work for their respective organizations the definitions themselves are a good starting point for battling current organizational biases and misconceptions.

The U.S. Space Traffic Management concept in 2026

"The future ain't what it used to be"
-- Yogi Berra[i]

When the 2026 STM concept was first described to the wargaming participants mentioned earlier, the persons who initially questioned the specifics did so prior to hearing the complete description (organizational biases, again). After hearing and discussing the structure, the questions slowly became statements about how the presentation complimented organizational efforts. The U.S. Department of Defense and Department of National Intelligence representatives began to see how STM could result in de-facto norms of behavior and "patterns of life" to help them quickly identify nefarious actions. Partner nations' Defence Department representatives recognized this concept was not going to be "imposed" but rather offered for consideration and cooperative development. Commercial organizations began to see a reduced level of risk to their profit-making assets. Department of State personnel recognized obvious opportunities for international cooperation based on mutual need for a sustainable, safe space domain. Reaching the ability to relate the ideas to existing needs, however, is only possible if one joins this conversation with an open minded desire to see a concept implemented and then assists in the development by offering improvements that compliment respective organizational needs. Below is a high-level summary of the 2026 Space Traffic Management concept played in the US Department of Defense wargame discussed in the opening of this paper:

Description:

- Civil US Space Traffic Management responsibility was given to DoT/FAA in 2017 by act of Congress. After a three-year period of demonstrations and transition, the civil space traffic system became operational in 2020.

-- The DoT delegated authority to Associate Administrator for Commercial Space Transportation (AST) through the Administrator of the FAA

- The FAA is an agency with regulatory authority

-- Determine the safety of flight parameters that guides commercial space activities

-- Establish and enforce standards and recommended procedures for safe conduct in space for US commercial operators.

-- Provide orbital safety advisory services and support to US commercial operators as well and foreign and civil space operators

Policy Issues:

- Goal of the US Commercial Space Traffic Management system: Safety of space operations and preservation of the space environment

- Space Traffic Management system will be operated in a manner that protects US national security concerns, foreign policy, and international obligations

- Protects sensitive US space operations and establishes norms for handling orbital information for sensitive US Government spacecraft not currently included in the public space catalog maintained by JFCC SPACE (Space-Track.org)

- Fulfil international agreements on authorizing space operations, notification, controlling debris, etc.

- FAA/AST will have oversight over bidirectional Space Situational Awareness agreements between the FAA and commercial organizations providing Space Traffic Management services

- Commercial Space Situational Awareness provides to the Civil Space Traffic Management system are indemnified from lawsuits under the act of Congress that established the Civil Space Traffic Management system

Organization and Structure:

- The Civil Space Traffic Management (CSTM) Operations Center serves as the point of interface to external systems and customers. The CSTM Operations Center is the central note for CSTM decision processes as well as status and other information about commercial space operations

-- FAA/AST leverages existing technology and available commercial Space Situational Awareness capabilities to efficiently execute Space Traffic Management for all US commercial Space Traffic

Services Provided:

- Physical conjunction management including planned maneuvers

-- Launch and re-entry

-- On-orbit

- RF interference mitigation support

- Space Weather support

- Satellite identification

- Zone regulations for small sats

- Oversight for Rendezvous Proximity Operations

- Risk and advisory services during catastrophic debris events

A much higher level of detail was available for the wargame participants in order to help address policy concerns that arise during specific scenarios. While considering these policy questions the wargame forces participants to address the future they were given and suggest changes that might produce more beneficial results for real-world STM users in 2026 and beyond. This concept is expected to be used in future DoD wargames and hopefully those events will guide US and international acceptance of the concept through the inputs the participants provide after the events.

Plausible alternative concepts

"In theory there is no difference between theory and practice. In practice there is."
-- Yogi Berra[i]

Very seldom does a concept meet with reality and not require "tweaking" of details. In a situation in which the US has influence over only space operators from the US, for instance, commercial operators will feel as though their international competitors, who are not subject to the same requirements, have an unfair commercial advantage. This has been a primary driver for the "Top Down" approach toward a global STM concept. While much more time consuming and complex, many owner/operators and governments prefer this approach as it provides more short-term leverage for them in the resulting global concept. Additionally, many point to United Nations resolutions or European Union policy-making as models for this type of functional capability. Others use the same examples as why a "Top Down" approach would hinder development of an operational capability citing the time-consuming nature of these bodies and their perceived ineffectiveness or regulatory dictates that are inconsistent with the nature of those on whom the rules are imposed.

Arguments have also been made for a purely commercial Space Traffic Management system. This concept promises a capability that is more responsive to quickly evolving commercial needs and a higher level of capability than an organization with significant fiscal constraints and bureaucratic hindrances. This concept also is likely to be much more expensive for owner/operators and non-compulsory by design and therefore not resulting in the level of participation expected by its proponents. The profit-potential for this idea, however, has resulted in some very good arguments for its implementation as well as very intense efforts to encourage governmental support for the idea.

A promising concept suggests that the vital nature of space-based capabilities categorizes the ground segments and certain space-based objects as critical US infrastructure thus placing responsibility for security under the purview of the US Department of Homeland Security. Similar arrangements exists for other critical infrastructure and it is possible to use those as models to quickly and efficiently develop useful operational concepts. However, the Department of Homeland Security does not have as much experience with the Space domain as the FAA given FAA/AST's Title 51 authorities and responsibilities as well as their previous work related to de-conflicting National Airspace Traffic with existing space operations.

A few other recommendations have been raised in recent years but none have gained traction in the way that the FAA/AST concept has. This concept has been addressed at very senior levels of the US government as well as the governments of other nations and currently appears to be the leading concept given that all nations seem to agree that without US leadership, no STM concept is likely to thrive regardless of where it begins. The FAA/AST concept has a distinct possibility of being a reality in the near-term, and with proper planning, a path to a US concept is feasible today.

Path to US concept

"When you come to a fork in the road, take it."
-- Yogi Berra[i]

Several phased implementation plans have been presented to discuss how the Joint Space Operations Center would transition many non-military services to some new entity. There is no perfect method, and any chosen path will surely be impacted by unforeseen influences. However, activity in space has progressed to the point where it is critical that an STM capability be available to owner/operators. Today it is important that the US begin moving toward an effective STM concept regardless of where it starts. Because of the significant number of variable involved, it may be impossible to make "the right decision" when picking a path. But by "making a decision and then making it right" the US can begin improving the safety and resiliency of the space domain quickly and steadily improve on the concept as new information becomes part of the decision-making calculus. Attachment 4 is an example path to transition some of the national security operations from the Joint Space Operations Center to the FAA/AST organization over a period of three to five years. In 2012, this was part of a bigger plan that was considered feasible by subject matter experts from USSTRATCOM and FAA/AST. The attached plan was developed through coordination with operators (now former operators) at the Joint Space Operations Center and former FAA/AST personnel as a starting point from which further discussions could be used to refine the plan in such a way as to meet with resource realities of both organizations and still help to ensure that the US developed an effective STM capability that could evolve into global standards and recommended procedures.

In recent years promising moves toward a much more refined version of this concept have gained support from senior US government entities in the Executive and Legislative branches. As this concept is further refined, the path might be altered but if the initial definitions were developed correctly, the destination will remain the same and eventually a global concept can be implemented effectively based on the US STM efforts.

Expansion to international stake holders

"The other teams could make trouble for us if they win."
-- Yogi Berra[i]

As technological advances lower the threshold for entry into space-dependent commerce, the need for an effective STM concept grows more critical at an exponential rate. Commercial viability of small systems will result in growth in the number of actors in space as well as the total number of objects in space. Out of necessity, some entity will produce a STM capability and a fair and equitable system should be the first to be created. It is plausible that a non-western-friendly entity could produce a system that results in a concept that is detrimental to US commercial capabilities and disruptive to many nations' national security interests. Because of the significant US reliance on space-dependent commerce and space-dependent national security capabilities, it is in United States best interests to lead the way in producing a non-restrictive, effective STM capability as quickly as possible. We also must ensure that our partner nations and close allies are involved in the development process to help prevent regulatory fratricide and to enable future international cooperation with respect to commercial, civil, and defense-related space operations.

Once established in the US, an effective STM capability can be expanded using the existing International Civil Aviation Organization (ICAO) structure to the existing ICAO members, the concept can be expanded in this manner to quickly improve the safety of operations in space while not impinging on the sovereignty of any nation. ICAO Standards and Recommended Procedures (SARPS) emerge from this concept as norms of behavior or transparency and confidence-building measures which improve not only the commercial and civil operations in space, but also provide a much needed military reference point during increased tensions between nations. Without a standard from which deviations can be measured, it is impossible for military decision-makers to determine if observations of other nations' space objects are routine or aggressive. A misunderstanding in this situation could result in an unnecessary escalation of actions between nations. In a non-military scenario, increased predictability and increased safety will continue to lower costs and lower barriers to entry into the space domain for commercial and civil owner/operators. Even the late President Emeritus of the ICAO Council, Assad Kotaite, recommended a new annex to the Chicago Convention to extend ICAO responsibilities for producing International Standards and Recommended Procedures for suborbital and orbital civil space flights.[iii] His conclusion that the current SARPs should be expanded highlights the criticality of including tropospheric transition of space-faring vehicles and commercial point-to-point suborbital transportation as considerations when developing new SARPs. The most important aspect of this idea is that it is developed on a recognized framework that allows for multi-national acceptance based on familiarity with the concept of the ICAO and the ability for each participating entity to retain sovereignty over their rule-making processes.

Advantage of bottom-up approach

"If the people don't want to come out to the ballpark, nobody's going to stop them"
-- Yogi Berra[i]

Numerous efforts have been made by countries and bodies around the world to develop agreed-upon norms of behavior for space and then "implement" those across multiple nations. While the efforts were made by highly intelligent people and very effective organizations, previously successful implementation of norms began from a more "bottom-up" approach. Laws of the Sea were accepted and expected practices that were later formalized into treaties and agreements. International Standards and Recommended Practices in aviation began as successful practices that through the Chicago Convention of 1944[iv] became a highly successful international set of accepted and expected norms. Basing space norms and standard practices on previously accepted norms and standard practices from other domains would speed up the process of reaching acceptable and expected practices in space. Attachment 5 contains examples of extrapolated norms based on U.S. aviation and international maritime norms and regulations. By taking a leadership role and implementing regulations applicable to US citizens (as defined in 49 USC § 401.5) these regulations can be vetted, adapted where needed, and offered as standards and recommended procedures (or Norms) through existing organizations.

Imposition of a concept developed by an entity without the subject matter expertise found in naturally evolved standards will be immediately met with national-level organizational biases. This is further complicated by language and cultural issues as well as the obvious lack of a sense of ownership which, by human nature, motivates a group to see an idea succeed. Without this motivation, a successful concept will take much longer to attain if it is possible at all.

Summing it up

"You can observe a lot by watching."
-- Yogi Berra[i]

In recent decades the influence of space-based capabilities was relegated to industry conferences or trade magazines. Today space is ubiquitous in the everyday lives of people around the planet. Whether it is buying gasoline or watching kids play games on their phones, it is difficult today to participate in any activity that doesn't have some relationship to space-based capabilities. We are, today, in the future conceived in the earliest STM writings. There is a time-sensitive requirement that is currently in need of leadership. The US should take the initiative to create an effective STM concept that can be expanded to other nations in a manner that allows all participants to maintain their respective sovereignty while working together toward maintaining a safe operating environment. By using existing architectures and frameworks, stake-holders can build a system that is quickly attainable and useful while being flexible enough to grow as lessons are learned and the operating environment evolves.

Attachment 1: 2010 Summary of Stake-Holder Roles

Space Traffic Awareness

Mission Phase		DoD	NASA	FAA	FCC	NTIA	NOAA
Launch Support Operations (Planning & Processing)							
	Authorities:	**DODI 3200.18 and AFI 91-217**		Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 404-406, Parts 413-417, Part 420, Part 431, Part 433, Part 435, Part 437, Part 440, and Part 460			1992 Land Remote Sensing Policy Act (LRSPA) and 15 CFR 960: Licensing of Private Land Remote Sensing systems.
	Responsibilities:	Ensure awareness of planned launches	Safety and mission assurance	Support Permitting and Licensing of Commercial Space Transportation, Verify Financial Responsibility			License consultations provide early awareness of future and potential space activity. Information on type and number of satellites provided in this phase, and confirmed through filing of an application. Private operators are required to notify NOAA of launch plans/launches. Conduct prelaunch and post launch compliance activities.
	Capabilities:	CLSRB, Range Scheduling; Coordinating w/ NTIA for GEO slot availability; Space wx awareness to monitor for any potential detrimental impacts	Provide awareness of NASA launch planning; WFF Range scheduling; pre-launch vehicle trajectory analyses and collision avoidance assessments for NASA crewed and robotic launches, active payloads and debris; long-range planning support including determination of statistical population of low-Earth orbiting RSO's smaller than 10cm and geo-synchronous Earth orbiting RSO's smaller than 1m and provision of a probabilistic risk assessment for small debris population; predict future Earth satellite population	Inspection of production facilities, technical evaluation of reliability/suitability of flight safety systems, determination of Acceptable Risk, Detemination of Maximum Probable Loss, Enforcement available if violations of license occur			Commercial Remote Sensing Regulatory Affairs (CRSRA) conducts prelaunch and post launch compliance activities (audits, inspections)
Flight Operations							
Launch/takeoff decisions	**Authorities:**	DoDI 3100.10, DODI 3200.18AFI 91-217, 10 U.S.C 2274(a), Unified Command Plan		Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Part 404, Part 417	Communications Act of 1934, as amended. See especially 47 USC Sections 301, 319; 47 CFR. Part 25		
	Responsibilities:	Assure public safety, Assure Mission Success	Safety and mission assurance	Assure safety of uninvolved public	Review/approve/disapprove license requests for U.S. non-federal government space stations		Provide space environment / weather data
	Capabilities:	Colision Avoidance (COLA) data, Satellite Surveillance Network, Range Clearance Procedures; Space wx awareness to monitor for any potential detrimental impacts	Collision Avoidance (COLA) analysis, WFF Range Clearance Procedures; provide space environment and weather data; vehicle trajectory analyses (ISS visiting vehicles)	On site monitors, with authority to inform operators of violation of License/permit and reprecussions of proceeding	Public notice and public data base maintenance.		
Ascent through the National Airspace System (NAS)	**Authorities:**	Using agency for R-2932, R-2933, R-2934, R-2935, R-2516, R-2517, R-2534A, R-2534B		Commercial Space Launch Ammendments Act 2004 and CFR Part 400			
	Responsibilities:	Safety and mission assurance	Safety and mission assurance	Public Safety			
	Capabilities:	(With FAA) **a**ctiviation of Restricted airspace, Notice to Airmen, Notice to Mariners, Range Clearance Procedures (e.g. Pegasus)	Share information on NASA spacecraft maneuver planning and execution; spacecraft/vehicle communication and tracking services	Activiation of Restricted Airspace IAW License Terms and Conditions and Airspace Agreements with Air Traffic Control Organization, Issue Notice to Airmen			

Mission Phase		DoD	NASA	FAA	FCC	NTIA	NOAA
Flight Operations (cont)							
Launch-to-orbit/on-orbit maneuver	**Authorities:**	10 USC 2274, Unified Command Plan, AFI 91-217		Commercial Space Launch Ammendments Act 2004 and CFR Part 400	Communications Act of 1934, as amended. 47 USC Sections 301, 319, and 47 CFR Parts 5,25, and 97		1992 LRSPA and 15 CFR 960: applies to only to private remote sensing satellite system operations
	Responsibilities:	Space Situational Awareness Operations, Sharing Space Situational Awareness Information	Safety and mission assurance	License responsibility ends with payload separation and safing of upper stage	Review/approve/disapprove license requests for U.S. non-federal government space stations		License permints operations in specific orbits and altitudes. Private operators are required to notify NOAA of orbit changes
	Capabilities:	Space Surveillance Network,, JSpOC TLE and CSM, HQ USSTRATCOM SSA Sharing Mission, www.space-track.org; space weather awareness	Share information on NASA spacecraft maneuver planning and execution; collision avoidance awareness to Russian partner for ISS manuever control; spacecraft/vehicle communication and tracking services	Verify pre launch COLA; verify operations of safety systems, verify compliance with licesenceor permit Terms and Conditions. Investigation and enforcement of violations.	Public notice and public data base maintenance.		Use of regulation, license, enforcement tools to monitor, audit, and inspect all activities globally.
Electromagnetic spectrum Activities	**Authorities:**	DODD 3100.10, PIRT	NPD 2570.5D NASA Electromagnetic (EM) Spectrum Management		Communications Act of 1934, as amended.	DOO 10-10 (see http://www.osec.doc.gov/omo/dmp/doos/doo10_10.html)	
	Responsibilities:	"Laser clearinghouse", Purposeful Interference Response Team, Global SATCOM Support Center	Safety and mission assurance wrt EM spectrum activities/environment		Maintain data bases on non-federal government spectrum use; Provide direct interface(in coordination with NTIA for federal government stations) with the ITU	• Establishes and issues policy regarding allocations and regulations governing Federal spectrum use • Serves as the executive branch agency principally responsible for advising the President on telecommunications and information policies • Assigns frequencies for federal users • Maintains federal spectrum use databases • Provides the technical engineering expertise needed to perform specific spectrum resources assessments and automated computer capabilities needed to carry out these investigations	Provide space environment / weather data
	Capabilities:	Approve window for laser operations, Monitor and support EMI/RFI resolution	Represent NASA RF spectrum activities within and external to NASA (domestic and international)		Allocations, regulations, frequency assignments, international registration of satellite networks, and, through the NTIA, federal user spectrum coordination	Allocations, regulations, spectrum certifications, frequency assignments, international registration of satellite networks, and, through the Federal Communications Commission, non-federal user spectrum coordination	Make available through internet and other methods products, warnings, forecasts and alerts of solar activity and solar wind
End of Life/Mission	**Authorities:**	**AFI 91-217**	NPD 8700.1, NASA Policy for Safety and Mission Success; NPR 8715.6A	Commercial Space Launch Ammendments Act 2004 and CFR	Communications Act of 1934, as amended.		1992 LRSPA and 15 CFR 960: applies to only to private remote sensing
	Responsibilities:	Awareness of disposal orbits, safety procedures	Safety and NASA policy compliance	Ensure Public Safety, compliance with Interanational Treaty Obligations	Awareness of disposal orbits, safety procedures		Private operators are required to notify NOAA of deorbit plans for approval. NOAA is responsible for the approval of all disposal plans, monitors plans for changes and works with the licensee at time of deorbit and potential reentry
	Capabilities:		NASA spacecraft/objects end-of-life planning and execution.		Public notice and public data base maintenance; FCC collects and provides NASA with information on disposal of FCC-licensed geostationary satellites for annual reports.		NOAA through regulations, license, works with licensee at time of deorbit by reviewing plans, verifying expected causulaty calculations and notifying appropriate agencies of the activity. Additionally, NOAA facilities interactions between licensee and other USG entities with responsiblities for such activities

Mission Phase		DoD	NASA	FAA	FCC	NTIA	NOAA
Re-entry/Return							
Approval of reentry mission planning	**Authorities:**	DODI 3100.10, AFI 1-217		Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 431, 433, and 435	Communications Act of 1934, as amended.		1992 LRSPA and 15 CFR 960: applies to only to private remote sensing satellite system operations
	Responsibilities:		Safety and mission assurance	Ensure Public Safety	Regulatory enforcement function		NOAA through regulations, license, works with licensee at time of deorbit by reviewing plans, verifying expected causulaty calculations and notifying appropriate agencies of the activity. Additionally, NOAA facilities interactions between licensee and other USG entities with responsiblities for such activities
	Capabilities:	Conjunction analysis and Collision avoidance data (e.g. STS, X-37, Hyabusa re-entry capsule)	Provide communication and tracking services; Evaluate risk of human casualties from space object reentries	Verify functionality of safety systems prior to reentry, Enforcement available if violations of license occur	Public notice and public data base maintenance		Regulate, license, monitor, audit, and inspect de-orbit activities
Approval for descent through the NAS and landing	**Authorities:**	Using agency for R-2932, R-2933, R-2934, R-2935, R-2516, R-2517, R-2534A, R-2534B		Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 431, 433, and 435			
	Responsibilities:	Safety and mission assurance		Ensure Public Safety			
	Capabilities:	(With FAA) activiation of Restricted airspace, Notice to Airmen, Notice to Mariners, Range Clearance Procedures (e.g. STS, X-37)	Provide communication and tracking services	Activiation of restricted airspace IAW License Terms and Conditions and Airspace Agreements with Air Traffic Control Organization, Notice to Airmen, Notice to Mariners, Enforcement Options available if violations of license occur			
Post Flight							
Ground inspections	**Authorities:**			Commercial Space Launch Ammendments Act 2004 and CFR Part 400			
	Responsibilities:	Observe on-orbit debris damage, and if any, report to	Safety and mission assurance (next mission)	Support Permitting and Licensing of Commercial Space Transportation,			
	Capabilities:		Sea recovery of spacecraft/object (shuttle SRB's, Falcon-9 first stage, Dragon); Shuttle (orbiter) inspection and turnaround for on-orbit debris damage	Inspection of production facilities, technical evaluation of reliability/suitability of flight safety systems, determination of Acceptable Risk, Detemination of Maximum Probable Loss, Enforcement available if violations of license occur			

Space Traffic Regulation and Enforcement

Mission Phase		DoD	NASA	FAA	FCC	NTIA	NOAA
Launch Support Operations (Planning & Processing)							
Launch Vehicle Design Safety	**Authorities:**	DoDI 3200.188, AFI 91-217, AFI 10-1211	NPD 8700.1, NASA Policy for Safety and Mission Success; NPR 8705.2B Human-Rating Requirements for Space Systems; 8715.6A NASA Procedural Requirements for Limiting Orbital Debris; NPD 8610.23C Launch Vehicle Technical Oversight Policy	Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 404-406, Parts 413-417, Part 420, Part 431, Part 433, Part 435, Part 437, Part 440, and Part 460	Communications Act of 1934, as amended. See especially 47 USC Sections 301, 319; Various rule parts in 47 CFR		
	Responsibilities:	Provide launch vehicle standards	Provide human rating and OD mitigation requirements	Support Permitting and Licensing of Commercial Space Transportation, Verify Financial Responsibility	Radio-frequency licensing for non-Federal Government stations "in the public interest".		
	Capabilities:	Develop Space Acquisition Safety Guidance & Standards, Develop Launch Vehicle Safety Standards, ensure debris mitigation guidelines are met	Develop human rating requirements; ensure (oversight) launch vehicles meet orbital debris mitigation standards when required by NASA	Inspection of production facilities and launch campaign support work, technical evaluation of reliability/suitability of flight safety systems, determination of Acceptable Risk, Detemination of Maximum Probable Loss, Enforcement available if violations of license occur	Coordination, investigation, enforcement		
Range Operations	**Authorities:**	DoDI 3200.188, AFI 91-217, AFI 10-1211		Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 404-406, Parts 413-417, Part 420, Part 431, Part 433, Part 435, Part 437, Part 440, and Part 460	Communications Act of 1934, as amended. See especially 47 USC Sections 301, 319; Various rule parts in 47 CFR	DOO 10-10 (see http://www.osec.doc.gov/omo/dmp/doos/doo10_10.html)	
	Responsibilities:	Provide launch range infrastructure to assure safe access to space	Provide launch range infrastructure at WFF to assure safe access to space	Support Permitting and Licensing of Commercial Space Transportation, Verify Financial Responsibility, Inspection of launch campaign, launch vehicle build up, testing and certification	Radiofrequency licensing for non-Federal Government stations "in the public interest".	• Establishes and issues policy regarding allocations and regulations governing Federal spectrum use • Serves as the executive branch agency principally responsible for advising the President on telecommunications and information policies • Assigns frequencies for federal users • Maintains federal spectrum use databases • Provides the technical engineering expertise needed to perform specific spectrum resources assessments and automated computer capabilities needed to carry out these investigations	
	Capabilities:	Develop Launch Range Safety Guidance and Standards, ensure public safety, provide worldwide tracking network, coordinate with external/international agencies, trajectory analysis/verification, ensure education and training standards are met, approve hypersonic point to point transportation, oversight of launch vehicle operations and regulations, approval for ascent through NAS	Develop and/or oversee guidelines and operations related to WFF range safety	Inspection of production facilities, technical evaluation of reliability/suitability of flight safety systems, determination of Acceptable Risk, Detemination of Maximum Probable Loss, Enforcement available if violations of license occur	Coordination, investigation, enforcement	Allocations, regulations, spectrum certifications, frequency assignments, and, through the Federal Communications Commission, non-federal user spectrum coordination	

Mission Phase		DoD	NASA	FAA	FCC	NTIA	NOAA
Launch Support Operations (Planning & Processing) (cont)							
Satellite Design/Configuration Oversight	**Authorities:**	DoDI 8581.01	NPD 8700.1, NASA Policy for Safety and Mission Success; NPR 8715.6A NASA Procedural Requirements for Limiting Orbital Debris	Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 404-406, Parts 413-417	Communications Act of 1934, as amended. See especially 47 USC Sections 301, 319, and 47 CFR Parts 5, 25,97		
	Responsibilities:	Ensure DoD satellites meet USG standards	Provide NASA satellites that meet NASA policies/standards		Review/disapprove license requests. Regulations address both RF and debris mitigation plans--includes requirements concerning satellite design and configuration		
	Capabilities:	Develop DoD spacecraft safety standards, ensure satellites meet orbital debris mitigation standards, ensure launch vehicle compatibilty,	Develop or oversee development of NASA satellites to meet orbital debris mitigation standards		Coordination, investigation, enforcement		
Investigate and Report Launch Mishaps	**Authorities:**	MOU between NTSB, AF, FAA; AF 91-217	NPD 8700.1, NASA Policy for Safety and Mission Success; NPR 8621.1B NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping	Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 404-406, Parts 413-417			
	Responsibilities:	Determine potential causes and develop lessons learned for DoD mishaps	Determine root cause and implement corrective action	Determine potential causes and develop lessons learned for commercial mishaps			
	Capabilities:	Ensure technical expertise of investigation team, develop coordination relationships, provide safety/accident investigative support, ensure education and training standards are met; Provide Range sensor and telemetry data	Ensure technical expertise of investigation team, develop coordination relationships, provide safety/accident investigative support, ensure education and training standards are met; perform root cause analysis; implement corrective action; develop lessons learned				
Flight Operations							
Space Object Oversight	**Authorities:**	DoDD 3100.10	NPD 8700.1, NASA Policy for Safety and Mission Success	Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 404-406, Parts 413-417	Communications Act of 1934, as amended. See especially, 47 USC Sections 301, 319, and 47 CFR Part 5, 25, and 97		
	Responsibilities:	Maintain accurate Space Object Catalog	Safety and mission assurance	Require Commercial operators to register space objects and comply with interantional treaty obligations	Licensing U.S. non-federal government satellites and reviewing foreign satellites seeking access to U.S. market entry		
	Capabilities:	Collision Avoidance, Conjunction Analysis, Space Object Identification, Improve Satellite Safety, Make Educated Choices, Charactarize Space Environment, Provide Risk Management Assessment, create a protected zones for traffic, ensure education and training standards are met	Establish orbital debris policies and requirements; represent U.S. interests in the Inter-Agency Space Debris Coordination Committee (IADC)	Grant or deny launch license; include Terms and Conditions to license; investigatge and fine operators for violation	Coordination, licensing, enforcement		

Mission Phase		DoD	NASA	FAA	FCC	NTIA	NOAA
Flight Operations (cont)							
Operate Launch Vehicle and Satellite Fleets	**Authorities:**	DoDD 3100.10, DoDI 8581.01	NPD 8700.1, NASA Policy for Safety and Mission Success			DOO 10-10 (see http://www.osec.doc.gov/omo/dmp/doos/doo10_10.html)	
	Responsibilities:	Provide infrastructure to operate and maintain DoD launch vehicle and satellite fleets	Safety and mission assurance			• Establishes and issues policy regarding allocations and regulations governing Federal spectrum use • Serves as the executive branch agency principally responsible for advising the President on telecommunications and information policies • Assigns frequencies for federal users • Maintains federal spectrum use databases • Provides the technical engineering expertise needed to perform specific spectrum resources assessments and automated computer capabilities needed to carry out these investigations	
	Capabilities:	Establish alternative yet equitable standards and enforcement of regulations for National Security Space, regulate on-orbit maneuvers, maintain satellite constellation, manage timely constellation replenishment/reconstitution, ensure education and training standards are met	Develop and/or oversee guidelines and operations related to NASA spacecraft, acquired commercial launch services, debris mitigation, orbital insertion, manuevers, end-of-life activities, manned system operations and space mishap investigations			Allocations, regulations, spectrum certifications, frequency assignments, international registration of satellite networks, and, through the Federal Communications Commission, non-federal user spectrum coordination	
Regulate Space Environment	**Authorities:**	Outer Space Treaty		Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 404-406, Parts 413-417, Part 420, Part 431, Part 433, Part 435, Part 437, Part 440, and Part 460	Outer Space Treaty;Communications Act of 1934, as amended. See especially, 47 USC Sections 301, 319, and 47 CFR Part 5, 25, and 97	DOO 10-10 (see http://www.osec.doc.gov/omo/dmp/doos/doo10_10.html)	
	Responsibilities:	Ensure DoD access to space		Require Commercial operators to register space objects and comply with interantional treaty obligations	Supervision of non-governmental entities (Outer Space Treaty Article VI)	• Establishes and issues policy regarding allocations and regulations governing Federal spectrum use • Serves as the executive branch agency principally responsible for advising the President on telecommunications and information policies • Assigns frequencies for federal users • Maintains federal spectrum use databases • Provides the technical engineering expertise needed to perform specific spectrum resources assessments and automated computer capabilities needed to carry out these investigations	
	Capabilities:	Ensure protection of space capabilities; strengthening interagency coordination, collaboration, and information sharing; stronger integration of space situational awareness, approve on-orbit maneuvers		Grant or deny launch license; include Terms and Conditions to license; investigatge and fine operators for violation	Coordination, licensing, enforcement	Allocations, regulations, spectrum certifications, frequency assignments, international registration of satellite networks, and, through the Federal Communications Commission, non-federal user spectrum coordination	

Mission Phase		DoD	NASA	FAA	FCC	NTIA	NOAA
Re-entry/Return							
Re-Entry	**Authorities:**	DoDD 3100.10	NPD 8700.1, NASA Policy for Safety and Mission Success		Communications Act of 1934, as amended. See especailly 47 USC Sections 301, 319, an d47 CFR Part 5, 25, and 97		
	Responsibilities:	Provide Infrastructure for Re-Entry functions	Safety and mission assurance		Licensing: review of RF, casualty risk, and other safety issues for FCC licensed spacecraft and for satellites seeking U.S. market entry.		
	Capabilities:	Planned/Unplanned re-entry, observe safety standards, provide warnings/notices, monitor non-US re-entries, provide C2 for re-entry as applicable,approve re-entry mission planning, ensure proper disposal of hazardous materials, coordinate with international agencies	Develop and/or oversee guidelines and operations related to NASA spacecraft reentry or end-of-life activities		Coordination, investigation, enforcement.		
Disposal	**Authorities:**	DoDD 3100.10	NPD 8700.1, NASA Policy for Safety and Mission Success; NPR 8715.6A NASA Procedural Requirements for Limiting Orbital Debris	Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 404-406, Parts 413-417, Part 420, Part 431, Part 433, Part 435, Part 437, Part 440, and Part 460	Communications Act of 1934, as amended. See especailly 47 USC Sections 301, 319, an d47 CFR Part 5, 25, and 97		
	Responsibilities:	Provide Infrastructure for Disposal Ops	Safety and NASA policy compliance	Require Commercial operators to register space objects and comply with interantional treaty obligations	Licensing: review of RF, casualty risk, and other safety issues for FCC licensed spacecraft and for satellites seeking U.S. market entry (exception: NOAA-licensed remote sensing satellites--review limited to RF matters).		
	Capabilities:	Manage C2 for disposal Ops, ensure adequate end of life plan for spacecraft, plan disposal maneuvers, approve slot for super-synchronous orbit	Develop and/or oversee guidelines and operations related to acquired commercial launch vehicle stage disposal, and NASA spacecraft reentry or end-of-life activities	Grant or deny launch license; include Terms and Conditions to license; investigatge and fine operators for violation	Coordination, licensing, enforcement		
Return	**Authorities:**	DoDD 3100.10		Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 404-406, Part 431, Part 433, Part 435			
	Responsibilities:	Provide infrastructure for Return Operations		Activiation of Restricted airspace IAW License Terms and Conditions and Airspace Agreements with Air Traffic Control Organization, Notice to Airmen, Notice to Mariners, Enforcement Options available if violations of license occur			
	Capabilities:	C2 for Return Ops, ensure tracking capability for return flight, approve mission planning for descent through NAS and landing		Air Traffic Control, Verification of Safety System Operations, enforcement of failure to comply			

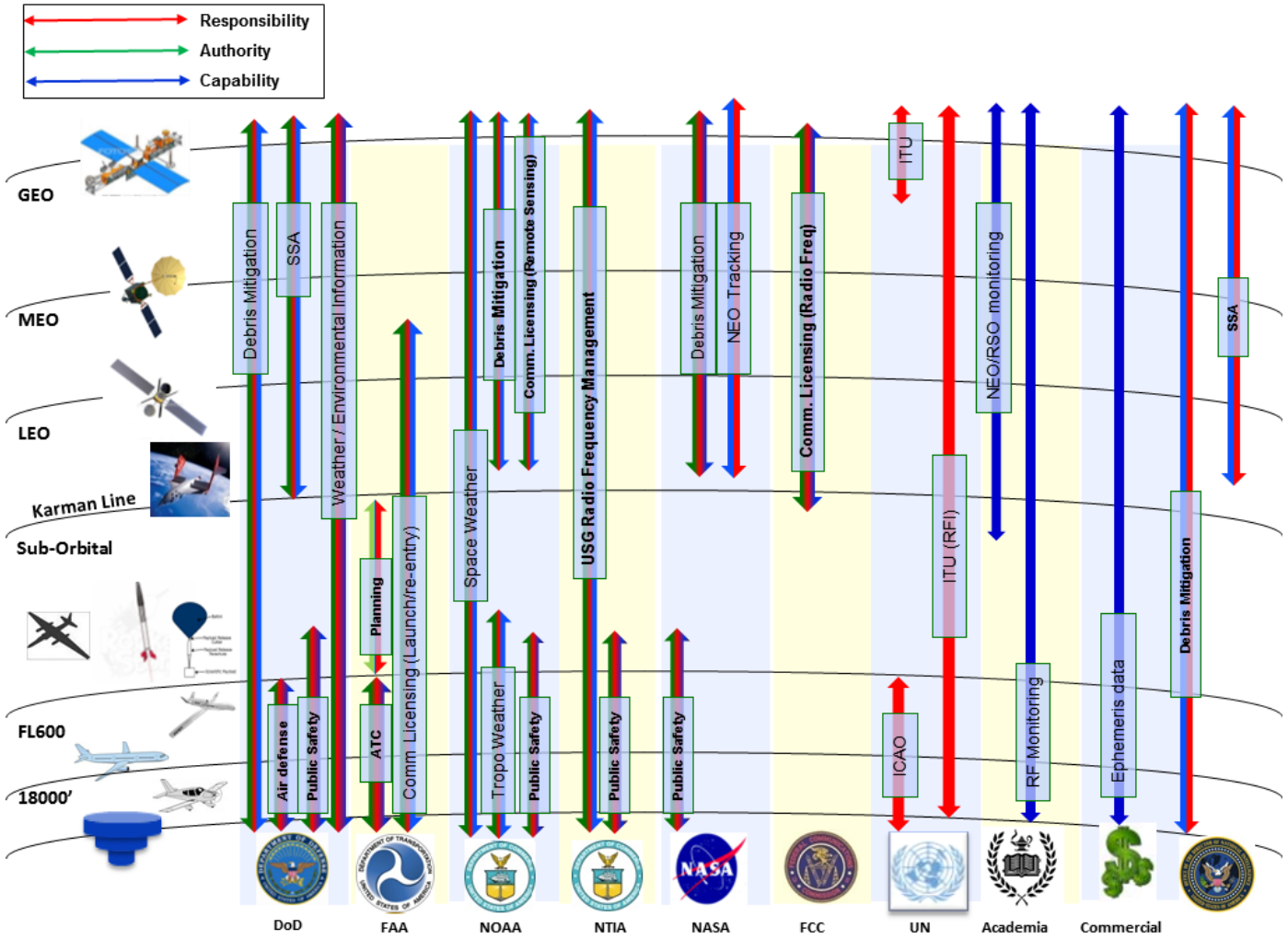
Mission Phase		DoD	NASA	FAA	FCC	NTIA	NOAA
Post Flight							
Ground inspection standards	**Authorities:**			Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 404-406, Parts 413-417, Part 420, Part 431, Part 433, Part 435, Part 437, Part 440, and Part 460			
	Responsibilities:	Safety inspections and reporting regulations	Safety and mission assurance (next flight)	Safety Inspections, reporting,			
	Capabilities:		Developed Shuttle orbiter inspection and turnaround requirements	Trained and credentialed federal safety inspectors			
Spacecraft Refurbishment	**Authorities:**	RSLP program; START and follow-on treaties		Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 404-406, Parts 413-417, Part 420, Part 431, Part 433, Part 435, Part 437, Part 440, and Part 460			
	Responsibilities:	Safety inspections and reporting regulations	Safety and mission assurance (next flight)	Safety Inspections, reporting,			
	Capabilities:	Convert excess ICBMs to spacelift vehicles	Oversight of Shuttle orbiter turnaround activities (e.g., any potential OD generating parts)	Trained and credentialed federal safety inspectors			

Space Traffic Control

Mission Phase		DoD	NASA	NRO	FAA	FCC	NTIA	NOAA
Launch Support Operations (Planning & Processing)								
Are there acquisitions authorities that are control-like mechanisms, e.g. Milestone Decision Authority?	**Authorities:**		NPD 8700.1, NASA Policy for Safety and Mission Success; NPR 8715.6A NASA Procedural Requirements for Limiting Orbital Debris					
	Responsibilities:		Provide commercial launch services for most NASA missions and develop spacecraft that meet NASA policy					
	Capabilities:		Contract for commercial launch services that meet NASA OD mitigation requirements for a given					
Flight Operations								
Launch Go/No-Go	**Authorities:**	DODI, 3200.18, Management and Operation of the Major Range and Test Facility Base, USD(AT&L); AFI 91-217, Space Safety and Mishap Prevention Program	NPD 8700.1, NASA Policy for Safety and Mission Success; NPD 8610.24C Launch Services Program Pre-Launch Readines Reviews		Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 404-406, Parts 413-417, Part 420, Part 431, Part 433, Part 435, Part 437, Part 440, and Part 460			
	Responsibilities:	Assure public safety and the mission, protect the space environment	Safety and mission success		Ensure Public Safety; Permitting and Licensing of Commercial Space Transportation; Terms and Conditions; Verify Financial Responsibility			
	Capabilities:	Complexes and facilities include blockhouses, booster preparation and payload check-out buildings, dynamic balance equipment, a timing/communications facility, wind measuring devices, communications and control instrumentation, radar and optical tracking stations, surveillance and tracking radar units, and other supporting facilities (over 1600 facilities in all just for the ETR). With FAA, control of range airspace during launch ops, and immediately following a mishap.	Launch go/nogo capability for NASA-managed launches		Technical evaluation of reliability/suitability of flight safety systems, determination of Acceptable Risk, Detemination of Maximum Probable Loss, Enforcement available; Launch Inspectors on site for commercial launch; Air Traffic Control			
Maneuvers	**Authorities:**	DoD Instruction 3100.12, Space Support; AFI 91-217, Space Safety and Mishap Prevention Program;						1992 LRSPA and 15 CFR 960: applies to only to private remote sensing satellite system operations
	Responsibilities:	Mission Assurance	Safety and mission assurance					Private operators are required to notify NOAA of deviations from their licensed orbit
	Capabilities:	Command, control and communications systems, instrumentation, radar and optical tracking stations, surveillance and tracking radar units, JSpOC, and other supporting units	Manage/coordinate launch, approach and docking of domestic and international spacecraft destined for the ISS					CRSRA regulate, license, monitor, audit, and inspect activities; Impose Shutter Control
Electromagnetic spectrum activities	**Authorities:**	CJCSI 3225.01, Illuminaiton of Objects in Space by Lasers	NPD 2570.5D NASA Electromagnetic (EM) Spectrum Management					
	Responsibilities:	Assure public safety and the mission	Manage NASA RF spectrum use					Provide warnings, alerts, forecasts
	Capabilities:	Predictive avoidance analysis or deconfliction with U.S., friendly, and other space operations	Obtaining and allotting adequate EM spectrum to support all NASA programs					Monitor situation, issue appropriate alerts, warnings in dangerous situations. Forecast eventst of solar activity including flairs and solar wind

Mission Phase		DoD	NASA	NRO	FAA	FCC	NTIA	NOAA
Flight Operations (cont)								
	Authorities:		NPD 8700.1, NASA Policy for Safety and Mission Success; NPR 8715.6A NASA Procedural Requirements for Limiting Orbital Debris					1992 LRSPA and 15 CFR 960: applies to only to private remote sensing satellite system operations
End of Life/Mission	**Responsibilities:**	Any specific actions related to disposal orbit or safing of upper stages/satellites	Meet NASA policy					Private operators are required to notify NOAA of disposal plans for approval
	Capabilities:		NASA spacecraft manuevers for disposal orbit or safing of upper stages/satellites					CRSRA regulate, license, monitor, audit, and inspect disposal activities
	Authorities:	DoD Instruction 3100.12, Space Support; AFI 91-217, Space Safety and Mishap Prevention Program; Is			Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 404-406, Parts 413-			
	Responsibilities:	Enviromental Protection, Mission Assurance			Ensure compliance with International Treaties			
Removal of Debris	**Capabilities:**	For the most part, DoD does not have any debris removal capabilities; however, certain requirements are built into space systems to ensure they mitigate debris creation			Terms and Conditions of License for upperr stage disposal; Enforcement action available for violation			
Re-entry/Return								
	Authorities:	DoD Instruction 3100.12, Space Support; AFI 91-217, Space Safety and Mishap Prevention Program;	NPD 8700.1, NASA Policy for Safety and Mission Success		Commercial Space Launch Ammendments Act 2004 and CFR Part 400, Parts 404-406, Parts 413-			1992 LRSPA and 15 CFR 960: applies to only to private remote sensing satellite system operations
	Responsibilities:	Assure public safety and the mission	Safety and mission assurance					Approve NOAA licensed private operators disposal plans. Monitor plan for any changes
Re-entry/Return Ops	**Capabilities:**	Communications and control systems, instrumentation, radar and optical tracking stations, surveillance and tracking radar units, JSpOC, and other supporting units	NASA Spacecraft/object re-entry manuever planning and execution					NOAA reviews and approves final plans at time of deorbit. Verifies calculations, coordinates with appropriate agencies. Provides contacts for this activity to licensee. Monitor event
Post Flight								
	Authorities:	DODI, 3200.18, Management and Operation of the Major Range and test Facility Base, USD(AT&L); AFI 91-217, Space Safety and Mishap Prevention Program						
DoD launch pads are regularly refurbed and reused	**Responsibilities:**	Assure public safety and the mission, protect the space environment	Maintain NASA-owned launch site infrastructure					
	Capabilities:							

Attachment 2: Single Page Summary of Capabilities, Authorities, and Responsibilities



Attachment 3: Example Definitions

Air carrier means a person who undertakes directly by lease, or other arrangement, to engage in air transportation. [49 USC § 1.1]

Air commerce means interstate, overseas, or foreign air commerce or the transportation of mail by aircraft or any operation or navigation of aircraft within the limits of any Federal airway or any operation or navigation of aircraft which directly affects, or which may endanger safety in, interstate, overseas, or foreign air commerce. [49 USC § 1.1]

Aircraft means a device that is used or intended to be used for flight in the air. [49 USC § 1.1]

Aircraft engine means an engine that is used or intended to be used for propelling aircraft. It includes turbosuperchargers, appurtenances, and accessories necessary for its functioning, but does not include propellers. [49 USC § 1.1]

Airframe means the fuselage, booms, nacelles, cowlings, fairings, airfoil surfaces (including rotors but excluding propellers and rotating airfoils of engines), and landing gear of an aircraft and their accessories and controls. [49 USC § 1.1]

Airplane means an engine-driven fixed-wing aircraft heavier than air, that is supported in flight by the dynamic reaction of the air against its wings. [49 USC § 1.1]

Airport means an area of land or water that is used or intended to be used for the landing and takeoff of aircraft, and includes its buildings and facilities, if any. [49 USC § 1.1]

Airship means an engine-driven lighter-than-air aircraft that can be steered. [49 USC § 1.1]

Air traffic means aircraft operating in the air or on an airport surface, exclusive of loading ramps and parking areas. [49 USC § 1.1]

Air traffic clearance means an authorization by air traffic control, for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified traffic conditions within controlled airspace. [49 USC § 1.1]

Air traffic control means a service operated by appropriate authority to promote the safe, orderly, and expeditious flow of air traffic. [49 USC § 1.1]

Air Traffic Service (ATS) route is a specified route designated for channeling the flow of traffic as necessary for the provision of air traffic services. The term “ATS route” refers to a variety of airways, including jet routes, area navigation (RNAV) routes, and arrival and departure routes. An ATS route is defined by route specifications, which may include: [49 USC § 1.1]
(1) An ATS route designator;
(2) The path to or from significant points;
(3) Distance between significant points;
(4) Reporting requirements; and
(5) The lowest safe altitude determined by the appropriate authority.

Air transportation means interstate, overseas, or foreign air transportation or the transportation of mail by aircraft. [49 USC § 1.1]

Approved , unless used with reference to another person, means approved by the FAA or any person to whom the FAA has delegated its authority in the matter concerned, or approved under the provisions of a bilateral agreement between the United States and a foreign country or jurisdiction. [49 USC § 1.1]

Armed Forces means the Army, Navy, Air Force, Marine Corps, and Coast Guard, including their regular and reserve components and members serving without component status. [49 USC § 1.1]

Commercial operator means a person who, for compensation or hire, engages in the carriage by aircraft in air commerce of persons or property, other than as an air carrier or foreign air carrier or under the authority of Part 375 of this title. Where it is doubtful that an operation is for “compensation or hire”, the test applied is whether the carriage by air is merely incidental to the person's other business or is, in itself, a major enterprise for profit. [49 USC § 1.1]

Controlled airspace means an airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification. [49 USC § 1.1] Note: Controlled airspace is a generic term that covers Class A, Class B, Class C, Class D, and Class E airspace.

Controlled Firing Area. A controlled firing area is established to contain activities, which if not conducted in a controlled environment, would be hazardous to nonparticipating aircraft. [49 USC § 1.1]

Contingency abort means cessation of vehicle flight during ascent or descent in a manner that does not jeopardize public health and safety and the safety of property, in accordance with mission rules and procedures. Contingency abort includes landing at an alternative location that has been designated as a contingency abort location in advance of vehicle flight. [49 USC § 401.5]

Crewmember means a person assigned to perform duty in an aircraft during flight time [49 USC § 1.1]. For the purposes of this document, *Crewmember* also refers to any employee or independent contractor of a licensee, transferee, or permittee, or of a contractor or subcontractor of a licensee, transferee, or permittee, who performs activities in the course of that employment or contract directly relating to the launch, reentry, or other operation of or in a launch vehicle or reentry vehicle that carries human beings. A crew consists of flight crew and any remote operator. [49 USC § 401.5]

Equivalent level of safety means an approximately equal level of safety as determined by qualitative or quantitative means. [49 USC § 401.5]

Expendable launch vehicle means a launch vehicle whose propulsive stages are flown only once. [49 USC § 401.5]

Experimental permit or *permit* means an authorization by the FAA to a person to launch or reenter a reusable suborbital rocket. [49 USC § 401.5]

Federal launch range means a launch site, from which launches routinely take place, that is owned and operated by the government of the United States. [49 USC § 401.5]

Flight crew means a pilot, flight engineer, or flight navigator assigned to duty in an aircraft during flight time [49 USC § 1.1]. *Flight crew* also refers to crew that is on board a vehicle during a launch or reentry. [49 USC § 401.5]

Flight level means a level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury. Each is stated in three digits that represent hundreds of feet. For example, flight level 250 represents a barometric altimeter indication of 25,000 feet; flight level 255, an indication of 25,500 feet. [49 USC § 1.1]

Flight plan means specified information, relating to the intended flight of an aircraft, that is filed orally or in writing with air traffic control. [49 USC § 1.1]

Flight time means: [49 USC § 1.1]
(1) Pilot time that commences when an aircraft moves under its own power for the purpose of flight and ends when the aircraft comes to rest after landing; or

(2) For a glider without self-launch capability, pilot time that commences when the glider is towed for the purpose of flight and ends when the glider comes to rest after landing.

Foreign air carrier means any person other than a citizen of the United States, who undertakes directly, by lease or other arrangement, to engage in air transportation. [49 USC § 1.1]

Foreign air commerce means the carriage by aircraft of persons or property for compensation or hire, or the carriage of mail by aircraft, or the operation or navigation of aircraft in the conduct or furtherance of a business or vocation, in commerce between a place in the United States and any place outside thereof; whether such commerce moves wholly by aircraft or partly by aircraft and partly by other forms of transportation. [49 USC § 1.1]

Foreign air transportation means the carriage by aircraft of persons or property as a common carrier for compensation or hire, or the carriage of mail by aircraft, in commerce between a place in the United States and any place outside of the United States, whether that commerce moves wholly by aircraft or partly by aircraft and partly by other forms of transportation. [49 USC § 1.1]

Flight safety system means a system designed to limit or restrict the hazards to public health and safety and the safety of property presented by a launch vehicle or reentry vehicle while in flight by initiating and accomplishing a controlled ending to vehicle flight. A flight safety system may be destructive resulting in intentional break up of a vehicle or nondestructive, such as engine thrust termination enabling vehicle landing or safe abort capability. [49 USC § 401.5]

Glider means a heavier-than-air aircraft, that is supported in flight by the dynamic reaction of the air against its lifting surfaces and whose free flight does not depend principally on an engine. [49 USC § 1.1]

Geosynchronous Earth Orbit (GEO) – for the purposes of this document, satellite orbits with a period equal to the Earth's rotational period (corresponding to an altitude of approximately 35,000km) [PPD-4, Task 2 White Paper]

Human space flight incident means an unplanned event that poses a high risk of causing a serious or fatal injury to a space flight participant or crew. [49 USC § 401.5]
Instantaneous impact point means an impact point, following thrust termination of a launch vehicle, calculated in the absence of atmospheric drag effects. [49 USC § 401.5]

Instrument means a device using an internal mechanism to show visually or aurally the attitude, altitude, or operation of an aircraft or aircraft part. It includes electronic devices for automatically controlling an aircraft in flight. [49 USC § 1.1]

Interstate air commerce means the carriage by aircraft of persons or property for compensation or hire, or the carriage of mail by aircraft, or the operation or navigation of aircraft in the conduct or furtherance of a business or vocation, in commerce between a place in any State of the United States, or the District of Columbia, and a place in any other State of the United States, or the District of Columbia; or between places in the same State of the United States through the airspace over any place outside thereof; or between places in the same territory or possession of the United States, or the District of Columbia. [49 USC § 1.1]

Interstate air transportation means the carriage by aircraft of persons or property as a common carrier for compensation or hire, or the carriage of mail by aircraft in commerce: [49 USC § 1.1]
(1) Between a place in a State or the District of Columbia and another place in another State or the District of Columbia;
(2) Between places in the same State through the airspace over any place outside that State; or
(3) Between places in the same possession of the United States;
Whether that commerce moves wholly by aircraft of partly by aircraft and partly by other forms of transportation.

Intrastate air transportation means the carriage of persons or property as a common carrier for compensation or hire, by turbojet-powered aircraft capable of carrying thirty or more persons, wholly within the same State of the United States. [49 USC § 1.1]
Large aircraft means aircraft of more than 12,500 pounds, maximum certificated takeoff weight. [49 USC § 1.1]

Launch means to place or try to place a launch vehicle or reentry vehicle and any payload from Earth in a suborbital trajectory, in Earth orbit in outer space, or otherwise in outer space, and includes preparing a launch vehicle for flight at a launch site in the United States. Launch includes the flight of a launch vehicle and includes pre- and post-flight ground operations as follows: [49 USC § 401.5]
(1) *Beginning of launch.* (i) Under a license, launch begins with the arrival of a launch vehicle or payload at a U.S. launch site.
(ii) Under a permit, launch begins when any pre-flight ground operation at a U.S. launch site meets all of the following criteria:
(A) Is closely proximate in time to flight,
(B) Entails critical steps preparatory to initiating flight,
(C) Is unique to space launch, and
(D) Is inherently so hazardous as to warrant the FAA's regulatory oversight.
(2) *End of launch.* (i) For launch of an orbital expendable launch vehicle (ELV), launch ends after the licensee's last exercise of control over its launch vehicle.
(ii) For launch of an orbital reusable launch vehicle (RLV) with a payload, launch ends after deployment of the payload. For any other orbital RLV, launch ends upon completion of the first sustained, steady-state orbit of an RLV at its intended location.
(iii) For a suborbital ELV or RLV launch, launch ends after reaching apogee if the flight includes a reentry, or otherwise after vehicle landing or impact on Earth, and after activities necessary to return the vehicle to a safe condition on the ground.
Launch accident means [49 USC § 401.5]
(1) An event that causes a fatality or serious injury (as defined in 49 CFR 830.2) to any person who is not associated with the flight;
(2) An event that causes damage estimated to exceed $25,000 to property not associated with the flight that is not located at the launch site or designated recovery area;
(3) An unplanned event occurring during the flight of a launch vehicle resulting in the impact of a launch vehicle, its payload or any component thereof:
(i) For an expendable launch vehicle, outside designated impact limit lines; and
(ii) For a reusable launch vehicle, outside a designated landing site.
(4) For a launch that takes place with a person on board, a fatality or serious injury to a space flight participant or crew member.
Launch incident means an unplanned event during the flight of a launch vehicle, other than a launch accident, involving a malfunction of a flight safety system or safety-critical system, or a failure of the licensee's or permittee's safety organization, design, or operations. [49 USC § 401.5]

Launch operator means a person who conducts or who will conduct the launch of a launch vehicle and any payload. [49 USC § 401.5]
Launch site means the location on Earth from which a launch takes place (as defined in a license the Secretary issues or transfers under this chapter) and necessary facilities at that location. [49 USC § 401.5]

Launch site safety assessment means an FAA assessment of a Federal launch range to determine if the range meets FAA safety requirements. A difference between range practice and FAA requirements is documented in the LSSA. [49 USC § 401.5]
Launch vehicle means a vehicle built to operate in, or place a payload in, outer space or a suborbital rocket. [49 USC § 401.5]

Long-range communication system (LRCS). A system that uses satellite relay, data link, high frequency, or another approved communication system which extends beyond line of sight. [49 USC § 1.1]

Long-range navigation system (LRNS). An electronic navigation unit that is approved for use under instrument flight rules as a primary means of navigation, and has at least one source of navigational input, such as inertial navigation system, global positioning system, Omega/very low frequency, or Loran C. [49 USC § 1.1]
Low Earth Orbit (LEO) – For the purposes of this document, satellite orbits with altitudes up to ~3,000km. [PPD-4, Task 2 White Paper]

Medium Earth Orbit (MEO) – For the purposes of this document, satellite orbits with altitudes between ~3,000km and ~22,000km. [PPD-4, Task 2 White Paper]

Military operations area. A military operations area (MOA) is airspace established outside Class A airspace to separate or segregate certain nonhazardous military activities from IFR Traffic and to identify for VFR traffic where these activities are conducted. [49 USC § 1.1]
National defense airspace means airspace established by a regulation prescribed, or an order issued under, 49 U.S.C. 40103(b)(3). [49 USC § 1.1]

Mishap means a launch or reentry accident, launch or reentry incident, launch site accident, failure to complete a launch or reentry as planned, or an unplanned event or series of events resulting in a fatality or serious injury (as defined in 49 CFR 830.2), or resulting in greater than $25,000 worth of damage to a payload, a launch or reentry vehicle, a launch or reentry support facility or government property located on the launch or reentry site. [49 USC § 401.5]

Nominal means, in reference to launch vehicle performance, trajectory, or stage impact point, a launch vehicle flight where all vehicle aerodynamic parameters are as expected, all vehicle internal and external systems perform exactly as planned, and there are no external perturbing influences other than atmospheric drag and gravity. [49 USC § 401.5]

Operation of a launch site means the conduct of approved safety operations at a permanent site to support the launching of vehicles and payloads. [49 USC § 401.5]

Operation of a reentry site means the conduct of safety operations at a permanent site on Earth at which a reentry vehicle and its payload, if any, is intended to land. [49 USC § 401.5]

Operator means a holder of a license or permit under 49 U.S.C. Subtitle IX, chapter 701. [49 USC § 401.5]

Navigable airspace means airspace at and above the minimum flight altitudes prescribed by or under this chapter, including airspace needed for safe takeoff and landing. [49 USC § 1.1]

Operational control, with respect to a flight, means the exercise of authority over initiating, conducting or terminating a flight [49 USC § 1.1]. For the purposes of this document Operational Control also refers to the having control over the altering an object's orbit, decay, or having control of emissions from an object. It does not include the mission of an object (Example: station-keeping, changes in orbit, or sending electron-magnetic energy from an object are operational control. Taking images from an object is not)

Orbit: For the purposes of this document, an object has reached orbit when it is subject to the gravitational effects of the earth yet its point of impact no is no longer on the surface of the Earth.

Overseas air commerce means the carriage by aircraft of persons or property for compensation or hire, or the carriage of mail by aircraft, or the operation or navigation of aircraft in the conduct or furtherance of a business or vocation, in commerce between a place in any State of the United States, or the District of Columbia, and any place in a territory or possession of the United States; or between a place in a territory or possession of the United States, and a place in any other territory or possession of the United States. [49 USC § 1.1]

Overseas air transportation means the carriage by aircraft of persons or property as a common carrier for compensation or hire, or the carriage of mail by aircraft, in commerce: [49 USC § 1.1]
(1) Between a place in a State or the District of Columbia and a place in a possession of the United States; or
(2) Between a place in a possession of the United States and a place in another possession of the United States; whether that commerce moves wholly by aircraft or partly by aircraft and partly by other forms of transportation.

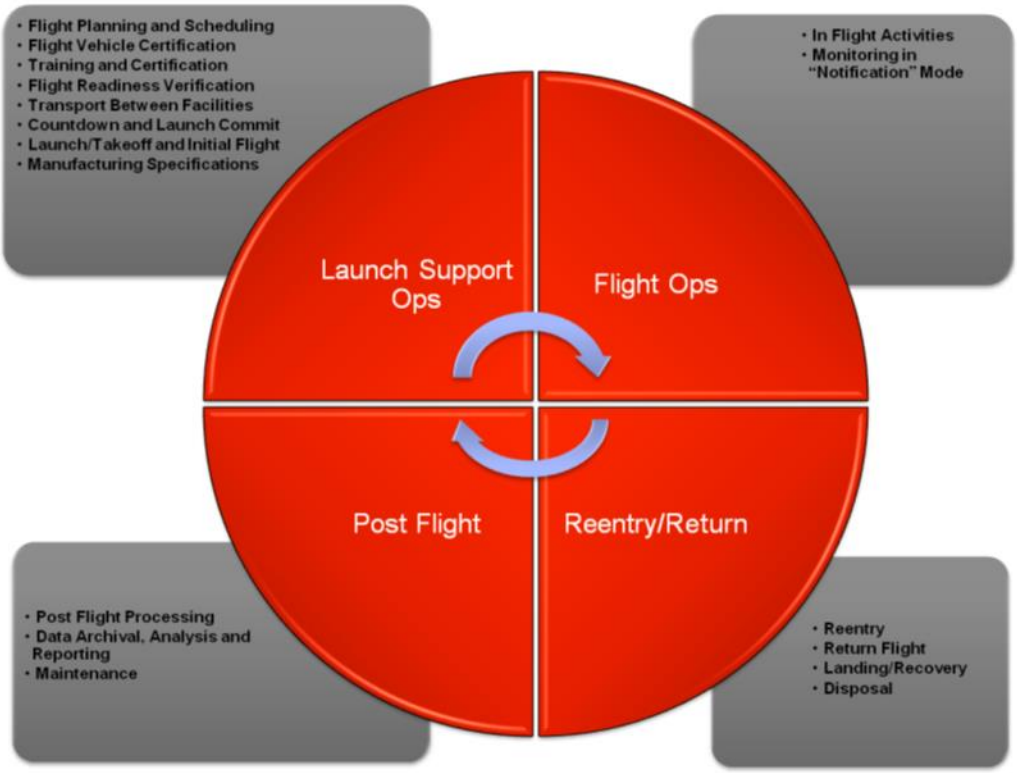
Owner/Operator additionally is used to refer to non-US citizens or organizations which operate man-made satellite systems. [Personnel reference, USSTRATCOM/J51, OSD(P)]

Person means an individual, firm, partnership, corporation, company, association, joint-stock association, or governmental entity. It includes a trustee, receiver, assignee, or similar representative of any of them. [49 USC § 1.1]

Payload means an object that a person undertakes to place in outer space by means of a launch vehicle, including components of the vehicle specifically designed or adapted for that object. [49 USC § 401.5]
Person means an individual or an entity organized or existing under the laws of a state or country. [49 USC § 401.5]

Pilot in command means the person who: [49 USC § 1.1]
(1) Has final authority and responsibility for the operation and safety of the flight;
(2) Has been designated as pilot in command before or during the flight; and
(3) Holds the appropriate category, class, and type rating, if appropriate, for the conduct of the flight.

Phases of space operations are defined as: [PPD-4, Task 2 White Paper]
- Launch Support Operations (Planning and Processing)
- Flight Operations
- Reentry/Return (End of Mission Activities)
- Post Flight



Positive control means control of all air traffic, within designated airspace, by air traffic control [49 USC § 1.1]. *Positive control* also refers to owner/operator directly in contact with, and able to react to FAA/AST direction for physical and operational control of a space object.

Prohibited area. A prohibited area is airspace designated under part 73 within which no person may operate an aircraft without the permission of the using agency. [49 USC § 1.1]
Public aircraft means any of the following aircraft when not being used for a commercial purpose or to carry an individual other than a crewmember or qualified non-crewmenber: [49 USC § 1.1]
(1) An aircraft used only for the United States Government; an aircraft owned by the Government and operated by any person for purposes related to crew training, equipment development, or demonstration; an aircraft owned and operated by the government of a State, the District of Columbia, or a territory or possession of the United States or a political subdivision of one of these governments; or an aircraft exclusively leased for at least 90 continuous days by the government of a State, the District of Columbia, or a territory or possession of the United States or a political subdivision of one of these governments.
(i) For the sole purpose of determining public aircraft status, *commercial purposes* means the transportation of persons or property for compensation or hire, but does not include the operation of an aircraft by the armed forces for reimbursement when that reimbursement is required by any Federal statute, regulation, or directive, in effect on November 1, 1999, or by one government on behalf of another government under a cost reimbursement agreement if the government on whose behalf the operation is conducted certifies to the Administrator of the Federal Aviation Administration that the operation is necessary to respond to a significant and imminent threat to life or property (including natural resources) and that no service by a private operator is reasonably available to meet the threat.
(ii) For the sole purpose of determining public aircraft status, *governmental function* means an activity undertaken by a government, such as national defense, intelligence missions, firefighting, search and rescue, law enforcement (including transport of prisoners, detainees, and illegal aliens), aeronautical research, or biological or geological resource management.

(iii) For the sole purpose of determining public aircraft status, *qualified non-crewmember* means an individual, other than a member of the crew, aboard an aircraft operated by the armed forces or an intelligence agency of the United States Government, or whose presence is required to perform, or is associated with the performance of, a governmental function.
(2) An aircraft owned or operated by the armed forces or chartered to provide transportation to the armed forces if—
(i) The aircraft is operated in accordance with title 10 of the United States Code;
(ii) The aircraft is operated in the performance of a governmental function under title 14, 31, 32, or 50 of the United States Code and the aircraft is not used for commercial purposes; or
(iii) The aircraft is chartered to provide transportation to the armed forces and the Secretary of Defense (or the Secretary of the department in which the Coast Guard is operating) designates the operation of the aircraft as being required in the national interest.
(3) An aircraft owned or operated by the National Guard of a State, the District of Columbia, or any territory or possession of the United States, and that meets the criteria of paragraph (2) of this definition, qualifies as a public aircraft only to the extent that it is operated under the direct control of the Department of Defense.

Populated area means [49 USC § 401.5]
(1) An outdoor location, structure, or cluster of structures that may be occupied by people;
(2) Sections of roadways and waterways that are frequented by automobile and boat traffic; or
(3) Agricultural lands, if routinely occupied by field workers.

Pilot means a flight crew member who has the ability to control, in real time, a launch or reentry vehicle's flight path. [49 USC § 401.5]

Public safety means, for a particular licensed launch, the safety of people and property that are not involved in supporting the launch and includes those people and property that may be located within the boundary of a launch site, such as visitors, individuals providing goods or services not related to launch processing or flight, and any other launch operator and its personnel. [49 USC § 401.5]

Rating means a statement that, as a part of a certificate, sets forth special conditions, privileges, or limitations. [49 USC § 1.1]

Reenter; reentry means to return or attempt to return, purposefully, a reentry vehicle and its payload, if any, from Earth orbit or from outer space to Earth. The term “reenter; reentry” includes activities conducted in Earth orbit or outer space to determine reentry readiness and that are critical to ensuring public health and safety and the safety of property during reentry flight. The term “reenter; reentry” also includes activities conducted on the ground after vehicle landing on Earth to ensure the reentry vehicle does not pose a threat to public health and safety or the safety of property. [49 USC § 401.5]

Reentry accident means [49 USC § 401.5]
(1) Any unplanned event occurring during the reentry of a reentry vehicle resulting in the impact of the reentry vehicle, its payload, or any component thereof, outside a designated reentry site;
(2) An event that causes a fatality or serious injury (as defined in 49 CFR 830.2) to any person who is not associated with the reentry;
(3) An event that causes damage estimated to exceed $25,000 to property not associated with the reentry and not located within a designated reentry site; and
(4) For a reentry that takes place with a person on board, a fatality or serious injury to a space flight participant or crew member.

Reentry incident means any unplanned event occurring during the reentry of a reentry vehicle, other than a reentry accident, involving a malfunction of a reentry safety-critical system or failure of the licensee's or permittee's safety organization, procedures, or operations. [49 USC § 401.5]

Reentry operator means a person responsible for conducting the reentry of a reentry vehicle as specified in a license issued by the FAA. [49 USC § 401.5]

Reentry site means the location on Earth where a reentry vehicle is intended to return. It includes the area within three standard deviations of the intended landing point (the predicted three-sigma footprint). [49 USC § 401.5]

Reentry vehicle means a vehicle designed to return from Earth orbit or outer space to Earth substantially intact. A reusable launch vehicle that is designed to return from Earth orbit or outer space to Earth substantially intact is a reentry vehicle. [49 USC § 401.5]

Remote operator means a crew member who [49 USC § 401.5]
(1) Has the ability to control, in real time, a launch or reentry vehicle's flight path, and
(2) Is not on board the controlled vehicle.

Reusable launch vehicle (RLV) means a launch vehicle that is designed to return to Earth substantially intact and therefore may be launched more than one time or that contains vehicle stages that may be recovered by a launch operator for future use in the operation of a substantially similar launch vehicle. [49 USC § 401.5]

Risk means a measure that accounts for both the probability of occurrence of a hazardous event and the consequence of that event to persons or property. [49 USC § 401.5]

Restricted area. A restricted area is airspace designated under Part 73 within which the flight of aircraft, while not wholly prohibited, is subject to restriction. [49 USC § 1.1]

Rocket means an aircraft propelled by ejected expanding gases generated in the engine from self-contained propellants and not dependent on the intake of outside substances. It includes any part which becomes separated during the operation. [49 USC § 1.1]

Route segment is a portion of a route bounded on each end by a fix or navigation aid (NAVAID). [49 USC § 1.1]

Safety critical means essential to safe performance or operation. A safety critical system, subsystem, component, condition, event, operation, process, or item is one whose proper recognition, control, performance, or tolerance is essential to ensuring public safety. Something that is safety critical item creates a safety hazard or provide protection from a safety hazard. [49 USC § 401.5]

Space: Although the term has never been successfully defined, a void in legal applicability exists with regard to operations above the National Airspace System which ends at the top of class E airspace (Karman Line).

Space Debris: all manmade objects including fragments and elements thereof, in near earth orbit and non-functional spacecraft. Mitigation measures include limiting the debris released during normal operations by minimizing the number, area, and orbital lifetime of the debris, as well as preventing explosions and ruptures at the end of missions and not initiating intentional destructions which will generate long lived orbital debris. [IADC Guidelines]

Space Traffic: Objects or vehicles that operate, or are intended to operate, above the U.S. National Airspace System [Personnel Derived based on discussions with USSTRATCOM and AFSPC personnel]

Space Traffic Management: the set of technical and regulatory provisions for promoting safe access into outer space, operations in outer space and return from outer space to Earth free of physical or radio-frequency interference. [PPD-4, Task 2 White Paper]

STM functions and processes include but are not limited to obtaining basic knowledge of the space environment, communicating information on space weather, understanding the implications of the electromagnetic spectrum, and enforcing binding regulatory guidance related to the physical activities of the spacecraft. Although these processes reflect actual spaceflight operations, consideration of this

guidance and its impacts are critical to the design and manufacturing process as well. [PPD-4, Task 2 White Paper]

STM processes are grouped and categorized into the following areas:
- Space Traffic Awareness
- Space Traffic Regulation and Enforcement
- Space Traffic Control

Space Traffic Regulation and Enforcement: Space Traffic Regulation includes functions and services that are duly authorized, by an appropriate authority, to assess, approve, and grant permission for spacecraft operations, to ensure approved processes are adhered to, and to guarantee the safety of equipment and personnel. Enforcement includes those means by which an appropriate authority can mandate compliance with approved processes and direction. [COSMIC Study on Space Traffic Management, 2006]

Space Traffic Control: Space Traffic Control includes functions and services supported by directive processes and procedures (pre-planned or real-time) by which an appropriate authority can direct and approve actions in order to promote the safe, orderly, and expeditious flow of space traffic. Due to the physics inherent in space traffic, the planned command and control events cannot be instantaneous, and require rigorous analysis and specialized expertise. [PPD-4, Task 2 White Paper]

Standard atmosphere means the atmosphere defined in U.S. Standard Atmosphere, 1962 (Geopotential altitude tables). [49 USC § 1.1]
Time in service, with respect to maintenance time records, means the time from the moment an aircraft leaves the surface of the earth until it touches it at the next point of landing. [49 USC § 1.1]

Sigma means a single standard deviation from a fixed value, such as a mean. [49 USC § 401.5]

Space flight participant means an individual, who is not crew, carried aboard a launch vehicle or reentry vehicle. [49 USC § 401.5]

State and United States means, when used in a geographical sense, the several States, the District of Columbia, the Commonwealth of Puerto Rico, American Samoa, the United States Virgin Islands, Guam, and any other commonwealth, territory, or possession of the United States; and [49 USC § 401.5]

Small aircraft means aircraft of 12,500 pounds or less, maximum certificated takeoff weight. [49 USC § 1.1]

Suborbital rocket means a vehicle, rocket-propelled in whole or in part, intended for flight on a suborbital trajectory, and the thrust of which is greater than its lift for the majority of the rocket-powered portion of its ascent. [49 USC § 401.5]

Suborbital trajectory means the intentional flight path of a launch vehicle, reentry vehicle, or any portion thereof, whose vacuum instantaneous impact point does not leave the surface of the Earth. [49 USC § 401.5]

Traffic pattern means the traffic flow that is prescribed for aircraft landing at, taxiing on, or taking off from, an airport. [49 USC § 1.1]

United States, in a geographical sense, means (1) the States, the District of Columbia, Puerto Rico, and the possessions, including the territorial waters, and (2) the airspace of those areas. [49 USC § 1.1]

United States air carrier means a citizen of the United States who undertakes directly by lease, or other arrangement, to engage in air transportation. [49 USC § 1.1]

United States citizen means: [49 USC § 401.5]

(1) Any individual who is a citizen of the United States;
(2) Any corporation, partnership, joint venture, association, or other entity organized or existing under the laws of the United States or any State; and
(3) Any corporation, partnership, joint venture, association, or other entity which is organized or exists under the laws of a foreign nation, if the controlling interest in such entity is held by an individual or entity described in paragraph (1) or (2) of this definition. *Controlling interest* means ownership of an amount of equity in such entity sufficient to direct management of the entity or to void transactions entered into by management. Ownership of at least fifty-one percent of the equity in an entity by persons described in paragraph (1) or (2) of this definition creates a rebuttable presumption that such interest is controlling.

Validation means an evaluation to determine that each safety measure derived from a system safety process is correct, complete, consistent, unambiguous, verifiable, and technically feasible. Validation ensures that the right safety measure is implemented, and that the safety measure is well understood. [49 USC § 401.5]

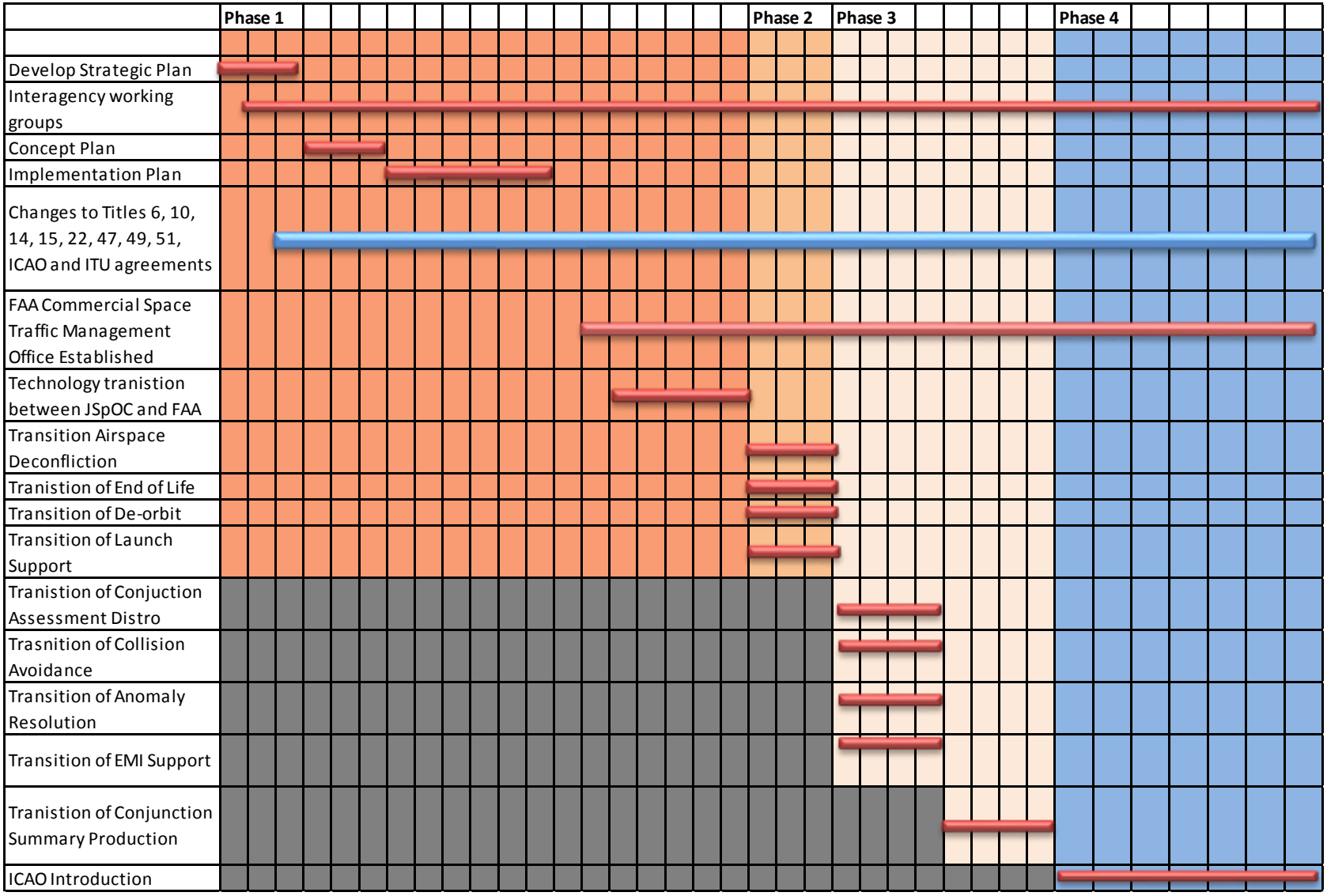
Vehicle safety operations personnel means those persons whose job performance is critical to public health and safety or the safety of property during RLV or reentry operations. [49 USC § 401.5]

Verification means an evaluation to determine that safety measures derived from a system safety process are effective and have been properly implemented. Verification provides measurable evidence that a safety measure reduces risk to acceptable levels. [49 USC § 401.5]

VFR over-the-top, with respect to the operation of aircraft, means the operation of an aircraft over-the-top under VFR when it is not being operated on an IFR flight plan. [49 USC § 1.1]

Warning area. A warning area is airspace of defined dimensions, extending from 3 nautical miles outward from the coast of the United States, that contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both. [49 USC § 1.1]

Attachment 4: Example Transition Path



Attachment 5: Example Extrapolated Regulations and Norms

		Title 14 basis for US Space regulations		
Title 14 CFR Part	**Para**	**Existing verbiage**	**Proposed verbiage**	**Intent**
71	7	All bearings and radials in this part are true and are applied from point of origin and all mileages in this part are stated as nautical miles.	All locations will be reported in conventional two-line element sets at a minimum. Higher accuracy data is preferred.	standardizes reported dat ensure all systems can in the provided data. A mor accurate form of standard data is preferred but must remain standardized.
71	31	The airspace descriptions contained in §71.33 and the routes contained in subpart A of FAA Order 7400.9Z (incorporated by reference, see §71.1) are designated as Class A airspace within which all pilots and aircraft are subject to the rating requirements, operating rules, and equipment requirements of part 91 of this chapter.	The zone described in §71.33 is designated a Class A zone within all owner/operators and objects are subject to operating rules and equipment requirements of part 91.	Designates that owner/operators must com with specific requirements they choose to operate in Class A zone.
71	33	§71.33 Class A airspace areas.(a) That airspace of the United States, including that airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States, from 18,000 feet MSL to and including FL600 excluding the states of Alaska and Hawaii.(b) That airspace of the State of Alaska, including that airspace overlying the waters within 12 nautical miles of the coast, from 18,000 feet MSL to and including FL600 but not including the airspace less than 1,500 feet above the surface of the earth and the Alaska Peninsula west of longitude 160°00?00? West.(c) The airspace areas listed as offshore airspace areas in subpart A of FAA Order 7400.9Z (incorporated by reference, see §71.1) that are designated in international airspace within areas of domestic radio navigational signal or ATC radar coverage, and within which domestic ATC procedures are applied.	Class A zone includes geosynchronous orbital areas 35,786 kilometers above the Earth's equator measured from Mean Sea Level at standard atmospheric conditions, and following the direction of the Earth's rotation.	Describes areas of type A

71	41	§71.41 Class B airspace. The Class B airspace areas listed in subpart B of FAA Order 7400.9Z (incorporated by reference, see §71.1) consist of specified airspace within which all aircraft operators are subject to the minimum pilot qualification requirements, operating rules, and aircraft equipment requirements of part 91 of this chapter. Each Class B airspace area designated for an airport in subpart B of FAA Order 7400.9Z (incorporated by reference, see §71.1) contains at least one primary airport around which the airspace is designated.	Class B zone includes orbital areas between 15000 and 25000 kilometers above the surface of the Earth measured from Mean Sea Level at standard atmospheric conditions	Describes type B orbital regimes with most restricti requirements and lists Spe areas of type B orbits
71	51	§71.51 Class C airspace. The Class C airspace areas listed in subpart C of FAA Order 7400.9Z (incorporated by reference, see §71.1) consist of specified airspace within which all aircraft operators are subject to operating rules and equipment requirements specified in part 91 of this chapter. Each Class C airspace area designated for an airport in subpart C of FAA Order 7400.9Z (incorporated by reference, see §71.1) contains at least one primary airport around which the airspace is designated.	Class C zone includes orbital areas beginning at the Karman line and ending 5000 kilometers above the surface of the Earth measured from Mean Sea Level at standard atmospheric conditions.	Describes type C orbital regimes with most restricti requirements and lists Spe areas of type C orbits
71	61	§71.61 Class D airspace. The Class D airspace areas listed in subpart D of FAA Order 7400.9Z (incorporated by reference, see §71.1) consist of specified airspace within which all aircraft operators are subject to operating rules and equipment requirements specified in part 91 of this chapter. Each Class D airspace area designated for an airport in subpart D of FAA Order 7400.9Z (incorporated by reference, see §71.1) contains at least one primary airport around which the airspace is designated.	Class D zones will be defined by specific requirements when non-circular orbits transition other zones. Owner/operators will ensure contact with U.S. STM entities is maintained.	Describes type D orbital regimes with most restricti requirements and lists Spe areas of type D orbits
71	71	§71.71 Class E airspace. Class E Airspace consists of:(a) The airspace of the United States, including that airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous states and Alaska, extending upward from 14,500 feet MSL up to, but not including 18,000 feet MSL, and the airspace above FL600, excluding—(1) The Alaska peninsula west of longitude 160°00?00? W.; and(2) The airspace below 1,500 feet above the surface of the earth.(b) The airspace areas designated for an airport in subpart E of FAA Order 7400.9Z	Class E zones will be any areas not already deemed zone A, B, C or D and below 40000 kilometers above the Earth's surface measured from Mean Sea Level at standard atmospheric conditions.	Describes type E orbital regimes with most restricti requirements and lists Spe areas of type E orbits

		(incorporated by reference, see §71.1) within which all aircraft operators are subject to the operating rules specified in part 91 of this chapter. (c) The airspace areas listed as domestic airspace areas in subpart E of FAA Order 7400.9Z (incorporated by reference, see §71.1) which extend upward from 700 feet or more above the surface of the earth when designated in conjunction with an airport for which an approved instrument approach procedure has been prescribed, or from 1,200 feet or more above the surface of the earth for the purpose of transitioning to or from the terminal or enroute environment. When such areas are designated in conjunction with airways or routes, the extent of such designation has the lateral extent identical to that of a Federal airway and extends upward from 1,200 feet or higher. Unless otherwise specified, the airspace areas in the paragraph extend upward from 1,200 feet or higher above the surface to, but not including, 14,500 feet MSL. (d) The Federal airways described in subpart E of FAA Order 7400.9Z (incorporated by reference, see §71.1). (e) The airspace areas listed as enroute domestic airspace areas in subpart E of FAA Order 7400.9Z (incorporated by reference, see §71.1). Unless otherwise specified, each airspace area has a lateral extent identical to that of a Federal airway and extends upward from 1,200 feet above the surface of the earth to the overlying or adjacent controlled airspace. (f) The airspace areas listed as offshore airspace areas in subpart E of FAA Order 7400.9Z (incorporated by reference, see §71.1) that are designated in international airspace within areas of domestic radio navigational signal or ATC radar coverage, and within which domestic ATC procedures are applied. Unless otherwise specified, each airspace area extends upward from a specified altitude up to, but not including, 18,000 feet MSL.		

71	109	§71.901 Applicability. Unless otherwise designated:(a) Each reporting point listed in subpart H of FAA Order 7400.9Z (incorporated by reference, see §71.1) applies to all directions of flight. In any case where a geographic location is designated as a reporting point for less than all airways passing through that point, or for a particular direction of flight along an airway only, it is so indicated by including the airways or direction of flight in the designation of geographical location.(b) Place names appearing in the reporting point descriptions indicate VOR or VORTAC facilities identified by those names.	Applicability. Reporting points will be established to require owner/operators to report to a controlling agency when they have reached a specific point in an anticipated maneuver.	Requires reporting when reaching an anticipated or location after launch, follo transfer orbits, or following maneuvers such as statio keeping or evasive efforts
73	1	§73.1 Applicability. The airspace that is described in subpart B and subpart C of this part is designated as special use airspace. These parts prescribe the requirements for the use of that airspace.	Applicability. The zones described in this subpart are designated special use airspace.	Applicability
73	3	§73.3 Special use airspace.(a) Special use airspace consists of airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature, or wherein limitations are imposed upon aircraft operations that are	Special use zones.(a) Special use zones consists of areas of defined dimensions wherein activities must be confined because of their nature, or wherein limitations are	Indented to provide opera with areas in which hazar operations could be prese

		not a part of those activities, or both. (b) The vertical limits of special use airspace are measured by designated altitude floors and ceilings expressed as flight levels or as feet above mean sea level. Unless otherwise specified, the word “to” (an altitude or flight level) means “to and including” (that altitude or flight level). (c) The horizontal limits of special use airspace are measured by boundaries described by geographic coordinates or other appropriate references that clearly define their perimeter. (d) The period of time during which a designation of special use airspace is in effect is stated in the designation.	imposed upon operations that are not a part of those activities, or both. (b) The period of time during which a designation of special use airspace is in effect is stated in the designation.	
73	11	§73.11 Applicability. This subpart designates restricted areas and prescribes limitations on the operation of aircraft within them.	Applicability. This subpart designates restricted zones and prescribes limitations on operations within them.	Restricted area applicabili
73	13	§73.13 Restrictions. No person may operate an aircraft within a restricted area between the designated altitudes and during the time of designation, unless he has the advance permission of (a) The using agency described in §73.15; or (b) The controlling agency described in §73.17.	Restrictions. No owner/operator may operate an object within a restricted zone within the designated distance from its center during the time of designation, unless that owner/operator has the advance permission of the using agency described in 73.15 or the controlling agency described in 73.17.	Describes Restrictions
73	15	§73.15 Using agency. (a) For the purposes of this subpart, the following are using agencies; (1) The agency, organization, or military command whose activity within a restricted area necessitated the area being so designated. (b) Upon the request of the FAA, the using agency shall execute a letter establishing procedures for joint use of a restricted area by the using agency and the controlling agency, under which the using agency would notify the controlling agency whenever the controlling agency may grant permission for transit through the restricted area in accordance with the terms of the letter. (c) The using agency shall— (1) Schedule activities within the restricted area; (2) Authorize transit through, or flight within, the restricted area as feasible; and (3) Contain within the restricted area all activities conducted therein in accordance	Using agency. (a) For the purposes of this subpart, the following are using agencies; (1) the agency, organization, or military command whose activity within a restricted zone necessitated the area being so designated. (b) Upon the request of the FAA, the using agency shall execute a letter establishing procedures for joint use of a restricted zone by the using agency and the controlling agency, under which the using agency would notify the controlling agency whenever the controlling agency may grant permission for transit through the restricted zone in accordance with the	Describes using agency

		with the purpose for which it was designated.	terms of the letter. (c) The using agency shall— (1) Schedule activities within the restricted area; (2) Authorize transit through, or operations within, the restricted zone as feasible; and (3) Contain within the restricted zone all activities conducted therein in accordance with the purpose for which it was designated.	
73	17	§73.17 Controlling agency. For the purposes of this part, the controlling agency is the FAA facility that may authorize transit through or flight within a restricted area in accordance with a joint-use letter issued under §73.15.	§73.17 Controlling agency. For the purposes of this part, the controlling agency is the FAA facility that may authorize transit through or operations within a restricted zone in accordance with a joint-use letter issued under §73.15.	Describes controlling ager
77	13	§77.13 Applicability. This subpart describes the standards used for determining obstructions to air navigation, navigational aids, or navigational facilities. These standards apply to the following: (a) Any object of natural growth, terrain, or permanent or temporary construction or alteration, including equipment or materials used and any permanent or temporary apparatus. (b) The alteration of any permanent or temporary existing structure by a change in its height, including appurtenances, or lateral dimensions, including equipment or material used therein.	§77.13 Applicability. This subpart describes the standards used for determining obstructions to orbital operations, navigational aids, navigational facilities or SSA capabilities. These standards apply to the following: (a) Any object of natural origin, or permanent or temporary construction or alteration, including equipment or materials used and any permanent or temporary apparatus. (b) The alteration of any permanent or temporary	Requirement to provide proposed construction or of objects which might obs commercial operations

			existing structure by a change in its height, including appurtenances, or lateral dimensions, including equipment or material used therein.	
91	1	(a) Except as provided in paragraphs (b) and (c) of this section and §§91.701 and 91.703, this part prescribes rules governing the operation of aircraft (other than moored balloons, kites, unmanned rockets, and unmanned free balloons, which are governed by part 101 of this chapter, and ultralight vehicles operated in accordance with part 103 of this chapter) within the United States, including the waters within 3 nautical miles of the U.S. coast	This part prescribes rules governing the operation of U.S. citizen-owned, man-made objects above the Karmen line. U.S. citizen is defined in 49 USC§401.5 as: (1) Any individual who is a citizen of the United States; (2) Any corporation, partnership, joint venture, association, or other entity organized or existing under the laws of the United States or any State; and (3) Any corporation, partnership, joint venture, association, or other entity which is organized or exists under the laws of a foreign nation, if the controlling interest in such entity is held by an individual or entity described in paragraph (1) or (2) of this definition. Controlling interest means ownership of an amount of equity in such entity sufficient to direct management of the entity or to void transactions entered into by management. Ownership of at least fifty-one percent of the equity in an entity by persons described in paragraph (1) or (2) of this definition creates a rebuttable presumption that such interest is controlling.	Applicability. - defines wh expected to operate unde these rules and regulation

91	3	(a) The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft. (b) In an in-flight emergency requiring immediate action, the pilot in command may deviate from any rule of this part to the extent required to meet that emergency. (c) Each pilot in command who deviates from a rule under paragraph (b) of this section shall, upon the request of the Administrator, send a written report of that deviation to the Administrator.	(a) The owner/operator of a man-made object operating above the Karman line is directly responsible for, and is the final authority as to, the operation of the object. (b) In an emergency requiring immediate action, the owner/operator may deviate from any rule of this part to the extent required to meet the emergency. (c) Each owner/operator who deviates from a rule under part (b) of this section shall, upon the request of the Administrator, send a written report of that deviation to the Administrator.	Defines owner/operator responsibility
91	7	(a) No person may operate a civil aircraft unless it is in an airworthy condition. (b) The pilot in command of a civil aircraft is responsible for determining whether that aircraft is in condition for safe flight. The pilot in command shall discontinue the flight when unairworthy mechanical, electrical, or structural conditions occur.	(a) no person may operate an object above the Karman line unless it is in a condition so as not to present a danger to other objects or persons. (b) the owner/operator is responsible for determining if an object is in a condition for continued safe operations and shall de-orbit or otherwise dispose of the object IAW previously approved licensing process.	Flight worthiness. When o object change from "missi capable" to "debris"
91	13	(a) Aircraft operations for the purpose of air navigation. No person may operate an aircraft in a careless or reckless manner so as to endanger the life or property of another (b) Aircraft operations other than for the purpose of air navigation. No person may operate an aircraft, other than for the purpose of air navigation, on any part of the surface of an airport used by aircraft for air commerce (including areas used by those aircraft for receiving or discharging	(a) no owner/operator may operate an object in a careless or reckless manner so as to endanger the life or property of another.	Careless or wreck less operation - restricts US lic objects from being operat a manner that might enda life or property of another.

		persons or cargo), in a careless or reckless manner so as to endanger the life or property of another		
91	15	No pilot in command of a civil aircraft may allow any object to be dropped from that aircraft in flight that creates a hazard to persons or property. However, this section does not prohibit the dropping of any object if reasonable precautions are taken to avoid injury or damage to persons or property	no owner/operator my de-orbit any object that may create a hazard to persons or property. However this does not prohibit de-orbiting objects if reasonable precautions are taken to avoid injury or damage to persons or property.	Restricts US licensed ope from de-orbiting objects in manner that might endang or property.
91	101	prescribes flight rules governing the operation of aircraft within the United States and within 12 nautical miles from the coast of the United States.	Prescribes rules governing operations of space objects owned or operated by US persons or objects for which the US government is considered responsible for under the liability convention.	Applicability of general flig rules
91	103	pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight. This information must include— (a) For a flight under IFR or a flight not in the vicinity of an airport, weather reports and forecasts, fuel requirements, alternatives available if the planned flight cannot be completed, and any known traffic delays of which the pilot in command has been advised by ATC; (b) For any flight, runway lengths at airports of intended use, and the following takeoff and landing distance information: (1) For civil aircraft for which an approved Airplane or Rotorcraft Flight Manual containing takeoff and landing distance data is required, the takeoff and landing distance data contained therein; and (2) For civil aircraft other than those specified in paragraph (b)(1) of this	Each owner/operator shall, before placing an object into the area above the Karman line, become familiar with all available information concerning operation of the object for the length of time it is anticipated to remain above the Karman line.	Preflight - defines requirer prior to placing an object i

		section, other reliable information appropriate to the aircraft, relating to aircraft performance under expected values of airport elevation and runway slope, aircraft gross weight, and wind and temperature.		
91	111	(a) No person may operate an aircraft so close to another aircraft as to create a collision hazard. (b) No person may operate an aircraft in formation flight except by arrangement with the pilot in command of each aircraft in the formation. (c) No person may operate an aircraft, carrying passengers for hire, in formation flight	No owner/operator may operate an object so close to another object as to create a collision hazard. (b) No owner/operator may operate an object in formation except by arrangement with the owner/operator of each object in the formation. (c) No owner/operator may operate an object carrying passengers for hire, in formation	Restricts operations Near objects
91	113	a) Inapplicability. This section does not apply to the operation of an aircraft on water. (b) General. When weather conditions permit, regardless of whether an operation is conducted under instrument flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft. When a rule of this section gives another aircraft the right-of-way, the pilot shall give way to that aircraft and may not pass over, under, or ahead of it unless well clear. (c) In distress. An aircraft in distress has the right-of-way over all other air traffic. (d) Converging. When aircraft of the same category are converging at approximately the same altitude (except head-on, or nearly so), the aircraft to the other's right has the right-of-way.	(a) General. Vigilance shall be maintained by each owner/operator operating an object so as to avoid other objects. When a rule of this section gives another object the right-of-way, the owner/operator shall give way to that object. (a) In distress. An object in distress has the right-of-way over all other traffic. (c) Converging. When maneuverable objects are converging priority shall be given in the following order: 1. Objects actively engaged in operations vital to national security or operations supporting immediate situations deemed to be critical to saving lives of human beings. 2. Objects occupied by human beings at the time of the converging event. 3. Object that would no longer be maneuverable if the required maneuver is undertaken (thereby making the object unsafe or a hazard to other objects). (d) if none of the above	Right of way consideration

			conditions exist the owner operators will determine required maneuvers to ensure continued safe operations. (e) if no owner/operators determine no maneuver is required but the controlling agency determines a maneuver is required, the controlling agency will provide direction to the owner/operators involved	
91	121	(a) Each person operating an aircraft shall maintain the cruising altitude or flight level of that aircraft, as the case may be, by reference to an altimeter that is set, when operating.... [verbiage continues].	(a) each owner operator will use an established standard to determine their relative position and vector.	Altitude baseline - ensures participating US owner operators are measuring altitude from the same poi
91	123	(a) When an ATC clearance has been obtained, no pilot in command may deviate from that clearance unless an amended clearance is obtained, an emergency exists, or the deviation is in response to a traffic alert and collision avoidance system resolution advisory.	(a) When a controlling agency issues direction to an owner/operator, no owner/operator may deviate from that direction unless an emergency exists, or the deviation is required to	Compliance with instructio from a traffic managemen entity

		However, except in Class A airspace, a pilot may cancel an IFR flight plan if the operation is being conducted in VFR weather conditions. When a pilot is uncertain of an ATC clearance, that pilot shall immediately request clarification from ATC. (b) Except in an emergency, no person may operate an aircraft contrary to an ATC instruction in an area in which air traffic control is exercised. (c) Each pilot in command who, in an emergency, or in response to a traffic alert and collision avoidance system resolution advisory, deviates from an ATC clearance or instruction shall notify ATC of that deviation as soon as possible. (d) Each pilot in command who (though not deviating from a rule of this subpart) is given priority by ATC in an emergency, shall submit a detailed report of that emergency within 48 hours to the manager of that ATC facility, if requested by ATC. (e) Unless otherwise authorized by ATC, no person operating an aircraft may operate that aircraft according to any clearance or instruction that has been issued to the pilot of another aircraft for radar air traffic control purposes.	prevent an emergency situation. (b) Except in an emergency, no person may operate an aircraft contrary to a controlling agency instruction in an area in which traffic control is exercised. (c) Each owner/operator who, in an emergency, deviates from a controlling agency instruction shall notify the controlling agency of that deviation as soon as possible. (d) Each owner/operator who (though not deviating from a rule of this subpart) is given priority by A controlling agency in an emergency, shall submit a detailed report of that emergency within 48 hours to the Administrator, if requested by the controlling agency.	

91	127	§91.127 Operating on or in the vicinity of an airport in Class E airspace. (a) Unless otherwise required by part 93 of this chapter or unless otherwise authorized or required by the ATC facility having jurisdiction over the Class E airspace area, each person operating an aircraft on or in the vicinity of an airport in a Class E airspace area must comply with the requirements of §91.126. (b) Departures. Each pilot of an aircraft must comply with any traffic patterns established for that airport in part 93 of this chapter. (c) Communications with control towers. Unless otherwise authorized or required by ATC, no person may operate an aircraft to, from, through, or on an airport having an operational control tower unless two-way radio communications are maintained between that aircraft and the control tower. Communications must be established prior to 4 nautical miles from the airport, up to and including 2,500 feet AGL. However, if the aircraft radio fails in flight, the pilot in command may operate that aircraft and land if weather conditions are at or above basic VFR weather minimums, visual contact with the tower is maintained, and a clearance to land is received. If the aircraft radio fails while in flight under IFR, the pilot must comply with §91.185.	Operations in Class E zones require clear operating plans with routine updates provided to FAA/AST	Describes operations in ty orbits
91	129	§91.129 Operations in Class D airspace. (a) General. Unless otherwise authorized or required by the ATC facility having jurisdiction over the Class D airspace area, each person operating an aircraft in Class D airspace must comply with the applicable provisions of this section. In addition, each person must comply with §§91.126 and 91.127. For the purpose of this section, the primary airport is the airport for which the Class D airspace area is designated. A satellite airport is any other airport within the Class D airspace area. (b) Deviations. An operator may deviate from any provision of this section under the provisions of an ATC authorization issued by the ATC facility having jurisdiction over the airspace concerned. ATC may authorize a deviation on a continuing basis or for an individual flight, as appropriate. (c) Communications. Each person operating an aircraft in Class D airspace must meet the following two-way radio	Operations in Class D zones require clear operating plan and communications with FAA/AST at designated times plus an ability to be in person-to-person communications with FAA/AST within 12 hours of requested contact.	Describes operations in ty orbits

		communications requirements: (1) Arrival or through flight. Each person must establish two-way radio communications with the ATC facility (including foreign ATC in the case of foreign airspace designated in the United States) providing air traffic services prior to entering that airspace and thereafter maintain those communications while within that airspace. (2) Departing flight. Each person— (i) From the primary airport or satellite airport with an operating control tower must establish and maintain two-way radio communications with the control tower, and thereafter as instructed by ATC while operating in the Class D airspace area; or (ii) From a satellite airport without an operating control tower, must establish and maintain two-way radio communications with the ATC facility having jurisdiction over the Class D airspace area as soon as practicable after departing. (d) Communications failure. Each person who operates an aircraft in a Class D airspace area must maintain two-way radio communications with the ATC facility having jurisdiction over that area. (1) If the aircraft radio fails in flight under IFR, the pilot must comply with §91.185 of the part. (2) If the aircraft radio fails in flight under VFR, the pilot in command may operate that aircraft and land if— (i) Weather conditions are at or above basic VFR weather minimums; (ii) Visual contact with the tower is maintained; and (iii) A clearance to land is received. (e) Minimum altitudes when operating to an airport in Class D airspace. (1) Unless required by the applicable distance-from-cloud criteria, each pilot operating a large or turbine-powered airplane must enter the traffic pattern at an altitude of at least 1,500 feet above the elevation of the airport and maintain at least 1,500 feet until further descent is required for a safe landing. (2) Each pilot operating a large or turbine-powered airplane approaching to land on a runway served by an instrument approach procedure with vertical guidance, if the airplane is so equipped, must: (i) Operate that airplane at an altitude at or above the glide path between the published final approach fix and the decision altitude (DA), or decision height (DH), as applicable; or (ii) If compliance with the applicable distance-		

		from-cloud criteria requires glide path interception closer in, operate that airplane at or above the glide path, between the point of interception of glide path and the DA or the DH. (3) Each pilot operating an airplane approaching to land on a runway served by a visual approach slope indicator must maintain an altitude at or above the glide path until a lower altitude is necessary for a safe landing. (4) Paragraphs (e)(2) and (e)(3) of this section do not prohibit normal bracketing maneuvers above or below the glide path that are conducted for the purpose of remaining on the glide path. (f) Approaches. Except when conducting a circling approach under part 97 of this chapter or unless otherwise required by ATC, each pilot must— (1) Circle the airport to the left, if operating an airplane; or (2) Avoid the flow of fixed-wing aircraft, if operating a helicopter. (g) Departures. No person may operate an aircraft departing from an airport except in compliance with the following: (1) Each pilot must comply with any departure procedures established for that airport by the FAA. (2) Unless otherwise required by the prescribed departure procedure for that airport or the applicable distance from clouds criteria, each pilot of a turbine-powered airplane and each pilot of a large airplane must climb to an altitude of 1,500 feet above the surface as rapidly as practicable. (h) Noise abatement. Where a formal runway use program has been established by the FAA, each pilot of a large or turbine-powered airplane assigned a noise abatement runway by ATC must use that runway. However, consistent with the final authority of the pilot in command concerning the safe operation of the aircraft as prescribed in §91.3(a), ATC may assign a different runway if requested by the pilot in the interest of safety. (i) Takeoff, landing, taxi clearance. No person may, at any airport with an operating control tower, operate an aircraft on a runway or taxiway, or take off or land an aircraft, unless an appropriate clearance is received from ATC.		

91	130	§91.130 Operations in Class C airspace. (a) General. Unless otherwise authorized by ATC, each aircraft operation in Class C airspace must be conducted in compliance with this section and §91.129. For the purpose of this section, the primary airport is the airport for which the Class C airspace area is designated. A satellite airport is any other airport within the Class C airspace area. (b) Traffic patterns. No person may take off or land an aircraft at a satellite airport within a Class C airspace area except in compliance with FAA arrival and departure traffic patterns. (c) Communications. Each person operating an aircraft in Class C airspace must meet the following two-way radio communications requirements: (1) Arrival or through flight. Each person must establish two-way radio communications with the ATC facility (including foreign ATC in the case of foreign airspace designated in the United States) providing air traffic services prior to entering that airspace and thereafter maintain those communications while within that airspace. (2) Departing flight. Each person— (i) From the primary airport or satellite airport with an operating control tower must establish and maintain two-way radio communications with the control tower, and thereafter as instructed by ATC while operating in the Class C airspace area; or (ii) From a satellite airport without an operating control tower, must establish and maintain two-way radio communications with the ATC facility having jurisdiction over the Class C airspace area as soon as practicable after departing. (d) Equipment requirements. Unless otherwise authorized by the ATC having jurisdiction over the Class C airspace area, no person may operate an aircraft within a Class C airspace area designated for an airport unless that aircraft is equipped with the applicable equipment specified in §91.215, and after January 1, 2020, §91.225. (e) Deviations. An operator may deviate from any provision of this section under the provisions of an ATC authorization issued by the ATC facility having jurisdiction over the airspace concerned. ATC may authorize a deviation on a continuing basis or for an individual flight, as appropriate.	Operations in Class C zones require clear operating plan and communications with FAA/AST at designated times plus an ability to be in person-to-person communications with FAA/AST within 2 hours of requested contact.	Describes operations in ty zones

91	131	Operations in Class B airspace. (a) Operating rules. No person may operate an aircraft within a Class B airspace area except in compliance with §91.129 and the following rules: (1) The operator must receive an ATC clearance from the ATC facility having jurisdiction for that area before operating an aircraft in that area. (2) Unless otherwise authorized by ATC, each person operating a large turbine engine-powered airplane to or from a primary airport for which a Class B airspace area is designated must operate at or above the designated floors of the Class B airspace area while within the lateral limits of that area. (3) Any person conducting pilot training operations at an airport within a Class B airspace area must comply with any procedures established by ATC for such operations in that area. (b) Pilot requirements. (1) No person may take off or land a civil aircraft at an airport within a Class B airspace area or operate a civil aircraft within a Class B airspace area unless— (i) The pilot in command holds at least a private pilot certificate; (ii) The pilot in command holds a recreational pilot certificate and has met— (A) The requirements of §61.101(d) of this chapter; or (B) The requirements for a student pilot seeking a recreational pilot certificate in §61.94 of this chapter; (iii) The pilot in command holds a sport pilot certificate and has met— (A) The requirements of §61.325 of this chapter; or (B) The requirements for a student pilot seeking a recreational pilot certificate in §61.94 of this chapter; or (iv) The aircraft is operated by a student pilot who has met the requirements of §61.94 or §61.95 of this chapter, as applicable. (2) Notwithstanding the provisions of paragraphs (b)(1)(ii), (b)(1)(iii) and (b)(1)(iv) of this section, no person may take off or land a civil aircraft at those airports listed in section 4 of appendix D to this part unless the pilot in command holds at least a private pilot certificate. (c) Communications and navigation equipment requirements. Unless otherwise authorized by ATC, no person may operate an aircraft within a Class B airspace area unless that aircraft is equipped with— (1) For IFR operation. An operable VOR or TACAN receiver or an operable and suitable RNAV system; and	Operations in a class B zone. No owner/operator may operate a space object in a class B zone except in compliance with §91.129 and the following rules: (1) The owner/operator must receive FAA Control Center clearance before operating a space object in that area. (2) The owner/operator must maintain the ability to receive and respond to direction from the FAA Control Center.	Describes operations in ty zones

		(2) For all operations. An operable two-way radio capable of communications with ATC on appropriate frequencies for that Class B airspace area. (d) Other equipment requirements. No person may operate an aircraft in a Class B airspace area unless the aircraft is equipped with— (1) The applicable operating transponder and automatic altitude reporting equipment specified in §91.215 (a), except as provided in §91.215 (e), and (2) After January 1, 2020, the applicable Automatic Dependent Surveillance-Broadcast Out equipment specified in §91.225.		

91	133	Restricted and prohibited areas. (a) No person may operate an aircraft within a restricted area (designated in part 73) contrary to the restrictions imposed, or within a prohibited area, unless that person has the permission of the using or controlling agency, as appropriate. (b) Each person conducting, within a restricted area, an aircraft operation (approved by the using agency) that creates the same hazards as the operations for which the restricted area was designated may deviate from the rules of this subpart that are not compatible with the operation of the aircraft.	No owner/operator may operate a space object within a restricted zone contrary to the restrictions imposed, or within a prohibited zone, unless that permission of the using or controlling agency, as appropriate. Each owner/operator (approved by the using agency) that creates the same hazards as the operations for which the restricted area was designated may deviate from the rules of this subpart that are not compatible with the operations of the space object.	Describes operations in prohibited or restricted zo
91	135	Operations in Class A airspace. Except as provided in paragraph (d) of this section, each person operating an aircraft in Class A airspace must conduct that operation under instrument flight rules (IFR) and in compliance with the following: (a) Clearance. Operations may be conducted only under an ATC clearance received prior to entering the airspace. (b) Communications. Unless otherwise authorized by ATC, each aircraft operating in Class A airspace must be equipped with a two-way radio capable of communicating with ATC on a frequency assigned by ATC. Each pilot must maintain two-way radio communications with ATC while operating in Class A airspace. (c) Equipment requirements. Unless otherwise authorized by ATC, no person may operate an aircraft within	Any owner/operator operating a space object in a class A orbit must conduct operations in such a manner as to be able to communicate with the FAA control center at the FAA Control Center at all times and comply with direction from the FAA Control Center.	Describes operations in ty orbits

		Class A airspace unless that aircraft is equipped with the applicable equipment specified in §91.215, and after January 1, 2020, §91.225. (d) ATC authorizations. An operator may deviate from any provision of this section under the provisions of an ATC authorization issued by the ATC facility having jurisdiction of the airspace concerned. In the case of an inoperative transponder, ATC may immediately approve an operation within a Class A airspace area allowing flight to continue, if desired, to the airport of ultimate destination, including any intermediate stops, or to proceed to a place where suitable repairs can be made, or both. Requests for deviation from any provision of this section must be submitted in writing, at least 4 days before the proposed operation. ATC may authorize a deviation on a continuing basis or for an individual flight.		
91	137	Temporary flight restrictions in the vicinity of disaster/hazard areas. (a) The Administrator will issue a Notice to Airmen (NOTAM) designating an area within which temporary flight restrictions apply and specifying the hazard or condition requiring their imposition, whenever he determines it is necessary in order to— (1) Protect persons and property on the surface or in the air from a hazard associated with an incident on the surface; (2) Provide a safe environment for the operation of disaster relief aircraft; or (3) Prevent an unsafe congestion of sightseeing and other aircraft above an incident or event which may generate a high degree of public interest. The Notice to Airmen will specify the hazard or condition that requires the imposition of temporary flight restrictions. (b) When a NOTAM has been issued under paragraph (a)(1) of this section, no person may operate an aircraft within the designated area unless that aircraft is participating in the hazard relief activities and is being operated under the direction of the official in charge of on scene emergency response activities. (c) When a NOTAM has been issued under paragraph (a)(2) of this section, no person may operate an aircraft within the designated area unless at least one of the following conditions are met: (1) The aircraft is participating in hazard relief activities and is being	No person may operate a space object in the vicinity an area designated as an emergency area without prior coordination with the FAA Control Center	Describes operations in temporary operations-rest areas

		operated under the direction of the official in charge of on scene emergency response activities. (2) The aircraft is carrying law enforcement officials. (3) The aircraft is operating under the ATC approved IFR flight plan. (4) The operation is conducted directly to or from an airport within the area, or is necessitated by the impracticability of VFR flight above or around the area due to weather, or terrain; notification is given to the Flight Service Station (FSS) or ATC facility specified in the NOTAM to receive advisories concerning disaster relief aircraft operations; and the operation does not hamper or endanger relief activities and is not conducted for the purpose of observing the disaster. (5) The aircraft is carrying properly accredited news representatives, and, prior to entering the area, a flight plan is filed with the appropriate FAA or ATC facility specified in the Notice to Airmen and the operation is conducted above the altitude used by the disaster relief aircraft, unless otherwise authorized by the official in charge of on scene emergency response activities. (d) When a NOTAM has been issued under paragraph (a)(3) of this section, no person may operate an aircraft within the designated area unless at least one of the following conditions is met: (1) The operation is conducted directly to or from an airport within the area, or is necessitated by the impracticability of VFR flight above or around the area due to weather or terrain, and the operation is not conducted for the purpose of observing the incident or event. (2) The aircraft is operating under an ATC approved IFR flight plan. (3) The aircraft is carrying incident or event personnel, or law enforcement officials. (4) The aircraft is carrying properly accredited news representatives and, prior to entering that area, a flight plan is filed with the appropriate FSS or ATC facility specified in the NOTAM. (e) Flight plans filed and notifications made with an FSS or ATC facility under this section shall include the following information: (1) Aircraft identification, type and color. (2) Radio communications frequencies to be used (3) Proposed times of entry of, and exit from, the designated area. (4) Name of news media or organization and purpose		

		of flight. (5) Any other information requested by ATC.		

91	139	Emergency air traffic rules: (a) This section prescribes a process for utilizing Notices to Airmen (NOTAMs) to advise of the issuance and operations under emergency air traffic rules and regulations and designates the official who is authorized to issue NOTAMs on behalf of the Administrator in certain matters under this section. (b) Whenever the Administrator determines that an emergency condition exists, or will exist, relating to the FAA's ability to operate the air traffic control system and during which normal flight operations under this chapter cannot be conducted consistent with the required levels of safety and efficiency— (1) The Administrator issues an immediately effective air traffic rule or regulation in response to that emergency condition; and (2) The Administrator or the Associate Administrator for Air Traffic may utilize the NOTAM system to provide notification of the issuance of the rule or regulation. Those NOTAMs communicate information concerning the rules and regulations that govern flight operations, the use of navigation facilities, and designation of that airspace in which the rules and regulations apply. (c) When a NOTAM has been issued under this section, no person may operate an aircraft, or other device governed by the regulation concerned, within the designated airspace except in accordance with the authorizations, terms, and conditions prescribed in the regulation covered by the NOTAM.	No person may operate a space object in the vicinity an area designated as an emergency area without prior coordination with the FAA Control Center	Anticipated media capabil view events in orbit, from and report on them. Simil restrictions of media helic over traffic accidents that prevent first responders fr reaching an accident scen

91	141	Flight restrictions in the proximity of the Presidential and other parties. No person may operate an aircraft over or in the vicinity of any area to be visited or traveled by the President, the Vice President, or other public figures contrary to the restrictions established by the Administrator and published in a Notice to Airmen (NOTAM).	No person may operate a space object in the vicinity of a space object occupied by humans without prior coordination with the FAA Control Center	Prohibits operations near human-inhabited space vehicles without coordinat
91	185	IFR operations: Two-way radio communications failure. (a) General. Unless otherwise authorized by ATC, each pilot who has two-way radio communications failure when operating under IFR shall comply with the rules of this section. (b) VFR conditions. If the failure occurs in VFR conditions, or if VFR conditions are encountered after the failure, each pilot shall continue the flight under VFR and land as soon as practicable. (c) IFR conditions. If the failure occurs in IFR conditions, or if paragraph (b) of this section cannot be complied with, each pilot shall continue the flight according to the following: (1) Route. (i) By the route assigned in the last ATC clearance received; (ii) If being radar vectored, by the direct route from the point of radio failure to the fix, route, or airway specified in the vector clearance; (iii) In the absence of an assigned route, by the route that ATC has advised may be expected in a further clearance; or (iv) In the absence of an assigned route or a route that ATC has advised may be expected in a further clearance, by the route filed in the flight plan. (2) Altitude. At the highest of the following altitudes or flight levels for the route segment being	An owner/operator must report any failure to communicate with a space object within one hour of discovery of the situation. This report must also include anticipated impact on the space object and the objects anticipated orbit.	Loss of communications w object/craft - requires notification to traffic management entity as we expected flight path after l communications.

		flown: (i) The altitude or flight level assigned in the last ATC clearance received; (ii) The minimum altitude (converted, if appropriate, to minimum flight level as prescribed in §91.121(c)) for IFR operations; or (iii) The altitude or flight level ATC has advised may be expected in a further clearance. (3) Leave clearance limit. (i) When the clearance limit is a fix from which an approach begins, commence descent or descent and approach as close as possible to the expect-further-clearance time if one has been received, or if one has not been received, as close as possible to the estimated time of arrival as calculated from the filed or amended (with ATC) estimated time en route. (ii) If the clearance limit is not a fix from which an approach begins, leave the clearance limit at the expect-further-clearance time if one has been received, or if none has been received, upon arrival over the clearance limit, and proceed to a fix from which an approach begins and commence descent or descent and approach as close as possible to the estimated time of arrival as calculated from the filed or amended (with ATC) estimated time en route.		

91	187	Operation under IFR in controlled airspace: Malfunction reports. (a) The pilot in command of each aircraft operated in controlled airspace under IFR shall report as soon as practical to ATC any malfunctions of navigational, approach, or communication equipment occurring in flight. (b) In each report required by paragraph (a) of this section, the pilot in command shall include the— (1) Aircraft identification; (2) Equipment affected; (3) Degree to which the capability of the pilot to operate under IFR in the ATC system is impaired; and (4) Nature and extent of assistance desired from ATC.	Any malfunction of a space object that could impact the ability of the owner/operator to communicate with or control the object, must be reported to the FAA Control Center within one hour of discovery of the malfunction regardless of the owner/operator's ability to remedy the condition (report it even if it is no longer a problem)	Malfunction reports - requ notification to traffic management entity of any malfunction that might imp control or boil it yeti track or craft.
91	1600	EXAMPLE: §91.1603 Special Federal Aviation Regulation No. 112—Prohibition Against Certain Flights Within the Tripoli (HLLL) Flight Information Region (FIR).	Commercial operations in the vicinity on open, ongoing hostilities are prohibited. If transition through such an area will occur by virtue of an per-existing orbital path, coordination with the JSpOC through the FAA Control Center must be established immediately upon learning of existence of this situation.	Special operating restricti civil and commercial opera beaded on on-going geo-political concerns
93	1	Applicability. This part prescribes special air traffic rules for operating aircraft in certain areas described in this part, unless otherwise authorized by air traffic control. [These include 13 specific areas such as extremely busy airports (LAX) or areas of national security (National Capital Region) where additional requirements are added above and beyond the existing FAA regulations]	Operations within 300 Km of the international space station require coordination with NASA's Johnson Spaceflight Center.	Special operating limitatio specific zones, orbits, area in the vicinity of specific ol (example: restricts operati ITU-approved slots that ha yet to be occupied)

		United Nations Convention on Law of the Sea		
Article		**Existing verbiage**	**Proposed verbiage**	**Intent**
17		Subject to this Convention, ships of all States, whether coastal or land-locked, enjoy the right of innocent passage through the territorial sea.	All objects of all states enjoy the right of innocent passage.	Despite regulatory authori over U.S. operators, no cl made to the zones or area above the Karman line. T U.S. does not claim any te above the Karman line an expects no other actors to sovereignty of these areas either.
18		Meaning of innocent passage 1.Passage is innocent so long as it is not prejudicial to the peace, good order or security of the coastal State. Such passage shall take place in conformity with this Convention and with other rules of international law. 2.Passage of a foreign ship shall be considered to be prejudicial to the peace, good order or security of the coastal State if in the territorial sea it engages in any of the following activities:(a) any threat or use of force against the sovereignty, territorial integrity or political independence of the coastal State, or in any other manner in violation of the principles of international law embodied in the Charter of the United Nations; (b) any exercise or practice with weapons of any kind; (c) any act aimed at collecting information to the prejudice of the defense or security of the coastal State; (d) any act of propaganda aimed at affecting the defense or security of the coastal State; (e) the launching, landing or taking on board of any aircraft;	Meaning of innocent passage 1.Passage is innocent so long as it is not prejudicial to the peace, good order or security of the coastal State. Such passage shall take place in conformity with this Convention and with other rules of international law. 2.Passage of an object shall be considered to be prejudicial to the peace, good order or security if it engages in any of the following activities:(a) any threat or use of force against the sovereignty, territorial integrity or political independence of a State (b) any exercise or practice with weapons of any kind; (c) any act of willful and serious pollution or debris creation (d) any act aimed at	Separates commercial fro military or national securit objects from purely comm objects.

		(f) the launching, landing or taking on board of any military device; (g) the loading or unloading of any commodity, currency or person contrary to the customs, fiscal, immigration or sanitary laws and regulations of the coastal State; (h) any act of willful and serious pollution contrary to this Convention; (i) any fishing activities; (j) the carrying out of research or survey activities; (k) any act aimed at interfering with any systems of communication or any other facilities or installations of the coastal State; (l) any other activity not having a direct bearing on passage.	interfering with any systems of communication or any other facilities or installations of a State (e) any other activity not having a direct bearing on passage.	

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