



Designation: F3388 – 23

Standard Classification for Space Launch and Reentry Vehicles¹

This standard is issued under the fixed designation F3388; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This classification provides the commercial space industry an accepted method of commonly classifying space launch and reentry vehicles through the use of commonly accepted and defined terms based on operational and flight envelope of the vessel. This classification may not cover all vehicle capabilities or vehicle categories but attempts to standardize the terminology that is applicable to a majority of the industry. This classification may be useful for, but is not intended to address, amateur launch vehicles.

1.2 This classification is not intended to pass judgement on the value or quality of a certain term but rather to provide the basis of common terminology so that, for instance, when multiple vehicle operators claim a certain capability in their system, they are equivalent for outside understanding.

1.3 *Units*—The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Terminology

2.1 Definitions:

2.1.1 *vehicle, n*—refers to a space launch or reentry flight vehicle.

2.1.1.1 *Discussion*—A launch vehicle payload is not itself considered a vehicle, though a reentry vehicle may fly as a payload on a launch vehicle. A carrier aircraft is only treated as a vehicle when a launch vehicle is attached.

¹ This classification is under the jurisdiction of ASTM Committee F47 on Commercial Spaceflight and is the direct responsibility of Subcommittee F47.03 on Launch and Reentry Vehicles.

Current edition approved Dec. 15, 2023. Published January 2024. DOI: 10.1520/F3388-23.

3. Significance and Use

3.1 This classification involves two focuses:

3.1.1 *Focus 1*, the classification of a vehicle given a range of total capability, and

3.1.2 *Focus 2*, a classification of a mission being performed by a vehicle.

3.2 The two-focus classification system was necessary since a vehicle could have certain capabilities in general, which could be limited/tailored based on the particular mission.

4. Basis of Classification

4.1 For focus 1 of classifying a vehicle for a range to total capability, a series of strata are used: regulatory type, mission type, vehicle's category, class, mode, capability, size, and propellant.

4.2 In the following sections, these strata are broken down and defined further. **Appendix X1** contains a form that follows these categories and can be used to classify the vehicles.

5. Regulatory Type

5.1 There are two regulatory types applicable to vehicle classification:

5.1.1 *Government*—A vehicle designed, developed, or contracted by a national government to be owned and operated by a government agency or a procured government launch service.

5.1.2 *Commercial*—A vehicle designed, developed, or contracted by a commercial company to be owned and operated by a commercial company, regardless of customer.

5.2 Only the commercial regulatory type requires licensing.

6. Mission Type

6.1 Four forms of mission type exist:

6.2 *Government for Government*—The government conducts a mission on a vehicle:

6.2.1 Owned and operated by the government (for example, the Space Shuttle, Orion), or

6.2.2 Procured from a commercial company that operates it under a government service contract (for example, DoD or NASA launch on Atlas V).

6.3 *Commercial for Government*—The government procures a mission conducted by a vehicle owned and operated by a commercial company through a commercial launch services

contract (for example, government purchased commercial services such as cargo resupply, commercial crew).

6.4 *Commercial for Commercial*—A commercial entity conducts a mission with a vehicle owned and operated by itself or another commercial company (for example, a SpaceX Falcon 9 flight with a commercial satellite such as Iridium).

6.5 *Government for Commercial*—A commercial entity procures a mission on a vehicle owned and operated by a government agency (for example, an Indian launch vehicle providing the launch service for a commercial company's satellite).

7. Vehicle Category

7.1 A vehicle's category is defined by its structural design and acceleration function.

7.2 *Rocket*—Vehicle propelled and steered by combustion, regardless of launch orientation or method.

7.3 *Spaceplane*—Winged vehicle that is self-propelled and steered by aerodynamic flight control surfaces in the atmosphere, but can also operate above the atmosphere.

7.4 *Lifting Body*—Winged vehicle that reenters as an unpowered glider.

7.5 *Capsule*—Aerodynamically stable reentry vehicle with negligible steering capability.

7.6 *Balloon*—Gas propelled lighter-than-air vehicle that hovers in the stratosphere.

8. Vehicle Class

8.1 A vehicle's class is defined by its launch orientation, launch domain, landing orientation, and recovery method as applicable.

8.2 Vehicle Launch Orientation:

8.2.1 *Vertical Launch*—The vehicle's initial lift is perpendicular to the earth's surface, generated solely by an onboard propulsion system.

8.2.2 *Horizontal Launch*—The vehicle's initial lift is roughly parallel to the earth's surface, generated by an onboard or external propulsion system and, in many cases, aerodynamic lifting surfaces.

8.2.3 *Payload (Orientation is N/A)*—The vehicle is launched as a payload on a separate launch vehicle.

8.3 Vehicle Launch Domain:

8.3.1 *Air Launch*—The vehicle launches from a carrier vehicle while the carrier vehicle is above the surface of the earth.

8.3.2 *Ground Launch*—The vehicle launches from a solid surface that is in contact with the earth.

8.3.3 *Sea Launch*—The vehicle launches from a surface that is either floating on water, a fixed offshore platform, or from a surface that is underwater (for example, submarine).

8.3.4 *Space Launch*—The vehicle launches in space after separation from a separate launch vehicle.

8.4 Vehicle Landing Orientation:

8.4.1 *Vertical Landing*—The vehicle conducts a touchdown perpendicular to the surface of the earth and has no intended horizontal velocity component after initial contact.

8.4.2 *Horizontal Landing*—The vehicle conducts a touchdown parallel to the surface of the earth with an intended horizontal velocity component after initial contact.

8.5 Vehicle Recovery Method:

8.5.1 *Air Recovery*—The vehicle is captured in air by a carrier vehicle during its descent back to earth.

8.5.2 *Ground Recovery*—The vehicle lands on a solid surface that is in contact with the earth.

8.5.3 *Sea Recovery*—The vehicle lands on a surface that is floating on water or in the water directly.

9. Vehicle Mode

9.1 Vehicle mode covers how the vehicle receives commands and how much authority it has over its intended flight path. Multiple modes can be selected as different phases of an operation may differ in mode.

9.1.1 *Piloted*—A vehicle's path of flight is under positive control of a human in the vehicle or at a remote location.

9.1.2 *Unguided (Ballistic)*—The vehicle's flight path is determined by dispersed environmental factors. The vehicle may have systems that control attitude but ultimately do not alter the flight path as a function of them operating.

9.1.3 *Autonomously Guided*—The vehicle's onboard computer(s) determine changes in flight path, velocity, and orientation to maintain a trajectory to intercept a predefined end point for the operation.

9.1.4 *Guided with External Commands*—The vehicle's onboard computer(s) operate autonomously but can also be updated via remotely received command(s) to maintain a trajectory to intercept a predefined end point for the operation.

9.1.5 *Autonomous and Piloted Hybrid*—A vehicle's flight path may be, at times, under positive control of a human or determined by the vehicle's onboard computers toward a predefined end point.

10. Vehicle Capability

10.1 Vehicle capability is intended to be a list of features that the vehicle either has or does not have or is not applicable to the operation. There are numerous options and no limit to how many can apply to a vehicle:

10.1.1 *Anti-Collision*—The vehicle or operator has the ability to sense and react to avoid a potential collision with another object.

10.1.2 *Propulsive*—The vehicle in the given operation has a propulsive mode other than for attitude control (non-propulsive).

10.1.3 *Stationary Powered Flight*—The vehicle has the ability to arrest its movement relative to a point on the Earth while under power and sustain its position.

10.1.3.1 If yes, identify for how long the vehicle will sustain powered stationary flight.

10.1.4 *Fast/Slow Approach and Landing Speed*—For reentry vehicles, display a plot of speed as a function of altitude and a final landing speed through touchdown.