

COMSTAC Safety Working Group Report May 2023

The FAA tasked the COMSTAC Safety Working Group (SWG) with the following:

1. Provide recommendations on how the FAA can measure the implementation of voluntary consensus standards developed within Standards Development Organizations in the U.S. commercial space industry.
2. Identify ways the FAA can encourage the development of industry consensus standards as a means of compliance for performance-based safety requirements.

For a nascent industry such as the U.S. commercial space industry, the development and implementation of voluntary consensus standards is critical to leveraging lessons learned to improve spaceflight safety and inform potential future regulations. With the possible expiration of the Learning Period this year, it is important that the current and future safety framework provides the flexibility for continued safety innovation while also improving the safety of commercial human spaceflight.

1. Measuring the Implementation of Developed Voluntary Consensus Standards in the U.S. Commercial Space Industry

Background

In the Commercial Space Launch Competitiveness Act of 2015 (CSLCA), Congress required the FAA to submit reports “on the progress of the commercial space transportation industry in developing voluntary industry consensus standards that promote best practices to improve industry safety.”¹ The Congressionally mandated reports required “an assessment from the Secretary on the general progress of the industry in adopting voluntary consensus standards.”² Since 2015, the FAA has submitted three reports in response to this requirement: the first in 2017, the second in 2019, and the most recent in 2022.

In its 2022 report to Congress, “the FAA found moderate progress” in the industry’s development of “voluntary industry consensus standards that promote best practices to improve industry safety.”³ Furthermore, “while the [FAA] was encouraged by the increasing availability” of industry standards, it determined that it was unclear “the extent to which industry is incorporating” standards into operations.⁴ A similar observation was made by the RAND Corporation’s FAA-sponsored independent report that found that “while some standards and guidance related to participant safety exist, companies have yet to clearly or consistently adopt them in a manner that can be confirmed or verified publicly.”⁵ In the FAA’s report, it was identified that there is “a need to assess the extent to which industry is accepting and implementing standards.”

¹ Commercial Space Launch Competitiveness Act of 2015, Pub. L. 114-90, § 111; 51 U.S.C. § 50905(c)(5) as amended [hereinafter CSLCA].

² *Id.*

³ FAA, *Report to Congress: Interim Report on Voluntary Consensus Standards Development – January 2022*, Jan. 14, 2022, at 6, available at https://www.faa.gov/sites/faa.gov/files/2022-04/PL_114-90_Sec_111_5_Voluntary_Industry_Consensus_Standards.pdf.

⁴ *Id.* at 3.

⁵ Douglas C. Ligor, et al., *ASSESSING THE READINESS FOR HUMAN COMMERCIAL SPACEFLIGHT SAFETY REGULATIONS: CHARTING A TRAJECTORY FROM REVOLUTIONARY TO ROUTINE TRAVEL (2023)*, RAND Corporation, available at https://www.rand.org/pubs/research_reports/RRA2466-1.html.

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The SWG found that being able to measure the implementation⁶ of voluntary consensus standards within the industry is important to demonstrate the improved safety outcomes and innovative safety solutions that an industry-led safety framework can produce. Moreover, the SWG believes that conducting such an assessment can provide the nascent commercial human spaceflight industry and the FAA an opportunity to gather valuable insights that can be used to continuously improve its safety performance. Specifically, such an assessment could provide the industry and FAA insight on:

- The effectiveness and quality of the standards developed;
- How well the standards developed achieve the FAA's interest in protecting public and human occupant safety;
- The applicability of existing standards to unique new technologies;
- Avoiding duplication of efforts with other government standards or requirements; and
- Guiding the development of voluntary consensus standards.

To that end, the SWG recommends that the FAA coordinates a voluntary, non-attributable survey with industry to assess the implementation of developed voluntary consensus standards. In addition, the SWG recommends taking the opportunity to engage with the industry to collect feedback that seeks to understand:

- 1) The degree to which a standard is implemented in a company's operations;
- 2) What benefits or burdens would implementing a standard create;
- 3) What lessons were learned by implementing a standard; and
- 4) What other government or industry standards and guidance materials are being used in place of voluntary consensus standards.

While the survey can provide an effective means to assess the industry's methods against standards, the SWG recommends that the FAA waits to conduct the survey until an initial set of high-priority human spaceflight standards are identified and developed that can serve as a more comprehensive baseline for the survey. As the industry continues to contribute significant time and effort to develop human spaceflight standards, several factors are still impacting standards development, such as vehicle and operational diversity, limited crewed flight data, and competing demands on resources. Despite this, the industry has been able to publish a few human spaceflight standards, with many more currently under development, as can be seen in Appendix A. As discussed in Section 2a below, increasing FAA's participation in strategic planning exercises for standards development efforts will help identify and develop an initial set of high-priority standards for the survey. By doing so, the recommended survey can provide more valuable insights that can better inform best practices and improve human spaceflight safety.

Should the FAA seek to conduct a survey before a more complete set of standards is written, then the SWG recommends that the survey also assess the implementation of contractually required government standards or other practices being used by a company in addition to published consensus standards. The SWG found that with a limited number of human spaceflight operators, many reference required government standards or guidance materials related to human spaceflight safety. Therefore, the survey should be used to instill public confidence in the fact that, while the industry works diligently in

⁶ When referring to measuring implementation of standards, the SWG understands it to mean assessing the ways in which companies meet the standards that are relevant to their operation.

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developing standards, it is still taking actions above and beyond what is available or required to ensure the safety of its operations.

2. Ways the FAA Can Encourage the Development of Industry Consensus Standards as a Means of Compliance for Performance-Based Safety Requirements

Background

In the CSLCA, Congress directed the FAA to “continue to work with the commercial space sector, including [COMSTAC], or its successor organization, to facilitate the development of voluntary industry consensus standards based on recommended best practices to improve the safety of crew, government astronauts, and space flight participants as the commercial space sector continues to mature.”⁷ Congress further clarified that “nothing” in Section 50905 of Title 51 “shall be construed to limit the authority of the Secretary to discuss potential regulatory approaches, potential performance standards, or any other topic related to this subsection with the commercial space industry.”⁸ For many years, both FAA-AST and COMSTAC have recognized the important role that the development of voluntary consensus standards can play to not only “improve the safety of the commercial human spaceflight industry as a whole,”⁹ but to also “help provide a baseline for compliance with potential future regulations covering human spaceflight”¹⁰ once the industry has reached sufficient operational cadence and technological maturity.

To that end, the SWG approached this task by first reviewing actions the FAA can take to encourage the development of voluntary consensus standards and then assessing how such standards can be used as a means of compliance with performance-based requirements.

a. Focus and Increase Its Participation in ASTM’s International Committee on Commercial Spaceflight; Provide Guidance on How Standards Will Be reviewed and Accepted as a Means of Compliance

In its 2022 Interim Report, the FAA finds that the existence of five Standards Development Organizations (SDOs) actively publishing and proposing standards addresses the need for an institutional framework to develop standards.¹¹ However, focusing standards development efforts into one SDO rather than multiple is important to avoid “disjointed efforts [that] could result in conflicting approaches, as well as duplication and attendant increased workload for all parties.”¹² This is especially

⁷ CSLCA, *supra* note 1, § 50905(c)(3).

⁸ *Id.* § 50905(c)(4).

⁹ Kelvin B. Coleman, Jennifer Bailey, Tara Halt, Rachita Puri, John Sloan, *Regulatory Preparation for U.S. Commercial Human Spaceflight*, 73rd International Astronautical Congress, Sept. 18-22, 2022, available at https://www.faa.gov/sites/faa.gov/files/Regulatory_Preparation_Commercial_HSF%20_FAA%20_Coleman_IAC_Paris_B3_2%20_Sept_2022.pdf.

¹⁰ FAA, *COMSTAC Recommendations for Human Spaceflight (HSF) Regulation*, at 2, Nov. 2021, available at https://www.faa.gov/space/additional_information/comstac/media/HSF_Recommendation_Summary_Final.pdf.

¹¹ *Supra* note 3, at 8.

¹² Michael Lopez-Alegria, Jane Kinney, Oscar Garcia, *Why consensus on standards & performance matters on commercial space*, Space News, Apr. 17, 2019, available at <https://spacenews.com/why-consensus-on-standards-performance-matters-in-commercial-space/>.

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important to avoid instances where standards are developed without the involvement of commercial stakeholders with more interest and experience in a given standard.

With more than 100 active members representing industry, government, and academic stakeholders in the commercial space industry, ASTM International Committee on Commercial Spaceflight is in the optimal position to continue the development of human spaceflight voluntary consensus standards. Therefore, the SWG reiterates a previous COMSTAC recommendation that the FAA “continue to support ASTM International Committee on Commercial Spaceflight as the technical standards organization responsible for the development of US commercial industry consensus standards.”¹³

Against this backdrop, COMSTAC is appreciative of, and welcomes, the FAA’s increased resource commitment to ASTM to help accelerate the development of human spaceflight standards. To encourage the development of human spaceflight standards, the FAA’s participation in ASTM should support three functions: guide, develop, and assess.

1. Guide: To help vector industry efforts to the development of high-priority human spaceflight standards that may be used as a future means of compliance, the SWG recommends that the FAA:
 - Play a more active role in strategic planning within ASTM F47 Committee, including the Standards Roadmapping Subcommittee.
 - Aggregate its knowledge of launch operators’ safety frameworks to recommend areas of high commonality that might lead to streamlined development of standards.
 - Evaluate the skillsets of its existing and planned resources against a standards roadmap and provide feedback as to where developing standards may help bolster any gaps in expertise.
2. Develop: FAA should continue to provide technical feedback on standards that have been developed or are currently under development and participate in the balloting process.
3. Assess: FAA should assess the completeness of standards to serve as a means of compliance and provide guidance on how it will review and accept standards as a means of compliance.

b. Seek Industry Feedback on the Updated Recommended Practices for Human Spaceflight Occupant Safety

Originally published in 2014, the FAA’s Recommended Best Practices for Human Space Flight Occupant Safety “was developed to provide a compilation of practices that the FAA believes are important.”¹⁴ The May 2022 Safety Working Group Report found “several companies have used these guidelines in development of human spaceflight systems, whether for strictly commercial use, or through compliance with NASA Commercial Crew requirements from which the document was derived (though revised

¹³ FAA, *COMSTAC Safety WG Report – Draft*, at 8, Sept. 2020, available at https://www.faa.gov/sites/faa.gov/files/space/additional_information/comstac/presentations/COMSTAC_Safety_WG_white_paper_14_Sept_2020.pdf.

¹⁴ FAA, *Draft Report to Congress: U.S. Department of Transportation Evaluation of Commercial Human Space Flight Activities Most Appropriate for New Safety Framework*, available at <https://www.faa.gov/media/27296>.

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multiple times since).¹⁵ Therefore, the previous SWG recommended a formal review of the document to provide comprehensive comments.

Given that the FAA views the updated document as providing “a good starting point to guide any upcoming safety framework discussions” and includes “information on how operators could verify the implementation of recommended practices,”¹⁶ a formal review of the updated document is advised to provide comprehensive comments and to identify how the document may be used to support strategic planning for the development of voluntary consensus standards.

c. Using Voluntary Consensus Standards as a Means of Compliance for Performance-Based Safety Requirements

In May 2022, the COMSTAC Safety Working Group identified the top five priorities for Human Spaceflight Regulation. One of the top priorities listed was the need to “consider the current and anticipated body of voluntary consensus standards to inform future regulations and serve as a means of compliance.”¹⁷ In particular, COMSTAC found that “performance-based regulations provide latitude for compliance,” and that “human spaceflight industry standards such as those published and planned by ASTM International provide best practices that can serve as a means of compliance to future regulations.”¹⁸

In accordance with the National Technology Transfer and Advancement Act and as outlined in the Office of Management and Budget’s Circular A-119, using voluntary consensus standards as a means of compliance is intended to achieve the following goals:

- Eliminating the cost to the Federal government of developing its own standards and decreasing the burden of complying with agency regulation;
- Providing incentives and opportunities to establish standards that serve national needs;
- Encouraging long-term growth for U.S. enterprises and promising efficiency, economic competition, and trade; and
- Furthering the reliance upon private sector expertise to supply the Federal government with cost-efficient goods and services.¹⁹

As voluntary consensus standards are becoming increasingly available, “particularly those from ASTM,”²⁰ and as government and industry chart the future safety framework of the commercial human spaceflight industry, the SWG is still reviewing its recommendation for how voluntary consensus standards can be used as a means of compliance with performance-based requirements.

¹⁵ FAA, *COMSTAC Safety Working Group Report May 2022*, at 2, May 2022, available at https://www.faa.gov/sites/faa.gov/files/2022-08/SWG_Report_May2022_Final.pdf.

¹⁶ *Supra* note 14, at 7.

¹⁷ *Supra* note 15, at 2.

¹⁸ *Id.*

¹⁹ National Technology Transfer and Achievement Act of 1995, Pub. L. 104-113; Office of Management and Budget, Circular A-119: Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities, 81 Fed. Reg. 4673, Effective Date Jan. 27, 2016, available at <https://www.federalregister.gov/documents/2016/01/27/2016-01606/revision-of-omb-circular-no-a-119-federal-participation-in-the-development-and-use-of-voluntary>.

²⁰ *Supra* note 14, at 6.

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However, the SWG's initial findings are that any future performance-based requirement should be clear in what the requirement is seeking to achieve for both operators and regulators and that the means of compliance should provide certainty to operators that the use of voluntary consensus standards will achieve the requirement's objective.

Moreover, the SWG found that the means of compliance for future performance-based requirements should not be limited to industry voluntary consensus standards, but should also include government standards and unique means of compliance developed by an individual applicant. Utilizing government standards as a means of compliance will avoid duplication of efforts and redundant requirements for operators who are contractually required to follow other government standards, such as NASA's human spaceflight design and certification requirements. Furthermore, enabling individual applicants to demonstrate unique means of compliance will help account for diverse levels of operator experience and types of systems, which will support the continued development and innovation of the industry.

The FAA has a long history of using voluntary consensus standards to support performance-based requirements in both the aviation and commercial space industry. While the differences between the two industries are significant, the SWG will be reviewing how voluntary consensus standards are used as a means of compliance in the various performance-based frameworks of both industries to inform its recommendation on this tasker.

3. Conclusion

The COMSTAC appreciates the opportunity to provide recommendations on how the FAA can measure the implementation of voluntary consensus standards and how it may encourage the development of such standards. In addition, COMSTAC looks forward to providing its formal recommendation on how the development of voluntary consensus standards can be used as a means of compliance for future performance-based requirements. We welcome the opportunity to provide clarification or further feedback wherever needed.

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Appendix A: Status of ASTM Development of Voluntary Consensus Standards

Standard ID Number	Standard Title	HSF-Related	Status
ASTM F3550-22	Standard Guide for Classifying Safety-Related Events	Yes	Published
ASTM F3520-21	Standard Guide for Training and Qualification of Safety-Critical Space Operations Personnel	Yes	Published
ASTM F3479-20	Standard Specification for Failure Tolerance for Occupant Safety of Suborbital Vehicles	Yes	Published
ASTM F3344-19	Standard Guide for Storage, Use, and Handling of Liquid Rocket Propellants		Published
ASTM F3377-20	Standard Terminology Relating to Commercial Spaceflight		Published
ASTM F3514-21	New Guide for Space Data Exchange to Support the Integration of Space Operations into Air Traffic Management		Published
ASTM F3610-23	Standard Classification for Descriptions of Spaceport Capabilities		Published
ASTM WK76057	Standard Guide for Medical Qualification for Suborbital Vehicle Passengers	Yes	On Ballot
ASTM WK61254	Standard Classification for Space Launch and Reentry Vehicles		On Ballot
ASTM WK70011	Standard Practice for Crew Safety	Yes	Under Development
ASTM WK73835	Standard Practice for Spaceflight Participant Safety and Emergency Training	Yes	Under Development
ASTM WK74019	Standard Guide for Qualification for Safety-Critical Systems in Space Flight	Yes	Under Development
ASTM WK76298	Standard Test Method for Verification of Software and Systems for Commercial Space Flight	Yes	Under Development
ASTM WK77620	Standard Guide for the Design of Space Vehicles	Yes	Under Development
ASTM WK84313	Standard Practice for Human Factors in Commercial Spaceflight	Yes	Under Development
ASTM WK85993	Standard Test Method for Measuring the Insulation and Contact Temperatures Changes of an Instrumented Hand in Glove Assemblies Worn on Extravehicular Activities		Under Development
ASTM WK85994	Standard Guide for Evaluating Impact Abrasion Resistance of Textile Fabrics Used in Spacesuits and Spacesuit Gloves		Under Development
ASTM WK85995	Standard Test Method for Measuring Cut Resistance of Materials Used in Spacesuits and Spacesuit Gloves Under Cryogenic Conditions with Tomodynamometer Test Equipment		Under Development