ASTM International Support
to the U.S. Unmanned Air Vehicle Systems Industry

Position Statement

1.0 Introduction

1.1 Background

Unmanned Aerial Vehicles (UAVs) have historically been flown only in restricted airspace (over military test and training ranges) or war zones and have thus largely avoided coming into conflict with manned civilian aircraft. This is changing. The Federal Aviation Administration's (FAA) traditional focus has been to ensure that the multitude of aircraft flown in the National Airspace System (NAS) pose a minimum hazard to people or property on the ground or in the air. With the 11 September 2001 terrorist attacks, national security has become an equal priority with safety. The operation of UAVs in both military and paramilitary roles, such as the Department of Homeland Security's renewed interest in UAVs and Department of Defense (DoD) NORTHCOM's new role in homeland defense, outside of restricted airspace, has become increasingly likely.

The United States' National Airspace System (NAS) must be shared by all users, manned and unmanned, to support national defense, homeland security, other civil government, and commercial applications. As a growing tool in these applications, UAVs (and the subset Remotely Operated Aircraft (ROA)) must seamlessly integrate into the current NAS infrastructure while conducting safe, efficient, and effective operations. To this end, there are a number of key UAV-related regulatory and technology issues which must be addressed jointly by FAA, DoD and other government UAV users, and the UAV industry, to include:

- Airworthiness
- Flight Operations
- Operator Qualifications

Today there are some 300 public UAVs in the U.S. military inventory; $1.7B is being spent on UAVs by DoD alone in 2004. By 2010, this number should triple, and DoD annual spending may exceed $3.5B. Greater numbers are operating in a wide variety of roles in foreign countries.

1.2 Vision

The ASTM Int'l vision is to enable UAVs to be built and flown throughout the NAS, using air traffic control rules and procedures similar to those governing general aviation and without compromising current levels of safety and security. The goal of ASTM is to provide standards that enable FAA publications addressing UAVs necessary for this vision to be realized (created, modified, or interpreted) through the development and use of supporting consensus standards.

1.3 Consensus-Based Standards

The Office of Management and Budget's Circular A-119 Revised, Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities, directs the heads of Executive Branch departments and agencies to use voluntary consensus standards in lieu of government-unique standards except where inconsistent with law or otherwise impractical. It defines a voluntary consensus standards body as having the attributes of 1) openness, 2) balance of interest, 3) due process, 4) an appeals process, and 5) consensus, defined as general agreement but not necessarily unanimity, with a process for attempting to resolve objections by interested parties.

Within the U.S., there are some 200 organizations involved in standards development for the aviation community, however, only a small number are consensus based. The American Society for Testing and Materials (ASTM) International is one of the consensus organizations that meets the objectives and requirements of the Office of Management and Budget's Circular A-119.

2.0 Role of ASTM INTERNATIONAL

2.1 Private/Public Sector Cooperation

The standards development process employed by ASTM leverages the value of the entirety of the relevant marketplace, with manufacturers, users, regulators, trade associations, consultants, and academia all having equal representation at the standards table. Industry sectors choose to work with ASTM for multiple reasons. While the quality and relevance of the product (standards) is without question, it is the more subtle value added and money saved to the taxpayer that is the hidden benefit of cooperation in this area. For example, a cost/benefit analysis (done at the request of FAA) discussing the value provided to the Light Sport Aircraft industry by ASTM International Committee F37 on Light Sport Aircraft is attached to this document for information.

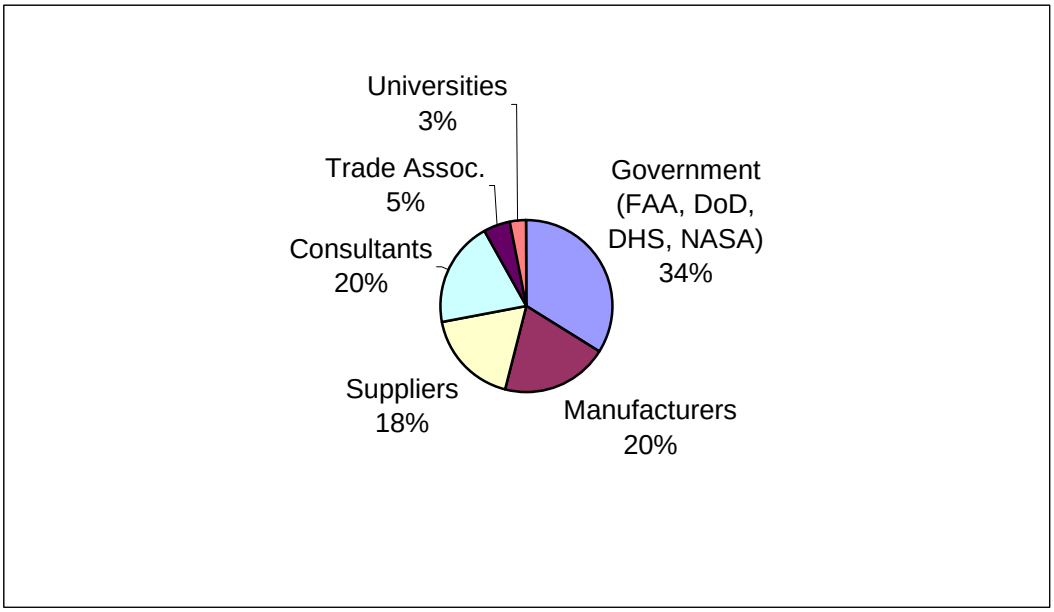
2.2 ASTM International's Relation with the UAV Industry

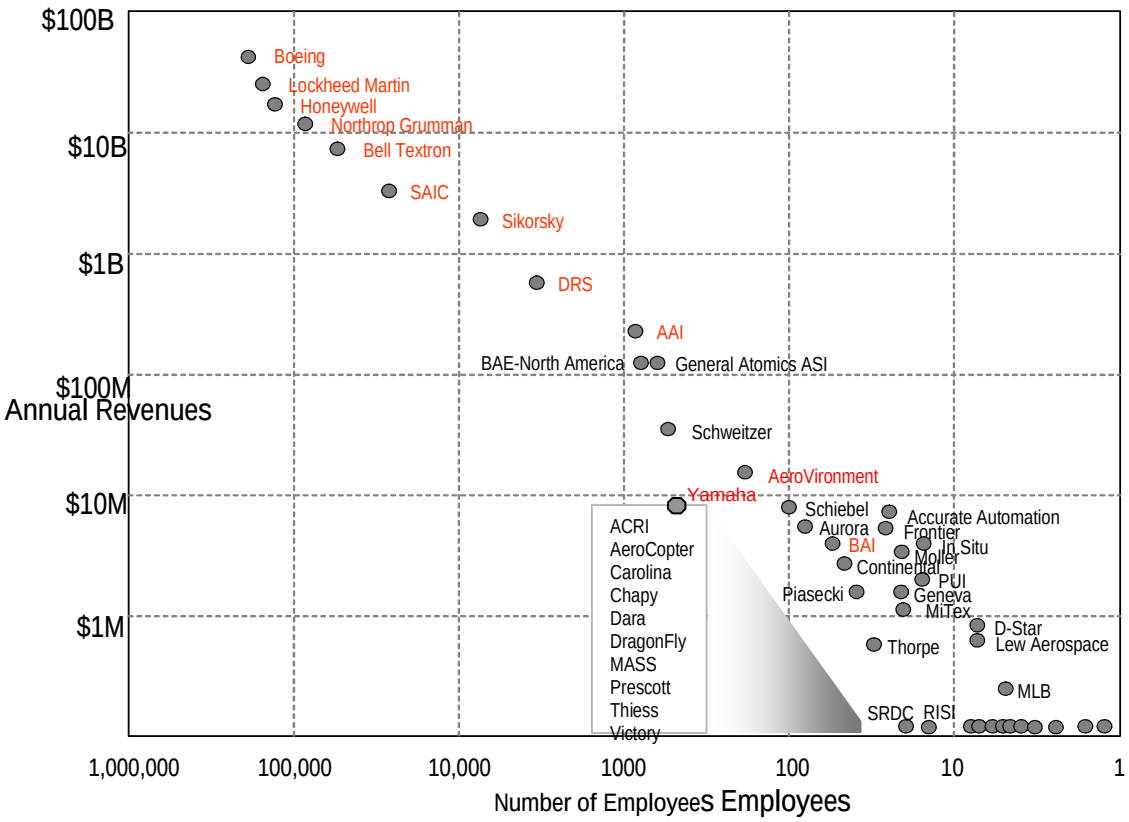
Recognizing that UAV introduction into the NAS will impact the current regulatory infrastructure governing it, and that the federal government is moving toward standards-based regulation, the UAV industry began meeting with ASTM in April 2003 to explore

their mutual interest in developing such standards. At an industry-wide organizational meeting in July 2003, some 167 UAV industry representatives of approximately 96 companies and organizations voted to engage ASTM International to help them develop these standards and to create the UAV-focused Committee F38 on Unmanned Air Vehicle Systems under ASTM International. ASTM was selected largely on the basis of its prior work with the Light and Sport Aircraft (LSA) community (Committee F37 on Light Sport Aircraft), an aviation group with many similarities and issues to those facing the UAV community, and the fact that ASTM develops standards on a consensus basis.

2.3 Committee F38 on Unmanned Air Vehicle Systems

Today (May 2004), Committee F38 has some 189 representatives of 120 UAV-related companies and organizations as voting members (a complete roster of the committee is attached). Twenty-four of these companies manufacture a broad spectrum of UAVs, from the 26,000-pound Global Hawk ROA to the 6-pound Raven UAV and include manufacturers of manned aircraft, among them Boeing and Gulfstream. Together, the F38 voting membership constitutes a broad spectrum of UAV builders and users as well as interests and expertise (see pie chart).





The chart above depicts the manufacturing segment of the UAV industry in terms of the numbers of their employees and their annual revenues. Note: This chart is not to imply that all employees or all revenues of those companies depicted are devoted solely to UAV activities. The companies highlighted in red are currently participating, in various capacities, on Committee F-38. **Together, they represent 99.4 percent of employees of U.S. companies involved in, and 99.7 percent of the revenues generated by, the U.S. UAV industry.**

All ASTM committees reflect as broad an industry sector as is possible; Committee F38 is no exception. With a user population that includes DoD, DHS, and NASA, standards developed by Committee F38 will be true reflections of the complete UAV industry, and therefore more likely to be uniformly accepted and applied.

As a consensus-standards development body, Committee F38 has organized itself along lines paralleling those of the FAA regulations its standards will support:

2.4 Subcommittee F38.01 on Airworthiness

Subcommittee Scope: The development of ASTM standards for design, certification, and continuing airworthiness for the unmanned air vehicle system. This scope will include the air vehicle, aircraft control data links, and ground control systems.

The work of this Subcommittee will be coordinated with the other ASTM UAV System Subcommittees.

The focus of the F38.01 Subcommittee on UAV System Airworthiness shall be the development of technical publications including:

- Minimum requirements for UAV system performance and safety for the UAV system classifications established in the regulations.

- Quality assurance - to identify manufacturing controls that will assure a UAV system conforms to design criteria.

- Production acceptance tests and procedures assuring that the completed UAV system meets reported performance as demonstrated in the prototype vehicle system. This includes limits such as: empty weight and center of gravity, performance specifications, controllability and maneuverability, trim, stability, stall speed and handling characteristics, engine cooling and operating characteristics, propeller/rotor limits, systems functions, and folding or removable lifting surfaces.

- A baseline plan for continued airworthiness systems, including methods for monitoring and maintaining continued operational safety, and processes for identifying, reporting, and remedying safety-of-flight issues.

2.5 Subcommittee F38.02 on Flight Operations

Subcommittee Scope: The development of standard practices for the operation of unmanned air vehicle systems. This scope will include orchestrating these practices with FAA requirements to operate in the NAS. The work of this Subcommittee will be coordinated with the other ASTM UAV System Subcommittees. Specific focus of the subcommittee on Flight Operations shall be the development of technical publications including:

- Operating procedures for the use of UAVs when the operation remains within Class G airspace and within visual range of the pilot.

- Operating procedures for the use of UAVs based on the limitations imposed by the airspace. Our starting assumption is that there will be UAVs similar to restricted category airplanes with similar limitations.

- Standard operating practices to support a business operation using Remotely Operated Aircraft conducting special purpose operations according to 14 CFR Part 91.

- A standard UAV operations application to support UAV approval for certificate of authorization like those in FAA Order 8700.1 Chapters 44-53.

2.6 Subcommittee F38.03 on Operator Qualifications

Subcommittee Scope: The development of qualification standards necessary for individuals to pilot UAVs in the National Airspace System. There is not an accepted, consistent means to evaluate proposals for UAV flight operators or pilots. Operators can use these standards to prepare for commercial flight operations, and apply for them. The FAA can use these standards as a means (but not the only means) to evaluate and manage the risks in non-military UAV operations. The work of this Subcommittee will be coordinated with the other ASTM UAV System Subcommittees.

3.0 Approach

3.1 Assumptions

- UAVs are aircraft for which the Pilot in Command is not onboard.
- The operations are not for sport or recreation.
- There is a large group of small, light, unmanned aircraft that can be safely licensed and regulated using industry standards by an organization recognized by the FAA to do so.
- The operators and operations of small unmanned aircraft can also be safely trained, licensed, and regulated through industry standards.
- Above this threshold, unmanned aircraft will require FAA certification of airworthiness, operations, and pilots.

3.2 Methodology

ASTM International Committee F38 intends for our standards to provide the Administrator, FAA, a means to approve appliances and certain types of unmanned aircraft (along with necessary remote systems) for routine operations. Development of each standard follows one of three general paths; adoption, modification, or creation. F38's approach to developing and maintaining these standards is proceeding as follows:

1. Develop a comprehensive outline of UAV-applicable functions and subsystems, such as command and control data links. It is anticipated that the majority of these functions and subsystems will be held in common with manned aviation, with only a small percentage being UAV-unique.

2. Identify existing standard(s) that address each of these functions and subsystems.

3. For those functions and subsystems having existing standards, those standards will be reviewed in detail for their applicability to UAV and be incorporated or cited as appropriate.

4. **Adoption.** For those existing standards that are fully applicable to UAV, such as aviation fuel quality, they will be collected and voted on under a “Best Practices and Guides” Standard, i.e., adopted as is as a consensus standard for the UAV industry.

5. **Modification.** For those existing standards that are not fully applicable to UAV, such as avionics hazards to aircrews, they will be used as the starting point for crafting UAV-applicable standards by adding or deleting appropriate sections, voting, and eventual adoption as modified, consensus standards.

6. **Creation.** For those functions and subsystems with no existing standard, such as automated see and avoid, Committee F38 will form a group within its membership to draft the missing standard, put the draft up to vote, and, in an iterative process, arrive at a new, consensus-based standard.

7. Offer these consensus-based standards to FAA for use in developing Technical Standard Orders (TSOs) under Part 21, regulations, or as references for Advisory Circulars.

8. Recognizing that standards must evolve to keep pace with technological and regulatory developments, Committee F38 will review its standards as necessary to ensure their currency – the ASTM development process allows for revisions to existing standards to be balloted whenever necessary to ensure market relevance.

3.3 Adoption of Existing Standards

A large body of aviation-related standards, consensus-based and otherwise, is currently in use and applicable in total to unmanned aviation. These can be listed under a single Practice/Guide standard and voted on by Committee F38 members. Examples are:

Originator	**Standard**	**Title**	**Consensus-based?**
ASTM	MNL 5	Manual of Aviation Fuel Quality Control Procedures	Yes
RTCA	DO-178B	Software Considerations in Airborne Systems and Equipment Certification	Yes
RTCA	DO-160C	Environmental Conditions and Test Procedures for Airborne Equipment	Yes

3.4 Modification of Existing Standards

A portion of the above standards will have provisions that are not applicable, or lack provisions that are applicable, to unmanned aviation. They will be modified to delete or incorporate such provisions before being voted on by Committee F38 members. Examples are:

Originator	**Standard**	**Title**	**Example Modification**
EAA	n/a	Training Standards for Ultralight Pilots	Emergency hand and body signals-Delete
DoD	MIL-STD-461E	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment	Aircrew exposure levels-Delete

3.5 Creation of New Standards

UAVs introduce some unique functions for which standards do not currently exist. One obvious example is our current draft standard for the “Design and Performance of Airborne Sense-and-Avoid Systems.” This standard would enable the approval of a collision avoidance appliance as providing an equivalent level of safety to the see-and-avoid capability of a manned aircraft. It does not apply to the design and performance of cooperative collision avoidance systems. (Standards and guidance already exist for these transponder or broadcast-based systems.) It would also support an Advisory Circular, or other document, which clarifies 14 CFR Part 91.113.

Among the membership, we have established terms of reference based on AIAA's published terminology in order to proceed with standards development. It is committee F-38’s intent to create new work items that will support FAA activity resulting in clarification, guidance, or regulation for UAVs to gain routine access to the NAS.

4.0 *Conclusion*

In conclusion, the unmanned aviation community recognizes that standards are the bedrock it currently lacks, a foundation on which its future products and operations must be anchored. ASTM International is to be the catalyst through which the widely diverse interests of this community (including manufacturers, users, regulators, trade associations, consultants, and academia will be focused to produce consensus-based standards. Finally, while Committee F38 on Unmanned Air Vehicle Systems is not intended to unify the international UAV community, it is intended to serve as a unified effort to develop standards for the international UAV community.