

2016 Rules for AUVSI Seafarer Chapter's 14th Annual Student UAS (SUAS) Competition

FINAL

Revision 1.0

20 October 2015



The Seafarer Chapter of Association for Unmanned Vehicle Systems International (AUVSI) will once again hold the Student Unmanned Aerial System (SUAS) Competition at the Navy's Webster Field, Maryland. The SUAS Competition, aimed at stimulating and fostering interest in unmanned air systems, technologies and careers, focuses on engaging students in a challenging mission. It requires the design, integration, reporting and demonstration of a system capable of conducting air operations which includes autonomous flight and navigation, and use of onboard payload sensors to execute specified tasks. The event has been held annually since 2002.

The Seafarer Chapter and AUVSI at large are not responsible for ensuring SUAS teams operate their UAS systems within the Federal Aviation Administration (FAA) rules and regulations. The Seafarer Chapter and AUVSI will only ensure SUAS teams stay within the competition safety requirements while operating their UAS systems at Webster Field during this competition.

FINAL

Table of Contents

Table of Contents	i
1. Introduction	1
2. References	3
3. Schedule.....	4
4. Major Elements of the Competition (Chronological Order)	5
5. System Requirements	13
6. Flight-Mission Demonstration Requirements.....	18
7. Description of Mission Tasks	25
8. Scoring Metrics for Graded Elements.....	43
9. Safety Regulations	49
10. Competition Clauses	54
Appendix A: Registration Application Form.....	A1
Appendix B: SUAS Team Composition Table	B1
Appendix C: SUAS Fact Sheet (UAS Systems) (EXAMPLE ONLY)	C1
Appendix D: Map of Competition (EXAMPLE ONLY).....	D1
Appendix E: Electronic Target Data Format (EXAMPLE ONLY)	E1
Appendix F: Target Score Sheets (EXAMPLE ONLY)	F1
Appendix G: SRIC Details.....	G1
Appendix H: Interoperability Specifications	H1
Appendix I: AUVSI SUAS Risk and Waiver of Liability Form	I1
Appendix J: Base Access Information Form and Personal ID.....	J1
Appendix K: Foreign National – Additional SECURITY Information	K1

1. Introduction

1.1. COMPETITION SUMMARY

- 1.1.1. The AUVSI Seafarer Chapter, located in Patuxent River, MD, hosts the Student Unmanned Aerial System (SUAS) Competition. The Seafarer Chapter solicits volunteers from industry, academia, U.S. Navy, and non-profit organizations, to form the SUAS Competition Committee and assist with the competition. The Seafarer Chapter raises funds through sponsorship, and the AUVSI Foundation assists with sponsorship organization and financial support.
- 1.1.2. The principal focus of the SUAS Competition is the safe application and execution of Systems Engineering principles to develop and operate an autonomous Unmanned Aerial System (UAS) to successfully accomplish a specific set of tasks.

1.2. SCOPE

- 1.2.1. This is a college level performance-based competition for fixed wing, rotary wing, and multi-copter UAS. Multiple government agencies, prime and sub-contractors, engineering firms, and universities are observing and judging this competition. Contestants will be awarded prizes for major graded elements, overall performance, or individual aspects of a graded element.

1.3. MAJOR ELEMENTS

- 1.3.1. The competition will focus on three major graded elements. Each element is structured to highlight a certain facet of a team's ability to execute in the UAS field.
- 1.3.2. Technical Journal Paper: Focuses on communicating the team's systems engineering approach, design, test and evaluation. The Journals are judged independently, and prior to the other phases of competition. Additionally, it also provides an opportunity to make an award if the air vehicle becomes incapable of performing the mission prior to the competition, providing the team still presents the Flight Readiness Review (FRR).
- 1.3.3. FRR Oral Briefing: Focuses on the analysis and testing performed, identification of safety and mission risks, risk mitigation, and overall readiness of team and UAS design. Also includes focus on team's presentation skills
- 1.3.4. Flight-Mission Demonstration Tasks: Focuses on the operational performance of their vehicle systems, payload systems, communications systems, and ground control systems. Also includes focus on the team's overall skills, coordination, processes, and preparedness.

1.4. OPPORTUNITIES

- 1.4.1. Teams will be judged based on their performance and that of their system, and top teams may earn prize money in a variety of categories.
- 1.4.2. Opportunities to interview for engineering, scientist, and leadership jobs in emerging technology areas, such as UAS, may be provided.

1.5. RULES

- 1.5.1. The SUAS competition will be based upon the rules outlined within this document containing competition and administrative elements. All teams and systems **shall** operate safely within the rules. These rules are aimed at a college-level curriculum.
- 1.5.2. The SUAS committee reserves the right to make changes to these rules and issue updates or addendums at any time.

1.6. REQUIREMENTS

- 1.6.1. The requirements for this competition are laid out in paragraph format, in line item numerical order, to facilitate tracking and task identification. Technical support tasks, documentation and products should be provided in accordance with these statements:
 - 1.6.1.1. "**Shall**" indicates a requirement that is a **THRESHOLD**. Failure to meet the threshold is failure to meet the minimum criteria, i.e. failure to meet a mandatory requirement.
 - 1.6.1.2. "**Should**" indicates a requirement that is an **OBJECTIVE**. Demonstrating these requirements will earn extra points, but the basic mission can be achieved without meeting it.
 - 1.6.1.3. "**May**" indicates a permissible implementation, but is not a requirement.
 - 1.6.1.4. "**Will**" indicates actions to be taken by the competition judges or other information pertaining to the conduct of the competition.

1.7. EXPECTATIONS

- 1.7.1. **ALL** teams should be present during **ALL** days of the competition unless dismissed by the Competition Director. Teams should display their vehicle and be present in the team tent in the pit area at all times unless they are in safety check or flying.
- 1.7.2. Commercial-off-the-Shelf (COTS) or custom parts, vehicles and software are allowed to be used. Teams are fully responsible for adhering to all legal copyright and licensing laws and for protecting team's own Intellectual Property (IP).
- 1.7.3. A strict zero tolerance policy will be enforced for any malicious action, or any communications or software security attacks (cyber or otherwise) against other team's systems or the Judge's scoring software. Any attempt (successful or not) will result in the swift disqualification and removal of the team from the competition site and disqualification from competing again for up to 3 years.
- 1.7.4. Teams are required to operate within the United States government regulations for International Traffic in Arms Regulations (ITAR) that control the export and import of defense-related articles, this includes technical substance contained in Journal Papers and video and telemetry data posted and shared on YouTube. The Seafarer Chapter and SUAS committee are not liable for any team's offense to ITAR.
- 1.7.5. By participating in the SUAS competition the team, sponsors, visitors, advisors, support members, judges, and volunteers agree to have any pictures of persons, vehicles, or equipment photographed and released to the public on public or private web pages, papers, published trade magazines, journals, or posters. Each team member shall sign the Liability Waiver, which includes release of this data.

2. References

- 2.1. AUVSI SUAS website with rules, etc.:
<http://www.auvsi-seafarer.org/news-events/2016-competition.aspx>
- 2.2. 2016 SUAS Competition Registration Application: <https://goo.gl/7CM3ud>
- 2.3. Google Group for communication with teams: email auvsi-suas@googlegroups.com;
website <https://groups.google.com/forum/#!forum/auvsi-suas>
- 2.4. AUVSI SUAS Questions of Interest document:(<http://www.auvsi-seafarer.org/AUVSISUASQuestionsofInterest.pdf>)
- 2.5. New Github Organization: <https://github.com/auvsi-suas>
- 2.6. Git Repository for Interoperability: <https://github.com/auvsi-suas/interop>
- 2.7. Interoperability Documentation: <http://auvsi-suas-competition-interoperability-system.readthedocs.org/en/latest/>
- 2.8. The GitHub Organization: <https://github.com/auvsi-suas>
- 2.9. The Interoperability Documentation: <http://auvsi-suas-competition-interoperability-system.readthedocs.org/en/latest/>
- 2.10. Academy of Model Aeronautics (AMA) National Model Aircraft Safety Code:
<http://www.modelaircraft.org/files/105.pdf>
- 2.11. IEEE STANDARD 802.11g-2003 - IEEE Standard for Information technology-- Local and metropolitan area networks-- Specific requirements-- Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Further Higher Data Rate Extension in the 2.4 GHz Band: <http://standards.ieee.org/findstds/standard/802.11g-2003.html>

3. Schedule

The SUAS competition schedule is shown below in Table 1 with explicit dates and times of **deadlines**. Each deliverable item **shall** be submitted to the SUAS committee *before* the specified deadline. Late submissions for any competition deliverables **shall NOT** be accepted, and **shall** be cause for teams to be disqualified from all phases of the competition. The SUAS Head Judge may grant an 8 hour (maximum) extension, but only if the Team Captain provides a written request and strong justification in advance of the deadline. If approved, the Team Captain will be notified by the Head Judge in writing.

Table 1: 2016 AUVSI SUAS Competition Schedule

Activity	Date(s)	Notes
Notice of Intent	Mon, Aug 31, 2015	Notice Posted on Seafarer Website.
Draft Rules Posted	Wed, Sept. 16, 2015	Open for written comments.
Team Written Comments	Mon, Oct. 5, 2015	Deadline , 11:59 PM EDT.
University Day	Wed, Oct. 7, 2015	Conference Call-in 11:00 – 12:30 PM EDT.
Final Rules Posted and Registration Open	Wed, Oct. 21, 2015	Final rules posted on Website. Registration period starts.
Early Bird Registration Closes (Application and Fee)	Wed, Nov. 18, 2015	Deadline , 11:59 PM EST.
Late Bird Registration Closes (Application and Fee)	Wed, Dec. 16, 2015	Deadline , 11:59 PM EST.
Competition Kick-Off Call	Thurs, Dec. 17, 2015	Conference Call-in 11:30 – 12:30 PM EDT.
Team Composition Table	Mon, March 1, 2016	Deadline , 11:59 PM EDT.
Fact Sheet/Flight Plan	Mon, March 1, 2016	Deadline , 11:59 PM EDT.
Base Access Information Data/ Signed Team Rosters	Mon, March 14, 2016	Deadline , 11:59 PM EDT.
Competition Mid-Course Call	Wed, March 16, 2016	Conference Call-in 11:30 – 12:30 PM EDT.
Proof of Flight Video, Telemetry Data, and Safety Pilot Log	Wed, May 18, 2016	Deadline , 11:59 PM EDT.
Journal Paper Submission	Wed, May 18, 2016	Deadline , 11:59 PM EDT.
Competition Readiness Call	Wed, June 8, 2016	Conference Call-in 11:30 – 12:30 PM EDT.
Info Sessions, Career Fair, and Student Interviews	Wed, June 15, 2016 1:00PM - 5:00PM	Upload Resumes in advance of attendance and bring copies.
Competition	Wed, June 15, 2016 5:00 PM EDT.	Check-in / Orientation Signed Notice of Risk; Disclaimer of Liability; Waiver of Claims Form
	Thurs, June 16, 2016	Safety Inspections / FRR briefings
	Fri - Sun, June 17-19, 2016	Flight-Mission Demonstration
	Sat, June 18, 2016	Awards Banquet
	Sun, June 19, 2016	Rain day for flying

NOTE: Date stamps of email, SharePoint upload, and mail postmark will be used as submittal time.

4. Major Elements of the Competition (Chronological Order)

The major elements of the competition are defined here in general terms in chronological order of the competition. Further details of these elements are defined elsewhere in these rules, as noted within the description below.

4.1. NOTICE OF INTENT

- 4.1.1. Seafarer Chapter will issue an announcement that the chapter intends to issue the draft rules and competition schedule on a specified date.

4.2. DRAFT RULES

- 4.2.1. The draft rules for the competition are issued in the first period of the new academic year. Professors and students are invited to review the new rules, propose changes, and form teams to participate in this student competition.
- 4.2.2. Teams are encouraged to review the rules and submit comments and questions to the SUAS committee before University Day. This will help the SUAS committee answer questions, clarify specific areas, and alter technical and administrative specifications as necessary.

4.3. UNIVERSITY DAY

- 4.3.1. University Day consists of a 1.5 hour-long conference phone call, in which all prospective competitors should participate. This event gives teams a strategic opportunity to pose questions directly to the judges that may influence the rules, to hear other teams' questions which could save a lot of work, and to learn answers several weeks before the final rules are posted.
- 4.3.2. Based on feedback received regarding draft rules and during University Day, the draft competition rules may be modified before the final release.
- 4.3.3. Although teams are encouraged to call in, the University Day event is not a graded element, and teams are not required to attend.
- 4.3.4. The date and time for University Day is listed in Section 3.
- 4.3.5. The conference call number and web meeting URL are defined in Section 10.1.

4.4. FINAL RULES

- 4.4.1. The final rules will be posted after University Day -- at least eight weeks before the deadline for submission of the applications and registration fee.
- 4.4.2. Details about the release of the final rules are found in the Schedule in Section 3.
- 4.4.3. It is intended that the final requirements remain fixed. However, the SUAS committee reserves the right to make changes as deemed necessary.
- 4.4.4. Any changes to the final rules after the release date will be posted to the official competition website as a revision and the Team Captain will be notified.

4.5. REGISTRATION PROCESS

- 4.5.1. The registration process will open at the time the final rules are posted. No early registrations will be accepted.
- 4.5.2. A completed registration application form and the full registration fee **shall** be received in order for a team to be qualified for entry into this competition.

- 4.5.3. To be accepted and processed, the registration application form and payment **shall BOTH** be received with official postmark, bank annotation or electronic file date/time stamped for submission no later than the schedule deadline in Section 3.
 - 4.5.4. The schedule of Section 3 has an early bird deadline that ends 4 weeks after registration opens, and a late bird deadline that ends 8 weeks after registration opens. Teams with acceptable application forms and registration fee submitted by the early bird deadline will have a reduced registration fee.
 - 4.5.5. A limited number of teams will be accepted and the registration period is subject to close at any time, even before either Early Bird or Late Bird registration deadlines.
 - 4.5.6. The typed registration application form **shall** be submitted electronically using the Google Forms format to be provided. The content required for the registration application form is located in **Appendix A: Registration Application Form**.
 - 4.5.7. Details about the application process and registration fees are found in Section 10.
 - 4.5.8. No withdrawals or refunds will be given to any team after the application form and registration fee has been submitted, and the team has received an acceptance notice from the SUAS committee.
- 4.6. **COMPETITION KICK-OFF CALL**
- 4.6.1. The competition Kick-off Call consists of a 1 hour-long conference phone call, in which all registered teams should participate. This event kicks off the competition and provides teams an awareness of who are competing, updates to the rules, and potential changes to deliverable deadlines.
 - 4.6.2. The date and time for Kick-off Call is listed in Section 3.
 - 4.6.3. The conference call number and web meeting URL are defined in Section 10.1.
- 4.7. **SHAREPOINT SITE LOGIN CREDENTIALS**
- 4.7.1. Each registered team's Captain and Advisor will be provided log-in and password credentials to access the SUAS SharePoint site.
 - 4.7.2. Explicit instructions will be provided to registered teams on how to log in and upload the deliverables to the team's unique folder on the SUAS SharePoint site.
 - 4.7.3. Several administrative details requiring team's inputs will be submitted using Google Forms format to be provided, based on content described in specified appendices. The key deliverables submitted by registered team for the competition **shall** be submitted in PDF file format and upload to the team's unique folder on the SUAS SharePoint site defined in Section 10.1. Judges will not review and score deliverable files in any other format.
- 4.8. **TEAM COMPOSITION TABLE/TEAM LIST**
- 4.8.1. Each registered team **shall** submit specific team information necessary for logistics and planning. Teams **shall** provide how many team members, advisor and guests will participate on-site at Webster Field in Maryland, how many are Foreign Nationals, how many have dietary restrictions, and how many for each size T-shirts are needed for the team members. Additionally, teams **shall** provide the names, e-mail contacts, positions and degree information of all team members.
 - 4.8.2. Each team **shall** enter the required information of Appendix B Team Composition Table and Team List to Google Forms before the deadline listed in Section 3.

4.9. **FACT SHEET/FLIGHT PLAN**

- 4.9.1. Each registered team **shall** submit a fact sheet providing descriptions of the UAS aircraft and systems being used in the competition. The Fact Sheet **shall** contain vehicle parameters such as vehicle size, weight, fuel or battery type, transmitted aircraft control and payload data frequencies, and large ground equipment that will be transported to the flight line. Additionally, the flight plan **shall** be submitted to define the tasks the team will execute during the mission demonstration.
- 4.9.2. Using Appendix C: Fact Sheet and Flight Plan as the example content, each team **shall** submit the required information using Google Forms before the deadline listed in Section 3.

4.10. **BASE ACCESS INFORMATION AND SIGNED TEAM ROSTERS**

- 4.10.1. The critical information required for base access, including the authorized team roster, **shall** be submitted before the deadline listed in Section 3. Late submissions will not be accepted and will disqualify individuals, or teams, from competing.
- 4.10.2. Each registered team **shall** submit the required personal data and information for all team members in the form of a complete and authorized team roster signed by the school officials, along with individual security forms and personal identities submitted to be reviewed for access to the military base at Webster Field.
- 4.10.3. Teams from U.S. schools **shall** provide the necessary personal data in order to access a military base detailed in Section 10.
- 4.10.4. Teams from schools outside the U.S., or U.S. teams with non-U.S. citizens, **shall** provide additional specific personal data and formal letters of authority from their school in order to access a military base detailed in Section 10.
- 4.10.5. The base access data **shall** be submitted by the specified date and time deadline detailed in Section 3. No individual alterations or team substitutions will be allowed after this deadline.

4.11. **COMPETITION MID-COURSE CALL**

- 4.11.1. The competition Mid-Course call consists of a 1 hour-long conference phone call, in which all registered teams should participate. This event ensures all teams are on track and aware of updates to rules, requirements and schedule.
- 4.11.2. The date and time for the Mid-Course call is listed in the Schedule of Section 3.
- 4.11.3. The conference call number and web meeting URL are defined in Section 10.1.

4.12. **PROOF-OF-FLIGHT/TELEMETRY (TM) DATA**

- 4.12.1. Prior to the competition, a proof-of-flight video and UAS telemetry (TM) data **shall** be submitted proving the team's aircraft mission configuration and Safety Pilot can meet the primary and secondary tasks and attain and sustain flight, search, and land in a safe manner. The term "UAS telemetry" means the autopilot telemetry data for the UAS being operated, and the TM data packet is described in the referenced Interoperability Documents.
- 4.12.2. The proof-of-flight video and TM data set are required for teams to participate in the flight-mission demonstration phase of the competition.
- 4.12.3. The proof-of-flight video is expected to demonstrate the capability to meet the goals of the primary autonomous tasks. The video and TM data **shall** show the aircraft at competition takeoff weight (accounting for all sensors), in full mission readiness for primary tasks. Any significant modifications made after this video may be grounds for disqualification from the flight-mission phase of competition.

- 4.12.4. The proof-of-flight video **shall** provide the following:
 - 4.12.4.1. Identify the school and the competition year.
 - 4.12.4.2. Show the vehicle takeoff, achieve controlled flight and land (crashes or unintentional off-field landings **shall** not count).
 - 4.12.4.3. Show evidence of successfully achieving each primary and secondary task planned in Flight Plan Table. If teams can't show a successful performance, they **shall** not be allowed to attempt at competition.
 - 4.12.4.4. Show evidence of the readiness of the competition aircraft and of the Safety Pilot as defined in section 9 Safety Regulations.
 - 4.12.5. The team's proof-of-flight video **shall** be posted on www.youtube.com, at least 1080p resolution and at least 24 fps. Only the character text string for the URL link to proof-of-flight video **shall** be uploaded to the competition SharePoint site. Only the text file with the link will be graded. Any video formatted file will be ignored.
 - 4.12.6. Each team **shall** also submit suitable TM data collected during the proof-of-flight that directly corresponds to the proof-of-flight video demonstration. The TM data **shall** validate the UAS and Ground Control System (GCS) capability to meet the network requirements defined in Section 5.3.
 - 4.12.7. The TM data will be submitted in the form of a database dump of the interoperability system and uploaded to the SharePoint site. This is the only deliverable data that is not required in PDF file format. The database dump **shall** be the JSON formatted dump generated by the Django framework. Details are provided in the interoperability website, which is defined in Appendix H.
 - 4.12.8. The team's assigned safety pilot **shall** log all incremental hours of flight, and achieve a minimum number of hours of logged flight time before being considered experienced enough to support flight during the competition. The team Advisor **shall** confirm the safety pilot meets the requirements defined in Section 9.
 - 4.12.9. A backup vehicle may be used for the flight-mission demonstration, but a separate proof-of-flight video, TM data set, and safety pilot log, as well as context described in Journal and FRR brief **shall** be required for each vehicle, and **shall** be submitted within the same deadline as all other vehicles. Backup airframes **shall** be the same form, fit and function, albeit perhaps limited in duplicating the same exact suite of expensive sensors, etc.. This way, autopilot and control settings, and Safety Pilots experience, are redundant and suitably safe for the competition. A backup vehicle is only allowed to be used if the primary vehicle fails to achieve first flight.
 - 4.12.10. Each team **shall** upload the required information to Google Forms, SharePoint site, and YouTube before the deadline listed in Section 3. No basic vehicle alterations or substitutions will be allowed after this deadline.
 - 4.12.11. The proof-of-flight video and TM data set filenames **shall** include the full school and team name and have the prefix "POF" and "TM" (ex., "POF- Mississippi State University, Xipiter.pdf", and "TM- Mississippi State University, Xipiter.json").
- 4.13. **JOURNAL PAPER**
- 4.13.1. Each team **shall** submit a technical journal paper that describes the design of their entry and the rationale behind their design choices. The purpose of the paper is to show the team's overall coordination and systems engineering process, design tradeoffs, final design solution, with analytical evidence and bench/flight test data proving it will safely fly and perform planned mission tasks. The journal paper **shall** address the mission tasks the team may be capable of achieving during flight.

- 4.13.2. Details about the journal paper requirements are found in Section 8 Scoring Metrics. The journal paper **shall** be typed and submitted in **PDF** file format.
- 4.13.3. Each team **shall** electronically upload their required journal paper to a specified folder on the SharePoint site before the deadline listed in Section 3.
- 4.13.4. The journal paper's filenames **shall** include the full school and team name and have the prefix "JP" (ex., "JP- Mississippi State University, Xipiter.pdf").

4.14. **COMPETITION READINESS CALL**

- 4.14.1. The competition Readiness call consists of a 1 hour-long conference phone call, in which all registered teams should participate. This event ensures all teams are ready and fully aware of all rules, requirements and schedule updates.
- 4.14.2. The date and time for the Readiness call is listed in the Schedule of Section 3.
- 4.14.3. The conference call number and web meeting URL are defined in Section 10.

4.15. **INFO SESSIONS, CAREER FAIR AND STUDENT INTERVIEWS**

- 4.15.1. Opportunities will be provided to the student team members defined in section 10.8.1 of registered teams participating to electronically upload their resumes in advance of the competition to be reviewed by key SUAS sponsors.
- 4.15.2. SUAS sponsors will be on-hand during the specified date and time detailed in the Schedule of Section 3, to present short information sessions defining sponsor's organizations and technologies. A mini career fair will be held concurrently, where prospective students can learn about sponsor's job openings, career opportunities, and potentially arrange for interviews at an alternate time and place. Attendance at these sessions will be limited to the team members recognized by the advisor and listed on the team roster to participate in the competition.
- 4.15.3. The location of the information sessions and career fair is defined in Section 10.
- 4.15.4. Students are still expected to arrive at the Team Check-In and Orientation and participate fully in the competition without interruption caused by interviews.
- 4.15.5. Students are encouraged to use AUVSI's Career Center online at <http://www.auvsi.org/resourcesold/jobboard>

4.16. **TEAM CHECK-IN AND ORIENTATION**

- 4.16.1. Teams **shall** be at the check-in and orientation briefing at the specified date and time detailed in the Schedule of Section 3.
- 4.16.2. During check-in teams receive critical instructions, badges and vehicle passes for base access.
- 4.16.3. During the check-in process, all students, academic advisors, and visitors **shall** sign the appropriate liability waiver form defined in Section 9 and Appendix I.
- 4.16.4. A simple BBQ meal will be provided for the students during the check-in process. Limited dietary restrictions will be accommodated with this meal at check-in.
- 4.16.5. During the orientation, teams will receive up-to-the-minute changes in plans and be provided reminders about rules and coordination. Teams will also be notified of the initial order for conducting the oral presentations the following morning.
- 4.16.6. There are many details of the competition, like the GPS coordinates of waypoints, which are specified to be given out Wednesday evening. The team captains **shall** obtain these details at the end of check-in and orientation. It is the captain's responsibility to obtain and retain these forms. The SUAS committee will not find you afterwards and will not provide extra copies if you lose your team's copy.

- 4.16.7. There is no guarantee that a team will be processed into the competition if they are unable to make this deadline, as detailed in the Schedule of Section 3.
- 4.16.8. Teams not in attendance for the check-in and orientation briefing **shall** risk being unable to access the government facility and forfeit their ability to compete.
 - 4.16.8.1. If the team encounters last minute unforeseen circumstances during travel that affect arrival schedules and cause them to miss the check-in and orientation briefing, the Team Captain, or alternate, **shall** contact the SUAS Competition Director **prior to check-in start time**.
 - 4.16.8.2. Poorly planned travel (ex. scheduling late flights, not accounting for rental cars/vans, unaware of the long 1-1/2 hour drive from local airports, minimal local taxi services, etc.) will not be acceptable excuses.
 - 4.16.8.3. The team captain will need to explain the circumstances and request exemption from attendance at check-in. Only if authorized, they will be provided guidance on how to undergo a late check-in process. **Teams not providing such communication with the SUAS Competition Director shall forfeit and not be scored in any phase of the competition.**
- 4.16.9. The location of the check-in and orientation is defined in Section 10.

4.17. SAFETY INSPECTIONS

- 4.17.1. Safety inspections **shall** include a physical inspection, fail-safe check, flight termination check, and a maximum weight check.
- 4.17.2. Safety inspections **shall** be performed on all aircraft by designated competition safety inspectors prior to being allowed to make any competition or non-competition (i.e., practice) flight.
- 4.17.3. The safety inspections are not a graded element, but teams **shall** pass inspection as a requirement to fly. All decisions of the safety inspector(s) **shall** be final.
- 4.17.4. The safety inspections **shall** be performed on the specified date detailed in the Schedule of Section 3.
- 4.17.5. Details about the safety inspection process are defined in Section 9.
- 4.17.6. Questions regarding conduct of the safety inspection may be sent to the SUAS Safety Inspector contact detailed in Section 10.
- 4.17.7. The location of the safety inspection is defined in Section 10.

4.18. FLIGHT READINESS REVIEW (FRR) BRIEFING & STATIC DISPLAY

- 4.18.1. The Flight Readiness Review (FRR) **shall** be an oral briefing presented to a team of judges during which the teams substantiate, with data, their capability and plans to safely accomplish the mission.
- 4.18.2. The FRR is the judge's final GO/NO-GO criteria to determine if the team will be allowed to proceed (GO) to the flight-mission phase of competition, or not (NO-GO) and be disqualified from flying in the flight-mission phase of competition.
- 4.18.3. The team **shall** demonstrate they are ready to compete safely, with low risk, using analysis, bench test data, and prior flight-mission test data. The FRR should not restate the technical journal paper, but **shall** address the mission tasks planned.
- 4.18.4. The FRR briefing and static display are graded elements of the oral presentation. The static display **shall** include visual aids and the actual system being demonstrated, to support and clarify the team's briefing. Teams are encouraged to leave certain aspects of their static display up for sponsors to see the work accomplished and for other teams to ask questions.

- 4.18.5. All team members present **shall** participate in some manner during the FRR briefing.
- 4.18.6. Following the FRR briefing's question and answer period, the judges **shall** perform a brief review and inspection of the team's UAS including aircraft exterior and interior, ground station, test data, safety checklists, and other supporting evidence.
- 4.18.7. The FRR **shall** be given on the date detailed in the Schedule of Section 3.
- 4.18.8. Details about the FRR requirements are found in Section 8 Scoring Metrics.
- 4.18.9. The location of the FRR is defined in Section 10.
 - 4.18.9.1. Examples from 2015 FRR can be viewed at the SUAS YouTube channel.
https://www.youtube.com/channel/UCI4Ud9E_EwKKCXsVy_sf8eg

4.19. FLIGHT-MISSION DEMONSTRATION

- 4.19.1. The flight-mission demonstration evaluates the teams' ability to conduct a mission operation with their vehicle. This is the culminating event of the competition.
 - 4.19.1.1. Only teams that submit all deliverables, for team and UAS system information, the Journal Paper, successfully pass the FRR (GO), and successfully pass the Safety Inspection will be allowed to fly.
- 4.19.2. Each team **shall** arrive prepared to immediately begin flight operations.
- 4.19.3. Flight demonstrations **shall** follow procedures briefed the day before during FRR.
- 4.19.4. A lead judge will be assigned to each team at the flight line. There will be additional judges assigned who are focused on different aspects of the competition (imagery, autonomy, safety, etc.) depending upon which tasks the team is planning to accomplish.
- 4.19.5. The flight-mission demonstration will be conducted on an active runway. It is important that all team members follow the instructions of the judges and the SUAS committee. Teams that fail to follow instructions shall be disqualified.
- 4.19.6. The flight-mission demonstration is a graded element.
- 4.19.7. The flight-mission demonstration has specified dates, and a back-up rain date, detailed in the Schedule of Section 3.
 - 4.19.7.1. **Note:** if weather interferes with the scheduled dates for flight-mission demonstration, teams may be scheduled to fly on the back-up rain date.
- 4.19.8. Details about the flight-mission demonstration requirements are found in Sections 6 and 7 of these rules.
- 4.19.9. The location of the flight-mission demonstration is defined in Section 10.
- 4.19.10. Each team should anticipate a crowd of judges and media at the flight line. Teams should actively control their team on the flight line and around their operational area.

4.20. COMPETITION PHOTO

- 4.20.1. All teams, advisors, judges and volunteers should stay at the competition site until the very last team has flown to show support for all teams and ensure maximum exchange of information among teams and students.
- 4.20.2. After the last flight all teams and advisors should gather with their aircraft, along with all the judges and volunteers, for a final SUAS competition photograph.

4.21. AWARDS BANQUET

- 4.21.1. The awards banquet includes a dinner and a keynote speaker, followed by the presentation of awards. The final standings of the competition will be announced during the presentation of awards and cash prizes.
- 4.21.2. Sponsors and industry members will be at the banquet.
- 4.21.3. Teams are strongly encouraged to attend this banquet.
- 4.21.4. Recommended attire for the banquet is business casual (e.g. collared shirts and slacks).
- 4.21.5. The awards banquet's date and time are detailed in the Schedule of Section 3.
 - 4.21.5.1. If a rain delay causes the competition to fly on Sunday, the awards banquet will still be held on Saturday, although only awards for journal papers and oral presentations will be awarded. The flight demonstration and final standings of the competition would then be announced at a later time.

5. System Requirements

This section lists system requirements or limitations that are not otherwise covered in the task descriptions.

5.1. AIRCRAFT REQUIREMENTS

- 5.1.1. The system **shall** be limited to one aircraft in the air at any time.
- 5.1.2. The air vehicle **shall** be capable of heavier-than-air flight.
- 5.1.3. The aircraft may be of any configuration except lighter-than-air, **shall** be free-flying, and **shall** have no entangling encumbrances such as tethers.
- 5.1.4. As a competition requirement, the air vehicle **shall** be capable of autonomous flight and navigation required to meet the minimum thresholds of the primary tasks defined in Section 7.
- 5.1.5. To earn additional points the air vehicle payloads **shall** be capable of meeting the minimum thresholds of the secondary tasks defined in Section 7.
- 5.1.6. The aircraft **shall** comply with the Safety Regulations described in Section 9.
- 5.1.7. Teams **shall** not deploy or use ground based sensors on the runway, taxiway or airfield other than the immediate area inside or around the team's flight-line tent.
- 5.1.8. Launchers will be inspected by competition safety inspectors before they are allowed for use in the competition. Safety inspection is covered in Section 9.

5.2. GROUND STATION REQUIREMENTS

- 5.2.1. As a competition requirement, the ground station **shall** be capable of meeting the minimum thresholds of the tasks defined in Section 7.
- 5.2.2. The system **shall** output position target data (location & characteristics) in accordance with the format defined in Section 7.
- 5.2.3. The judges **shall** be able to view the safety-of-flight information on the ground control system displays at all times, including in bright sunlight conditions.
- 5.2.4. Teams may bring their own ground based sensors, but are restricted to locating the sensors at the team's tent at the flight line or in the pit area. No antenna masts, balloons, or other obstacles on the airfield taller than the flight line tents (approximately 10-12 ft.) will be permitted.
- 5.2.5. Teams **shall NOT** use any other means to collect imagery (including using other teams' systems).
- 5.2.6. The ground control system **shall** not exceed one standard motor vehicle and one standard trailer at the flight line.

5.3. TELEMETRY DATA FOR JUDGING

- 5.3.1. As a flight-mission demonstration requirement, teams **shall** upload the UAS autopilot telemetry (TM) data (position, altitude, and related attributes) to support scoring using the interoperability system defined in Section 7.9 and in Appendix H.
 - 5.3.1.1. In this case the interoperability network is used to upload basic autopilot TM data for the judges to review, much like the ground station with displays are used for the judges to review air vehicle position or imaging data.

- 5.3.1.2. The interoperability secondary task goes beyond this to assess if the team's system can perform the basic downloading of data and display of info, time and obstacles from the interoperability network - as a prerequisite to the 7.10 SDA task.
- 5.3.1.3. If the team's system cannot provide TM data to the judges using the interoperability system they will not be allowed to fly - just like if they had not displays to show the judges' the air vehicles position.
- 5.3.2. The UAS **shall** upload this TM data at a target rate of 10Hz from the first takeoff until the last landing. If the average rate of upload across all flight periods is below 8 Hz, the team will receive no points for the mission demonstration. The difference between 10 Hz and 8 Hz is intended to allow for short and temporary data link outages.
- 5.3.3. Data dropouts, which impact the ability for the judges to use the telemetry data to judge mission components, will be counted against the team. For example, if data dropout makes it unclear whether waypoints were captured within 50ft and in order, it will be assumed the team did not do so. If the data dropout occurs near a flight zone boundary, it will be assumed the team spent the entire time out of bounds. If the data dropout occurs near obstacles, it will be assumed those obstacles were hit. For data dropout evaluation, it will be assumed the UAS traveled at the maximum allowed competition airspeed (100 KIAS).
- 5.3.4. The UAS may upload the position whenever the interoperability network is available, and is not restricted to airborne flight periods. Teams should also upload position whenever the UAS occupies the runway.
- 5.3.5. Data uploaded **shall** be genuine autopilot flight telemetry data which is not interpolated, extrapolated, duplicated, simulated, or otherwise edited by team's code/operators before being passed to the interoperability system. The data must be generated by the autopilot at 10Hz, or greater, and thus the UAS will need sensors and data links which can support sufficient data rates.
- 5.3.6. Details about the interoperability system, which is used to upload the UAS telemetry, can be found in Section 7.9 and in Appendix H.

5.4. RF COMMUNICATIONS REQUIREMENTS

- 5.4.1. The SUAS competition **shall** allow multiple teams to transmit on Wi-Fi (2.4/5.8GHz) and on multiple Radio Frequency (RF) communications bands at the same time, except for 900 MHz. The 900 MHz band will be tightly controlled, and only one team shall be allowed to transmit at any time during the competition regardless of being at the pits, the flightline, or airborne. This is intended to provide teams additional setup/troubleshooting time, improve the efficiency of the competition, and require teams to seriously address RF system design.
 - 5.4.1.1. In the event that unforeseen safety issues arise in executing simultaneous teams transmitting RF, the competition reserves the right to revert to one team transmitting RF at a time or other measures.
 - 5.4.1.1.1. Systems should be designed for this contingency. If the competition reverts to one team transmitting RF halfway through flight demonstrations, there will be no re-flights for teams who previously flew their mission.

- 5.4.2. Systems **shall** be designed such that multiple systems can operate simultaneously using a RF spectrum management scheme described below. Use of any communication frequencies not described **shall** be prohibited unless the details are clearly defined in the Fact Sheet submitted and the team has received written authorization from the SUAS Competition Director or Head Judge.
 - 5.4.2.1. Systems that do not comply with these requirements may be prohibited from operating on unapproved frequencies.
 - 5.4.2.2. Manufacturer name, model numbers and Specifications (frequencies, bandwidths, channels, etc.) on the equipment of all RF transmitters and receivers **shall** be provided in the Fact Sheet.
- 5.4.3. Teams are strongly encouraged to consider use of all forms of hardwired RF interface cables and/or antenna 'hats' to connect the aircraft's RF systems to the ground station's RF elements during operational checkout and troubleshooting on the ground to avoid conflicting with RF transmission restrictions on or off the airfield.
- 5.4.4. Frequency management concept. Frequency management and control is being pushed onto the teams, more akin to real-world operations. Teams **shall** not use radio "default" settings. Use of encryption, directional antennas, RF filters, RF amplifiers, or other means to safely improve RF performance are highly encouraged. It is expected that teams come prepared with fallback plans.
- 5.4.5. Specific frequency management requirements for each band:
 - 5.4.5.1. 72 MHz: The use of 72 MHz for RC control is strongly discouraged; however, teams with existing systems using 72 MHz RC **shall** provide specific channel information in the Fact Sheet (including channel selection capabilities). Earlier notification is highly desirable. Coordination of use of channels within 72 MHz RC control will be managed on a case-by-case basis during competition.
 - 5.4.5.2. 433 MHz: Use of UHF ISM Band 433MHz (431-435MHz) **shall** be limited to use of Frequency Hopping Spread Spectrum technology.
 - 5.4.5.3. 462.7 MHz: Handheld radios on General Mobile Radio Service (GMRS) will be operated by the competition staff in close proximity to aircraft and ground stations.
 - 5.4.5.3.1. Note: Teams should consider using RF filters in their equipment to prevent interference from GMRS radios.
 - 5.4.5.4. 900 MHz: ISM b Output Frequency is CONTROLLED. Teams will be granted approval for 900MHz only one at a time while they are on the mission clock during mission-flight demonstration. This precludes all 900 MHz wireless operation in the pits/spectator area unless the Competition Director or Head Judge authorizes this while no other team is on the flight line or on mission clock.
 - 5.4.5.4.1. Unauthorized transmission on 900MHz without permission to transmit **shall** be prohibited. Repeated offenders may be excluded from further participation in the competition.
 - 5.4.5.5. 1.08, 1.12, 1.16, 1.2, 1.24, 1.28, 1.32, and 1.36 GHz: Limited to use of Frequency Hopping Spread Spectrum technology.

- 5.4.5.6. 1.2 - 1.3 GHz: Limited to analog or digital video systems.
- 5.4.5.7. 2.4 GHz RC (2.4- 2.485 GHz): Spread Spectrum techniques in accordance with FCC regulation CFR 47 part 15.
- 5.4.5.8. 2.4 GHz Wi-Fi (802.11 b/g/n): Use of 2.4 GHz Wi-Fi **shall** be OPEN.
- 5.4.5.9. 5 GHz Wi-Fi (802.11a/h/j/n/ac): Use of 5 GHz Wi-Fi **shall** be OPEN.
- 5.4.5.10. Use of cellular and mobile Wi-Fi will not be restricted.
 - 5.4.5.10.1. NOTE: Cellular reception at the competition site is poor and unreliable.
- 5.4.6. 802.11 wireless (a/b/g/h/i/n) **shall** have an SSID of the team's school and/or team name (e.g. Bob_University) for quick and easy identification. The team's SSID **shall** be provided in the Fact Sheet and **shall** not change during competition.
 - 5.4.6.1. Any 802.11 wireless system **shall** have over-the-air encryption (WPA, WEP, or otherwise) enabled.
- 5.5. **ELECTROMAGNETIC ENVIRONMENTAL EFFECTS (E³) REQUIREMENTS**
 - 5.5.1. The SUAS committee will NOT attempt to prevent airfield electromagnetic emissions except for in the 900 MHz band. The teams' systems should incorporate basic electromagnetic interference (EMI) and electromagnetic compatibility (EMC) design considerations.
 - 5.5.2. The SUAS teams should monitor all RF frequencies and channels at the flight line and in the pit area to identify any specific RF signals at the airfield that may interfere with their own systems. The teams should use this data to avoid operating in specific channels the teams may feel are problematic for their own system's operating frequencies. The SUAS committee will also be monitoring all RF frequencies and channels to identify any specific RF signals at the field, but the teams should not solely rely on this monitoring.
 - 5.5.3. Teams should also anticipate that numerous mobile and wireless devices (phones, PDAs, computers, GoPro cameras, etc.) will be operating on the airfield that will not be controlled.
 - 5.5.4. Any team found to be intentionally jamming another team during flight operations will be eliminated from the competition.
- 5.6. **WEATHER REQUIREMENTS**
 - 5.6.1. Teams **shall** be able to compete in the following conditions:
 - 5.6.1.1. The aircraft **shall** be capable of takeoff and landing in crosswinds to the runway of 8 knots with gusts to 12 knots (when using the most favorable runway/direction for runway dependent systems). Two runway options of approximately 90 degrees apart are available.
 - 5.6.1.2. The aircraft **shall** be capable of operating during all mission phases in tower reported surface winds of 15 knots with gusts to 20 knots.
 - 5.6.1.3. The system **shall** be capable of completing mission objectives in surface temperatures up to 110 degrees Fahrenheit.
 - 5.6.1.4. The system **shall** be cable of completing the mission after exposure to temperatures of 100 degrees Fahrenheit for up to 12 hours.
 - 5.6.1.5. The system **shall** be capable of operating in fog conditions of visibility of 2 miles or greater with no precipitation.

- 5.6.2. If conditions fall outside weather requirements, or if the judges feel environmental conditions are unsafe (such as approaching thunderstorms), the competition will be suspended.
- 5.6.3. The aircraft and ground station should be easily secured during windy conditions, and any sensitive electronics or components of high value should be able to be rapidly protected from rain in short notice (e.g. cases or tarpaulins).

5.7. PIT AND AIRFIELD PROVISIONS

- 5.7.1. In the pits and at the airfield, the SUAS committee will ensure the teams are provided a tent for shade, a folding table, chairs, and a single electrical power extension cord from a mobile generator.
- 5.7.2. The electrical power provided will be 115 VAC, 60 Hz, rated up to 15 amperes. This may not be enough for many ground stations, and teams should consider bringing additional generators and UPS battery backups if required.
- 5.7.3. There is a possibility the mobile generator may run out of gas at any time during the competition and not be refilled and restarted for some undetermined period of time. Teams **shall** be capable of operating in the field without electrical power provided by the competition for up to 10 minutes.
 - 5.7.3.1. The Lead Judge will make appropriate accommodations should an unplanned electrical power outage exceed the 10 minute limit.

5.8. AIRFIELD NOTES

- 5.8.1. Airfield coordinates: 38°09'01.5"N, 76°25'29.7"W
- 5.8.2. Airfield elevation is 22 feet MSL.
- 5.8.3. Airfield magnetic deviation is 11 degrees west.
- 5.8.4. The runway is a paved asphalt surface, roughly 100 feet wide, with no height obstacles.
- 5.8.5. Grass areas within the takeoff/landing area will not be prepared.
- 5.8.6. A map of the competition area is shown in Appendix D (from 2015 SUAS and is only for an example).

6. Flight-Mission Demonstration Requirements

6.1. FLIGHT TASKS

- 6.1.1. Only systems in the proof-of-flight video, presented in the FRR, inspected by safety inspectors, and included in the preflight brief will be permitted to fly.

6.2. OPERATIONAL TIMELINE

6.2.1. Timeline Increments

- 6.2.1.1. The SUAS committee reserves the right to adjust the time for these segments at any time of the overall competition evolution. The value of a minute of mission time will not be provided to student teams.

6.2.2. Transportation to Flight Line

- 6.2.2.1. Specified Time = 10 minutes maximum
- 6.2.2.2. Each team **shall** have a maximum specified period of time to transport their system from the staging area to the flight line upon notification (and, if requested, availability of competition-provided transportation).

6.2.3. Setup Time

- 6.2.3.1. Specified Time = 20 minutes maximum
- 6.2.3.2. Each team **shall** have a maximum specified period of time to set up equipment on the flight line prior to starting their mission clock. After the maximum setup time has elapsed, the judges may declare mission start, regardless of the team's readiness to launch the mission. If another team is on the mission clock, the team on setup may benefit from additional time before being called to start their mission time.
- 6.2.3.3. Setup time begins when the team arrives at the flight line. A lead judge will be assigned to each team and will start a dedicated stopwatch after communicating with the Team Captain.
- 6.2.3.4. During set up, teams **shall** abide by the RF transmitting rules specified in Section 5.3.
- 6.2.3.5. A pre-mission briefing **shall** be accomplished prior to flight. This briefing is to inform the judging team of:
 - 6.2.3.5.1. The structured flight operations.
 - 6.2.3.5.2. Safety, including the process for manual override and the process for activating the FTS.
 - 6.2.3.5.3. The tasks the team plans to attempt.
- 6.2.3.6. The pre-mission briefing **shall** be accomplished during setup time and will not be counted against Mission Time.

6.2.4. Mission Time

- 6.2.4.1. Mission Time (T_M) = 45 minutes absolute maximum
- 6.2.4.2. Mission Time is split into two (2) separate periods: Flying Time plus Post Processing Time. The total Mission Time is scored, while the two periods allow for bonus or penalties points, or termination of scoring.

- 6.2.4.2.1. Mission Time equals the Flying Time until the team either stops occupying the airfield and runway and 900 MHz band, or the judge terminates the mission.
- 6.2.4.2.2. After ending the Flying Time, the Mission Time may seamlessly continue with the Post Processing Time.
- 6.2.4.3. Bonus points may be scored for ending Flying Time period early.
- 6.2.4.4. Mission Time shall start at the declaration of Mission Clock start from the Lead Judge, who will have a dedicated Mission Clock stopwatch.
- 6.2.4.5. Mission Time shall stop/end once one of the following occurs:
 - 6.2.4.5.1. Standard: The vehicle has ended its flight (landed, crashed, or terminated), and both the aircraft and team members are back at the team's tent and off the runway, and 900 Hz transmitters are off, and all scoring materials are turned into the Lead Judge.
 - 6.2.4.5.2. Timeout: A Timeout is called by the Team Captain and the Timeout criteria are met (section 6.2.6). If the Mission Clock is started again after Timeout the total elapsed Mission Time will be counted.
 - 6.2.4.5.3. Judge's Call: The Lead Judge declares the Mission Time stopped or terminates the mission due to rules/safety.
- 6.2.4.6. Flying Time:
 - 6.2.4.6.1. Flying Time = 30 minutes maximum
 - 6.2.4.6.2. Flying Time is the first period of the Mission Clock and constitutes time the team is occupying the runway and airspace and allowed to transmit on 900 MHz band.
 - 6.2.4.6.3. During Flying Time teams **shall** be permitted to radiate RF (including 900 MHz band), run propulsion systems, and use the active runway and airfield.
 - 6.2.4.6.4. A team may elect to cycle through the takeoff and landing sequence during the Flying Time more than once for a variety of valid reasons (change batteries, etc.). No points will be lost, but critical mission time will be consumed.
 - 6.2.4.6.5. Flying Time starts with the beginning of the Mission Clock and the amount of Flying Time **shall** be scored.
 - 6.2.4.6.6. Flying Time stops (see 6.2.4.5) when the vehicle has completed flight (landed, crashed, or terminated), and the aircraft and team no longer occupies the active airfield or runway, and the team has turned off 900MHz transmitters. The Lead Judge will confirm with the Team Captain the Flying Time period has stopped and the Post Processing Time period starts.
 - 6.2.4.6.7. Flying Time = 20 minute termination: If the aircraft has not achieved flight by this elapsed Mission Time, the mission will be terminated by the Lead Judge and no further scoring is possible.

- 6.2.4.6.8. Hard Limit (Flying Time): (see 6.2.4.6.1) If a team reaches maximum Flying Time and still occupies the active airfield or runway (even if the aircraft is on approach), the Lead Judge will terminate the Mission Clock and the team **shall** have no further opportunity to provide data for scoring. This is a **hard limit and will be enforced** (intended to give all teams a chance to fly).
- 6.2.4.7. Post-Processing Time
 - 6.2.4.7.1. Post Processing Time = 15 minutes maximum
 - 6.2.4.7.2. Post Processing Time is an optional second period of Mission Time that can be used without penalty. This time is dedicated to post-processing to both better utilize the airfield and to improve the quality of each teams' imagery data.
 - 6.2.4.7.3. The Team Captain **shall** notify the Lead Judge if Post Processing Time is planned during the pre-mission brief. The Lead Judge will announce when the Flying Time has stopped and the Post Processing Time starts.
 - 6.2.4.7.4. Post-Processing Time starts immediately after the Flying Time stops.
 - 6.2.4.7.5. Post-Processing Time stops when the Team Captain hands in the scoring sheets which ends Mission Time, or if the maximum Post Processing Time is exceeded and the Lead Judge terminates scoring.
 - 6.2.4.7.6. Hard Limit (Post-Processing Time): At the maximum Post Processing Time, the Lead Judge will immediately stop the Mission Clock and no further opportunities for scoring will be given. Teams **shall** hand in all scoring material prior to the hard limit. This is a **hard limit and will be enforced**.
- 6.2.5. Teardown Time
 - 6.2.5.1. Specified Time = 10 minutes maximum
 - 6.2.5.2. The system **shall** be disassembled and transported off of the flight line within a maximum specified amount of time from the end of the mission (or post-processing time if used).
 - 6.2.5.2.1. The judges may give the team a post-flight debriefing immediately following the mission or post-processing time, before the teardown clock is started.
 - 6.2.5.3. Transportation to the pits will be provided, if requested.
- 6.2.6. Timeouts
 - 6.2.6.1. Each team **shall** only be allowed one Timeout to stop the Mission Clock.
 - 6.2.6.2. Two types of timeout **shall** be allowed: Timeout-in-Place or Timeout-in-the-Pits.

- 6.2.6.3. A Timeout-in-the-Pit **shall** only be taken while in the Pits and when the team is called to be ready for being transported to the flight line. Once the "Transportation to Flight Line" clock is started, the team is preparing to move the flight line, and any time after that, only Timeout-in-Place **shall** be allowed.
- 6.2.6.4. Timeouts **shall** not be available during transport to the flight line or during set-up.
- 6.2.6.5. Teams can land and change configuration more than once, but must stay on the Mission Clock.
- 6.2.6.6. RF transmission in the 900 MHz band **shall** not be performed during a Timeout.
- 6.2.6.7. Data processing **shall** not be performed during Timeouts.
- 6.2.6.8. Use of a Timeout **shall** incur penalty points.
 - 6.2.6.8.1. The penalty for Timeout-in-the Pits is equivalent of 2 targets at threshold level.
 - 6.2.6.8.2. The penalty for Timeout-in-the Place is equivalent of 1 target at threshold level.
 - 6.2.6.8.3. Team **shall** not perform data or image processing or transmitting in the 900 MHz band during a Timeout or risk disqualification.
- 6.2.6.9. Timeout-in-Place = 10 minutes minimum
 - 6.2.6.9.1. A team may elect to take a Timeout-in-Place once on the flight line. This **shall** guarantee the team a minimum amount of time at the flight line (not occupying the airfield or runway), off the Mission Clock.
- 6.2.6.10. Timeout-in-the-Pit = Allocated time depends on many random circumstances.
 - 6.2.6.10.1. A team may elect to take Timeout-in-the-Pit.
 - 6.2.6.10.2. Teams should call Timeout-in-the-Pit any time before being transported to the flight line.
 - 6.2.6.10.3. Any team that takes a Timeout-in-the-Pit **shall** move to the back of the flight queue and may not have another opportunity to fly.
 - 6.2.6.10.4. All teams who have taken a Timeout-in-the-Pit **shall** be re-called in random order. If there is not enough time to fly all teams who took a Timeout-in-the-Pit, the judges will assess if any team will be called back to the flight line.
- 6.2.6.11. Calling a Timeout
 - 6.2.6.11.1. Only the Team Captain **shall** call time-out. The announcement **shall** be made clearly to the Air Boss (in the Pits) or Lead Judge (on flight line). The Lead Judge will confirm the call before the Mission Clock is stopped.
 - 6.2.6.11.2. The type of timeout **shall** be announced when the Team Captain makes the call and cannot be changed.

- 6.2.6.11.3. Timeout notification may be made anytime, but the Timeout **shall** NOT begin until the Air Boss notifies the Lead Judge (Timeout in the Pits) or the Lead Judge has stopped the Mission Clock (Timeout in Place).

6.3. MISSION LIMITATIONS

6.3.1. Mission Boundaries

- 6.3.1.1. During the entire mission, aircraft **shall** remain in controlled flight and within the no-fly-zone boundary. A specific no-fly-zone boundary definition will be provided to teams at the Check-in and Orientation. Any vehicle appearing uncontrolled or moving beyond the no-fly-zone boundary will be subject to immediate manual override. Failure of manual override will result in flight termination.
- 6.3.1.2. Points will be deducted for flying in no-fly-zones. Examples of no-fly-zones are shown on the Competition Map (**Example**) of Appendix C. Significant points will be deducted for any over-flight of the spectator area and may be terminated.
- 6.3.1.3. Teams **shall** display their aircraft location and altitude in real-time with respect to the no-fly-zones and approved altitude limits, and successfully pass their TM data to the judge's network -- **this is a prerequisite for any flight.**
 - 6.3.1.3.1. Purely manual RC flights shall be limited as defined in Section 6.3.3.
- 6.3.1.4. After takeoff, the aircraft **shall** sustain flight at an altitude between 100 and 750 feet MSL for the duration of the mission.
 - 6.3.1.4.1. Decent below 100 feet MSL (except during takeoff and landing in the recovery area) or above 750 feet MSL at any time **shall** require manual override. Failure of manual override will result in flight termination.
- 6.3.1.5. Obstacles (Avoidance)
 - 6.3.1.5.1. During certain tasks, such as Sense, Detect and Avoid, remember NOT to exceed the boundaries or altitude limits while avoiding the stationary and moving obstacles.

6.3.2. Takeoff

- 6.3.2.1. Takeoff **shall** take place within the designated takeoff/landing area, shown in the example Competition Map of Appendix D, depending on wind direction.
- 6.3.2.2. Systems utilizing launchers and/or not performing a wheeled takeoff may utilize the grass immediately adjacent to the runway.
- 6.3.2.3. Teams choosing to use the grass area must work with their assigned safety judge regarding launch direction. There may be safety restrictions that limit the direction a launcher can be faced.
- 6.3.2.4. Takeoff from moving vehicles **shall** be prohibited.
- 6.3.2.5. Takeoff under manual control with transition to autonomous flight will be permitted but does not count as an autonomous take off.

- 6.3.2.6. The first takeoff will be scored, regardless if it is manual or autonomous. Only autonomous takeoff attempts on the first takeoff will earn points. Any other attempts at autonomous takeoff will be eligible for a prize.
- 6.3.3. Flight
 - 6.3.3.1. Teams **shall** be discouraged from flying manually during the competition. This is a new requirement intended to promote teams preparing in advance to fly the competition autonomously.
 - 6.3.3.2. Teams will be monitored for the amount of manual flight time they are executing while attempting to fly autonomously. Each team **shall** be limited to a maximum of 10 minutes manual flight time before the Lead Judge will terminate the mission.
 - 6.3.3.2.1. The time spent on the ground does not count towards the time limit minutes of manual flight (UAS is not in flight). Time spent in manual control during the takeoff process does count towards the time limit.
 - 6.3.3.3. Teams will be monitored for the number of manual takeovers required, indicating the team is unable to fly autonomously. Each team **shall** be limited to a maximum of 3 manual takeovers before being penalized for each additional occurrence. The Lead Judge has authority to terminate the mission if the team is unable to sustain safe autonomous flight.
 - 6.3.3.3.1. Performing a manual takeoff and transition to autonomous flight will not count as 1 of the 3 manual takeovers.
 - 6.3.3.3.2. Once the Team Captain declares they are performing a manual landing and are setting up approach to land, the manual takeover will not count. If the team Captain declares they are performing an autonomous landing and are setting up approach to land, any manual takeovers will be counted.
- 6.3.4. Landing
 - 6.3.4.1. Landing **shall** take place within the designated takeoff/landing area, shown in the example Competition Map of Appendix D, depending on wind direction.
 - 6.3.4.2. All grass landings must be done within the takeoff/landing area, with a runway or taxiway between the aircraft and the student's and judge's tents on the flight line.
 - 6.3.4.3. Transition to manual control will be permitted for landing.
 - 6.3.4.4. Crashes and/or terminations will not be eligible to earn bonus points to shorten the mission clock.
- 6.4. **TARGET DATA**
 - 6.4.1. Competitors **shall** record the target characteristics of all observed targets and provide this data to the judges either a USB flash drive or using the interoperability network defined in Appendix H: Interoperability Specifications. There is only one network, the interoperability network. Teams shall interface to one (1) Ethernet cable connected to the Judge's router using one static IP address, and a range for DHCP. Teams may connect multiple team computers to this one Ethernet cable.

- 6.4.2. All data characteristics **shall** be submitted in the format given in Appendix E: Electronic Target Data Format and Appendix F: Target Score Sheets (Example). Hardcopy target data sheets **shall** only be accepted as back-up data source if the primary data source is sufficiently present but corrupted. Hardcopy data sheets **shall** not be scored if no electronic data is provided.
- 6.4.3. Images **shall** be provided to the judges electronically in JPEG format on either the interoperability network or USB flash drive for proof during post-mission scoring. Targets **shall** be recognizable in the image to receive points. Images **shall** be cropped small enough to locate the target within the image, and have sufficient resolution required to recognize the target details without guessing.

7. Description of Mission Tasks

The flight-mission demonstration has been divided into primary and secondary tasks. Teams **shall** achieve all primary tasks first (except landing), prior to attempting any secondary tasks. Teams **shall** perform safe takeoff and landing, accurately capture waypoints in order, maintain navigation within threshold level, and acquire at least one target characteristic within threshold accuracy in order to score any points in secondary tasks.

All tasks are listed in this section, whereas Section 8.0 provides the relative weighting of task scores.

7.1. AUTONOMOUS FLIGHT TASK (PRIMARY)

Table 2: Autonomous Flight Parameters

Parameter	Threshold	Objective
Takeoff	Achieve controlled takeoff. Properly transition to autonomous flight.	Achieve controlled autonomous takeoff. Properly transition to autonomous flight.
Flight	Maximum of 3 minutes manual flight. Maximum of 3 manual takeovers from autonomous flight.	Achieve controlled autonomous flight with no manual flight, except for transition from manual takeoff.
Waypoint navigation (every waypoint)	Capture waypoint in sequence with ± 50 ft. accuracy, and maintain navigation ± 100 ft. along the planned flight path.	Capture waypoint in sequence while in autopilot control with ± 50 ft. accuracy, and maintain navigation ± 100 ft. along the planned flight path.
GCS display items	Accurately display "no-fly-zone boundaries" and shall accurately display current aircraft position with respect to the "no-fly-zone" boundary, display indicated airspeed (KIAS) and altitude (feet-MSL) to the operators and judges.	Specific requirements listed in Section 7.1.5.
Landing	Achieve controlled landing. Properly transition from autonomous flight.	Achieve controlled autonomous landing. Properly transition from autonomous flight.

7.1.1. Takeoff

- 7.1.1.1. A takeoff is considered autonomous if the aircraft is put into autopilot mode and the pilot does not command the vehicle during takeoff.
 - 7.1.1.1.1. The pilot or ground station operator **shall** activate a command, button, or switch to initiate the takeoff.
- 7.1.1.2. A manually activated mechanical launcher with the aircraft in autopilot mode during the launch and climb-out maneuver will be a valid autonomous takeoff.
- 7.1.1.3. A hand-launch with the aircraft in autopilot mode during the entire throw and climb-out is considered an autonomous takeoff.
- 7.1.1.4. Control in takeoff will be subjectively graded for precision and safety.

- 7.1.1.5. A team may elect to cycle through the takeoff and landing sequence more than one time, if necessary, for a variety of valid reasons (fix something, change batteries, etc.). **No points will be lost for landings and take-offs while on the mission clock.**
- 7.1.1.6. The **first** takeoff is scored, regardless if it is manual or autonomous. Any other attempts at autonomous takeoff will be eligible for a prize.
- 7.1.2. Flight
 - 7.1.2.1. The flight task evaluates the ability to safely sustain controlled flight.
 - 7.1.2.2. To receive autonomy points, the vehicle **shall** sustain controlled flight with no direct pilot input to flight controls or propulsion power, within the requirements of Section 6.3.3.
 - 7.1.2.3. The sensor payloads (network links, gimbal systems, cameras, etc.) may be manually steered/controlled while flying under autonomous control (i.e. autopilot guidance), higher points of roughly one target at objective level are awarded if sensor payload is also under autonomous control.
- 7.1.3. Waypoint Navigation
 - 7.1.3.1. All aircrafts **shall** capture waypoints at the specified location and altitude and provide TM interoperability data required for verification to receive credit for waypoint capture.
 - 7.1.3.2. The aircraft **shall** not vary from the waypoint flight paths (± 100 ft).
 - 7.1.3.3. Each waypoint's specified location and altitude **shall** be achieved within an observed accuracy of ± 50 ft.
 - 7.1.3.4. The specified waypoint path will include changes in altitude.
 - 7.1.3.5. To achieve points for waypoints, they **shall** be captured in order. Waypoints captured out of sequence will not be scored.
 - 7.1.3.6. Waypoints shall be flown upon achieving first successful takeoff, before advancing to other tasks and activities. Once all waypoints have been successfully achieved they are not required to be re-flown upon any successive takeoffs.
- 7.1.4. Landing
 - 7.1.4.1. A landing is considered autonomous if the aircraft remains under autopilot control during the approach, descent, touchdown, and rollout (if applicable) to a full-stop.
 - 7.1.4.2. A deep-stall landing is an acceptable autonomous landing provided the aircraft is in autopilot during the approach and the maneuver is scheduled, not initiated by an operator selection. (The intent is for the maneuver to be completed without a human input providing final guidance timing).
 - 7.1.4.3. A landing using a parachute method is not acceptable for standard landing scoring. Using a parachute during an emergency for flight termination recovery is acceptable.
 - 7.1.4.4. The last landing is scored, regardless if it is manual or autonomous. Only autonomous landing attempts on the last landing will earn points. Any other attempts at autonomous landings will be eligible for a prize.
 - 7.1.4.5. Control in landing will be subjectively graded for precision and safety.

7.1.5. Ground Station

7.1.5.1. The system **shall** accurately display, and provide as TM data via interoperability network, the “no-fly-zone boundaries”, current aircraft position with respect to the “no-fly-zone” boundary, indicated airspeed (**KIAS**), and altitude (**feet-MSL**) to the operators and judges. ***Failure to meet this requirement will result in disapproval to fly in the competition.***

7.1.5.1.1. For rotary-winged aircraft, ground speed in knots **shall** be deemed acceptable.

7.1.5.2. The system **shall** display waypoints with respect to the “no-fly-zone boundary” to the operators and judges.

7.1.5.3. The system **shall** enable teams to submit all target characteristic and imagery data in accordance with Section 6.4.

7.2. SEARCH AREA TASK (PRIMARY)

Table 3: Search Area Parameters

Parameter	Threshold	Objective
Localization (each standard and QRC target)	Determine target location within 150 ft. Must be paired with at least a threshold classification.	Determine target location within 75 ft. Must be paired with at least a threshold classification.
Classification (each standard target)	Provide any two target characteristics, electronically.	Provide all five target characteristics, electronically.
Classification (QRC target)	Detection.	Decode the message.
Imagery (each target)	n/a	Provide cropped target image ($\geq 25\%$ of image frame).
Autonomous Search	n/a	Aircraft in autopilot control during search.
Secret message	n/a	Decipher the message anagram collected from the targets in the search area.

- 7.2.1. Waypoints and search area coordinates will be provided to teams during the Check-In and Orientation event.
- 7.2.2. Teams **shall** complete the waypoint navigation task in proper sequence and must pass through the last waypoint before entering the search area.
 - 7.2.2.1. 2 to 20 waypoints may be defined for this navigation task.
- 7.2.3. Once transitioning into the search area, the vehicle **shall** search for specific targets of interest while staying within the no-fly-zone boundaries. Targets will be distributed throughout the search area.
 - 7.2.3.1. 5 to 15 targets may be defined for this classification and imagery task.
- 7.2.4. The UAS **shall** capture target images and identify target characteristics and locations for scores. Images of the targets shall be viewable by the judges when observed on the ground station display during the conduct of the mission.
- 7.2.5. The teams **shall** submit all target characteristic and imagery data for judging in accordance with Section 6.4, before mission time expires.
- 7.2.6. Area Search
 - 7.2.6.1. The system should display search area boundaries to the operators and judges.
 - 7.2.6.2. Aircraft **shall** search the area at any altitude as specified in section 6.3.1.4.
 - 7.2.6.3. The targets will be located in the search area. The aircraft may fly outside the search area while searching for targets, but **shall** not fly outside the no-fly-zone boundary. There will be a minimum of 200 feet margin between the search area and the no-fly-zone boundary.
- 7.2.7. Standard Targets
 - 7.2.7.1. A number of standard targets will be constructed of plywood of a given size, basic geometric shape, and painted a color using flat paint. For an example, see Figures 1 and 3.



Figure 1: Example Target

- 7.2.7.2. The targets will be different geometric shapes (triangles, circles, etc.) and background colors; with a different color alphanumeric than the background color. The targets may be any mix of geometric shapes, letters and colors, and may repeat and duplicate each characteristic.
- 7.2.7.3. Target characteristics are:
 - 7.2.7.3.1. Location: latitude and longitude
 - 7.2.7.3.2. Letter orientation: N, NE, E, SE, S, SW, W, NW
 - 7.2.7.3.3. Shape: Circle, Semicircle, Quarter Circle, Triangle, Square, Rectangle, Trapezoid, Pentagon, Hexagon, Heptagon, Octagon, Star, or Cross.
 - 7.2.7.3.4. Alphanumeric: 0123456789ABCDEFGHIJKLMNOPQRSTU VWXYZabcdefghijklmnopqrstuvwxyz. Case sensitive letters that are ambiguous (c, s, v, z, etc.) may have an underline indicating capital letter, or either letter given will be accepted and scored.
 - 7.2.7.3.5. Alphanumeric color: White, Black, Gray, Red, Blue, Green, Yellow, Purple, Brown, or Orange.
 - 7.2.7.3.6. Background color: White, Black, Gray, Red, Blue, Green, Yellow, Purple, Brown, or Orange.
- 7.2.7.4. The minimum dimension of the targets (length or width) will be two feet, and the maximum dimension will be 8 feet.
- 7.2.7.5. The alphanumeric will be sized to fit within the overall dimensions of the target varying between 50-90% of the length/width of the target and between 2-6 inches in thickness, and will vary in color and contrast.
- 7.2.8. Quick Response Code (QRC) Target
 - 7.2.8.1. One QR Code target will either be painted using flat paint or printed on weatherproof banner material and laminated onto plywood. For an example, see Figure 2.
 - 7.2.8.2. The QR code will be generated using <http://www.qr-code-generator.com/> using either URL or text options.
 - 7.2.8.3. QR Code Target characteristics are:
 - 7.2.8.3.1. QR Code size = 6-10 ft. square.
 - 7.2.8.3.2. Minimum Pixel size = 2 in. square.
 - 7.2.8.3.3. QR Code Colors = Black pixels with White background.

- 7.2.8.4. No Wi-Fi internet access will be provided at the flight-line, so teams **shall** display and provide the text encoded in the QR code to Judges. If the text is a URL, provide the URL as a text string.
- 7.2.8.5. In the example shown in Figure 2 the QR Code is for the URL of the English Wikipedia Mobile main page. The correct presentation of data to Judges would be; <http://en.m.wikipedia.org>.



Figure 2: Example of a QR Code Target

- 7.2.9. Secret Message
 - 7.2.9.1. Teams should arrange the alphanumeric of the targets to decode the “secret” message anagram, either using manual or automated methods.
 - 7.2.9.2. Teams **shall** write down the correct anagram submit it to the Judge as the Secret Message before end of mission time.
 - 7.2.9.3. To get credit for this task parameter the images of several targets **shall** also be submitted to the Judge before end of mission time.
 - 7.2.9.4. In the example shown in Figure 3 the anagram is “SECURITY”.



Figure 3: Example Secret Message

7.3. AUTOMATIC DETECTION, LOCALIZATION, AND CLASSIFICATION (ADLC) TASK (SECONDARY)

Table 4: ADLC Parameters

Parameter	Threshold	Objective
Automatic Localization (each target, standard and QRC)	n/a	Automatically tag and identify target position within 150 ft.
Automatic Classification (each standard target)	n/a	Provide at least three of five target characteristics electronically.
Automatic Classification (each QRC target)	n/a	Automatically decode the message.
False Alarm Rate (FAR) on Classification.	n/a	Demonstrate $\geq 50\%$ (with only 6 detections $>50\%$ is a 67% classification rate).

- 7.3.1. Teams **shall** develop an algorithm which performs automated imaging detection of potential targets and cues the imagery judge. The algorithm **shall** localize the detected targets and automatically determine the target characteristics.
- 7.3.2. Credit will be given for each target automatically detected & cued. **A maximum of six targets may be submitted by the team, and all six are eligible to be scored.**
- 7.3.3. ADLC may be performed by any combination of airborne or ground-based processing.
- 7.3.4. Teams **shall** make their ADLC process **very clear** to the imagery judge prior to aircraft takeoff.
 - 7.3.4.1. Manual control for pointing a gimballed camera may be used, although no manual initiation of automated imaging detection **shall** be allowed.
 - 7.3.4.2. If the imagery judge is unclear about, or suspects manual assistance to, the ADLC process, the team **shall** not receive ADLC task points.
- 7.3.5. Demonstrating an ADLC target:
 - 7.3.5.1. ALL automatic detections **shall** be clearly shown to the imagery judge without human interaction (e.g. a pop-up window).
 - 7.3.5.2. All detections provided **shall** be considered for the ADLC task.
 - 7.3.5.3. The teams **shall** submit all ADLC detections and target characteristic, along with captured imagery data, for judging in accordance with Section 6.4 using the ADLC target sheets, before mission time expires.
 - 7.3.5.4. The ADLC target sheet **shall** be marked clearly in tab 11 as "Auto Detection" and submitted separate from other imagery sheets.
- 7.3.6. False Alarm Rate (insufficient precision)
 - 7.3.6.1. If a listed target fails to meet the objective for classification, the target will be considered a false detection. The number of incorrect ADLC targets reported will be divided by the total number of ADLC targets reported to determine false alarm rate.
 - 7.3.6.2. Each detection/target is counted once. If the false alarm rate exceeds the objective limit, no credit will be given for the ADLC task.

7.4. ACTIONABLE INTELLIGENCE TASK (SECONDARY)

Table 5: Actionable Intelligence Parameters

Parameter	Threshold	Objective
Actionable Intelligence (any target)	Provide target location within 150 ft. and 3 characteristics electronically, while airborne during the same flight.	Provide target location within 75 ft. and all 5 characteristics electronically, while airborne during the same flight.

- 7.4.1. The actionable intelligence task **shall** provide judges complete and accurate real-time information of any standard target identified during flight.
- 7.4.2. Once the information is provided to the judges as “actionable intelligence”, it cannot be retracted and replaced with substitute information at any time.
- 7.4.3. The standard target **shall** be of those located within the search area defined in the Search Area task.
- 7.4.4. Credit for actionable intelligence will only be given if target data meets the criteria.
- 7.4.5. The team **shall** turn in the Actionable Intelligence data while the aircraft is airborne.
- 7.4.6. The teams **shall** submit all target characteristic and imagery data for judging in accordance with Section 6.4.
- 7.4.7. Actionable Intelligence **shall** only be credited with correct identification of target characteristics (shape, background color, alphanumeric, alphanumeric color, and orientation) and proper location accuracy, provided the target data is submitted while the aircraft is still in-flight.
 - 7.4.7.1. Target data downloaded from an aircraft while on the ground and then turned in when the aircraft is airborne again will not be scored.**

7.5. OFF-AXIS STANDARD TARGET TASK (SECONDARY)

Table 6: Off-Axis Target Parameters

Parameter	Threshold	Objective
Imagery	n/a	Provide an image of the off-axis target electronically.
Classification	Provide any two target characteristics electronically.	Provide all five target characteristics electronically.
Payload Autonomy	n/a	Automatic persistent tracking of the off-axis target during search.

- 7.5.1. Teams **shall** capture imagery of the off-axis standard target, which will have features the same as those described for targets in section 7.2, Search Area task.
- 7.5.2. The off-axis target will be located outside the no-fly-zone.
 - 7.5.2.1. The coordinates for the off-axis target will be provided by the Lead Judge to the Team Captain at the start of Set-Up time.
- 7.5.3. The off-axis target may be a non-standard target and include multiple alphanumeric characters, otherwise meeting the standards referred to in Section 7.2.6.
- 7.5.4. Teams **shall** capture imagery of the off-axis target ***without crossing into the no-fly-zone boundary***. Teams are warned: do NOT enter the specified off-axis target location as a waypoint or the center of an orbit or YOU WILL FLY OUT OF BOUNDS and be penalized or required to terminate flight.
- 7.5.5. The location of the off-axis target will be approximately 250 – 500 feet beyond the edge of the no-fly-zone. The system **shall** have the capability to capture imagery at an angle sufficient to detect and image the off-axis target without directly overflying it.
- 7.5.6. Images of the off-axis target should be viewed by the judges when observed on the ground station display during the conduct of the mission.
- 7.5.7. The teams **shall** submit all off-axis target characteristic, with imagery data, for judging in accordance with Section 6.4, before mission time expires.
- 7.5.8. The off-axis target **shall** be marked clearly as “Off Axis” in tab 11 of the target sheet submitted electronically by USB or network interface.

7.6. EMERGENT TARGET TASK (SECONDARY)

Table 7: Emergent Target Parameters

Parameter	Threshold	Objective
In-flight re-tasking	n/a	Add last known position of the emergent target as a waypoint.
Autonomous Search	n/a	Autopilot control during search.
Target Identification	Provide an image of the emergent target, electronically.	Provide an image of the target, electronically, along with target location within 75 ft and an adequate description of the emergent target's activity, electronically.

- 7.6.1. At the start of Set-Up time an updated waypoint for the last known position (LKP) of the emergent target will be given to the Team Captain. This new waypoint **shall** be uploaded to the aircraft in-flight to meet the in-flight re-tasking objective and will assist in the location of the emergent target.
- 7.6.2. The UAS **shall** be under autopilot control during search for the emergent target.
- 7.6.3. The emergent target will be in the form of a human engaged in an activity of interest, notably, a mannequin dressed up in some manner performing an activity. For example, see Figure 4.



Figure 4: The Emergent Target (a Fireman up close and from above)

- 7.6.4. The teams **shall** submit all emergent target characteristic, with imagery data, for judging in accordance with Section 6.4, before mission time expires.
- 7.6.5. The observed emergent target **shall** be marked clearly as "Emergent" in tab 11 of the target sheet.
- 7.6.6. The emergent target **shall** be described with enough detail to convince the judges of the target's activity.
 - 7.6.6.1. An inadequate description of the emergent target activity poorly describes the target and misses the activity (for example: "a man dressed in yellow.>").
 - 7.6.6.2. An adequate description of the emergent target activity has enough detail to identify the specific activity (for example: "a fireman near a burning tree... he appears to be putting out the fire with a hose and extinguisher.>").

7.7. AIR-DROP TASK (SECONDARY)

Table 11: Air-Drop Parameters

Parameter	Threshold	Objective
Release	Manual release within constraints.	Autonomous release within constraints.
Drop Accuracy	≤100 ft. from center.	≤30 ft. from center.
Bull's Eye Delivery	n/a	Hit the 5 ft. radius bull's eye.

- 7.7.1. Teams shall demonstrate an air-drop task using an 8 ounce (oz.) water bottle for emergency relief.
- 7.7.2. An air-drop target will be located near the spectator area, within the operational area boundaries.
- 7.7.3. The GPS coordinates of the air-drop target will be provided to teams at the Check-In and Orientation event.
- 7.7.4. Each UAS team participating in the air-drop task **shall** only drop one (1) bottle.
- 7.7.5. Water Bottle (provided by each team):
 - 7.7.5.1. Each team participating in this task shall provide their own standard 8 oz. water bottle, which will be made from traditional plastic. Bottles which are not commercially available as a standard 8 oz. water bottle shall be rejected and not allowed to be used for this air drop task.
 - 7.7.5.2. No external jackets, enclosures, fins, etc. shall encase the water bottle during its free fall from the air vehicle during the air drop task. However, any safe means of retaining the water bottle during takeoff, flight, and landing will be considered, providing the Safety Inspections and Safety Judge approve the retaining and release mechanisms.
 - 7.7.5.3. Each water bottle **shall** be filled only with water. Teams **shall** bring empty water bottles that **shall** be filled with standard tap water at the competition. The judges may elect to add food coloring to the water.
 - 7.7.5.4. Each team **shall** use a drag ribbon for each water bottle. The ribbon **shall** not be stiff; it will be soft and limber fabric. The ribbon **shall** be a minimum of 1.5 inches wide and a minimum of 5 feet long. The ribbon **shall** be fastened around the neck of the water bottle as shown in Figure 5.



Figure 5: 8 oz. Water Bottle with 5 Ft. Drag Ribbon (EXAMPLE)

- 7.7.5.5. The water bottle's drag ribbon **shall** be highly visible colors such as red or orange (not green!) to be easily identified in the grass and retrieved from the field to prevent Foreign Object Debris (FOD).
- 7.7.5.6. The standard 8 oz. water bottle with drag ribbon **shall** have an absolute maximum weight of 10 oz.
- 7.7.5.7. A judge will fasten the drag ribbon to the water bottle and measure the weight of the canister to ensure it meets the specifications.
- 7.7.5.8. The team **shall** derive a means to attach the water bottle and stow the ribbon. The drag ribbon **shall** successfully deploy its entire length before landing, and **shall** not separate from the bottle.
- 7.7.5.9. The Lead judge assigned to the team at the flight line will provide the Team Captain with the water bottle with drag ribbon once the set-up clock has started. The Safety judge will inspect and monitor the team loading the water bottle onto the aircraft prior to flight.
- 7.7.6. Release constraints:
 - 7.7.6.1. The water bottle **shall** be released into the airstream at an altitude between 350 ft. to 450 ft. MSL, at a horizontal airspeed > 15 KIAS.
 - 7.7.6.2. The UAS team may make multiple passes over the air-drop target, for example, to measure winds aloft or to visually identify the target for improving drop accuracy.
 - 7.7.6.3. The UAS team **shall** approach the air-drop target parallel to the closest no-fly-zone boundary. This is to prevent an unintentional early or late drop from entering into the no-fly-zone.
- 7.7.7. Target:
 - 7.7.7.1. The air-drop target will be a single geo-referenced bulls-eye approximately 5 foot diameter.
- 7.7.8. Release authority
 - 7.7.8.1. There **shall** be a human in the loop to provide final air-drop release authority of the air-drop system, e.g. a human activated switch.
 - 7.7.8.2. For an autonomous release, a human **shall** still be in the loop with full control: a human can hold a release approval switch/button for any duration of time, but the system **shall** go safe once the human rescinds the approval.
- 7.7.9. Release mechanism
 - 7.7.9.1. No explosive, combustible, or corrosive materials **shall** be used in the construction of the air-drop task's release mechanism.
 - 7.7.9.2. Compressed air release systems based on AMA rules may be used.
- 7.7.10. Release process
 - 7.7.10.1. The Team Captain **shall** announce to the Safety Judge when the air-drop is imminent (30 seconds prior to manual release authority switch activation), when the release authority switch is engaged, and when the release authority switch is put back in safe mode.
 - 7.7.10.2. The Safety Judge will echo these announcements via radio so participants and spectators can be given a heads-up.
 - 7.7.10.3. If an uncommanded releases occurs, a safety penalty will be assessed.

- 7.7.11. Participation in the air-drop task **shall** only be allowed for those teams that provide demonstrated proof of safe and successful water bottle drops with documented results in proof of flight video, and as briefed during the FRR presentation.
- 7.7.12. The team's water bottle release mechanism shall pass safety inspection and the judge's risk assessment before being allowed to execute this task in the flight-mission demonstration phase of the competition.

7.8. SIMULATED REMOTE INFORMATION CENTER (SRIC) TASK (SECONDARY)

Table 8: SRIC Parameters

Parameter	Threshold	Objective
SRIC Download task	n/a	Download the SRIC message. Download path: /team/X/download.txt
SRIC Upload task	n/a	Upload a secret text file to the same folder. Upload path: /team/X/upload.txt
Autonomous SRIC task	n/a	Automatically detect SRIC and perform download and upload tasks.

- 7.8.1. The aircraft **shall** carry an RF data communications payload capable of receiving data from and sending data to a third party Simulated Remote Information Center (SRIC). The airborne payload **shall** communicate with the team's ground station to enable logging into, downloading, and uploading data to the SRIC.
- 7.8.2. The SRIC has a directional antenna located in the operational area that will be pointed in the vertical, skyward, direction. The aircraft **shall** stay within the competition boundary and altitude restrictions when communicating with the SRIC.
- 7.8.3. The SRIC IP address (and subnet mask) will be provided to teams at the Check-In and Orientation event.
- 7.8.4. Each team **shall** be provided the position of the SRIC, and a unique team folder (X) name and login information at start of Set-up time before the Pre-Mission Brief.
- 7.8.5. The payload **shall** be capable of maintaining sufficient RF communication link with the SRIC (loitering, etc.) to use the team's private SRIC login credentials to access the SRIC folder and download the team's private SRIC Upload Login credentials for the upload task.
- 7.8.6. While the payload maintains sufficient RF communication link with the SRIC, the team **shall** use the private SRIC Upload Login credentials to upload a secret text file verified by the Imagery Judge to the same team SRIC folder to score points.
- 7.8.7. For more information about the SRIC communications, see Appendix G: SRIC Details.

7.9. INTEROPERABILITY TASK (SECONDARY)

Table 9: Interoperability Parameters

Parameter	Threshold	Objective
Download & Display Server Info and Time	Download & display at 1 Hz	Download & display at 10 Hz
Download & Display Obstacles	Download & display at 1 Hz	Download & display at 10 Hz
Upload Target Details	n/a	Upload all submitted targets and their details.

- 7.9.1. **Purpose.** The interoperability task is based on the requirement for systems to integrate with each other using standard interface architectures. Interoperability enables systems to communicate critical information like aircraft position.
- 7.9.2. An external system will be provided by the competition that implements a standard interface architecture. The UAS **shall** integrate with this system. Such integration **shall** provide the teams with the server clock, provide judges with the UAS position, provide the UAS with positions of obstacles, upload target details, and allow the judges to evaluate UAS performance. More information can be found in Appendix H.
- 7.9.3. **Deliverables.** Each interoperability component requires specific deliverables to verify satisfaction of the component. The competition judges will only evaluate the deliverables and will not evaluate the code or other indicators of interoperability. In order to receive credit, all deliverables **shall** be provided from before the first takeoff until after the last landing, and teams must provide the deliverable at the rate specified. Failure to update at the specified rate will result in failing the task.
- 7.9.4. **Download & Display Rates.** The goal rates for download and display are 1 Hz for the threshold and 10 Hz for the objective. A download or display rate that is on average below ½ Hz will fail the threshold. A download or display rate that is on average below 8 Hz will fail the objective. The rates will be computed during the flight clock. Teams **shall** begin downloading and displaying from before the first takeoff and until after the last landing. The rates for each task parameter will be evaluated individually.
- 7.9.5. **Display Server Time.** The server time **shall** be displayed in real time at the autopilot operator station. This time will include the server wall clock time as well as other fields to verify correct integration. The server time and other fields will be updated on the competition server in real time.
- 7.9.6. **Display Obstacles.** There are virtual obstacles for the Sense, Detect, and Avoid (SDA) task. The positions and sizes of the obstacles are provided by the interoperability server. This information **shall** be downloaded and displayed at the same UAS autopilot operator interface (e.g. the same laptop), used in the Ground Control Station. These obstacles **shall** be displayed in a view that also shows the UAS position, the mission boundaries, the task positions, and the UAS' waypoints. This view does not need to be the autopilot interface (e.g. the desktop application), itself, but it **shall** be automatically synced with any autopilot or mission changes.
- 7.9.7. **Upload Target Data.** The targets identified by the UAS and team should be uploaded to the interoperability system as the primary mechanism for target submission. Teams may also submit the USB drive or a printed hardcopy as backup.

- 7.9.8. **Mission Operation.** In the competition rules, teams are given the information necessary to build systems that integrate with standard interface architecture. The teams will receive additional information at competition, the day before flights, which will enable teams to configure their systems.
- 7.9.9. **Before Competition.** The standard interface architecture will be provided to teams as part of releasing the rules. This includes the format of the URLs, which indicate the relative paths but not the base path (hostname and port), the various HTTP parameters, and the format of the JSON data. During the year before competition, updates may be applied to the interoperability server and synced with the code repository. Teams **shall** download and sync updates through the code repository.
- 7.9.10. **Day Before Mission Demonstration (Flights).** Teams will be given the static IP address and the port of the web server, which together comprise the base path of the request URLs. Teams will also be given authentication credentials, which shall not be shared with other teams. Teams are responsible for retrieving these details by the end of the day. These details will not change, so it is the team's responsibility to bring the details with them to the mission demonstration. A test deployment with dummy data will be provided at safety inspection for teams to verify proper networking and authentication.
- 7.9.11. **Mission Setup Time.** Teams will be able to physically connect Ethernet cables to their UAS ground station. The Ethernet cord may or may not be connected to the router. Regardless of whether the cord is connected or not, the web server will ignore requests and return appropriate error codes.
- 7.9.12. **Mission Flight Time.** At the start of the mission the judge server will be reconfigured to accept and respond to requests from the UAS system. If the Ethernet cord was not connected, it will be connected and allow teams to communicate. Teams **shall** then start downloading and displaying the server clock, downloading and displaying the obstacles, and uploading the UAS position. The teams **shall** continue downloading and uploading for the remainder of the mission flight time.

7.10. SENSE, DETECT AND AVOID (SDA) TASK (SECONDARY))

Table 12: SDA Avoid Parameters

Parameter	Threshold	Objective
Stationary Obstacle Avoidance	Avoid collision with the stationary virtual obstacle(s).	Autonomously adjust flight path to avoid obstacle(s)
Moving Obstacle Avoidance	Avoid collision with the moving virtual obstacle(s).	Autonomously adjust flight path to avoid obstacle(s)

- 7.10.1. **Prerequisites.** The UAS needs the obstacle positions in order to be able to avoid the obstacles, and the judges need the UAS position to evaluate proximity to virtual targets.
 - 7.10.1.1. In order to be eligible for the SDA task, the UAS **shall** accomplish all objectives and requirements for the Interoperability task's UAS telemetry upload and obstacle display. This includes all interoperability tasks: server clock, UAS position reporting, and obstacle display.
 - 7.10.1.2. The interoperability implementation **shall** download, upload, and display at the goal rate while near obstacles. If data dropouts, reduced update rates, or other such problems make it difficult to evaluate obstacle avoidance, then the team will fail the SDA task.
- 7.10.2. **Purpose.** The Sense, Detect, and Avoid (SDA) task is based on the National Airspace (NAS) requirement that a UAS must operate under standard aviation See and Avoid rules of engagement when operating in proximity of other aircraft.
- 7.10.3. This task is designed to gradually develop towards full SDA capabilities. For this competition, the obstacles will be virtual and the task of sensing and detecting obstacles will be simulated through the interoperability task. The goal is to develop UAS obstacle avoidance capabilities. In future years the competition may be expanded to include sensing and detecting real obstacles.
- 7.10.4. **Obstacles.** Obstacles may be placed anywhere, as could occur in the real world. They can be placed anywhere inside or outside the flight areas. This includes over targets, in the search area, in the waypoint path, etc. Obstacle placement will ensure that it's possible to achieve all mission objectives. However, there may be temporary blockages to tasks (e.g. moving obstacle can temporarily block a waypoint), or require you to use previously required capabilities (e.g. off-axis stare to see a target under an obstacle). Keep in mind this is a secondary objective and a difficult real-world task.
 - 7.10.4.1. The waypoint navigation task may have obstacles in the path. These obstacles may temporarily block completion (e.g. moving obstacle temporarily moves through the waypoint), or partially block but still allow completion (e.g. stationary obstacle in direct waypoint path but allows space to stay within 100 ft. path tolerance).
 - 7.10.4.2. The UAS has collided with an obstacle if the UAS position (GPS and altitude) is contained within the obstacle. Collision with an obstacle fails the task threshold. The stationary and moving obstacle tasks are evaluated independently.

- 7.10.5. The JSON data, which contains obstacle positions, will contain 0, 1, or many obstacles. The UAS should not make any assumptions about the number or the type of obstacles.
- 7.10.6. Stationary Obstacles.
 - 7.10.6.1. Defined as cylinders with a given radius, height, and GPS position.
 - 7.10.6.2. The height axis is aligned perpendicular to ground, and the radius axis parallel to ground. The lower circular cap to the cylinder will be at ground and parallel with it. The height gives the altitude of the upper circular cap of the cylinder.
 - 7.10.6.3. The GPS position reported will be that of the cylinder's centroid.
 - 7.10.6.4. Stationary obstacle will be between 30 feet and 300 feet in radius, and will have heights between 0 feet and 750 feet.
- 7.10.7. Moving Obstacles.
 - 7.10.7.1. Defined as spheres with a given radius, GPS position, and altitude.
 - 7.10.7.2. The GPS position reported will be that of the sphere's centroid.
 - 7.10.7.3. The path that moving obstacles will follow will be a smooth continuous path, but reported obstacle positions will be sampled at 10 Hz. The moving obstacles will follow a predetermined path and will not react to external influences like the UAS. The path may or may not be a loop. The speed may change over the course of the mission.
 - 7.10.7.4. Moving obstacles will be between 30 feet and 200 feet in radius, and will move at a speed between 0 KIAS and 40 KIAS.
- 7.10.8. **Obstacle Avoidance.** The stationary and moving obstacle avoidance tasks are evaluated independently. For example, the UAS can achieve the objective for one of the tasks and fail to receive the threshold for the other.
 - 7.10.8.1. To achieve threshold obstacle avoidance, the system **shall** perform the entire mission without colliding with an obstacle.
 - 7.10.8.2. To achieve objective obstacle avoidance the system **shall** autonomously, without human input, update the flight plan to avoid the obstacle. Flight plans that are manually generated before the mission and happen to avoid the obstacles will not constitute a failure to automatically avoid. Similarly, changing the flight plan to adjust for the emergent target task will not constitute a failure to automatically avoid. Manual flight plan adjustments that appear to be in reaction to obstacles will constitute a failure to automatically avoid.
 - 7.10.8.3. If a team's flight plan consists of waypoints, the autopilot is allowed to update those waypoints (and reflect them on the ground station) to autonomously avoid an obstacle. The autopilot can also automatically adjust its track along the waypoints previously programmed.
 - 7.10.8.4. The reported telemetry will indicate whether an obstacle was struck. A judge will observe the autopilot interface for confirmation of such, and will observe the operator to validate no manual input was needed to avoid. The judges have sole discretion to judge whether human input violates the automatic avoidance objective.

8. Scoring Metrics for Graded Elements

8.1. RELATIVE WEIGHTING

- 8.1.1. The Seafarer Chapter does not specify rubric or point values associated with scoring for each task of this competition. However, the relative weighting of the various sections is specified so teams can determine how to focus their efforts.
- 8.1.2. The major graded elements and their weighting are:
 - 8.1.2.1. 25% Journal Paper
 - 8.1.2.2. 25% FRR Oral Presentation
 - 8.1.2.3. 50% Flight-Mission Demonstration
- 8.1.3. For each phase of the competition and each mission task, special scoring emphasis will be separately assessed for communication in journal papers and oral presentation, format in journal papers, and systems engineering, mission performance, autonomy, and safety during the mission tasks.
- 8.1.4. Safety is integral to the continuation of unmanned flight in controlled airspace and future extension into un-controlled airspace. As such, safety will be graded in all phases of the competition, to include operational, design and programmatic risks and safety considerations. Safety will be weighted 5-10% of each graded element.
- 8.1.5. Additionally penalties will be assessed for exceeding no fly zone and altitude limits, judge directed flight termination, "Things Falling off Aircraft" and Crashes.

8.2. NORMALIZATION PROCESS

- 8.2.1. A normalization process is used for both the journal paper and the FRR briefings in order to equalize individual judges or groups in teams of judges.
- 8.2.2. For the journal paper, one team's paper is randomly selected for all judges to read to establish a normalization factor for all individual judges' scores of other papers.
- 8.2.3. For the oral presentation, one team's FRR briefing will be heard by all the judges at the same time to establish a normalization factor for all individual judges' scores of other team's FRR briefings.
- 8.2.4. The flight-mission demonstration element is not normalized.

8.3. JOURNAL PAPER

- 8.3.1. The journal paper **shall** include the following sections:
 - 8.3.1.1. Title page with abstract (included in page limit count)
 - 8.3.1.2. Description of the systems engineering approach
 - 8.3.1.2.1. Mission requirements analysis of planned tasks
 - 8.3.1.2.2. Design rationale
 - 8.3.1.2.3. Expected task performance
 - 8.3.1.2.4. Programmatic risks and mitigation methods
 - 8.3.1.3. Descriptions of the UAS design
 - 8.3.1.3.1. Design descriptions of the aircraft, autopilot system, data link, payloads, ground control station, data processing, and mission planning
 - 8.3.1.3.2. Target types for autonomous detection (if utilized)
 - 8.3.1.3.3. The paper **shall** include a photo of the UAS aircraft

- 8.3.1.4. Test and evaluation results
 - 8.3.1.4.1. Mission task performance
 - 8.3.1.4.2. Payload system performance
 - 8.3.1.4.3. Autopilot system performance
 - 8.3.1.4.4. Evaluation results supporting evidence of likely mission accomplishment.
- 8.3.1.5. Safety considerations/approach
 - 8.3.1.5.1. Specific safety criteria for both operations and design
 - 8.3.1.5.2. Safety risks and mitigation methods
- 8.3.1.6. Cyber-Security Appendix (Optional)
 - 8.3.1.6.1. Define how the team addressed cyber security for the ground station and vehicle systems for protection of vehicle and payload control and data. This is not limited to basic encryption or software solutions.
 - 8.3.1.6.2. The team should research the real world, mission objectives, and safety issues, and define potential threats and cyber security which may include EMI considerations, data encryption, and even GPS spoofing protection among a myriad of other considerations.
- 8.3.2. Writing style will be scored for clarity, accuracy, logic, precision, relevance, depth and suitability.
- 8.3.3. The electronic journal paper **shall** be prepared so that if an evaluator prints the document, it meets the following format requirements:
 - 8.3.3.1. 8.5 x 11 inch paper
 - 8.3.3.2. Single-spaced typed lines
 - 8.3.3.3. Not less than 1 inch margins
 - 8.3.3.4. Text in Times New Roman, no smaller than 10-point font
 - 8.3.3.5. Each page **shall** have the school and team name, and page number, in the footer on every page.
 - 8.3.3.6. **Shall** be no more than 20 pages total including the title page. Pages beyond 20 pages will not be graded (*except for the optional Cyber-Security appendix).
 - 8.3.3.7. The optional Cyber-Security Appendix **shall** be limited to 2 pages maximum and will be graded separate from main Journal paper content.
- 8.3.4. Journal papers **shall** be electronically submitted in PDF format with compressed file sizes of less than 6 MB, or the file will not be accepted for scoring.
- 8.3.5. The journal paper's filenames **shall** include the full school and team name and have the prefix "JP" (ex., "JP- Mississippi State University, Xipiter.pdf").

- 8.3.6. Upload the journal papers to the team's unique folder on the SUAS SharePoint site, per Section 10.1.
- 8.3.7. To give teams the ability to optimize their allocation of resources for the journal, the **approximate** relative worth of each area of the presentation is given:
 - 8.3.7.1. System Engineering-10%
 - 8.3.7.2. Design Description-30%
 - 8.3.7.3. Test and Evaluation Results-25%
 - 8.3.7.4. Safety Considerations-10%
 - 8.3.7.5. Writing Style-20%
 - 8.3.7.6. Format-5%
 - 8.3.7.7. Cyber-Security – Prize Barrel
- 8.3.8. Examples of Journals from the 2015 SUAS can be found on the Seafarer Chapter website: <http://www.auvsi-seafarer.org/news-events/2015-competition.aspx>.
- 8.4. **FRR Briefing & Static Display**
 - 8.4.1. The FRR briefing will be assessed on the team's ability to effectively articulate the scope and depth of the developmental testing performed, the ability of the system design to perform the planned flight tasks, and the preparations made to improve the chances of a successful Flight-Mission Phase.
 - 8.4.2. A static display **shall** be used to assist in communication during the briefing. The static display **shall** include visual aids and the actual system being demonstrated, to support and clarify the team's briefing.
 - 8.4.3. The FRR briefing **shall** not exceed 15 minutes in duration, followed by a maximum period of 5 minutes where the judges will ask questions and the team **shall** answer. Afterwards, another period of roughly 5 minutes is allocated for judges to review and inspect the static display. A judge will time the presentation, provide a 2 minute warning, and cut off extended presentations as needed.
 - 8.4.4. The breadth of the presentation will be scored based upon inclusion of the following elements:
 - 8.4.4.1. Team member introductions including flight mission demonstration roles and experience.
 - 8.4.4.2. A brief system overview, flight tasks planned, expected performance, programmatic and safety risks, and mitigations.
 - 8.4.4.3. System Safety with identified design and operational, avoidance, and mitigation strategies.
 - 8.4.4.4. Developmental Test Results including: the scope of test planning from simulation and analysis, through laboratory and ground testing, to flight testing; the conduct of system integration from component/subsystem testing, through Air Vehicle, Ground Control Station and full system testing, to mission performance testing; efforts to acquire test data and evaluate performance, the results of flight testing including an assessment of their sufficiency, any corrective action taken and the impact on the mission design.

- 8.4.4.5. Evidence of Mission Accomplishments, to include evidence that the system is sufficiently mature, defined and representative to accomplish the planned test objectives and/or support defined program objections; verification of all traceable design requirements, identification of defined flight/system limitations and justification of readiness to proceed to the Mission Phase
- 8.4.4.6. Pre-Mission Briefing, including proper resourcing for the flight (people, test article or articles, facilities, data systems, support equipment, logistics, etc.) and crew member training; final, standard and anomalous condition reporting procedures; Go/No-Go criteria and fallback plans should a technical issue or potential showstopper arise during flight-mission demonstration.
- 8.4.4.7. Static Display including display materials, air vehicle and ground control station, relevant equipment (antennas, safety equipment, etc.), and supporting documentation (test data, safety checklists, and other supporting evidence). A PowerPoint slide display alone is not adequate.
- 8.4.4.8. Team member participation.
- 8.4.5. The content of the presentation will be assessed in general based upon the team's communication skills and specifically as indicated for the following areas:
 - 8.4.5.1. Question and Answer session to include knowledge of the system, mission performance, testing scope and methods, results and risks.
 - 8.4.5.2. Craftsmanship of the air vehicle and ground control station will be assessed during the static display element.
 - 8.4.5.3. Identification the risk level is acceptable and judgment that previous component, subsystem, and system test results form a satisfactory basis for proceeding into flight-mission demonstration
- 8.4.6. In the interests of expediency, oral reference to relevant briefing information that is visible on the static display materials will be considered in scoring the breadth of the presentation, but may not be sufficient to receive full credit alone.
- 8.4.7. Communication skills will be scored for clarity, accuracy, logic, precision, relevance, depth and suitability. International students will not be downgraded for difficulties with spoken English as long as the intent of the speech is understood.
- 8.4.8. To give teams the ability to optimize their allocation of time within the FRR, the approximate relative worth of each area of the presentation is given:
 - 8.4.8.1. System Description-5%
 - 8.4.8.2. System Safety Overview-5%
 - 8.4.8.3. Developmental Test Results
 - 8.4.8.3.1. Test Planning & Execution-20%
 - 8.4.8.3.2. Test Results-10%
 - 8.4.8.4. Evidence of Mission Accomplishment-10%
 - 8.4.8.5. Pre-Mission Brief-10%
 - 8.4.8.6. Question and Answer-5%
 - 8.4.8.7. Static Display-15%
 - 8.4.8.8. Communication Skills-20%

- 8.4.9. Portions of the presentation exceeding the specified time limits (see section 4.14) will not be considered for score.
- 8.4.10. For the past 13 years, the FRR briefing has been conducted in an open-air environment with only minimal protection from sunlight, wind and/or rain, and ambient noise. The teams **shall** come prepared to speak loudly and deal with a noisy, outdoor environment. The SUAS committee will make every effort to arrange for FRR briefings in doors, which may impact teams who have Ground Control Systems installed in trailers.
 - 8.4.10.1. Teams who are not presenting FRR **shall** maintain a respectful quiet and **shall** be prevented from moving aircraft and vehicles while in close proximity of teams presenting FRR briefings.
 - 8.4.10.2. It should be noted that video cameras recording FRR briefings often can't pick up quality audio from the speakers – an indicator for all speakers to practice speaking loud.
 - 8.4.10.3. Examples from 2015 FRR can be viewed at the SUAS YouTube channel.
https://www.youtube.com/channel/UCI4Ud9E_EwKkCXsVy_sf8eg

8.5. FLIGHT-MISSION DEMONSTRATION

- 8.5.1. The mission is split into several independent tasks with each task having graded parameters that highlight certain capabilities of the competitor's system. Emphasis has been placed on ensuring these tasks are clearly gradable.
- 8.5.2. Teams may choose to complete any number of tasks. The more tasks that can be completed increases the total number of points a team earns, but beware that exceeding mission time will result in a loss of points.
- 8.5.3. It is the SUAS committee's intent to supply more tasks than can be completed in the available mission time. The teams should perform trade-studies (hint: use the relative worth of tasks) to assess their mission objectives and design approach.
- 8.5.4. Task priority weighting tiers are specified as either primary or secondary.
 - 8.5.4.1. Primary tasks are intended to be the core mission focus, and teams **shall** achieve primary points defined in Section 7.0 before earning any points on secondary tasks.
 - 8.5.4.1.1. Teams **shall** achieve at least a threshold level of performance on all Autonomous Flight Task parameters and target Classification for at least one standard target in the Search Area Task to earn points for any secondary tasks.
 - 8.5.4.2. Secondary tasks are intended to be stretch objectives, and as such will be scored with less weighting than primary tasks.
 - 8.5.4.3. The weightings of task priorities are:
 - 8.5.4.3.1. 60% Primary
 - 8.5.4.3.2. 40% Secondary
- 8.5.5. Parameters in the same task are scored equally with the exception of the Search Area Task, Localization Parameter, which will be double the weight of the other parameters in that task.

- 8.5.6. Each mission task parameter is split into three completion levels: incomplete, threshold, and objective. These completion levels denote weighting tiers. See the description of each task in Section 7.0 for details about the completion level for an individual task parameter.
 - 8.5.6.1. Incomplete specifies that a team did not achieve the threshold criteria.
 - 8.5.6.2. Threshold specifies the minimally acceptable completion criteria, and is scored at a loss relative to the objective level.
 - 8.5.6.3. Objective specifies the desired completion criteria for maximum points.
 - 8.5.6.4. The weightings of completion levels are:
 - 8.5.6.4.1. 0% Incomplete
 - 8.5.6.4.2. 50% Threshold
 - 8.5.6.4.3. 100% Objective
- 8.5.7. To give teams the ability to perform a trade study in their systems engineering design process, the relative worth of each task in its priority tier are given:
 - 8.5.7.1. Primary
 - 8.5.7.1.1. Autonomous flight – 50%
 - 8.5.7.1.2. Search area – 50%
 - 8.5.7.2. Secondary
 - 8.5.7.2.1. ADLC – 20%
 - 8.5.7.2.2. Actionable Intelligence – 15%
 - 8.5.7.2.3. Off-axis – 10%
 - 8.5.7.2.4. Emergent Target – 10%
 - 8.5.7.2.5. SRIC – 10%
 - 8.5.7.2.6. Air Drop – 5%
 - 8.5.7.2.7. Interoperability – 10%
 - 8.5.7.2.8. Sense, Detect and Avoid – 20%

8.6. JUDGES

- 8.6.1. The judges for the competition are volunteers from across industry and the government, and there may be uniformed service members acting as judges. Many of the judges have extensive UAS experience and judged this competition for many years, and some are experienced students having competed in SUAS.
- 8.6.2. Many judges help grade journal papers as well as the FRR briefs and flight-mission demonstrations. However, a majority of judges will not have read your journal paper and will not be familiar with your system. Judges involved with the oral briefing are required to stay involved throughout all oral briefings. Judging teams for the flight-mission demonstration are required to stay with a team while that team is on the mission clock.

9. Safety Regulations

9.1. FLIGHT OPERATIONS

- 9.1.1. Flight operations of any type involve some level of risk to personnel and property. It is the responsibility of all personnel involved in and around flight operations to identify, evaluate and mitigate risks to the maximum extent possible. Systems that do not meet the requirements listed below will not be permitted to fly.
- 9.1.2. An interruption of flight operations due to a crash shall be grounds for termination of the team from further competition. Definition of a crash is a subjective decision of the Lead Judge. As a general rule of thumb - if the landing looked intentional and under control but sustained some damage, and if the UAS looks like it could take-off again after minor repairs, then it may not be considered a crash.

9.2. SAFETY PILOT

- 9.2.1. Each team **shall** have an experienced safety pilot registered as a team member in order to compete in the SUAS competition. The safety pilot **shall** be directly involved in the development and testing of the team's UAS and flight termination system as recorded in the flight logs during development flight testing, in the team list of Appendix B-2, and discussed by name during the Proof-of-Flight video.
- 9.2.2. Prior to arriving at the competition, the safety pilot **shall** have recorded a minimum number of hours direct experience manually flying the same aircraft (with competition configuration weight and balance) planned for the competition's flight-mission demonstration. Each team **shall** maintain a flight log to record each flight of the Safety Pilot and commands executed (# of manual take-offs, autonomous-to-manual control takeovers, manual landings), and results (general, safety mishaps, crashes, etc.). The team advisor **shall** sign and submit an official letter with a flight log confirming the number of hours the safety pilot has experienced flying the same aircraft configuration and submit this prior to the deadline date and time listed in the Schedule of Section 3. Teams are encouraged to show proof of their Safety Pilot's prior recorded experience, but this **shall** not relieve these stated requirements.
- 9.2.3. If the team's safety pilot is unable to compete, due to unforeseen last minute circumstance, the Team Captain **shall** immediately contact the Competition Director and provide an explanation. If the team has already successfully met the qualified safety pilot requirements, then the SUAS committee may provide a replacement volunteer safety pilot for the team to use during the competition's flight-mission demonstration. There is no guarantee SUAS will provide a safety pilot, or have a qualified resource available to provide. The team will assume all risk of an unfamiliar volunteer safety pilot flying their aircraft.

9.3. DOCUMENTED EXPERIENCE AND READINESS

- 9.3.1. Flight / Testing Requirement (Advisor signs form attesting compliance)
 - 9.3.1.1. Any aircraft brought to competition **shall** have a minimum of 5 hours of flight, of which at least 2 hours **shall** be autonomous.

- 9.3.1.2. Any Safety Pilot brought to competition **shall** have 4 hours of manual flight, of which at least 2 **shall** be with the competition aircraft configured with proper weight and balance to account for mission payload mass and CG, even if the actual payload systems are not installed.
- 9.3.2. Additional Proof of Flight Video Requirement
 - 9.3.2.1. In addition to the Proof of Flight Video addressed in section 4.12, a video **shall** also include two (2) extra flights with the safety pilot and aircraft used in competition configuration. The video **shall** show the safety pilot and the competition aircraft configured as described above.
 - 9.3.2.2. Flight 1:
 - 9.3.2.2.1. The video **shall** show a manual takeoff, continuous manual flight for at least 5 minutes, followed by a manual landing.
 - 9.3.2.2.2. The video **shall** show that the aircraft gets at least 1000 feet from the pilot.
 - 9.3.2.2.3. The video **shall** show turns, ascents, and descents.
 - 9.3.2.3. Flight 2:
 - 9.3.2.3.1. The video **shall** show autonomous flight (for 2 minutes), followed by a transition to manual flight (for 2 minutes), followed by a transition to autonomous flight (for 2 minutes).
 - 9.3.2.3.2. The video **shall** show autonomous flight (for 2 minutes), followed by a transition to manual flight, followed by a manual landing.

9.4. **LIABILITY**

- 9.4.1. Seafarer Chapter of AUVSI and the host organization, their employees and agents, as well as the SUAS committee, are in no way liable for any injury or damage caused by any entry, or by the disqualification of an entry.
- 9.4.2. Each member of participating teams **shall** sign and submit a waiver holding Seafarer Chapter of AUVSI and the host organization harmless of any accident claims. The form, described in Appendix I, **shall** be turned in during the Check-in and Orientation process.

9.5. **AIRCRAFT**

- 9.5.1. Aircraft **shall** comply with the Academy of Model Aeronautics (AMA) National Model Aircraft Safety Code, (<http://www.modelaircraft.org/files/105.pdf>) except as noted below:
 - 9.5.1.1. Autonomous operation is authorized.
 - 9.5.1.2. GENERAL rules apply; 2(f) replaced by team name, not AMA team name.
 - 9.5.1.3. RADIO CONTROL – all rules apply.
 - 9.5.1.4. FREE FLIGHT – not applicable.
 - 9.5.1.5. CONTROL LINE – not applicable.

- 9.5.2. The maximum takeoff gross weight of the aircraft **shall** be less than 55 lbs. when fueled and weighed with a calibrated scale during SUAS competition inspections.
- 9.5.3. The maximum airspeed of the aircraft **shall** not exceed 100 KIAS.
- 9.5.4. The system **shall** provide sufficient information to the judges on a continuous basis to ensure that it is operating within the no-fly/altitude boundaries.
- 9.5.5. The aircraft **shall** be capable of manual override by the safety pilot during any phase of flight.
 - 9.5.5.1.1. The safety pilot must be able to take manual control at all times. The autopilot may give over manual control automatically, but such delegation cannot be required for the safety pilot to take control.
- 9.5.6. Flight Termination
 - 9.5.6.1. The flight termination system **shall** be capable of activation by the safety pilot or pilot in command.
 - 9.5.6.2. A return home or return to land (RTL) system, if installed, **shall** be capable of activation by the safety pilot.
 - 9.5.6.3. The aircraft **shall** automatically return home (takeoff location) after loss of primary communications link signal of more than 30 seconds.
 - 9.5.6.4. The aircraft **shall** automatically terminate flight after loss of primary communications link of more than 3 minutes.
 - 9.5.6.4.1. If the aircraft flight termination system is independent of the primary communications link then the aircraft may continue with an autonomous return to home or RTL routine if installed.
 - 9.5.6.5. Flight termination for fixed wing aircraft without an alternate recovery system (like a parachute) **shall** select:
 - 9.5.6.5.1. Throttle closed
 - 9.5.6.5.2. Full up elevator
 - 9.5.6.5.3. Full right rudder
 - 9.5.6.5.4. Full right (or left) aileron
 - 9.5.6.5.5. Full flaps down (if so equipped)
 - 9.5.6.5.6. For other than fixed-wing aircrafts, similar safety requirements will be assessed which result in a power off recovery in minimum energy manner at a spot on the ground no more than 500 ft radius over the ground from the point of the termination command.
 - 9.5.6.6. Parachute recovery systems are allowed, but shall be inspected for proper packing procedures and reliable deployment mechanisms.
 - 9.5.6.7. The fail-safe check will demonstrate flight termination on the ground by switching off the transmit radio for 30 seconds or 3 minutes (whichever applies) and observing activation of flight terminate commands.
 - 9.5.6.7.1. Questions regarding conduct of the safety check may be sent to the SUAS Competition Director detailed in Section 10.1.

- 9.5.7. Exotic, unusual fuels/batteries or components **shall** not be used. Any fuel/battery combination deemed high risk in the opinion of judges will be disqualified.
- 9.5.8. All batteries used in the aircraft **shall** be colored brightly to facilitate locating them in the event of a crash. Wrapping batteries in bright colored tape is preferred.
- 9.5.9. At least 25% of the upper, lower and each side surface of the vehicle **shall** be a bright color (white, yellow, etc.) to facilitate visibility in the air and in the event of a crash.

9.6. GROUND CONTROL SYSTEM (GCS)

- 9.6.1. The Ground Control System (GCS), being a local repository on the flight line of all aspects of the overall system except the aircraft, should include adequate safety materials for personnel protective equipment (PPE) (tools, gloves, eye protection, hearing protection, etc.), safety risk mitigation (training, check lists, radios, etc.) and equipment to support rapid response to accidents (first aid kit, fire extinguisher, etc.) as needed.
- 9.6.2. The GCS should be verified to ensure the proper display of information in the correct manner required and engineer units expected, and to test and validate the GCS properly interfaces with the Judge's Network and the TM data is properly received as required in accordance with Section 5.3.
- 9.6.3. All ground vehicles **shall** be off the runway area and parked in the grass.

9.7. SAFETY INSPECTIONS

- 9.7.1. All aircraft **shall** undergo a safety inspection by designated competition safety inspectors prior to being allowed to make any competition or non-competition (i.e., practice) flight.
- 9.7.2. All decisions of the safety inspector(s) **shall** be final.
- 9.7.3. Questions regarding conduct of the safety inspection may be sent to the SUAS Safety Inspector contact detailed in Section 10.1.8.
- 9.7.4. Safety inspections **shall** include a physical inspection, fail-safe check, flight termination check, and a maximum weight check.
- 9.7.5. Physical inspection of aircraft **shall** include:
 - 9.7.5.1. Verify all components adequately secured to vehicle.
 - 9.7.5.2. Verify all fasteners tight and have either safety wire, locktite (fluid) or nylock nuts.
 - 9.7.5.3. Verify propeller/rotor structural and attachment integrity.
 - 9.7.5.4. Visual inspection of all electronic wiring to assure adequate wire gauges and connectors in use. Teams **shall** notify safety inspector of expected maximum current draw for the propulsion system, if electric.
 - 9.7.5.5. Radio range checks, motor off and motor on.
 - 9.7.5.6. Verify all controls move in the proper sense.
 - 9.7.5.7. Check general integrity of the payload system.
 - 9.7.5.8. Verification of fail-safe mode operation covered by manual override and pilot-commanded flight termination.

9.8. LAUNCHERS

- 9.8.1. Takeoff **shall** not be allowed from moving vehicles.

- 9.8.2. Launchers **shall** be inspected by competition safety inspectors before they are allowed for use in the competition.

9.9. OTHER

- 9.9.1. Section 10.8 restricts the number of team members allowed in the mission area.
- 9.9.2. Location of aircrafts for take-off must be past the centerline, away from the tents, and the direction of flight during taking off and landing should avoid using the runway near the team and judging flight line area.
- 9.9.3. No objects **shall** depart from the aircraft while in flight (except during intentional execution of the air-drop task).
- 9.9.4. Any team's hardware, software, or personnel that, in the opinions of the competition officials or the representatives of the host facilities, pose an unreasonable safety hazard to personnel or property, or risk to the integrity of the host facility, will be disqualified and not be allowed to operate.
- 9.9.5. Officials will have the right to disqualify any entry that they deem a hazard.
- 9.9.6. No Foreign Object Debris (FOD) recover teams **shall** be on the active field/runway when another aircraft is preparing to launch or in the air unless coordinated and approved by the Competition Director or Safety Judge.
- 9.9.7. Open toed shoes/flip flops should not be worn during safety inspections, flight line operations, or when aircraft engines are powered (even in the pit area).
- 9.9.8. If anyone observes anyone in an unsafe activity or an imminently unsafe activity, say something! Safety is a shared responsibility.
- 9.9.9. Judges may deduct points as penalty for procedural safety errors (even accidental), not related directly to flight, such as improper safety practice in the pit area.
- 9.9.10. The decision on a safety call by the on-field Safety Judge **shall** be final.

10. Competition Clauses

10.1. OFFICIAL INFORMATION SOURCE

- 10.1.1. If a team experiences technical difficulties with electronic submissions, they must contact the SUAS Committee prior to the relevant submission deadline.
- 10.1.2. All submittals will be electronic via the team's folder on the SUAS competition SharePoint site, except the initial registration application and registration fee.
- 10.1.3. The SUAS Competition internet URL:
 - 10.1.3.1. <http://www.auvsi-seafarer.org>
- 10.1.4. The SUAS Competition SharePoint login URL:
 - 10.1.4.1. <https://docs.goctsi.com/sites/SUAS>
 - 10.1.4.2. Specific team usernames and passwords will be provided by the SUAS Committee after registrations have been accepted and processed.
- 10.1.5. SUAS committee will communicate with the teams using Google Groups:
 - 10.1.5.1. auvsi-suas@googlegroups.com
 - 10.1.5.2. <https://groups.google.com/forum/#!forum/auvsi-suas>
- 10.1.6. AUVSI Seafarer Chapter mailing address (**do NOT ship FEDEX or UPS here**):
 - AUVSI Seafarer Chapter
 - Post Office (P.O.) Box 141
 - California, MD 20619
 - ATTN: Chapter President
- 10.1.7. **SUAS University Day** conference phone call number and WebEx meeting URL:
 - 10.1.7.1. Choose one of the following numbers to dial:
 - If teams call in from an office location with on-site number(s) (listed below), try this number first. If you do not have on-site access, or you are not a member of the host's company/organization, use one of the other numbers shown.
 - Toll-Free Number (in USA): 888-369-1427
 - When prompted, enter the Meeting Access Code: 2303854#
 - A number in your country or in a country close to you (may be toll free):
<https://www.teleconference.att.com/servlet/glbAccess?process=1&accessNumber=8883691427&accessCode=2303854>
 - 10.1.7.2. To connect to the WebEx conference use URL:
<https://connect15.uc.att.com/urs/meet/?ExEventID=82303854>
- 10.1.8. SUAS Competition primary point of contacts:
 - Seafarer Chapter President – Tim Piester
 - Competition Director – Mark Pilling
 - Head Judge – Wayne Devereux
 - Safety Inspector – Rob Ross
- 10.1.9. **SUAS Check-in and Orientation** location address:
 - Bay District Volunteer Fire Department
 - 46900 South Shangri-La Drive
 - Lexington Park, MD 20653
 - (301) 737-0654
 - Website: <http://www.bdvsfd.org/content/hall/>

- 10.1.10. **SUAS Competition location** (for oral presentation and flight-mission demonstration) address:

Naval Air Station Patuxent River
Webster Outlying Field
St. Inigoes, MD 20684

Website: http://www.wiki.somd.com/index.php/Webster_Field

- 10.1.11. **SUAS Awards Banquet** location and address:

Hollywood Volunteer Fire Department (HVFD) Social Hall
24801 Three Notch Rd
Hollywood, MD 20636
Phone: 301-373-3910

Website: <http://www.hvfd7.com/content/hall/>

10.2. OFFICIAL PARTICIPATION

- 10.2.1. All e-mails, written submissions, oral presentations, and discussions **shall** be in English.
- 10.2.2. All applications, forms, technical journals, photos, etc. uploaded to the official SharePoint site **shall** be submitted in PDF file format.
- 10.2.3. All official registration fee payments **shall** be made in U.S. dollars (USD).
- 10.2.4. The team's registration is not considered officially received until the properly completed application form and the full amount of entry fee have been received by AUVSI Seafarer Chapter, in accordance with the requirements of Section 10 and before the deadline listed in the Schedule table in Section 3.

10.3. OFFICIAL REGISTRATION APPLICATION

- 10.3.1. Each team **shall** complete the Appendix A: Competition Registration Application form using the Google Form format. No other form of application will be accepted.
- 10.3.1.1. Teams must provide primary financial and technical contacts with detailed addresses to ensure registration and payment questions, reimbursements, and prize money payments can be properly accounted for and tracked.
- 10.3.2. Each application **shall** include both team Advisor and Captain contact information.
- 10.3.3. Deadlines for the early and late registration application form and payment are listed in the Schedule of Section 3.
- 10.3.4. Teams will receive an acknowledgement of receipt of registration application and payment from the SUAS committee. If applications are incomplete, payment will not be processed and may be returned with a failure to meet registration notice.
- 10.3.5. Teams who fail to properly meet the application requirements will be informed by the Competition Director or Treasure of the AUVSI Seafarer's Chapter within two weeks after the deadline listed in the Schedule table in Section 3.
- 10.3.6. Due to the large number of teams interested in competing, the SUAS committee reserves the right to limit the type to colleges and total number of entries that are allowed to compete by declaring the competition closed to new entries at any time.
- 10.3.6.1. As with all official information, this announcement (should it be necessary) will appear on the official information source website.

10.4. OFFICIAL REGISTRATION FEE

- 10.4.1. Registration fee amounts **shall** be US\$1,000 during the early registration period or US\$1,250.00 during the late registration period, as defined in Section 3.
- 10.4.2. Registration fee payment **shall** be as Check or Money Order, or alternatively:
 - 10.4.2.1. Electronic Bank Transfers will be accepted and **shall** carry an additional US\$30.00 charge payable in full with the registration fee.
 - 10.4.2.2. Credit Card payments *may* be accepted, and **shall** carry an additional charge (est. 2.9% + US\$0.30), payable in full with the registration fee.
- 10.4.3. Payment **shall** be made to: "AUVSI Seafarer Chapter".
- 10.4.4. Payments for registration fee **shall** be mailed to the AUVSI Seafarer Chapter at the address listed in Section 10.1.6.
- 10.4.5. Deadline for the registration fee is listed in the Schedule table in Section 3.
- 10.4.6. Registration application and registration fee payment must BOTH be post marked no later than the deadline in the competition Schedule to be registered.
- 10.4.7. If a team does not meet the registration process requirements, the registration fee will be returned.
- 10.4.8. No refunds **shall** be provided after a team has been successfully registered.
- 10.4.9. No credits to future competitions **shall** be granted.

10.5. WITHDRAWAL PROCESS

- 10.5.1. There is no deadline for a team to withdraw from the SUAS competition.
- 10.5.2. If a team decides to withdraw from the competition, the Team Captain **shall** formally submit a written request to withdraw to the SUAS Committee. Failure to properly withdraw from the competition **shall** result in the team being disqualified from the current competition and next year's competition.
- 10.5.3. No refunds **shall** be provided after a team has been successfully registered.

10.6. DOWN-SELECTION

- 10.6.1. The SUAS committee may implement a down-selection process to restrict the number of teams from participating in any one or all phases of the competition.
- 10.6.2. The initial form of down-selection is accomplished through registration process, on a first-come-first-served basis. Therefore, late submission of a team's application form and/or registration fee will result in that team's registration not being accepted to compete. Teams are encouraged to register early.
- 10.6.3. Other forms of down selection may be used to reduce the number of teams able to execute the flight-mission phase. This may be implemented as the competition timeline progresses and depends on the team's timely submission and content of: Fact Sheets and Proof-of-Flight video; Technical-Journal Papers; Oral Presentations; and Safety Inspections. Schools **may** be limited to entering a single team.
- 10.6.4. As with all official information, this announcement (should it be necessary) will be broadcast by the SUAS committee by e-mail to the team's Captain and advisor.

10.7. TEAM PARTICIPATION

- 10.7.1. If a team submits a journal paper, but cannot attend the competition days, they will not be eligible to win a cash prize or rank for the journal paper. However, a team that submits a journal paper and gives their FRR brief, but cannot perform the flight-mission demonstration may still receive prizes. This might occur due to a crash of their aircraft shortly prior to the competition.
- 10.7.2. Prerequisites for participation in the flight-mission demonstration phase include successful submission of all deliverables, technical journal paper, successfully passing the safety inspection and presenting the oral briefing FRR where judges assess the team's readiness and risk for flight is acceptable.
- 10.7.3. Team's advisors **shall** be prohibited from participating in the FRR briefing or flight-mission at anytime, unless they are filling the roll of the team's aircraft safety pilot. At no time **shall** the team's advisor provide direction or commentary to the team or judges, unless it pertains to safety.

10.8. TEAM MEMBERSHIP

- 10.8.1. Each team will be restricted to no more than ten (10) students/advisor team being able to enter the base at Webster Field and participate during the competition.
 - 10.8.1.1. The maximum limit of ten (10) team members apply to all team participants in the pit area, FRR presentation, flight-mission demonstration, and banquet.
 - 10.8.1.2. The team may be larger than ten (10) during development phase and contributing to the Journal paper at school, providing they are qualified undergraduate students as defined in section 10.8.
 - 10.8.1.3. Only the approved registered student from each team will be covered by competition expenses (food, water, shirts, banquet, etc.) and AUVSI insurance. Any additional team or accompanying guests will be required to pay for their expenses (food, water, shirts, banquet, etc.).
- 10.8.2. Each team will be restricted to no more than ten (10) accompanying guests (other team members, faculty, family, associates, etc.) to enter the base at Webster Field during the competition. Accompanying guests shall not be involved in technical actions within the pits, shall not be allowed to present in FRR, and shall not go to the flight line. Any accompanying guest shall purchase tickets for food and banquet, and t-shirts, which will be available for purchase at the competition.
- 10.8.3. Full-time undergraduate, or high school students, including no more than one (1) graduate student **shall** compose the team in all facets of all activities, including those performed during development at the school.
- 10.8.4. If required, the team's aircraft Safety Pilot may be a faculty advisor, non-student of school, or SUAS committee member, which **shall** be counted as one (1) of the ten (10) team's member. In the case of a Safety Pilot not being a student of the school, the advisor **shall** submit a written justification to the Head Judge why the team was unable to provide a student Safety Pilot, and how this non-student individual was kept from overly influencing the student team's design and operational learning.

- 10.8.5. Members from industry, government agencies, or universities (in the case of faculty or additional graduate students) may advise the team outside of the competition. However, they should not direct the creation of the strategy, design, or testing. And, they are prohibited from direct involvement with the journal paper, FRR presentation, and flight-mission execution.
 - 10.8.6. University participants **shall** be considered "students" if they are enrolled at their schools for at least 12 credit hours or more per quarter or semester during fall, winter and spring or if they are officially enrolled in the schools Co-Op program and defined as a full-time student. The status of any Co-Op student **shall** be documented by the team's advisor and student's employer in a letter to the Seafarer Chapter to confirm Co-Op status and affirm the student will not be working on the team's UAS design when employed. Seniors graduating in winter or spring are not considered graduated students for this competition.
 - 10.8.7. High school students **shall** be enrolled at their schools according to the county, state, or country requirements. Home-schooled high school students are welcome to join other high school teams or create their own team.
 - 10.8.8. Registered teams **shall** provide the information required in Appendix B, SUAS Team General Composition Table and Team Roster **shall** be submitted by the deadline in the Schedule of Section 3.
 - 10.8.9. A letter on College or University letterhead, signed by an official school administrator **shall** be provided.
 - 10.8.10. The faculty member/advisor will sign a statement that the team consisted of no more than one (1) graduate student and submit it with the team list (roster) stating the names of each student/advisors and confirming they are enrolled in the school as fulltime students or confirming that they meet the part-time student criteria defined below.
 - 10.8.11. Each team **shall** have a formal school faculty member/advisor or official point of contact (POC) from the team's school that **shall** state in writing to the SUAS committee that the school knows the team is representing the school, that the team is traveling for the competition, and that this is done in compliance with Section 10.8.10. College teams whose entire team is age 18 years or above are not required to have the advisor or school official travel with the team. For any college team with a member younger than 18 years of age, and for all high school teams, at least two adults who are a school advisor and/or parent **shall** travel with the team and **shall** take full responsibility for the students. The teams' advisor's name and contact information **shall** be provided with the registration application form to be accepted. The team's advisor will be contacted during the SUAS registration acceptance process.
- 10.9. **STUDENT PARTICIPATION**
- 10.9.1. All student members of a team **shall** make significant contributions to the development of their entry.
 - 10.9.2. Only one (1) student member of the team **shall** be designated as the "Team Captain." Only the Team Captain will speak for the team related to all aspects of the competition.
 - 10.9.3. Teams registering to compete **shall** indicate on their application form the name of the individual or organization to whom prize checks will be made payable.

- 10.9.4. Advisors may only operate as safety pilots and may only communicate to the team in the safety pilot role. These are the only advisors that **shall** be counted as a team member.
- 10.9.5. Advisors **shall** not coach or participate with the team on non-safety conduct of the mission. Faculty and/or advisors cannot do anything but be the safety pilot during the competition. Students **shall** operate the systems, present data analysis, etc. in all phases of the competition.

10.10. GOVERNMENT FACILITIES

- 10.10.1. The AUVSI Seafarer Chapter of SUAS Competition **shall** be conducted aboard:
 - 10.10.1.1. Naval Air Station (NAS) Patuxent River, Maryland (MD), Webster Field.
- 10.10.2. All personnel attending the SUAS Competition **shall** be cleared for access to Webster Field. For team members, faculty, or guests that are United States citizens, the information required in Appendix J, US Citizen Base Access Form **shall** be submitted by the deadline in the Schedule of Section 3.
 - 10.10.2.1. Name, Date of Birth, Place of Birth, and Social Security Number.
- 10.10.3. All non-U.S. citizens, and those U.S. citizens who were born outside the U.S., **shall** submit a copy of a passport, Visa, or naturalization certificate.
- 10.10.4. All non-U.S. citizens **shall** be escorted when on-site at Webster Field.
- 10.10.5. If teams require letters of invitation to the competition, a request for a letter **shall** be addressed to SUAS Competition Director along with the registration application.
- 10.10.6. For international teams or U.S. teams with non-U.S. citizens, the information required in Appendix K, Foreign National Base Access Form **shall** be submitted by the deadline in the Schedule of Section 3.
- 10.10.7. International teams must begin the process ***very early*** in order to obtain passports and Visas so that the required data can be submitted to Navy Security officials in order to gain access to Webster Field, and to allow international travel in the U.S.
- 10.10.8. Failure to obtain passports and Visas in time to meet the Base Access deadline submission in the Schedule of Section 3 shall not be cause for any extension.**
 - 10.10.8.1. Any non-U.S. citizens who submit their passports or Visas after the deadline defined in the Section of Section 3 will ***NOT*** have their Base Access request processed, and shall not access the base.
- 10.10.9. All non-U.S. citizens (members, students, or visitors) must receive proper base access badge and vehicle passes, and be escorted on base by authorized SUAS representatives.
- 10.10.10. Officials **shall** have the right to have any persons immediately escorted from the facility without notice.
- 10.10.11. Any violation of base security policy, by a team member or guest of a team will immediately result in the team forfeiting the competition and the removal of the entire team and guests from the base.

10.11. BASIS FOR AWARDS

- 10.11.1. The judging team will evaluate each competitor's compliance to the requirements set forth in this solicitation and assess all Journal, FRR presentation, and Flight-Mission Demonstration scores on a graduated basis.
- 10.11.2. Awards for the top tier overall combined scores will be presented.

- 10.11.3. Additional awards may be given to the best overall safety, sportsmanship and tenacity categories, and others as deemed suitable.
- 10.11.4. Judges may award prize barrels for completing certain specialized flight and mission tasks (subject to change, based on sponsorship funding for the year).

10.12. OFFICIAL PAYMENT OF PRIZE MONEY

- 10.12.1. Trophies, plaques and/or prize money are awarded to the teams excelling in the competition's primary categories and achieving the select prize barrels.
- 10.12.2. Teams receiving prize money will be given checks for the specified prize amount at the Awards Banquet.
- 10.12.3. Checks will be made out for distribution to the academic, team or individual name specified on the team's application form.
- 10.12.4. Checks for prize money that has not been cashed within 90 days of the SUAS competition will be VOID and Seafarer Chapter will no longer be responsible for payment.

10.13. TEAM LOGISTICS

- 10.13.1. Teams **shall** be solely responsible for all planning, execution and shipping costs (inclusive of all export rules and duties) for transportation of equipment to/from the competition. No team **shall** ship equipment direct to the Navy's military base. Teams must coordinate shipping with their hotels and handle all associated affairs without any support from the SUAS committee.
- 10.13.2. Teams **shall** be solely responsible for all planning, execution and travel costs of team personnel to/from the competition, including hotels and food outside the competition. The Seafarer Chapter, SUAS Committee or affiliated sponsors or volunteers will not provide transportation from/to the airport or hotel, and/or the Navy's military base, for any student, team, or advisor.
- 10.13.3. Teams **shall** be responsible to for all change fees or cancelation fees associated with airline tickets and hotels reservations, even if the SUAS committee does not accept the team's registration application, or the team fails to meet any of the competition requirements and is down-selected or becomes disqualified.

Appendix A: Registration Application Form

2016 SUAS Competition Registration Application

Go to: <https://goo.gl/7CM3ud>

Registration Application | SUAS 2016

14th Annual AUVSI SUAS Competition
June 15 - 19, 2016
AUVSI Seafarer Chapter

This must be submitted by the Team Captain to register for the 2016 AUVSI SUAS Competition.

Form & Payment: Must be date/time-stamped before the deadline in Rules, Section 3.

Registration Fee: Registration fee shall be \$1,000 USD during the early bird registration period or \$1,250.00 USD during the late bird registration period, as defined in Section 3. No refunds.

Method of Payment: Check or Money Order accepted with no fee. Electronic Bank Transfers will be accepted and shall carry an additional \$30.00 USD charge payable in full with registration fee. Credit Card payments may be accepted, and shall carry an additional charge (est. 2.9% + \$0.30 USD), payable in full with the registration fee.
Make Payable to: AUVSI Seafarer Chapter
Mail Payment: As stated in Section 10.1.6 of the Rules

* Required

Team

School Name *

Team's Name *

Team's Physical Mailing Address *

Team's City, State/Province *

Team's Zip Code, Country *

Award Check Payable To *
IMPORTANT. Name to write on any award checks at the competition.

Team's Sponsors

List if sponsors known, one per line.

Team Captain

Captain's Name *

Captain's Telephone Number *

Captain's Email Address *

Faculty Advisor

Advisor's Name *

Advisor's Telephone Number *

Advisor's Email Address *

Never submit passwords through Google Forms.

Appendix B: SUAS Team Composition Table

SUAS Team Composition Table (EXAMPLE ONLY)

> **NEW GOOGLEFORM LINK WILL BE PROVIDED TO TEAMS ACCEPTED TO COMPETITION** <

TEAM NAME _____ DATE _____

#	COMMENT/QUESTION	Numbers
1	How many "team" members, including the team advisor, will require access to NAWCAD Webster Field (MAX of 10, including Advisor)?	
2	How many of the above "team" members, including the team advisor, are Foreign Nationals and require special access to Webster Field?	
3	How many non-team members/guests/support group, will arrive and require access to NAWCAD Webster Field (MAX of 10)?	
4	How many of the above non-team members/guests/support group, are Foreign Nationals and require special access to Webster Field?	
5	How many team members and guest have vegetarian diets or have dietary limitations? Explain in the comments section as needed.	
6	How many/size T-shirts (S, M, L, XL, XXL) for "team" members are required?	
	Small = _____ Medium = _____ Large _____ Extra Large = _____ 2xExtra- Large = _____ 3 xExtra- Large = _____ <i>NOTE: Non-team members and guests are not to be counted, and will be offered the opportunity to buy T-shirts on-site during the competition.</i>	
COMMENTS		

SUAS Team List **(EXAMPLE ONLY)**

> NEW GOOGLEFORM LINK WILL BE PROVIDED TO TEAMS ACCEPTED TO COMPETITION <

TEAM NAME _____ DATE _____

TEAM MEMBERS

No.	Team Position	Name	e-mail	Grade	Degree (pursing)	Etc.
1	Advisor					
2	Team Captain					
3						
4						
5						
6						
7						
8						
9						
10						

Appendix C: SUAS Fact Sheet (UAS Systems) **(EXAMPLE ONLY)**

> NEW GOOGLEFORM LINK WILL BE PROVIDED TO TEAMS ACCEPTED TO COMPETITION <

1. School / Team Name:

2. Team Captain Point of Contact (name, email address, & phone number):

3. Team Advisor Point of Contact (name, email address, & phone number):

4. Basic description of fixed/rotary wing aircraft, payload systems, and ground control system:

5. RF Transmitter details for all aircraft control system, payload systems and any voice communication radios (Mfr., model numbers, specifications, frequencies, bandwidths, channels, etc.):

6. Fuel and/or battery type: _____

7. Aircraft LxWxH dimensions (inches): _____

8. Aircraft gross weight (lbs.): _____

9. Launchers Description (if used): _____

10. Number of Vehicles, Trailers and other large equipment that will be brought to the competition:

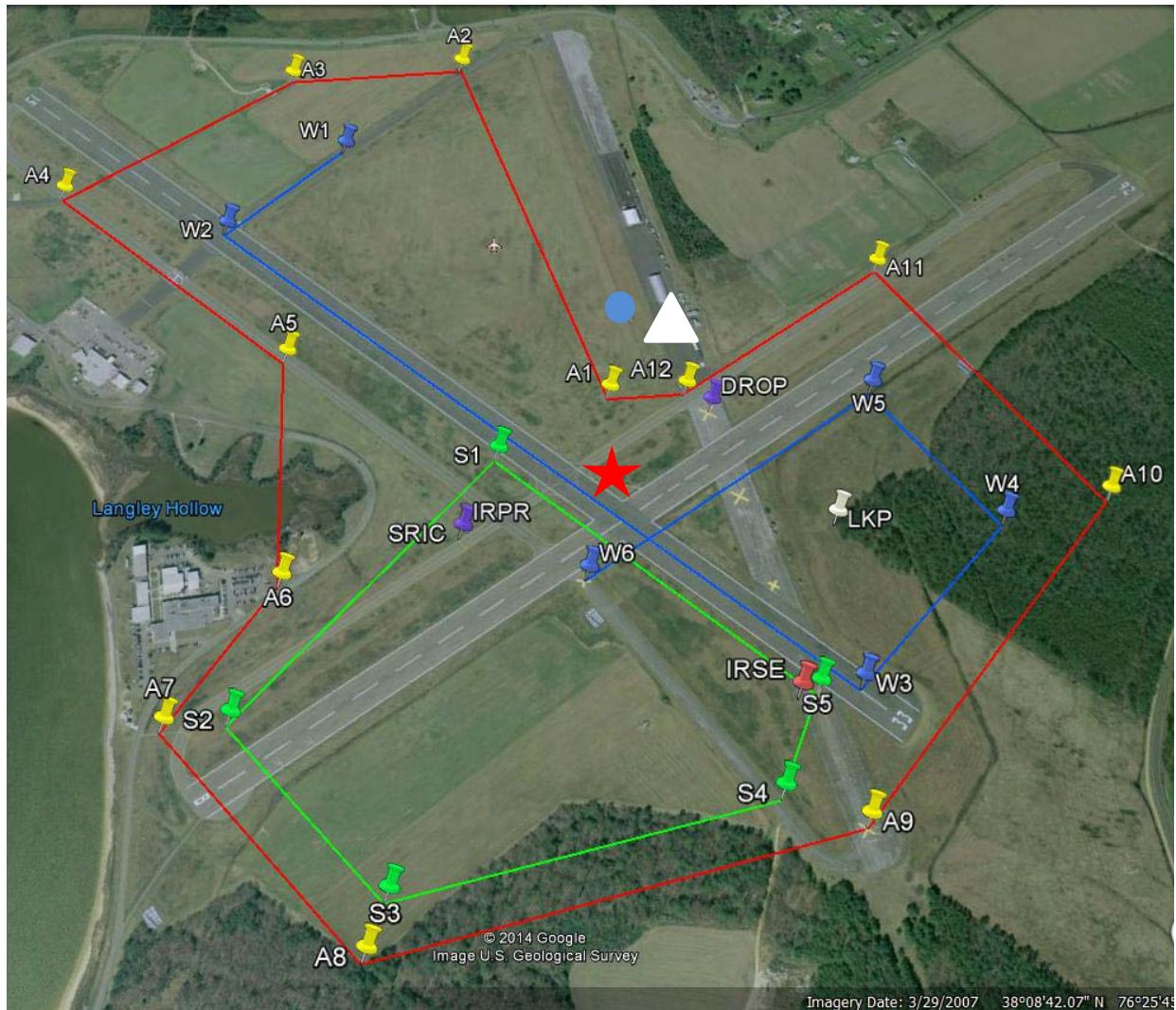
2016 SUAS Team Flight Plan Table (EXAMPLE ONLY)

> NEW GOOGLEFORM LINK WILL BE PROVIDED TO TEAMS ACCEPTED TO COMPETITION <

TEAM NAME: _____

	SECTION	TASK	YES	NO
PRIMARY	7.1	AUTONOMOUS FLIGHT TASK		
	7.2	SEARCH AREA TASK		
SECONDARY	7.3	AUTO DETECT, LOCALIZE, AND CLASSIFY (ADLC) TASK		
	7.4	ACTIONABLE INTELLIGENCE TASK		
	7.5	OFF-AXIS TARGET TASK		
	7.6	EMERGENT TARGET TASK		
	7.7	SIMULATED REMOTE INFORMATION CENTER (SRIC) TASK		
	7.8	AIR-DROP TASK		
	7.9	INTEROPERABILITY TASK		
	7.10	SENSE, DETECT AND AVOID (SDA) TASK		

Appendix D: Map of Competition (EXAMPLE ONLY)



Map key (EXAMPLE ONLY - NOT ACTUAL LOCATIONS FOR THIS YEAR)

- White Triangle: Pit Area Tents (same each year)
- Red Star: Flight Line Tents (same each year)
- Red outline: No-fly-zone boundary (generally the same each year)
- Yellow pins: Boundary judge station s(generally the same each year)
- Blue outline: Waypoint sequence (different each year)
- Green outline: Target search area (different each year)
- Blue Circle: Off-axis target (different each year)
- DROP: Egg Drop location (same each year)
- SRIC and LKP: SRIC and Last Known Position locations (different each year)
- IRPr and IRSE: Infrared target locations (different each year, not planned this year)

Appendix E: Electronic Target Data Format (EXAMPLE ONLY)

Name the file using the initials of your school or team as a text file (.txt). Example: JHU.txt

11 fields, tab delimited, new target on each line. **Example for two targets** is shown here:

1	2	3	4	5	6	7	8	9	10	11
01	STD	N30 35 34.123	W075 48 47.123	N	rectangle	red	A	orange	T1.jpg	AutoDetect
02	STD	S34 00 12.345	E002 01 12.345	SE	square	orange	4	yellow	T2.jpg	Actionable Intel
03	QRC	N51 28 40.125	W000 00 05.310						T3.jpg	www.example.edu
04	EMG	N38 53 19.680	W077 01 12.000						T4.jpg	fire fighter....
05	OAX			E	triangle	green	F	white	T5.jpg	
06										
07										

Field 1 - Target number, two digits, starting at 01 and increment by one for each additional target.

Target number is assigned by team.

Example: 01, 02, 03, etc.

Field 2 - Target Type in 3 digit form: Standard = STD, Quick Reaction Code = QRC, Off-Axis = OAX, Emergent = EMG

Field 3 - Latitude in the following format: first character N or S, two digit degrees (use leading zeros if necessary), followed by space, two digit minutes, followed by space, two digit seconds followed by decimal point and up to 3 digits (thousandths of a second)

Example: N30 35 34.123

Field 4 - Longitude in the following format: first character E or W, three digit degrees (use leading zeros if necessary), followed by space, two digit minutes, followed by space, two digit seconds followed by decimal point and up to 3 digits (thousandths of a second)

Example: W075 48 47.123

Field 5 - Target cardinal and ordinal directions, up to two characters

Example: N, NE, E, SE, S, SW, W, NW

Field 6 - Target shape; list geometric shape as appropriate:

Example: Circle, Semicircle, Quarter Circle, Triangle, Square, Rectangle, Trapezoid, Pentagon, Hexagon, Heptagon, Octagon, Star, or Cross.

Field 7 - Target colors, list as appropriate.

Example: White, Black, Gray, Red, Blue, Green, Yellow, Purple, Brown, or Orange.

Field 8 - Alphanumeric may consist of one or more characters defined as:

Example: 0123456789ABCDEFGHIJKLMNQRSTUUVWXYZabcdefghijklmnopqrstuvwxyz.

Field 9 - Alphanumeric colors, list as appropriate.

Example: White, Black, Gray, Red, Blue, Green, Yellow, Purple, Brown, or Orange.

Field 10 - Name of JPEG file with image of target

Example: T1.jpg

Field 11 - Amplifying Text, as appropriate.

Example: "Actionable Intelligence", "Automatic Detections", emergent target description, Active IR target description, etc.

Appendix F: Target Score Sheets (EXAMPLE ONLY)

Team: _____

Standard Target, Actionable Intelligence and Off-Axis Target

Target # _____ Action Intel? Y Off-Axis: Y	Target # _____ Action Intel? Y Off-Axis: Y
Latitude (except Off-Axis Target): (N/S ddd mm ss.sss)	Latitude (except Off-Axis Target): (N/S ddd mm ss.sss)
Longitude (except Off-Axis Target): (E/W ddd mm ss.sss)	Longitude (except Off-Axis Target): (E/W ddd mm ss.sss)
Orientation: (N, NE, E, SE, S, SW, W, NW)	Orientation: (N, NE, E, SE, S, SW, W, NW)
Shape:	Shape:
Background Color:	Background Color:
Alphanumeric:	Alphanumeric:
Alphanumeric Color:	Alphanumeric Color:
Target # _____ Action Intel? Y Off-Axis: Y	Target # _____ Action Intel? Y Off-Axis: Y
Latitude (except Off-Axis Target): (N/S ddd mm ss.sss)	Latitude (except Off-Axis Target): (N/S ddd mm ss.sss)
Longitude (except Off-Axis Target): (E/W ddd mm ss.sss)	Longitude (except Off-Axis Target): (E/W ddd mm ss.sss)
Orientation: (N, NE, E, SE, S, SW, W, NW)	Orientation: (N, NE, E, SE, S, SW, W, NW)
Shape:	Shape:
Background Color:	Background Color:
Alphanumeric:	Alphanumeric:
Alphanumeric Color:	Alphanumeric Color:
Target # _____ Action Intel? Y Off-Axis: Y	Target # _____ Action Intel? Y Off-Axis: Y
Latitude (except Off-Axis Target): (N/S ddd mm ss.sss)	Latitude (except Off-Axis Target): (N/S ddd mm ss.sss)
Longitude (except Off-Axis Target): (E/W ddd mm ss.sss)	Longitude (except Off-Axis Target): (E/W ddd mm ss.sss)
Orientation: (N, NE, E, SE, S, SW, W, NW)	Orientation: (N, NE, E, SE, S, SW, W, NW)
Shape:	Shape:
Background Color:	Background Color:
Alphanumeric:	Alphanumeric:
Alphanumeric Color:	Alphanumeric Color:

Team: _____

Autonomously Detected, Located and Classified Targets (EXAMPLE ONLY)

Target # _____ Standard? Y QRC: Y	Target # _____ Standard? Y QRC: Y
Latitude: (N/S ddd mm ss.sss)	Latitude: (N/S ddd mm ss.sss)
Longitude: (E/W ddd mm ss.sss)	Longitude: (E/W ddd mm ss.sss)
Orientation (Standard Target Only): (N, NE, E, SE, S, SW, W, NW)	Orientation (Standard Target Only): (N, NE, E, SE, S, SW, W, NW)
Shape (Standard Target Only):	Shape (Standard Target Only):
Background Color(Standard Target Only):	Background Color(Standard Target Only):
Alphanumeric(Standard Target Only):	Alphanumeric(Standard Target Only):
Alphanumeric Color (Standard Target Only):	Alphanumeric Color (Standard Target Only):
Message (QRC Only):	Message (QRC Only):
Target # _____ Standard? Y QRC: Y	Target # _____ Standard? Y QRC: Y
Latitude: (N/S ddd mm ss.sss)	Latitude: (N/S ddd mm ss.sss)
Longitude: (E/W ddd mm ss.sss)	Longitude: (E/W ddd mm ss.sss)
Orientation (Standard Target Only): (N, NE, E, SE, S, SW, W, NW)	Orientation (Standard Target Only): (N, NE, E, SE, S, SW, W, NW)
Shape (Standard Target Only):	Shape (Standard Target Only):
Background Color(Standard Target Only):	Background Color(Standard Target Only):
Alphanumeric(Standard Target Only):	Alphanumeric(Standard Target Only):
Alphanumeric Color (Standard Target Only):	Alphanumeric Color (Standard Target Only):
Message (QRC Only):	Message (QRC Only):
Target # _____ Standard? Y QRC: Y	Target # _____ Standard? Y QRC: Y
Latitude: (N/S ddd mm ss.sss)	Latitude: (N/S ddd mm ss.sss)
Longitude: (E/W ddd mm ss.sss)	Longitude: (E/W ddd mm ss.sss)
Orientation (Standard Target Only): (N, NE, E, SE, S, SW, W, NW)	Orientation (Standard Target Only): (N, NE, E, SE, S, SW, W, NW)
Shape (Standard Target Only):	Shape (Standard Target Only):
Background Color(Standard Target Only):	Background Color(Standard Target Only):
Alphanumeric(Standard Target Only):	Alphanumeric(Standard Target Only):
Alphanumeric Color (Standard Target Only):	Alphanumeric Color (Standard Target Only):
Message (QRC Only):	Message (QRC Only):

Team: _____

Emergent Target, Quick Reaction Code Target and IR Targets (EXAMPLE ONLY)

Target # _____ EMERGENT TARGET	Target # _____ QUICK REACTION CODE TARGET
Latitude: (N/S ddd mm ss.sss)	Latitude (except Off-Axis Target): (N/S ddd mm ss.sss)
Longitude: (E/W ddd mm ss.sss)	Longitude (except Off-Axis Target): (E/W ddd mm ss.sss)
Description: _____	Text: _____
_____	_____
_____	_____
Target # _____ QUICK REACTION CODE TARGET	Target # _____ QUICK REACTION CODE TARGET
Latitude: (N/S ddd mm ss.sss)	Latitude (except Off-Axis Target): (N/S ddd mm ss.sss)
Longitude: (E/W ddd mm ss.sss)	Longitude (except Off-Axis Target): (E/W ddd mm ss.sss)
Text: _____	Text: _____
_____	_____
_____	_____
Target # _____ IR PRIMARY TARGET	Target # _____ IR SECONDARY TARGET
Orientation: (N, NE, E, SE, S, SW, W, NW)	Orientation: (N, NE, E, SE, S, SW, W, NW)
Symbol:	Symbol: _____

SECRET MESSAGE	

Appendix G: SRIC Details

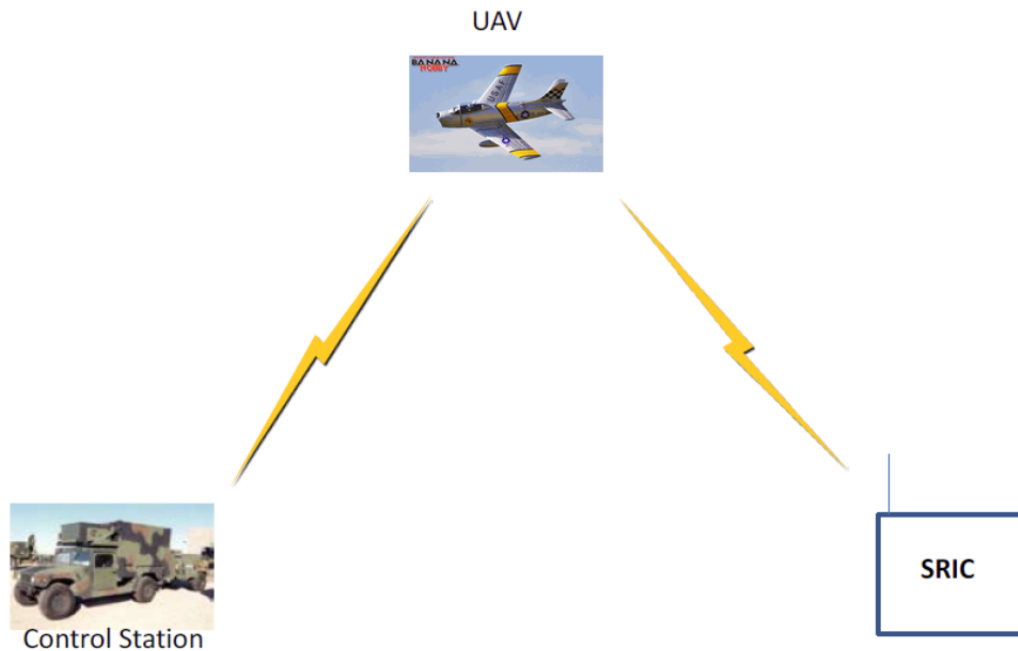


FIGURE G-1: SRIC CONNECTION DIAGRAM

1.0 General

1.1 **Scope:** This document provides or references the data definitions required for transfer of data from the Simulated Remote Information Center (SRIC) to the competing team's UAS. These definitions encompass the data link and message interfaces.

2.0 Equipment Definition:

2.1 The SRIC will comprise of a computer running an FTP server, a Linksys Model WRT54GL Wireless Broadband Router, a 10 dB attenuator, and a TRENDnet Model TEW-A014D High-gain directional antenna. The SRIC block diagram is shown in Figure 2.

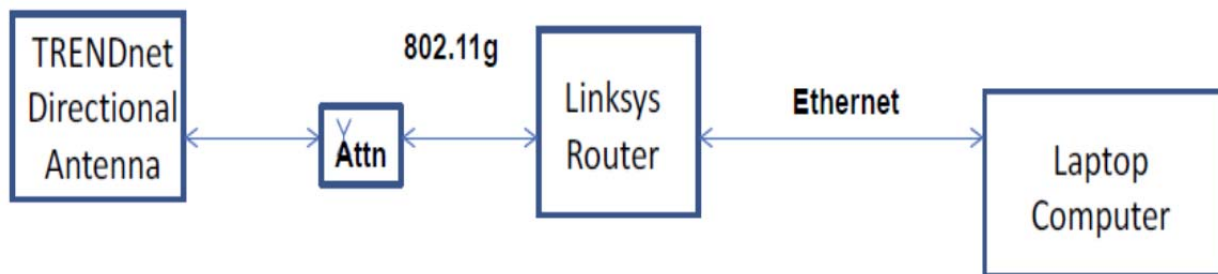


FIGURE G-2: SRIC BLOCK DIAGRAM

2.2 The Linksys WRT54GL Router and the Linksys URL are shown in Figure 3.

2.3 The TRENDnet Model TEW-A014D High-gain Directional Antenna and the TRENDnet URL are shown in Figure 4.



FIGURE G-3: SRIC ROUTER

http://homedownloads.cisco.com/downloads/WRT54GL_V11_DS_NC-WEB,0.pdf



FIGURE G-4: SRIC ANTENNA

http://www.trendnet.com/products/proddetail.asp?prod=145_TEW-A014D&cat=926

3.0 APPLICABLE DOCUMENTS

3.1 IEEE 802.11g specification available at:
<http://standards.ieee.org/findstds/standard/802.11g-2003.html>

4.0 INTERFACE DESCRIPTIONS

4.1 **Logon Procedures:** Each team will be provided unique logins, including both username and password.

- 4.1.1 The antenna location and the wireless network name (SSID) will be provided at the Check-in and Orientation event.
- 4.1.2 The router IP address, netmask, static IP Address, network passphrase, and folder name will be provided by the Lead Judge at the start of setup time on the flight line.
- 4.1.3 Students will be allowed to test the network connection during safety inspection.
- 4.1.4 The student teams **shall** use secure encryption when accessing SRIC.
- 4.1.5 When flying in the specified area, connect to the network. The router will be located on wireless channel 1 at 2.412 GHz.
- 4.1.6 Enter the provided network passphrase.
- 4.1.7 Dynamic Host Configuration Protocol (DHCP) will be enabled. At check-in and orientation, teams will be provided a static IP address they may use and the DHCP range.
- 4.1.8 After network connection is confirmed, enter the provided IP address.
 - 4.1.8.1 An example for Team 1 is below:
 - 4.1.8.1.1 FTP://192.168.1.110/auvsi/team1/X/download.txt.
- 4.1.9 Open the folder and find a unique team file within the folder.
- 4.1.10 Follow the SUAS rules to allow the judges to score the team's success in opening the folder and accessing the unique team file within the folder.

4.2 **Antenna Patterns**

- 4.2.1 The directional antenna patterns are shown in Figure 5.
 - 4.2.1.1 **NOTE:** The air vehicle **MUST** stay within the SRIC beam width to log into the network, receive the secret word, and uplink imagery.

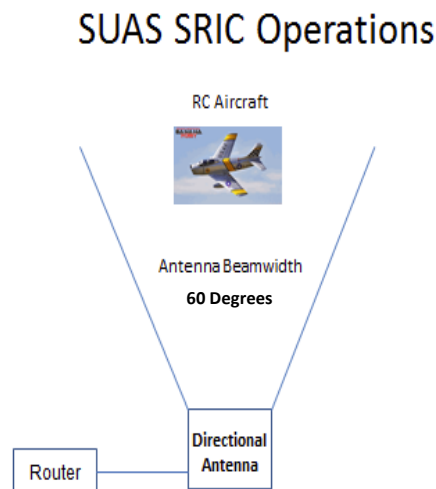


FIGURE G-5: DIRECTIONAL ANTENNA PATTERN

Appendix H: Interoperability Specifications

1. This section gives the Interoperability Specification, which includes how to setup the physical network, how to configure the network, where to find specifications for the interoperability interface, and what the interoperability deliverables should look like.
2. **Implementation – Service Interface**
 - 2.1. **Implementation.** The interoperability task is based on standard web communication. Teams should connect to the web server to both upload and download data via HTTP requests. All JSON formatted data and HTTP parameters will have a specific format that specifies the interface.
 - 2.2. **Network for Communication.** The UAS ground system should connect to the competition system using a provided Ethernet cable. This cable will be connected to a router configured with both DHCP and static IP addresses. A computer provided by the competition will also be connected to the router, and this computer will host the web server. The IP address and hostname of the web server shall be provided during the competition.
 - 2.3. **Inter-Computer Data Transport.** The team's ground system should make HTTP requests to the web server at the specified rate. URLs will be provided which specify the resource path for downloading and uploading data. Teams shall authenticate using standard web authentication in order to make requests.
 - 2.4. **Service Interface.** The teams shall be provided with JSON format descriptions, relative URL paths, and HTTP parameter documentation. For testing prior to competition, the teams shall be provided with a sample web server that will implement the interface defined. This may or may not be the final server used at competition.
3. **Interoperability Network.**
 - 3.1. The judges will provide the interoperability network during the competition. Multiple teams may be connected to the network at one time. Care will be taken to ensure that the network is partitioned through components like VLAN, IP range restrictions, and web authentication. This section describes what is necessary to develop and test interoperability.
 - 3.1.1. **Network Hardware.** The hardware required is a router, 2 Ethernet cables, and 2 computers. One computer will act as the interoperability web server, and at competition the judges will provide it. The other computer will be provided by the team and will contain software that performs the interoperability task. The Ethernet cables will be provided and will be standard Cat5e cables for gigabit Ethernet. Both computers do not need to support gigabit Ethernet, but they should be able to provide 100 Mbps full duplex. The router provided will be a Linksys WRT54GL. Although this is the same router model as the SRIC task, two separate routers will be used during the competition. The two networks, one for SRIC and one for interoperability, will remain unconnected. The Wi-Fi on the router for interoperability will be disabled.
 - 3.1.2. **Network Setup.** To setup the network, connect one Ethernet computer from the team's computer to the router. Connect another Ethernet computer from the router to the computer that will operate the interoperability web server. The router will be configured to assign DHCP addresses in a specific range, and accept static IP addresses in a separate range. The two ranges will be provided at the competition. The IP addresses will be on the subnet 10.10.130.XXX with subnet mask 255.255.255.0.

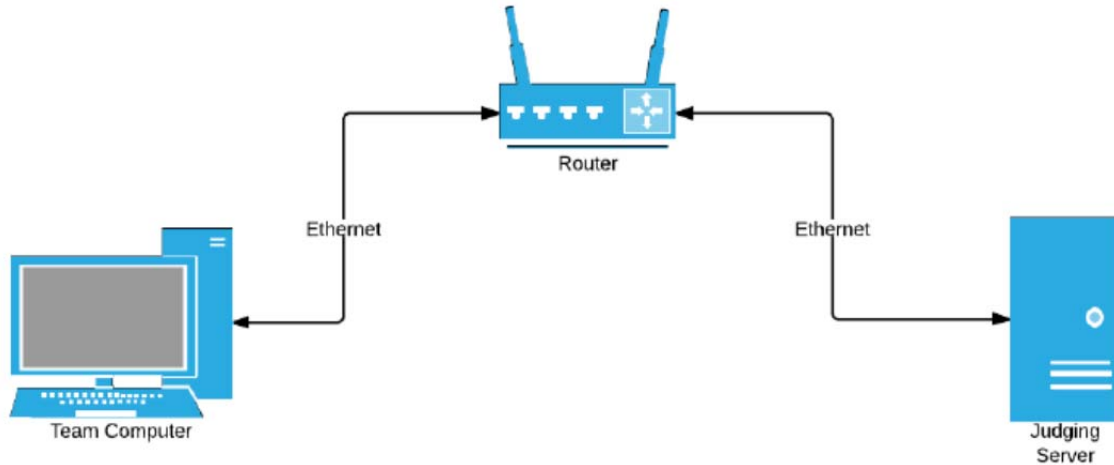


FIGURE H-1

3.1.3. Network Stack. The interoperability web server will communicate via HTTP over TCP/IP. Requests will be generated by the team's software, it will be forwarded over the network, and it will be delivered to the web server. The web server will interpret the URL and HTTP parameters provided to form an appropriate response. The response will then be forwarded back to the team's software. The web server will provide appropriate error messages should the request be incorrect or a problem occur. Teams should display these errors for debugging during a mission.

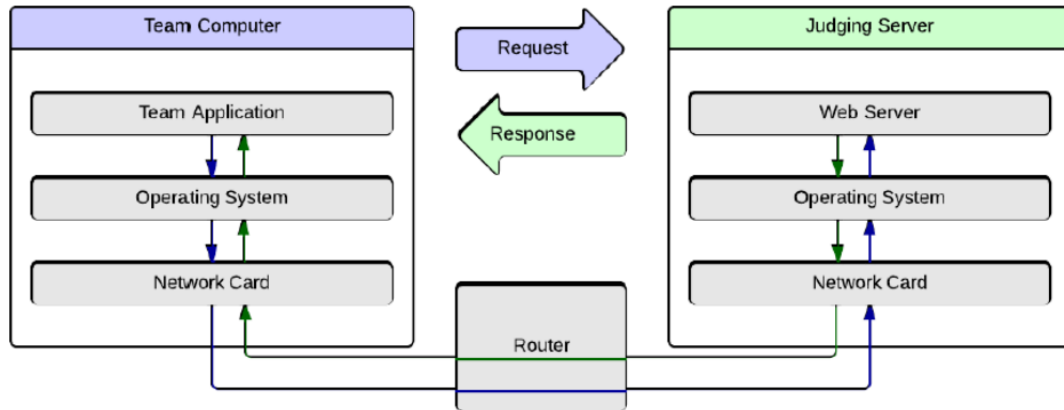


FIGURE H-2

3.2. Code Repository.

3.2.1. The code for the interoperability web server is on the Code Repository. The repository is hosted on Github and is explained in the interoperability documentation website which contains instructions for how to checkout (download) the Code Repository. Cloning (downloading) and viewing the repository can be done by anybody (public), but pushing (uploading) to the repository is restricted. The repository contains the URL specifications, the JSON specifications, and the processing logic for the server. The source code is provided so that teams can get a better understanding of how the server is implemented, and so that teams can debug their implementations.

3.2.2. The interoperability documentation website contains documentation for the source code, the URL formats, and the JSON specifications. It also contains documentation for how to setup the server, how to configure the server, how to start the server, how to stop the server, and how to view server logs. The server logs will contain information useful for debugging implementations.

3.2.2.1. The GitHub Organization: <https://github.com/auvsi-suas>

3.2.2.2. The Git Repository: <https://github.com/auvsi-suas/interop>

3.2.2.3. The Interoperability Documentation: <http://auvsi-suas-competition-interoperability-system.readthedocs.org/en/latest/>

4. Mission Operation – Mission Flight Time

4.1. **Mission Operation.** In the competition rules, teams are given the information necessary to build systems that integrate with standard interface architecture. The teams will receive additional information at competition, the day before flights, which will enable teams to configure their systems.

4.2. **Before Competition.** The standard interface architecture will be provided to teams as part of releasing the rules. This includes the format of the URLs, which indicate the relative paths but not the base path (hostname and port), the various HTTP parameters, and the format of the JSON data. During the year before competition, updates may be applied to the interoperability server and synced with the code repository. Teams shall download and sync updates through the code repository.

4.3. **Day Before Mission Demonstration (Flights).** Teams will be given the static IP address, the hostname, and the port of the web server, which together comprise the base path of the request URLs.

4.4. **Mission Setup Time.** Teams will be able to physically connect Ethernet cables to their UAS ground station. The Ethernet cord may or may not be connected to the router. Regardless of whether the cord is connected or not, the web server will ignore requests and return appropriate error codes. Teams will also be given authentication credentials. Teams must not share these credentials.

4.5. **Mission Flight Time.** At the start of the mission the judge server will be reconfigured to accept and respond to requests from the UAS system. If the Ethernet cord was not connected, it will be connected and allow teams to communicate. Teams **shall** then start downloading and displaying the server clock, downloading and displaying the obstacles, and uploading the UAS position. The teams **shall** continue downloading and uploading for the remainder of the mission flight time.

4.6. **Report UAS Position.** The UAS position **shall** be uploaded to the competition server. The reported data must be unique. It must be generated by the autopilot. The data reported cannot be interpolated or extrapolated from autopilot data. The judges will have a system to evaluate whether the reported position corresponds to where the aircraft is actually located.

4.7. **Upload Target Data.** The targets identified by the UAS and team should be uploaded to the interoperability system as the primary mechanism for target submission. Teams should also submit the USB drive and a printed hard copy as backup.

Appendix I: AUVSI SUAS Risk and Waiver of Liability Form

Association for Unmanned Vehicle Systems International (AUVSI) Foundation and Seafarer Chapter Student Unmanned Aerial System (SUAS) Competition Release and Waiver of Liability Form

Name of Participant _____ Date of birth _____

Emergency contact: Name _____ Telephone # _____

If you have any serious health issues/problems and would like us to be aware of them, please list here:

I understand my participation in the AUVSI Foundation and AUVSI Seafarer Chapter's Student UAS (SUAS) Competition requires me to be present on Federal Government property at the Webster Outlying Field (aka. Webster Field) Facility located at the Naval Air Warfare Center Aircraft Division (NAWCAD), Naval Air Station (NAS) Patuxent River (PAX River), Maryland (MD), United States of America (USA).

The U.S. Navy and NAWCAD and NAS PAX River make every effort to minimize potential dangers at SUAS; however, such risks can never be completely eliminated. Participants and related persons should be adequately prepared for potential hazards to persons and/or property involving transiting to and from the NAS PAX River Webster Field Facility, transporting equipment, and accidental drowning.

In exchange for the privilege of participating in SUAS, I agree, for myself, my heirs, executors and administrators, to release, indemnify, and hold harmless the U.S. Navy, NAWCAD and NAS PAX River, its personnel and equipment, and the AUVSI Foundation and AUVSI Seafarer Chapter, their staff, contractors, sponsors and volunteers from any and all liability, claims, demands, and causes of action whatsoever, including bodily injury resulting from SUAS or anyone administering emergency assistance, and including risk of loss or damage to personal property to me or other participants, arising out of my presence at or participation in SUAS, whether it results from negligence or any other cause.

I agree while on NAS PAX River Webster Field property that I will comply with all rules and regulations governing my presence. I understand I may be subject to search upon entrance to NAS PAX River Webster Field and must submit to such search of my vehicle or person. I assume full responsibility for any bodily injury and/or property damage arising out of or related to my attendance and/or participation.

I further agree that if at anytime I feel any activity during SUAS to be unsafe or if I observe unsafe behavior on the part of other participants/observers, I will immediately notify the appropriate Competition or Government official and/or refuse to participate in or observe any further activities.

I am aware of the risks and hazards inherent in participating in SUAS and I elect to voluntarily participate, knowing that participation may entail a risk of injury.

In signing this release, I acknowledge and represent:

- (a) That I have read the above release, understand it, and sign voluntarily;
- (b) That I have no known physical or mental impairment that might increase the likelihood of serious injury from such participation;
- (c) That, if signing on behalf of a Minor participant, I have the legal capacity to do so.

Photo, Video, and Audio Release: I hereby assign and grant to the AUVSI Foundation and AUVSI Seafarer Chapter the right and permission to use and publish the photographs/film/video/audio/electronic representations and/or sound recordings resulting from my participation in SUAS, and I hereby release the AUVSI Foundation and AUVSI Seafarer Chapter and any photo, video, audio and/or electronic content contractor, sponsor or volunteer, from any and all liability from such use and publication.

Signature: _____ Date _____ Phone _____

Printed: _____ Email: _____

(PARENT'S OR GUARDIAN'S ADDITIONAL INDEMNIFICATION ON REVERSE SIDE)

PARENT 'S OR GUARDIAN 'S ADDITIONAL INDEMNIFICATION:
(Must be completed for participants under the age of 18)

In consideration of _____(Minor)
being permitted to participate in SUAS and to use the Webster Field Facility located at NAS PAX River, I
further agree to indemnify and hold harmless the U.S. Navy and NAWCAD, NAS PAX River, and Webster
Field, its personnel and equipment, and the AUVSI Foundation and AUVSI Seafarer Chapter, from any
and all claims which are brought by, or on behalf of Minor, and which are in any way connected with
such use or participation by Minor.

Signature: _____ Date _____ Phone _____

Printed: _____ Email: _____

Appendix J: Base Access Information Form and Personal ID

Data Required for Base Access

- 1) All attendees of the AUVSI Student UAS (SUAS) competition held at Webster Field, Maryland, must have approved Navy base access. If you already have access with a CAC, or RapidGATE and Visitors Badge, you do not need to do any more. If you do not already have base access, you are required to provide the following information within the required time.
- 2) Arranging Base Access is a major task with the number of participants and guests. We strongly recommend each team member to get their personal data submitted as early as possible. Failure to provide the required form and data prior to the deadline will result in those individual's data to not be processed and those individual's not being allowed to access the Navy base, effectively eliminating them from the competition.
- 3) **The SECNAV form and identification (ID) data are due before the deadline listed in Section 3.0.**
- 4) **SECNAV FORM REQUIRED FOR BASE ACCESS.** **ALL** students, advisors, support groups, parents, volunteers, judges, sponsors, and visitors that require Base Access, and do not already have it, **shall** complete the attached Security Form, SECNAV 5512/1, DEPARTMENT OF THE NAVY LOCAL POPULATION ID CARD/BASE ACCESS PASS REGISTRATION, with the required proof of identification.
 - a) Block 25 — Already filled in with our military sponsor.
 - b) Blocks 26, 27 or 28 — N/A; not required for this event.
 - c) Block 30 — Must return passes to the SUAS sponsor at the end of this event.
 - d) **Block 31 — This block must be signed for the form to be processed.**
- 5) **BACKGROUND CHECKS:** Base Access will not be allowed without a background check. A background check cannot be performed without completing the required form and signature.
- 6) **FORMS OF IDENTIFICATION REQUIRED.** Legible copies of the required forms of identification (ID) **shall** be provided.
 - a) Foreign Nationals: Required ID is a Passport.
 - b) All Others: Either only a Passport, or if no Passport provide one form of ID from **both** list A **and** B below:

A (one)	B (one)
Driver's License /Permit/State ID	Social Security Card
School ID	Birth Certificate (Original or Certified copy)
Voter's Registration Card	Certificate of Born Abroad issued by State
Military ID or Dependent's ID card	Department
If under age 18: School ID or Report card	US Citizen ID Card

- c) **You shall bring the SAME** identification with you to the competition to be verified on-site.
- 7) To ensure a secure method of submission, teams **shall** mail letters, data, and photo copies of ID, along with the completed and signed SECNAV 5512/1 forms and required forms of identifications to the *AUVSI Seafarer Chapter* address below, or by UPS or FEDEX to the alternate addresses below:

U.S. Postal Service	UPS or FEDEX
AUVSI Seafarer Chapter P.O. Box 141 California, MD 20619 ATTN: Mr. Tim Piester	AECOM 46591 Expedition Drive, Suite 100 Lexington Park, Maryland 20653 ATTN: Mr. Tim Piester/ 301-862-1246

- 8) This data **shall** NOT be uploaded to SharePoint, **shall** NOT be e-mailed and **shall** NOT be sent by FAX.

OMB 0703-0061 Exp. 31 Mar 2017

DEPARTMENT OF THE NAVY LOCAL POPULATION ID CARD/BASE ACCESS PASS REGISTRATION						
PRIVACY ACT STATEMENT:						
AUTHORITY: 10 U.S.C. 5013, Secretary of the Navy; 10 U.S.C. 5041, Headquarters, Marine Corps; OPNAVINST 5530.14E, Navy Physical Security; Marine Corps Order 5530.14A, Marine Corps Physical Security Program Manual; and E.O. 9397 (SSN), as amended, SORN <u>NM05512-2</u> . PURPOSE(S): To control physical access to Department of Defense (DoD), Department of the Navy (DON) or U.S. Marine Corps installations/units controlled information, installations, facilities, or areas over which DoD, DON, or U.S. Marine Corps has security responsibilities by identifying or verifying an individual through the use of biometric databases and associated data processing/information services for designated populations for purposes of protecting U.S./Coalition/allied government/national security areas of responsibility and information; to issue badges, replace lost badges, and retrieve passes upon separation; to maintain visitor statistics; collect information to adjudicate access to facility; and track the entry/exit times of personnel. ROUTINE USE(S): To designated contractors, Federal agencies, and foreign governments for the purpose of granting Navy officials access to their facility. DISCLOSURE: Providing registration information is voluntary. Failure to provide requested information may result in denial of access to benefits, privileges, and DoD installations, facilities and buildings.						
IDENTITY PROOFING AND APPLICANT INFORMATION						
1. LAST NAME:		2. FIRST NAME:		3. MIDDLE NAME:		
				4. NAME SUFFIX: <input type="checkbox"/> Jr. <input type="checkbox"/> Sr. <input type="checkbox"/> I <input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> IV		
5. HISPANIC OR LATINO (Check one): <input type="checkbox"/> YES <input type="checkbox"/> NO		6. RACE (Check one or more): <input type="checkbox"/> WHITE <input type="checkbox"/> AFRICAN AMERICAN OR BLACK <input type="checkbox"/> ASIAN <input type="checkbox"/> AMERICAN INDIAN OR ALASKIN NATIVE <input type="checkbox"/> NATIVE HAWAIIAN OR OTHER PACIFIC ISLANDER				
7. GENDER (Check one): <input type="checkbox"/> MALE <input type="checkbox"/> FEMALE		8. DATE OF BIRTH:	9. CITY OF BIRTH:	10. STATE OF BIRTH:	11. BIRTH COUNTRY:	
12. US CITIZEN (Check): <input type="checkbox"/> YES <input type="checkbox"/> NO		13. DUAL CITIZENSHIP: <input type="checkbox"/> YES <input type="checkbox"/> NO CITIZENSHIP IF OTHER THAN US (Country) :				
U.S. Citizen Minimum Documentation Required: By Birth - Social Security No and/or State ID/Drivers License. Naturalized - Certification Number, Petition Number, Date, Place and Court, United States passport number, Social Security No and/or State ID/Drivers License. Derived - Parent's certification number, Social Security No and/or State ID/Drivers License.						
Alien Minimum Documentation Required: Registration Number, Expiration date, Date of entry, Port of entry.						
14. IDENTITY SOURCE DOCUMENTS PRESENTED:		15. DOCUMENT NUMBER:	16. ISSUED BY STATE/COURT:	17. ISSUED BY COUNTRY:	18. ISSUED:	
<input type="checkbox"/> Social Security No.				United States		
<input type="checkbox"/> State ID/Drivers License				United States		
<input type="checkbox"/> Passport No.						
<input type="checkbox"/> Certification Number and Petition Number						
<input type="checkbox"/> Derived - Parent's Certification Number:				United States		
<input type="checkbox"/> Alien Registration No.				United States		
			Date of Entry:		Port of Entry:	
OTHER APPROVED IDENTITY SOURCE DOCUMENTS:						
<input type="checkbox"/>						
<input type="checkbox"/>						
20. WEIGHT (Pounds):	21. HEIGHT (Inches):	22. HAIR COLOR (Check one): <input type="checkbox"/> Blond <input type="checkbox"/> Brown <input type="checkbox"/> Black <input type="checkbox"/> Gray <input type="checkbox"/> Red <input type="checkbox"/> White <input type="checkbox"/> Silver <input type="checkbox"/> Auburn <input type="checkbox"/> Bald			23. EYE COLOR (Check one): <input type="checkbox"/> Brown <input type="checkbox"/> Green <input type="checkbox"/> Blue <input type="checkbox"/> Hazel <input type="checkbox"/> Black <input type="checkbox"/> Gray <input type="checkbox"/> Violet <input type="checkbox"/> Unknown	
24. HOME ADDRESS (Include city, state, zip code):				HOME PHONE (Include Area Code):		
25. BASE SPONSOR'S NAME:				SPONSOR PHONE (Include Area Code):		
EMPLOYMENT ACTIVITY INFORMATION						
26. EMPLOYER NAME AND ADDRESS (Include city/state/zip code):				EMPLOYER PHONE (Include Area Code):		
27. SUPERVISOR NAME AND ADDRESS (Include city/state/zip code):				SUPERVISOR PHONE (Include Area Code):		
SECNAV 5512/1 (APR 2014) Page 1 of 3 FOR OFFICIAL USE ONLY WHEN FILLED - PRIVACY SENSITIVE: Any misuse or unauthorized disclosure of this information may result in both criminal and civil penalties.						

OMB 0703-0081 Exp. 31 Mar 2017			
28. Check the applicable box for WORK HOURS box or check the OTHER box and enter the work hours, then check the applicable for WORK DAYS:			
WORK HOURS: <input type="checkbox"/> 0600-1800 <input type="checkbox"/> 0800-1700 <input type="checkbox"/> OTHER _____		WORK DAYS: <input type="checkbox"/> SN <input type="checkbox"/> M <input type="checkbox"/> T <input type="checkbox"/> W <input type="checkbox"/> TH <input type="checkbox"/> F <input type="checkbox"/> ST	
PRIOR FELONY CONVICTIONS			
29. Have you ever been convicted of a Felony? <input type="checkbox"/> YES <input type="checkbox"/> NO _____ <i>Initial</i>			
REQUIREMENT TO RETURN LOCAL POPULATION ID CARD			
30. I understand that I am required to return my Local Population Identification Card to the Base Pass Office when it expires or if my employment is terminated for any reason. _____ <i>(Initial)</i>			
AUTHORIZATION AND RELEASE AND CERTIFICATION			
<p>31. I hereby authorize the DOD/DON and other authorized Federal agencies to obtain any information required from the Federal government and/or state agencies, including but not limited to, the Federal Bureau of Investigation (FBI), the Defense Security Service (DSS), the U.S. Department of Homeland Security (DHS).</p> <p>I have been notified of DON right to perform minimal vetting and fitness determination as a condition of access to DON installation/facilities. I understand that I may request a record identifier; the source of the record and that I may obtain records from the State Law Enforcement Office as may be available to me under the law. I also understand that this information will be treated as privileged and confidential information.</p> <p>I release any individual, including records custodians, any component of the U.S. Government or the individual State Criminal History Repository supplying information, from all liability for damages that may result on account of compliance, or any attempts to comply with this authorization. This release is binding, now and in the future, on my heirs, assigns, associates, and personal representative(s) of any nature. Copies of this authorization that show my signature are as valid as the original release signed by me.</p> <p>FALSE STATEMENTS ARE PUNISHABLE BY LAW AND COULD RESULT IN FINES AND/OR IMPRISONMENT UP TO FIVE YEARS.</p> <p>BEFORE SIGNING THIS FORM, REVIEW IT CAREFULLY TO MAKE SURE YOU HAVE ANSWERED ALL QUESTIONS FULLY AND CORRECTLY.</p> <p>I DECLARE UNDER PENALTY OF PERJURY THAT THE STATEMENTS MADE BY ME ON THIS FORM ARE TRUE, COMPLETE AND CORRECT</p> <p>DATE _____ SIGNATURE _____</p> <p>FINAL DETERMINATION ON YOUR ACCESS: The Base Commanding Officer has final authority for determination on granting physical access to DON controlled installations/facilities under his/her jurisdiction.</p>			
BELOW COMPLETED BY BASE REGISTRAR PERSON CONDUCTING IDENTITY PROOFING and NCIC CHECK			
32. INFORMATION VERIFIED BY:	33. ENTERED IN C/S SYSTEM BY:	34. PASS ISSUE DATE:	35. PASS EXPIRATION DATE:
36. NCIC CHECK PERFORMED BY:	37. RESULTS OF NCIC CHECK: <input type="checkbox"/> NO RECORDS <input type="checkbox"/> RECORD IDENTIFIER RECORD NUMBER: _____	38. RESULTS OF LOCAL RECORDS CHECK: <input type="checkbox"/> NO RECORDS <input type="checkbox"/> RECORD IDENTIFIER RECORD NUMBER: _____	
Office of Under Secretary of Defense Directive-Type Memorandum (DTM) 09-012, "Interim Policy Guidance for DoD Physical Access Control," December 8, 2009. DTM 09-012 requires that DoD installation government representatives query the National Crime Information Center (NCIC) and Terrorist Screening Database to vet the claimed identity and to determine the fitness of non-federal government and non-DoD-issued card holders (i.e. visitors) who are requesting unescorted access to a DoD installation. The minimum criteria to determine the fitness of a visitor is: 1) not on a terrorist watch list; 2) not on a DoD installation debarment list; and 3) not on a FBI National Criminal Information Center (NCIC) felony wants and warrants list. Additionally, SECNAV Memo, Policy for Sex Offender Tracking and Assignment and Access Restrictions within the Department of the Navy, of 7 Oct 08 and OPNAVINST 1752.3 established the Navy's policy on sex offenders, requiring Region Commanders (REGCOMs) and Installation Commanding Officers (COs) to prohibit sex offender access to DoN facilities and Navy owned, leased or PPV housing. This form describes the authority and purpose to collect and share the required information; and identifies the applicant/visitor and sponsor; and authorizes the DoD to perform the minimum vetting and fitness determination criteria. A favorable response on the vetting and fitness determination is required to receive access to DOD-controlled installation/facilities.			
SECNAV 5512/1 (APR 2014)		FOR OFFICIAL USE ONLY WHEN FILLED - PRIVACY SENSITIVE: Any misuse or unauthorized disclosure of this information may result in both criminal and civil penalties.	
		Page 2 of 3	

Instruction for completing the Local Population Access Registration Form

INSTRUCTIONS: Please complete all information in black ink (printed) or by typing. By voluntarily providing your Personal information, you agree to the following terms and restrictions:

RESTRICTIONS: Local Population Identification Card/Base Access Pass may only be used by person to whom they are issued and for the specific business/purpose issued. Applicants are reminded that soliciting (i.e., door-to-door sales) is prohibited on the base, and that such activity is grounds for cancellation of the Pass. Additionally, such action may result in debarment from the base and legal action. The Base Commanding Officer has discretion over specifying the period of validity for any Local Population ID Cards/Base Access Passes that are issued under his/her jurisdiction. Review the Privacy At Statement that is printed at the top of the form

<p>Block 1: Enter the Last Name. Block 2: Enter the First Name. Block 3: Enter the Middle Name. Block 4: If applicable, check the box for Name Suffix. Block 5: Check the applicable box for Hispanic or Latino. Block 6: Check the applicable box for Race. Block 7: Check the applicable box for Gender. Block 8: Enter Date of Birth. Block 9: Enter City of Birth. Block 10: Enter State of Birth. Block 11: Enter Country of Birth. Block 12: Check the applicable box for US Citizenship. Block 13: If not a US Citizen, enter the name of the Country of Citizenship. Block 14: Two forms of identity source documents from the list of acceptable documents listed below must be presented to the base registrar with this completed form. Check the box for the type of Documents that will be presented for identify proofing. If the document type is not listed, use the two rows under Other Approved Identity Source Documents to enter the type of document(s) that you will present. Block 15: Enter the Document Number located on the Identity Proofing Source document that was checked in Block 14. Block 16: Enter the State that issued the Identity Source Document. Block 17: Enter the Country that issued the Identity Source Document.</p>	<p>Block 18: Enter the Date that the Identity Source Document was issued. Block 19: Enter the Date that the Identity Source Document will expire. Block 20: Enter Weight in pounds. Block 21: Enter Height in Inches. Block 22: Check the applicable box for Hair Color. Block 23: Check the applicable box for Eye Color. Block 24: Enter Home Address including City, State, Zip Code, and Home Telephone Number. Block 25: Enter Name of Registrant's Base Sponsor and Base Sponsor's Telephone Number. Block 26: Enter Employer Name and address including City, State, Zip Code, and Employer's Telephone Number. Block 27: Enter Supervisor's Name including City, State, Zip Code, and Supervisor's Telephone Number. Block 28: Check the applicable box for Work Hours box or check the OTHER box and enter the work hours, then check applicable boxes for Work Days. Block 28: Check the applicable answer if you have been convicted of Felony and enter initials. Block 29: Check the applicable box for felony conviction. Block 30: Enter initials to accept terms for returning Local Population Identification Card. Block 31: Sign and date the form to attest that the foregoing information is true and complete to best of your knowledge.</p>
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**LIST OF ACCEPTABLE DOCUMENTS - All documents must not be expired.
 Must present one selection from List A or a combination of one selection from List B and one selection from List C.**

List A - Documents that Establish Identity and Employment Authorization	OR	List B - Documents that Establish Identity	AND	List C - Documents that Establish Employment Authorization
<ol style="list-style-type: none"> 1. U.S. Passport or U.S. Passport Card. 2. Permanent Resident Card or Alien Registration Receipt Card (Form I-551). 3. Foreign passport that contains a temporary I-551 stamp or temporary I-551 printed notation on a machine-readable Immigrant visa. 4. Employment Authorization Document that contains a photograph (Form I-766). 5. For a nonimmigrant alien authorized to work for a specific employer because of his or her status: <ol style="list-style-type: none"> a. Foreign Passport; and b. Form I-94 or Form I-94A that has the following: <ol style="list-style-type: none"> (1) The same name as the passport; and (2) An endorsement of the alien's nonimmigrant status as long as that period of endorsement has not yet expired and the proposed employment is not in conflict with and restrictions or limitations identified on form. 6. Passport from the Federal States of Micronesia (FSM) or the Republic of the Marshall Islands (RM) with Form I-94 or Form I-94A indicating nonimmigrant admission under the Compact of Free Association Between the United States and FSM or RM. 	<ol style="list-style-type: none"> 1. Driver's license or ID card issued by a State or outlying possession of the United States provided it contains a photograph or information such as name, date of birth, gender, height, eye color, and address. 2. ID card issued by federal, state or local government agencies or entities, provided it contains a photograph or information such as name, date of birth, gender, height, eye color, and address. 3. School ID card with a photograph 4. Voter's registration card. 5. U.S. Military card or draft record. 6. Military dependent's ID card. 7. U.S. Coast Guard Merchant Mariner Card. 8. Native American tribal document. 9. Driver's license issued by a Canadian government authority. <p>For persons under age 18 who are unable to present a document listed above:</p> <ol style="list-style-type: none"> 10. School record or report card. 11. Clinic, doctor, or hospital record. 12. Day-care or nursery school record. 	<ol style="list-style-type: none"> 1. A Social Security Account Number card, unless the card includes one of the following restrictions: <ol style="list-style-type: none"> (1) NOT VALID FOR EMPLOYMENT (2) VALID FOR WORK ONLY WITH INS AUTHORIZATION. (3) VALID FOR WORK ONLY WITH DHS AUTHORIZATION. 2. Certification of Birth Abroad issued by the Department of State (Form FS-545). 3. Certification of Birth issued by the Department of State (Form DS-1360). 4. Original or certified copy of birth certificate issued by a State, county, municipal authority or territory of the United States bearing an official seal. 5. Native American tribal document. 6. U.S. Citizen ID Card (Form I-197). 7. Identification Card for Use of Resident Citizen in the United States (Form I-179). 8. Employment authorization document issued by the Department of Homeland Security. 		

The remainder of the form will be completed by the Base Registrar Person conducting Identify Proofing process and NCIC check.

AGENCY DISCLOSURE STATEMENT:

The public reporting burden for this collection of information is estimated to average 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to the Department of Defense, Washington Headquarters Services, Executive Services Directorate, Information Management Division, 4800 Mark Center Drive, East Tower, Suite 02G09, Alexandria, VA 22350-3100 OMB 0703-0061. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PLEASE DO NOT RETURN COMPLETED FORM TO THE ABOVE ADDRESS.

Completed form should be submitted to the Base Registrar.

Appendix K: Foreign National – Additional SECURITY Information

Additional Information/Data Required for FOREIGN NATIONAL TEAM MEMBERS OR VISITORS

1. To gain base access to Webster Field, each person **shall** comply with the requirements of Appendix J and submit the Base Access Information Form and Personal Identification (ID) information.
2. **In addition, every team with a foreign national team member, guest or visitor shall provide a signed letter listing all of the foreign national's names and required data as described below.**
3. **All foreign students, faculty, or guests from the same university may be added on one letter.**
4. **No alterations or changes will be allowed after submission of the required letter.**
5. **The letter and identification (ID) data are due before the base access deadline listed in Section 3.0.**
6. Each team **shall** prepare a letter and provide the information requested below for each foreign national on **university letterhead** and **signed** by a responsible university official. The letter **shall** contain the following at a minimum:
 - a. **Purpose of visit:** **UNCLASSIFIED**, Students from this (*name of University or College*) will participate in the Association for Unmanned Vehicle Systems International (AUVSI) Student UAS (SUAS) Competition to be held at Webster Field, St. Inigoes, Maryland. Student teams will inspect and check their airplane and system, present an oral brief on the airplane and system they have built to fly in the competition, and will fly the vehicle around a prescribed course at Webster Field under the guidance and supervision of Navy Government personnel and other AUVSI officials and volunteers.
 - b. Confirmation that the visitation is strictly limited to the dates and times of the SUAS competition held at Webster Field, MD.
 - c. List the information requested below:
 - i. Name: (full legal name please)
 - ii. Place of Birth (POB):
 - iii. Date of Birth (DOB):
 - iv. Country of Citizenship:
 - v. Country of Residence:
 - vi. Title/position: (Team Lead, Team Member, Faculty Advisor, Guest, Sponsor, etc.)
 - vii. Passport, Visa or Resident Alien "Green Card" number (**specify**) and expiration date:
 1. **Also provide a photo copy of the passport or green card.**
 - viii. **Include University address, and phone and fax numbers.**
 - d. A **responsible University official** (a Dean, Department Head, or Senior Faculty official), other than persons listed on the request, **shall** sign the letter. **The official name and position, and the date, must be typed on the letter, along with the official's written signature and date.**