2014 Rules for AUVSI Seafarer Chapter 12th Annual Student UAS (SUAS) Competition

FINAL

Revision 1.0

24 October 2013

The Seafarer Chapter of the Association for Unmanned Vehicle Systems International (AUVSI) continues the Student UAS (SUAS) Competition aimed at stimulating and fostering interest in unmanned systems, technologies, and careers. The focus is on engaging students in systems engineering a total solution to a challenging mission, requiring the analysis, design, fabrication and demonstration of a system capable of completing specific autonomous aerial operations.

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1. Concept of Operations (CONOPS)

1.1. A huge forest fire raging in the steep, rugged forests of south central **Idaho** has already swollen to more than 100,000 acres and continues to grow due to high winds. Over 1,000 firefighters, from across the country, are currently fighting the stubborn, 10-day old blaze, which continues to threaten one of the West's most popular recreation areas. Approximately 2,500 residences, from nearby isolated residential communities, have been evacuated, while others from neighboring communities remain under a pre-evacuation warning. Forest Service crews, coupled with local fire departments and private crews hired by insurers and homeowners, battle both the main blaze and spot fires, in an effort protect homes from being consumed.

1.2. The U.S. Forest Service has requested intelligence, surveillance and reconnaissance (ISR) support using Unmanned Aircraft Systems (UAS) from the National Guard. The U.S. Forest Service stated that the aircraft "will identify where fire activity is located and how it is moving, which will improve the odds to protect life, property, and natural resources." A spokesman for the State's fire agency noted that the military UAS is being tasked for its most significant firefighting test to date and will provide commanders with real-time images and information on fire activity near firefighters and residents. The possibility exists that these UASs may be uniquely equipped to air-drop relief supplies to fire fighters caught behind the massive fire line. "Because the fire is so large ... we're hoping that new technology will allow us to better deploy our resources to save lives,'' he said.

1.3. The firefighters battling the blaze are aided by retardant-dropping helicopters and tanker airplanes. The UAS will assist firefighters by shouldering the burden normally carried out by larger manned helicopters, which must be refueled every two hours. ''The UAS is providing data directly back to the incident commander, allowing for quick decisions regarding which resources to deploy and where,'' the spokesman said. Officials were careful to point out that the images are being used to aid fire containment efforts. Outside the fire area, the UAS will fly a narrow and restricted flight path, monitored by State Officials.

1.4. Your team has been called upon to provide rapid response, via an UAS, that can support this ISR mission; which may evolve into a Search and Rescue (SAR) mission. In order to support this mission, your UAS must comply with Special Instructions (SPINS) for departure and arrival procedures, and then remain within assigned airspace. It will be tasked to search an area for items of interest and, if requested, to conduct point reconnaissance. Immediate ISR re-tasking may be required outside currently assigned airspace, causing the UAS operators to execute deviations to the flight plan.

1.5. Additionally, UASs outfitted with improved communication systems will be more capable of achieving higher levels of availability which this mission may demand. If the UAS is outfitted to support Simulated Remote Information Center (SRIC) messages, it will be capable of receiving vital messages that could provide last known locations of firefighters in life threatening situations. UASs outfitted with thermal imaging sensors will be in high demand to locate and track firefighter's positions. The few UAS that can also accurately deliver retardant or water where directed, have the highest probability of actually saving trapped personnel.

2. Introduction

2.1. THRUST

2.1.1. The principal thrust of the Student UAS (SUAS) competition is the safe application and execution of Systems Engineering principles to develop and operate an autonomous UAS to successfully accomplish the mission tasks.

2.2. GRADED ELEMENTS

2.2.1. The graded elements of this competition are:

2.2.1.1. Technical Journal Paper (20 page limit)

2.2.1.2. Oral Briefing of a Flight Readiness Review (FRR)

2.2.1.3. Flight-Mission Demonstration

2.3. OPPORTUNITIES

2.3.1. Student 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. Opportunities for interaction with UAS engineers, scientists and leadership will be provided.

2.4. RULES

2.4.1. The SUAS competition will be based upon the competition rules outlined within this document containing administrative and performance objectives. These rules are aimed at a college-level curriculum. Upon DRAFT release of these rules, potential competitors are invited to provide comments or questions prior to "University Day". After University Day, these rules may be updated with clarifications or updates and posted as the official rules for competition. The SUAS committee reserves the right to make changes to these rules and issue updates or addendums at any time.

2.5. SCOPE

2.5.1. This is a performance-based competition. 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.

2.6. REQUIREMENTS

2.6.1. 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:

2.6.1.1. "**Shall**" indicates a requirement that is a **THRESHOLD**. Failure to meet the threshold is failure to meet the minimum criteria, i.e. the system is judged inadequate.

2.6.1.2. "**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.

2.6.1.3. "**May**" indicates a permissible implementation, but is not a requirement.

2.6.1.4. "**Will**" indicates actions to be taken by the competition judges or other information pertaining to the conduct of the competition.

3. Schedule

The 2014 AUVSI SUAS competition schedule is shown below in table 1.

Table 1: 2014 AUVSI SUAS Competition Schedule

Activity	Date(s)	Notes
Draft Rules Posted	Mon, September 30, 2013	Open for comments.
Team Written Comments	Mon, October 7, 2013	**Deadline**, 11:59 PM EDT.
University Day	Thurs, October 10, 2013	Conference Call-in 11:00 – 12:30 PM EDT.
Final Rules Posted and Registration Open	Thurs, October 24, 2013	Final rules. 8-week registration period starts.
Application and Registration Fee	Thurs, December 19, 2013	**Deadline**, 11:59 PM EST.
Refund Registration Fee	Wed, April 30, 2014	**Deadline**, 11:59 PM EDT. Last day to withdraw and have registration fee refunded.
Fact Sheet	Wed, May 7, 2014	**Deadline**, 11:59 PM EDT.
Journal Paper Submission	Wed, May 28, 2014	**Deadline**, 11:59 PM EDT.
Proof of Flight Video	Wed, June 4, 2014	**Deadline**, 11:59 PM EDT.
Base Access Information Data	Wed, June 11, 2014	**Deadline**, 11:59 PM EDT.
Competition	Wed, June 18, 2014 5:00 PM EDT.	Check-in / Orientation Notice of Risk; Disclaimer of Liability; Waiver of Claims Form
	Thurs, June 19, 2014	Safety Inspections / Oral briefings
	Fri & Sat, June 20-21, 2014	Flight-Mission Demonstration
	Sat, June 21, 2014	Awards Banquet
	Sun, June 22, 2014	Rain day for flying

NOTE: Teams are encouraged to submit all items with deadlines <u>EARLY</u>. For email the date stamp for the email will be used as the time. For posted mail, the postmark will be used as the time.

4. Major Elements of the Competition (Chronological Order)

The major elements of the competition are defined here in general terms to express the level of effort 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. DRAFT RULES

4.1.1. 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.

4.1.2. 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.

4.2. UNIVERSITY DAY

4.2.1. University Day consists of a 1-1/2 hour long conference phone call, in which all perspective competitors are encouraged to participate. This event provides the opportunity to pose general and specific questions directly to the judges.

4.2.2. Although teams are encouraged to call in, the University Day event is not a graded element, and teams are not required to attend.

4.2.3. The date and time for University Day is listed in the Schedule of Section 3.

4.2.4. The phone conference call number and web meeting URL are defined in Section 10.1.7.

4.2.5. Based on feedback received regarding draft rules and during University Day, these competition rules may be modified by the SUAS committee.

4.3. FINAL RULES

4.3.1. The final rules will be posted after University Day -- at least eight weeks before the deadline for submission of the applications and registration fee.

4.3.2. Details about the release of the final rules are found in the Schedule in Section 3.

4.3.3. It is intended that the final requirements remain fixed. However, the SUAS committee reserves the right to make changes as deemed necessary.

4.3.4. 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.

4.4. REGISTRATION PROCESS

4.4.1. A completed registration application form and the full registration fee shall be received in order for a team to begin the qualification process to enter this competition.

4.4.2. The registration process will open at the same time the Final rules are posted.

4.4.3. 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 deadline stated.

4.4.4. Registration application form and payment shall be submitted by the specified date and time deadline detailed in the Schedule of Section 3.

4.4.5. Details about the registration process are found in Sections 10.2 thru 10.4. The required registration application form is located in Appendix A: Application Form.

4.5. DOWN-SELECTION

4.5.1. Due to the large number of teams interested in competing, the SUAS committee reserves the right to implement a down-selection process. This may restrict teams from participating in a single or multiple phases of the competition, based on requirements laid out in these rules.

4.5.2. A down-selection process may occur at any time, even after the withdraw deadline.

4.5.3. Details about the down-selection process are in defined Section 10.6.

4.5.4. Teams shall complete all required items as soon as possible to avoid down selection due to content or schedule.

4.6. REFUND REGISTRATION FEE DEADLINE

4.6.1. The last day a team may formally request to be withdrawn from the SUAS competition and be reimbursed the registration fee.

4.6.2. Withdrawal shall be requested before the deadline detailed in the Schedule of Section 3 in order to receive reimbursement.

4.6.3. Failure to properly withdraw from the competition by the deadline will result in forfeiture of the registration fee.

4.6.4. Details about the withdraw process are defined in Section 10.

4.7. FACT SHEET

4.7.1. After being accepted into the competition, a fact sheet providing basic descriptions of the air vehicle and systems shall be submitted to AUVSI Seafarer Chapter. As this is the first introduction to your system, the fact sheet shall provide necessary data for logistics and safety. The Fact Sheet shall inform the SUAS committee and judges of general vehicle parameters for safety purposes, such as vehicle size, weight, fuel or battery type, transmitted air vehicle control and payload data frequencies, and large ground equipment that will be transported to the flight line. The Fact Sheet should provide the SUAS committee insight into the mission tasks the team will attempt to achieve during flight.

4.7.2. The fact sheet due date will be used as the first down select filter, with the content of the fact sheet being secondary.

4.7.3. The timely submission of the fact sheet affects the grading of the flight element.

4.7.4. The factsheet shall be submitted by the specified date and time deadline detailed in the Schedule of Section 3.

4.7.4.1. Late submission of the fact sheet will only be extended 5 days after the deadline. Each day late will result in point deductions from the team's score for the flight-mission demonstration phase of the competition.

4.7.4.2. Failure to submit the fact sheet by the 5th day post deadline will result in disqualification from the flight-mission demonstration phase of the competition.

4.7.4.3. The fact sheet deadline is past the withdraw date, so NO refunds will be processed for teams who fail to participate after the extended timeframe.

4.7.5. The fact sheet submitted shall generally follow the suggested one-page format provided in Appendix B: Fact Sheet Format.

4.7.6. The fact sheet shall be electronically submitted in PDF format.

4.7.7. The fact sheet's filenames shall include the school and team name, abbreviated as needed, and have the prefix "FS" (capital letters "FS" will identify the file as the fact sheet, which must be different from the journal paper filename).

4.7.8. Each registered team will be provided explicit instructions on how to log in and upload the fact sheet to the team's unique folder on the SUAS SharePoint site.

4.8. BASE ACCESS INFORMATION

4.8.1. Prior to the competition, the registered teams shall submit the required personal data and information for all team members.

4.8.2. Teams from U.S. schools shall provide the data in order to access a military base.

4.8.3. Teams from schools outside the U.S., or U.S. teams with non-U.S. citizens, shall provide additional specific data and formal letters of authority from their school in order to access a military base.

4.8.4. The base access information is required to participate in oral presentation and flight-mission phases of the competition.

4.8.5. The base access data shall be submitted by the specified date and time deadline detailed in the Schedule of Section 3.

4.8.6. The base access shall be submitted in accordance with the details in Section 10.

4.9. PROOF-OF-FLIGHT

4.9.1. Prior to the competition, a video shall be submitted as proof to the SUAS committee that the team's system has successfully flown at least once.

4.9.2. At a minimum, the video shall demonstrate the vehicle can attain flight, sustain flight, and terminate flight in a safe manner, independent of the mission systems.

4.9.3. The proof-of-flight video does not need to have the aircraft in a full-up mission flight configuration. It is acceptable to demonstrate a Radio Controlled (RC) flight (at expected competition takeoff weight).

4.9.4. The proof-of-flight video shall provide of the following:

4.9.4.1. Identify the school and team, Team Captain and safety pilot name (s).

4.9.4.2. Show the vehicle in the following phases of flight:

4.9.4.2.1. Takeoff

4.9.4.2.2. Flight

4.9.4.2.3. Landing (crashes or unintentional off-field landings do not count)

4.9.5. The proof-of-flight video should show that the vehicle position and altitude are being properly displayed on the ground control station and monitored by the team, even if the air vehicle is not flying autonomously.

4.9.5.1. <u>NOTE</u>: This segment of the proof-of-flight video can as simple as the camera operator panning from the vehicle in flight to the GCS screen and then return to the same vehicle in flight.

4.9.6. If a backup vehicle may be used for the flight-mission demonstration, a separate proof-of-flight video shall be required to be submitted within the same deadline.

4.9.7. If possible, it is desired to have the same pilot from the proof-of-flight video be the competition safety pilot.

4.9.8. The proof-of-flight video shall be uploaded to the competition SharePoint site (see SharePoint instructions) either as a video file or as a text file containing a link to the team's video posted on www.youtube.com.

4.9.9. The proof-of-flight video is required to participate in the flight-mission demonstration phase of the competition.

4.9.10. The proof-of-flight video shall be submitted by the specified date and time deadline detailed in the Schedule of Section 3.

4.9.10.1. Late submission of the proof-of-flight video will only be extended 5 days after the deadline. Each day late will result in a significant point deduction from the team's score for the flight-mission demonstration phase of the competition.

4.9.10.2. Failure to submit the proof-of-flight video by the 5th day post-deadline will result in disqualification from the flight-mission demonstration phase of the competition.

4.9.10.3. The proof-of-flight video deadline is past the withdraw date, so NO refunds will be processed for teams who do not participate after the extended timeframe.

4.10. JOURNAL PAPER

4.10.1. 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 systems engineering process, design tradeoffs, final design solution for the system, illustrate how it will safely perform mission tasks, and provide test results verifying same. The journal paper shall address the mission tasks the team may be capable of achieving during flight.

4.10.2. The journal paper shall be a graded element.

4.10.3. The journal paper shall be submitted by the specified date and time deadline detailed in the Schedule of Section 3.

4.10.3.1. Late submission of the journal paper will only be extended 5 days after the deadline. Each day late will result in a significant point deduction from the team's score for the journal paper phase of the competition.

4.10.3.2. Failure to submit the journal paper by the 5th day post-deadline will result in disqualification from the competition.

4.10.3.3. The journal paper deadline is past the withdraw date, so NO refunds will be processed for teams who fail to participate after the extended timeframe.

4.10.4. Details about the journal paper requirements are found in Section 8 Scoring Metrics.

4.10.5. The journal paper shall be submitted by uploading it to the team's SharePoint folder defined in Section 10.1.4.

4.11. TEAM CHECK-IN AND ORIENTATION

4.11.1. During check-in, teams will receive instructions, badges and vehicle passes for base access. Non-U.S. citizens will have a different pass processes that is followed during check-in.

4.11.2. During the check-in process, all students, academic advisors, and visitors shall sign the appropriate liability waiver form defined in Section 9.

4.11.3. 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.

4.11.4. A simple meal will be provided for the students during the check-in process.

4.11.5. The mission waypoint GPS coordinates and altitudes will be supplied to the Team Captains at the check-in and orientation.

4.11.6. Team shall be at the check-in and orientation briefing at the specified date and time detailed in the Schedule of Section 3.

4.11.6.1. There is no guarantee that a team will be processed into the competition if they are unable to make all the deadlines detailed in the Schedule of Section 3.

4.11.6.2. 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.

4.11.6.3. If the team encounters 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 make every effort to contact the SUAS Competition Director prior to check-in start time. They will need to explain the circumstances and request exemption from attendance at check-in. They will be provided guidance on how to undergo a late check-in process.

4.11.7. The location of the check-in and orientation are defined in Section 10.1.10.

4.12. ORAL/STATIC PRESENTATION

4.12.1. The oral presentation will be a Flight Readiness Review (FRR) briefing to judges during which the teams substantiate, with data, their plans to safely accomplish the mission. The intention is to demonstrate to the judges that the team is ready to compete safely, with low risk, in the flight-mission demonstration phase of the competition. The oral presentation shall address the mission tasks the team plans to achieve during flight.

4.12.2. Following the FRR oral presentation's question and answer period, the judges shall perform a brief review and inspection of the team's UAS, including air vehicle exterior (and interior if available), ground station, test data, safety checklists and equipment, and other supporting evidence of readiness, safety and risk reduction.

4.12.3. The FRR briefing will be 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.

4.12.4. All team members present are encouraged to participate.

4.12.5. The oral presentation and a static display are graded elements of the oral presentation.

4.12.6. The static display shall include visual aids and the actual system being demonstrated, to support and clarify the team's oral presentation.

4.12.7. 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.

4.12.8. The oral presentation shall be given on the date detailed in the Schedule of Section 3.

4.12.8.1. The oral presentation date is past the withdraw date, so NO refunds will be processed for teams who fail to participate.

4.12.9. Details about the oral presentation requirements are found in Section 8 Scoring Metrics and described in Appendix C: Flight Readiness Review (FRR) Rubric.

4.12.10. The location of the oral presentation is defined in Section 10.

4.13. FLIGHT-MISSION DEMONSTRATION

4.13.1. The flight-mission demonstration evaluates the teams' ability to conduct a mission operation with their vehicle. This is the culminating event of the competition.

4.13.1.1. Only teams who successfully submit the fact sheet and journal paper, and successfully pass the FRR and safety inspection, shall be allowed to fly.

4.13.2. Each team shall arrive prepared to begin flight operations.

4.13.3. Flight demonstrations shall follow procedures briefed the day before during FRR.

4.13.4. 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.

4.13.5. 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 repeatedly fail to follow instructions **may be disqualified from the competition**.

4.13.6. The flight-mission demonstration is a graded element.

4.13.7. The flight-mission demonstration has specified dates, and a back-up rain date, detailed in the Schedule of Section 3.

4.13.7.1. **Note**; if weather interferes with the scheduled dates for flight-mission demonstration, teams may be scheduled to fly on the back-up rain date which is Sunday.

4.13.7.2. The flight-mission demonstration dates are past the withdraw date, so NO refunds will be processed for teams who fail to participate.

4.13.8. Details about the flight-mission demonstration requirements are found in Sections 6 and 7 of these rules.

4.13.9. The location of the flight-mission demonstration is defined in Section 10.

4.13.10. Each team should anticipate a crowd of judges and media at the flight line. Teams are encouraged to actively control their team on the flight line and around their operational area.

4.14. AWARDS BANQUET

4.14.1. 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.

4.14.2. Sponsors and industry members will be at the banquet.

4.14.3. Teams are strongly encouraged to attend this banquet.

4.14.4. Recommended attire for the banquet is business casual (collared shirts and slacks).

4.14.5. The awards banquet's date and time are detailed in the Schedule of Section 3.

4.14.5.1. 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 will be announced at a later time.

4.15. JOBS, RESUMES, AND COMPANIES

4.15.1. A primary reason for organizing the Student UAS competition is to foster a passion for UAS in students, with the hope that they will seek to work in the UAS industry supporting NAVAIR and local industry and academic partners.

4.15.2. On the days scheduled for the oral presentation briefing and flight-mission demonstration, there may be SUAS company sponsors at the venue seeking to hire students.

4.15.3. Students are encouraged to identify the SUAS sponsors listed on the Seafarer Chapter's website, review company websites, and possibly arrange for interviews prior to arriving for the competition. All students who are interested in employment should bring resumes and evaluate the different job opportunities.

5. System Requirements

5.1. AIRCRAFT REQUIREMENTS

5.1.1. The system shall be limited to one air vehicle in the air at any time.

5.1.2. The air vehicle shall be capable of heavier-than-air flight.

5.1.3. The air vehicle 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. The air vehicle shall comply with the Safety Regulations described in Section 9 of these rules.

5.1.5. The air vehicle should be autonomous capable.

5.1.5.1. If the air vehicle is going to be engaged in autonomous flight (e.g. flown by the on-board autopilot) then the system must meet and demonstrate the required safety overrides as described in Section 9, Safety Regulations.

5.1.6. The air vehicle RF communications systems shall comply with the RF spectrum management scheme described in Section 6.4.

5.1.7. Payloads

5.1.7.1. The air vehicle shall provide a means to capture target images that can be displayed to the judges.

5.1.7.2. The images shall be provided to the judges during the conduct of the mission.

5.1.7.3. Target data should be handed in to judges as a hard copy mission report sheet. Proof of capturing the target images should be provided to the judges in JPEG format.

5.1.7.4. The system shall have the capability to capture images in the visible light spectrum using Electro-Optic sensors, and should have the capability to capture images in the Infrared (IR) spectrum using IR sensors.

5.1.7.5. The system shall not deploy or employ its own ground based sensors on the airfield (this is not applicable to the competition's Simulated Remote Information Center (SRIC)). Teams may bring their own ground based sensors, but are restricted to the locating the sensors at the team's tent at the flight line or in the pit area. No tall antenna masts, balloons or other obstacles to the airfield will be permitted.

5.1.7.6. The system should be capable of safely dispensing an air-dropped relief canister onto a target vertically below.

5.2. GROUND STATION REQUIREMENTS

5.2.1. The system shall accurately display "no fly zones" to the operators and judges.

5.2.2. The system shall accurately display current air vehicle position with respect to the "no fly zones" to the operator and judges. ***Failure to meet this requirement will result in disapproval to fly in the competition.***

5.2.3. The system shall display accurately altitude (**feet-MSL**) to the judges and operator.

5.2.4. The system shall display indicated airspeed (**KIAS**) to the operator and judges.

5.2.5. The system should display search area boundaries and waypoints to the operators and judges.

5.2.6. The system should have the capability to adjust mission search areas and waypoints in flight. If the system has the capability to change mission search areas in flight, the new boundaries should be displayed to the operator.

5.2.7. The system should output target data (location & characteristics) in accordance with the format provided in Appendix E: Electronic Target Data Format and Appendix F: Target Score Sheet.

5.2.7.1. Each target on the spreadsheet should have an associated image in a JPEG format with a name target*n*.jpg (where *n* is the target number).

5.2.7.2. The ground control system should be able to output this target data to a USB memory stick provided by the SUAS judges.

5.2.7.2.1. Hardcopy target score sheets are highly encouraged, even if printed from the ground system. Several teams in the past acquired targets but turned in empty USB sticks and received no score for their targets acquired.

5.2.8. The ground control system's RF communications systems shall comply with the RF spectrum management scheme described in Section 6.4.

5.2.9. 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.

5.3. RF COMMUNICATIONS INTEROPERABILITY

5.3.1. The SUAS committee plans to allow multiple teams to transmit Radio Frequency (RF) communications at the same time. This is intended to provide teams additional useful setup/troubleshooting time as well as improve the efficiency of the competition. Additionally, it simulates the real world where systems shall manage communication accounting for other systems in a theater of operations.

5.3.1.1. In the event that unforeseen difficulties arise in executing simultaneous teams transmitting RF, the competition reserves the right to revert to one team transmitting RF at a time (like past competitions) or other appropriate measures. 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.

5.3.2. 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.

5.3.2.1. Systems that do not comply with these requirements may be prohibited from operating on unapproved frequencies.

5.3.2.2. Manufacture and model numbers of all transmitter/receivers shall be provided in the Fact sheet.

5.3.3. Teams are strongly encouraged to consider use of all forms of hardwired RF interface cables and/or antenna 'hats' to connect the air vehicle'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.

5.3.4. Frequency management concept. Frequency packages will be assigned to each of the four tents on the airfield (A-D). Systems shall be designed to operate within the parameters of any one of the frequency packages described in Appendix G: Radio Frequency Management Packages.

5.3.4.1. Frequency package E shall be used by all teams when their systems initialize to avoid interference with active teams. Frequency package E will also be available to a single team at a time with prior coordination with the pit manager for trouble shooting. Frequency packages are described in Appendix G: Radio Frequency Tent Assignments.

5.3.5. Specific frequency management requirements for each band.

5.3.5.1. 72 MHz: The use of 72 MHz for RC control is discouraged; however, in order to prevent additional cost, 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. Note: Coordination of use of channels within 72 MHz RC control will be managed on a case-by-case basis during competition.

5.3.5.2. 433 MHz: Use of UHF ISM Band 433MHZ (431-435MHZ) shall be limited to use of Frequency Hopping Spread Spectrum technology.

5.3.5.3. 900 MHz: ISM b Output Frequency.

5.3.5.4. 1.08, 1.12, 1.16, 1.2, 1.24, 1.28, 1.32, an 1.36 GHz Output Frequency:

5.3.5.4.1. 1.08, 1.12, 1.16, 1.2, 1.24, 1.28, 1.32, 1.36 GHz, and radio modem covering the 902 - 928 MHz frequency band shall be limited to use of Frequency Hopping Spread Spectrum technology

5.3.5.5. 1.2 – 1.3 GHz: Use of 1.2.-1.3 GHz shall be limited to analog video systems that can select one of 8 channels assigned during the competition.

5.3.5.5.1. Channels 1-8 are as follows: 1.08, 1.12, 1.16, 1.2, 1.24, 1.28, 1.32, 1.36 GHz. Systems utilizing this frequency shall initialize on a designated assigned channel (Frequency package E) and shall have the capability to then select another channel (Frequency packages A-D).

5.3.6. 2.4 GHz: RC (2.4- 2.485 GHz) Spread Spectrum techniques in accordance with FCC regulation CFR 47 part 15.

5.3.7. 2.4 GHz Wi-Fi (802.11 b/g/n): Use of 2.4 GHz Wi-Fi shall be limited to systems that can select between one of the 11 US Wi-Fi channels within the band. Systems shall utilize only one channel within the band (with the exception of channel 1, if attempting to connect to SRIC). Channels to be assigned are 3, 5, 7, 9, and 11. Systems shall be designed to operate with any of the other assigned channels in simultaneous use. Systems utilizing this frequency shall initialize on a designated assigned channel (Frequency package E) and shall have the capability to then select another channel (Frequency packages A-D). 802.11 g/n shall use 20 MHz channel width. Operating 2.4 GHz Wi-Fi in the middle channels (5 and 7)

generally does not perform as well as the outside channels. Selecting channels is a part of the team's trade studies for alterative design architectures.

5.3.8. 5 GHz Wi-Fi (802.11a/h/j/n/ac): Use of 5 GHz Wi-Fi shall utilize Dynamic Frequency Selection (DFS) (preferred) for channels 52, 56, 60, 64, 100, 104, 108, 112, 116, 132, 136, and 140. If DFS is not used, the system shall be capable of selecting a single one of the following manual channels: 36, 44, 149, 157, or 165 in accordance with the frequency plan in Appendix G: Radio Frequency Management Packages.

5.3.9. Systems utilizing manual channels shall initialize on a designated assigned channel (Frequency package E) and shall have the capability to then select another channel (Frequency packages A-D)

5.3.10. 802.11 wireless communication systems shall have an SSID of the team's school and/or team name (e.g. Joesengineeringschool1) for quick and easy identification.

5.3.10.1. Any 802.11 wireless system shall have over-the-air encryption (WPA, WEP, or otherwise) enabled.

5.3.11. Use of cellular technology will not be limited.

5.3.11.1. NOTE: Cellular reception at the competition site is poor and unreliable.

5.3.12. Unauthorized transmission when not assigned a frequency package shall be prohibited. This includes operating wireless RF in the pits or spectator area.

5.3.13. Only one team is assigned Frequency package E in the Pits at a time.

5.4. ELECTROMAGNETIC ENVIRONMENTAL EFFECTS

5.4.1. The SUAS committee will attempt to prevent airfield electromagnetic emissions at the frequency and channel used for air vehicle command and control. However, the system should incorporate basic electromagnetic interference (EMI) and electromagnetic compatibility (EMC) design considerations.

5.4.2. The SUAS committee will be monitoring all RF frequencies and channels at the flight line and in the pit area to identify any specific RF signals at the field.

5.4.3. The competition staff will be operating hand-held General Mobile Radio Service (GMRS) radios at 462.7 MHz in close proximity to aircraft and ground stations.

5.4.4. Additionally, video crew and others may be operating GMRS radios on the airfield.

5.4.5. Teams should also anticipate that numerous mobile devices (phones, PDAs, computers, etc.) will be operating on the airfield.

5.5. WEATHER REQUIREMENTS

5.5.1. Teams shall be able to compete in the following conditions:

5.5.1.1. The air vehicle 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.

5.5.1.2. The air vehicle shall be capable of operating during all mission phases in tower reported surface winds of 15 knots with gusts to 20 knots.

5.5.1.3. The system shall be capable of completing mission objectives in surface temperatures up to 110 degrees Fahrenheit.

5.5.1.4. The system shall be cable of completing the mission after exposure to temperatures of 100 degrees Fahrenheit for up to 10 hours.

5.5.1.5. The system shall be capable of operating in fog conditions of visibility of 2 miles or greater with no precipitation.

5.5.2. If conditions fall outside weather requirements, or if the judges feel environmental conditions are unsafe (such as approaching thunderstorms), the competition will be suspended.

5.5.3. NOTE: The air vehicle 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).

5.6. PIT AND AIR FIELD PROVISIONS

5.6.1. 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 115 VAC, 60 Hz, electrical power with one extension cable.

6. Flight-Mission Demonstration Requirements

6.1. FLIGHT TASKS

6.1.1. Only teams and 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

6.2.2.2. Each team shall have a minimum 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

6.2.3.2. Each team shall have a minimum specified period of time to set up equipment on the flight line prior to starting their mission clock. After the minimum 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 setup 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 new RF transmitting rules specified in the section 5.3, *RF Communications Interoperability* during setup time.

6.2.4. Pre-Mission Brief

6.2.4.1. A pre-mission briefing shall be accomplished prior to flight. This briefing is to inform the team, and specifically all the judges, of the structured operations, safety, and tasks the team plans to attempt.

6.2.4.2. The pre-mission briefing shall be accomplished during setup time and will not be counted against mission time.

6.2.5. Mission Time

6.2.5.1. Mission Time (T_M) = 40 minutes Maximum. At the maximum T_M the Lead Judge will terminate the mission clock and teams shall have no further opportunity to provide data to the Judges for scoring. The tear-down clock shall immediately start at this time, unless the Team Captain has already called mission complete.

6.2.5.2. For $T_M \leq 20$ minutes mission time, no points will be scored for less time.

6.2.5.3. For $20 < T_M \leq 30$ minutes mission time, bonus points may be scored.

6.2.5.4. For $30 < T_M < 40$ minutes mission time:

6.2.5.4.1. Teams with the air vehicle flying or intending to fly again, or otherwise occupying the active airfield or runway, shall incur penalty points for each additional minute the air vehicle prevents another team from occupying the airfield up to the Maximum T_M.

6.2.5.4.2. Teams with the air vehicle removed from the active runway and not obstructing the airfield, and not intending to fly again (i.e., other teams can take to the airfield), may continue processing data with no penalty up to the Maximum T_M.

6.2.5.5. During mission time, teams shall be permitted to radiate, run propulsion systems, and use the active runway and airfield.

6.2.5.6. Mission time shall start at the declaration of mission clock start from the lead judge, who will have a dedicated mission clock stopwatch.

6.2.5.7. Mission time shall end once the vehicle has terminated flight (landed, crashed, or terminated), the air vehicle is back at the team's tent on the flight line, the scores are turned in, a timeout is called by the Team's Captain, or the Lead Judge declares the mission time stopped.

6.2.5.8. Mission terminated by Judges:

6.2.5.8.1. Specified $T_M = 20$ minutes

6.2.5.8.2. If the air vehicle has not achieved flight by this elapsed mission time, the mission will be terminated by the Lead Judge and no further scoring is possible.

6.2.5.9. A team may elect to cycle through the takeoff and landing sequence during mission 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.

6.2.5.10. Teams shall NOT use any other means to collect imagery (including using other teams' systems).

6.2.6. Teardown Time

6.2.6.1. Specified Time = 10 minutes

6.2.6.2. 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).

6.2.6.3. Transportation will be provided but must be requested prior to start of mission time.

6.2.7. Timeouts

6.2.7.1. Specified Time = 10 minutes (Minimum)

6.2.7.2. Each team shall only be allowed one timeout. Timeouts shall not be available during set-up or teardown. Teams can land and change

configuration more than once, but must stay on the mission clock. Data processing shall not be performed during timeouts.

6.2.7.3. Calling a Timeout

6.2.7.3.1. Only the Team Captain shall call time-out. The announcement shall be made clearly to the Lead Judge, and the Lead Judge will confirm the call before the mission clock is stopped.

6.2.7.3.2. Timeout “notification" may be made anytime, but the timeout shall NOT begin until Mission clock STOPS.

6.2.7.3.3. The type of timeout shall be announced when the Team Captain makes the call and cannot be changed.

6.2.7.3.4. Time-out shall only stop the mission clock when the team has their aircraft on the ground at their flight-line tent, and they conform to the regulations regarding RF transmitting on the flight line.

6.2.7.3.5. Regulations regarding RF transmitting on the flight line and in the pits are intact during timeouts and covered in the section 5.3, *RF Communications Interoperability*

6.2.7.3.6. The type of timeout shall be announced when the Team Captain makes the call and cannot be changed.

6.2.7.4. During mission time, two types of timeout shall be allowed: timeout in-place or timeout in-the-pits.

6.2.7.4.1. Teams may call timeout in-the-pits, before being called to the flight line.

6.2.7.5. Timeout In-Place

6.2.7.5.1. A team may take an in-place timeout on the flight line. This shall guarantee a team the minimum specified amount of time in Section 6.2.7.1 at the flight line.

6.2.7.6. Timeout In-The-Pits

6.2.7.6.1. A team may elect to take timeout in-the-pits. The team shall vacate the flight line and return to the spectator area.

6.2.7.6.2. Any team that takes a timeout in-the-pit shall move to the back of the line for flight slots and may not get to fly. All other teams shall get to fly first, including teams who have taken an in-place timeout.

6.2.7.6.3. If there is not enough time to fly all teams who took timeout in-the-pits, the judges will assess if any team will be called back to the flight line.

6.3. MISSION LIMITATIONS

6.3.1. Mission Boundaries

6.3.1.1. During the entire mission, air vehicles 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 ***Example*** Map of Appendix D. 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 -- **this is a prerequisite for any flight**.

6.3.1.3.1. Purely manual RC flights within the search area will only be allowed if aircraft location and altitude can be displayed on the mission map display with mission boundary no fly zones, under direct supervision of an AUVSI safety officer, and accurately displayed for judge's assessment.

6.3.1.4. After takeoff, the air vehicle 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.

6.3.2. <u>Takeoff</u>

6.3.2.1. Takeoff shall take place within the designated takeoff/landing area, shown on the example map of Appendix D, depending on wind direction. This area will be paved asphalt surface, roughly 100 feet wide, with no height obstacles.

6.3.2.2. Systems utilizing launchers and/or not performing a wheeled takeoff may utilize the grass immediately adjacent to the runway; however, see section 6.3.4 on airfield notes.

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. Launchers will be inspected by competition safety inspectors before they are allowed for use in the competition. Safety inspection is covered in another subsequent section 9.5 of these rules.

6.3.2.5. Takeoff from moving vehicles shall be prohibited.

6.3.2.6. Takeoff under manual control with transition to autonomous flight will be permitted but does not count as an autonomous take off.

6.3.2.7. 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. <u>Landing</u>

6.3.3.1. Landing shall take place within the designated takeoff/landing area, shown on the example map of Appendix D, depending on wind

direction. This area includes paved asphalt surface, roughly 100 feet wide, with no height obstacles.

6.3.3.2. The takeoff/landing area will include an area for grass takeoffs and landings. All grass takeoffs and landings must be done within the takeoff/landing area, with a runway or taxiway between the air vehicle and the student's and judge's tents on the flight line.

6.3.3.3. Control in landing will be subjectively graded for precision and safety.

6.3.3.4. Transition to manual control will be permitted for landing.

6.3.3.5. The last landing is scored, regardless if it is manual or autonomous. Only autonomous landing attempts on the first landing will earn points. Any other attempts at autonomous landings will be eligible for a prize.

6.3.3.6. Crashes and/or terminations will not be eligible to earn bonus points for a safe landing or short mission clocks.

6.3.4. Airfield Notes

6.3.4.1. Airfield elevation is 22 feet MSL.

6.3.4.2. Airfield magnetic deviation is 11 degrees west.

6.3.4.3. Grass areas in within the takeoff/landing area will not be prepared.

7. Description of Mission Tasks

The flight-mission demonstration has been divided into a series of primary and secondary tasks. Teams shall meet all primary task parameter thresholds first (except landing), prior to attempting any secondary tasks. The landing may occur after attempting any number of secondary tasks. The team shall meet the landing threshold in order to receive credit for any secondary tasks; failure to meet the primary landing parameter threshold will eliminate all secondary task scores.

The available tasks are listed in this section, whereas Section 8.0 provides the relative weighting of tasks.

7.1. AUTONOMOUS FLIGHT TASK (PRIMARY)

Table 2: Autonomous Flight Task

Parameter	Threshold	Objective
Take off	Achieve controlled takeoff.	Achieve controlled autonomous takeoff.
Flight	Achieve controlled flight.	Achieve controlled autonomous flight.
Waypoint navigation (each waypoint)	Capture waypoint in sequence.	Capture waypoint autonomously in sequence.
Landing	Achieve controlled landing.	Achieve controlled autonomous landing.

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 operators may select a takeoff button or switch.

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.

7.1.2. Flight

7.1.2.1. The flight task evaluates the ability to safely sustain controlled flight.

7.1.2.2. Once in autonomous flight, the vehicle should sustain controlled flight with no direct pilot input to flight controls or propulsion power to receive autonomy points.

7.1.2.3. The sensor payload may be manually controlled while under autonomous flight.

7.1.3. Waypoint Navigation

7.1.3.1. All air vehicles shall overfly waypoints at the specified location and altitude to receive credit for waypoint capture.

7.1.3.2. The air vehicle 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 waypoint path specified may include changes in altitude.

7.1.3.5. To achieve points for waypoints, they shall be achieved in order. Waypoints achieved out of sequence will not be scored.

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).

7.2. SEARCH AREA TASK (PRIMARY)

Table 3: Search Area Tasks

Parameter	Threshold	Objective
Localization (each target)	Determine target location within 100 ft. Must be paired with at least a threshold classification.	Determine target location within 50 ft. Must be paired with at least a threshold classification.
Classification (each target)	Identify any two target characteristics.	Identify all five target characteristics.
Autonomous Search	Fly the search area.	Fly the search area autonomously.
Secret message	n/a	Decipher the message anagram collected from the targets in the search area.

7.2.1. Teams shall complete the waypoint navigation task in proper sequence and must pass through the last waypoint before entering the search area. If one waypoint is out of order teams shall not score full points for targets located/classified.

7.2.2. Once transitioning into the predefined search area, the vehicle shall search for specific targets of interest while staying within the no-fly boundaries. Search area coordinates will be provided to teams during the check-in and orientation event. Targets will be distributed throughout the search area.

7.2.3. The UAS shall capture target images and identify target characteristics and locations for scores. The images shall be provided to the judges either when observed on the ground station display during the conduct of the mission or when handing in the target report sheet with the team's USB memory stick.

7.2.4. Competitors shall record the target characteristics of all observed targets and provide this data to the judges on a target data sheet and/or in electronic form in the format given in Appendix E: Electronic Target Data Format and Appendix F: Target Score Sheet.

7.2.5. Images should be provided to the judges on the USB memory stick in JPEG format for proof during post-mission scoring.

7.2.6. Area Search

7.2.6.1. Air vehicles shall search the area at any altitude between 100 and 750 feet MSL.

7.2.6.2. The targets will be located in the search area. The air vehicle 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. Targets

7.2.7.1. Targets will be constructed of plywood of a given size, basic geometric shape, and color. For an example, see Figure 1 (and cover page).

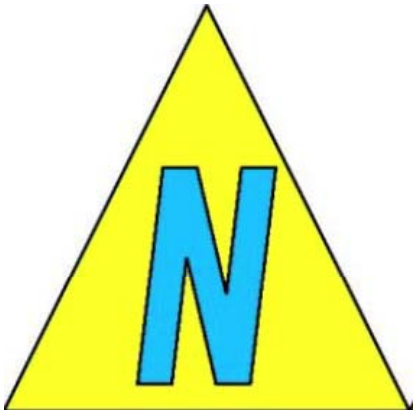


Figure 1: Example Target

7.2.7.2. Each target will be a different geometric shape (triangles, circles, etc.) and a unique color; a different color alphanumeric will be painted on each target.

7.2.7.3. Target characteristics are:

7.2.7.3.1. Shape

7.2.7.3.2. Background color

7.2.7.3.3. Letter Orientation (N, NE, E, SE, S, SW, W, NW)

7.2.7.3.4. Alphanumeric

7.2.7.3.5. Alphanumeric color

7.2.7.3.6. Location (latitude, longitude)

7.2.7.4. There will be an unknown number of targets in the area.

7.2.7.5. The minimum dimension of the targets (length or width) will be 2 feet, and the maximum dimension will be 8 feet.

7.2.7.6. 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. Secret Message

7.2.8.1. Teams shall arrange the alphanumeric of the targets to decode the spelling of a “secret” message, before end of mission time, in order to receive bonus points and a cash prize.

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

Table 4: Automatic Detection and Classification Task

Parameter	Threshold	Objective
Automatic Localization (each target)	n/a	Identify target position within 100 ft.
Automatic Classification (each target)	n/a	Identify at least three of five target characteristics.
False Alarm Rate (FAR)	n/a	Demonstrate <50% FAR.

7.3.1. Teams shall develop an algorithm which performs automated 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, **up to six targets**.

7.3.3. ADC may be performed by any combination of airborne or ground-based processing.

7.3.4. Teams shall make their ALDC process very clear to the imagery judge prior to aircraft takeoff.

7.3.4.1. If a judge is unclear about or suspects manual assistance to the ADLC process, the team shall not receive ADLC task points.

7.3.5. <u>Demonstrating an ADLC target</u>

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. The **first six detections shown** shall be considered a team's entry for the ADLC task. These detections shall be turned into the judges by filling out a single dedicated target information sheet, given in Appendix X. This target information sheet shall be marked clearly with "Automatic Detections" and handed in separate from other imagery sheets.

7.3.6. <u>False Alarm Rate</u>

7.3.6.1. If a listed target fails to meet the objective for localization AND classification, that target will be considered a false detection. The number of correct ADLC targets will be divided by the number of listed ADLC targets 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 Task

Parameter	Threshold	Objective
Actionable Intelligence	n/a	Identify target location and all 5 characteristics within 50 ft. for a single target while airborne.

7.4.1. The actionable intelligence task shall provide judges complete and accurate information of one alphanumeric target identified during flight. Once the information is provided to the judges, it cannot be retracted at any time.

7.4.2. The alphanumeric target shall be one of those located within the same search area defined in the Search Area task.

7.4.3. Actionable intelligence is only credited if all five target characteristics (shape, background color, alphanumeric, alphanumeric color, and orientation) and location are provided while the aircraft is still in-flight, are recorded on the target data sheet, and are correct.

7.4.3.1. Target data downloaded from an air vehicle while on the ground and then turned in when the air vehicle is airborne again will not be scored.

7.4.4. Credit for actionable intelligence will only be given for one target.

7.5. OFF-AXIS TARGET TASK (SECONDARY)

Table 6: Off-axis Target Task

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

7.5.1. Teams shall capture imagery of the off-axis 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 alphanumeric target will be located outside the no-fly zone. The coordinates for the off-axis target will be provided by the Lead Judge to the Team Captain at the start of mission time.

7.5.3. 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.

7.5.4. The location of the off-axis target will be approximately 250 – 500 feet beyond the edge of the no-fly-zone. The system should have the capability to capture imagery at an angle sufficient to detect and image the off-axis target without directly overflying it.

7.5.5. Images of the off-axis target shall be provided to the judges when observed on the ground station display during the conduct of the mission.

7.5.6. Competitors shall record the characteristics of the observed off-axis target and provide this data to the judges on a target data sheet and/or in electronic form in the format given in Appendix E: Electronic Target Data Format and Appendix F: Target Score Sheet.

7.5.7. An image should be provided to the judges on the USB memory stick in JPEG format for proof during post-mission scoring.

7.5.8. The off-axis target shall be identified on the target score sheet or USB stick by providing the given coordinates for same.

7.6. EMERGENT TARGET TASK (SECONDARY)

Table 7: Emergent Target Task

Parameter	Threshold	Objective
In-flight re-tasking	n/a	Add last known position of the emergent target as a waypoint.
Autonomous Search	Searching for emergent target.	Autonomously searching for emergent target.
Target Identification	Provide an image of the emergent target.	Provide an image, target location within 50 ft, and adequate description of the emergent target's activity.

7.6.1. At the start of mission clock, the lead judge will give the Team Captain a new emergent search area (within the existing no fly zone boundaries). The UAS shall search within the emergent search area to locate the emergent target.

7.6.2. At the time of vehicle takeoff, 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.

7.6.3. The UAS flight during search for the emergent target should be autonomous.

7.6.4. <u>Emergent Target:</u>

7.6.4.1. 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 a task. For example, see Figure 2.

Figure 2: The Emergent Target Rescue Randina (left)

7.6.5. The UAS shall capture the emergent target in an image for threshold score. The image shall be provided to the judges either when observed on the ground station display during the conduct of the mission or when handing in the target report sheet with the team's USB memory stick.

7.6.6. Competitors shall record the characteristics of the observed emergent target and provide this data to the judges on a target data sheet and/or in electronic form in the format given in Appendix E: Electronic Target Data Format and Appendix F: Target Score Sheet.

7.6.7. Images should be provided to the judges on the USB memory stick in JPEG format for proof during post-mission scoring.

7.6.8. The emergent target shall be imaged and described with enough detail to convince the judges of the target's activity.

7.6.8.1. An inadequate description of the emergent target activity poorly describes the target and misses the activity (for example: "a lady is sitting in a chair.").

7.6.8.2. An adequate description of the emergent target activity has enough detail to identify the specific activity (for example: "a lady in sunglasses and a bikini is sitting a chair with an umbrella and a towel ... she appears to be sunbathing.").

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

Table 8: Simulated Remote Information Center Task

Parameter	Threshold	Objective
SRIC task	Download the secret SRIC message.	Download the team's SRIC message and perform the task defined in the message.

7.7.1. The air vehicle shall carry an RF communications relay payload capable of receiving data from a third party Simulated Remote Information Center (SRIC) RF transmitter and communicating the data down to the team's ground station for data capture, display and action.

7.7.2. The SRIC has a directional antenna and will be located in the search area. The air vehicle should be capable of remaining within the beam width at an altitude within the competition altitude restrictions for the duration of time it takes to obtain the data from the team folder on the SRIC and relay to the ground station.

7.7.3. The position of the SRIC will be provided to teams at the Check-In and Orientation event.

7.7.4. The UAS shall login to the SRIC, download the team's private SRIC message and display to the judges, and perform the task defined in the message to verify success.

7.7.5. For more information about the SRIC communications, see Appendix H: SRIC Details.

7.8. INTEROPERABILITY TASK (SECONDARY)

Table 9: Interoperability Task

Parameter	Threshold	Objective
Interoperability task	n/a	Provide a standard positioning reference to the judges.

7.8.1. The interoperability task is intended to expose teams to the concept of system-of-systems by providing their aircraft position to an external system.

7.8.2. The UAS aircraft position shall be displayed to judges (and maybe to spectators) on a Google Earth console using the connection supplied by teams.

7.8.2.1. A judge will have the Google Earth laptop which has a DB-9 connector (female, with pins). To participate, teams shall provide their own method of interfacing to this early serial RS-232 interface standard.

7.8.3. Interface Control Documentation

7.8.3.1. Output NMEA standard data ($GPGGA at a minimum) on an RS232 port, 9600 baud, 8 bits, no parity, 1 stop bit.

7.8.3.2. Teams can test this by configuring Google Earth in real-time GPS import mode: http://www.google.com/earth/outreach/tutorials/importgps.html.

7.9. INFRARED (IR) SEARCH TASK (SECONDARY)

Table 10: Infrared Search Task

Parameter	Threshold	Objective
Classification	Identify the primary target or symbol.	Identify both primary (and secondary) target or symbol and orientation.
Autonomous Search	Fly the search area while capturing the IR target image.	Fly the search area autonomously while capturing the IR target image.

7.9.1. Teams shall demonstrate they have an IR capability and capture and locate the IR target using an IR sensor (using an EO camera and guessing is not allowed).

7.9.2. An Infrared (IR) target will be located within the search area previously defined in Search Area task. The coordinate position of the IR Target will be provided to teams at the Check-In and Orientation event.

7.9.3. The UAS search for the IR target should be autonomous.

7.9.4. Once transitioning into the predefined search area, the vehicle shall search for the IR target of interest while staying within the no-fly boundaries. Search area coordinates will be provided to teams during the check-in and orientation event.

7.9.5. A primary IR target will be located within the search area. An alternate secondary IR target may be presented, also located within the search area.

7.9.6. <u>IR Target (Primary)</u>

7.9.6.1. The primary IR target will be constructed of a rectangular plywood base between 3-6 feet in length and 3-6 feet in width. The plywood base will be painted so it blends into the background of the search area.

7.9.6.2. The target will contain a single Latin symbol or capital letter outlined by a heated wire as illustrated in Figure 3.

7.9.6.2.1. The wire will be of the type typically used by hobbyists to cut foam and electrically heated to provide a distinct thermal signature able to be contrasted with the target background.

7.9.6.2.2. The wire will be held approximately 3” above the plywood by standoffs.

7.9.6.3. The symbol or letter will be approximately 80% of the size of the plywood base.

7.9.7. Target characteristics to be recorded are limited to:

7.9.7.1. Location

7.9.7.2. Orientation (N, NE, E, SE, S, SW, W, NW)

7.9.7.3. Symbol or Capital Letter (Example):

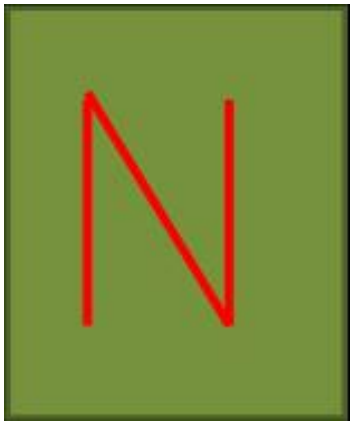


Figure 3: IR Target Example

7.9.8. IR Target (Secondary)

7.9.8.1. The secondary IR target will be constructed to present a complex IR target that may demonstrate a moving thermal image within a specified area.

7.9.8.2. The SUAS committee reserves the right to introduce, change or eliminate this complex IR target before the flight-demonstration phase.

7.9.9. The UAS shall capture the IR target images and identify target characteristics and location for scores. The images shall be provided to the judges either when observed on the ground station display during the conduct of the mission or when handing in the target report sheet with the team's USB memory stick.

7.9.10. Competitors shall record the target characteristics of all observed targets and provide this data to the judges on a target data sheet and/or in electronic form in the format given in Appendix E: Electronic Target Data Format and Appendix F: Target Score Sheet.

7.9.11. Images should be provided to the judges on the USB memory stick in JPEG format for proof during post-mission scoring.

7.10. AIR-DROP TASK (SECONDARY)

Table 11: Air Drop Task

Parameter	Threshold	Objective
Release	Manual release within the target area, from a specified direction, when < 200 ft. from the target, from an altitude ≥ 300 ft. but < 400 ft.	Autonomous release within the target area, from a specified direction, when < 200 ft. from the target, from an altitude ≥ 300 ft. but < 400 ft.
Drop Accuracy	≤100 ft. from bulls-eye.	≤50 ft. from bulls-eye.

7.10.1. The air drop task is based on a UAS search and rescue operation requirement to drop an emergency rescue canister containing communications equipment to a firefighter.

7.10.2. Teams shall demonstrate they have an air-drop using an air-drop canister (plastic egg).

7.10.3. An air-drop target will be located off the run-way in the grass area near the pit and spectator area but within the search area previously defined in Search Area task.

7.10.4. The coordinate position of the air-drop target will be provided to teams at the Check-In and Orientation event. The rescue UAS should use the target coordinates to visually find the exact location of the air-drop target and deliver the air-drop canister. Precise delivery of the air-drop canister will determine the success or failure of the drop.

7.10.5. Each UAS team participating in the air-drop task shall only drop one (1) canister.

7.10.6. Air-Drop Algorithm

7.10.6.1. The air-drop canister shall be release into the airstream at a distance <200 ft. from the air-drop target coordinates.

7.10.6.2. The air-drop canister shall be release into the airstream at an altitude between 300 ft. to 400 ft. AGL.

7.10.6.3. The air-drop canister shall be released into the airstream at an airspeed no less than 25 kts.

7.10.6.4. The UAS team may make multiple passes over the air-drop target in order to visually determine the targets precise coordinates.

7.10.6.5. The UAS team shall approach the air-drop target from a specified direction for the canister drop. The Lead Judge will give the Team Captain the specified direction based upon location to observers, prevailing winds and safety factors.

7.10.6.6. The Relief Supply drop decision will follow the logic diagram shown in Figure 4.

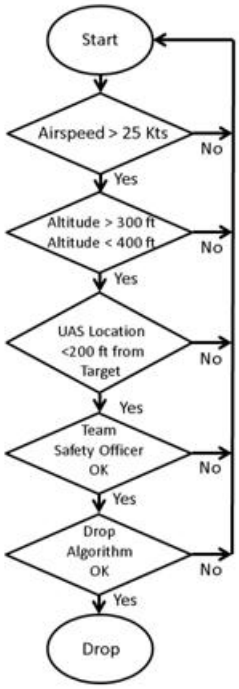


Figure 4: Air-Drop Decision Logic

7.10.7. Target

7.10.7.1. The air-drop target shall use a bulls-eye, with concentric rings at 50 ft. and 100 ft. radius away from the center, as illustrated in Figure 5.

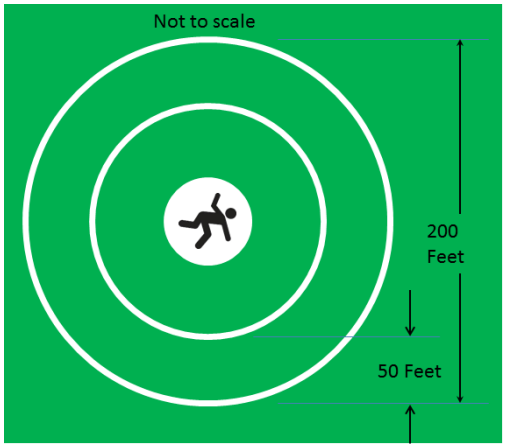


Figure 5: Air-Drop Target

7.10.7.2. Teams will be scored for successful air-drops within the target rings. Contact with the bulls-eye will be scored as a bonus.

7.10.8. Air-Drop Canister

7.10.8.1. Teams shall provide the air-drop canister, which shall be made from a single traditional plastic toy egg shell that separates into two halves.

7.10.8.2. The canister shall be filled with common baking flour.

7.10.8.2.1. To ensure all teams have proper ingredients during the competition (non-U.S. teams may not be able to bring their flour into US), the SUAS committee will provide the baking flour to fill the canisters before competing in the air-drop task.

7.10.8.3. The team shall fill the air-drop canister during team set-up time with the Safety judge monitoring the process of filling, sealing (non-toxic), and loading the canister onto the air vehicle prior to flight.

7.10.8.4. The air-drop canister shall meet the specifications defined here and shown in Figure 5. Any variations to the canister design will result in disqualification to participate in the air-drop task.

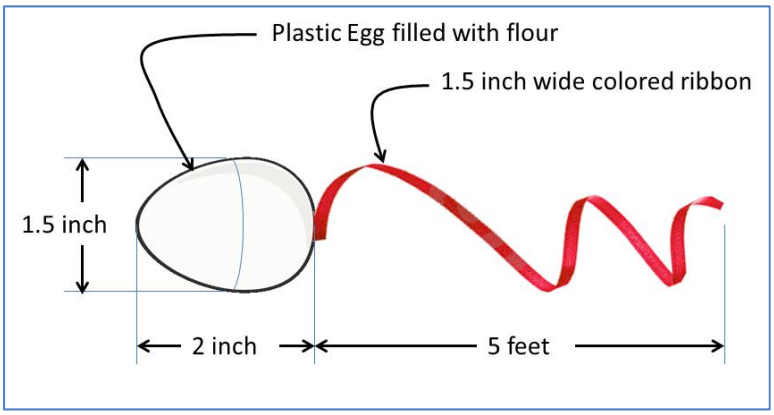


Figure 5: Air-Drop Canister Design Specifications

7.10.8.5. The air-drop canister's size shall not exceed 1.5 inches x 2.0 inches, not counting the ribbon. A Go/No-Go form-fit box will be used by the judges prior to flight to ensure the air-drop canister does not exceed the required size.

7.10.8.6. The air-drop canister shall use a drag ribbon consisting of a ribbon. The ribbon shall be 1.5 inches wide and 5 feet long. The ribbon shall be attached either internally or externally to the air-drop canister.

7.10.8.7. The completed air-drop relief canister, with drag ribbon, shall weigh a maximum of 4 oz.

7.10.8.8. The drag ribbon shall successfully deploy its entire length, and shall not separate from the canister.

7.10.8.9. The air-drop canister and drag ribbon shall be highly visible colors such as red or florescent orange to be easily identified in the grass and retrieved from the field to prevent Foreign Object Debris (FOD).

7.10.8.9.1. Annotations, coloring and or other markings on the air-drop canister may be used, provided the total weight does not exceed the maximum allowed.

7.10.9. Release mechanism

7.10.9.1. 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.

7.10.9.1.1. If a team wishes to use an autonomous system, a human shall still be in the loop with full control; a human can hold the release approval switch/button for any duration of time, but the system shall go safe once the human releases the approval.

7.10.10. Release authority

7.10.10.1. The Team Captain shall announce to the Safety Judge when the air-drop is imminent (30 seconds prior to manual release mechanism activation) and the Arming switch is engaged.

7.10.10.2. The Team Captain shall announce immediately to the Safety Judge when the manual release it put back in safe mode.

7.10.10.3. The Safety Judge will echo via radio these announcements so participants and spectators can be given a heads-up.

7.10.10.4. If the air-drop canister releases unexpectedly, a safety penalty will be assessed.

7.10.11. No explosive, combustible or corrosive materials shall be used in the construction of the air-drop task's release mechanism.

7.10.12. Participation in the air-drop task shall only be allowed for those teams that provide demonstrated proof of prior safe and successful canister drops with documented results in the team's journal paper.

7.10.13. The team's air-drop task's release mechanism, drop logic and air-drop canister shall pass UAS safety inspection and the judge's risk assessment during the FRR oral presentation, before being allowed to execute this task in the flight-mission demonstration phase of the competition.

7.10.14. Compressed air release systems based on AMA rules may pass safety inspection.

8. Scoring Metrics for Graded Elements

8.1. MISSION TASKS

8.1.1. The mission is split into several independent tasks. Each task is a graded element and comprises a feature of the competitor's system. Tasks each have specific measureable achievement criteria with an emphasis on three tiers: objective, threshold, and incomplete. Emphasis has been placed on ensuring these tasks are clearly gradable, based on feedback from student competitors and judges over previous years.

8.1.2. 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.

8.1.3. It is the SUAS committee's intent to supply more tasks than can be completed in the available mission time. The teams shall perform trade-studies to assess their mission objectives, and design approach.

8.1.4. With this compartmentalizing of the mission into tasks, new tasks will be added or deleted from year to year to add some variability to the mission.

8.2. JUDGES

8.2.1. 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.

8.2.2. Many judges help grade journal papers as well as the oral briefs and flight demonstrations, but some judges are only judging the journal papers. Judges involved with the oral briefing are required to stay involved through all oral briefings. Other judges are only assisting with the flight-mission demonstration phase. Do not assume that every judge has read your journal paper and is familiar with your system.

8.3. RELATIVE WEIGHTING

8.3.1. 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.

8.3.2. The major graded elements and their weighting are:

8.3.2.1. 25% Journal Paper

8.3.2.2. 25% Oral Presentation

8.3.2.3. 50% Flight-Mission Demonstration

8.3.3. 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 tasks in the flight-mission phase.

8.4. NORMALIZATION PROCESS

8.4.1. Introduced in the 2013 competition, a normalization process is used for both the journal paper and the oral briefings in order to equalize individual judges or groups in teams of judges.

8.4.2. For the journal paper, one team's paper is selected for all the judges to read to establish a normalization factor for all individual judges' scores for other papers.

8.4.3. For the oral presentation, one team is selected to present their FRR briefing to all the judges at the same time, but scored as separate judging teams, to establish a normalization factor for each judging team.

8.4.4. The flight-mission demonstration element is not normalized.

8.5. JOURNAL PAPER

8.5.1. The journal paper shall include the following sections:

8.5.1.1. Title page with Abstract

8.5.1.2. Description of the systems engineering approach

8.5.1.2.1. Mission requirements analysis (what tasks are planned)

8.5.1.2.2. Design rationale

8.5.1.2.3. Expected performance (achieving the tasks planned for)

8.5.1.2.4. Programmatic risks and mitigation methods

8.5.1.3. Descriptions of the UAS design

8.5.1.3.1. Design descriptions of the air vehicle, method of autonomy, data link, payload, ground control station, data processing, and mission planning

8.5.1.3.2. Mission tasks being attempted

8.5.1.3.3. Target types supported by autonomous detection (if utilized)

8.5.1.3.4. The journal paper shall include a photo of the UAS air vehicle

8.5.1.4. Test and evaluation results

8.5.1.4.1. Mission task performance

8.5.1.4.2. Payload system performance

8.5.1.4.3. Guidance system performance

8.5.1.4.4. Evaluation results supporting evidence of likely mission accomplishment.

8.5.1.5. Safety considerations/approach

8.5.1.5.1. Specific safety criteria for both operations and design

8.5.1.5.2. Safety risks and mitigation methods

8.5.2. The electronic journal paper shall be prepared so that if an evaluator prints the document, it meets the following format requirements:

8.5.2.1. 8.5 x 11 inch paper

8.5.2.2. Single-spaced typed lines

8.5.2.3. Not less than 1 inch margins

8.5.2.4. Not smaller than 10-point Times New Roman font in text

8.5.2.5. Each page shall have the school and team name, and page number, in the footer.

8.5.2.6. No more than 20 pages total. Pages beyond 20 pages will not be graded (*judges are instructed to only print pages 1-20).

8.5.2.7. A formal cover page will not be included in the page count limit.

8.5.3. Journal papers shall be electronically submitted in PDF format.

8.5.4. Journal paper's filenames shall include the school and team name, abbreviated as needed, and have the pre-fix "JP" (capital letters "JP" will identify the file as the journal paper, which must be different from the fact sheet filename)

8.5.5. Each team will be provided explicit instructions on how to log in and upload the journal papers to the team's unique folder on the SUAS SharePoint site.

8.6. ORAL PRESENTATION

8.6.1. The oral presentation shall be a Flight Readiness Review (FRR) briefing to a team of judges, and will not be a restatement of the technical journal paper as suggested in Appendix C: Flight Readiness Review (FRR) Rubric.

8.6.2. The FRR oral presentation shall not exceed 15 minutes in total 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 presentations if needed.

8.6.3. The FRR oral presentation shall cover the following topics:

8.6.3.1. A pre-mission brief

8.6.3.2. System and safety overview (what tasks are planned for)

8.6.3.3. Results of developmental test (DT)

8.6.3.4. Evidence and test data validating a likely mission accomplishment

8.6.3.5. A static display shall be used to assist in communication during the briefing, and will include the air vehicle, ground control system, relevant equipment and other supporting documentation and preparations of readiness to perform the mission.

8.6.3.5.1. A display limited to PowerPoint slides is not adequate.

8.6.4. The FRR Oral Presentation should follow a simple outline as suggested below:

8.6.4.1. Team Coordination

8.6.4.1.1. Review the team members' experience and effectiveness of coordination.

8.6.4.2. System Description

8.6.4.2.1. Describe the system, what tasks are planned, and any programmatic risks (only sufficient for the judges to understand the basic elements and team confidence).

8.6.4.3. System Safety Overview

8.6.4.3.1. Identify safety risks, avoidance and mitigation strategy.

8.6.4.4. Results of Developmental Test (DT)

8.6.4.4.1. Discuss test planning, what tests were performed, the results, any corrective actions taken and impact they had on system implementation. This scope can include sub-system and system level simulation and testing performed during bench/laboratory, ground, and flight test efforts to acquire test data and evaluate performance of: components or subsystems, air vehicle integration, ground control system integration, full UAS integration, and mission performance.

8.6.4.5. Evidence of Likely Mission Accomplishment

8.6.4.5.1. Review demonstrated performance based upon either system or subsystem-level development tests that support successful mission task accomplishment during the flight demonstration.

8.7. FLIGHT-MISSION DEMONSTRATION

8.7.1. The flight-mission demonstration is broken into tasks. These tasks are given relative weighting in order to aide teams in focusing their technical efforts.

8.7.2. Tasks priorities weighting tiers are specified as either primary or secondary. Task parameters in the same tier are scored with the same maximum weighting (i.e., say that Task A and Task B are both primary priority. Task A consists of three parameters, and Task B consists of one parameter. Full completion of Task A is worth 3 times as much as full completion of Task B). See the description of each task in Section 7 for a listing of the task parameters.

8.7.2.1. Primary tasks are intended to be the core mission focus, and shall be completed first before scoring any points on secondary tasks.

8.7.2.2. Secondary tasks are intended to be stretch objectives, and as such will be scored with less weighting than primary tasks.

8.7.2.3. The weightings of tasks are:

8.7.2.3.1. 60% Primary

8.7.2.3.2. 40% Secondary

8.7.3. 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 mission task.

8.7.3.1. Incomplete specifies that a team did not achieve the threshold criteria

8.7.3.2. Threshold specifies the minimally acceptable completion criteria, and is scored at a loss relative to the objective level

8.7.3.3. Objective specifies the desired completion criteria for maximum points

8.7.3.4. The weightings of completion levels are:

8.7.3.4.1. 0% Incomplete

8.7.3.4.2. 50% Threshold

8.7.3.4.3. 100% Objective

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.

9.2. LIABILITY

9.2.1. 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.

9.2.2. 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 C: Flight Readiness Review (FRR) Rubric, shall be turned in during the Check-in and Orientation process.

9.3. AIR VEHICLE

9.3.1. Aircraft shall comply with the 2013 Official Academy of Model Aeronautics (AMA) National Model Aircraft Safety Code, (http://www.modelaircraft.org/files/105.pdf) except as noted below:

9.3.1.1. Autonomous operation is authorized.

9.3.1.2. GENERAL – all rules apply; 2(f) replaced by team name, not AMA team name.

9.3.1.3. RADIO CONTROL – all rules apply.

9.3.1.4. FREE FLIGHT – not applicable.

9.3.1.5. CONTROL LINE – not applicable.

9.3.2. The maximum takeoff gross weight of the air vehicle shall be less than 55 lbs. when fueled and weighed with a calibrated scale during SUAS competition inspections.

9.3.3. The maximum airspeed of the air vehicle shall not exceed 100 KIAS.

9.3.4. 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.

9.3.5. The air vehicle shall be capable of manual override by the safety pilot during any phase of flight.

9.3.6. Flight Termination

9.3.6.1. The flight termination system shall be capable of activation by the safety pilot or pilot in command.

9.3.6.2. A return home or return to land (RTL) system, if installed, shall be capable of activation by the safety pilot.

9.3.6.3. The air vehicle shall automatically return home (takeoff location) after loss of primary communications link signal of more than 30 seconds.

9.3.6.4. The air vehicle shall automatically terminate flight after loss of primary communications link of more than 3 minutes.

9.3.6.4.1. If the air vehicle flight termination system is independent of the primary communications link then the air vehicle may continue with an autonomous return to home or RTL routine if installed.

9.3.6.5. Flight termination for fixed wing aircraft without an alternate recovery system (like a parachute) shall select:

9.3.6.5.1. Throttle closed

9.3.6.5.2. Full up elevator

9.3.6.5.3. Full right rudder

9.3.6.5.4. Full right (or left) aileron

9.3.6.5.5. Full flaps down (if so equipped)

9.3.6.5.6. For other than fixed-wing air vehicles, 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.

9.3.6.6. 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.

9.3.6.6.1. Questions regarding conduct of the safety check may be sent to the SUAS Competition Director detailed in Section 10.1.8

9.3.7. 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.

9.3.8. All batteries used in the air vehicle shall be colored brightly to facilitate locating them in the event of a crash. Wrapping batteries in bright colored tape is preferred.

9.3.9. 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.

9.4. GROUND CONTROL SYSTEM

9.4.1. The ground control system shall not exceed more than one motor vehicle and one trailer at the flight line.

9.4.2. All ground vehicles shall be off the runway area and parked in the grass.

9.4.3. The ground control system, being a local repository on the flight line of all aspects of the overall system except the air vehicle, should include adequate safety materials for personnel protective equipment (PED) (tools, gloves, eye protection, hearing protection, etc.), safety risk mitigation (training, check lists, etc.) and equipment to support rapid response to accidents (first aid kit, fire extinguisher, etc.) as needed.

9.5. SAFETY INSPECTIONS

9.5.1. 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.

9.5.2. All decisions of the safety inspector(s) shall be final.

9.5.3. Questions regarding conduct of the safety inspection may be sent to the SUAS Safety Inspector contact detailed in Section 10.1.8.

9.5.4. Safety inspections shall include a physical inspection, fail-safe check, flight termination check, and a maximum weight check.

9.5.5. Physical inspection of aircraft shall include:

9.5.5.1. Verify all components adequately secured to vehicle.

9.5.5.2. Verify all fasteners tight and have either safety wire, locktite (fluid) or nylock nuts.

9.5.5.3. Verify propeller/rotor structural and attachment integrity.

9.5.5.4. 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.

9.5.5.5. Radio range checks, motor off and motor on.

9.5.5.6. Verify all controls move in the proper sense.

9.5.5.7. Check general integrity of the payload system.

9.5.5.8. Verification of fail-safe mode operation covered by manual override and pilot-commanded flight termination.

9.6. LAUNCHERS

9.6.1. Takeoff shall not be allowed from moving vehicles.

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

9.7. OTHER

9.7.1. No more than ten team members, one advisor, and one pilot will be allowed in the mission area (total of 12 people).

9.7.2. Location of air vehicles 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.

9.7.3. No objects shall depart from the aircraft while in flight (except during intentional execution of the air-drop task).

9.7.4. 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.

9.7.5. Officials will have the right to disqualify any entry that they deem a hazard.

9.7.6. No team's 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.

9.7.7. Open toed shoes/flip flops should not be worn during safety inspections, flight line operations, or when air vehicle engines are powered (even in the pit area).

9.7.8. If anyone observes anyone in an unsafe activity or an imminently unsafe activity, say something! Safety is a shared responsibility.

9.7.9. Judges may deduct points as penalty for procedural safety errors (even accidental), not related directly to flight mission, such as improper safety practice in the pit area.

9.7.10. The decision on a safety call by the On-Field Safety Officer will 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 Competition Director 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 information:

10.1.4.1. SharePoint URL: https://suas.auvsi-seafarer.org/SitePages/Home.aspx

10.1.4.2. Specific team usernames and passwords will be provided by the Competition Director after registrations have been accepted.

10.1.5. The SUAS Competition e-mail addresses:

10.1.5.1. To (all): tim.piester@urs.com; wayne.devereux@wyle.com; mark.r.pilling@saic.com; elledge_kerstin@bah.com

10.1.5.2. Subject line: "2014 SUAS" and "school or team name".

10.1.6. The SUAS Competition mailing address:

AUVSI Seafarer Chapter
P.O. Box 141
California, MD 20619

10.1.7. The 2014 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
* Caller-Paid number: 602-333-2024
* Blackberry (Toll-Free Number): 8883691427x2303854#
* 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

When prompted, enter the Meeting Access Code: 2303854#

10.1.7.2. To connect to the Web Conference use URL: https://connect15.uc.att.com/urs/meet/?ExEventID=82303854

10.1.7.3. If teams are interested, the SUAS committee can forward the Webex meeting maker if the schools provide an e-mail address.

10.1.8. The 2014 SUAS Competition point of contact:

Seafarer Chapter President – Tim Piester
Base Access – Dawn Jaeger and Jim Curry
Competition Director – Mark Pilling
Head Judge – Wayne Devereux
Safety Inspector – Rob Ross

10.1.9. The official Electronic Funds Deposit information (restricted to US teams and sponsors):

Account Reference: Seafarer Chapter, Inc.
Bank Name: PNC
Bank Account Number: 5570088086
Bank ABA Routing Number: 054000030

10.1.10. The 2014 SUAS Check-in and Orientation location address:

Patuxent River Naval Air Museum
22156 Three Notch Rd, Lexington Park, MD 20653
Phone: 301-863-7418
Website: http://paxmuseum.com/

10.1.11. The 2014 SUAS competition (oral presentation and flight-mission demonstration) location and address:

Naval Air Station Patuxent River
Webster Outlying Field
St. Inigoes, MD 20684
Website: http://www.wiki.somd.com/index.php/Webster_Field

10.1.12. The 2014 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. provided either as an e-mail attachment or uploaded to the official SharePoint site, shall be submitted in PDF format.

10.2.3. All official payments shall be made in U.S. dollars (USD).

10.2.4. Registration payment shall be as Check, Money Order, or Electronic Bank Deposit.

10.2.5. 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 must complete the application form in Appendix A: Application Form.

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. Deadline for the registration application form and payment is listed in the Schedule table in Section 3.

10.3.3. Registration application forms shall be either mailed or e-mailed to Treasurer, AUVSI Seafarer Chapter, at the address listed in Section 10.1.

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 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. The 2014 SUAS Competition registration fee is $500 USD.

10.4.1.1. Teams outside of the United States must mail checks or money orders.

10.4.2. Payment shall be to: "AUVSI Seafarer Chapter".

10.4.3. Registration fees shall be mailed or wired to the Treasurer, AUVSI Seafarer Chapter, at the address listed in Section 10.1.6.

10.4.4. Deadline for the registration fee is listed in the Schedule table in Section 3.

10.4.5. Registration application and registration payment must BOTH be post marked no later than the deadline date and time in the competition Schedule to be registered.

10.4.6. If a team does not meet the registration process requirements, the registration fee will be reimbursed.

10.4.7. No credits to future competitions shall be granted.

10.5. WITHDRAWAL PROCESS

10.5.1. If a team decides to withdraw from the competition, the Team Captain must formally submit a written request to withdraw to the SUAS Competition Director.

10.5.2. The request to withdraw may be by e-mail or by posting a written document titled "Withdrawal" in the team's SharePoint, as defined in Section 10.1.

10.5.3. The deadline a team may withdraw from the SUAS competition and still receive a reimbursement of the registration fee is detailed in the schedule of Section 3.

10.5.4. Failure to properly withdraw from the competition by the deadline shall result in forfeiture of the registration fee.

10.5.5. Reimbursement checks will be made out to the person or organization listed on the registration application to receive the prize money, unless the withdrawal notification indicates a different person or organization.

10.5.6. No credits to future competitions shall be granted.

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 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 mission. 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 more than one team.

10.6.4. Some of the down-selection process can occur after the withdraw deadline has passed, at which time the team shall forfeit its ability to compete in this phase.

10.6.5. As with all official information, this announcement (should it be necessary) will appear on the official information source website.

10.7. TEAM PARTICIPATION

10.7.1. Teams do not need to compete in all portions of the competition to win prizes. If a team submits a journal paper, but cannot attend the competition days, they may still win a cash prize for ranking of the journal paper. Likewise a team could submit a journal paper and give their oral brief without performing the flight-mission demonstration and still receive prizes. This might occur due to a crash of their air vehicle shortly prior to the competition.

10.7.2. Prerequisites for participation in the flight-mission demonstration phase include successful submission of a technical journal paper, successfully passing the safety inspection and presenting the oral briefing FRR where judges assess the team's readiness for flight is acceptable.

10.8. TEAM MEMBERSHIP

10.8.1. Full-time undergraduate or high school students including no more than one graduate student shall compose the team.

10.8.2. If a faculty advisor, non-students or AUVSI Staff is used as the air vehicle pilot, they are not counted as team members.

10.8.3. Members from industry, government agencies, or universities (in the case of faculty or additional graduate students) may advise the team; however, they should not directly contribute in the creation of the design, test, paper, or presentation.

10.8.4. The faculty member/advisor will sign a statement that the team consisted of no more than one graduate student and submit it with the team list.

10.8.5. No more than ten people from each school will be covered by competition expenses (food, shirts, etc.). Any additional team or accompanying members will be required to pay for their expenses.

10.8.6. University participants shall be enrolled at their schools for at least 12 credit hours or more per quarter or semester during winter 2013 and/or spring 2014 to be considered "students" unless cleared by the Competition Director (Winter 2013 or Spring 2014 graduating seniors are not considered as grad 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.

10.9. STUDENT PARTICIPATION

10.9.1. The student members of a team shall make significant contributions to the development of their entry.

10.9.2. One 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 operate as safety pilots and may communicate to the team in the safety pilot role.

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. CONTESTANT FACILITIES

10.10.1. Competitors are **not required** to identify the facilities they used for system integration and flight testing.

10.11. GOVERNMENT FACILITIES

10.11.1. The AUVSI Seafarer Chapter of SUAS Competition shall be conducted aboard:

10.11.1.1. Naval Air Station (NAS) Patuxent River, Maryland (MD), Webster Field Annex.

10.11.2. All personnel attending the SUAS Competition shall be cleared for access to Webster Field.

10.11.3. For team members, faculty, or guests that are United States citizens, the following information shall be submitted in the team's SharePoint folder by the deadline in the Schedule of Section 3.

10.11.3.1. Name, Date of Birth, Place of Birth, and Social Security Number.

10.11.4. 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.

10.11.5. All non-U.S. citizens shall be escorted when on-site at Webster Field.

10.11.6. 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.

10.11.7. For international teams or U.S. teams with non-U.S. citizens, a letter on College or University letterhead, signed by an official school administrator, shall be submitted by the deadline in the Schedule of Section 3.

10.11.7.1. A sample of the letter to be submitted, data requirements, and forwarding instructions will be sent to the team after registration has been accepted.

10.11.8. 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.

10.11.8.1. In past competitions, some teams have not been able to travel because they delayed in obtaining passports and visas.

10.11.9. 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.

10.11.9.1. Any non-U.S. citizens who submit their passports or visas after the deadline defined in the Section of Section 3 shall NOT be granted access to Webster Field.

10.11.10. Officials shall have the right to have any persons immediately escorted from the facility without notice.

10.12. BASIS FOR AWARDS

10.12.1. The judging team will evaluate on a graduated basis the competitor's compliance to the requirements set forth in this solicitation.

10.12.2. Judges may award prize barrels for completing mission tasks (**subject to change, based on sponsorship funding**):

10.12.2.1. An award may be given to the best overall safety approach/execution.

10.12.2.2. Overall award for the best combined score from Journal, Oral Presentation (FRR), and Flight-Mission Demonstration.

10.13. OFFICIAL PAYMENT OF PRIZE MONEY

10.13.1. Plaques and/or prize money are awarded to the teams excelling in the competition's primary categories and achieving the select prize barrels.

10.13.2. Teams receiving prize money will be given checks for the specified prize amount at the Awards Banquet.

10.13.3. Checks will be made out for distribution to the academic, team or individual name specified on the team's application form.

10.14. TEAM LOGISTICS

10.14.1. Teams shall be responsible for all planning, execution and shipping costs (inclusive of all export rules and duties) for transportation of equipment to/from the competition.

10.14.2. Teams shall be responsible for all planning, execution and travel costs to/from the competition, including hotels and food outside the competition.

10.14.3. 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.

11. Appendix A: Application Form

Application
2014 Student UAS Competition

Twelfth Annual Student UAS Competition

June 18 - 22, 2013

NAS Patuxent River; Webster Field, MD.

1. College/University/School: _____

2. Name of Team/Vehicle: _____

3. Faculty Advisor/Staff (including phone #): _____

4. Faculty Advisor Phone Number: _____

5. Faculty Email address: _____

6. Team Captain Name: _____

7. Team Captain Telephone Number _____

8. Team Captain Email: _____

9. Team Contact Address: _____

10. Team City, State/Province: _____

11. Team Zip Code/Country: _____

12. **Important!** Name on Check Prize Awards written to: _____

13. Sponsor(s) if any: _____

APPLICATION FORM and PAYMENT: Must be date/time stamped by DEADLINE in Rules, Section 3.
Registration Fee: $500 USD.
Payable to: AUVSI Seafarer Chapter
Mailing Address:

AUVSI Seafarer Chapter, Treasure
P.O. Box 141
California, MD 20619

12. Appendix B: Fact Sheet Format

1. School: _____

2. Name of Team/Vehicle _____

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

_____

4. Basic description of air vehicle and systems:

_____

_____

_____

_____

_____

_____

_____

_____

_____

5. Air vehicle control frequencies: _____

_____

6. Payload control and/or imagery receipt frequencies: _____

_____

7. Fuel and/or battery type: _____

_____

8. Air vehicle dimensions (including gross weight): _____

9. Launchers, vehicles, and other large equipment that will be brought to the competition:

_____

13. Appendix C: Flight Readiness Review (FRR) Rubric

The FRR is a multi-disciplinary technical review to ensure that the subsystem or system under review is ready to proceed into flight-mission demonstration. The FRR assesses test objectives, test methods and procedures, scope of tests, and safety. The FRR verifies the traceability of tests to competition requirements. The FRR determines the completeness of test procedures. The FRR assesses the system under review for development maturity, effectiveness, and risk to determine readiness to proceed to flight-mission demonstration.

The FRR should answer the following questions:

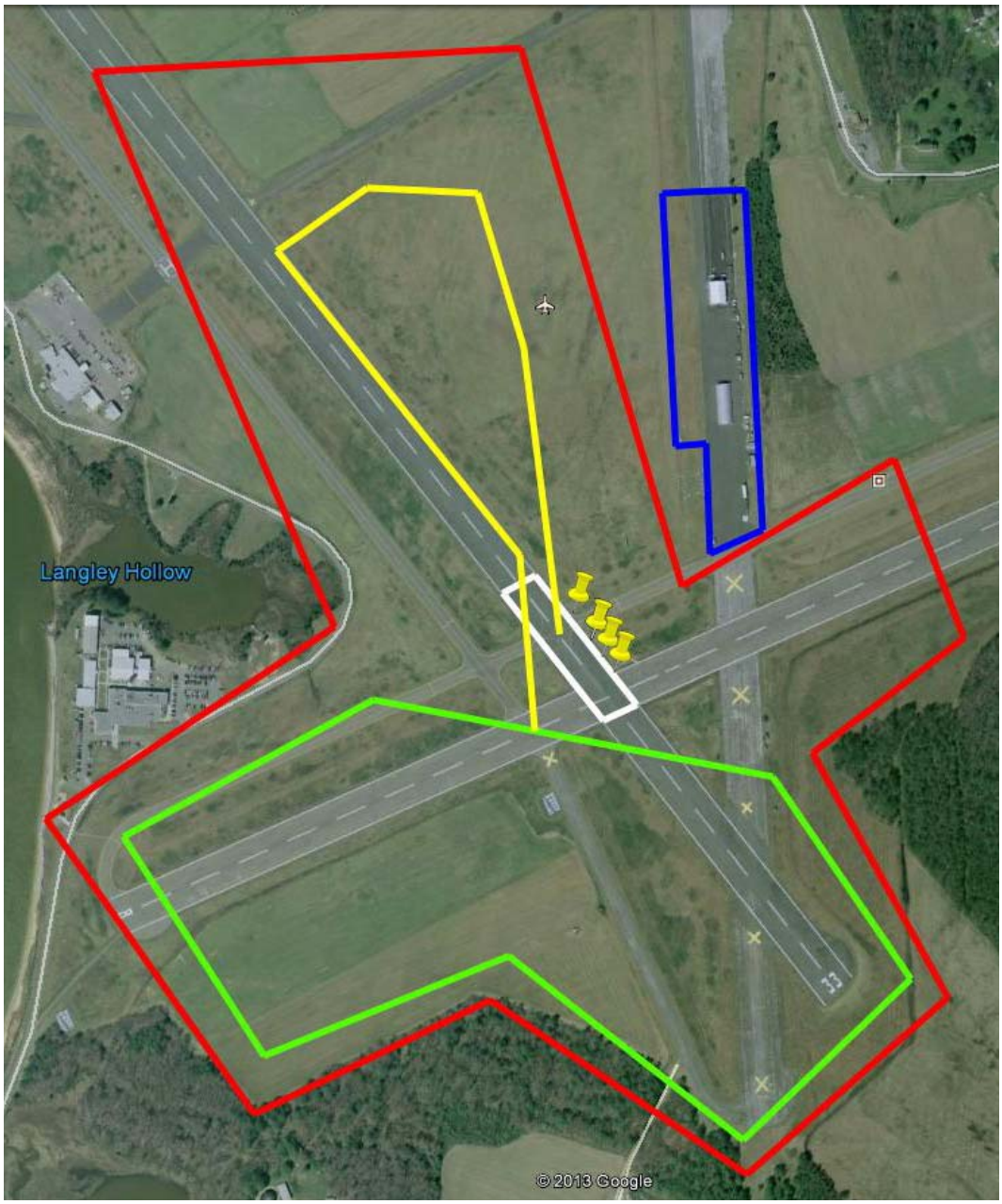
- Will the planned flight verify all directly traceable requirements?
- Is the configuration of the system sufficiently mature, defined, and representative to accomplish planned test objectives and/or support defined program objectives?
- Have all planned preliminary, informal, functional, unit level, subsystem, system, and qualification tests been conducted, and are the results satisfactory?
- Have all applicable flight/system limitations been defined and agreed to?
- Is the planned test properly resourced (people, test article or articles, facilities, data systems, support equipment, logistics, etc.)?
- Have the crew members been trained properly?
- Has a discrepancy identification and reporting system been defined and agreed to?
- Have Go/No-Go criteria been defined and agreed to?
- What is the fall-back plan should a technical issue or potential showstopper arise during flight-mission demonstration?
- Has a final reporting process been defined and agreed to?
- What is the expected result and how do the test results affect the expected flight-mission demonstration outcome?
- What are the risks associated with the flight-mission demonstration, and how are they being mitigated?

FRR success criteria:

A. Identified risk level is acceptable.
B. The judgment that previous component, subsystem, and system test results form a satisfactory basis for proceeding into flight-mission demonstration.

Test and evaluation is critical to evaluating the system. The FRR ensures that the testing which was conducted properly evaluated the system and that the system is ready to be flown in the flight-mission demonstration.

14. Appendix D: Map of Competition from 2010 SUAS (*Example Only*)



Map key

- Blue outline: spectator and parking area
- Red outline: no-fly zone boundary
- Green outline: search area
- Yellow path: waypoint sequence
- White outline: takeoff and landing designated area
- Yellow pins: flight line stations

15. Appendix E: Electronic Target Data Format

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

9 fields, tab delimited, new target on each line. Example for two targets:

1	2	3	4	5	6	7	8	9
01	N30 35 34.123	W075 48 47.123	N	rectangle	red	A	orange	target1.jpg
02	S34 00 12.345	E002 01 12.345	SE	square	orange	4	yellow	target2.jpg

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 - 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 3 - 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 4 - Target orientation, up to two characters
Example: N, NE, E, SE, S, SW, W, NW

Field 5 - Target shape; list geometric shape as appropriate:
Example: rectangle, square, triangle

Field 6 - Target color, as appropriate.
Example: Red, Orange, Yellow, etc.

Field 7 - Alphanumeric, as appropriate
Example: A, b, 2, &

Field 8 - Alphanumeric color, as appropriate
Example: Red, Orange, Yellow, etc.

Field 9 - Name of JPEG file with image of target
Example: target1.jpg

16. Appendix F: Target Score Sheet (Example)

Target # _____ Action Intel? Y IR? Y	**Target # _____ Action Intel? Y IR? 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: (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 IR? Y	**Target # _____ Action Intel? Y IR? 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: (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 IR? Y	**Target # _____ Action Intel? Y IR? 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: (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:

17. Appendix G: Radio Frequency Management Packages

FREQUENCY BAND	A	B	C	D	E (pits) Initialization
72 MHz for RC	Team-by-team special approval required				
UHF ISM Band 433MHZ (431-435MHZ)	FHSS				
ISM bISM 1nd radio modem covering the 902 - 928 MHz	FHSS				
1.2.-1.3 GHz analog video systems	Channel 1 1.08GHz	Channel 3 1.16GHz	Channel 5 1.24GHz	Channel 7 1.32 GHz	Channel 8 1.36 GHz
2.4 GHz RC (2.4- 2.485)	Spread Spectrum				
2.4 GHz Wi-Fi	Channel 3 Channel 1 for SRIC	Channel 5 Channel 1 for SRIC	Channel 7 Channel 1 for SRIC	Channel 9 Channel 1 for SRIC	Channel 11 Channel 1 for SRIC
5 GHz Wi-Fi	DFS Or Channel 36	DFS Or Channel 44	DFS Or Channel 149	DFS Or Channel 157	DFS Or Channel 165

NOTE: Systems shall be designed such that multiple systems can operate simultaneously using the RF spectrum management scheme described in the rules. 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 Competition Director.

18. Appendix H: SRIC Details

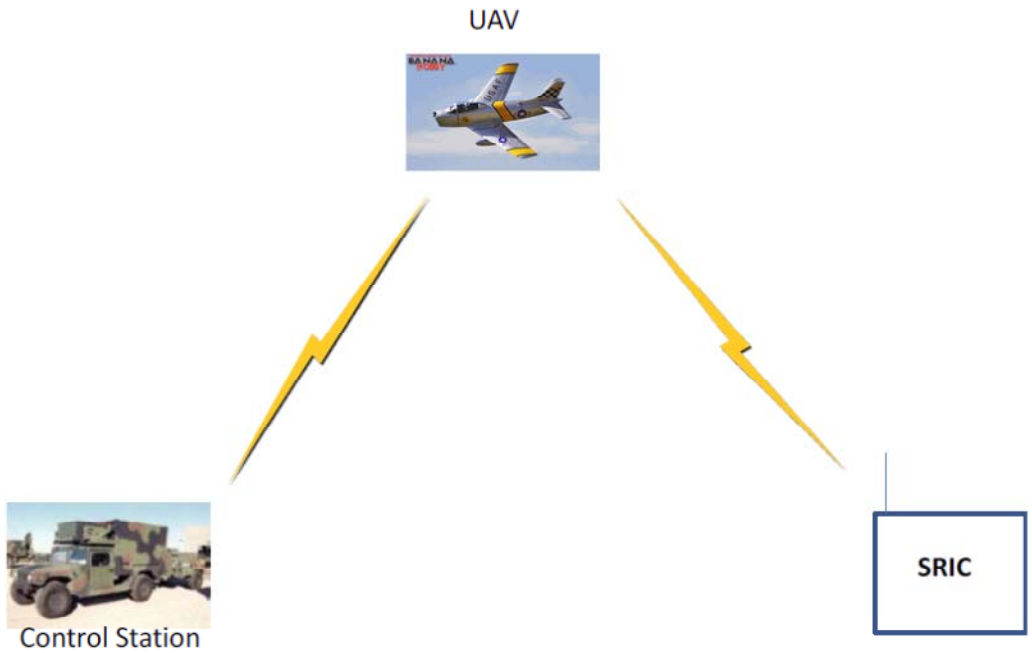


FIGURE 1: SRIC CONNECTION DIAGRAM

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 laptop computer running Microsoft Windows 7, 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.

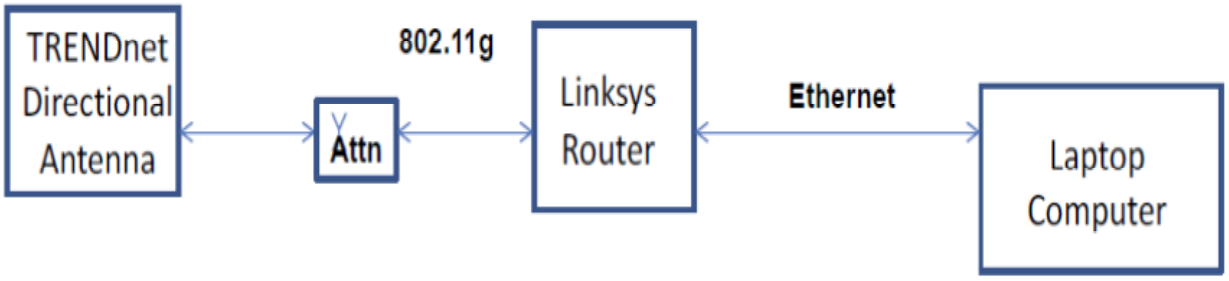


FIGURE 2: SRIC BLOCK DIAGRAM

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 3: SRIC ROUTER

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

FIGURE 4: SRIC ANTENNA

http://www.trendnet.com/products/proddetail.asp?prod=145_TEW-AO14D&cat=926

3.0 APPLICABLE DOCUMENTS

3.1 IEEE 802.11g specification available at:
http://standards.ieee.org/about/get/802/802.11g.html

3.2 The SUAS Rules are available from the AUVSI Student Competition website.
http://www.auvsi-seafarer.org

4.0 INTERFACE DESCRIPTIONS

4.1 Logon Procedures:

4.1.1 The antenna location and the wireless network name will be provided at the Check-in and Orientation event.

4.1.2 The router IP address, netmask, and 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 the practice day.

4.1.4 The student teams shall use Wired Equivalent Privacy (WEP) 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. If dynamic IP is not used, a static IP address will be provided.

4.1.8 After network connection is confirmed, enter the provided IP address.

4.1.8.1 An example is below: FTP://192.168.1.110/auvsi/team1.

4.1.9 Open the folder and find a unique team file within the folder. This folder will be read only.

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.

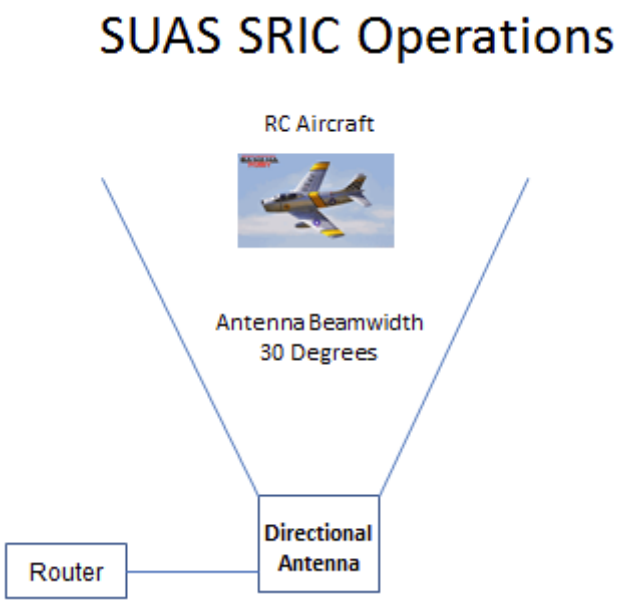


FIGURE 5: DIRECTIONAL ANTENNA PATTERN

19. Appendix I: Notice of Risk; Disclaimer of Liability; Waiver of Claims Form

I. NOTICE OF RISK; DISCLAIMER OF LIABILITY; WAIVER OF CLAIMS

1. Activities associated with the Student UAV Competition can at times involve substantial risk of injury, property damage, and other dangers associated with participation in the event. Dangers peculiar to such activities include, but are not limited to: hypothermia, drowning, broken bones, stains, sprains, bruises, concussion, heart attack, heat exhaustion, cuts, abrasions, burns, electrical shock, poisoning, and blunt trauma.

Check 2a or 2b:

2a. I have no serious health issues or problems that would preclude me from participating in this competition or that present an abnormal, unusual or unreasonable risk of, or susceptibility to, injury.

_____ Initials _____ Date

2b. I have a disability which I have disclosed to the competition officials, and I have:

Check (i) or (ii):

(i) not requested any reasonable modifications in policies, practices or procedures.

_____ Initials _____ Date

(ii) requested reasonable modifications in policies, practices, or procedures which will not fundamentally alter the nature of the competition.

_____ Initials _____ Date

_____ Initials _____ Date

3. Each sponsor, participant, judge, hired service provider, volunteer, or staff member in the Student UAV Competition should realize that there are inherent risks, hazards, and dangers involved including transport of equipment, preparation for competing, training/testing, travel to and from the event, and, of course, competing in the event itself. It is the responsibility of each person involved to engage only in those activities from which s/he has the prerequisite skills, qualifications, preparation, and training.

_____ Initials _____ Date

II. ACKNOWLEDGEMENT AND ASSUMPTION OF RISK

4. I have read the above notice carefully and acknowledge receipt of a copy thereof. In consideration of the benefits received, I hereby assume all risks of damages or injury, including death, that I may sustain while participating in or as a result of, or in any way growing out of my activity associated with the Student UAV Competition.

5. In particular, without limiting the generality of the foregoing, I fully understand and acknowledge that there are risks and dangers associated with participation in the Student UAV Competition events and activities which could result in bodily injury, partial and/or total disability, paralysis and death. The social and economic losses and/or damages to me, my family and others, which could result from these risks and dangers described above, could be severe. These risks and dangers may be caused by my own action, inaction or negligence or the action, inaction or negligence of others, including, but not limited to, the Association for Unmanned Vehicle Systems International (AUVSI), its members individually and its officers, agents and volunteers and employees, the competition organizer, the organizer's family and estate, and the United States Government and its employees and agents (hereafter, collectively referred to as the "Releasees"). There may be other risks not known to us or not reasonably foreseeable at this time.

6. I accept and assume such risks and responsibility for the losses and/or damages following such injury, disability, paralysis or death, however caused and whether caused in whole or in part by the negligence of the Releasees named above.

_____ Initials _____ Date

III. RELEASE AND WAIVER OF LIABILITY AND COVENANT NOT TO SUE (READ CAREFULLY BEFORE SIGNING)

7. I hereby acknowledge that participation in risk oriented programs and activities involves an inherent risk of physical injury and I assume all risks. I hereby agree that for the sole consideration of AUVSI's and the U.S. Government's allowing me to participate in the Student UAV Competition for which the United States Government has made available facilities, equipment, grounds, and personnel, and the AUVSI has made available equipment, awards, and volunteer staff, I, for myself, my personal representatives, assigns, executors, heirs and next of kin, do hereby release and forever discharge the Releasees from and of any and all claims, demands, rights and causes of action of whatever kind or nature, arising from and by reason of any and all known and unknown, foreseen and unforeseen bodily and personal injuries (INCLUDING BUT NOT LIMITED TO THE DEATH OF THE PARTICIPANT OR DAMAGE TO PROPERTY), damage to property, and the consequences thereof, whether or not caused or contributed to in whole or in part by the negligence of the Releasees, resulting from any participation in any way connected with the Student UAV Competition.

8. I further expressly agree that the foregoing release, waiver, and covenant not to sue is intended to be as broad and inclusive as is permitted by the law of the State in which the event is conducted.

9. I further covenant and agree that for the consideration stated above, I will not sue the Releasees for any claim for damages arising or growing out of my participation in the Student UAV Competition. I understand that the acceptance of this release and covenant not to sue the Releasees shall not constitute a waive in whole or in part, or any sovereign or official immunity which may be possessed by any of the Releasees.

10. I have received a copy of this document and I certify that I am ___ years of age and suffering under no legal disabilities and that I have read the above carefully before signing.

11. This entire agreement, including the notice, assumption of risk, and release, waiver of liability and covenant not to sue shall be construed and applied so as to conform to the law of the State whose laws are deemed to be controlling. In the event any clause of this agreement shall be deemed not to be in compliance with applicable law, that clause shall be either be given no force or effect, or shall be construed and applied to conform to State law, the validity and enforceability of all other clauses and of the agreement itself otherwise not being affected.

12. I HAVE READ THIS RELEASE AND WAIVER OF LIABILITY, ASSUMPTION OF RISK AND COVENANT NOT TO SUE AGREEMENT, FULLY UNDERSTAND ITS TERMS, UNDERSTAND THAT I HAVE GIVEN UP SUBSTANTIAL RIGHTS BY SIGNING IT, AND HAVE SIGNED IT FREELY AND VOLUNTARILY WITHOUT ANY INDUCEMENT, ASSURANCE, OR GUARANTEE BEING MADE TO ME AND INTEND MY SIGNATURE TO BE COMPLETE AND UNCONDITIONAL RELEASE OF ALL LIABILITY TO THE GREATEST EXTENT ALLOWED BY LAW.

Name	Date
Signature	Signature of Parent or Guardian (If participant is under 18)
Witness	Witness