

SECTION DESCRIPTION

- A CONCEPT OF OPERATIONS
- C DESCRIPTION AND SPECIFICATIONS
 - C-1 STATEMENT OF WORK FOR SEAFARER CHAPTER OF THE ASSOCIATION OF UNMANNED VEHICLE SYSTEMS INTERNATIONAL (AUVSI) STUDENT UNMANNED AERIAL SYSTEM (SUAS) COMPETITION
- I COMPETITION CLAUSES
- J LIST OF ATTACHMENTS
- L INSTRUCTIONS, CONDITIONS, AND NOTICES TO COMPETITORS
- M EVALUATION FACTORS FOR AWARD

SECTION A CONCEPT OF OPERATIONS

A company of US Marines is conducting a patrol. Your unmanned aerial system (UAS) is supporting their sweep with intelligence, surveillance and reconnaissance (ISR). In order to support them, your UAS must comply with Air Tasking Order (ATO) Special Instructions (SPINS) for departure and arrival procedures, and then remain within assigned airspace. It will be tasked to search a large area for typical targets, and may be tasked to conduct an immediate route reconnaissance for convoy support or a point reconnaissance if requested. Immediate ISR tasking may be requested outside currently assigned airspace, causing the UAS operators to request deviations.

SECTION C DESCRIPTIONS AND SPECIFICATIONS

C-1 STATEMENT OF WORK FOR SEAFARER CHAPTER OF THE ASSOCIATION OF UNMANNED VEHICLE SYSTEMS INTERNATIONAL (AUVSI) STUDENT UNMANNED AERIAL SYSTEM (SUAS) COMPETITION

1.0 Introduction

- 1.1 This statement of work (SOW) defines the tasks to be performed by the competitor in performing all aspects of the SUAS competition.
- 1.2. The Seafarer Chapter of the Association for Unmanned Vehicle Systems International (AUVSI) continues the Student UAS 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 design, fabrication and demonstration of a system capable of completing a specific autonomous aerial operation.

Student teams will be judged based on their system performance, and top teams will earn prize money. Opportunities for interaction with top UAS designers, engineers, scientists and leadership will be provided.

- 1.3 The principal thrusts of the competition are the safe application and execution of Systems Engineering to develop autonomous operation in successful mission accomplishment.
- 1.4 The major graded items/events are:
 - 1.4.1 Final Journal Paper
 - 1.4.2 Oral Presentation
 - 1.4.3 Flight Demonstration
- 2.0 Scope. This is a Performance-Based competition. Multiple government agencies, prime contractors, engineering firms and Universities are observing and judging this competition. Contestants may be awarded prizes for major graded items/event, overall performance or individual aspects of a graded item/event.
- 3.0 Requirements. The Statement of Work for this competition is laid out in paragraph format in contract line item number order to facilitate tracking and task identification. Technical support tasks, documentation and products should be provided in accordance with the Statement of Work.
 - 3.1 System Design & Development (SDD). There are no graded events during SDD – this SOW task is entirely to aid the competitor to understand the requirements and the systems engineering process. Each team will establish its own Plan of Action and Milestones (POA&M) to complete SDD within the

time available before the graded Flight Demonstration. Teams may compress, consolidate or eliminate suggested reviews (at their peril).

- 3.2 Fact Sheet. Six weeks prior to the competition (May 4, 2009) a one-page fact sheet providing basic descriptions of the air vehicle and systems shall be submitted to AUVSI Seafarer Chapter. It shall include frequencies used for air vehicle control (manual or autonomous) and payload control/imagery receipt, fuel and/or battery type and air vehicle dimensions including gross weight.
- 3.3 Journal Paper. Each team is required to electronically submit a journal paper that describes the design of their entry and the rationale behind their design choices. The paper shall include a description of the systems engineering approach used for total systems design, descriptions of the UAS design, test and evaluation results (including payload and navigation system performance), and safety considerations/approach. Systems engineering includes mission/requirements analysis, design rationale, and expected performance. Design descriptions are required for the air vehicle, ground control station, data link, payload, mission planning, data processing and method of autonomy and target types supported by autonomous cueing/recognition (if utilized). Specific attention shall be paid to safety criteria. The journal paper shall include a photo of the UAS air vehicle. The journal paper (including proof of flight video or statement) must be received by AUVSI Seafarer Chapter no later than May 27, 2009.
- 3.4 Oral Presentation. The Oral Presentation will not be a restatement of the Journal Paper. Instead, it will take the shape of a Test Readiness Review (TRR) during which the competitors will present the judges with
 - 3.4.1 System Safety Overview
 - 3.4.2 Results of developmental test (DT)
 - 3.4.3 Evidence of likely Mission Accomplishment
 - 3.4.4 Pre-Mission Brief
 - 3.4.5 A static display describing the elements above
- 3.5 Flight Demonstration.
 - 3.5.1 Takeoff_- Takeoff shall take place within one of two designated Takeoff/Landing areas, depending on wind direction. This area will be paved asphalt surface, roughly 100 ft wide, with no height obstacles. Systems utilizing launchers and/or not performing wheeled landing may utilize the grass immediately adjacent to the runway; however, grass area will not be prepared. Takeoff from moving vehicles is prohibited. Launchers will be inspected by competition safety inspectors before they are allowed for use in the competition. After takeoff, the air vehicle shall maintain steady, controlled flight at altitudes above 100 feet and under 750 ft MSL (Note: airfield elevation is approximately 10 ft MSL).

- 3.5.2 Waypoint Navigation – Air vehicles shall overfly selected waypoints and remain inside assigned airspace, and avoid no-fly zones. Teams will fly a predetermined course that includes changes in altitude and in heading, to and from the search area.
- 3.5.2.1 Waypoints - GPS coordinates (ddd.mm.ssss) and altitudes will be announced the day prior to the flight competition. However, because of the dynamic nature of modern warfare, it is possible that additional waypoint(s) and or search area adjustment(s) will be required.
- 3.5.2.2 Enroute Search – Air vehicles will be required to fly specific altitudes and airspeeds while identifying several targets along the predefined entry/exit route. One of the targets will be directly along the route when the vehicle is required to be at 500 ft MSL (± 50 ft). Another target will be up to 250 ft from the center of the flight path while the vehicle is required to be at 200 ft MSL (± 50 ft). The team will be given the position of the off-center target. UAS shall not vary from the flight paths (± 100 ft tolerance) briefed during the mission planning in order to obtain an image of the target; flight path deviations shall not be permitted as to avoid being shot down by hostile or friendly forces.
- 3.5.2.3 Targets - Targets will be constructed of plywood of a given size, basic geometric shape, and color; for an example, see Figure 1. Each target will be a different shape and a unique color; a different color alphanumeric will be painted on each target. There are an unknown number of targets in the area. The additional target will be more reflective of a realistic surveillance target. The minimum dimension of the targets (length or width) will be 4 feet, and the maximum dimension will be 8 feet. Alphanumerics will be sized to fit within the overall dimensions of the target.

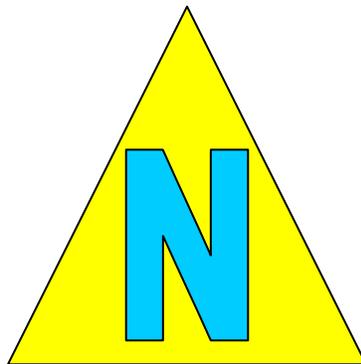


Figure 1.

- 3.5.3 Area Search - once transitioning into the predefined search area via the entry/exit route, the air vehicle shall search for specific targets on

interest. Air vehicles may search the area at any altitude between 100 and 750 ft MSL. Targets will be distributed throughout the search area. Competitors shall record the characteristics (location, shape, color, orientation, alpha, alpha color) of all observed targets on a target data sheet and provide this sheet to the judges at completion of the mission.

While executing the search mission, the team will be provided with a new search area (within the existing no fly zone boundaries) allowing you to locate “pop-up” targets. There will be a minimum of 200 ft margin between the search area and the no fly zone boundary. Teams choosing to look for these targets shall display the new search area to the operator and judges.

- 3.5.4 Landing - Landing shall be performed completely within the designated takeoff/landing area. Transition to manual control is permitted for landing. Extra credit and a cash award will be provided for autonomous landing. Control in landing will be graded. Mission completion is when the air vehicle motion ceases, engine is shutdown, and the mission data sheet and imagery have been provided to the judges.
- 3.5.5 Total Mission Time - Total mission time is the time from declaration of mission start from the judges and permission to turn on transmitters until the vehicle has landed, transmitters are shut off, and mission data sheet is handed to the judges. Accuracy of results and time required to submit results will be measured. Missions completed between 20 and 40 minutes will receive some bonus points for each minute less than 40 minutes; however, no additional points will be awarded for mission times less than 20 minutes. Significant points will be deducted for each minute over 40 minutes mission time, up to 60 minutes total where it is mandatory to turn in results. It should also be noted that each team will be given 40 minutes time to set up equipment prior to the beginning of the mission. After 40 minutes, the judges may declare mission start, regardless of the team’s readiness to launch the mission.

Extra credit will be given for providing complete and accurate information (actionable intelligence) during flight: once that information is provided it cannot be modified later. Actionable intelligence is all six target characteristics (shape, background color, alphanumeric, alphanumeric color, orientation, and location) provided at that time and recorded on the target data sheet. This will not be considered to be actionable intelligence unless you designate it as such. Credit for actionable intelligence will only be given for one target.

- 4.0 General Requirements. Flight operations of any type involve some level of risk to personnel and property. It is the responsibility all personnel involved in flight operations to identify, evaluate and mitigate risks to the maximum extent possible.
- 4.1 Safety. Systems that do not meet the requirements listed below will not be permitted to fly.
- 4.1.1 The Maximum takeoff gross weight of the air vehicle shall be less than 55 lbs.
 - 4.1.2 The system shall provide sufficient information to the judges to ensure that it is operating within the no-fly/altitude boundaries on a continuous basis.
 - 4.1.3 The air vehicle shall be capable of manual override by the safety pilot during any phase of flight.
 - 4.1.4 The air vehicle shall automatically return home or terminate flight after loss of transmit signal of more than 30 sec.
 - 4.1.5 The air vehicle shall automatically terminate flight after loss of signal of more than 3 minutes.
 - 4.1.6 The return home system, if installed, shall be capable of activation by the safety pilot.
 - 4.1.7 The flight termination system shall be capable of activation by the safety pilot.
 - 4.1.8 Flight termination for fixed wing aircraft without an alternate recovery system (like a parachute) shall select:
 - 4.1.8.1 Throttle closed
 - 4.1.8.2 Full up elevator
 - 4.1.8.3 Full right rudder
 - 4.1.8.4 Full right (or left) aileron
 - 4.1.8.5 Full Flaps down (if so equipped)
 - 4.1.8.6 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.
 - 4.1.9 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.
 - 4.1.10 The maximum airspeed of the air vehicle shall not exceed 100 KIAS.
 - 4.1.11 Batteries used in the air vehicle shall contain bright colors to facilitate locating them in the event of a crash.
 - 4.1.12 All vehicles will undergo a safety inspection by designated competition safety inspectors prior to being allowed to make any competition or non-competition (i.e. practice) flight. All decisions of the safety inspector(s) are final. Safety inspections will include a physical inspection, fail-safe check, and flight termination check.
 - 4.1.13 Physical inspection of vehicle to insure structural integrity, including:

- 4.1.13.1 Verify all components adequately secured to vehicle. Verify all fasteners tight and have either safety wire, locktite (fluid) or nylock nuts.
- 4.1.13.2 Verify propeller structural and attachment integrity.
- 4.1.13.3 Visual inspection of all electronic wiring to assure adequate wire gauges and connectors in use. Teams shall notify inspector of expected maximum current draw for the propulsion system.
- 4.1.13.4 Radio range checks, motor off and motor on.
- 4.1.13.5 Verify all controls move in the proper sense.
- 4.1.13.6 Check general integrity of the payload system.
- 4.1.13.7 Verification of AMA Fail-safe mode operation covered by manual override and pilot commanded flight termination.
- 4.1.14 Officials will disqualify any entry that they deem to pose an unreasonable safety hazard.
- 4.1.15 Officials will confer with representatives of the host facility, and any entries that, in the opinions of the officials or of the representatives of the host facilities, pose an unreasonable risk to the integrity of the host facility will be disqualified. Seafarer Chapter of AUVSI and the host organization, their employees and agents, as well as the organizing committee, are in no way liable for any injury or damage caused by any entry, or by the disqualification of an entry.
- 4.1.16 Takeoff from moving vehicles is prohibited.
- 4.1.17 Launchers will be inspected by competition safety inspectors before they are allowed for use in the competition.
- 4.2 Air Vehicle
 - 4.2.1 The system shall be limited to one air vehicle in the air at any time.
 - 4.2.2 The system shall not employ any ground based sensors.
 - 4.2.3 The system shall be capable of commanded altitude changes.
 - 4.2.4 The system shall be capable of commanded airspeed changes.
 - 4.2.5 The air vehicle shall be capable of heavier than air flight.
 - 4.2.6 The aircraft may be of any configuration except lighter-than-air and shall be free-flying, autonomous capable and have no entangling encumbrances such as tethers.
 - 4.2.7 Aircraft shall comply with the 2007 Official Academy of Model Aeronautics (AMA) National Model Aircraft Safety Code except as noted below
 - 4.2.7.1 Autonomous operation is authorized.
 - 4.2.7.2 Aircraft take-off gross weight shall be less than 55lb.
 - 4.2.7.3 GENERAL - (experimental aircraft rules do not apply)
 - 4.2.7.4 RADIO CONTROL - (combat does not apply and organized racing event does not apply)
 - 4.2.7.5 FREE FLIGHT - does not apply
 - 4.2.7.6 CONTROL LINE - does not apply
 - 4.2.7.7 GAS TURBINE restriction does not apply
 - 4.2.7.8 GIANT SCALE RATING - does not apply

- 4.3 Environmental. If conditions fall outside environmental requirements or if the judges feel environmental conditions are unsafe (such as approaching thunderstorms), the competition will be suspended. Teams are expected to be able to compete within the required environmental conditions.
 - 4.3.1 The air vehicle shall be capable of takeoff and landing in crosswinds to the runway of 8 kts with gusts to 11 kts.
 - 4.3.2 The system shall be capable of completing mission objectives in temperatures up to 110 deg F at the surface.
 - 4.3.3 The system shall be capable of operating in fog conditions of visibility of 2 miles or greater with no precipitation.
- 4.4 Ground Control. The system should have the capability to adjust mission search areas in flight. If the system has the capability to change mission search areas in flight, the new boundaries shall be displayed to the operator.
 - 4.4.1 The system should be able to automatically detect/cue targets with a false alarm rate that does not exceed the detection rate.
 - 4.4.2 The system should be able to provide imagery and actionable intelligence in real time.
 - 4.4.3 The ground control system displays shall be readable in bright sunlight conditions.
 - 4.4.4 The system shall display “no fly zones” to the operators and judges.
 - 4.4.5 The system shall display search area boundaries to the operators and judges.
 - 4.4.6 The system shall display current air vehicle position with respect to the “no fly zones” and mission search areas to the operator and judges.
 - 4.4.7 The system shall display altitude (MSL) to the judges and operator.
- 4.5 Rules
 - 4.5.1 During the entire mission, air vehicles shall remain in controlled flight and within the no-fly boundary. A specific no-fly boundary definition and diagram will be provided. Any vehicle appearing uncontrolled or moving beyond the no-fly boundary shall be subject to immediate manual override. Failure of manual override will result in flight termination. Points will be deducted for flying in no-fly zones or over flight of the crowd area.
 - 4.5.2 After takeoff, the air vehicles shall attain and remain in flight at an altitude between 100 and 750 ft MSL for the duration of the mission. Decent below 100 ft MSL (except in the recovery area) or above 750 ft MSL shall require manual override and immediate return to land. No additional points will be scored.
 - 4.5.3 Once in autonomous flight the vehicle shall operate with no direct pilot control to flight controls or power. The sensor payload may be manually controlled while under autonomous flight, the team will be directed to provide in-flight mission update to the vehicle.
 - 4.5.4 Exotic, unusual fuels/batteries or components are discouraged. All designs and systems will undergo a rigorous safety inspection before

being permitted to proceed. Any fuel/battery combination deemed high risk in the opinion of judges shall be disqualified.

- 4.5.5 The mission will end as previously defined, or when any of the following occur:
 - 4.5.5.1 The judges order the end of the mission.
 - 4.5.5.2 The team captain requests the end of the mission.
- 4.5.6 Advisors may operate as safety/RC pilots and may communicate to the team in the safety pilot role. Advisors shall not coach the team on non-safety/RC aspects of the conduct of the mission.

5.0 Place of Performance

- 5.1 Contestant Facilities. Competitor must identify the facilities they used for system integration and flight test and include the information in with the proof of flight video or statement.
- 5.2 Government Facilities. The Seafarer Chapter of AU VSI SUAS Competition flight phase will be conducted aboard NAS Patuxent River, MD Webster Field Annex.

6.0 Performance Metrics

- 6.1 The major graded items/events are:
 - 6.1 Final Journal Paper
 - 6.2 Oral Presentation
 - 6.3 Flight Demonstration
- 6.2 Each item/event will be measured in four respects:
 - 6.2.1 Autonomy. – The degree to which the system can operate without human intervention will be evaluated as part of the judges' discretionary score.
 - 6.2.2 Systems Engineering. A methodical approach to deriving performance requirements, allocating functionality to subsystems, system design, adjustments made due to test & evaluation.
 - 6.2.3 Mission Accomplishment. The ability to meet the top-level system requirements that enable mission accomplishment.
 - 6.2.4 Safety. A system safety approach that identifies risk to mission performance, material safety and personal safety, then implements mitigation strategies and procedures to reduce those risks.

SECTION I COMPETITION CLAUSES

- 1.0 PROOF OF FLIGHT. Based on experience from the 2005 competition, we now require validation that team air vehicles have flown prior to arrival at Webster Field. A video that shows your air vehicle in flight or a statement signed by a faculty member of your university or school that verifies your system has successfully flown at least once shall be submitted with the journal paper. The proof of flight video or statement will identify the facility (or facilities) used for system integration and flight test.
- 2.0 OFFICIAL RULES, SUBMISSIONS, AND FEES
- 2.1 The official source for all information concerning rules, interpretations, and information updates for the Seafarer Chapter of AUVSI 2009 Student UAS Competition is the World Wide Web home page at: <http://www.auvsi.org> or <http://www.auvsi-seafarer.org>.
- 2.2 An Application form is available on the website. A completed form with entry fee is due to AUVSI Seafarer Chapter no later than January 7, 2009.
- 2.3 The submission shall be in English and is not considered official until the entry fee of five hundred U.S. dollars (\$500) has been received by AUVSI Seafarer Chapter. As the competition format cannot handle an unlimited number of entries, the organizers reserve the right to limit the total number of entries that are allowed to compete by declaring the competition closed to new entries before the due date above. Flight Competition/Mission phase may be further limited based upon results of journal paper, static display/oral brief and safety inspection. As with all official information, this announcement (should it be necessary) will appear on the official website.
- 2.4 Team members physically present at the competition shall comprise a combination of no more than 10 Inter-disciplinary undergraduate students or high school students. Members from industry, government agencies, or universities (in the case of faculty) may participate upon approval from the Competition Director; however full-time students shall compose the team with the exception of the air vehicle pilot, and no more than one graduate student. Faculty/advisors cannot do anything but be the safety pilot during the competition. Students shall present data analysis, etc. Participants shall be enrolled at their schools for at least 12 credit hours or more per quarter/semester during winter and spring 2009 to be considered "students" unless cleared by the Competition Director (for cases of 2009 graduating seniors are not considered as grad students for this competition).
- 2.5 The student members of a joint team shall make significant contributions to the development of their entry. Only the student component of each team is eligible for the cash awards. One student member of the team shall be designated as the "team captain." Only the team captain will speak for the team during the competition run. 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.

3.0 TIMELINE

The 2009 competition will be a simplified model of the US Department of Defense system acquisition process. The competition rules will simulate a Performance Specification and Statement of Objectives. These will initially be released as a Request for Information (RFI). What this means is that this is a draft of the final specification & rules. Potential competitors are invited to provide comments or questions. This will be followed by a virtual “University Day” (modeled after industry day). This will consist of a phone conference that all competitors can dial into to hear directly from the judges and to ask questions. The competition rules will then be modified based on the feedback and put out in its final form that simulates a Request for Proposal. It is the intent of the judges to keep these requirements stable for the rest of the competition, but we reserve the right to make changes we deem necessary.

Date	Item
September 4, 2008	Draft Request for Proposals Released (Competition rules simulating a performance specification and statement of objectives).
September 26, 2008	Deadline for comments or questions
October 2, 2008	University Day (3:00 PM, EDT, phone conference with competition judges. Call 877-896-9095, (International callers dial 301 342-9906) then enter 3656# to be connected to the phone bridge.)
December 18, 2008	Request for Proposal Released (Final competition rules).
January 7, 2009	Completed entry form and registration fee received by AUVSI Seafarer Chapter.
May 4, 2009	Fact Sheet received by AUVSI Seafarer Chapter
May 27, 2009	Journal paper received by AUVSI Seafarer Chapter (including proof of flight video or statement)
June 17-21, 2009	2009 Undergraduate Students Unmanned Aerial Systems Competition

SECTION J LIST OF ATTACHMENTS

Attachment 1 Optional Pre-flight Briefing Format
Attachment 2 Test Readiness Review

SECTION L INSTRUCTIONS, CONDITIONS, AND NOTICES TO COMPETITORS

1.0 GENERAL

- 1.1 Format: In order to maximize efficiency and minimize the time for proposal evaluation, it is required that all competitors submit their proposal in accordance with the format and content specified. The electronic proposal shall be prepared so that if an evaluator prints the proposal, it meets the following format requirements.
 - 1.1.1 8.5 x 11 inch paper
 - 1.1.2 Single-spaced typed lines
 - 1.1.3 Not less than 1 inch margins
 - 1.1.4 Not smaller than 10-point Times New Roman font in text
 - 1.1.5 Electronic submission in pdf format is desired but not required.

2.0 COMPETITOR INFORMATION:

- 2.1 Cover Letter. Identify at a minimum the Competitor Team Name, University affiliation, and abstract of proposal including basic descriptions of the air vehicle and systems. The description shall include frequencies used for air vehicle control (manual or autonomous), payload control, imagery receipt, type of fuel, battery type, and air vehicle dimensions including gross weight.

3.0 TECHNICAL:

Note: Do not reiterate the SOW tasks descriptions as that is ineffective in supporting the competitor's proposal.

- 3.1 Journal Paper – Shall consist of no more than 20 pages total. Pages beyond 20 pages will not be judged.
- 3.2 Oral Presentation. (Test Readiness Review - TRR) The Oral Presentation (TRR) shall be reviewed by a panel of AUVSI Seafarer Chapter judges and shall be conducted in an open-air environment, with only minimal overhead protection from sun light and/or rain. Maximum team participation is encouraged, but not required.
 - 3.2.1 The Oral Presentation (TRR) should follow a simple outline:
 - 3.2.1.1 Team Coordination. Briefly review team members' experience, effectiveness of coordination.
 - 3.2.1.2 System Safety Overview. Review identified risks; avoidance, mitigation, procedural strategies.
 - 3.2.1.3 Results of developmental test (DT). Discuss what tests were performed, the results, any corrective actions taken, 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.
- 3.2.1.4 Evidence of likely Mission Accomplishment. Review demonstrated performance based upon either system or sub-system level development tests that supports successful mission accomplishment during the flight demonstration.
 - 3.2.1.5 Pre-Mission Brief.
 - 3.2.2 Duration. The Oral Presentation (TRR) shall be limited to no more than 15 minutes, with a 5 minute period for the judges to ask question of the team presenters.
 - 3.2.3 Static Display. Upon completion of the Oral Presentation (TRR) question and answer period, the judges shall be provided a brief 5 minute review and inspection of the team's AUS, including air vehicle exterior (and interior if available), ground station, safety check lists, and other supporting evidence of readiness.
- 3.3 Flight Demonstration. Each team will arrive prepared to begin flight operations. The team will be called forward, set-up at the flight line during their preparation time, then commence start procedures once their demonstration time begins. Flight demonstrations should follow procedures briefed the day before during TRR.

SECTION M EVALUATION FACTORS FOR AWARD

M-1 EVALUATIONS FACTORS FOR AWARD

1.0 GENERAL

1.1 The major graded items/events are:

- 1.1.1 Final Journal Paper
- 1.1.2 Oral Presentation
- 1.1.3 Flight Operations

The Final Journal Paper is equal to Oral Presentation, and Flight Operations is equal to the other two combined.

1.2 Each item/event will be measured in four respects:

- 1.2.1 Mission Accomplishment
- 1.2.2 Systems Engineering
- 1.2.3 Autonomy
- 1.2.4 Safety

Safety is important, Mission Accomplishment is equally important with Systems Engineering, and Autonomy is more important than either.

1.3 Weighting Matrix by percentages

Judging Elements \ Graded Items	Mission Accomplishment	System Engineering	Autonomy	Safety	Total
Final Journal Paper	6.25	6.25	8.25	4.25	25.00
Oral Presentation	6.25	6.25	8.25	4.25	25.00
Flight Operations	12.50	12.50	16.50	8.50	50.00
Total	25.00	25.00	33.00	17.00	100.00

2.0 COMPETITOR INFORMATION

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

3.0 ITEMS/EVENTS

3.1 Journal Paper

3.2 Oral Presentation

3.3 Flight Operations

4.0 BASIS FOR AWARD

- 4.1 Judges may award cash barrels for these (or other) requirements:
 - 4.1.1 Autonomy
 - 4.1.1.1 The overall requirement for intervention during the conduct of the mission.
 - 4.1.1.2 Autonomous navigation
 - 4.1.1.3 Autonomous takeoff and landing
 - 4.1.1.4 Automatic target cueing, recognition or location
 - 4.1.2 Systems Engineering. A methodical approach to deriving performance requirements, allocating functionality to subsystems, system design, adjustments made due to test & evaluation.
 - 4.1.3 Mission Accomplishment. The ability to meet the top-level system requirements that enable mission accomplishment.
 - 4.1.3.1 Locate Targets to greatest accuracy
 - 4.1.3.2 Identify most Target Characteristics (color, shape, etc.) of one target, during flight
 - 4.1.3.3 Locate & Identify realistic pop-up target
 - 4.1.3.4 Minimum Mission Time
 - 4.1.3.5 Navigate to new waypoint in flight
 - 4.1.3.6 Increase search area in flight
 - 4.1.4 Safety. A system safety approach that identifies risk to mission performance, material safety and personal safety, then implements mitigation strategies and procedures to reduce those risks.
 - 4.1.4.1 Risk Management Plan
 - 4.1.4.2 Flight Procedures
 - 4.1.4.3 Crew Coordination
 - 4.1.4.4 System Safety Analysis

Student Team Leader shall brief his/her team prior to setup on the runway. At least one judge must be present during the entirety of the brief. An emphasis shall be placed upon operational and personal safety. This brief shall occur during the 40 minute set-up time described in Section C, paragraph 3.5.5.

OPTIONAL PRE-FLIGHT BRIEFING FORMAT

- | | |
|--|---|
| <p>1. MISSION
Mission Objectives</p> <p>2. ADMIN
Estimated set up time
Estimated launch time
Roll Call
Crew Assignments</p> <p>3. BEFORE MOVING TO RUNWAY
Weather Check
Go/No-Go Criteria
Fuel/Battery Check
Payload</p> <p>4. TIMING
Move to Runway
Complete Set up and Preflight
System Power On
Pre-Launch Checks
Engine Start
Taxi
Takeoff
Time On Station
Land
Post-Flight Checks
Debrief</p> <p>5. COMMUNICATIONS
Crew Coordination
Judge Coordination</p> <p>6. AIRFIELD PROCEDURES
Set up</p> <p>7. LAUNCH AND DEPARTURE</p> | <p>8. MISSION
Navigation
Mission Sensors
Fuel Checks</p> <p>9. LANDING</p> <p>10. SUPPORT ASSETS</p> <p>11. OPERATIONAL SAFETY – ALL HANDS REQUIRED
Contingencies
Marginal Weather
System Degradation
Emergencies
Abort
Datalink Loss
Flameout
Departure
No-Fly Zone Penetration</p> <p>12. PERSONNEL SAFETY – ALL HANDS REQUIRED
Danger Areas Clear
Avoid Props and Rotors
Personal Safety Equipment
Goggles
Ear Plugs
Other</p> |
|--|---|

Test Readiness Review (TRR)

The TRR is a multi-disciplined technical review to ensure that the subsystem or system under review is ready to proceed into formal test. The TRR assesses test objectives, test methods and procedures, scope of tests, and safety. The TRR verifies the traceability of planned tests to program requirements and user needs. The TRR determines the completeness of test procedures. The TRR assesses the system under review for development maturity, effectiveness, and risk to determine readiness to proceed to flight testing.

The TRR should answer the following questions:

- Will the planned flight test verify all directly traceable requirements?
- Is the configuration of the system under test 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 agreed to?
- What is the fall-back plan should a technical issue or potential showstopper arise during testing?
- Has a final reporting process been defined and agreed to?
- What is the expected result and how can/do the test results affect the program?
- What are the risks associated with the tests and how are they being mitigated?

TRR 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 planned tests.

Test and evaluation is critical to evaluating the system. The TRR ensures that the testing to be conducted properly evaluates the system and that the system is ready to be tested.