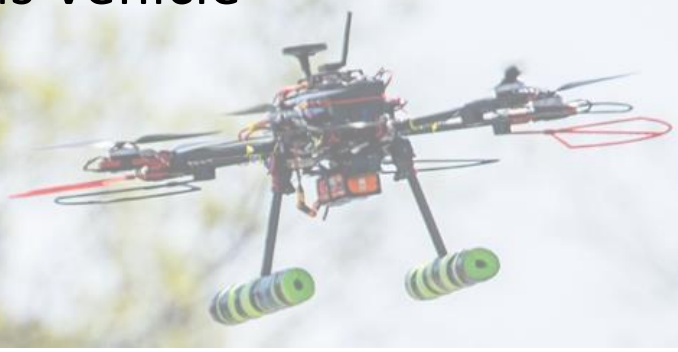
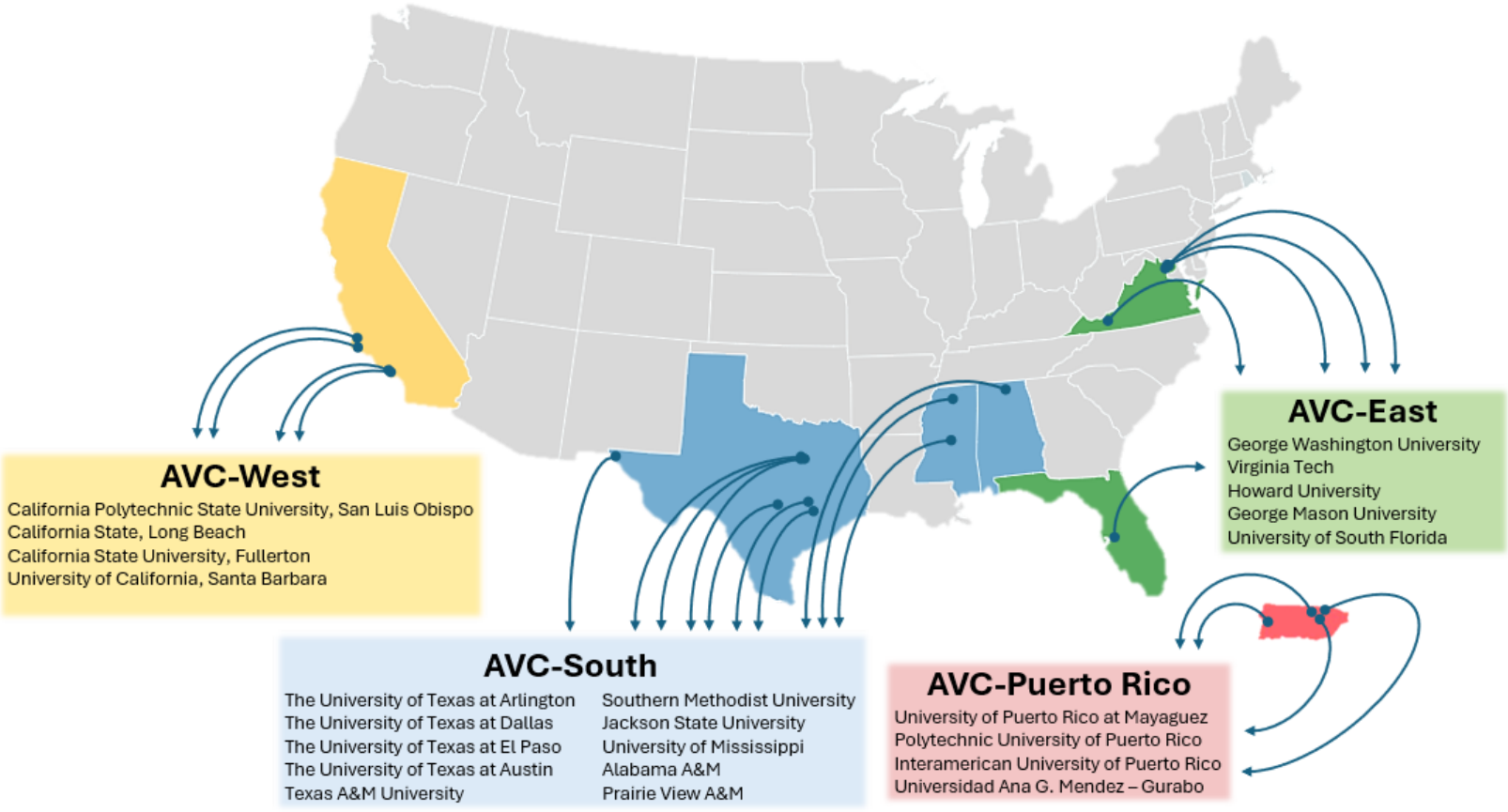
Raytheon
An RTX Business

'2526 Raytheon Autonomous Vehicle Competition Rules
Fall 2025 – Spring 2026





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1 INTRODUCTION

1.1 Mission & Vision

Welcome to the Annual Raytheon Autonomous Vehicle Competition!

Raytheon's mission is to partner with universities across 4 different regions to develop top talent, strengthen university relationships, and enhance the Raytheon mission.

The Raytheon Autonomous Vehicle Competition (AVC) is an event sponsored by Raytheon, an RTX business. The purpose of the AVC is to provide students an opportunity to solve existing real-world problems by using their creativity, innovation, and team-solving skills to research, develop, integrate, and test an Unmanned Vehicle system.

This team-oriented effort is an opportunity for university students to engage and put into practice their project-management and problem-solving skills on open-ended problems in a professional, industry work environment. For the corporate sponsor, it provides the opportunity to evaluate and assess top graduates, promote corporate branding, and explore the latest technologies.

The Raytheon Autonomous Vehicle Competition will take place in the following regions with the respective Universities:

South Region

1. The University of Texas at Arlington
2. The University of Texas at Dallas
3. The University of Texas at El Paso
4. The University of Texas at Austin
5. Texas A&M University
6. Southern Methodist University
7. Jackson State University
8. University of Mississippi
9. Alabama A&M
10. Prairie View A&M

Puerto Rico Region

1. University of Puerto Rico at Mayaguez
2. Polytechnic University of Puerto Rico
3. Interamerican University of Puerto Rico
4. Universidad Ana G. Mendez – Gurabo

West Coast Region

1. California Polytechnic State University, San Luis Obispo
2. California State, Long Beach
3. University of California, Santa Barbara
4. California State University, Fullerton

East Coast Region

1. George Washington University
2. Virginia Polytechnic Institute and State University
3. Howard University
4. George Mason University
5. University of South Florida

The direct participants of the AVC will be the assigned students, while University faculty and industry mentors act as project guidance / “coach” and do not work on the project itself. Judges will observe the final competition and grade based on performance and requirements met. Judges will not be student mentors.

Note: If there is need for region specific guidance, rule clarification, challenge modifications, please refer to the Region-Specific Attachment accompanied by this ROE to be released at a future date as needed.

2 COMPETITION

2.1 Introduction

The Raytheon AVC challenges students with the design, implementation, integration, and test of complex system of systems. This requires developing skills in electromechanical design, embedded development, sensor systems, wireless communications, computer vision, cloud & edge processing, artificial intelligence, autonomous & avoidance algorithms, command and control systems, integration & test planning, and advanced manufacturing. Competition day is the team's opportunity to put all your skills and labor to the test.

The competition day is intended to be a fun, challenging, and high energy event. The goal of the event is to test your project and experience the satisfaction of having taken a system from a blank sheet of paper to a real-world implementation competing against your peers. The accomplishment of all the hard work throughout the year is an immense reward.

Note: Gameday decisions may be made to accommodate the competition's goals. Flexibility is key!

2.2 Theme: "Operation Touchdown" -Autonomous Navigation, Target Identification, Collaborative Autonomy

The AVC scenario for the '2526 season is dubbed "Operation Touchdown"! Scenarios will include at least 2 vehicles provided by each team:

- 1 Unmanned Aerial Vehicle (UAV)
- 1 Unmanned Ground Vehicle (UGV)

The UAV will autonomously launch and scout the field containing 1 destination ArUco marker and several stationary real-life obstacles. The UAV will directly communicate the location of the destination to the UGV without using a ground station. The UGV will begin its route to the destination avoiding the obstacles and while the UGV is travelling, the UAV will land on the UGV system and continue with the UGV system to the destination. The judges will randomly arrange the ArUco marker and obstacles on the field for Competition Day.

In all scenarios, the UAV and UGV are to behave fully autonomously.

2.3 Real World Application

The Mars 2020 mission was a groundbreaking technology demonstration of coordination between a UAV (Ingenuity,) and UGV, (Perseverance) on another planet. The success of Ingenuity paves the way for future aerial exploration of Mars and other planetary bodies, enhancing our ability to scout terrain, identify areas of interest, and support future human missions.

The collaborative relationship demonstrated on Mars is also applicable on Earth where UAVs could scout the environment and aid ground vehicles in executing missions from emergency responses in a disaster to search and rescue and delivery of supplies in remote areas.

Drones have changed the defense industry, allowing for remote missions that keep our troops safe. They currently have several applications in the field and as automation technologies grow the opportunities to advance the use-case of drones increases too. This year's theme, Operation Touchdown, immerses students in a challenge engineers face across the defense industry.

The 2026 Raytheon AVC seeks to have students create their own collaborative systems where UAV scouts for and augments a ground system's exploration and navigation of an area.

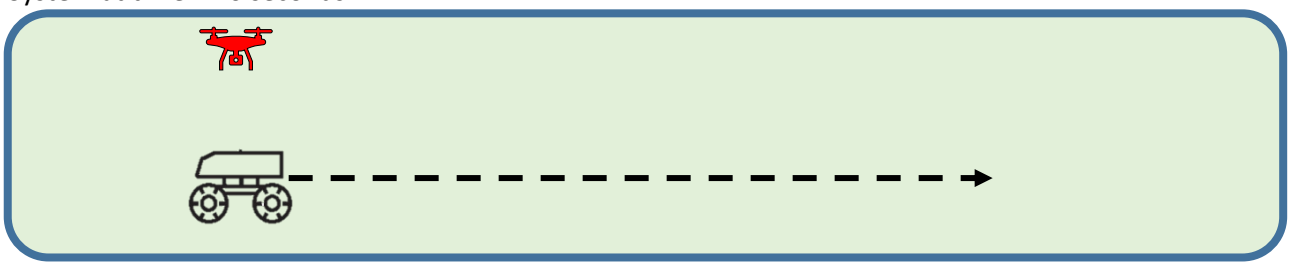
2.4 Challenge 1

The UAV shall autonomously take off from the UGV. After the UAV has launched, the UGV shall begin moving at a minimum speed of .2 mph in a straight line across the field. The UAV shall meet a minimum flight time of 5 seconds at minimum altitude of 4 feet. The UAV must safely land on the moving UGV system within 7 min. Once the UAV has landed on the UGV system, it must continue traveling with the UGV system for thirty seconds without separating. Time stops once UAV has traveled with the moving UGV system for thirty seconds. Each school's system will have an opportunity to execute this challenge.

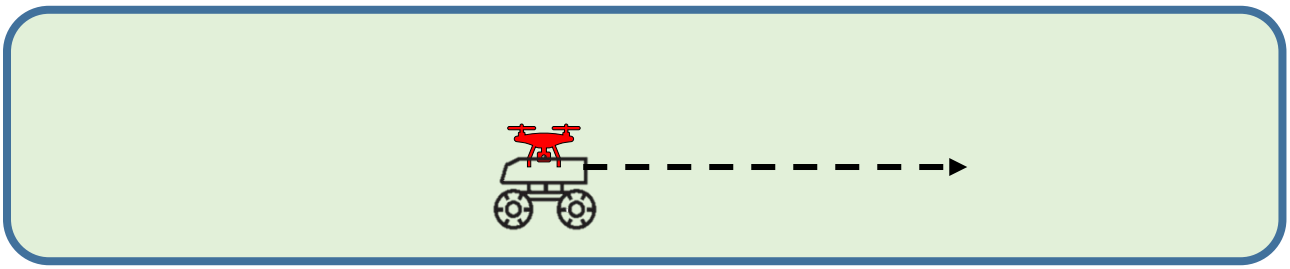
1. UAV autonomously launches, UGV system begins traveling in straight line
2. UAV autonomously lands on the moving UGV system and continues traveling for thirty seconds.

The following picture is an example of a school UAV (red) searching for the UGV system and successfully landing within 7 minutes.

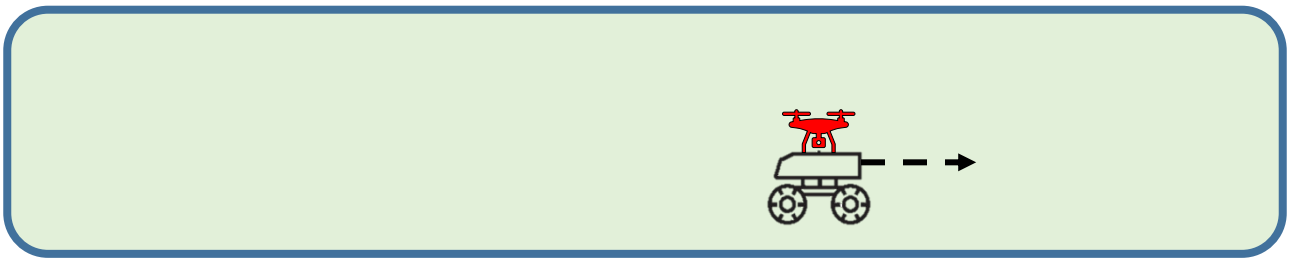
System at time = 20 seconds



System at time = 60 seconds



System at time = 80 seconds

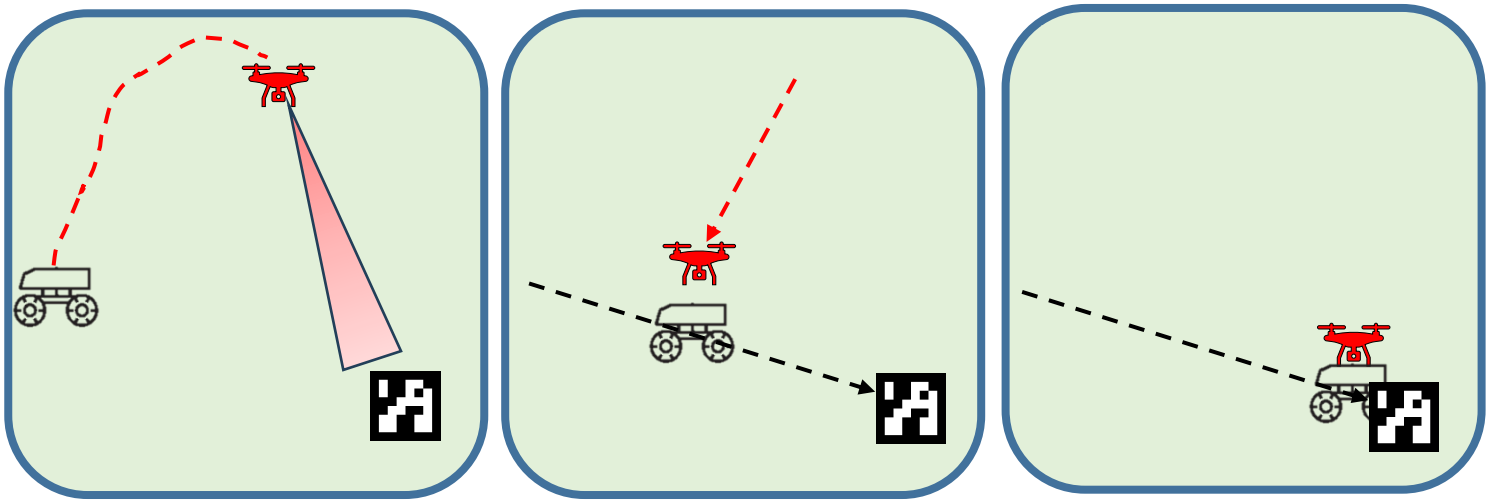


2.5 Challenge 2

The judge will randomly place an ArUco marker on the field. The UAV shall autonomously take off from the UGV. After the UAV has launched, the UAV will Identify the destination via ArUco marker and communicate this directly back to the UGV without a ground station. The UGV will begin moving to the destination at a minimum speed of .2 mph. The UAV shall meet a minimum flight time of 5 seconds at minimum altitude of 4 feet. The UAV must safely land on the moving UGV system within 10 min from the first UGV movement. Once the UAV has landed on the UGV system, it must continue traveling with the UGV system for 10 seconds without separating. The UGV system shall stop once it reaches the destination ArUco marker. Time stops once the system has stopped moving. Each school's system will have an opportunity to execute this challenge.

1. UAV autonomously launched and identifies the ArUco marker's location
2. UGV starts traveling to the destination and the UAV lands on moving UGV system
3. Entire System arrives and stops at the destination.

The following picture is an example of the challenge. The UAV (red) autonomously searched for the ArUco marker location, communicated the destination location to the UGV to which the UGV started moving towards. The UAV will land on the UGV system while it is moving and will arrive at the destination.

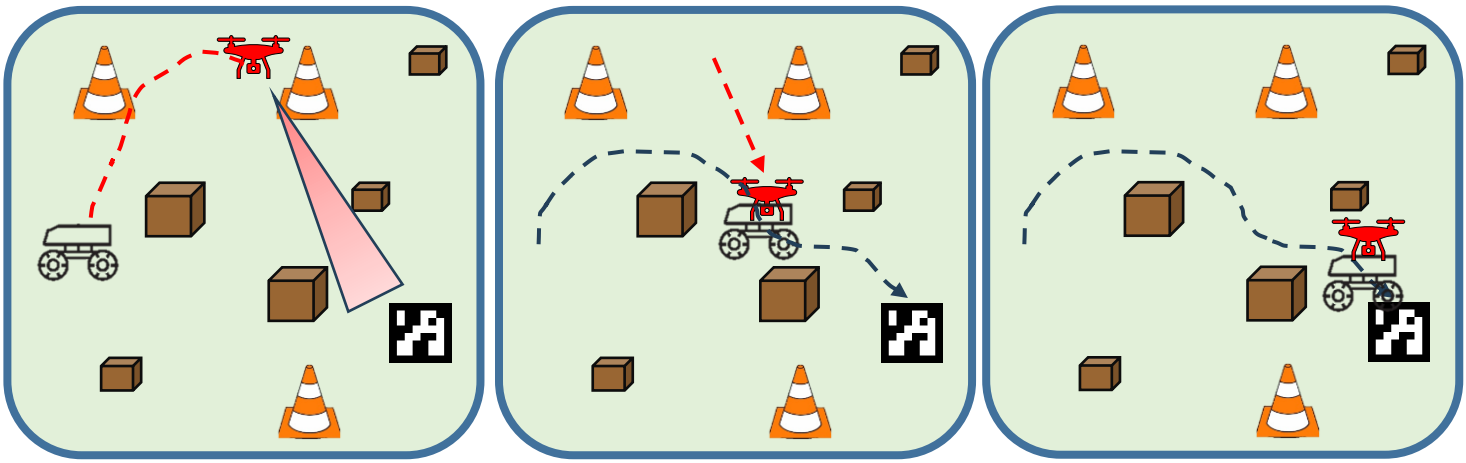


2.6 Challenge 3

The judge will randomly place an ArUco marker on the field. The UAV shall autonomously take off from the UGV. After the UAV has launched, the UAV will identify the destination via ArUco marker and communicate this directly back to the UGV without a ground station. The UGV will begin moving to the destination at a minimum speed of .2 mph around real-life stationary obstacles. The UAV shall meet a minimum flight time of 5 seconds at minimum altitude of 4 feet. The UAV must safely land on the moving UGV system within 10 min from the first UGV movement. Once the UAV has landed on the UGV system, it must continue with the UGV system for 10 seconds without separating. The UGV system shall stop once it reaches the destination. Time stops once the system has stopped moving. Each school's system will have an opportunity to execute this challenge.

1. UAV autonomously launched and identifies the ArUco marker's location
2. UGV starts travel around obstacles to the destination and the UAV lands on moving UGV system
3. Entire System arrives and stops at the destination.

The following picture is an example of the challenge. The UAV (red) autonomously searched for the ArUco marker location, communicated the destination location to the UGV to which the UGV started moving towards. The UAV will land on the UGV system while it is moving and will arrive at the destination. All Obstacles were avoided.



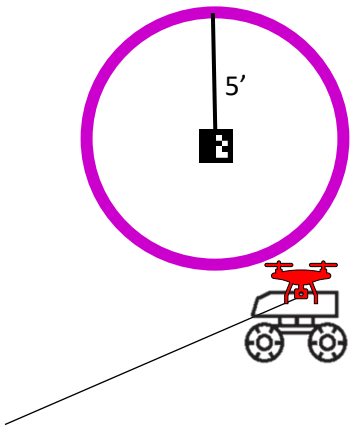
2.7 Obstacles

Obstacles in Challenge 3 will be three dimmensional objects the UGV can not drive over. These will consist only of: small, medium or large sized cardboard boxes, traffic cones, and buckets. There will be an unknown about of obstacles present but the minimum spacing between the objectacles will be 5 feet.

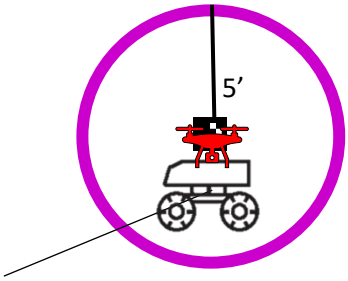
2.8 Destination Arrival Requirements

The entire UAV/UGV system is required to arrive at the destination. The destination is defined as the space within a 5-foot radius circle from the center of the designated ArUco marker.

Does NOT count as arriving at the destination



DOES count as arriving at the destination



2.9 Project Management

Students are expected to manage their project using industry best practices. Students are responsible for project management training on their own time (e.g., Agile methodologies, DevSecOps, etc.). The university is expected to provide project management resources (e.g., MS Project, TEAMS, Jira, GitHub, MS Office, etc.)

Note: What has worked well in the past is for the teams to use a collaboration platform (e.g., TEAMS, Discord, Slack, etc.) and invite the mentor to that platform.

The Raytheon mentor will attend periodic team meetings. The meetings typically meet weekly, and last about 1 to 2 hours per week.

3 RULES

3.1 General Rules

3.1.1 AV FAA Compliance

Participating teams will follow the Federal Aviation Administration (FAA) UAV Requirements. The UAS field is always evolving, so please refer to the FAA for the latest specifications and regulations.

For FAA references, please see Appendix E

- Participating teams will follow the Federal Aviation Administration (FAA) UAV Requirements. The UAS field is always evolving, so please refer to the FAA for the latest specifications and regulations.
- For FAA references, please see Appendix D
- Safety is the highest priority for the participants. No careless or reckless operations and no carriage of hazardous materials.
- Each university will be responsible for providing an area (i.e., field) for students to access to perform development and testing. This location will conform to the rules and regulations of the educational institution and FAA flight restrictions.
- AVC aircraft will be limited to flying within an approved geofence or an approved drone enclosure.
- Participants will not allow UAV flight over any persons not participating in the operation.
- Pre-flight inspection will be performed prior to the AVC to verify UAV is safe to fly and meets all rules and regulations.
- At least one student will need to become an FAA Certified UAV Pilot prior to any flight tests.

3.1.2 Budget

- Each university will have a budget of $5,000 USD to use on this project. This budget can be used for hardware and software expenses to help the students to develop their prototype.
- Procurement of hardware and software will be done via the university procurement process.
    - Students will be asked to provide a budget breakdown prior to the AVC
- The use of open-source hardware and software is recommended.
- Schools can use resources from previous competition years to help prototype and test their solutions. Note: there is risk in using old platforms without proper background knowledge.
    - The full cost of the drones executing at the AVC must be <= $5K. The Bill of Materials (BOM) for the cost of the Autonomous Vehicles' components competing can be priced with depreciation.

3.1.3 System Operation

- The system of systems shall be capable of navigating around three-dimensional, real-life obstacles on the competition field and arrive at the prescribed destination
- The system shall be composed of a minimum of 1 UGV and 1 UAV

3.1.4 Field requirements

- 15 yards wide x 15 yard long (subject to change by venue)
- Consists of either a turf field or predominantly grass covered mowed <6” in height. This is dependent on region.
- Topography varied: May include slopes, holes, rocks, and differing vegetation.

3.2 BrainChip

BrainChip offers a Neuromorphic approach to AI compute, as their compute methods are inspired by the human brain (highly efficient compute) and utilize at memory-based compute. BrainChip's technology offers a paradigm shift by allowing AI compute typically implemented on server farms in the "Cloud", to now be implemented on a battery on the true edge.

Teams will be required to incorporate the provided BrainChips into their system on either the UAV or UGV.

Resources found here:

(https://doc.brainchipinc.com/examples/general/plot_5_voc_yolo_detection.html#sphx-glr-examples-general-plot-5-voc-yolo-detection-py)Akida vision edge learning — Akida Examples documentation (https://doc.brainchipinc.com/examples/edge/plot_0_edge_learning_vision.html#sphx-glr-examples-edge-plot-0-edge-learning-vision-py) Here is the latest Rasp PI user guide: Akida-RaspberryPi_EvalKit_UG_111b (https://brainchip.com/wp-content/uploads/2022/06/Akida-RaspberryPi_EvalKit_UG_111b.pdf)

3.3 Deep Perception

Deep Perception, a BrainChip Solutions Partner, specializes in building end-to-end edge and hybrid AI solutions that leverage this neuromorphic technology. Deep Perception develops complete systems from model development and media pipeline engineering to third-party integrations, delivering production-ready solutions that bring AI compute to the edge.

3.4 Unmanned Vehicle Requirements

Students can conduct a trade study on what hardware and software configuration are necessary to complete the assigned tasks and will have to assess with their mentors the best path forward. Items to consider are weight, speed, complexity, location of components, battery life, open-source vs custom design, etc. Note: This is not an exhaustive list of requirements. Test Documentation and Requirements Matrix should list other items inherently necessary to meet the challenge objectives.

3.4.1 UGV Requirements

- Shall autonomously navigate terrain within field requirements.
- Shall provide ability for launch and landing of UAV.
- Shall be capable of traversing terrain loaded with UAV.
- Shall provide a means of real-time verification of speed.
- Shall employ a kill switch to terminate autonomous operation and halt motion in <3 seconds.
- Shall **not** employ GPS.

3.4.2 UAV Requirements

- Shall comply with all FAA regulations, including but not limited to:
  - Each UAV shall weigh less than 55 lbs.
  - All UAVs shall be registered for a Remote ID.
- Shall have propeller guards installed.
- Shall implement a GPS based geofence to maintain control only, GPS is not allowed for any other application (navigation, target location identification, etc.)
- Shall implement a kill switch that overrides programmed or autonomous operation
- Shall autonomously take off from UGV
- Shall identify ArUco marker location as input to pathing UGV to destination
- Shall be capable of autonomously landing on/in a moving UGV.

3.4.3 Autonomy

Based on the Challenge descriptions above, the Autonomous Vehicles shall autonomously complete their tasks and be programmed with flexibility for items such as:

- Start and End location of challenge.
- Flight operational boundaries
- Change in the field dimensions
- Duration of challenge
- Destination target selection (The Judges can select any ArUco Marker ID 0-4)

3.4.4 RF Spectrum Utilization

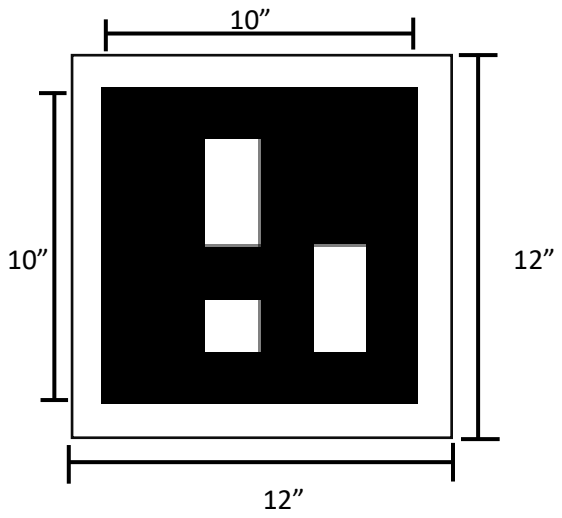
- Each UAV and UGV shall comply with FCC requirements for RF emissions.
- Each Team shall provide a preliminary spectrum management plan to their Raytheon mentor by January 31st, 2026, to include:
  - Frequency / channel
  - Bandwidth

- Power
- Contingency plan for cross-team interference

3.5 ArUco Marker

3.5.1 ArUco Marker

The ArUco Marker design (available via opensource) can be created via a website found here: ArUco Marker. The ArUco marker is 6x6 grid, 1 ft by 1 ft square facing-up horizontal to the field. The 12”x12” total size is made up of a 10” x 10” marker pattern in the middle with a 1” white border on all four sides of the black marker pattern. Each Team is responsible for producing and bringing their own set of ArUco markers to Competition Day. ArUco ID’s 0-4 may be used. The marker itself cannot contain internal homing beacons to communicate with other vehicles (i.e., Bluetooth, Wi-Fi, or GPS). This is done to simulate a no communications environment.



3.6 Scoring

Referenced the Scoring Attachment for scoring specifics.

Note: Only after all challenge objectives have been met will time be used as a tie breaker. If necessary the Judges may factor in accuracy to the destination as well. If the system does not reach the destination, the UAV does not safely land on a moving UGV, if obstacles were hit, etc, the team will not receive points for meeting the objective and will not be eligible to beat teams that did meet the challenge objective.

3.7 Healthy Tips

Obtain training for:

- Project Management (PM)
- Agile (entire Team)
- SRR, SDR, CDR, TRR
- Machine Learning
- Image Recognition
- UAV Pilot

Order your Team T-Shirt Early!!!

4 SCHEDULE

The universities will compete in their respective region. The timeline for the competition will differ from Region to Region. Each schedule will be agreed upon per region.

Students will follow best practice development methodologies and meet with university and corporate mentors frequently (e.g., weekly) to ensure project progress.

At a high level, students will:

1. Conduct studies on existing state of the art solutions and work with stakeholders to gather all specifications and requirements for the project.

2. Generate project artifacts based on school requirements (e.g. proposals, design documentation, final presentations, etc.).

3. Design, Prototype, Implement, Test, and Demonstrate solution.

4. Compete in the 2025-2026 Regional Raytheon Autonomous Vehicle Competition

5. Prepare all classroom documentation requirements (i.e., poster, presentation, final report)

4.1 Milestones

4.1.1 Semester Based Milestones Template / Notional Schedule

Note: this is a template, and not *required* for the project. It is meant to be a reference for building a schedule.

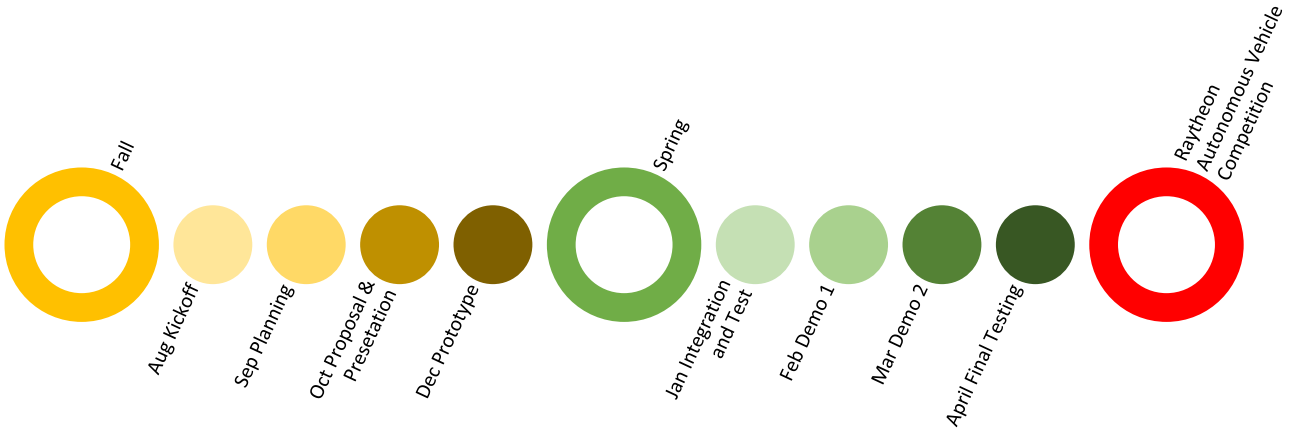


Figure 1 Semester Based Notional Milestone Template Set

Date	Milestones
August - Project Kickoff (August)	Requirements Review & Clarification / Q&A by students over the Rules of Engagement.
September - Project Planning (e.g., System Requirements Review)	Configuration Management Project Logistics
October	Project Proposal & Presentation (e.g., System Design Review) Order Parts
December	Prototype creation a. Mid-Year report is due (e.g., Critical Design Review) i. template can be provided if needed. b. Prototype Demonstration(s)
Spring Demos (e.g., Test Readiness Reviews)	a. Integration and Test b. AVC Demo 1 c. AVC Demo 2 d. Final Testing
April	Raytheon Autonomous Vehicle Competition!

4.1.2 Quarter Base Milestone Template / Notional Schedule

Note: this is a template, and not *required* for the project. It is meant to be a reference for building a schedule.

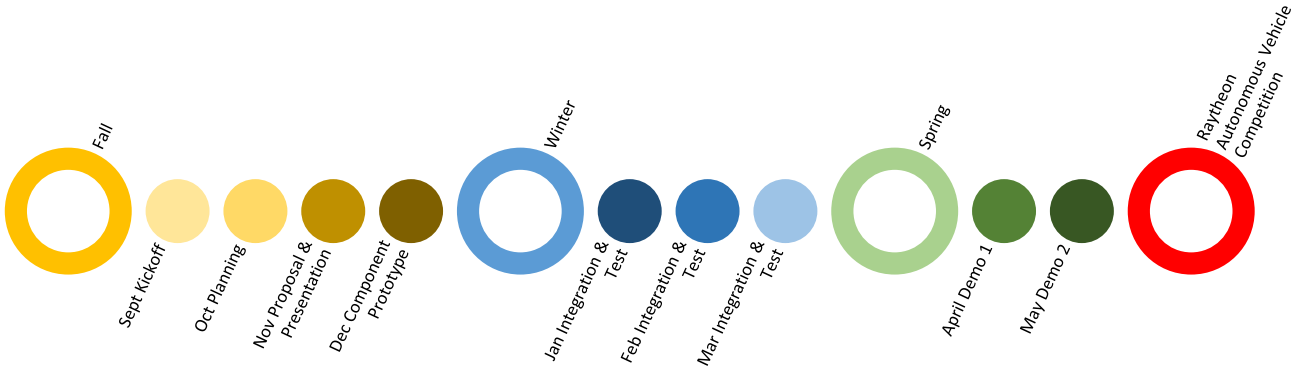


Figure 2 Semester Based Notional Milestone Template Set

Date	Milestones
September - Project Kickoff (August)	Requirements Review & Clarification / Q&A by students over the Rules of Engagement.
October - Project Planning (e.g., System Requirements Review)	Configuration Management Project Logistics
November	Project Proposal & Presentation (e.g., System Design Review) Order Parts
December - Component Prototype creation	Critical Design Review Component Prototype Demonstration(s)
January (e.g., Test Readiness Reviews)	Integration & Test
February	Integration & Test
March	Integration & Test
April	Demo 1
May	Demo 2
June	Raytheon Autonomous Vehicle Competition!

4.1.3 Competition Event Schedules by Region

AVC Regions	AVC Dates
Southern	April 17th
East Coast	April 24th
Puerto Rico	April 24th
West Coast	June 6th

5 DESIGN AND TEST GUIDENCE

As students design their system, they should follow standard engineering processes. University classes should have assignments guiding students through this process. This section will outline some important steps and pose questions to assist students in making design choices and testing their system.

Understand the Problem

Read the Rules Document thoroughly

Read the Qual Test thoroughly

Create a Requirements Matrix

Make a Plan and Assign Team Roles

Begin to ask questions and make high level design choices

- What subsystems can the overall deliverable be broken into?
- What research is required for each subsystem?
- What are the single point failure elements of the system?
- What software languages will be used?

Who will be doing what work?

Make a timeline with specific dates

Begin Designing in Detail and Order Parts

Ask more specific questions that will drive part selection

- If a UGV, how many and what type of wheels/tracks will be used? Can it drive several surfaces?
- What material can we use from previous years' designs?
- What parts will be needed to identify the Destination?
- How will the drones know their own location and height?
- How will all the hardware be mounted together?
- How will the hardware manage power?
- Can we build custom parts to make our lives easier and design cheaper? 3D Printing etc.
- Are the parts I want from approved vendors?

Begin making models, drawings and electrical interconnects for the selected parts

Prototyping and Testing

As designs become prototypes, begin testing your design while there is plenty of time to make changes. Review the Rules Document and ensure the design meets all the requirements. Continue asking questions to look for fatal design flaws. Your goal should be to find ways your system could fail and then go fix them!

- Will I have all my parts in time?
- Do I have a clear path forward to integrate all system elements.
- Is my design flexible?
- Do I have a way to power on everything at the same time?
- Is there anything that I'm overcomplicating?
- Did I code in a way that can be changed quickly on competition day? Think field size, speed, etc.
- How can I test and prove my system meets the requirements?
- How can I test that my system is reliable in non-ideal conditions?
    - How far away can an ArUco Marker be detected? At an angle? Different lighting? What if the sun is shining at an odd angle?
    - Can my UGV drive on turf? Can it drive onto the marker or deploy the package on the marker without driving onto it?
    - Is my UAV stable in windy conditions?
- Document testing and cross reference with your Requirements Matrix!

Competition Preparation

Get excited for the big day as you enter the last phase of integration.

- **COMPLETE THE QUAL TEST AS EARLY AS POSSIBLE**
- Do I have tools and spare parts to perform drone surgery at the competition?
- Do I have a monitor, mouse and keyboard to easily debug coding errors that may appear at the competition?
- Read through the Rules again and make sure your system meets all of them. Requirements Matrix and Testing Documentation?
- Think of every possible way something could go wrong and then make a plan for how your system will overcome that!

5.1 Requirements Matrix

It is required to build a Requirements Matrix to help keep students organized throughout the duration of the project. It is a tool that ensures students do not forget requirements they have been given as well as preventing unnecessary scope creep. A Requirements Matrix is common practice for industry Factory Acceptance Tests. A sample of a partial Requirements Matrix can be seen below:

Requirement ID	Description
1	UAV shall have propeller guards.
2	UAV shall have a kill switch
3	UGV shall have a kill switch
4	System can display UAV velocity

5.2 Test Documentation

It is required for teams to produce Test Documentation. Testing Documentation ensures that every requirement has been met. It can also prevent unnecessary testing when a requirement has already been proved in a previous test. Writing and executing good tests will aid in overall organization and efficiency towards the end of the project. Thorough testing documentation is common practice for industry Factory Acceptance Tests. A sample of a partial Test Document can be seen below:

Test ID	Test Description	Requirements Tested
1	Verify the UAV has propeller guards installed	1
2	Autonomously launch the UAV and execute a straight flight path. Verify the system can display the UAV's velocity. In the middle of the flight, flip the kill switch. Verify the UAV safely stops flight and lands within 10 seconds of the kill switch being flipped.	2, 4
3	Autonomously start the UGV and execute a straight navigation path. In the middle of the path, flip the kill switch. Verify the UGV safely stops within 10 seconds of the kill switch being flipped.	3

6 ROLES AND RESPONSIBILITIES

6.1 Project Mentor

Each university will be given a Raytheon representative as a project mentor to help guide the project.

6.2 Judges

Judges will observe the final competition and grade based on performance and requirements met. Judges will not be project mentors.

6.3 Faculty Advisor

The Faculty Advisor(s) are the professors of each respective engineering domain. Faculty advisors are typically responsible for team creation, grades, monetary logistics, and course work.

6.4 Project Manager

Students can choose a PM that will lead all the teams and be responsible for team communication, logistics, requirements verification and validation, and overall success of the project.

6.5 Student Teams

Teams will consist of undergraduate students in the field of computer science and engineering disciplines.

7 AWARDS AND EVALUATION

Raytheon's desire is to encourage students to embrace innovation and real-world experience to further both the school and the individual's experience. Independent Raytheon leadership will evaluate each team's project based on the following categories:

Core Scored Elements:

Description	Weights
Requirements Matrix	5% Points for turning in a Requirements Matrix.
Test Documentation	5% Points for turning in Testing Documentation.
Qualifier Test	20 % Points for completing the qualifier test as pass/fail activity submitted via YouTube
Poster / Video	5% Points based on the RTN evaluation presentation artifacts: Video/Poster
Challenge 1	10% of execution of Challenge 1.
Challenge 2	20% of execution of Challenge 2.
Challenge 3	35% of execution of Challenge 3

Note: Only after all challenge objectives have been met will time be used as a tie breaker.

Bonus Opportunities:

Description	Weights
Early Bird Incentive Bonus	Tiered bonus for completing qualifier test early. Assume N is the number of teams on region, the first team to complete all the qual test receives (N-1) % bonus, second team (N-2)% and continue until the last team gets nothing. **Only Qual Test received a week before the Competition Date are eligible for these bonus points**. Idea is to incentivize experimentation and test earlier
STEM Outreach Bonus	**5**% bonus to be awarded to each team that completes a STEM outreach activity to school (any level). Example: Teams present their project to a local high school club.
High School Shadow	**5%** bonus to teams who mentor a high school student through a shadowing experience. The high school student should not take ownership of any project tasks but would gain experience through periodically shadowing the team throughout the project. Note, additional training may be required. Must begin shadowing by January of 2026 to receive full credit. Partial may be offered if started later.
Team Shirts	**1%** bonus to be awarded to schools who design and wear their own unique T-Shirts on Competition Day

Penalties:

Description	Weights
Calibration Points	5 Points will be deducted from the final score for each Calibration Point used on the field. Calibration Point is defined as a physical object added to the field for visual purposes to assist the system in special awareness of the field. Note this does not apply to a visual reference used on the UGV. Calibration points do not send off any kind of signal. Example: Red Dot on a corner of the field.
Beacon	10 Points will be deducted from the final score for each beacon device used. This includes dropping a Beacon on the destination or using a Beacons to map the field. Beacon is defined as any device outputting a signal to call out a location. Examples: Bluetooth, wifi, sound, radio, etc.

Scoring Examples:

If a Team in a region of 10 schools receives full credit for all the Core Scoring Elements and receives the max number of Bonus Points with no penalties, they would be scored as shown below with the percentage breakdown in red and the points scored in blue:

Core Scored Elements Score:

Qual Test Req Matrix Test Docs Poster/Video C1 C2 C3

.2(150) + .05(100) + .05(100) + .05(100) + .1(100) + .2(100) + .35(100) = 110 Points

Bonus Points Opportunities:

Early Bird STEM Outreach Shadow T-Shirts

(10-1) + .05(100) + .05(100) + .01(100) = 20 Bonus

Total

Core Scored Elements Points + Bonus Points

110 + 20 = 145 Total Points

Scenario A: Team A has received all the available points on their Qual Test, Requirements Matrix and Test Documentation. However, they were not eligible for the Early Bird Bonus. They received full credit for their poster and video. On competition day they successfully completed both Challenge 1, Challenge 2, and Challenge 3 with no problems and received full credit. They did NOT complete a STEM outreach or have a shadow student, but they did make some super cool custom T-Shirts! They received a penalty for using one Beacon. They would be scored as follows with the percentage breakdown in red and the points scored in blue:

Core Scored Elements Score:

Qual Test	Req Matrix	Test Docs	Poster/Video	C1	C2	C3	
.2(150)	+ .05(100)	+ .05(100)	+ .05(100)	+ .1(100)	+ .2(100)	+ .35(100)	= 110 Points

Bonus Points Opportunities:

Early Bird	STEM Outreach	Shadow	T-Shirts	
(0)	+ .05(0)	+ .05(0)	+ .01(100)	= 1 Bonus

Total

Core Scored Elements Points	+	Bonus Points	-	Penalties	
110	+	1	-	10	= 101 Total Points

Scenario B: Team B was the third school in a region of 10 to turn in their qual test early and received 132 points on their Qual Test. They did not complete a Requirements Matrix or Testing Documentation. They received full credit for their poster and video. On competition day they successfully completed Challenge 1 and Challenge 2 but only received 80/100 points for Challenge 3. They completed a STEM Outreach, had a shadow student and make T-Shirts. They received no penalties. They would be scored as follows with the percentage breakdown in red and the points scored in blue:

Core Scored Elements Score:

Qual Test	Req Matrix	Test Docs	Poster/Video	C1	C2	C3	
.2(132)	+ .05(0)	+ .05(0)	+ .05(100)	+ .1(100)	+ .2(100)	+ .35(80)	= 89.4 Points

Bonus Points Opportunities:

Early Bird	STEM Outreach	Shadow	T-Shirts	
(10-3)	+ .05(100)	+ .05(100)	+ .01(100)	= 18 Bonus

Total

Core Scored Elements Points	+	Bonus Points	
89.4	+	18	= 107.4 Total Points

8 Appendix A – Internet Access (optional)

Internet access to the aerial and ground vehicles is optional; however, it may help facilitate flight and target identification options in appendices B and C.

8.1 Option 1: Local “Guest” network to "base station area"

If the supporting venue provides guest Wi-Fi to the staging area(s), any network usage passes through each team's base station to their vehicle(s) through telemetry radios. Most base station software (Mission Planner, QGC, etc.) support this functionality. Please note that the UTA Guest network may be unreliable both in connectivity and speed.

8.2 Option 2: "You're on your own"

In practice, this means bring your own cellular model and/or hotspot and infrastructure to ensure each component has the necessary Internet connectivity.

9 Appendix B – Logging

Logging is required for all UGV's to help determine intended actions.

The following actions must be logged:

- UAV Start Time
- Destination discovery
- Communication between Autonomous Vehicles
- Location of the destination
- UGV Start Time
- UGV receipt of destination location
- UGV generated path
- UGV speed
- UGV End time
- UAV End time

10 Appendix C – Q&A

- In a GPS denied scenario, would the team be allowed to place known point-targets on the field to act as calibrating anchors? (i.e. ultra-wideband anchors)
    - Yes, but penalties will be acquired.
- Do you need to start UAV by code or can we hit a button by hand. Do you have to be hands off when starting at dynamic position
    - Either works. One can push a button after placing the Scout in the starting position
- Will the final event be outdoors? What is the dimension of the space?
    - Yes - should be 15 yards by 15 yards
- Is there a Power restriction?
    - No
- Where is the Kill switch supposed to be? Can you use laptop for the kill switch?
    - Usually the "Kill Switch" is on the hand controller. Hand Controller should be available for emergency situation, but not used during flight
- How many ArUco markers will be on the fields at once?
    - Only 1
- What is the dB limit for a sound beacon to mark the delivery location?
    - OSHA Rules
- The IP form states in Section 1: STUDENT EMPLOYMENT STATUS "Student represents and warrants that he/she is not an employee of the University." Does this disqualify students that work at the University Bookstore, Fitness Center or other campus jobs?
    - Please have the student mark up the IP agreement to make it accurate to the student's situation and we can choose to fully execute or not.
- What are the non-ideal conditions that could occur on competition day? Rain? Heavy wind?
    - The only reason we would delay is if the conditions were not safe for us to be outside (lighting, tornado, etc.). There may be heavy wind.
- Will there be a defined maximum altitude or ceiling for UAV flight during the challenges?
    - No, just as long as they are compliant with FAA rules
- Can the drone carry the ground vehicle?
    - Yes, they must meet the flight/ride time requirements and stay under 55lbs combined per FAA regulation
- Can they place a marker next to but not on the marker.
    - Yes, but a penalty will be aquired
- Is time in the score?
    - Yes, but only after the objective is met. If your team hits all the obstacles or doesn't land while their UGV is moving they will not be able to make up these points with a fast time.
- Can there be more than one UAV?
    - Yes. All of the UAV's must land on the UGV. At least one UAV must land on the UGV while landing, others may land on a stopped UGV. A**ll must safely** land before the Judge will stop time. Points will be deducted for crash landings.
- What does "no crash landing" mean?
    - No significant damage to either vehicle. Both should be able to fully operate after landing. If it looks like a crash, the judges will mark it as a crash.

11 Appendix D FAA Regulations

There are 3 categories of Drone Flight:

- Commercial
- Recreational
- Educational

The Raytheon AVC expects to operate in the Education Category

If the 2025-2026 AVC operates under the **Educational** Category,

- The FAA Regulations regarding the Educational Category can be found here Educational Users | Federal Aviation Administration (faa.gov).
- Note: At the time of this writing, Remote ID is not required for Drones operating in a FRIA: UAS Remote Identification | Federal Aviation Administration (faa.gov)
- Note: FRIA zones can only be requested by non-profit organizations or educational institutions
- Note: At the time of this writing, none of the AVC Competition areas have been verified as FRIA zones, but may be by the time of the competition
- **Institutions of Higher Education.** There is also a statutory provision (PL 115-254, Section 350) that distinguishes some educational and research uses of UAV by institutions of higher education as recreational in nature.

If the 2025-2026 AVC operates under the **Recreational** Category.

- The FAA Regulations regarding the Recreational Category can be found here: Recreational Flyers & Community-Based Organizations | Federal Aviation Administration (faa.gov)
- Note: At the time of this writing, TRUST certification is required for recreational fliers. Information about TRUST can be found here: The Recreational UAS Safety Test (TRUST) | Federal Aviation Administration (faa.gov)
- Note: At the time of this writing, Beginning September 16, 2023 all drone pilots required to register, including those who fly for recreation, business, or public safety, must operate their drone in accordance with the rule on Remote ID. Information about Remote ID can be found here: UAS Remote Identification | Federal Aviation Administration (faa.gov)

12 Appendix E Sky Labs Research

Sky Labs Research is a company created by students who have competed in the Raytheon Autonomous Vehicle Competition previously. They are offering consultation services to provide recommendations on drone parts and systems integration. The company / service is not affiliated with Raytheon in any way but is provided here as an example for teams who would like to try and accelerate their research and prototyping.

- Consultation services: https://skylabsresearch.com/products/consultations
- On the site, Sky Labs will be offering consultation meeting scheduling for students to meet and discuss how they can best be supported by Sky Labs. After the first meeting the service will transition to a free email correspondence, or you may schedule more meetings as needed.

Sky Labs will not provide design decisions/ideas but will help try and guide them to reach their own design choices.

- Free Nugget: eCalc - https://www.ecalc.ch/ is used to calculate drone power trains. It should be used by students during the drones' design phase.

13 Appendix F Discord

Please ask your mentor about joining the discord with BrainChip and Deep Perception for assistance using their products.

14 Appendix G Points of Contact

`Raytheon Technologies Points of Contact

1. Jesse Lee (Raytheon Autonomous Vehicle Competition Lead), UT Student Mentor, email: jesse@rtx.com, Phone: 806-535-2271
2. Leonard Chen (Raytheon Senior Leadership), Technology Outreach and University Research, email: lpchen@rtx.com, Phone: 805-895-6427
3. Melissa Im, Raytheon Drone Council, email: Melissa.Im@rtx.com, Phone: 703-216-1734
4. Alfonso Lopez (Competition Council), UTEP Student Mentor, email: Alfonso.A.Lopez@rtx.com, Phone: 214-502-7018
5. Hector Irizarry (Competition Council), Puerto Rico Representative, email: Hector.Irizarry@rtx.com , Phone: 214-608-2586

14.1 Mentors

14.1.1 South Region

1. Marta Tatu, University of Texas at Dallas Student Mentor, email: marta.tatu@rtx.com
2. Raghav Vadhera, University of Texas at Arlington Student Mentor, email: bhanu.p.vadhera@rtx.com
3. Meredith Burke, Southern Methodist University Student Mentor, email: Meredith.s.burke@rtx.com
4. Bentley Davis, Texas A&M University Student Mentor, email: bentley.davis@rtx.com
5. Lamarious Carter, Jackson State University Student Mentor, email: Lamarious.Carter@rtx.com
6. Aly Bybee, University of Mississippi Student Mentor, email: alyson.parsons@rtx.com
7. Jesse Lee, University of Texas at Austin Student Mentor, email: email: jesse@rtx.com
8. Alfonso Lopez, University of Texas at El Paso Student Mentor, email: Alfonso.A.Lopez@rtx.com
9. Jonathan Tamplin, Prairie View A&M Student Mentor, email: jonathan.tamplin@rtx.com
10. Lauryn Page, Alabama A&M Student Mentor, email: lauryn.page@rtx.com

14.1.1.1 Puerto Rico Region

1. Angel Diaz, Interamerican University of Puerto Rico Student Mentor, email: angel.diaz@rtx.com
2. Josues Gonzalez, UAGM-G Student Mentor, email: josues.gonzalez@rtx.com
3. Marycarmen Torres, University of Puerto Rico at Mayaguez Student Mentor, email: marycarmen.torres2@prattwhitney.com
4. Julissa Almodovar, University of Puerto Rico at Mayaguez Student Mentor, email: JULISSA.ALMODOVAR@collins.com
5. Hector Irizarry Polytechnic University of Puerto Rico Student Mentor, email: Hector.Irizarry@rtx.com

14.1.1.2 West Coast Region

1. Ryan Conolley, University of California Santa Barbara Student Mentor, email: conolley@rtx.com
2. Luis Esparza, California Polytechnic State University Student Mentor, email: luis.esparza@rtx.com
3. James Cooper , California State, Long Beach Student Mentor, email: james.i.cooper@rtx.com

14.1.1.3 East Coast Region

1. Nandi Leslie, Howard University Student Mentor, email: Nandi.O.Leslie@rtx.com
2. Jarick Cammarato, George Washington University Student Mentor, email: Jar.Cammarato@rtx.com

3. Johnathan L Lyles, George Mason University Student Mentor, email: jlyles@rtx.com
4. Alice Jackson / Nathan Pagel, Virginia Polytechnic Institute and State University Student Mentor, email: Alice.C.Diggs@rtx.com / npagel@rtx.com
5. J Schroder, University of South Florida, email: J.Schroder@rtx.com