

# NASA Community College Aerospace Scholars (NCAS) Competition

## Optional Competition

### AIHEC NCAS Competition Objectives:

- Strengthen existing Science programs at TCUs and stimulate new interest in STEM fields.
- Showcase talent and skills.
- Strengthen the relationship between NASA and the Tribal Colleges and Universities.

### AIHEC NCAS Registration:

- Questions about competition can be directed to both Alex Gladney-Lemon (alexander.d.gladney-lemon@nasa.gov) and Karen Wilson (karen.j.wilson@nasa.gov).
- Only 4 teams may participate in this competition.
- Teams of 5 to 7 member teams are recommended. Teams larger than 7 need to contact us.
- Teams of fewer than 4 members may be grouped with another team in order to participate.
- Teams of 4 members or more may opt-in to allow a smaller team to join them.
- The first 4 teams of 4 or more to register will be selected.
- All team members must be available for orientation on Saturday, March 10 at 6:00pm. Location will be sent after registration is complete.

### AIHEC NCAS Competition Rules

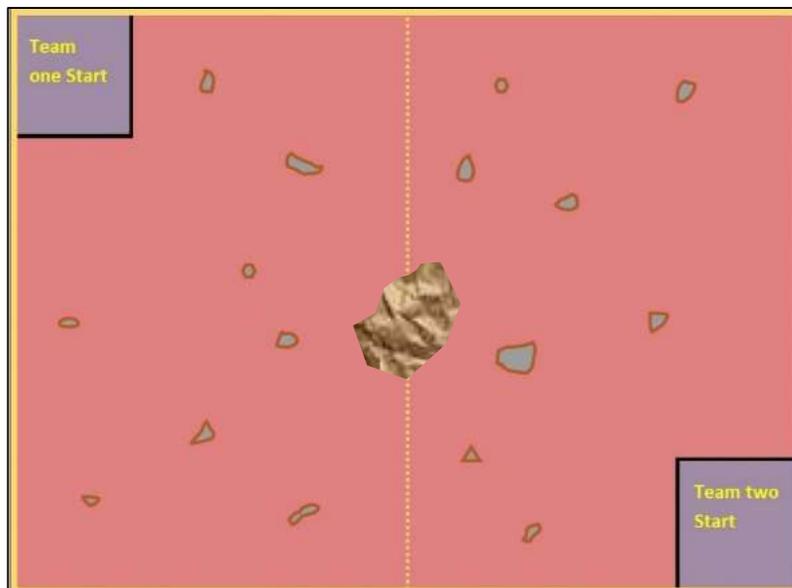
1. All AIHEC member institutions may register for the event. Registration must be submitted online.
2. The NCAS Competition will have two rounds:
  - a. In the first round on the first day of the NCAS Competition a team of 4-7 members and a CEO/Coach will spend time according to the table below building a rover. The first round will end with a first-round competition at the end of the first day of the NCAS Competition where each team will traverse the Mars Yard with their rover, gather rocks and bring them to the extraction area and “identify the minerals” in select locations on the course.

Hours a team needs to log prior to competition one				
	4 person team	5 person team	6 person team	7 person team
Spend at least this much time to earn bonus of \$6,000,000	16 hours	20 hours	24 hours	28 hours
Spend at most	24 hours	30 hours	36 hours	42 hours

- b. In the second round the same teams will spend time according to the table below making repairs and adjustments to their rover. The second round will end with a second-round competition at the end of the second day of the NCAS Competition where each team will drive a rover towards stranded Mars Buggies, secure them, and bring them back to the start area. The team will also “identify minerals” in select areas of the course for a second time.

Hours a team needs to log prior to competition two				
	4 person team	5 person team	6 person team	7 person team
Spend at least this much time to earn bonus of \$6,000,000	10 hours	12.5 hours	15 hours	17.5 hours
Spend at most	16 hours	20 hours	24 hours	28 hours

## MARS YARD LAYOUT



*OLYMPUS MONS SHOWN DIRECT CENTER*

The NCAS Mars Yard consists of interlocking foam squares to form the Martian surface. Atop the surface are various targets and obstacles of different sizes and shapes. The competition area is bisected down the middle allowing two teams to compete at one time.

## Logging Time

3. As team members come into the competition they must stop at headquarters to check-in to log their time. When a team member leaves they must check out. Deliverables and maximum time are based on particular number of total hours that has been accrued. (See Charts in Rule 31, Rule 2a and Rule 2b).
4. Each team member must log at least 3 hours prior to first completion and at least 2 additional hours prior to second competition to be counted as a team member.

## Team Roles

5. Each team must have a CEO: a competition mentor, coach, or advisor; usually a TCU faculty member.
6. Teams must fill the positions (detailed descriptions of each position will be provided at the project orientation) based on the team size. Four (4) team members is the minimum, but five (5) to seven (7) team members is strongly encouraged:

For a 4 person team:

Project Manager  
Operations Engineer (who will also do the work of the Test/Assembly Engineer)  
Systems Engineer (who will also do the work of the software/design Engineer)  
Procurement/Financial Officer

For a 5 person team:

Project Manager  
Operations Engineer  
Systems Engineer  
Procurement/Financial Officer  
Add either a Test/Assembly Engineer or a Software/Design Engineer

For a 6 person team

Project Manager  
Operations Engineer  
Systems Engineer  
Procurement/Financial Officer  
Test/Assembly Engineer  
Software/Design Engineer

For a 7 person team

Project Manager  
Operations Engineer  
Systems Engineer  
Procurement/Financial Officer  
Test/Assembly Engineer  
Software/Design Engineer  
Marketing & Communication Manager

## Rover Construction Specifications

7. Only parts included in the kit provided may be used in rover construction.
8. A rover suspension is required to traverse the Martian terrain and transport a chassis.
9. A rover chassis is required to carrying operating systems and allow for successful deployment of scientific instrumentation.
  - a. A power source - battery pack, solar panels, etc.
  - b. Sensors - light, touch, color, gyro etc.- include at least one (1) in the design (rover must run autonomously)
    - i. Use of sound sensor is not permitted
  - c. Robotic-mechanical arms - capability to reach/extend to move, push or scoop up objects
  - d. Wheels - Include at least three (3) wheels for proper function or a pair of tracks
10. A Communications Package: computer for navigation
  - a. Create different programs on the brick of the rover is encouraged to handle different situations
  - b. The programs must be able to return the rover back to the extraction area autonomously.

## General Rules

11. All rover wheels must touch the ground.
12. Teams may orient their rover in whichever direction they choose, within the extraction area, upon starting.
13. Each team's rover must be able to move and/or pick up samples.
  - a. Dragging rocks by wires is not allowed.
14. A rock/buggie may be moved once it has reached the extraction area.
15. A rock/buggie is in the extraction area when over 50% of the object is in the extraction area (including being on the masking tape).
16. When the competition starts, hands off! Let the rover run its full software program.
17. Any object knocked loose or moved inadvertently by the rover will remain in its resting place. At no time during the competition will there be any modification of the Mars Yard. Only after the team completes their iteration will the Mars Yard be reset by NCAS to ensure fair play for all teams.
18. When "identifying minerals" the rover must say the name of the color of the mineral found.
19. Each team will have a total of **14 minutes** on the Mars Yard
  - a. **2 minutes** to test rover to determine if modifications are needed
  - b. **2 minutes** to make modifications
  - c. **10 minutes** to push/carry rocks to the extraction area and to "identify minerals".
20. ***If a wheel or any other part falls off the rover during the 10 minute time period, it remains off – NO REPAIRS!***
21. Teams must remain within their half of the competition area.
  - a. An out-of-bounds penalty will be assessed upon any part of the rover that crosses over to an opponent's side or out of bounds.
  - b. Out of bounds will be denoted with blue tape.
  - c. Out of bounds exceptions:
    - i. Only the color sensor is allowed out of bounds.
    - ii. When at least 50% of the rover enters the extraction area on return, it is "safe" and will not count as going out of bounds.

- iii. Olympus Mons is considered neutral territory. As long as a team's rover does not fall off the mountain into the opponent's area, they will not be counted out of bounds.
- 22. Penalty for an out of bounds rover: The judge will instruct the team that went out of bounds to pick up their rover and hold it until the software program finishes. Once the software program finishes the team may set their rover in the extraction area. The judge will assess a 30-second penalty. During the penalty the team cannot touch the rover. Once the penalty has been completed the team may continue the competition.
- 23. Penalty for becoming stranded on the Martian surface: If a rover does not return to the extraction area (over 50% of the rover must be in the extraction area) or becomes stuck, the judge will wait until the software program finishes then instruct the team with the stranded rover to pick up the rover and return to the extraction area. The judge will assess a 30-second penalty. During the penalty the team cannot touch the rover. Once the penalty has been completed the team may continue the competition.

## Budget

- 24. Points are **not** awarded based on how much under the budget a team is, but only that the team remains under their total budget.
  - a. Starting Budget: \$600,000,000
- 25. Besides the cost of building the rover (prices of parts will be provided) the team is able to purchase additional items below:
  - a. Rock Samples
    - i. Large \$500,000
    - ii. Medium \$300,000
    - iii. Small \$100,000
  - b. Mars Terrain Tile (per tile): \$1,000,000
  - c. Extra two (2) minutes Rover Course Viewing Time: \$2,000,000
  - d. Test Buggy: \$2,000,000
  - e. Mineral Samples: \$250,000 each
  - f. Mars Terrain Imagery Set: \$1,500,000
  - g. Fines: Varies
- 26. A team may earn additional funds for the team company by:
  - a. Retrieving Rocks (Only awarded during Competition 1)
    - i. Large: \$30,000,000
    - ii. Medium: \$20,000,000
    - iii. Small: \$10,000,000
  - b. Retrieving Rovers: 75,000,000 (Only awarded during Competition 2)
  - c. Scaling Olympus Mons: \$150,000,000
  - d. Identifying Minerals: \$15,000,000
  - e. Constructing a Functioning Arm: \$2,000,000 (an arm that moves)
  - f. Bonuses: Varies
- 27. Each team has the option to sell excess parts from their kits to other teams. The procurement manager/financial officer is responsible for approving all sales and purchases, maintaining all transaction receipts, and obtaining and releasing all parts. All deals must be completed at Headquarters by the Project Manager.  
Note: Teams will be fined if they fail to return sold parts to their original kits at the end of the competition.

28. Teams will be fined \$500,000 for each lost part, or if they are found on the floor.

## **Final Presentation**

29. Each team will give a final presentation on the last day. This presentation is expected to be about 7-10 minutes in length and the goal is to win funding from Headquarters. Each team may use any presentation format, but Power Point, Prezi, or i-movie are recommended. All team members must participate in the presentation. A more detailed rubric will be provided by Headquarters.

30. Items that must be included in each team presentation:

- a. Company name and logo
- b. Company motto
- c. Organization of company
- d. Parts of the team Rover Design
- e. Desired performance outcomes for rover and their alignment with NASA goals, lessons learned
- f. Report of prototype testing results
- g. Modifications, if any, to prototype
- h. Overall budget along with points earned for missions and challenges the team faced
- i. Alignment to NASA Goals
- j. Public outreach and education plans (Only for teams with 7 members)
- k. Conclusion
  - i. Why should the team be awarded the contract for the next Mars Rover mission?
  - ii. What about the team stands out over the other teams?

## **Deliverables to NASA Headquarters**

31. Periodically during the first and second rounds of the NCAS Competition each team will provide certain deliverables to the NASA Headquarters or Competition Coordinators (descriptions are below time table of when they are due is below):

- a. A Statement of Work (SOW) is a formal document that defines the work activities, timeline, cost, and metrics that will be executed during a team's work period. It is expected to be no longer than 1 page in length and contain:
  1. Planned work activities
  2. Timeline of project
  3. Expected pricing of rover
  4. Desired performance outcomes
- b. Progress Report #1 must include a timeline to tell Headquarters the tasks that have been accomplished and the tasks that still need to be accomplished to complete the team's rover.
- c. Progress Report #2 must include a timeline to tell Headquarters the tasks that have been accomplished and the tasks that still need to be accomplished to complete the team's rover.
- d. Final Presentation Report must include a timeline to tell Headquarters the tasks that have been accomplished and the tasks that still need to be complete the final presentation.
- e. A Budget Report is based on a template that will be provided by Headquarters.

Reports due to Headquarters				
	4 person team	5 person team	6 person team	7 person team
Statement of Work	12 hours	15 hours	18 hours	21 hours
Progress Report #1	20 hours or first competition	25 hours or first competition	30 hours or first competition	35 hours or first competition
Progress Report #2	32 hours or second competition	40 hours or second competition	48 hours or second competition	56 hours or second competition
Presentation Report	32 hours or second competition	40 hours or second competition	48 hours or second competition	56 hours or second competition
Budget Report	Before the first team presents			

### Winning Team Selection

32. The overall winning team will be determined at the discretion of Headquarters.
  - a. Individual activities will be worth:
    - i. 40% - Rock Retrieval and Mineral Identification Mission
    - ii. 30% - Rover Rescue and Mineral Identification Mission
    - iii. 15% - Final Presentation
    - iv. 10% - Reports and Communication
    - v. 5% - Team Spirit & Professionalism

# Official AIHEC NCAS Competition Roster Registration Form

This form shall be submitted by *February 15, 2018*

Submit the form to: [alexander.d.gladney-lemon@nasa.gov](mailto:alexander.d.gladney-lemon@nasa.gov) and [karen.j.wilson@nasa.gov](mailto:karen.j.wilson@nasa.gov) with a subject of: *AIHEC NCAS Registration*

Team CEO, Coach, Advisor (Main Contact Person For Team) \_\_\_\_\_

Name of School: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone number and e-mail: \_\_\_\_\_

Team Member 1

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_

Email: \_\_\_\_\_

Tribal Affiliation: \_\_\_\_\_

Team Member 2

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_

Email: \_\_\_\_\_

Tribal Affiliation: \_\_\_\_\_

Team Member 3

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_

Email: \_\_\_\_\_

Tribal Affiliation: \_\_\_\_\_

Team Member 4

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_

Email: \_\_\_\_\_

Tribal Affiliation: \_\_\_\_\_

Team Member 5

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Telephone: \_\_\_\_\_  
City, State, Zip: \_\_\_\_\_  
Email: \_\_\_\_\_  
Tribal Affiliation: \_\_\_\_\_

Team Member 6

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Telephone: \_\_\_\_\_  
City, State, Zip: \_\_\_\_\_  
Email: \_\_\_\_\_  
Tribal Affiliation: \_\_\_\_\_

Team Member 7

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Telephone: \_\_\_\_\_  
City, State, Zip: \_\_\_\_\_  
Email: \_\_\_\_\_  
Tribal Affiliation: \_\_\_\_\_

\*If your team is more than 7 members please contact us and we can make arrangements.

The competition is limited to the first four (4) registered teams. Four (4) team members, in addition to the coach, is a minimum; however, it is highly encouraged to have a team of five (5) to seven (7) members.

I certify that the Tribal College participants listed on the roster meet all eligibility guidelines of the American Indian Higher Education Consortium (AIHEC) and are eligible to participate in the AIHEC Student Conference.

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Signature – NCAS Competition CEO/Coach/Advisor

Date

# NASA COMMUNITY COLLEGE AEROSPACE SCHOLARS

## NCAS COMPETITION GUIDELINES AND PROCEDURES

- The NCAS coordinator will reserve an appropriately-sized NCAS location. NCAS will require two rooms, a competition room (20' x 20' space) and a main room (40' x 20')
- The NCAS coordinator will provide periodic updates to the host committee concerning registration numbers and the cost of the NCAS supplies.
- The NCAS coordinator may use the proven rules from above and make adjustments as the need arises to adapt to the specific host location, participant-entry size, budget limitations, etc.
- The NCAS coordinator might need to recruit ~ two (2) people (faculty, students, or other AIHEC staff members) to assist with judging.
- Suggested Checklist of Materials for the coordinator (NASA will bring these to the 2018 competition) to bring to the conference: 4 sets of Lego EV3, 40 2' x 2' foam mats, various sized rocks, extra Legos to make buggies, 14 copies of the company book.
- Have a firm registration deadline. Postmarked, faxed, emailed, etc. at least seven (7) days before the start of the conference. No exceptions.
- Enter registered students into a master spreadsheet by college/team to ease the checking in process at the conference.
- The coordinator arrives at the conference at least a day before the competition to setup the rooms reserved for NCAS with at least ten (10) tables and to set up the competition course.
- The coordinator may also be the judge for the competition
- There are four (4) teams that compete through all three (3) days of the competition
- Once the conference begins, the students are responsible for their own scheduling of other conference competitions.
- The NCAS coordinator is responsible for reporting the winning team to the awards' banquet coordinator.
- Video and audio taping of the competition is allowed, while teams are at work. During the rover competitions no video/audio/pictures are allowed.