V3.1

IRoC-U 2025 Rule Book

ISRO ROBOTICS CHALLENGE-URSC: IROC-U 2025

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1 Background:

ISRO Robotics Challenge-URSC 2024 (IRoC-U 2024) provided an opportunity to the student community to showcase their engineering problem solving capabilities for space missions. The student community responded to IRoC-U 2024 with great enthusiasm, and its unprecedented success served as an inspiration for the next challenge IRoC-U 2025.

One of ISRO's future goal is the exploration of Martian surface and as a part of Martian surface exploration, an Autonomous Aerial Vehicle will carry out scientific activities. ISRO solicits from the youth of India, innovative ideas and designs in the area of navigation for future missions through the conduct of Robotics Challenge.

2 Challenge

The IRoC-U 2025 challenges the students to develop '**Autonomous Navigation for an Aerial Vehicle (ANAV)**' *without any external navigation aid like GNSS, pseudolite or reflector arrays with a tagline* '**Fly me on MARS**'.

The challenge on Martian surface is non-availability of any external navigation aid like GNSS, pseudolite or reflector arrays. Hence, a dedicated navigation technique required for aerial vehicles for exploration of Martian surface. Hence current challenge focuses only on developing and demonstrating navigation and guidance techniques rather than building aerial vehicles. Students can use/develop any available (off-the-shelf) aerial vehicle complying with existing DGCA rules.

The student community needs to develop and demonstrate the autonomous capabilities of ANAV:

a) for navigation and guidance without the aid of any external navigation.
b) to identify safe landing spots and perform stable landing and take-off.

3 Tasks during the challenge:

ANAV has to perform the following tasks during the challenge during the various rounds.

a) Stable Vertical take-off, hover and landing.
b) ANAV shall scan the arena to identify the boundary, and the safe spots for landing.
c) ANAV shall choose the sequence and stable landing at each safe spot.
d) After safe landing, the ANAV shall return to the home position.

Note: Task details will be provided after preliminary rounds.

Identifying the target spots should not be based on the colour, and must be based on surface topography.

4 Schedule of the Events

#	Description	Date
1.	Announcement of the challenge and registration	20.11.2024
2.	Last date for submission of complete proposal for Preliminary round	7.01.2025
3.	Announcement of Selection of teams of Preliminary round	27.01.2025
4.	Commencement of Qualification round	29.01.2025
5.	Last date for submission of detailed design report and videos for Qualification round	20.04.2025
6.	Evaluation of Qualification round	20.04.2025 to 04.05.2025
7.	Announcement of results of Qualification round	06.05.2025
8.	Commencement of Elimination round	07.05.2025
9.	Last date for Submission of Videos for Elimination round	10.06.2025
10	Evaluation of Elimination round	11.06.2025 to 29.06.2025
11	Announcement of results of Elimination round	30.06.2025
12	Commencement of Final round	01.07.2025
13	Final field round and evaluation at the venue	Tentatively in last week of July 2025 & First week of August 2025. Exact dates will be announced shortly.
14	Announcement of results	
15	Awards Ceremony on National Space Day	23.08.2025

Note:

1. The details of the challenge will be available after the registration.
2. Only one proposal per college will be entertained.
3. Organisers reserve the right to change the dates depending on exigency of situation / to refine the task details of the challenge.
4. All deadlines are at 8.30 PM (IST) on the respective dates.

5 Venue

The final onsite competition to perform the required tasks is planned to be conducted in U R Rao Satellite Centre (URSC), Bengaluru - 560017, in the month of July 2025. For information about the IRoC-U 2025 competition venue, please follow our updates on website 5.1.1.

5.1 Contact Information

5.1.1 **Website address:** https://www.ursc.gov.in/IRoC-U2025

5.1.2 Email address for Teams: irocu2025@ursc.gov.in

5.2 Awards and Recognitions

The first three teams will be awarded based on the evaluation by jury and fair play attitude of teams. Additionally, two consolation prizes will also be awarded. The awards in the form of cash is planned as follows:

1st place	Rs 10 Lakh
2nd place	Rs 7 Lakh
3rd place	Rs 5 Lakh
Consolation prize	Rs 2 Lakh
Prize for innovative and non-intuitive thinking	Rs 1 Lakh

The teams qualifying for the Field Round and participating on challenge day will be awarded with an appreciation certificate to each of the team members and mentors.

The teams qualifying for the Qualification and who have submitted the design report will be awarded with participation certificate to each of the team members and mentors. No certificates will be given to the teams who fail to submit the design report by the specified timeline.

5.3 Intellectual Property Rights

Intellectual properties (IPs) generated by the team qualifying for the Field Round during the IRoC-U 2025 challenge shall be sole property of ISRO/DOS. These teams shall enter into non-disclosure agreement with ISRO/DOS.

The ANAV design arrived by the teams qualifying for the Field round shall not be used by the teams in any other competition without the written consent of the ISRO/DOS.

5.4 Rules and regulations by Department of Civil Aviation:

The rules and regulations issued by Department of Civil Aviation shall be strictly followed. For more details on rules issued by Ministry of Civil Aviation please visit and follow https://www.civilaviation.gov.in/ministry-documents/rules

IRoC-U 2025 organizing team is not responsible for any violation of the rules issued by DGCA that are committed by the individual teams during any stage of the challenge.

6 PARTICIPATING TEAMS

6.1 Registration

All teams must complete the registration process on the website. The registration procedure includes:

1. Team login account creation.
2. Filling out the team details and download auto-generated registration form.
3. Get downloaded registration form duly certified by the Head of the institute.

4. Upload the softcopy of the proposal and the certified registration form in .pdf format (Proposal can be of maximum pages:30 with the file size limited to 15 MB).

NOTE: Registration shall deem to be completed only after uploading as per step 3 and 4.

6.2 Team formation

1. The competition is open to students of Indian origin studying in educational institutions located in India.
2. The team is to consist of bona-fide **students** pursuing (full time and non-sponsored) under graduation/post-graduation/research. Sponsored/External students are not eligible for participating in the IRoC-U 2025.
3. The team should consist of minimum of 3 members and maximum of 10 members excluding mentors.
4. Team can have at most two mentors, one of whom must be a faculty from the parent institute and other may be from the Parent Institute/ Industry.
5. Each team should identify one member as team lead.
6. *Any communication from the organisers will be sent to only team lead and any query/clarification should also be raised only using the team lead's registered email id. No response will be provided to the email addresses other than that of the registered email id.*

6.3 Selection Process

The selection process is detailed below. The number of teams selected from Prelims round will be based on the evaluation of the entries.

The number of teams selected for all the rounds is at discretion of the committee. The decision of the organisers in this regard will be final and binding.

- **Prelims Round requirement**: Registration and Submission of Proposal Report and presentation.
- **Qualification Round requirement**: Submission of Detailed Design Report and Demonstration of laboratory Prototype (Details shall be provided).
- **Elimination Round requirement:** Demonstration of ANAV in the simulated arena at the respective parent institute premises (Details shall be provided).
- **Field Round requirement:** The final onsite competition to perform the required tasks is planned to be conducted at URSC Bengaluru (Details shall be provided).

The present document outlines rules for the Preliminary round (the rules of subsequent rounds shall be uploaded).

7 Requirements of the various rounds

7.1 Preliminary round Report Submission

Each registered team must submit proposal. The proposal should introduce the team and provide explanation for the salient features/innovations of their proposal. It should confirm that the team has read, analysed and understood the task requirements.

The team needs to download the proposal report format and follow the guidelines provided in the document. The document (maximum 15 MB) needs to be uploaded on the website.

The details and rules of the subsequent rounds will be provided 1 day prior to the commencement of the respective rounds.

Note: Only one team from each institute is permitted to participate in the contest. It is the responsibility of the institute to select the team based on their established criteria. Furthermore, the chosen team must secure an endorsement from the head of the institution, confirming that they are the sole representatives for their institute in the competition. If more than one entry is found from any institute, first submitted proposal shall be entertained for the further rounds and the remaining proposals shall be rejected.

Note: The proposal report carries a score of 10 marks out of total marks 100 for the entire challenge. The breakup of 90 marks will be announced during the qualification round of the challenge.

7.2 ANAV specification and requirements

Features:

a) Hardware: Teams can develop or use readily available hardware platform. (Aerial vehicle)

b) Mass of ANAV: limited to 2 kg.

c) Compliances:

- The teams need to specify in the proposal report the compliance of the proposed ANAV with respect to the specifications as per Table-1.
- To meet the challenge as proposed, the use of satellite-based navigation systems, external markers, or local positioning systems is strictly prohibited, mirroring the challenges faced by an actual planetary ANAV on distant celestial body where traditional Earth-based navigation aids are unavailable.
- ANAV shall have an emergency call off mode, in case of exigencies.

Table-1: Typical Specifications of Autonomous Navigation for an Aerial Vehicle (ANAV)

Sl. No.	Type	Description
1	Aerial Vehicle	Rotor Craft (Micro Drone, Mass < 2 kg) (As per Drone rules-2021, issued by Ministry of Civil Aviation as per the Gazette of India CG-DL-E-26082021-229221 or the latest version)
2	Software capabilities	Indigenously developed softwares/algorithms
3	Power Source	Battery operated only
4	Communication	RF radiation mode only
5	Slope landing capability	Minimum 15˚

7.3 Simulated Arena details for elimination round:

Refer to section 10.2.

7.4 Challenge rounds details:

Challenge rounds are designed to evaluate the core ANAV characteristics and capabilities necessary to achieve the final objective. During the qualification round, the ANAV must showcase its essential skills of flying, hovering, and landing. In the elimination round, students will be required to build their own arena, develop and integrate an autonomous navigation system into the ANAV, and demonstrate the core skills of navigation and guidance. Teams that successfully qualify the elimination round will advance to the final field round of the challenge.

Here are the few definitions of the terms to be noted and followed.

- **Base station:** Base station can be a laptop / remote controller from which the initial command and emergency commands will be given. All communication between the base station and the ANAV shall be wireless.
- **Telemetry information:** ANAV is expected to deliver the following telemetry information which will be monitored during the challenge.
    - Navigation parameters like Position (X, Y, Height), vertical velocity, horizontal velocity, safe site co-ordinates etc.
    - Battery health and status.
    - Other information if any.
- **ANAV Modes**

  Manual: After Switch on it immediately enters in manual mode. In manual mode ANAV can be operated using base station.

  Autonomous: After receiving auto-start command in manual mode ANAV gets into Autonomous mode and start the task defined in respective rounds.

  Safe: During emergency conditions like low battery, lost-link, etc. the ANAV shall go to a safe mode and do safe landing without manual intervention.

  Other likely emergency conditions
    - Any hint of collision, or malfunction of software or hardware, or malfunction of Control system etc.
    - Any unforeseen deviations.
- **Home position:**
  It will be an arbitrary starting position which will be approximately an area of 1.5 sq. m.
- **Safe spot:**
  A spot / an area approximately 1.5 sq. m. which has the least undulation of surface is referred to a safe spot.

7.4.1 Qualification round:

Refer to Section 9.

7.4.2 Elimination round:

Refer to Section 10.

7.4.3 Field round:

The tasks of field round are similar to that of earlier rounds and the teams have to demonstrate ANAV's autonomous capabilities on the URSC built arena. The additional task to be performed will be "Returning to the home position from the last landing site". The field round will be conducted at URSC premises in Bangalore, Karnataka.

8 General Rules and Regulations

The ISRO Robotics Challenge, URSC – 2025, referred to as 'IRoC-U 2025' is owned, coordinated, operated and judged by IRoC-U 2025 organizing committee constituted by URSC consisting of experts across the ISRO Centres. By taking part in the IRoC-U 2025, teams agree to place a promotional sticker on their ANAV (max. size of the sticker: 10 cm X 10 cm).

8.1 Organisers' Disclaimer

Teams SHALL take full responsibility for any damages, accidents or unsettling events caused by their hardware/software as well as for the members of the participating team. Teams are obliged to follow all safety and good conduct rules specified by the organisers. Any breach of safety rules and requirements will result in the disqualification of the team from the entire competition.

8.2 Changes to the Competition Rules

The organisers retain the right to effect any essential / inevitable changes to the competition rules. However, any changes introduced shall not impact the overall design of ANAV. All changes will be announced in advance and updated on the website.

8.3 Deadline Extension

The organisers retain the right to extend the deadline for any round. All deadline extensions will be announced in advance and details will be updated on the website.

8.4 FAQ

The relevant queries related to the challenge raised by the teams will be updated on FAQ section of the website. Queries to any challenge related questions that arise should be mailed to contact mail ID from team lead's email ID with subject line FAQ. Teams are requested to check FAQ section before raising the query.

8.5 Challenge Scoring Issues

All issues with scoring during the challenge will be resolved solely by the independent jury. Teams cannot appeal to any other party.

8.6 Organisational Issues

Organisational issues, including team eligibility, conduct of challenge and execution of jury decisions will be resolved by the organisers.

8.7 General Challenge Issues

In case any conflict related to the challenge is encountered, the organisers' decision will be considered as final and binding.

8.8 Disqualification

The organisers may disqualify a team in the event of a serious breach of the rules, safety regulations or fair play. The organiser's decision shall be considered as final and binding. Teams cannot appeal to any other party including social media platforms.

8.9 Cancellation of Event

The organisers reserve the right to cancel the IRoC-U 2025 finals in the event of unforeseen circumstances preventing its safe conduct. In case of event cancellation, the organisers will inform the participating teams directly or through web portal.

8.10 Organiser's Responsibility

The organiser's civil liability is limited solely to the responsibility for organising the event in accordance with the local law and local regulations.

8.11 Copyright of the challenge

The organisers retain all copyright to the competition rules, logo, tagline and the description of the tasks. No alterations or additions to the competition rules can be made and their sale is forbidden. The rules can only be used or copied for the IRoC-U 2025 connected activities (e.g. registration process).

8.12 Personal Data Storage

Team members agree to their personal data (registration data), the documentation delivered as well as other promotional materials and visuals being stored and processed in the organiser's computer systems for the purpose of the IRoC-U 2025 programme.

The organiser shall keep all technical documentation confidential and shall not publish or disclose it to any third parties without prior approval from the respective team's representatives. The sole exception to this is the challenge's jury team – technical documentation will be disclosed to judges for scoring and mentoring purposes only.

The team members also give the organiser, parties designated by the organiser and the audience, the right to disclose and publish any photos, videos or other visuals, their names and surnames, identifiable pictures of themselves and any other persons, as well as pictures of machines, devices and equipment in any and all of the available formats, by any and every known method, in any and every known medium.

Teams grant permission to the organiser to use promotional materials and visuals (e.g. photos and videos), as well as any additional photos, videos, portraits, documents, interviews and other materials resulting from participation in the challenge (using the name of the participant or not) on all media, in any language, anywhere in the world, in any manner, for advertising and promotional purposes.

8.13 Miscellaneous

- Individuals or teams may be excluded from participation at the discretion of IRoC-U 2025 for unauthorized behaviour, including but not limited to (i) impersonating a ISRO/DOS official whether intentionally or in a manner that results in confusion, (ii) misuse of the logos or identifiers of ISRO/DOS, any sponsoring organisation, or any infringement of a commercial logo or trademark, (iii) failure to abide by competition rules, directives or instructions from the competition host or organisers, and (iv) asserting or implying a ISRO/DOS affiliation or sponsorship where none exists.

- ISRO/DOS does not host pre-competitions or competitions conducted by any organisation other than organizers of IRoC-U committee constituted by URSC. This IRoC-U 2025 competition is neither affiliated with, nor sponsors or endorses any ANAV Challenge competition other than the IRoC-U 2025. Outside competitions have no bearing on the IRoC-U 2025 qualification or registration process, and representation to the contrary is strictly prohibited. No competition may imply any affiliation with ISRO/DOS or use the ISRO/DOS logo without permission of ISRO/DOS. Any assertions made by organisations that represent themselves as "ISRO/DOS", "Official ISRO/DOS ANAV Ambassador", "ISRO/DOS Judge", or any similar titles suggesting a tie to ISRO/DOS are unauthorized. Representations or suggestions that any organisation or individual can assure teams of being accepted for registration or participation in the challenge are unauthorized. All requirements for participation in the IRoC-U 2025 are outlined in this rules book.
- Participant hereby waives any claims against ISRO/DOS, its employees, its related entities, (including, but not limited to, contractors and subcontractors at any tier, grantees, investigators, volunteers, customers, users, and their contractors and subcontractors, at any tier) and employees of ISRO/DOS's related entities for any injury, death, or property damage/loss arising from or related to the IRoC-U 2025, whether such injury, death, or property damage/loss arises through negligence or otherwise, except in the case of wilful misconduct. Any team member or advisor found to be exhibiting unsportsmanlike conduct may be disqualified from the challenge individually or as a team. All scoring decisions are final.
- Teams not meeting any requirement listed above may be disqualified.

9 Qualification Round:

9.1 Platform requirements for Qualification round

9.1.1 Base station (Telemetry and commanding),

- **Telemetry information:** ANAV is expected to deliver the following telemetry information which will be monitored during the challenge.
  - Navigation parameters like Position (X, Y, Height), vertical velocity, horizontal velocity, safe site co-ordinates etc.
  - Battery health and status.
  - Other information if any.
- **Command modes**
  - Manual: After Switch on it immediately enters in manual mode. In manual mode ANAV to be operated using base station.
  - Autonomous: After receiving auto-start command in manual mode ANAV gets into Autonomous mode to start the task defined in respective rounds.

9.1.2 ANAV Safety features:

Safe: During emergency conditions like low battery, lost-link, etc. the ANAV shall go to a safe mode and do safe landing without manual intervention.

Other likely emergency conditions

- Any hint of collision, or malfunction of software or hardware, or malfunction of Control system etc.

- Any unforeseen deviations.

9.2 Qualification round tasks:

During qualification round the ANAV has to demonstrate the following autonomous capabilities.

9.2.1 Stable Vertical Take-off: ANAV must have a controlled take-off from home position and maintain their intended course (only vertical) maintaining nearly a constant speed until they reach the defined **hovering height between 3m to 10 m**.

Home position: The area of home position is a bounded square of 1.2 m x 1.2 m.

Manual: After Switch on it immediately enters in manual mode. In manual mode ANAV can be operated using base station and start the task defined in Qualification round.

Autonomous: After receiving auto-start command in manual mode ANAV gets into Autonomous mode and start the task defined in Qualification round.

9.2.2 Hovering time: After reaching a hovering height, the ANAV shall hover for minimum of 30 seconds.

9.2.3 Landing: The ANAV shall land within the boundary of home position.

9.2.4 ANAV Safety features demonstration: The safety features defined in 9.1.2 shall be demonstrated.

9.3 Tasks submission:

9.3.1 Shortlisted Teams after developing the platform, the tasks demonstrated at their college shall be recorded in HD resolution with time stamp.

9.3.2 A video for all four tasks 9.2.1, 9.2.2, 9.2.3, 9.2.4 and another video describing the configuration/features of ANAV shall be uploaded along with the detailed design report.

Guidelines for uploading the videos and detailed design report will be provided shortly in the website.

9.3.3 The videos shall be captured in proper light conditions. The detailed design report may be in similar lines of the outline detailed in the ‘template for proposal report’.

10 Elimination round:

10.1 Platform requirements for elimination round:

Platform requirement for elimination round remains as same as that of qualification round, however the platform is to be improved with hardware and software required for carrying out the tasks in elimination round.

10.2 Arena:

The participating teams in elimination round (qualified teams for elimination round) need to prepare the arena in their college premises. Arena details are given below.

10.2.1 Size of Arena: 30 ft. x 40 ft. (rectangular shape)
Border/boundary of the arena: 1 ft. width yellow colour border along the periphery of the arena. ANAV flight/ movement shall be restricted to be well within this border. Refer figure-1 for arena illustration.

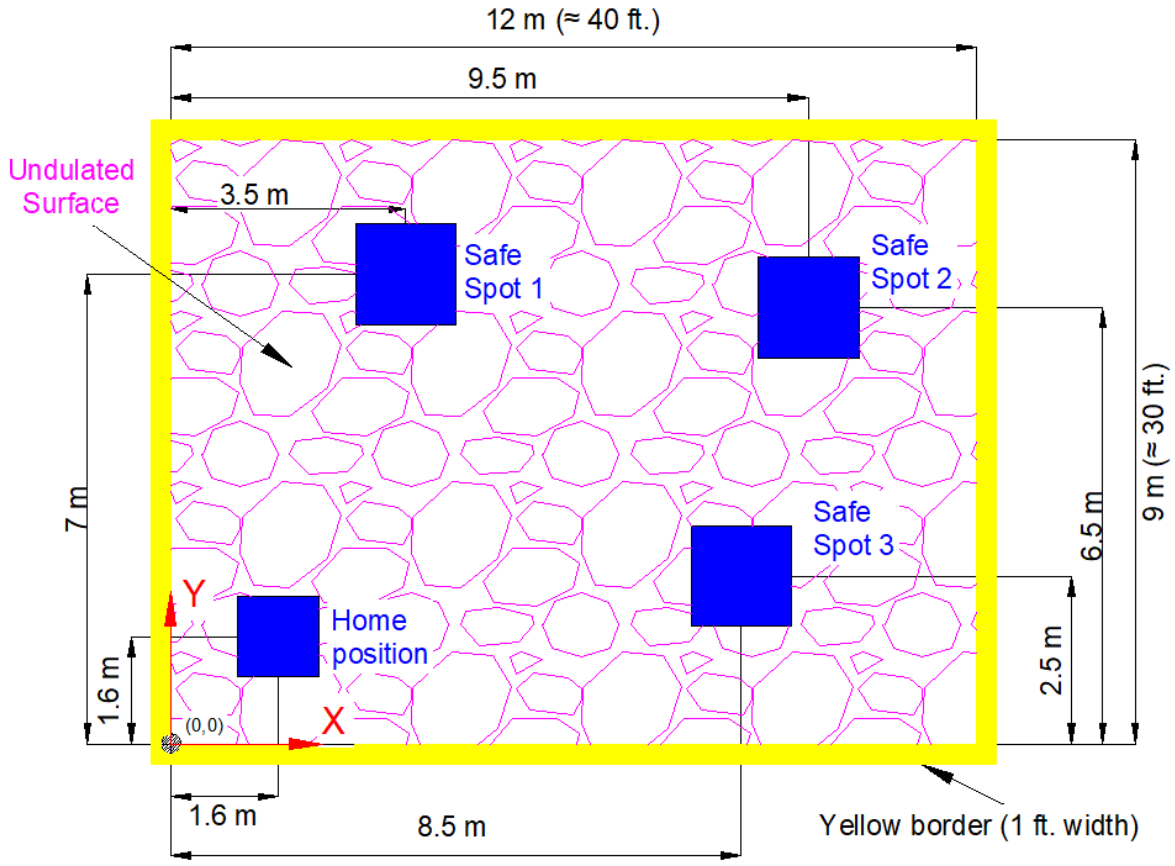

Figure 1: Arena Illustration - IRoC-U 2025

10.2.2 Home position: 4 ft. x 4 ft. square flat surface. Refer the drawing for the coordinates of home position. Boundary of home position shall be marked with thin coloured line for evaluators to identify the home position.
The location of home position is shown in figure-1. However, teams shall need to move the home position location if instructed by evaluators during evaluation of elimination round.

10.2.3 Safe spots: 5 ft. x 5 ft. square flat surface. Refer the drawing for the coordinates of safe spots. Slope of one of the safe spots is to be 15 deg (nearly) with horizontal level. Boundary of Safe spots shall be marked with thin coloured line for evaluators to identify the safe spots.

10.2.4 Colour of the arena: *Home position and safe spots should not be marked or coated with any unique or distinguishing colour.*

10.2.5 Rest of the arena to be filled with suitable material to simulate highly undulated surface. Illustrative examples:

a. Undulated arena can be filled with gravel / boulders / sand dunes or any other materials.
b. Home position (4 ft. x 4 ft.) & Safe spots (5 ft. x 5 ft.) must have a levelled sand/filling material (less than or equal to 15 deg from horizontal level).

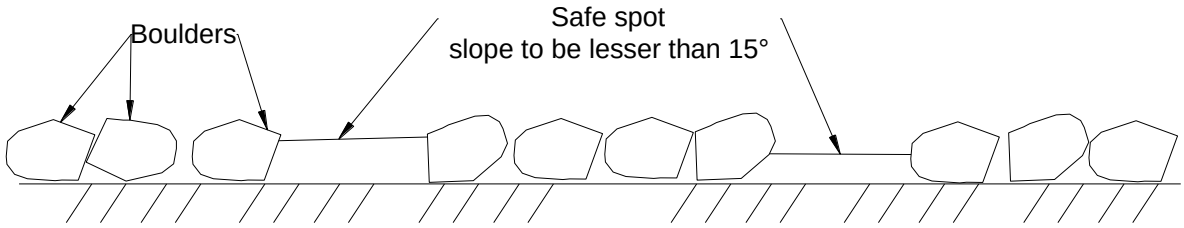

Figure 2: Illustrative example for arena filled with boulders

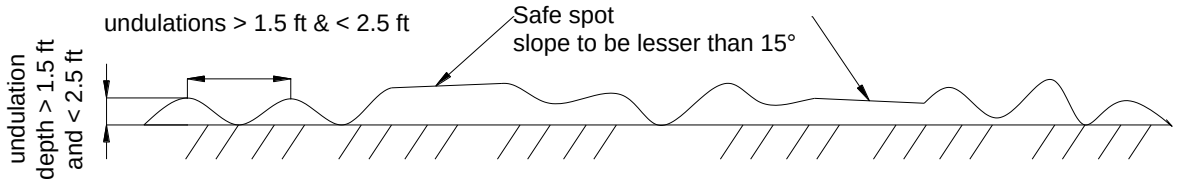

Figure 3: Illustrative example for arena filled with loose material like sand/gravel

Note: The filling material can be mix of different substances and is completely the choice of the teams. **However, surface undulations are must.** Other recommended materials are carton boxes, thermocol pieces, wooden boxes etc.

10.2.6 Net around the arena (optional):

Arena to be surrounded by a net to restrict the flight/movement of the ANAV within the Arena.

10.2.7 Height of the ANAV flight:

minimum height of ANAV Flight : 3 m from ground

maximum height of ANAV Flight : 6 m from ground

Note: *The teams are required to make a note that the maximum height during Field round is also restricted to 6 m.* This constraint is to be considered by all teams.

10.3 Elimination round tasks:

Only one command from base station is allowed to start the tasks. No further intervention of teams is allowed (i.e. ANAV shall not be controlled using joystick or base station once the start command is given).

The tasks are given below.

10.3.1 Stable vertical take-off:

It is similar to that of task defined in the qualification round. However, the hovering or flying height to be restricted to 6 m.

10.3.2 Scanning of the arena:

- ANAV has to limit itself well within the boundary of the arena. The boundary is a continuous yellow border approximately 1 feet width.
- The ANAV has to perform the task of identifying all the safe spots. The identified safe spot location (coordinates) shall be shown on base station screen.

10.3.3 Landing in the safe spot:

- Further as defined in the arena, ANAV has to land properly on the identified safe spots. The sequence of landing on each safe spot is the choice of teams. After successful landing on each safe spot, the ANAV shall perform
  - the vertical take-off as mentioned in 10.3.1
  - scanning of the arena as mentioned in 10.3.2 (if required)
  - landing in the next safe spot as mentioned in 10.3.3 (till ANAV completes landing in all three safe spots).
- Also, teams may demonstrate ANAV's landing capabilities on the safe spots as instructed by the evaluators.

There is no specific colour assigned to the safe spot. Hence ANAV shall be able to identify the safe spot not based on the colour but the topography.

Note on Illumination conditions and wind velocity: ANAV shall be less-sensitive to the illumination conditions. However, the challenge tasks will be conducted at moderate illumination conditions. The arena shall be prepared to have minimal wind disturbance.

In a nutshell,

1. ANAV shall be flying or hovering or both (with minimum height of 3 m from the home position) during scanning of the arena.
2. Scanning of arena shall be in real-time.
3. Once ANAV takes off, it should land only in safe spot.
4. Only one command is allowed to start/initiate the tasks of the autonomous mode.

10.4 The evaluation methodology for elimination round:

1. The teams shall record the video of all tasks performed by ANAV for this round.
2. The camera shall be fixed at one corner of the arena (zero, zero coordinates of the arena, i.e. near to home position) such that the camera shall cover both the base station screen and the movement of ANAV throughout the Arena during task demonstration.
3. The video comprising all tasks performed by ANAV shall be submitted before the deadline (for deadline of the rounds, please visit the IRoC-U 2025 website).
4. Based on the Sl. No. 3, the shortlisted teams will be evaluated in online mode or visit by IRoC-U 2025 evaluation committee at the college premises, for further shortlisting.

10.5 Instructions for uploading video and design report for Elimination round:

1. Video-1 shall comprise all tasks of elimination round performed by ANAV
2. Video-2 shall comprise all the features of arena as detailed in section 10.2
3. Design report (not exceeding 5 pages) that consists of additional configuration changes of ANAV from qualification round.
    a. Changes/Additions in Hardware (mechanical elements, sensors, actuators etc.)
    b. Changes/Additions in Software algorithms.