



APRS Mission Payload Design Competition



Handbook



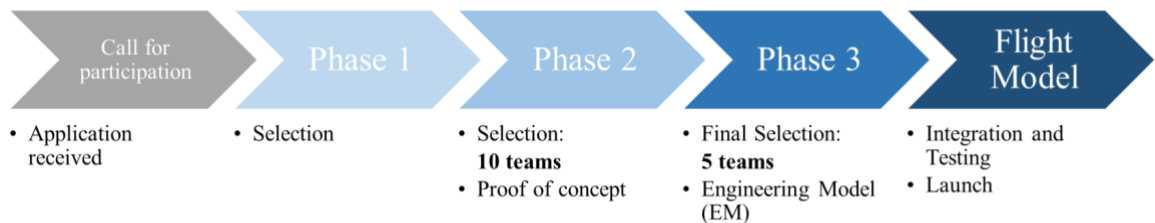
Revision History

Version	Description	Date
v1.0	Initial document creation	29/12/2022
V1.1	Schedule modification	24/08/2023



1. Introduction

BIRDS-X Automatic Packet Reporting System (APRS) Payload Design Competition will provide an opportunity for students, engineers, space enthusiasts and amateur radio operators to launch their designed payload in a 2U CubeSat based on BIRDS Open-Source Bus design (<https://birds-project.com/open-source>). The competition is open to everyone. Five final APRS payloads will be selected through a series of competition phases. The payload designs if selected will be launched to space and will be able to provide services to the amateur radio community through APRS digipeating and Store and Forward (S&F) mission of the satellite.



2. Objectives

Increase the users of amateur radio community by using one APRS payload space of a 2U CubeSat, as well as helping people to get involved in the design, development, testing and on-orbit operation of that payload, resulting in the improvement of technical skills and democratization of space.

3. Revision

The Master Schedule Document will be updated as needed throughout the period leading up to the selection of five payload boards. The up-to-date version will be maintained in the BIRDS-X Project Website. All participants are responsible for working with the correct version by checking the revision date.



4. Documentation

The following documents includes the interface control document, guidelines, application forms for Phase 1 and Phase 2 and the scoring criteria.

Document	File Location
Application form for Phase 1	
Application form for Phase 2	
Guidelines	
Interface Control Document (ICD)	

5. Deliverables and Deadlines

The following table details the schedule on which the teams for *BIRDS-X APRS Payload Design Competition* must submit the required deliverables to be considered for selection.

Date	Action
28 December 2022	Call for Participation
22:00 JST 14 January 2023	Webinar for Q&A regarding the competition
28 February 2023	Application Deadline for Phase 1
10 March 2023	Announcement of selected teams for Phase 1
5 May 2023	Application Deadline for Phase 2
31 May 2023	Announcement of 10 selected teams for Phase 2
7 September 2023	Submission of Phase 3 Application
14 September 2023	Submission of Engineering Model boards
31 October 2023	Announcement of final 5 (6) selected teams
31 st December 2023	Submission of Flight Model Boards



6. Detailed Schedule until Selection of Flight Models

This section will describe the flow of competition of each phase and the scoring criteria for evaluation.

6.1 Phase 1

Phase 1 will determine the motivation, objectives and expected outcomes of all teams for participating in the *BIRDS-X APRS Payload Design Competition*. Selection of teams will be made based on the submitted application form and video explaining the motivation, objective, and concept of operations. The application form is available at blahblah.com.

The deliverables for Phase 1 are:

1. Application form, limit 10 pages (link)
2. Video for extra points (Info, motivation, objective, concept of operation)
3. Consent for open sourcing of all the documents of the participating team

The application form, link to the video and consent form **MUST** be submitted through the BIRDS-X website (link).

The general terms of participation for Phase 1 are:

1. Only ONE entry can be submitted per team/participant (no limit for number of team members)
2. Each team/participant **MUST** have an affiliation(s)
3. The teams that will progress to the next phase will be those with the highest number of points
4. All teams **MUST** mention point of contact in the application form so that the person can be reached immediately through the entire period of competition
5. All teams **MUST** provide the required documents



6. All teams **MUST** consent to Open Sourcing of the payload design if selected after the competition ends.
7. Any violation of the rules may result in disqualification

Scoring will be performed based on the following table:

Extra points for developing country	5 points
Team composition	Max 5 points
All students up to MS	5 points
Mix	3 points
All professionals and PhD students	2 points
Motivation, objectives and expected outcome, Mission definition	30 points
Block diagram for the payload	10 points
Concept of operations	10 points
Preliminary budget plan	10 points
Schedule	10 points
Plan for outreach	10 points
Quality of application and Video Explanation	10 points

Schedule for Phase 1

TASK	2022					2023													
	DEC					JANUARY					FEBRUARY				MARCH				
	4 8	4 9	5 0	5 1	5 2	1	2	3	4	5	6	7	8	9	1 0	1 1	1 2	1 3	
Preliminary announcement																			
1st Phase																			
Call for Participation																			
Application Deadline																			
Evaluation period																			
Announcement of selected teams																			

6.2 Phase 2

The objective of Phase 2 is to determine the commitment and progress of all teams for the development of *BIRDS-X APRS Payload* and select the 10 best teams to proceed to Phase 3. Each



team should have a bread board model developed, *Proof of Concept* of operation verified and have preliminary test results. Selection of teams will be based on the deliverables summarized in the Progress Report form available at blahblah. More detailed interface control document (ICD) and webinars will be provided for any additional information.

The deliverables for Phase 2 are:

1. Progress Report form with all the required information

The general terms of participation for Phase 2 are same as those in Phase 1 and the following additional points:

1. At least one of the team members **MUST** have Amateur Radio license for the Phase 2
2. Each team/participant **MUST** provide a datasheet for every component and materials used in the design

Scoring will be performed based on the following table:

System Block Diagram	20 points
Bill of material (BOM)	5 points
Feasibility study and function test:	
• Power budget	10 points
• Mass & volume for each component and the total mass of the payload	10 points
• Concept of operation	10 points
• Preliminary link budget	10 points
Safety compliance	10 points
• Measures to avoid interference to the other subsystems	
• Measures isolate the payload from the satellite during emergency	
Quality of submission	5 points
Schedule	10 points
Outreach	10 points



Schedule for Phase 2

TASK	2023														
	MARCH				APRIL					MAY					
	10	11	12	13	14	15	16	17	18	19	20	21	22		
2nd Phase															
Development period															
Application deadline															
Evaluation period															
Announcement of selected 10 (11) teams															

6.3 Phase 3

The objective of Phase 3 is to select the final 5(6) payload designs that will be launched in the BIRD-X satellite. Selection of the final teams will be performed based on the technical compatibility of the submitted Engineering Models with the satellite bus. The payloads will be integrated with the satellite bus and series of tests will be performed.

The detailed information regarding the payload design will be provided by the BIRDS-X team for developing the EM board and all teams **MUST** comply with the following requirements:

1. Physical dimensions (mass, position of holes, size, thickness)
2. Software and commands ICD
3. PIN assignment
4. Power consumption and operating voltage
5. Programming platform and communication protocols
6. Antenna connector type
7. Testing and integration procedures
8. Manufacturing numbers

The deliverables for Phase 3 are:

1. Engineering Model complying with:



- Sensitivity (RF output, link budget)
- Size and mass requirements
- Ability to survive in space environment
- Power budget
- Ability to communicate with the satellite
- Safety (not harming the satellite, noise, isolation capability of the payload...)

2. Documents

- Functional test report for the board
- Operation manual
- Link budget
- Test environment report
- Sensitivity (RF output, link budget)

3. Operation software

4. Schematic, PCB design

5. CAD model

The selection for Phase 3 will be performed according to the integration tests and results of the submitted payload with the satellite.

Schedule for Phase 3

TASK	2023																																																			
	JUNE					JULY					AUGUST					SEPTEMBER					OCTOBER					NOVEMBER					DECEMBER																					
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52																					
3rd Phase																																																				
Development period																																																				
Submission of EM Board																																																				
Evaluation period																																																				
Announcement of selected 5 (6) teams																																																				
Flight model development																																																				
Flight model Arrival																																																				



7. Schedule after Competition

The schedule after the selection of the flight model although depends on the launch schedule is detailed below:

Date	Action
31 March 2024	Flight Readiness Review
30 April 2024	Hand over of satellite to JAXA
September 2024	Release of satellite from ISS
October 2024 ~	Operation of the missions