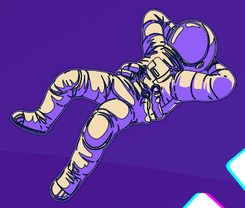
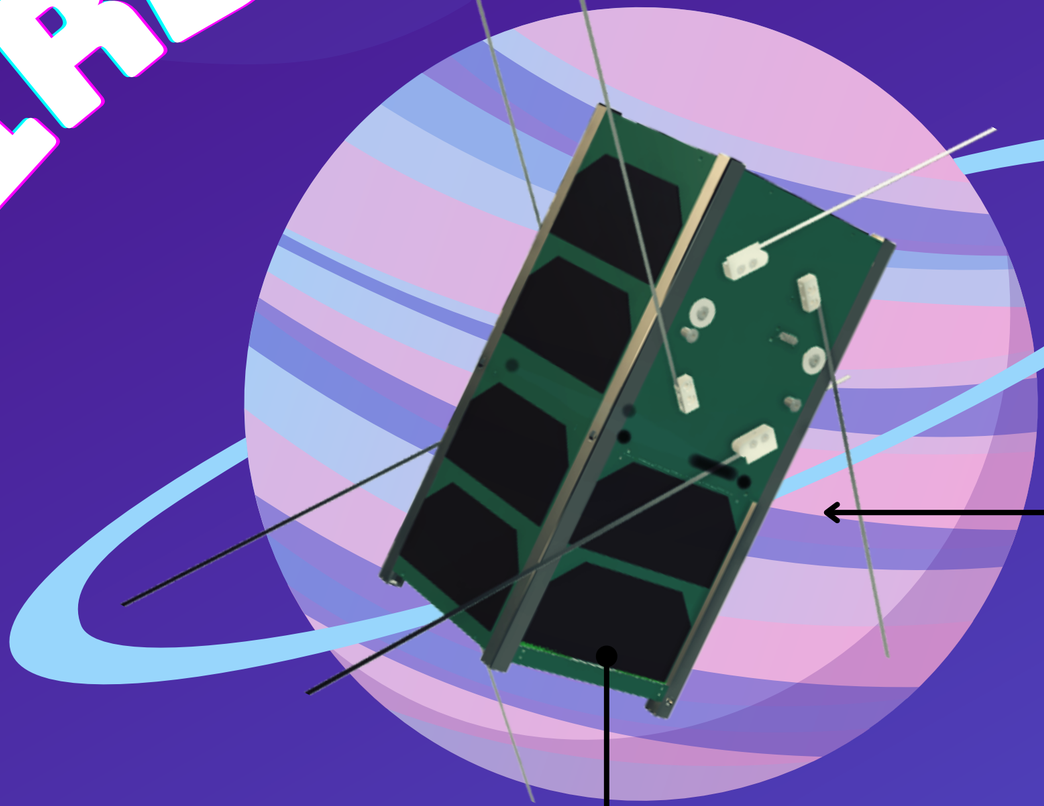
BIRDS-X PROJECT





Dragonfly satellite

APRS Payload

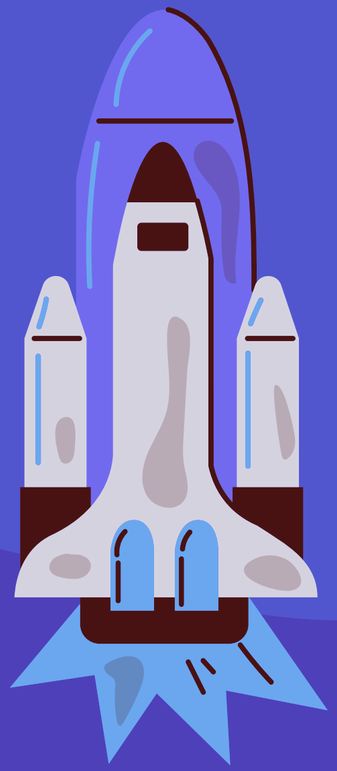
BIRDS-X
九州工業大学 APRS MISSION

La SEINE

CONTENTS

- Application form Explanation
  - System diagram
  - Bill of materials
  - Feasibility study
  - Safety compliance
  - Schedule
  - Outreach effort
- Contact point information
- Question and Answer

PHASE 2 TIMELINE



PERIOD

15 March - 31 May

SUBMISSION DEADLINE

5 May

ANNOUNCEMENT OF 10 TEAMS

31 May

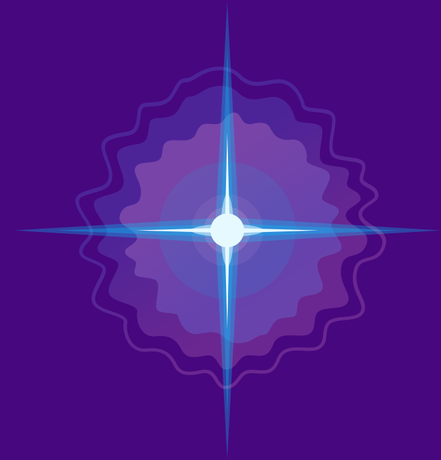
PHASE 2 - POINT ALLOCATION

System Block Diagram	**20 points**
Bill of material (BOM)	**5 points**
Feasibility study and functional test	**40 points**
Safety compliance	**10 points**
Quality of submission	**5 points**
Schedule	**10 points**
Outreach	**10 points**

PHASE 2 APPLICATION

- Deliverables
  - Detailed description of your payload
  - Developed Bread Board Model (BBM)

    Functional test results
  - Outreaching efforts
  - Video presentation



PHASE 2 APPLICATION

SUBMISSION

APPLICATION FORM

PRESENTATION VIDEO

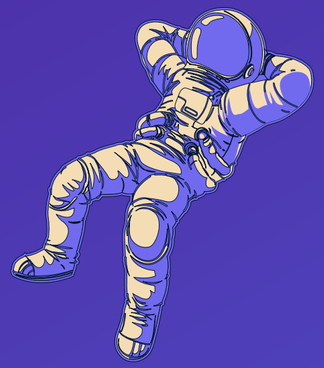
Within 15 slides

Within 10 minutes

Show your team members

NO BBM

APPLICATION FORM



SYSTEM BLOCK DIAGRAM

SYSTEM BLOCK DIAGRAM

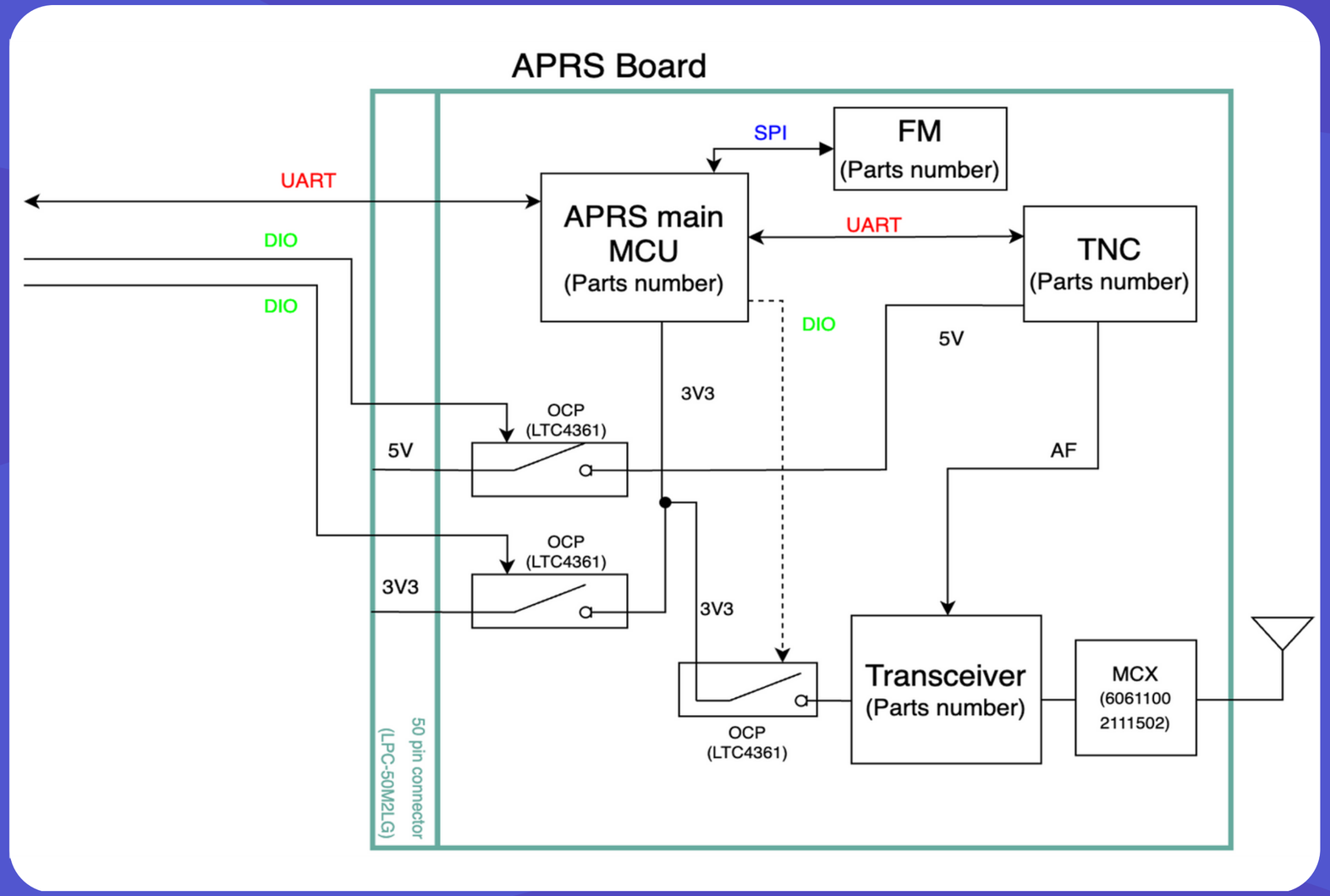
SCHEMATIC

PARAMETERS

Show the parts number, voltage, impedance, communication protocol, power consumption, etc.

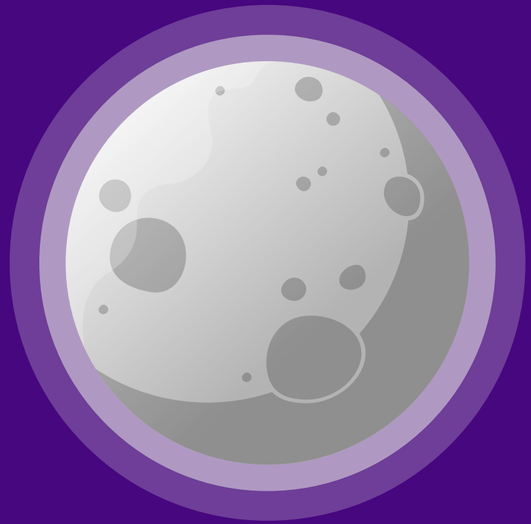
WRITE A DETAILED EXPLANATION

SYSTEM BLOCK DIAGRAM



PIN ASSIGNMENT

- 50 pin assignment table
- Detailed explanation for each pin
- Conciseness



PIN ASSIGNMENT

Signal name	Pin #		Signal name
Programming/debug #2	2	1	Programming/debug #1
	4	3	Programming/debug #3
GND_SYS	14	13	GND_SYS
SUP_5VO	16	15	SUP_5VO
UART (MCU Tx to Mission Boss)	18	17	UART (MCU Rx to Mission Boss)
DI/O_2 (5VO OCP control)	20	19	DI/O_2 (3V3 OCP control)
SUP_UNREG_1	24	23	SUP_UNREG_1
SUP_3V3_2	26	25	SUP_3V3_2
SUP_UNREG_2	36	35	SUP_UNREG_2
SUP_3V3_1	50	49	SUP_3V3_1

Pins No. 1 -3 are used for programming.
Pin No.1 is for Master clear
Pin No.2 is for PGC
Pin No.3 is for PGD

Pin No. 17-18 are used for UART communication between the payload mission control unit (MCU) and the Mission Boss PIC.
Pin No.17 is for Rx
Pin No.18 is for Tx

Pin No. 19-20 are used for DI/O line to control over current protection (OCP) from Mission Boss PIC.
Pin No.19 is for controlling the 3.3V line
Pin No.20 is for controlling the 5V line

BILL OF MATERIALS (BOM)

- Cost in USD (for each component)
- Operating temperature
- Mention inventory

No.	Components	Manufacturer	Model number	Cost (USD)	Operating temperature
1	0.1 uF capacitor	Kemet	C0603C104K3RAC7867	1.06	-55 to 125C°
2	MCU	Microchip	PIC18F67J94-I PT	62.93	-40 to 85C°
3	Flash Memory	Micron	MT25QL01GBBB8ESF0SIT	143.84	-40 to 85C°

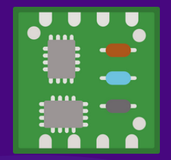
No.1 we can get this component on 20 May 2023

FEASIBILITY STUDY

Power budget

Power budget

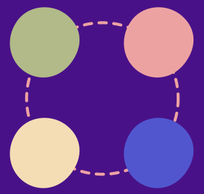
Time of operation



Mass and volume

Mass & dimension

3D model



Concept of operation

Flow process

Task definition

Sequence

Preliminary link budget

Power output

Sensitivity

This part is the **most important** section of this phase

POWER BUDGET

- The power budget requirements
  - Operating current
  - Operating voltage
  - Operating power
- Power consumption for each mode

POWER BUDGET

Example

Mode	Components		Operating current (mA)	Operating Voltage (V)	Operating Power (mW)	Total power consumption of your board
Digipeating	Microcontroller		1.3	5	65	Estimate here your total power consumption according to your design
	OCP		0.1	5	0.5	
	OCP		0.1	5	0.5	
	OCP		0.1	5	0.5	
	Flash memory		16	3.3	52.8	
	Transceiver	Rx	32	5	160	
		Tx	210	5	1050	
	TNC		0.4	5	2	

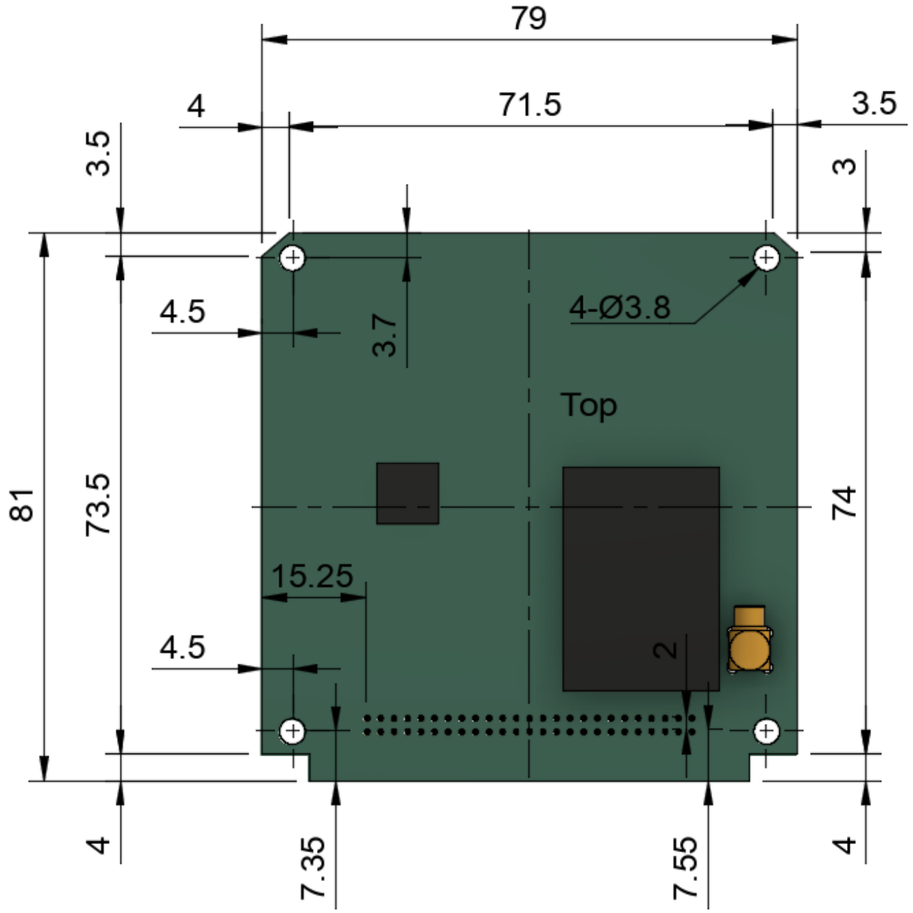
Don't forget to add Store and Forward mode

POWER CONSUMPTION LIMITATION OF THE APRS BOARD

APRS Power Consumption limitation	
Mode	**Max Power (mW)**
Rx	300
Tx	1750

MASS AND VOLUME

- Mass and dimension
- 3D model and/or picture
- Parts distribution
- Detailed explanation



Maximum thickness: 13.6 mm (including PCB)

Maximum mass: 90 g

CONCEPT OF OPERATION

- Flow process of each working mode
- Task definition by component
- Sequence of the process

EXAMPLE

Digipeater mode

Note

The switch for the transceiver is usually turned on, and if the MCU receives a specific command from the Mission Boss, it will be turned off

Activation

- At first, the MCU of APRS and TNC will be turned on by Mission Boss.
- At the same time, the antenna will be connected to this board. (Mission Boss will switch the 6way RF switch)
- TNC will work for digipeating

Shut down

Mission Boss will turn off both OCP connected to power lines

PRELIMINARY LINK BUDGET

Test

- Power output
- Sensitivity

LINK BUDGET (UPLINK)

PARAMETERS		
Objective		APRS-Digipeater and Store and Forward Mission
Frequency	[MHz]	145.825
Emission Type		15K0F2D
Modulation		AFSK
Data Rate	[bps]	1200
Protocol		AX.25
GROUND STATION		
Ground Station Transmitter Power Output	[W]	50.0
	[dBw]	17.0
Ground Station Total Transmission Line Losses	[dB]	1.5
Antenna Gain	[dBi]	16.0
Ground Station EIRP	[dBw]	31.5

UPLINK PATH		
Orbit Altitude	[km]	400
Elevation Angle	[degree]	10.0
Slant Range	[km]	1439.8
Ground Station Antenna Pointing Loss	[dB]	1.0
Ground Station to Spacecraft Antenna Polarization Loss	[dB]	3.0
Path Loss	[dB]	138.9
Atmospheric Losses	[dB]	1.1
Ionospheric Losses	[dB]	0.7
Rain Losses	[dB]	0.0
Isotropic Signal Level at Spacecraft	[dBw]	-113.2
SPACECRAFT (RX Power Sensitivity Method)		
Spacecraft Antenna Pointing Loss	[dB]	5.0
Spacecraft Antenna Gain	[dBi]	2.2
Spacecraft Total Transmission Line Losses	[dB]	2.3
Signal Power at Spacecraft LNA Input	[dBw]	-118.4
	[dBmW]	-88.4
Required Signal Power at Spacecraft LNA Input	[dBmW]	-105.0
System Link Margin	[dB]	16.6

EXAMPLE

LINK BUDGET (DOWNLINK)

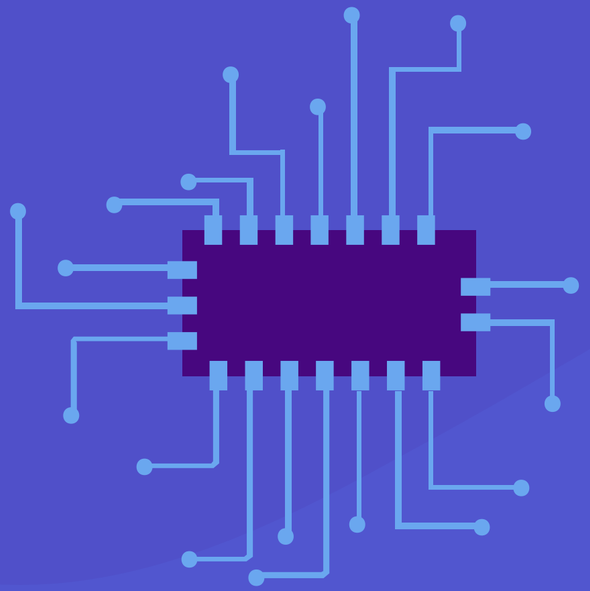
PARAMETERS		
Objective		APRS-Digipeater and Store and Forward Mission
Frequency	[MHz}	145.825
Emission Type		15K0F2D
Modulation		AFSK
Data Rate	[bps]	1200
Protocol		AX.25
SPACECRAFT		
Spacecraft Transmitter Power Output	[W]	2.0
	[dBw]	3.0
Spacecraft Total Transmission Line Losses	[dB]	2.3
Spacecraft Antenna Gain	[dBi]	2.2
Spacecraft EIRP	[dBw]	2.8

EXAMPLE

DOWNLINK PATH		
Orbit Altitude	[km]	400
Elevation Angle	[degree]	10.0
Slant Range	[km]	1439.8
Spacecraft Antenna Pointing Loss	[dB]	5.0
Spacecraft-to-Ground Antenna Polarization Loss	[dB]	3.0
Path Loss	[dB]	138.9
Atmospheric Losses	[dB]	1.1
Ionospheric Losses	[dB]	0.7
Rain Losses	[dB]	0.0
Isotropic Signal Level at Ground Station	[dBw]	-145.9
GROUND STATION (SNR Method)		
Ground Station Antenna Pointing Loss	[dB]	1.0
Ground Station Antenna Gain	[dBi]	16.0
Ground Station Total Transmission Line Losses	[dB]	1.5
Ground Station Effective Noise Temperature	[K]	1000.0
Signal Power at Ground Station LNA Input	[dBw]	-132.4
Ground Station Receiver Bandwidth	[Hz]	15000.0
Ground Station Receiver Noise Power	[dBw]	-156.8
Signal-to-Noise Power Ratio (SNR) at Ground Station Receiver	[dB]	24.5
Required SNR for Ground Station receiver	[dB]	11.5
System Link Margin	[dB]	13.0

SAFETY COMPLIANCE

- Avoid interference (mechanical and electrical)



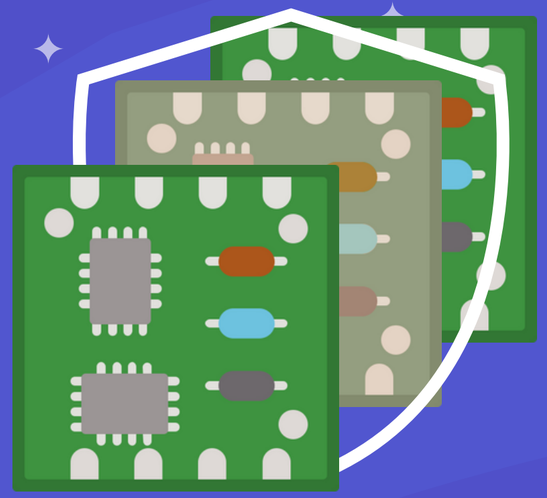
ICD

Check the ICD

https://eprpartner.com/wp-content/uploads/2018/11/Blog-Marcel-S_example-of-RF-shielding-1.png

ISOLATION SYSTEM

- Describe the way to isolate your payload
- Mention situations when the isolation system could work



SCHEDULE

- Make schedule until the end of the competition
- Detailed schedule
- Mark finished, ongoing, and delayed tasks

SCHEDULE

TASKS

Task1 : completed

Task2 : completed

Task3 : delayed

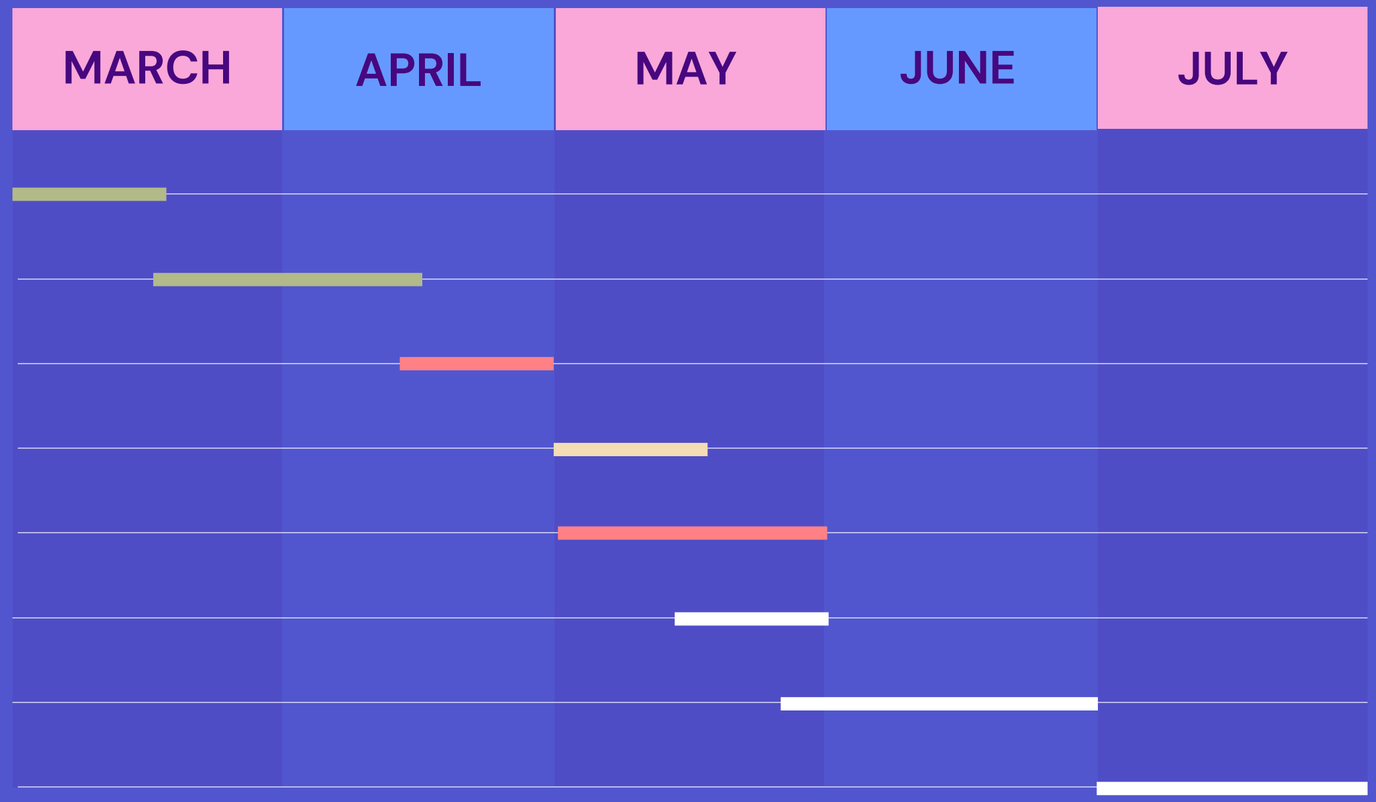
Task4 : on going

Task5 : delayed

Task6

Task7

Task8



OUTREACH EFFORT

Show completed tasks and elaborate future plans

SOCIAL MEDIA

Instagram
LinkedIn
Facebook
YouTube
Twitter

ATTEND CONFERENCES

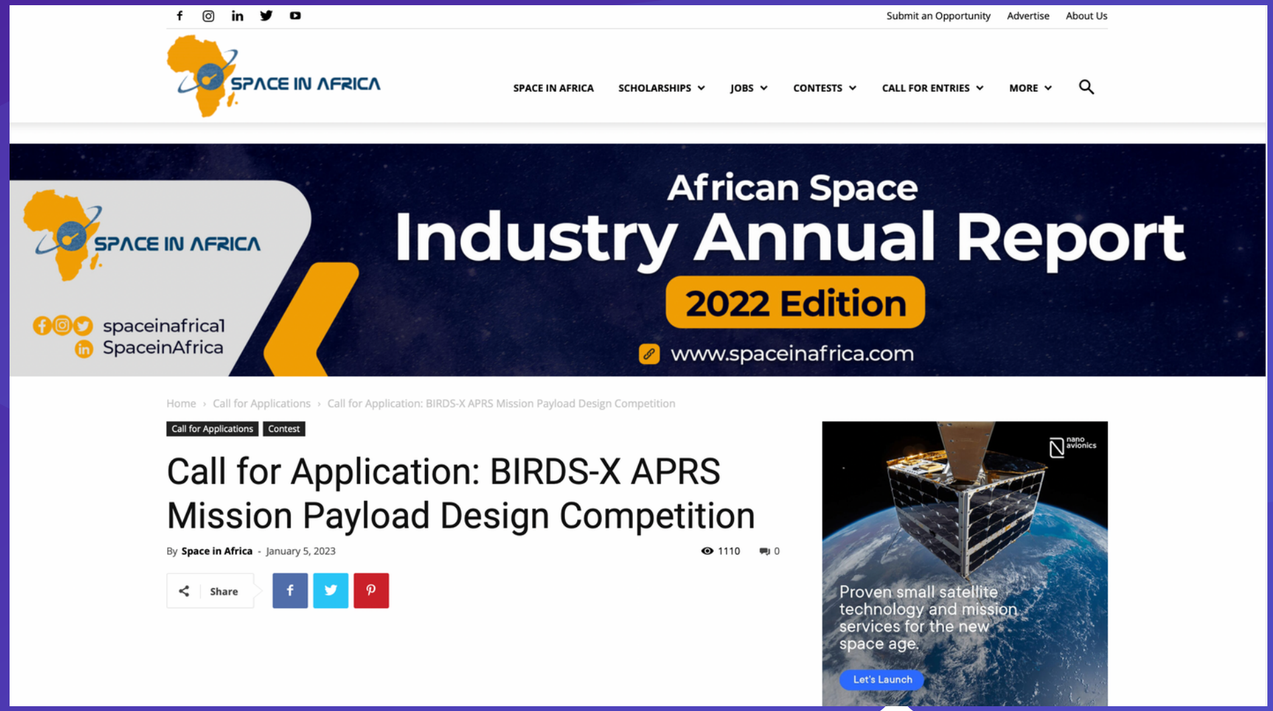
Amateur radio

HOLD THE WORKSHOP

Invite high school students

FUTURE PLAN

OUTREACH EFFORT

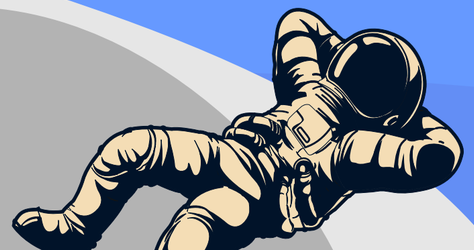


SOCIAL MEDIA

@BIRDSXKYUTECH

BIRDS-X SATELLITE PROJECT

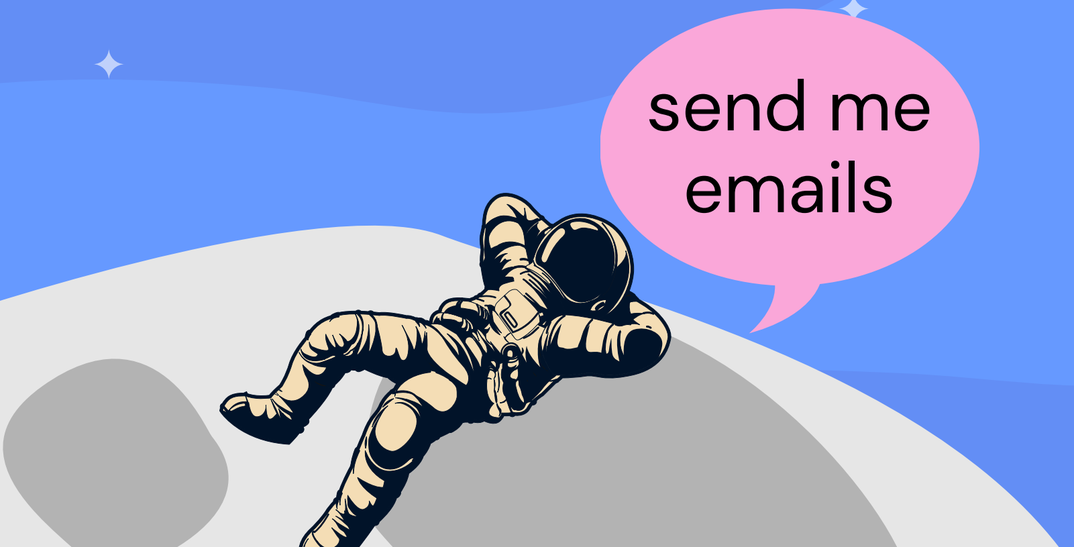
BIRDSX_SATELLITE_PROJECT



CONTACT US

BIRDS-X.BIRDS-PROJECT.COM

BIRDS-X-PROJECT@KYUTECH-LASEINE.NET



QUESTION & ANSWER