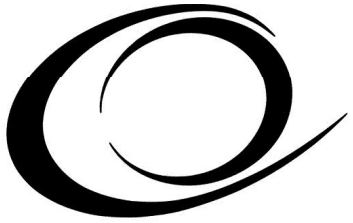


Aerospace Research Institute

ARI CANSAT TEAM

ARIC-1 Preliminary Design Review

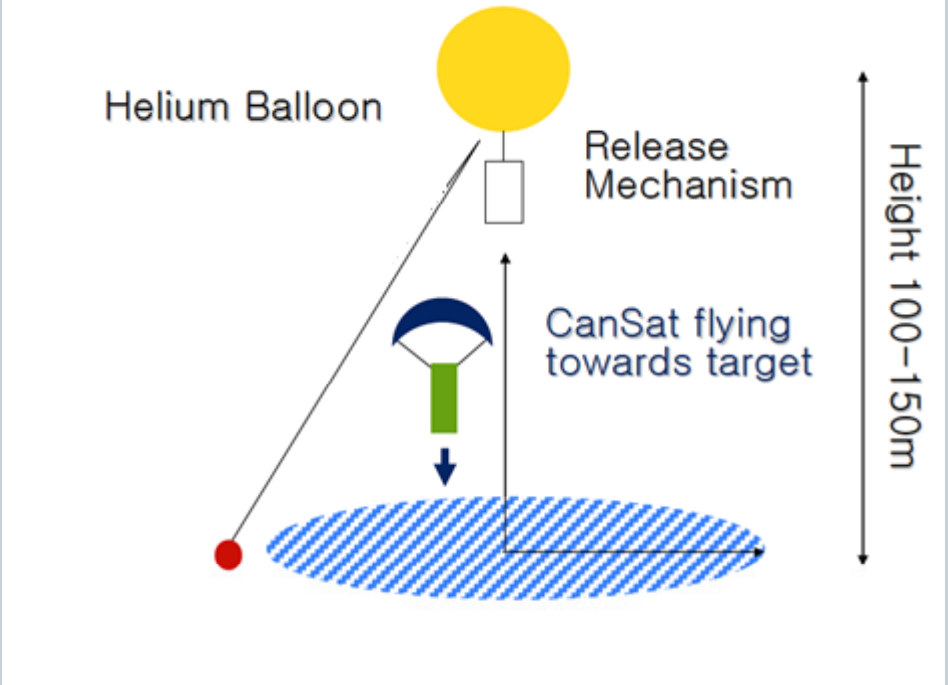
France Cansat Competition
February 2011

Team Organization

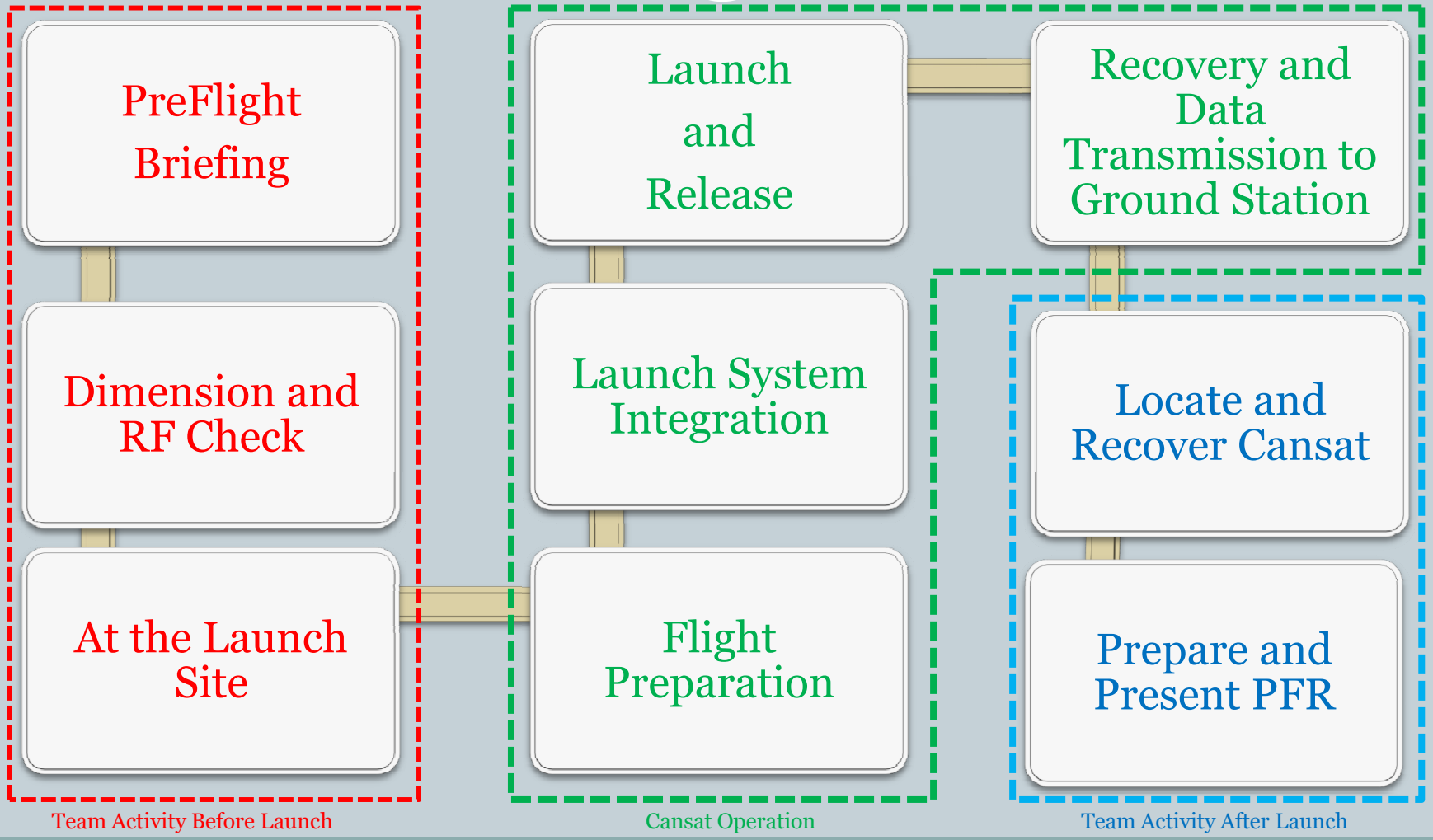
- Sajjad Ghazanfarinia, System Design, Team Leader
- Hooman Jazebizadeh, System Design
- Sahar Bakhtiari, Aerospace Engineering
- Mohammadreza Simard, Electrical Engineering
- Ghazale Ahmadi, Recovery
- Samane Tadayyon, Recovery

Mission Objectives

- Atmospheric Data Collection During Flight
- Deployment of Antenna at Ground Touch
- Real-Time Data Transmission



Concept of Operations



System Functional Requirements & Physical Allocations

ID	Requirement	Source	Physical Allocation	Priority	VM
SYS-01	Cansat Mass Shall be Under 350gr.	Competition	Structure	High	I
SYS-02	Cansat Dimensions Shall Fit Standard Soda Can. (r66,h115)	Competition	Structure	High	I
SYS-03	Cansat Shall be Compatible with Launch System.	Competition	Structure,Recovry	High	I
SYS-04	Cansat Shall Land on Ground Safely.	Mission	Recovery	Medium	T
SYS-05	Cansat Materials Shall be Unharmful.	Competition	Structure	Medium	I
SYS-06	Cansat Shall Obey Telecommunication Regulations.	Competition	Communication	High	A,D
SYS-07	Cansat Shall Sound Atmospheric Parameters.	Mission	Payload	High	T
SYS-08	Cansat Shall Collect Data Related to Sounding Sensors.	Mission	OBDH	High	D
SYS-09	Cansat Shall Transmit GPS, Sensors and HK data.	Mission	Communication	Medium	D,T
SYS-10	Cansat Cost Shall be Under 500 €.	Funding	-	Low	I,A
SYS-11	Cansat Shall Remain Operational for 90 (TBC) Minutes.	CONOPS	Power	Low	A,T
SYS-12	Cansat Shall Resist Operation Loads.	CONOPS	Structure	Medium	A,T
SYS-13	Cansat Shall Deploy an Antenna at Landing.	Mission	Payload	High	T

Subsystems

- Payloads
- Onboard Computer
- Communication
- Power
- Recovery
- Structure

Payload-1

- Function: Atmospheric Sounding
- Requirements

ID	Requirement	Source	Physical Allocation	Priority	VM
PAY-01	Payload-1 Shall Sound Air Temperature, Pressure and Humidity.	SYS-07	Sensors	High	D,T
PAY-02	Payload-1 Shall Provide GPS Location.	SYS-07	GPS Receiver	High	D,T
PAY-03	Payload-1 Shall Acceleration Profile during Operation.	SYS-07	Accelerometer	Medium	D,T
PAY-04	Payload-1 Shall Support Sensors for Electronic Connections.	SYS-07	Electronic Boards	High	T
PAY-05	Payload-1 Mass Shall be Under 60 grams.	SYS-01	Payload-1	High	I
PAY-06	Payload-1 Power Consumption Shall be Under 150mW.	SYS-11	Payload-1	Medium	T

- Elements:

  Sensors for Temperature and Humidity (SHT10), Pressure (MPX6300) and Acceleration (ADXL303), and GPS (GT723).

Payload-2

- Function: Antenna Deployment
- Requirements

ID	Requirement	Source	Physical Allocation	Priority	VM
PAY-07	Payload-2 Shall Sense Landing Instance.	SYS-12	GPS Receiver	High	D,T
PAY-08	Payload-2 Shall Deploy an Antenna at Landing.	SYS-12	Deployment Mechanism	High	D,T
PAY-09	Payload-2 Shall Deploy Antenna with OBC Command.	SYS-12	Deployment Mechanism	Medium	D,T
PAY-11	Payload-2 Mass Shall be Under 55 grams.	SYS-01	Payload-2	High	I
PAY-12	Payload-2 Power Consumption Shall be Under 150mW.	SYS-11	Payload-2	Medium	T

- Elements

Accelerometer (ADXL303), Spring Antenna, Deployment Mechanism

Onboard Computer

- Function: Data and Command Handling
- Requirements

ID	Requirement	Source	Physical Allocation	Priority	VM
OBC-01	OBC Shall Collect Data from Sensors and GPS.	SYS-08	Electrical Boards	High	T
OBC-02	OBC Shall Save Data in Packages on a Memory during Mission.	Mission	Memory	Medium	T
OBC-03	OBC Shall Make Data Packages Ready for Transmitting.	SYS-09	Microprocessor	High	T
OBC-04	OBC Shall Send Data Package to COM.	SYS-09	Microprocessor	High	T
OBC-05	OBC Shall Command Antenna Deployment.	SYS-12	Microprocessor	High	T
OBC-06	OBC Mass Shall be Under 30 grams.	SYS-01	OBC	High	I
OBC-07	OBC Power Consumption Shall be Under 50mW.	SYS-11	OBC	Medium	T

- Elements

  Microprocessor (ATMega8) and Connectors

Communication

- Function: Data Transmission
- Requirements

ID	Requirement	Source	Physical Allocation	Priority	VM
COM-01	COM Shall Transmit Data Packages to Ground Station.	SYS-09	Transmitter	High	T
COM-02	COM Shall Obey Competition Regulation for Transmit Frequency.	SYS-06	Transmitter, Antenna	High	A,T
COM-03	COM Shall Obey Competition Regulations for Transmit Power.	SYS-06	Transmitter	High	A,T
COM-04	Antenna Shall Fit in Cansat Size During Launch Phase.	SYS-02	Antenna	High	A,T
COM-05	Transmitter Shall Support 150 meters of Range.	Competition	Transmitter	High	A,T
COM-06	COM Mass Shall be Under 40 grams.	SYS-01	COM	High	I
COM-07	COM Power Consumption Shall be Under 100mW.	SYS-11	COM	Medium	T

- Elements

  Transceiver (RXQ2), Antenna

Power

- Function: Electrical Energy Supply
- Requirements:

ID	Requirement	Source	Physical Allocation	Priority	VM
EPS-01	EPS Shall Support Voltage of all Parts.	Mission	Regulators, Battery	High	T
EPS-02	EPS Shall Support Needed Current of all Parts.	Mission	Regulators, Battery	High	T
EPS-03	EPS Shall Support System with Power for 90 (TBC) Minutes.	SYS-11	Battery	Medium	T
EPS-04	EPS Shall Provide On/Off Mode for System.	Competition	Switch	High	D
EPS-05	Battery Shall be Replaceable.	-	Connectors	Medium	D
EPS-06	EPS Mass Shall be Under 50 grams.	SYS-01	EPS	High	I
EPS-07	EPS Power Consumption Shall be Under 30mW.	SYS-11	EPS	Medium	T

- Elements:

  Battery, Regulators, Switch and Connectors

Recovery

- Function: Returning in a Safe Flight
- Requirements:

ID	Requirement	Source	Physical Allocation	Priority	VM
RCV-01	RCV Shall Operate Automatically and Passive.	Mission	Packing	High	T
RCV-02	RCV Shall Make System to Descend Lower than 5mps.	SYS-04	Parachute	High	A,T
RCV-03	RCV Shall Fit Soda Can Size other than Cansat During Launch.	SYS-02	RCV	High	I
RCV-04	RCV Shall Resist Deployment Loads.	SYS-12	Parachute and Fixture	High	T
RCV-05	RCV Material Shall be Unharmful.	SYS-05	Parachute Fabric	Medium	I
RCV-06	RCV Mass Shall be Under 55 grams.	SYS-01	RCV	High	I

- Elements:

  Parachute, Fixture

Structure

- Function: Providing Fixture and Shape of Parts
- Requirements:

ID	Requirement	Source	Physical Allocation	Priority	VM
STR-01	STR Shall Fit Soda Can Size.	SYS-02	STR	High	I
STR-02	STR Shall be Compatible with Launch System.	SYS-03	STR	High	I,T
STR-03	STR Shall Resist all Operational Loads.	SYS-12	Material	High	T
STR-04	STR Shall Resist Crash Loads in case of RCV Failure.	Mission	STR	Medium	T
STR-05	STR Material Shall be Unharmful.	SYS-05	Material	Medium	I
STR-06	STR Mass Shall be Under 60 grams.	SYS-01	STR	High	I

- Elements:

  Frame Rods, Casing

Ground Station

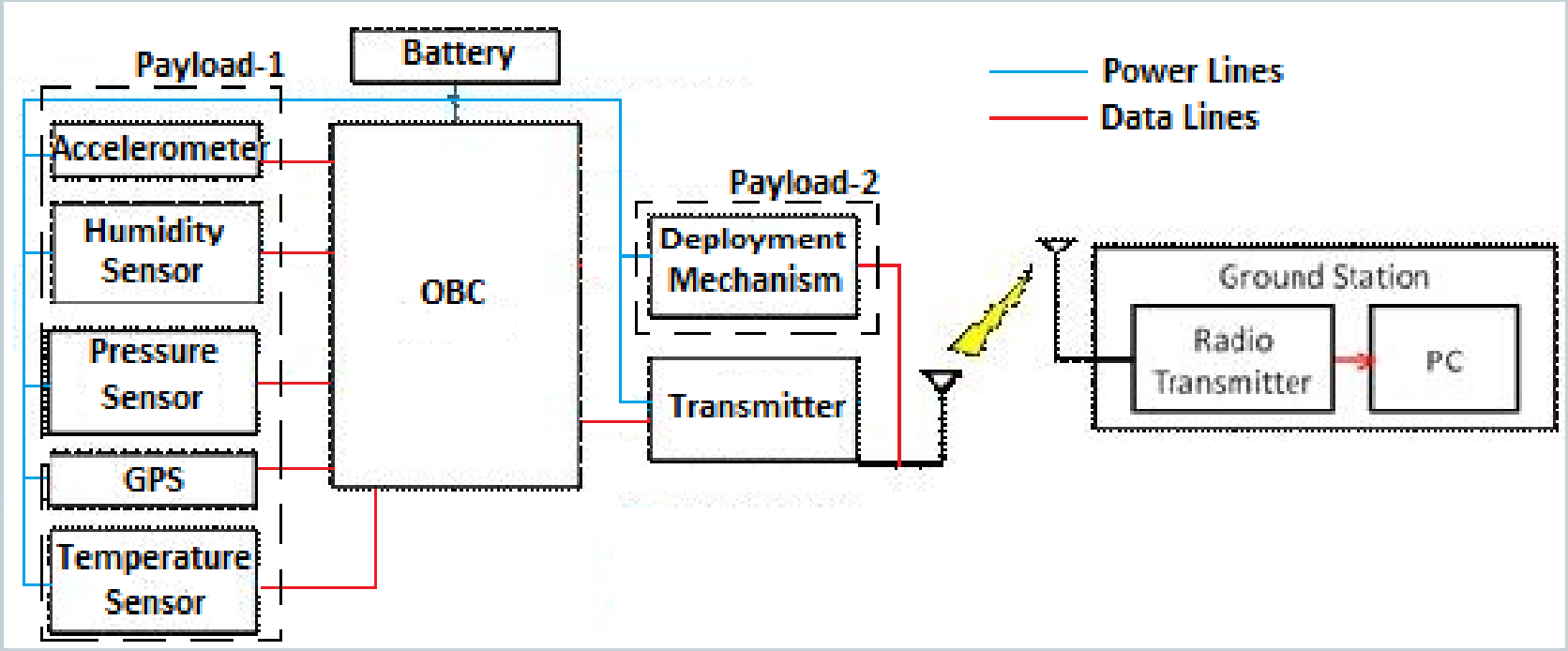
- Function: Display of Cansat Results
- Requirements:

ID	Requirement	Source	Physical Allocation	Priority	VM
GSE-01	GS Shall Provide a HW Compatible with Cansat.	Mission	GS HW	Medium	T
GSE-02	GS Shall Provide an Interface with Computer.	Mission	GS HW	Medium	T
GSE-03	GS Shall be able to Show Cansat Data on Computer Screen.	Mission	GS SW	Low	D,T
GSE-04	GS SW Shall Provide Related Graphs on Computer Screen.	Mission	GS SW	Low	D
GSE-05	GS Power Shall be Supported by Computer Connection.	-	GS HW	Medium	T
GSE-06	GS Has NO Constraint on Mass or Power Budgets.	-	GS	-	-

- Elements:

  Antenna, Transceiver, Computer Interface, Software

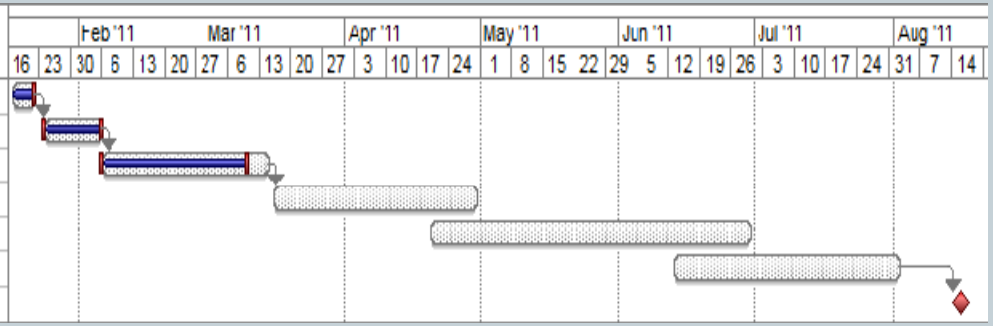
System Architecture



Budgets and Schedule

	Payload-1	Payload-2	OBC	COM	EPS	RCV	STR	Total	GSE
Mass (gr)	60	55	30	40	50	55	60	350	150
Power (mW)	150	150	50	100	50	0	0	500	150
Cost (€)	100	20	30	50	70	40	90	400	100

ID	Task Name	Duration	Start	Finish	Predecessors
1	Mission Definition	5 days?	Mon 1/17/11	Fri 1/21/11	
2	System Concept	11 days?	Mon 1/24/11	Sat 2/5/11	1
3	Preliminary Design	27 days?	Sun 2/6/11	Mon 3/14/11	2
4	Detailed Design	33 days?	Wed 3/16/11	Fri 4/29/11	3
5	Development and Manufacturing	52 days?	Wed 4/20/11	Wed 6/29/11	
6	Tests	36 days?	Mon 6/13/11	Mon 8/1/11	
7	Operation and Documentation	10 days	Tue 8/2/11	Mon 8/15/11	6



Thanks

Questions?