PARM
Subsystem Testing Review

Tohoku U. / U. Tokyo / Nagoya U. / U. Electro-Communications / JAXA

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Feb 26, 2018  Ver 1
1.0 Mission Overview

Keisuke Hosokawa + Yoshi Miyoshi
The PARM mission will transit a region of Pulsating Aurora (PsA) with instruments that can provide high-time resolution observations:

To understand:
the loss of the Earth’s radiation belts
due to precipitation of high-energy magnetospheric electrons during PsA

To imply:
the impact of high-energy electrons
on the Earth’s atmosphere, for example,
the possible loss of ozone (O₃)
Mission Overview: Mission Objectives

Planned instruments:

1. Two electron detectors (HEP and MED) which seamlessly cover the high-energy part of PsA electrons from 20 keV to 2 MeV

Miyoshi et al. [2015]
Mission Overview: Mission Objectives

Planned instruments:

2. An auroral camera (wide-FOV camera: AIC) and magnetometer (AFG), which can identify the spatial distribution of PsA and associated electric current from space. AIC can observe not only the vertical thickness of the PsA but also the horizontal 2D structure of PsA, which can be compared with the particle observations.
Mission Overview: Concept of Operations

The Arase satellite measures magnetosphere

Precipitating electrons
Along the magnetic field-line

Emission layer of PsA
(ranges from 95 to 105 km)

Electric current caused by PsA observed by the AFG

Field-of-view of AIC

Magnetic field lines

Start of HEP / MED
Right after the open of nose cone at ~70 km alt.

Ground-based supporting all-sky aurora camera
What are the minimum and comprehensive success criteria?

Minimum Success:

• Identification of temporal variations of precipitating electrons, optical emissions and electric current during PsA (Note that good weather condition at Andøya is not always necessary).

Nominal Success:

• Identification of temporal modulations of precipitating electrons in a wide energy range from tens keV to MeV energy during PsA

Extra Success:

• Identification of inverse energy dispersion that is a definitive evidence for the electron precipitation in the wide energy range

• Identification of the minimum altitude of PsA
Launch Conditions: Requirement from Science

It would be better to identify PsA clearly from the ground by using all-sky camera at Andøya at the time of launch:

To meet this launch criteria, we expect the following possible launch conditions which will be discussed with the project manager:

1. **New moon periods** to prevent contamination from moonlight (New moon in Jan 2019 is “Jan 4 – Jan 11”)
2. **Active geomagnetic condition** (just after aurora substorm)
3. **Morning side**, which is a hotspot of PsA
4. **Good weather conditions**, i.e., clear sky, to observe PsA optically at one of our ground-based optical observation sites (clear sky is not always necessary at Andøya)
Some additional notes on launch condition

PsA

PMWE
Occurrence Distribution of PsA

2-years of optical observations in Tromsø, Norway

- **PsAs are morning side phenomena**: they appear mostly during 00-06 LT during periods of high-energy particle precipitation
- Occurrence is higher during active geomagnetic conditions

PsA

![Graph showing PsA occurrence distribution with local times and seasonal variations](image-url)
Occurrence Distribution of PMWE

2-years of radar observations in Andøya, Norway

- PMWEs are daytime phenomena, but they are sometimes seen before sunrise during periods of high-energy particle precipitation
- Occurrence is higher during active geomagnetic conditions

Latteck and Strelnikova [JGR, 2015]
Occurrence Distribution of PMWE

2-years of radar observations in Andøya, Norway

- PMWEs are daytime phenomena, but they are sometimes seen before sunrise during periods of high-energy particle precipitation
- Occurrence is higher during active geomagnetic conditions

Latteck and Strelnikova [JGR, 2015]
PsA and PMWE may appear at the same time?

Latteck and Strelnikova, JGR, 2015
Key is high-time particle precipitation

- High energy particle precipitation often takes place during PsA, which should contribute to create PMWE in darkness
- Simultaneous observations of PsA and PMWE might be possible in the morning side during high-energy particle precipitation
Payload Location

- Please confirm your mounting location
## Concept of Operations (Timer event)

<table>
<thead>
<tr>
<th>Event</th>
<th>Time On</th>
<th>Dwell</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSE 1</td>
<td>T-600 sec</td>
<td>1200sec</td>
<td>Start on the instruments.</td>
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<td>GSE 2</td>
<td>T-570 sec</td>
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<td>TE-1</td>
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<td>PARM sequence timer start</td>
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<tr>
<td>TE-2</td>
<td>T+55 sec</td>
<td>10 sec</td>
<td>MED HVPS ramp up</td>
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<tr>
<td>TE-3</td>
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<td></td>
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<tr>
<td>TE-R</td>
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### RS-XN 2019 Mission Timeline (1st Draft)

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<th>Event</th>
<th>Time (sec)</th>
<th>2 sigma Low Altitude (km)</th>
<th>Nominal Altitude (km)</th>
<th>2 sigma High Altitude (km)</th>
<th>Nominal Range (km)</th>
<th>Velocity (m/s)</th>
<th>Nominal Q (psf)</th>
<th>Mach NO.</th>
<th>Flight Elevation (deg)</th>
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2.0 Final Design Description

Name of Presenter
Status of PDR Questions (1/2):

1. PARM has checkout connectors on the instruments. Are these checkout connectors accessible from outside when PARM is assembled in the rocket (in case of the nose cone open)?
   -> Closed. Yes

2. Should we consider the instantaneous power cut? If so, how long?
   -> Closed. It is not necessary.

3. If we make unit-level vibration testing, what level should we take? The level shown in Appendix B of RockSat users manual is that for assembled rocket (payload).
   -> Closed. We have received the example level.

4. Temperature testing: Could you tell us possible temperature range the RockSat payload will experience?
   -> Not available.

5. We need a GSE which can act as Rocket (Wallops) system for testing COMMON-E. Can we borrow it from the Rocket. If so, when? How?
   -> It seems to be difficult.
Status of PDR Questions (2/2):

6. GSE (QL hardware and software) is necessary when PARM is installed on the Rocket. Currently, TLM distribution interface is unclear. What/How/When do we prepare? Could you send us interface docs and information about available hardware for us?
   -> Closed. It will be ‘delayed look’, which means, TLM data stream is in somehow sent from the Wallops server to the PARM’s local computer and instrument behavior is checked with the copied data.

6. Timing of nose cone jettison. When is it occur during flight? Can it be jettisoned below 70km altitude at upleg?
   -> Closed. It will be ok. There is another team which wants to open the nose cone in even lower altitude. We have to continue requesting.

8. Length of harnesses. How can we estimate the length between COMMON-E and HEP? They will be mounted on different decks.
   -> Closed. Wallop will provide the PARM harness between the PARM aft. deck and the top deck. The connector of PARM side will be fixed to the deck by the dedicated brackets before installation of the decks into the rocket.

9. Can we use a gluing agent to fix the harnesses on the deck by ourselves? We prefer to glue a mounting base onto the deck, and tie the harnesses to it.
   -> Closed. Gluing is ok to use.
Status of CDR questions (1/2)

1. We expect that delivery of PARM to RockSat-XN (Wallops) is end of May, 2018. Is this ok?
Closed. OK. PARM delivery to the Wallops will be August, 2018.

1. Please tell us status of HEP/AFG accommodation issue and how we should proceed.
Closed. We shall keep the configuration which was sent from PARM to Chris at Nov 4, 2017.

1. In order to start manufacturing, accommodation issues of HEP, AFG, MED, and AIC shall be solved (mainly related to FOV interference issues). How should we proceed? We think discussion with other teams may be necessary.
Open. We would like to know optical characteristics of VT's extension materials (tapes and balls)... ex. reflectivity in visible wavelength range, materials, and surface treatment, etc.

1. Who is responsible for preparing harnesses between the PARM lower deck and the top deck where HEP and AFG is installed? If it is PARM side, we need length information.
Closed. Wallops will prepare.

1. Could you show us specification etc. of the Wallops data distribution and display system, we may consider about our own data display system to be connected to the Wallops system.
Closed. It is not easy to connect PARM own system to the Wallops system.

1. Is it possible for the tip of AIC (lens hood) to go beyond the stay out zone for 10 mm?
Closed. Yes. It is ok if the tip of AIC does not go beyond the edge of the deck (not stay-out zone).
Status of CDR questions (2/2)

1. Could you show us location of decks next to the PARM lower deck?
   Open. VT’s deck location can be expected. But we do not know the shape of hardware located at the opposite side of the VT’s deck.

1. What is the latest timing of payload access by PARM team (for removal of non-flight items) before launch?
   Open.

1. We need to establish a contract between JAXA and RockSat-XN (University of Colorado?) in order to proceed the payment. It may take rather long time (a few months, according to JAXA administration office). Please tell us the point of contact at RockSat-SN side for this issue.
   Closed. We will go for the non-contract solution.
Status of CDR action items

1. PARM shall send the PARM dedicated testing procedure at Wallops and the launch site. Sent to Chris at Feb 5, 2018.
Status of questions at Jan 10, 2018 meeting

1. It will be necessary to make the additional machining to the PARM aft. deck and the top deck. Who shall machine them, PARM or Wallops? If PARM, when will the flight deck come to Japan? If Wallops, what is the due date of sending the drawing to the Wallops (Chris)?

Open.
System Changes Since CDR

• No major changes.
Instruments

• PARM consists of four instruments: HEP, AIC, MED, and AFG
• They are controlled by COMMON electronics unit which has electrical interfaces to the Wallops system
Design Overview: Functional Block Diagram

Inter-instrument interface:
Communication: LVDS
Power: bus
System Overview: Electrical Design: Common_E

“Common_E” Block Diagram

- Timing_Generate
- Serial to Parallel
- FIFO (FIFO)
- FPGA Cyclone2
- JTAG, Lv_uART
- RS232C
- (To GSE)
- Read Strobe 1
- (Read Strobe 2)
- TLM 1
- (TLM 2)
- Timer I/F (28V)
- TE-RA/RB
- TE-1, -2, -3
- 5 Pair
- +28V Power
- (+/- 6V)(0.7A)
- DC/DC
- 28V to 5V
- 5V
- Fuse 2A
- +28V Power
- (+/- 6V)(0.7A)

- HEP I/F
  - MFS, ENA, BCL
  - DAT
  - TE-i, TE-RA, RB
  - +28V PS (0.3A)
- AIC I/F
  - MFS, ENA, BCL
  - DAT
  - TE-1
  - +28V PS (0.35A)
- AFG I/F
  - MFS, ENA, BCL
  - DAT
  - TE-1
  - +28V PS (0.15A)
- MED I/F
  - MFS, ENA, BCL
  - DAT
  - TE-1, -2
  - +28V PS (0.25A)
- Filter Dumping
  - Fuse 2A
- Fuse 2A
- +28V Power
  - (+/- 6V)(0.7A)
System Overview: Electrical Design: HEP
System Overview: Electrical Design: AIC

AIC

AIC-S

CCD Electronics

Remote Controller (non flight)

Lens

12V power

Analog video

CTL (SPI)

AIC-E

Digital (BT656)

Binning

Double_Buffer

Time

FPGA

5V/3.3V power

DC/DC

28V

2018 STR

CHECKOUT BOX (non flight)

TLM

GSE-2

Power Timer

TE_1
System Overview: Electrical Design: MED

MED

- APD board
  - APD
  - Temp. sensor

- Analog board
  - CSA
  - Shaper
  - Lower discrim.
  - P/H

- FPGA board
  - ADC

- HV board incl.
  - LVPS (DC/DC)

HV distrib. board

APD board
- APD
- Temp. sensor

FPGA board
- ADC

Analog board
- CSA
- Shaper
- Lower discrim.
- P/H

DAC

FPGA

CTRL MON

DC/DC

HV (-300 V max)

C/O, F/S connector

PARM
Common Elec.

GSE

CMD

TLM

TIMER

LVDS

+28V

3.3V +/- 12V

TLM

+28V

3.3V +/- 12V

GSE

PARM
Common Elec.

FPGA

LVDS
System Overview: Electrical Design: MED

(-200V approx.)

HV hot pad 10MΩ APD (50pF) 10nF C2 Signal pad (preamp)

R1 10nF R2 10MΩ

HV return pad

HV return pad

R3 0 Ω

Signal Gnd pad (preamp)

2-lead FLATPACK

AD590

V+ pad V- pad
System Overview: Electrical Design (AFG)

AFG

sensor×3

f

excitation

Check out connector

Cal in

feedback

AMP

BFP

Phase detection

∫

ASIC chip

A/D

FPGA

DATA

DC/DC 12V
DC/DC 3.3V
DC/DC 1.25V

28V

COMMON ELEC.

TE_1

TLM

2f

DC/DC 28V

Check out connector

Cal in
Instrument accommodation

PARM lower deck
Instrument accommodation
What is the shape of this area?
Instrument accommodation

Top deck

Dimension of the deck supports may not be correct. Please tell us correct dimension.
Proposed instrument accommodation

Top deck
Detailed Weight Budget (1/2)

- Values are preliminary
- Target value = 20+/-0.5 lbs.
  \[(9.07+/-0.23kg)\]
- Full payload spaces must = 30+/-1.0 lbs.
- Shared payload spaces must = 15+/-0.5 lbs.
  - Weight of payload deck is 3.425 lbs.

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Total Weight (lbf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIC-S</td>
<td>1 kg (2.2 lbs)</td>
</tr>
<tr>
<td>AIC-E</td>
<td>1.5 kg (3.3 lbs)</td>
</tr>
<tr>
<td>MED</td>
<td>3.5 kg (7.7 lbs)</td>
</tr>
<tr>
<td>COMMON-E</td>
<td>1 kg (2.2 lbs)</td>
</tr>
<tr>
<td>Harness</td>
<td>0.7 kg (1.5 lbs)</td>
</tr>
<tr>
<td>Deck plate</td>
<td>1.6 kg (3.425 lbs)</td>
</tr>
</tbody>
</table>

Total \[9.3 \text{ kg (20.5 lbs)}\]

Over/Under \[(0.22 \text{ kg (0.5 lbs)})\]

Harness weight is very rough.
Detailed Weight Budget (2/2)

- Values are preliminary
- Target value = 20+/−0.5 lbs. (9.07+/−0.23kg)

  - Weight of payload deck is 3.425 lbs.

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Total Weight (lbf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEP-S</td>
<td>1.5 kg (3.3 lbs)</td>
</tr>
<tr>
<td>HEP-E</td>
<td>1 kg (2.2 lbs)</td>
</tr>
<tr>
<td>AFG</td>
<td>2 kg (4.4 lbs)</td>
</tr>
<tr>
<td>Harness</td>
<td>1 kg (2.2 lbs)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5.5 kg (12.1 lbs)</strong></td>
</tr>
</tbody>
</table>

Deck weight is NOT included.
Harness weight is very rough.

---
# Materials List: COMMON-E

<table>
<thead>
<tr>
<th>Identification</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A5052</td>
<td>structure</td>
<td>Alminum alloy</td>
</tr>
<tr>
<td>SUS304</td>
<td>screws, nuts,</td>
<td>Stainless steel</td>
</tr>
<tr>
<td></td>
<td>washers</td>
<td></td>
</tr>
<tr>
<td>FR-4</td>
<td>PCB</td>
<td>GFRP</td>
</tr>
<tr>
<td>Araldite</td>
<td></td>
<td>Epoxidic adhesive</td>
</tr>
<tr>
<td>Hysol-0151</td>
<td></td>
<td>Epoxidic adhesive</td>
</tr>
<tr>
<td>SE-9186L</td>
<td></td>
<td>adhesive</td>
</tr>
<tr>
<td>PTFE / FEP</td>
<td>Cables</td>
<td></td>
</tr>
<tr>
<td>Ag plated Cu</td>
<td>wires</td>
<td></td>
</tr>
<tr>
<td>Soldering wire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kapton tape</td>
<td></td>
<td>Kapton</td>
</tr>
<tr>
<td>Nitoflon tape</td>
<td>Harnesses</td>
<td>Fluoroethylene resin</td>
</tr>
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</table>
## Materials List: HEP

<table>
<thead>
<tr>
<th>Identification</th>
<th>Location</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>A5052</td>
<td>structure</td>
<td>Alminum alloy</td>
</tr>
<tr>
<td>SUS304</td>
<td>screws, nuts, washers</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>FR-4</td>
<td>PCB</td>
<td>GFRP</td>
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<tr>
<td>Araldite</td>
<td></td>
<td>Epoxidic adhesive</td>
</tr>
<tr>
<td>PTFE / FEP</td>
<td>Cables</td>
<td></td>
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<tr>
<td>Ag plated Cu</td>
<td>wires</td>
<td></td>
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<td>Soldering wire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kapton tape</td>
<td></td>
<td>Kapton</td>
</tr>
<tr>
<td>Nitoflon tape</td>
<td>Harnesses</td>
<td>Fluoroethylene resin</td>
</tr>
<tr>
<td>Lacing tape</td>
<td>Harnesses</td>
<td>Polyester</td>
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<tr>
<td>Silicon</td>
<td>Detector</td>
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## Materials List: AIC

<table>
<thead>
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<th>Location</th>
<th>Material</th>
</tr>
</thead>
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<td>Alminum alloy</td>
</tr>
<tr>
<td>SUS304</td>
<td>screws, nuts, washers</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>FR-4</td>
<td>PCB</td>
<td>GFRP</td>
</tr>
<tr>
<td>Araldite</td>
<td></td>
<td>Epoxidic adhesive</td>
</tr>
<tr>
<td>PTFE / FEP</td>
<td>Cables</td>
<td></td>
</tr>
<tr>
<td>Ag plated Cu</td>
<td>wires</td>
<td></td>
</tr>
<tr>
<td>Soldering wire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kapton tape</td>
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<td>Kapton</td>
</tr>
<tr>
<td>Nitoflon tape</td>
<td>Harnesses</td>
<td>Fluoroethylene resin</td>
</tr>
<tr>
<td>Lacing tape</td>
<td>Harnesses</td>
<td>Polyester</td>
</tr>
<tr>
<td>Vacuum epoxy</td>
<td>PCB, Lens, Filter</td>
<td>Thorlabs TS10</td>
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## Materials List: MED

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<tr>
<td>SUS304</td>
<td>screws, nuts, washers</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>FR-4</td>
<td>PCB</td>
<td>GFRP</td>
</tr>
<tr>
<td>Araldite</td>
<td>Electronics board</td>
<td>Epoxide adhesive</td>
</tr>
<tr>
<td>Penguin cement 1039</td>
<td>Electronics board</td>
<td>Epoxide adhesive</td>
</tr>
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<td>PTFE / FEP</td>
<td>Cables</td>
<td></td>
</tr>
<tr>
<td>Ag plated Cu</td>
<td>Wires</td>
<td></td>
</tr>
<tr>
<td>Solder</td>
<td>Electronics board</td>
<td></td>
</tr>
<tr>
<td>Polyimide tape</td>
<td>Cable, chassis</td>
<td>Polyimide</td>
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<tr>
<td>Silicon</td>
<td>detector</td>
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## Materials List: AFG

<table>
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<th>Comments</th>
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<tr>
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<td>SUS304</td>
<td>screws, nuts, washers</td>
<td>Stainless steel</td>
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<tr>
<td>FR-4</td>
<td>PCB</td>
<td>GFRP</td>
</tr>
<tr>
<td>Araldite</td>
<td></td>
<td>Epoxidic adhesive</td>
</tr>
<tr>
<td>PTFE / FEP</td>
<td>Cables</td>
<td></td>
</tr>
<tr>
<td>Ag plated Cu</td>
<td>wires</td>
<td></td>
</tr>
<tr>
<td>Soldering wire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kapton tape</td>
<td></td>
<td>Kapton</td>
</tr>
<tr>
<td>Nitoflon tape</td>
<td>Harnesses</td>
<td>Fluoroethylene resin</td>
</tr>
<tr>
<td>chloroprene rubber glue</td>
<td>electronics</td>
<td>glue</td>
</tr>
<tr>
<td>ULTEM2300/ceramics/Almina</td>
<td>sensor</td>
<td>Sensor core base, bobbin, plates</td>
</tr>
<tr>
<td>vinyl chloride</td>
<td></td>
<td>Sensor cover</td>
</tr>
<tr>
<td>brass</td>
<td></td>
<td>Sensor screws</td>
</tr>
<tr>
<td>Alminum</td>
<td></td>
<td>Sensor cable holder</td>
</tr>
<tr>
<td>solabond</td>
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<td>Sensor pickup coil</td>
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<tr>
<td>UEW</td>
<td></td>
<td>Sensor drive coil</td>
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<tr>
<td>permalloy</td>
<td></td>
<td>Sensor core</td>
</tr>
<tr>
<td>Epoxy glue</td>
<td></td>
<td>glue</td>
</tr>
</tbody>
</table>
Hazardous Mechanical Items:

- PARM has no mechanical hazardous items onboard.
Electrical Schematics:

Electrical schematics are provided by separate pdf files.
Updated Power Budget

- Preliminary estimates on power usage for each subsystem

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Voltage (V)</th>
<th>Current (A)</th>
<th>Time On (min)</th>
<th>Amp-Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEP</td>
<td>28</td>
<td>0.3</td>
<td>20</td>
<td>0.1</td>
</tr>
<tr>
<td>AFG</td>
<td>28</td>
<td>0.15</td>
<td>20</td>
<td>0.05</td>
</tr>
<tr>
<td>AIC</td>
<td>28</td>
<td>0.35</td>
<td>20</td>
<td>0.12</td>
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<tr>
<td>MED</td>
<td>28</td>
<td>0.25</td>
<td>20</td>
<td>0.08</td>
</tr>
<tr>
<td>COMMON-E</td>
<td>28</td>
<td>0.2</td>
<td>20</td>
<td>0.07</td>
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</table>

Total (A*hr): 0.42

Over/Under 0.58
## Pin Assignments: Power

<table>
<thead>
<tr>
<th>Power Connector--Customer Side</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 1</td>
<td>GSE 1</td>
</tr>
<tr>
<td>2</td>
<td>Timer Event Redundant (TE-RA)</td>
</tr>
<tr>
<td>3</td>
<td>Timer Event Redundant (TE-RB)</td>
</tr>
<tr>
<td>4</td>
<td>Timer Event 1 (TE-1)</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
</tr>
<tr>
<td>9</td>
<td>GSE 2</td>
</tr>
<tr>
<td>10</td>
<td>Timer Event 2 (TE-2)</td>
</tr>
<tr>
<td>11</td>
<td>Timer Event 3 (TE-3)</td>
</tr>
<tr>
<td>12</td>
<td>GND</td>
</tr>
<tr>
<td>13</td>
<td>GND</td>
</tr>
<tr>
<td>14</td>
<td>GND</td>
</tr>
<tr>
<td>15</td>
<td>GND</td>
</tr>
</tbody>
</table>
## Pin Assignments: Telemetry

<table>
<thead>
<tr>
<th>Telemetry Connector--Customer Side</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pin</strong></td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
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<tr>
<td>17</td>
</tr>
<tr>
<td>18</td>
</tr>
<tr>
<td>19</td>
</tr>
</tbody>
</table>
Hazardous Electrical Items:

- **Use of high voltage**
  - HEP and MED use high voltages during the observation. When safety plug is mated, high voltage is not generated. Flight plus shall be mated during the flight.
    - Maximum output voltage: 300V
    - Typical / maximum output current: 0.0 / 2.5mA.
Software Design:

PARM has no onboard software.
Update on Partnerships

JAXA, Japan
Role: development of HEP, AFG, and COMMON-E project management

<table>
<thead>
<tr>
<th>Partnership with collaborators</th>
<th>Interaction with PARM team</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronics design / component selection</td>
<td>Frequent discussion to decide the design</td>
</tr>
<tr>
<td>Mechanical design</td>
<td>Frequent discussion to decide the design</td>
</tr>
</tbody>
</table>

Tohoku Univ., Japan
Role: development of AIC

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<thead>
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</tr>
<tr>
<td>Mechanical design</td>
<td>Frequent discussion to decide the design</td>
</tr>
</tbody>
</table>

Univ. of Tokyo, Japan
Role: development of MED

<table>
<thead>
<tr>
<th>Partnership with collaborators</th>
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</thead>
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<tr>
<td>Mechanical design</td>
<td>Frequent discussion to decide the design</td>
</tr>
</tbody>
</table>
De-Scopes and Off-Ramps

- All of the PARM subsystems (HEP, AIC, MED, AFG, and COMMON-E) have their own heritages for flight in space.
- We believe there is no serious risks to build the instruments.
- The necessary budget to develop the PARM subsystems that includes launch fee, travel expense, hardware development, and environmental testings have been authorized by Japanese government (JSPS).
- Therefore, de-scopes and off-ramps on schedule/budget constraints have not been considered at this time.
System Overview: Special Requests

• Telemetry
  – 300kbps for PARM is necessary

• Field of view (FOV)
  – FOV of HEP shall include upward direction (topward in reference frame of the rocket)
  – There shall be no obstacles in FOV of AIC and MED
    – We would like to have the tip of AIC (lens hood) located beyond the stay out zone for 10 mm.

• Electrical connection between the decks
  – Electrical connection (dedicated harness) is necessary between the top deck (where HEP and AFG are mounted) and PARM lower deck. Twisted pairing of communication lines are necessary, since PARM inter-subsystem communication uses LVDS-based serial data transfer with a little bit high bit rate.

• Use of high voltage
  – HEP and MED use high voltages during the observation
    Maximum output voltage: 300V
    Typical / maximum output current: 0.0 / 2.5mA.

• Nose cone jettison
  – Lower than altitude of 70km is necessary

• Non-magnetized material for the top deck
  – AFG wants to have non-magnetized material for the deck where AFG is mounted. For example, aluminum alloy is preferred material.
System Overview: Special Requests

Attitude of the rocket during the flight
- In order to capture the geomagnetic field direction (upward) in FOV of HEP, the spin axis direction of the rocket should point almost upward throughout the mission (almost unchanged during the flight).

Non-flight item
- HEP, AIC, and MED have non-flight items (dust covers). They shall be removed just before nose cone integration to the rocket.
- HEP, AIC, MED, and AFG have F/S and/or check-out connectors. Flight connectors shall be mated to all of them during flight.

Heater control at ground tests when there is a risk of dew condensation

Verification of PARM functions in Wallops and the launch site
Could you show us the following? It is necessary to decode the TLM data to get the PARM data stream.
  a. The RockSat-XN telemetry word assign table
  b. The data format of the file which will be sent to us at the testing and at the launch
- TLM data of PARM is generated based on our own packet format. (Observed data of HEP, AIC, MED, and AFG are packed in one single data stream and it does not follow number of TLM word of Wallops TLM frame format.) Therefore it will be necessary to apply data decoding system dedicated for PARM, i.e., it will be difficult to check the TLM data just by watching specific words of TLM with simple data display system
System Overview: Special Requests

Test after integration of the instruments to RockSatXN system at Wallops

- HEP
  • In order to measure noise level in the flight configuration, F/S connector should be set to ‘flight’ mode once in ground test configuration. Only a very small current of the order of micro-ampere flows in the HEP system.

- MED
  • In order to measure noise level in the flight configuration, F/S connector should be set to ‘flight’ mode once in ground test configuration. Only a very small current of the order of micro-ampere flows in the MED system.

- AIC
  • To get video, the checkout connector on AIC-E is used in the integration test.
  • Noise check will be carried out. For dark current noise test, we will use the lens cap but it may be necessary to make the room dark.
  • Image quality test (focus and alignment check) will be performed.
Health check of AFG after system environmental tests at Wallops
Function test will be done with the calibration signal input using the checkout connector.

– at least once after system environmental tests
– with signal inputs by Signal Generator through the additional electric board (Cal-Box)
System Overview: Special Requests

• Test at the launch site
  – HEP
    • In order to measure noise level in the flight configuration, F/S connector should be set to ‘flight’ mode once in ground test configuration. Only a very small current of the order of micro-ampere flows in the HEP system.
  – MED
    • In order to measure noise level in the flight configuration, F/S connector should be set to ‘flight’ mode once in ground test configuration. Only a very small current of the order of micro-ampere flows in the MED system.
  – AIC
    • Image quality (focus and alignment check) with room light will be performed using TLM data.
  – AFG
    • Function test will be done with the calibration signal input using the checkout connector.
      – at least once after system environmental tests
      – with signal inputs by Signal Generator through the additional electric board (Cal-Box)

![Diagram showing AFG-E, Cal-box, and SG with Power and calibration signal input with the checkout connector]
3.0 Hardware Procurement Status

Name of Presenter
Mechanical Elements (COMMON-E)

- Purchased component
  - Chassis parts
- Schedule
  - Mar - Apr, 2018: Fit check with electronics, the PARM aft. deck (dummy) and assembling
Mechanical Elements (HEP)

- Purchased component
  - Chassis parts
- Schedule
  - Mar - Apr, 2018: Fit check with electronics, the top deck (dummy) and assembling
Done:
• Procurement of WAT-910BD and a image board for PC for prototype test purpose.
• Dec./2017 – Feb./2018: Finalizing the detailed design of mechanical case and manufacturing.

PLAN
• Mar./2018: Fabrication of mechanical cases of AIC-S and AIC-E, and cables.
• Mar-May/2018: Focus and alignment adjustment. Gluing with vacuum epoxy and assembly.
• June/2018: Integration test at Wallops. Focus and alignment check needed.
Mechanical Elements: MED

- Manufactured component
  - Chassis parts
- Schedule
  - Feb-Mar, 2018: Sensor ASSY
Mechanical Elements (AFG)

- Purchased component
  - Chassis parts
- Schedule
  - Mar - Apr, 2018: Fit check with electronics, the top deck (dummy) and assembling
Electrical Elements (COMMON-E)

- Purchased components
  - Electronics parts
  - Soldering
- Anticipated revisions
  - 1-2 times
- Schedule
  Feb, 2018 - Mar, 2018
    - Correction of electronics parts and soldering
  Mar, 2018
    - Fit check with mechanical parts and assembling
  Mar – Jul, 2018
    - function check, interface check with other PARM subcomponents
  Jun - Jul, 2018
    - Environmental testing
  Aug, 2018
    - Testing at Wallops
Electrical Elements (HEP)

- Purchased components
  - Electronics parts
    - DC/DC convertors, Charge sensitive preamplifier, high voltage power supply, FPGA, op-amps, passive components
  - Soldering
- Anticipated revisions
  - 1-2 times
- Schedule
  
  Dec, 2017 - Mar, 2018: Collection of electronics parts and soldering
  Mar, 2018: Fit check with mechanical parts and assembling
  Mar - Jun, 2018:
    - Evaluation of silicon detectors with manufactured analog boards.
    - function check, interface check with COMMON-E
  Jun – Jul, 2018
    - Environmental testing
  Aug, 2018
    - Testing at Wallops
Done:
• Procurement of WAT-910BD and a digital image board for PC for prototype test purpose.
• Procurement of flight model AIC-S electronics (WAT-910BD).
• Dec./2017 Intensity calibration with FM-equivalent lens and AIC-S CCD electronics, and with an EM filter using the integrated sphere in NIPR.
• Jan. to Feb./2018: Finalizing the detailed design of electronics of AIC-E, and and manufacturing.

PLAN
• Mar./2018: Fabrication of mechanical case and AIC-E, unit test (sensor and electrical performance), calibration with flight model (by an integrated sphere in NIPR
• Mar-May/2018: Focus and alignment adjustment. Gluing with vacuum epoxy and assembly. Thermal vacuum and vibration tests in ISAS/JAXA.
• June/2018: Integration test at Wallops
Electrical Elements: MED

- Manufactured
  - Digital board
    - FPGA, op-amps, passive components have been procured
- Soldering
  - Passive components and temperature sensor around APD
- Anticipated revisions
  - 1-2 times
- Schedule

  Feb-Mar, 2018: Electronics test in the air
  Apr, 2018:
    - function check, interface check with COMMON-E
    - Evaluation of electron measurement performances
  May-June, 2018
    - Environmental testing
  July, 2018
    - Ready of testing at Wallops
Electrical Elements (AFG)

- Purchased components
  - Electronics parts
    - DC/DC convertors, FPGA, op-amps, passive components
  - Soldering
- Anticipated revisions
  - 1-2 times
- Schedule
  - Feb, 2018: Fit check with mechanical parts and assembling
  - Mar - Apr, 2018:
    - Evaluation of the magnetic sensor with manufactured analog boards.
    - function check, interface check with COMMON-E
  - Apr – Jul, 2018
    - Environmental/Calibration testing
  - Aug, 2018
    - Testing at Wallops
Software Elements

PARM has no onboard software.
4.0 Subsystem Testing Results

Name of Presenter
Subsystem Design: COMMON-E

- **Power and data of subsystem**
  - 5.6 W (28V x 0.2A)
  - 0.5 kbps (generated by COMMON-E)

- **Electrical interface to Wallops**
  - Yes (power, timer, and data)
  - COMMON-E is the only subcomponent which has the electrical interface to Wallops.

- **Hardware used**
  - COMMON-E is just an electronics.

- **Subsystem Weight:**
  - 1.0 kg

- **Other**
  - COMMON-E design is near FINAL.
  - Weight and power consumption are estimated values. Only minor changes could be expected.
Subsystem Design: COMMON-E

Interface to Wallops

Power Line Interface

Timer Line Interface

GSE_1/2
Power Input

TE-RA, RB
TE-1, 2, 3

Connect to DCDC_Converter
Subsystem Design: COMMON-E

Interface to Wallops

Parallel Read Strobe

Parallel Data Interface

Telemetry
Parallel Data
(Parallel Bit 1 (MSB) to Bit 16 (LSB))

1-B9 to 1-B16
- Quick Status
  Completed
  - Circuit drawing
  - PCB layout (design)

Items to be done
- Components assembling
- Functional testing
- Fit check to the deck
- Environmental testing

- Pictures
COMMON-E

- Completed tests
  None
- Test results
  No test results available
PARM.RSK.1: Mission objectives may not be met IF COMMON-E can’t survive launch conditions.
Subsystem [HEP]  Power/Weight/etc

• Power and data of subsystem
  – 8.4 W (28V x 0.3A)
  – 150 kbps
    = 85 count x (8 energy (num of SSDs) x 8bit + 1 time x 24bit) / 0.05s
    + 440bit(HK) / 1s

• Hardware used
  – Silicon detectors
  – Charge sensitive preamplifier (Hybrid IC)

• Subsystem Weight: Total 2.5 kg
  – HEP-S: 1.5 kg
  – HEP-E: 1.0 kg

• Other
  – HEP design is near FINAL.
  – Weight and power consumption are estimated values. Only minor changes could be expected.
Subsystem [HEP] HEP-S drawings
Subsystem [HEP] HEP-E drawings
Subsystem [HEP] Quick status

- **HEP-S**
  - Silicon detectors: Under evaluation.
  - Analog board which readout the Si detectors is in manufacturing process.
  - Mechanical parts are being manufactured.

- **HEP-E**
  - PCB is in manufacturing process.
  - Mechanical parts are being manufactured.
Subsystem [HEP] Test plan and status

- **HEP Unit level:**
  - Function tests
    - Silicon detector test with radioactive isotope (RI)
    - Analog board (preamp+shaper) test with calibration pulse
    - TLM/TE tests for digital board
    - Test High-voltage (300V) power supply unit with HEP-E.
    - Combination test analog board and digital board
    - TLM/TE tests for the assembled sensor
  - Performance tests
    - Gamma-ray measurements with RI
    - Electron measurements in the vacuum (including end-to-end test of high voltage supply unit.).
  - Environmental tests
    - Vibration (sine, random)
    - Temperature test
    - Function (TLM/TE) tests after vibration./temperature tests

- **PARM level:**
  - Function tests (PWR/TIMER/TLM)
One of eight silicon detector was evaluated with a general readout system.

Results: noise level meet the requirement

→ Energy of an electron can be measured with the required level.

The remaining seven detectors are being evaluated.

Radioactive isotope (241Am)

600 µm thick silicon detector

![Measured spectrum](image)

Calibration pulse to measure electrical noise level

ΔE ≃ 4 keV

✓ Energy resolution is ~ 4 keV and meets the requirement.
Risk Matrix: HEP

HEP.RSK.1: HEP(silicon detectors and electronics) can’t survive launch conditions, and the mission objectives aren’t met,
HEP.RSK.2: HEP shipment may delay IF unexpected and significant problems are found during assembly and verification.
HEP.RSK.3: Mission objectives may not be met IF HVPS discharges in-flight
Subsystem Design: AIC

✓ Drawing/model/sketch of subsystem

- **Power and data of subsystem**
  - 10 W (28V x 0.35A)
  - 81.92 kbps (science data) + 0.512 bps (HK data)

- **Electrical interface to Wallops**
  - No (interface to COMMON-E)

- **Hardware used**
  - Electronics, CCD, optical lens, optical filter

- **Subsystem Weight:**
  - 2.5 kg (1.0kg for AIC-S, 1.5kg for AIC-E)

- **Other**
  - Weight and power consumption are estimated values, and may have minor changes.
Subsystem Design: AIC

- Mechanical interface on the deck

Final design
Subsystem Design: AIC

Quick status

- FM CCD electronics (WAT-910BD): delivered
- FM filter (Andover/Schott RG665): delivered
- FM Lens (Space com. HF3.5M-2): will be delivered by the end of March
- EM: lens and CCD electronics delivered
- FM mechanical case: will be fabricated by the end of March
- AIC-E and cables: will be fabricated by the end of March
- Others: Vacuum epoxy delivered
- Test data acquisition performed
- Test for calibration performed
- Vibration and thermal vacuum test will be carried out in April to March
Subsystem Design: AIC

• Test results
  - CCD digital data acquisition completed with a commercial image board and a laptop PC
  - Sensitivity calibration carried out: Calibration data showed AIC has good performance for pulsating auroral emission: linear response for 2 – 150 kR intensity with S/N of 9 – 250 with exposure time of 0.067 sec and high-gain mode.

Calibration test of AIC-S with an integrated sphere

Sensitivity data showing good performance for pulsating auroral emission

Example of binned image (32 x 16 bins)
Risk Matrix: AIC

AIC.RSK.1: AIC system (optics and electronics) can’t survive launch conditions, and the mission objectives aren’t met,
AIC.RSK.2: Significant misalignment in focal position of optical system due to the vibration of launch may cause fatal degradation of data quality,
AIC.RSK.3: Frost may occur on/in the optical system and cause significant degradation of data quality
AIC.RSK.4: The AIC shipment may delay IF unexpected and significant problems are found during AIC unit assembly and verification.
Subsystem: MED

- **Power and data of subsystem**
  - 7.0 W (2.5W/amp + 2W/Digital + 2.5W/PS, incl. DC/DC efficiency)
  - 25.6 kbps (science data) + 0.512 bps (HK data)
    * Science data: (16-energy bin x 5-detectors x 8-bit (counter depth) + 32-bit (Time) / (0.625-ms x (40 + 2))
    * HK: Time, temperature, HV-monitor, etc, at 512bit/1sec

- **Hardware used**
  - Avalanche Photodiodes
  - Amp boards (HIC charge-amp, shaper, peak holder, etc)
  - Digital boards (FPGA, ADC, etc)
  - Power boards (DC/DC, HV, etc)

- **Subsystem Weight: Total 3.5 kg**

- **Other**
  - MED design is assumed to be FINAL.
  - Minor changes is possible if any problems are found during assembly and tests
Subsystem: MED

- Quick status
  Completed
  - All subcomponents have been fabricated
- Yet to be done
  - Full ASSY
  - Tests after full ASSY
  - Fit check to the deck
  - Environmental tests
  - Full function check for TE/TLM

Chassis

Amplifier board

APD

Digital board

Power board

2018
Subsystem: MED

- Quick status
  Completed
  - The low noise level of the amplifier board has been verified
  - HV output linearity has been verified
Subsystem: MED

- Quick status
  - **Completed**
  - The low noise level of the amplifier board has been verified ➡️ success
  - HV output linearity has been verified ➡️ success

Deviation from the mean signal output [mV]

Noise level evaluation
equiv. to 0.54 keV

**HV output evaluation**

\[ y = 59.996x - 1.0973 \]
\[ R^2 = 1 \]

Counts vs. output(V)

-30 -20 -10 0 10 20 30

-350 -300 -250 -200 -150 -100 -50 0

0.00 1.00 2.00 3.00 4.00 5.00 6.00

HVRef(V)
MED.RSK.1: The MED system cannot survive launch conditions, and the mission objectives are not met
MED.RSK.2: Mission objectives may not be met IF HVPS discharges in-flight
MED.RSK.3: The MED shipment may delay IF unexpected and significant problems are found during MED unit assembly and verification
Subsystem Design: AFG (Drawings)

AFG-S
Subsystem Design: AFG (Drawings)
Subsystem Design: AFG

- Drawing/model/sketch of subsystem
- Power and data of subsystem
  - 4.2 W (28V x 0.15A)
  - 12.5 kbps
    1250(bit/0.1s) = 26bit(header) + 24bit(counter) + 20bit(data) * 3(components) * 20(samples/0.1s)
- Hardware used
  - sensors
- Subsystem Weight: Total 2.0 kg
  - AFG-S: 0.3 kg
  - AFG-E: 1.5 kg
  - Cable: 0.2 kg
- Other
  - AFG design is FINAL.
  - Weight and power consumption are estimated values. Only minor changes could be expected.
Quick Status

Completed
- Circuit drawing
- PCB layout (design)

Items to be done
- Components assembling
- Functional testing
- Fit check to the deck
- Environmental testing

Pictures
AFG

- Completed tests
  None
- Test results
  No test results available
Risk Matrix: (AFG)

AFG.RSK.1: AFG (sensors and electronics) can’t survive launch conditions, and the mission objectives aren’t met,
AFG.RSK.2: AFG shipment may delay IF unexpected and significant problems are found during assembly and verification.
AFG.RSK.3: Mission objectives may not be met IF AFG cannot measure the magnetic field because of a significant magnetic disturbance from other instruments.
5.0 Plan for Integrated Subsystem Testing Review (ISTR)

Name of Presenter
## Plan for ISTR

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Activity Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar 2018</td>
<td>Manufacturing of chassis and electronics</td>
</tr>
<tr>
<td>Mar 2018</td>
<td>Fit check and assembling of subsystem</td>
</tr>
<tr>
<td>Mar – Apr, 2018</td>
<td>Fit check to the dummy decks</td>
</tr>
<tr>
<td>Apr – Jul, 2018</td>
<td>Function check (subcomponents level)</td>
</tr>
<tr>
<td></td>
<td>Interface check (PARM level)</td>
</tr>
<tr>
<td></td>
<td>Function check (PARM level)</td>
</tr>
<tr>
<td>Jun-Jul, 2018</td>
<td>Environmental testing</td>
</tr>
<tr>
<td>Aug, 2018</td>
<td>Delivery of PARM to Wallops</td>
</tr>
</tbody>
</table>
6.0 Plan for Full Mission Simulation Review (FMSR)

Name of Presenter
Mechanical Testing

- Environmental testing (subcomponent level) will be done with the specified level shown in RockSat-XN User’s Guide (This level is, however, not the subsystem level specification).
- The testing will be done at June to July.
- PARM has no deployable systems.
- PARM has no mechanical inhibits which will apply at the environmental testing at Wallops.
Electrical Testing (COMMON-E)

• COMMON-E Unit level:
  – Function tests
    • Function test with a dummy jig for Wallops components (TLM, power, and timer interfaces).
    • Function test with dummy subcomponent board and the dummy jig for Wallops components.
    • TLM/TE tests
  – Environmental tests
    • Temperature test

• PARM level:
  – Function tests (PWR/TIMER/TLM)
### Electrical Testing (HEP)

#### HEP Unit level:
- **Function tests**
  - Silicon detector test with radioactive isotope (RI)
  - Analog board (preamp+shaper) test with calibration pulse
  - TLM/TE tests for digital board
  - Test High-voltage (300V) power supply unit with HEP-E.
  - Combination test analog board and digital board
  - TLM/TE tests for the assembled sensor
- **Performance tests**
  - Gamma-ray measurements with RI
  - Electron measurements in the vacuum (including end-to-end test of high voltage supply unit.).
- **Environmental tests**
  - Vibration (sine, random)
  - Temperature test
  - Function (TLM/TE) tests after vibration./temperature tests

#### PARM level:
- **Function tests (PWR/TIMER/TLM)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar-Apr</td>
<td>Test High-voltage (300V) power supply unit with HEP-E.</td>
</tr>
<tr>
<td>Apr-May</td>
<td>Gamma-ray measurements with RI</td>
</tr>
<tr>
<td>Jun-Jul</td>
<td>Electron measurements in the vacuum (including end-to-end test of high voltage supply unit.).</td>
</tr>
</tbody>
</table>
## Electrical Testing (AIC)

- **AIC Unit level:**
  - **Function tests (Mar. 2018)**
    - Power supply, settings of binning, pre-amp gain, frame rate, etc.
    - Calibration with integrated sphere
    - TLM/TE tests for digital board
    - TLM/TE tests for the assembled sensor
  - **Performance tests (Mar. - Apr. 2018)**
    - Calibration with integrated sphere and monochromatic light source
    - Focus adjustment in atmosphere
    - Function (TLM/TE) tests in vacuum
    - Focus check in vacuum
  - **Environmental tests (May. 2018)**
    - Vibration (sine, random)
    - Temperature test (down to -30 degC)
    - Function (TLM/TE) tests after vib./tmp. tests in vacuum
    - Focus check before and after environmental tests

- **PARM level: Jun 2018**
  - Function tests (PWR/TIMER/TLM)
  - Focus check
  - Alignment test
## Electrical Testing (MED)

- **MED Unit level:**
  - **Function tests**
    - Amp board test (test pulse etc.)
    - HVPS performance and calibration
    - TLM/TE tests for digital board
  
- **Performance tests**
  - X-ray measurements in the atmosphere
  - Function (TLM/TE) tests in the vacuum
  - Electron measurements in the vacuum

- **Environmental tests**
  - Vibration (sine, random)
  - Temperature test (down to -30°C)
  - Function (TLM/TE) tests after vib./tmp. tests in the vac.

- **PARM level:**
  - Function tests (PWR/TIMER/TLM)

---

**HVPS PWR ON**

- board-level
- sensor-level

---

**HVPS PWR ON**

- sensor-level

---

**HVPS PWR ON**
Electrical Testing (AFG)

• AFG Unit level:
  – Function tests
    • Combination test sensor and board
    • TLM/TE tests for digital board
    • Sensitivity/noise test with calibration signals
    • Frequency/linearity response measurement
    • TLM/TE tests for the assembled sensor
  – Performance tests
    • Sensitivity/offset/alignment/noise measurements under zero-magnetic field environment
    • Frequency/linearity response measurement
  – Environmental tests
    • Vibration (sine, random)
    • Temperature test
    • Function (TLM/TE) tests after vibration./temperature tests

• PARM level:
  – Function tests (PWR/TIMER/TLM)
Software Testing

- PARM has no software onboard.
System Level Testing

- Fit-check with the dummy decks. Mass and CG measurement and adjusting will be done also, although it may depend on whether PARM dedicated machining is applied to the dummy decks.
- We will prepare a dummy jig for TLM, power, and timer interfaces. It will be used for verify the functions of COMMON-E and other subsystems.
- Power on sequence check. Measurement of in-rush currents at GSE1 / GSE2 turning on.
- Measurement of power consumptions.
- Inter-instrument interface check (TLM, power, and timer)
- Performance check for each subsystem.

System level testing will be done from May to July.
7.0 User Guide Compliance

Name of Presenter
# User Guide Compliance: Summary

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Status/Reason (if needed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center of gravity in 1&quot; plane of plate?</td>
<td>Within 1&quot; currently</td>
</tr>
<tr>
<td>Weight 30.0+-1.0 (15.0 +/- 0.5) lbs?</td>
<td>32.6 lbs (32.6 lbs is assigned value)</td>
</tr>
<tr>
<td>Max Height &lt; 10.75” (5.13”)</td>
<td>245 mm (9.65”) excl. deck thickness for the PARM lower plate 285 mm (11.22”) for the top plate</td>
</tr>
<tr>
<td>Bottom of deck has flush mount hardware?</td>
<td>YES</td>
</tr>
<tr>
<td>Within Keep-Out Zone</td>
<td>YES</td>
</tr>
<tr>
<td>Using &lt; 10 A/D Lines</td>
<td>No</td>
</tr>
<tr>
<td>Using/Understand Parallel Line</td>
<td>Yes, 300kbps</td>
</tr>
<tr>
<td>Using/Understand Asynchronous Line</td>
<td>No</td>
</tr>
<tr>
<td>Using X GSE Line(s)</td>
<td>YES, GSE 1 and GSE 2</td>
</tr>
<tr>
<td>Using X Non-Redundant PWR Lines (TE-1, TE-2, TE-3)</td>
<td>YES, TE-1 and TE-2</td>
</tr>
<tr>
<td>Using X Redundant Power Lines (TE-R)</td>
<td>YES, TE-R</td>
</tr>
<tr>
<td>Using &lt; 1 Ah</td>
<td>0.42Ah</td>
</tr>
<tr>
<td>Using &lt;= 28 V</td>
<td>Yes, 300 V</td>
</tr>
<tr>
<td>Using RF (If yes, list frequency and TX Power)</td>
<td>No</td>
</tr>
<tr>
<td>Using deployable?</td>
<td>No</td>
</tr>
<tr>
<td>Whole team consists of US Persons</td>
<td>No</td>
</tr>
<tr>
<td>Using ITAR and/or Export Controlled hardware</td>
<td>NO</td>
</tr>
</tbody>
</table>
8.0 Project Management Update

Name of Presenter
Management

Team organization chart:

PI
Asamura

Supervisor
Fujii

Science
Miyoshi

HEP
Mitani
Namekawa
Hasegawa
Saito

AIC
Sakanoi
Fukizawa
Yagi
Hino

MED
Sugo
Kawashima
Takaki
Kasahara

AFG
Nomura
Teramoto

COMMON-E
Asamura

Ground observation
Hosokawa
## Schedule

### Schedule in RockSat-XN web page
- **Feb 21, 2018**
  - First Installment Due
- **Mar 2018**
  - Experiment Decks and Connectors Sent to Teams
- **Apr 20, 2018**
  - Second instrument due
- **Apr 2018**
  - Integrated Subsystem Testing Review (ISTR)
- **Jun 2018**
  - Full Mission Simulation Review (FMSR)
- **Jun 2018**
  - Weekly Teleconferences Begin
- **Jul 2018**
  - Integration Readiness Review (IRR) Teleconferences
- **Aug 2018**
  - SGE checkouts at Refuge Inn
  - Testing and environmental testing with Wallops
  - Final integration at Wallops
- **Sep 2018**
  - Rocket shipped to ASC
- **Jan, 2019**
  - Launch

### PARM schedule
- **Mar, 2018**
  - Manufacturing of chassis and electronics
  - Fit check and assembling of subsystem
- **Mar – Jul, 2018**
  - function check, interface check with other PARM subcomponents
  - Function and performance check
  - PARM-level testing
- **Jun – Jul, 2018**
  - Environmental testing
- **Early August, 2018**
  - Delivery of PARM to Wallops
Monetary budget

We have a fund from Japanese Government (JSPS) which covers until March 2020, including launch fee, travel expense, hardware development, and environmental testings.

Deposit:
USD2,000 has been paid.

Remaining sum of RockSat-XN program fee:
USD23,000 will be paid at April 25th (to the local bank Flywire specifies in Japan). We do not pay anything at the first instrument due.
# PMP: Latest Contact Matrix

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Phone Numbers</th>
<th>Email Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principle Investigator</td>
<td>Kazushi Asamura</td>
<td>+81-50-3362-2136</td>
<td><a href="mailto:asamura@stp.isas.jaxa.jp">asamura@stp.isas.jaxa.jp</a></td>
</tr>
<tr>
<td>Supervisor</td>
<td>Ryoichi Fujii</td>
<td>+81-3-6402-6201</td>
<td><a href="mailto:eiscatfujii@gmail.com">eiscatfujii@gmail.com</a></td>
</tr>
<tr>
<td>Science</td>
<td>Yoshizumi Miyoshi</td>
<td>+81-52-747-6340</td>
<td><a href="mailto:miyoshi@isee.nagoya-u.ac.jp">miyoshi@isee.nagoya-u.ac.jp</a></td>
</tr>
<tr>
<td>Ground Observation Lead</td>
<td>Keisuke Hosokawa</td>
<td>+81-42-443-5299</td>
<td><a href="mailto:keisuke.hosokawa@uec.ac.jp">keisuke.hosokawa@uec.ac.jp</a></td>
</tr>
<tr>
<td>High-energy electron analyzer (HEP)</td>
<td>Takefumi Mitani</td>
<td>+81-50-3362-4161</td>
<td><a href="mailto:mitani@planeta.sci.isas.jaxa.jp">mitani@planeta.sci.isas.jaxa.jp</a></td>
</tr>
<tr>
<td>High-energy electron analyzer (HEP)</td>
<td>Tatsuya Hesegawa</td>
<td>+81-50-3362-4179</td>
<td><a href="mailto:t.hasegawa@stp.isas.jaxa.jp">t.hasegawa@stp.isas.jaxa.jp</a></td>
</tr>
<tr>
<td>High-energy electron analyzer (HEP)</td>
<td>Taku Namekawa</td>
<td>+81-50-3362-4179</td>
<td><a href="mailto:namekawa@stp.isas.jaxa.jp">namekawa@stp.isas.jaxa.jp</a></td>
</tr>
<tr>
<td>High-energy electron analyzer (HEP)</td>
<td>Yoshifumi Saito</td>
<td>+81-50-3362-4632</td>
<td><a href="mailto:saito@stp.isas.jaxa.jp">saito@stp.isas.jaxa.jp</a></td>
</tr>
<tr>
<td>Auroral camera (AIC)</td>
<td>Takeshi Sakanoi</td>
<td>+81-22-795-6609</td>
<td><a href="mailto:tsakanoi@pparc.gp.tohoku.ac.jp">tsakanoi@pparc.gp.tohoku.ac.jp</a></td>
</tr>
<tr>
<td>Auroral camera (AIC)</td>
<td>Mizuki Fukizawa</td>
<td>+81-22-795-6609</td>
<td><a href="mailto:fukizawa.m@pparc.gp.tohoku.ac.jp">fukizawa.m@pparc.gp.tohoku.ac.jp</a></td>
</tr>
<tr>
<td>Auroral camera (AIC)</td>
<td>Naoshi Yagi</td>
<td>+81-22-795-6609</td>
<td><a href="mailto:naoshi.yagi.s3@dc.tohoku.ac.jp">naoshi.yagi.s3@dc.tohoku.ac.jp</a></td>
</tr>
<tr>
<td>Auroral camera (AIC)</td>
<td>Taiyo Hino</td>
<td>+81-22-795-6609</td>
<td><a href="mailto:hino.taiyo@gmail.com">hino.taiyo@gmail.com</a></td>
</tr>
<tr>
<td>Medium-energy electron detector (MED)</td>
<td>Shin Sugo</td>
<td>+81-3-5841-4651</td>
<td><a href="mailto:shin-sugo708@g.ecc.u-tokyo.ac.jp">shin-sugo708@g.ecc.u-tokyo.ac.jp</a></td>
</tr>
<tr>
<td>Medium-energy electron detector (MED)</td>
<td>Oya Kawashima</td>
<td>+81-3-5841-4651</td>
<td><a href="mailto:okawashi0311@g.ecc.u-tokyo.ac.jp">okawashi0311@g.ecc.u-tokyo.ac.jp</a></td>
</tr>
<tr>
<td>Medium-energy electron detector (MED)</td>
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</tbody>
</table>
**Worries and Concerns**

**Interference of FOVs**
There should be no obstacles in FOV of HEP, AIC, and MED. Especially for AIC and MED, decks of other teams located next to the PARM lower deck may interfere. Also, structures in the opposite side of VT’s deck may interfere MED’s FOV. We would like to know location and dimensions of these structures in detail.

**Verification of TLM data at Wallops and the launch site**
TLM data of PARM is generated based on our own packet format. (Observed data of HEP, AIC, MED, and AFG are packed in one single data stream and it does not follow number of TLM word of Wallops TLM frame format.) Therefore it will be necessary to apply data decoding system dedicated for PARM, i.e., it will be difficult to check the TLM data just by watching specific words of TLM with simple data display system.

1. Could you show us the following? It is necessary to decode the TLM data to get the PARM data stream.
   a. The RockSat-XN telemetry word assign table
   b. The data format of the file which will be sent to us at the testing and at the launch
Questions

1. Could you show us the following? It is necessary to decode the TLM data to get the PARM data stream.
   a. The RockSat-XN telemetry word assign table
   b. The data format of the file which will be sent to us at the testing and at the launch
2. What is the status of PARM dedicated testing at the Wallops and the launch site?
3. How is the launch condition decided?