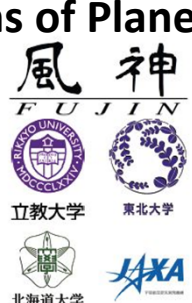


The Circumpolar Stratospheric Telescope – FUJIN – for Observations of Planets

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1. Science Objective of FUJIN

The FUJIN project aims at studies of the planetary atmospheres and plasmas by observations using an optical telescope lifted up to the polar stratosphere by a scientific balloon.

2. FUJIN-1 Experiment in 2013

- Flight Window
May/June in 2013
- Location
Taiki Aerospace Research Field, Hokkaido, Japan
- Purpose
System function test and observation of Venus
- Result



Fig. 1 The FUJIN-1 gondola prepared for launch at TARF.

Unfortunately due to a failure in the bus system provided by JAXA the FUJIN-1 experiment was canceled. Since its functions have been thoroughly checked through the various tests on the ground and in a vacuum chamber, it was decided that the FUJIN-1 experiment was closed to proceed the next step.

3. FUJIN-2 Experiment in 2015

- Flight Window
April/May in 2015
- Place
SSC/ESRANGE, Kiruna, Sweden
- Target Planets
Venus, Jupiter and Mercury
- Observation Wavelengths
Venus
365 nm and 418 nm
Jupiter
889nm and 750nm

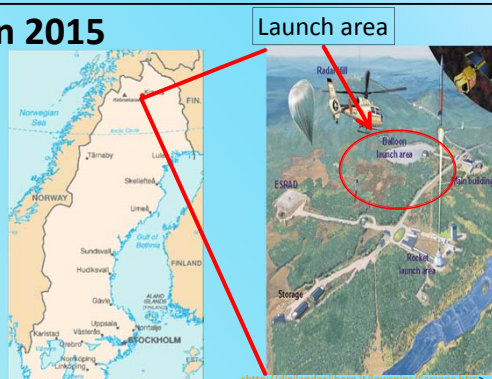


Fig. 2 Location of ESRANGE and bird-view of launch area.

- Flight Plan
FUJIN-2 will be launched at ESRANGE operated by SSC and recovered in the large impact area north of Kiruna after one or two days flight in the turn-around period.

5. FUJIN-2 Optics

Table 1. Optics of FUJIN-2	
Telescope	Cassegrain with Nasmyth focuses
Aperture	400 mm
Filters	10 pcs
Detector	CCD camera



Fig. 4 The telescope changing filters in a wheel.

Star sensors with wide and narrow field-of-view guide the telescope to a target planet. A tip-tilt mirror installed in the optical path corrects guiding errors of the telescope mount to stabilize the image at the center of field-of-view. Observation wavelength is selectable by

6. Scientific Purposes

- Venus
→Dynamics of Venusian upper atmosphere including super-rotation by tracking cloud pattern seen in the ultraviolet region.
→Chemistry, lightening, airglow and aurora.
- Jupiter (Option)
→Cloud physics and dynamics of the Jovian atmosphere
→Satellites and gas and plasma emitted from them
- Mercury (Option)
→Formation mechanism of sodium atmosphere and tail

4. FUJIN-2 System

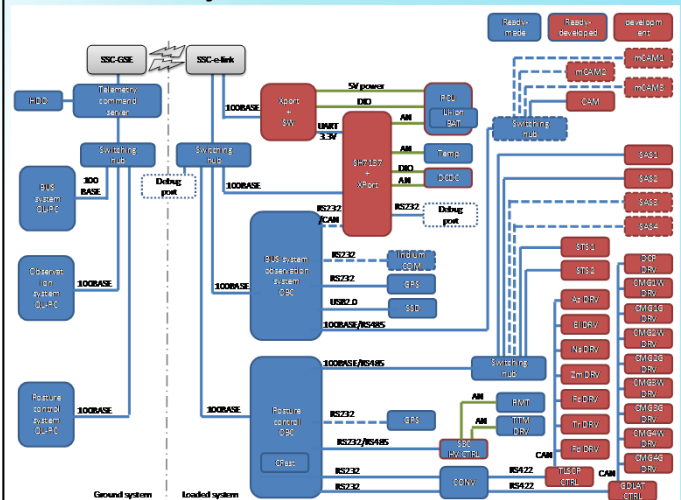


Fig. 3 A block diagram of FUJIN-2 system.

Two industrial PCs control sub-systems of FUJIN-2. Data are downlinked and commands are uplinked through the e-link system provided by SSC/ESRANGE.

7. FUJIN-3 Experiment

- Fujin-2 will be launched during the turn around period while the wind direction in the stratosphere changes.
- During the summer season the easterly wind is dominant in the stratosphere. A balloon can fly along a circle in almost constant latitude back to the launch site. FUJIN-3 will try observation for two weeks and a few days by a circumpolar flight.



Fig. 5 A star map that shows positions of the planets and the Sun at FUJIN-2 observation.

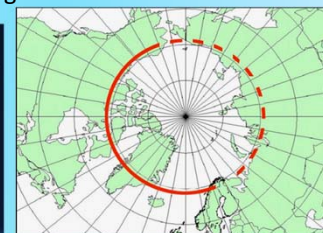


Fig. 6 A predicted trajectory of circumpolar flight during summer.

8. Future Plan

The following developments are being considered after FUJIN-3:

- utilization of a super-pressure balloon for longer flight,
- a meter-class telescope,
- and a mobile gondola that can move to the center of polar vortex where more stable environment is expected.

Reference

Shoji et al., Development of the Balloon born Telescope for Planets -FUJIN-1-, To be published in JAXA-RR, 2014.