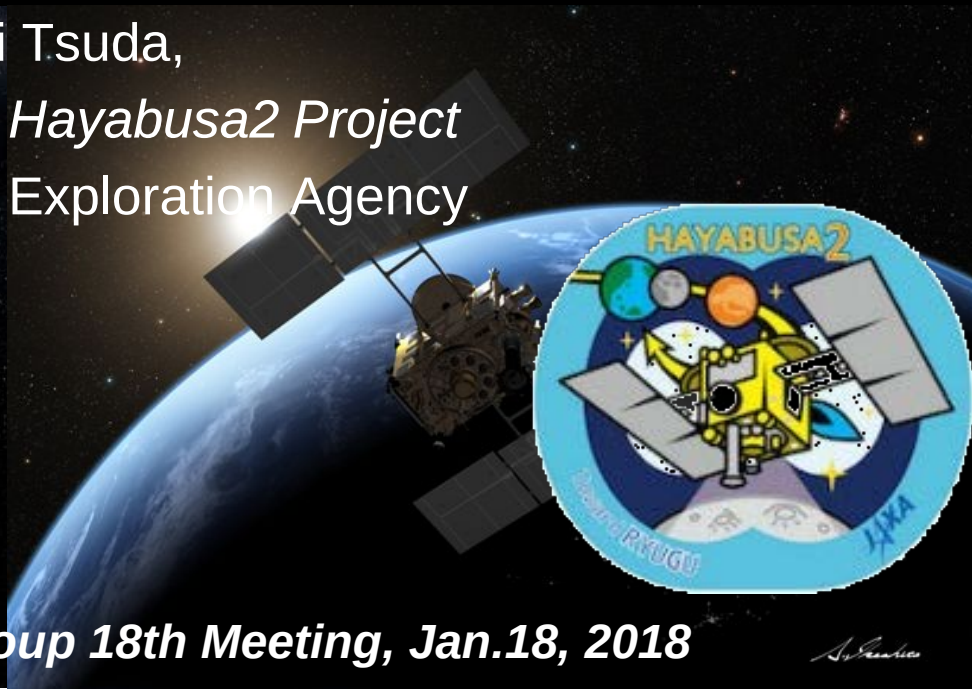
Current Status of Hayabusa2

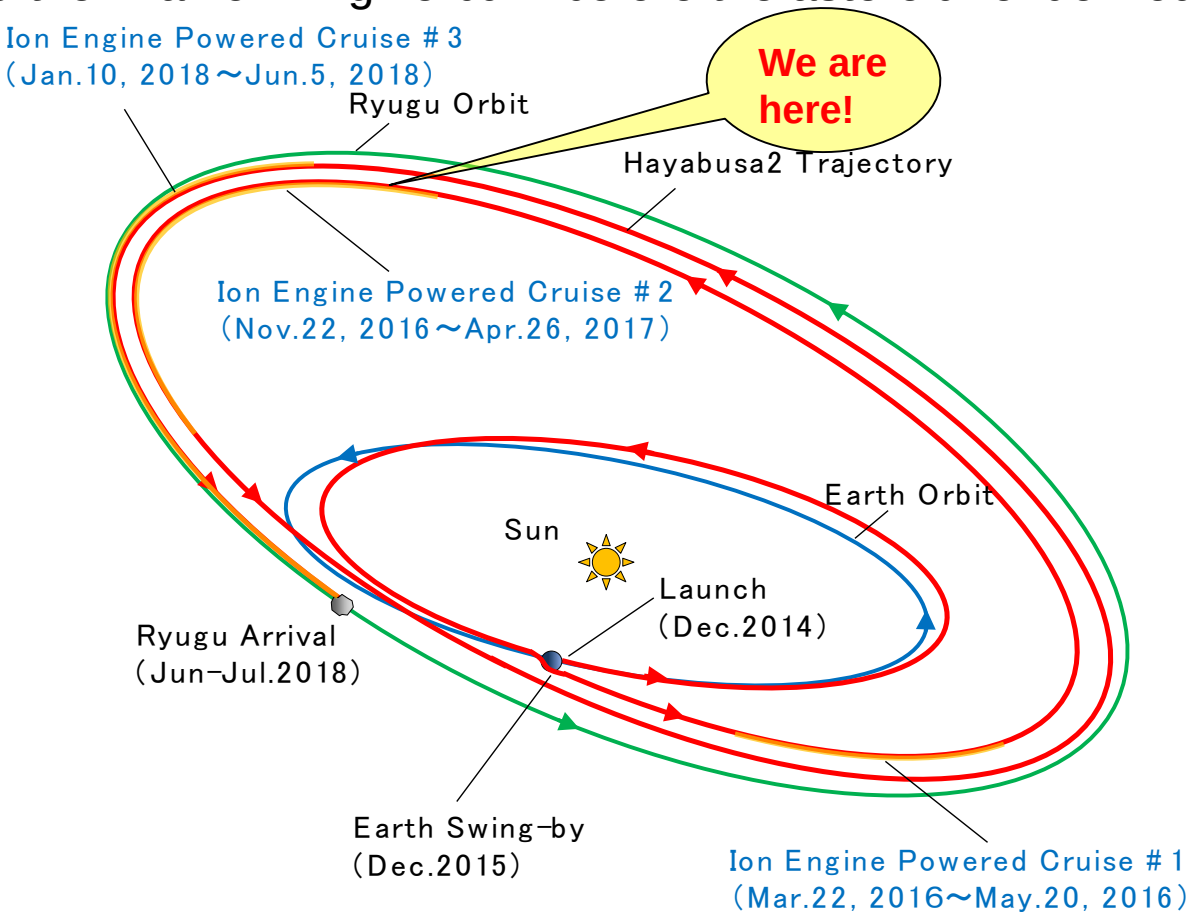
Yuichi Tsuda,
Project Manager, Hayabusa2 Project
Japan Aerospace Exploration Agency



Small Body Assessment Group 18th Meeting, Jan.18, 2018

Present Status of Hayabusa2 (as of Jan.16, 2018)

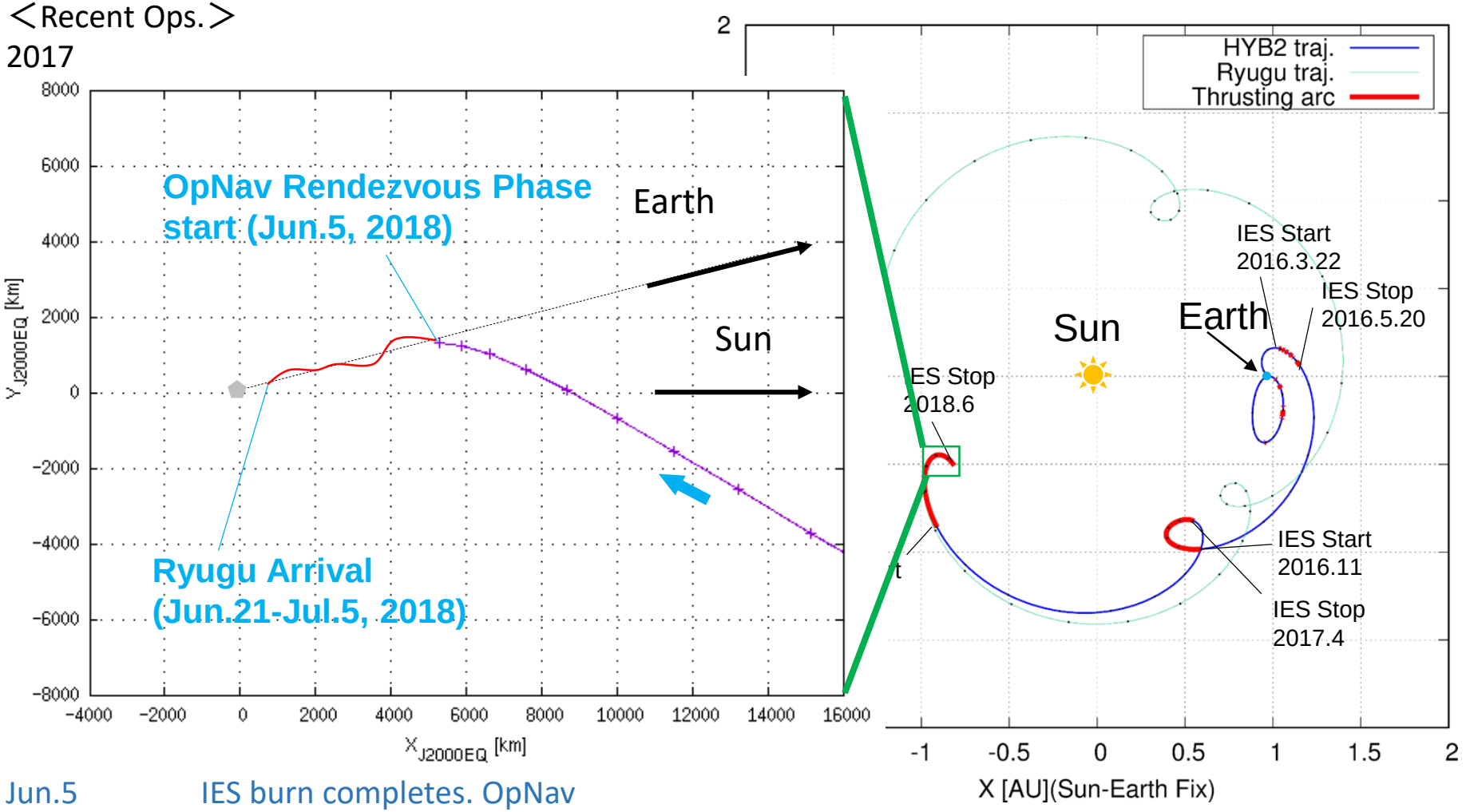
- Traveled 2.79 billion km (w.r.t heliocentric inertial frame)
- Solar distance 1.25AU.
- Earth distance 2.08AU (RTLT=34min.)
- Just started the final Ion Engine burn before the asteroid rendezvous on Jan 10.



Recent / Near Future Cruise Operation

＜Recent Ops.＞

2017



Jun.5 IES burn completes. OpNav begins.

Proximity Operation Plan

Typical plan, Actual schedule fixed after arrival

Spacecraft ‘hovers’ at 20km altitude. All descent ops listed here are *critical* operations.

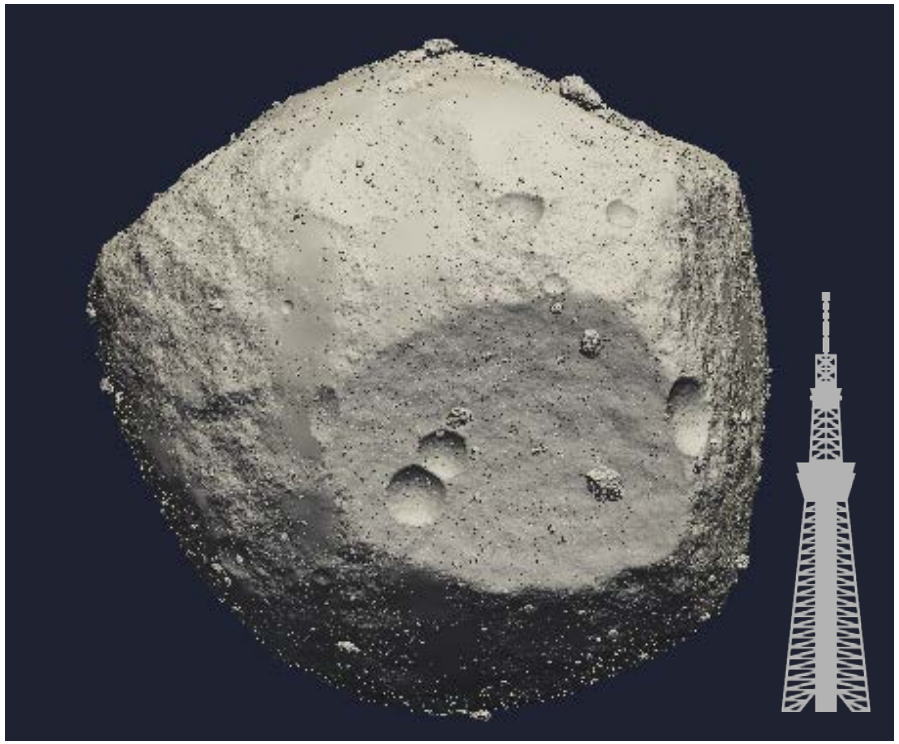
Prox Operation Training Campaign 2017

- Landing Site Selection (LSS) Training (2Q-3Q, 2017)
  - Purpose: Verification of LSS process
    - Decision making framework/criteria, Tools and interface, ...
  - Trainee
    - 100+ participants, JAXA engineering, Science (International), MASCOT team
  - Training data
    - Asteroid images (CG) based on actual observation operation plan
    - Science data (Thermal, near infra-red, LIDAR data, gravity, …)
    - Navigation data (position & velocity of S/C), Attitude data.

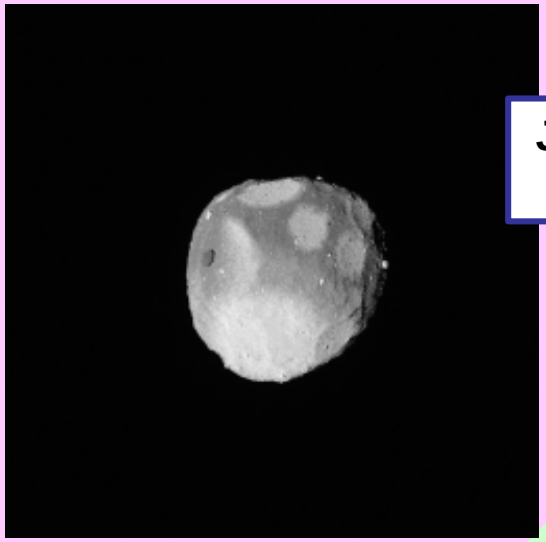
- Real-Time Integrated Operation (RIO) Training (4Q, 2017-1Q, 2018)
  - Purpose: Real-time operation training, Verification of ground support tools
    - Touchdown operation, Impact operation, rover landing…
  - Trainee: all the operation staffs
  - Training data
    - Asteroid images (CG, real-time)
    - Telemetry data (with communication delay)

Landing Site Selection Practice step1: ‘God team’ creates Ryugoid

- Virtual asteroid ‘Ryugoid’ in place of mysterious Ryugu.
- Assume from the formation history of Ryugoid. The shape and all the other properties were derived from the history.
- Each property was Intendedly deviated from known Ryugu property.
- The rotation state is randomly selected from public via Twitter.
- Shape model: 25cm resolution, 370 million polygon.
- Observation data generated based on actual operation plan & actual instruments performance.
  - Generates attitude/trajectory simulation data based on operation plan
  - Observation data and their ancillary data generated based on the simulation data.
  - Goes through all the ground pipe line process as it really is.



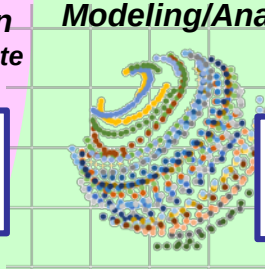
Landing Site Selection Practice step2: Sci.&Eng. teams to solve the problem



Observation
(Simulated date generation)

Jan-Jun, 2017

Modeling/Analysis



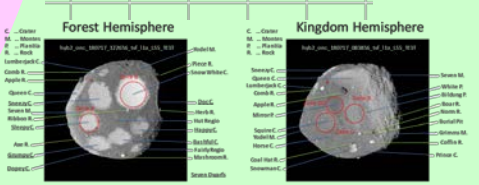
May-Aug, 2017

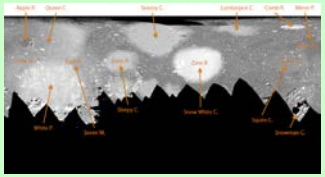
Evaluation

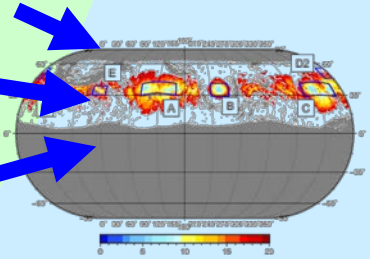
Jun-Aug, 2017

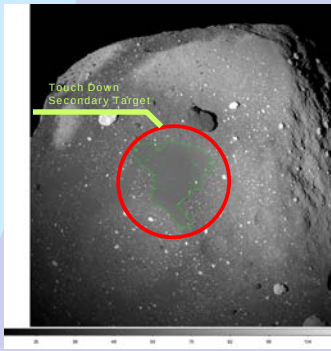
Landing Site Decision

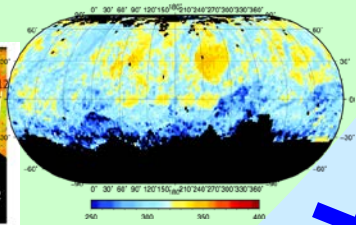
Sep 4, 2017

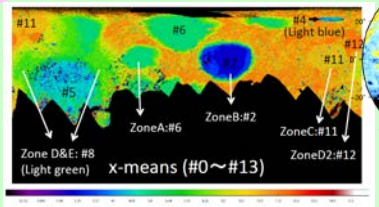


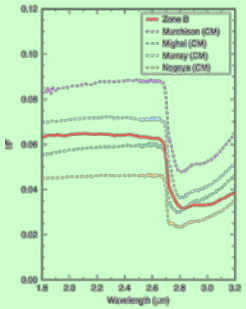


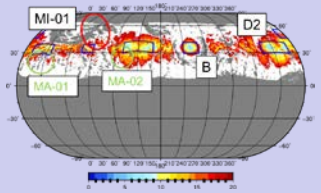


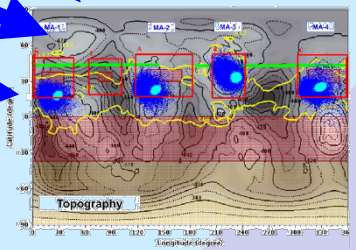


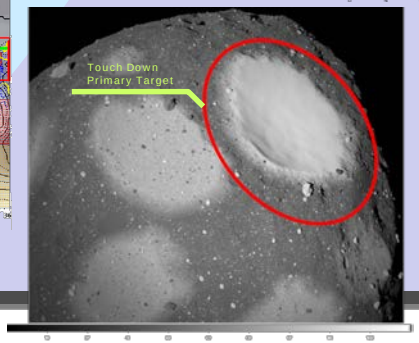






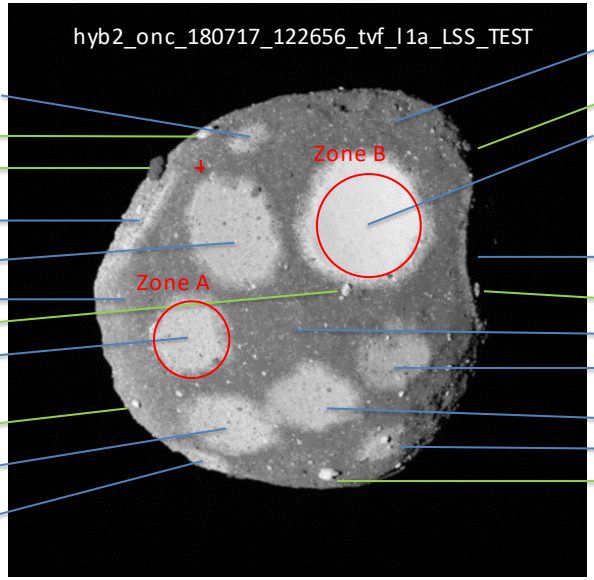




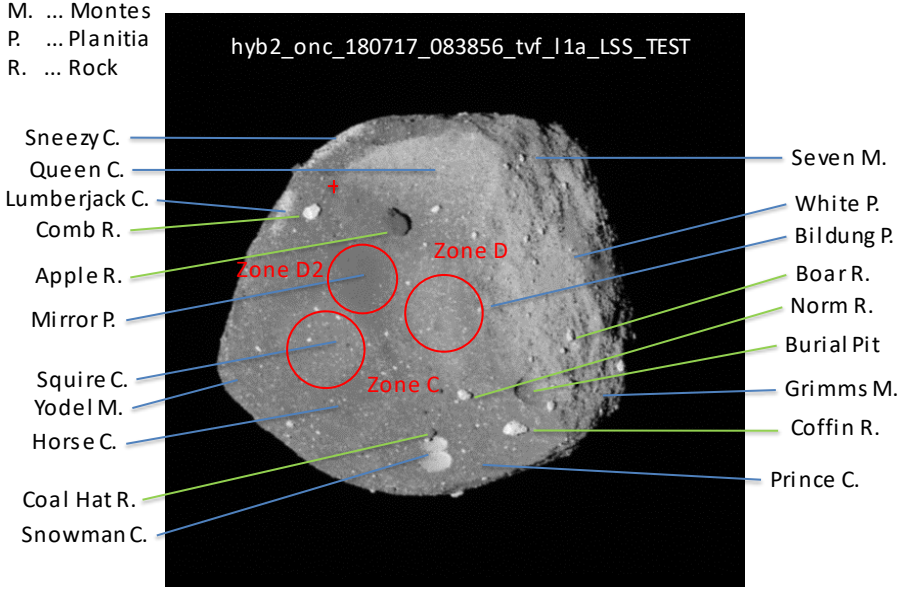


Surface feature of Ryugoid

Forest Hemisphere

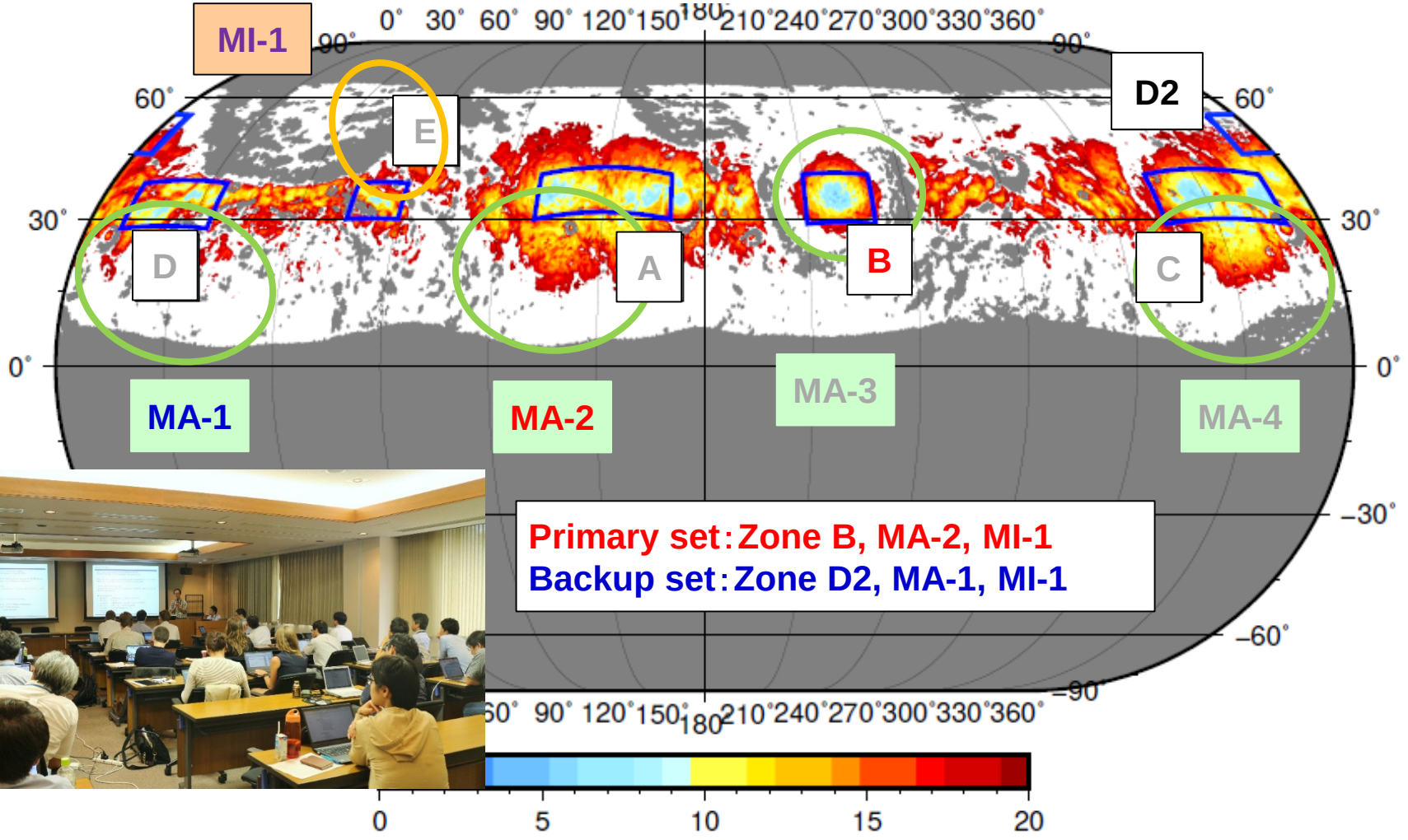


Kingdom Hemisphere



Landing Site Selection Practice step3: Landing Site Decision

Two set of Mother spacecraft landing, MASCOT lander landing, MINERVA-II rovers landing sites are derived based on safety and scientific value.

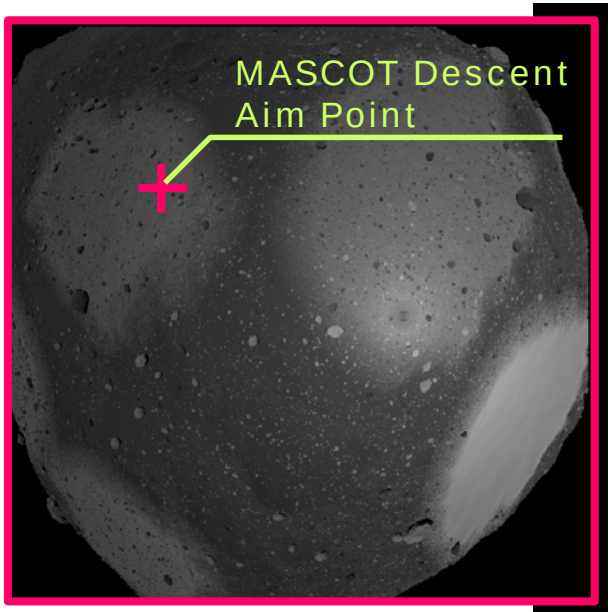


Primary set：Zone B, MA-2, MI-1
Backup set：Zone D2, MA-1, MI-1

Real-time Integrated Operation Practice (RIO)

TRIO (Training of RIO) Jan-Sep,2017: 18 run – 13 crush – 5 success/okey
RIO Oct.2017-Apr.2018: total 30 run planned, 13 run – 4 crush – 9 success/okey.

RIO Example: MASCOT Release Operation Practice (Oct.19-20,2017)



View of Optical Navigation Camera ONC-W1

Descent start (-1m/s)
↓
Slow Down (-0.1m/s)
↓
60m arrival/release
↓
Ascent to 3km
↓
Hovering

“Imagining Ryugu” Space Art Contest

http://www.hayabusa2.jaxa.jp/topics/20171227_e/

Can you predict Ryugu appearance better than scientists?

Thank you!