



Planetary Space Weather Services

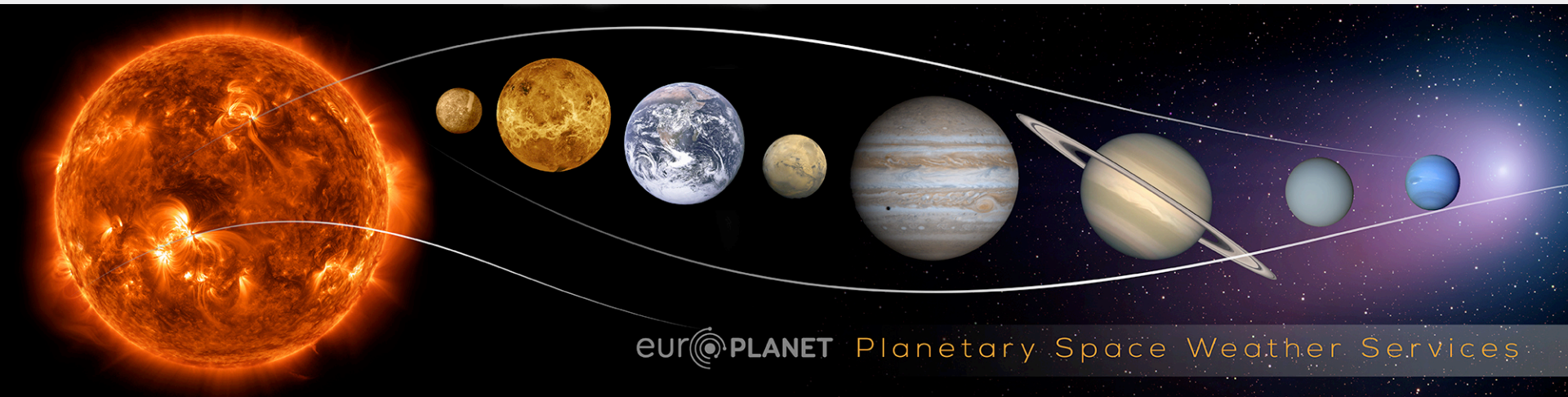
Nicolas André & Manuel Grande, on behalf of all PSWS partners

PSWS will make five entirely new ‘toolkits’ accessible to the research community and to industrial partners planning for space missions:

1. General planetary space weather toolkit
2. Novel “event-diary” toolkit aiming at predicting and detecting planetary events like meteor showers and impacts

as well as three toolkits dedicated to the following key planetary environments:

3. Mars (in support of ESA ExoMars missions to be launched in 2016 and 2018)
4. Comets (building on the expected success of the ESA Rosetta mission)
5. Outer planets (in preparation for ESA JUICE mission to be launched in 2022)



H2020 – A very favorable context

Before 2016

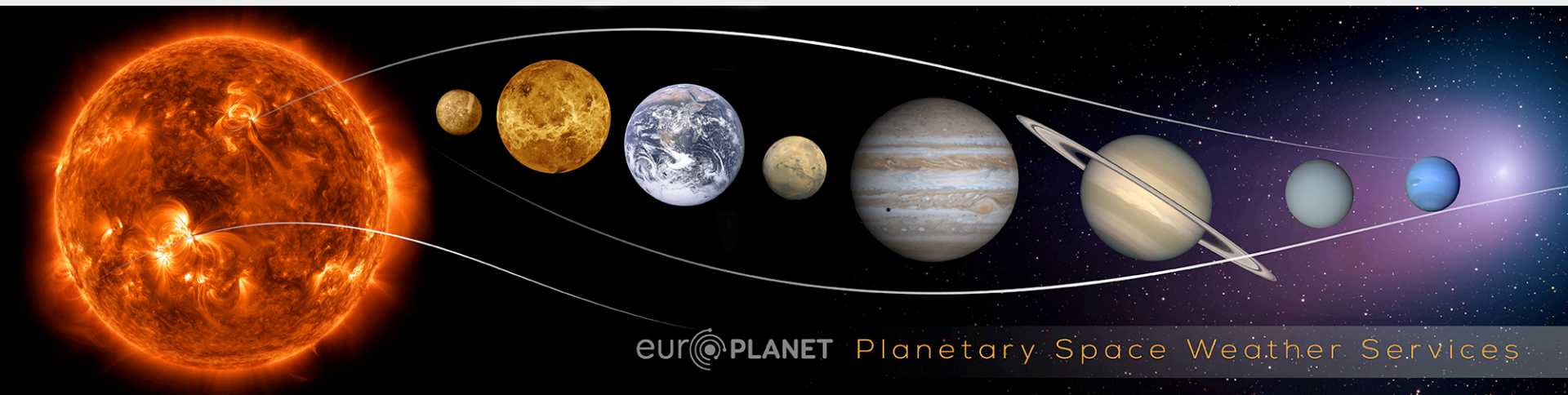
Smart 1, Rosetta, MEX, MAVEN, VEX, HST, MSL, Dawn

2016-2020

Exomars, Juno, HST/JWST, Solar Orbiter

After 2020

BepiColombo, JUICE, Europa Flyby mission



PSWS users

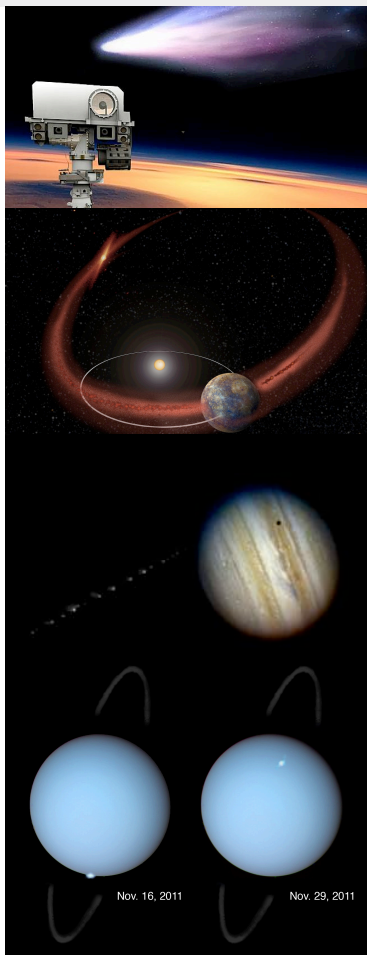
User #1. Scientific community

User #2. Amateur community and General Public

User #3. Space Agencies and Industrial Partners

Our deliverables detailed (PM 12-18, PM 18-24):

1. Planetary meteor shower prediction tool (J. Vaubaillon)
2. Lunar impact detection software (T. Cook)
3. Giant planet fireball detection software (R. Hueso)
4. Generic space weather 1D MHD propagation tool (CDPP)
5. Coupled solar wind/magnetosphere/ionosphere models at Mars (P.-L. Blelly)
6. Comet tail analysis and crossing detection (G. Jones)
7. Coupled solar wind/magnetosphere/ionosphere models at Mars (P.-L. Blelly)
8. Coupled solar wind/magnetosphere/ionosphere models at Jupiter (N. Achilleos)
9. Coupled solar wind/atmosphere/surface model at Mars (M. Grande)



Siding spring comet at Mars + Lunar flashes

MAVEN, MEX, MSL observations in 2014

All PSWS users impacted (User #3: Instruments turned-off for safety)



Comet Encke causes seasonal showers of meteor at Mercury

MESSENGER observations in 2013

All PSWS users impacted (e.g., User #3: BepiColombo operation scenario)

Shoemaker-Levy 9 at Jupiter / Giant planet fireballs at Saturn

Dedicated campaign in 1994 / Detection by amateur astronomer A. Wesley

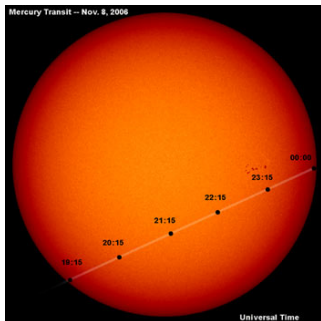
All PSWS users impacted (e.g., User #2: Jupiter Watch network)

HST observation of shock-driven auroral emissions at Uranus

HST observations by Lamy et al. in 2012

All PSWS users impacted (e.g., User #3: Ice Giant mission design)

- Will similar events occur during H2020 ?
Yes, undoubtedly (all events in previous slide occurred during FP7).
- Can we predict them and alert our users?
Yes, this is the MAIN objective of PSWS
But, our developments/services need to be ready early to be efficient
- How can we anticipate in advance?
Train/educate (Link to other Europlanet WGs, LAST SLIDE)
Identify opportunities for warm-up (NEXT SLIDE)
Communicate material (Link to other Europlanet WGs, LAST SLIDE)



Transit of Mercury 9 May 2016

Predict and Monitor the Sun's activity during the transit
Educate and encourage participation from general public
Europlanet Solarscope to be distributed



Juno Orbit Insertion 04 July 2016 and JUNO first observations

Added-value from PSWS models (propagation tool, MIT coupling)
Promote tools within the Juno science teams



Cassini Grand Final 15 September 2017

Controlled fall into Saturn's atmosphere - **A (very small) artificial fireball**
Encourage participation from general public/amateurs in the end of
life monitoring campaign

- **Link with NA1 (proposals for workshops)**

- ✓ 2 scientific workshops on 'The Sun Influence on Planets' and on 'Planetary Cataclysms'
- ✓ 1 innovation and Technical Foresight workshop on 'Planetary Environment Models'

- **Link with NA2 Outreach/Impact (plenty of ideas to share !!!)**



- ✓ Convert Space weather toolkit into 'outreach kits'
e.g., Comet Zoo, [Europlanet Solarscope](#), Mini-Planeterella,
+ The Martian ([Tamagotchi-like videogame](#)): help an astronaut in cruise/at the surface of Mars to protect himself against solar disturbances/radiation predicted by PSWS tools)

- **Link with VESPA**

- ✓ Archive of amateur observations (R. Hueso) + Use of **VO Event** for alerts (B. Cecconi)

- **Link with EPSC and Publications**

- ✓ Dedicated **session and splinter at EPSC** to be proposed from PSWS
- ✓ Special issue of **Journal of Space Weather and Space Climate** devoted to PSWS developments/achievements (J. Liliensten)

- <http://planetaryspaceweather-europlanet.irap.omp.eu/>
- PSWS Team:

CNRS, Aberystwyth, DLR, GFI Informatique, IAP, OBSPARIS, UCL, UPV/EHU, SRC, Wigner

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