

Report from Horizon 2061 Synthesis Workshop Pillar 2: From representative missions to technology requirements

Ralph Mc Nutt (1), Pierre Bousquet (2), Anil Bhardvaj (3), Manuel Grande (4), Oleg Korablev (5), Franck Montmessin (6) Olivier Hainaut (7) and Michel Blanc (8)

(1) JHU/APL, MD, USA, (2) CNES, France, (3) PLR, India, (4) University of Aberystwyth, UK, (5) IKI, Russia, (6) LATMOS, France, (7) ESO, Chile, (8) IRAP, France

Abstract

This talk will summarize the presentations that will be performed during the Horizon 2061 Synthesis Workshop, the third step of the "Planetary Exploration, Horizon 2061" exercise, on September 11 to 13, 2019 in Toulouse, concerning Pillar 2 of the exercise: representative space missions. They will offer their conclusions and will open for their discussion by the EPSC-DPS community present in Geneva, in preparation for the writing of the final report of the Horizon 2061 exercise to COSPAR.

1. Introduction

"Planetary Exploration, Horizon 2061" is a long-term foresight exercise initially proposed by the Air and Space Academy and led by scientists, engineers and technology experts heavily involved in planetary sciences and in the space exploration of the Solar System. This foresight exercise is opened to all scientists, engineers, technicians, journalists, industry and space agencies and people interested in the future of planetary exploration and the space adventure.

1.1. Ultimate objective

The Toulouse synthesis workshop ultimate objective is to draw up to the 2061 horizon (H2061) a long-term picture of the four pillars of planetary exploration:

1. our major **scientific questions** on planetary systems;
2. the different types of **space missions** that we need to fly to address these questions;
3. the key **technologies** we need to master to make these missions flyable;
4. the **ground-based and space-based infrastructures** needed in support to these missions.

The year 2061 symbolically represents the intention to encompass both robotic and human exploration in the same perspective. Its distant horizon, located well beyond the usual horizons of the planning exercises of space agencies, avoids any possible confusion with them and is intended to "free the imaginations". During the workshop, on the one hand, planetary scientists are invited to formulate what they think are the most relevant and important scientific questions independently of the *a priori* technical possibilities of answering them, and on the other hand, engineers and technology experts are invited to contribute to the exercise by looking for innovative technical solutions that will make it possible to fly the challenging space missions that will allow us to address these questions.

1.2. Three successive steps

The "Horizon 2061" exercise involves three successive steps designed to progressively build the three pillars. Its third step is the "Horizon 2061 synthesis workshop", hosted by the Institut Aéronautique et Spatial (IAS) in Toulouse from September 11th to 13th, 2019. Its conclusions will be presented for discussions at the joint EPSC-DPS meeting in Geneva (September 15th to 20th, 2019), and later for discussion and final approval at the COSPAR General Assembly (Sydney, August 15th to 23rd, 2020).

The authors of this abstract will present the contributions to the Toulouse workshop made in the Pillar 2 sessions, which deals with the identification of a representative set of space missions which will be able to address the major science questions of the Horizon 2061 exercise and the following discussion.

2. Contents of this report

The speaker will summarize the presentations made in Toulouse on the representative missions that are

expected to address the major science questions of H2061. These missions can be divided into six “provinces” of destinations:

- the Earth and near-by orbits, from which future Earth-based telescopes can do remote sensing observations of the entire solar system with an accuracy that will increase with telescope size and performances;
- the Earth-Moon system;
- Terrestrial planets
- Giant planets;
- Small bodies;
- The Heliopause boundaries and beyond.

In this summary report, the emphasis will be on identifying the key technologies that will be needed to fly these missions within the Horizon 2061 time frame. The conclusions of the panel discussion following the talks will also be presented.

3. Summary and Conclusions

The presenters will summarize the contents of the Horizon 2061 Pillar 2 on representative space missions and their requirements on enabling technologies, as presented in the corresponding session of the Horizon 2061 Synthesis workshop in Toulouse (September 11-13, 2019). They will summarize the discussions that followed the talks, in the perspective of the report of the Horizon 2061 exercise to COSPAR.