SYMPOSIUM ON TECHNOLOGICAL REQUIREMENTS FOR FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS (A7)
Scientific Motivation and Requirements for Future Space Astronomy and Solar System Science Missions (1)

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EXOPLANET DETECTION TO OBSERVATORIES ROAD-MAP

Abstract

The EXOPLANET detection, identification and characterisation with the ultimate goal to perform analysis of the atmosphere of Earth Like exoplanet are major science objectives. This science will require innovative space system. Since the early 2000's Thales Alenia Space has played a major role in the development of space solutions for exoplanets detection and has indeed been prime of the first European Exoplanet finder: COROT. Building on this experience and system studies (ESA or CNES) , the paper will assess the different step of Exoplanet science and define the associated space concepts and technologies steps to achieve the detections:

- PLATO will be the next European step to increase drastically the catalog of explonets by the wide field observatory made to few tenth of small telescopes. PLATO builds on the experience of COROT for the observation and stabilisation concepts. Much larger, PLATO will benefits of the new generation L2 inertial pointed and high stable platform, developed in the frame of EUCLID. A key challenge will be the production and integration of about 30 small telescopes.

- ECHO could be the next step to perform observation and atmosphere characterisation of large exoplanets. The observed spectral bands induces the need for a cryogenic satellite, and a large aperture to achieve the necessary resolution. For such mission, TAS has retained a thermal architecture derived from PLANCK with V-grooves for a 1st stage of passive cooling associated to a platform inherited from EUCLID. ECHO requires a very high stability but also cryogenic large (1.1m) aperturn instrument.

- DARWIN or LPTF would be the next step to provide observation capability of Earth Like Exoplanet atmosphere. DARWIN will build on the technologies developed on these missions (fine pointing, cold gaz control, cryogeny) but will make a major step by distributing the instrument on 4 satellites to build a nulling interferometer and increasing drastically the size of the mirror. The 4 satellites will be controlled information flying with a tremendous accuracy (few 100 m).. The Darwin mission has been studied since the 2000's by TAS and optical breadboards, formation flying simulators have been designed to demonstrate key performances. The size of the DARWIN mission (4 large spacecrafts, 1 ARIANE V launch) leads to a major challenge to design an affordable system.

From these mission and technology concepts, the paper will build a consistent incremental technology and mission road-maps to make at 2030 horizon exoplanet atmosphere characterisation a reality.