Ice Giant System Architectures: Ramifications for Mission Architectures and Key Technologies

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Abstract

Despite many close similarities between Uranus and Neptune, those planets' systems have some very different architectural elements, such as their positions and orientations in the solar system and the characters of their satellite and ring systems. For instance, Neptune's average heliocentric distance is more than 10 AU larger than Uranus's; Uranus's 97∘ obliquity is radically different from Neptune's more Earth-like 28∘. These differences have significant ramifications for the architectures of scientific flight missions to those planets, for in-situ investigations and platforms that are parts of those missions, and for technologies key to mission feasibility and success.

This presentation will include descriptions of the architectures of the Uranus and Neptune systems, emphasizing characteristics that drive mission architectural options and associated key technologies. The challenge of delivering a flight system of useful mass to the destination ice giant is a significant part of the architectural trade because this limits the mass available for an in situ platform. That delivered mass capability is generally a function of the project's budget (among other influences such as launch date), and the scientific value of the mission typically grows quickly as delivered mass increases. As the tremendously successful *Cassini-Huygens* mission demonstrated, international collaboration can be a significant avenue for maximizing a mission's scientific value, capitalizing on the combined resources of multiple nations and institutions.

This presentation will describe several architectural options (e.g., spacecraft architectures, orbit designs, communications options), with a focus on delivering and supporting in situ platforms and their investigations. This will include brief summaries of the results of the NASA-led Ice Giant Missions study of 2016 and the NASA-sponsored SNAP study of 2017. Discussions of key technologies will accompany the descriptions of the architectures.

Keywords: Ice giant system architectures, mission architectural options, key technologies

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