

# AI in Space: The Era of Autonomous Space Systems

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Abstract: The development of autonomy capabilities is the key to three vastly important strategic technical challenges facing NASA: the reduction of mission costs, the continuing return of quality science products through limited communications bandwidth, and the launching of a new era of solar system exploration characterized by sustained presence and in-depth scientific studies, including the search for life.

Autonomy will benefit future NASA missions by migrating routine, traditionally ground-based functions to the spacecraft, by directly supporting the decoupling of spacecraft from the ground through new operations concepts, by enabling direct links between scientists and the space platforms carrying their instruments of investigation, and by the closing of planning and control loops onboard, enabling space platforms to directly address uncertainty in the real-time mission context.

The talk will survey ongoing autonomy technology development projects at NASA, many of which have been or will soon be the subject of flight technology experiments, or are already targeted for mission use. The talk will also survey the exciting suite of future NASA space exploration missions, and make the case for the central role of autonomy in achieving the goals of these bold, unprecedented missions: cooperating rovers on the surface of Mars, the search for Earth-like planets around nearby stars, asteroid and comet landers, aerobots in planetary atmospheres, and a series of missions to intriguing Europa, perhaps culminating in a submersible to investigate its putative ocean.

Finally, the talk will conclude with some farther-reaching speculations on how to create properties such as long-term survivability and evolvability in future space systems, such that they will be well equipped to extend humanity's exploratory presence into the interstellar realm.