Speech Summaries for Daniel R. Adamo

Questioning The Surface Of Mars As The 21st Century's Ultimate Pioneering Destination In Space

This 1-hour lecture reviews historic Earthly distinctions between exploring and pioneering before applying these distinctions to destinations in space. Although a case can be made for human and robotic *exploration* in space, there is as yet no compelling rationale for "putting down roots" to *pioneer* anywhere off Earth. Why then is the surface of Mars widely accepted as humanity's future "home away from home" to the extent some 200,000 people are willing to attempt forming a permanent colony there? There is no evidence suggesting humans can survive on the surface of Mars long-term, let alone thrive there to produce viable offspring. A variety of evidence is presented to affirm the surface of Mars is a "socio-cultural" destination whose suitability for human pioneering is based on more than a century of fictional literature and poorly informed research as the Space Age dawned. More current knowledge of the "unexplored country" in our Solar System suggests small bodies such as asteroids and the moons of Mars are humanity's best hope for pioneering off Earth this century.

***Aquarius*, A Reusable Water-Based Interplanetary Human Spaceflight Transport**

This 1-hour lecture reviews major challenges to interplanetary human spaceflight and suggests strategies by which they may be addressed. These strategies include pre-emplaced Earth return consumables at the interplanetary destination, water used as a high-efficiency/high-thrust propellant also serving as crew radiation shielding, and transport servicing in a distant retrograde orbit about the Moon. Applied to a hypothetical transport christened *Aquarius*, the strategies are shown to enable routine and sustainable roundtrips between Earth and Deimos, the outer moon of Mars. Knowledge gaps pertaining to *Aquarius* are identified with the intent of motivating changes in current technology roadmaps. After listening to this lecture, anyone with interplanetary human spaceflight interests will be conversant with associated technology issues and plausible means by which they might be resolved.

Trajectory Challenges Faced By Orbiting Infrastructure Supporting Multiple Earth Departures For Mars

This 1.5-hour lecture initially assumes massive payload departures for Mars are conducted in 2020 and 2022 starting from reusable infrastructure in a circular low Earth orbit (LEO) at 400 km height. Coasted LEO motion following the 2020 departure indicates a formidable LEO plane change is required to satisfy 2022's departure geometry for Mars. Celestial sphere plots (CSPs) are introduced and used to illustrate Earth departure geometry for Mars in 2020 and 2022. Strategies are suggested by which the 2020 orbit can be evolved to support a 2022 departure without launching single-use infrastructure. From listening to this lecture, it will become apparent why a LEO-based propellant depot cannot routinely support multiple interplanetary departures.

Interplanetary Cruising With Earth-To-Mars Transit Examples

This 1.5-hour lecture introduces the fundamentals of orbit motion and applies them to designing a realistic Mars mission by solving the *Lambert boundary value problem* for Sun-centered trajectories. The *patched conic* technique is then applied to a Sun-centered transit from Earth to Mars, producing geometric constraints on Earth departure as an example. Summarizing this process, the fundamental design trade between minimal time-of-flight and minimal propulsion is made apparent for missions to the Moon, near-Earth asteroids, and Mars. By listening to this

lecture, anyone with an understanding of high school physics will become familiar with the challenges of interplanetary spaceflight, particularly when human factors are considered.