White Paper - ASAT AIAA SpaceDock

Abstract

We describe herein a novel approach to establish a cislunar infrastructure designed to support the commercial exploitation of both near and interplanetary space. We propose that the commercial space industry place in certain orbits (discussed below) a fleet of multipurpose spacecraft (hereafter referred to as Spacedocks) with autonomous fueling and maintenance capabilities for satellites and other spacecraft.

This paper is organized as follows:
Introduction
Optimal Orbits
Spacedock Functionality
Spacedock Roadmap
The Business Model

Optimal Orbits
The orbits will be selected such that the Spacedocks maintaining the orbit can be reached by a one stage rocket or the first stage of a multistage rocket from high usage spaceports such as Kennedy and Edwards. (lists of 'popular' high usage spaceports).

The SpaceDock
These Spacedocks would provide one or more of the following capabilities:

SpaceDock is designed and built to simplify autonomous construction and to support modular expansion as required by future endeavors.
Common satellite-bus components (solar panels and power management system, attitude control system and flywheels, station keeping thrusters) sufficient to support envisioned modular expansion, docked spacecraft, and leased real estate.
Sufficient intelligence to perform its mission autonomously
A modular structure to allow expansion and fission.
A fuel depot and autonomous fueling capability
One or more manipulator arms to dock and maintain spacecraft.
An additive manufacturing capability
A semi-permanent docking station for research or commercial spacecraft/satellites wherein Spacedock provides the usual satellite-bus requirements, such as power, attitude control, temperature management, stability, etc., and other 'designer' capabilities as required.
One or more optional autonomous mobile units (Spacetugs) with:
Sufficent intelligence to perform its mission,
Generic docking collar(s),
Enough thrust to performing orbital transfer operations on cislunar spacecraft,

Optional manipulator arm(s).

The SpaceDock Roadmap
Identify Optimal Orbits
Identify minimal capabilities for first launch
Specify Drain & Fill Fixture standards
Identify strategic alliances
Design and build Spacetugs and Spacedock support facility.
Launch Spacedock & Spacetug into first orbit and stabilize system.
Launch Fuel depot supplies and dock with Spacedock via Spacetug.
Open for business.

The Business Model

The business model will be similar to a conventional Earth based service station or airport FBO. The Spacedock will fuel (and refuel) spacecraft enroute to other orbits, and will refuel and recharge on-orbit satellites thus increasing the lifespan of geosynchronous (GEO) communications satellites and other high earth (HEO) orbit satellites.

Our Spacetugs will meet a spacecraft enroute, refuel it, and optinally carry it to its designated orbit. The multistage refueling and ferrying costs will be significantly less than the cost of carrying fuel onboard a launch vehicle as is shown in the tables below.

Our Spacetugs will have the capability to ferry fuel and other consumables to onorbit satellites to refresh them via standard drain & fill adapters at significant savings over other methods.

The SpaceDock 'real estate leasing' endeavor will reduce the cost of launching and maintaining research or commercial satellites on orbit. The customer need only get the approved device to a specified orbit or trajectory, and the Spacetug will take it from there to either the specified Spacedock or to a specified orbit.