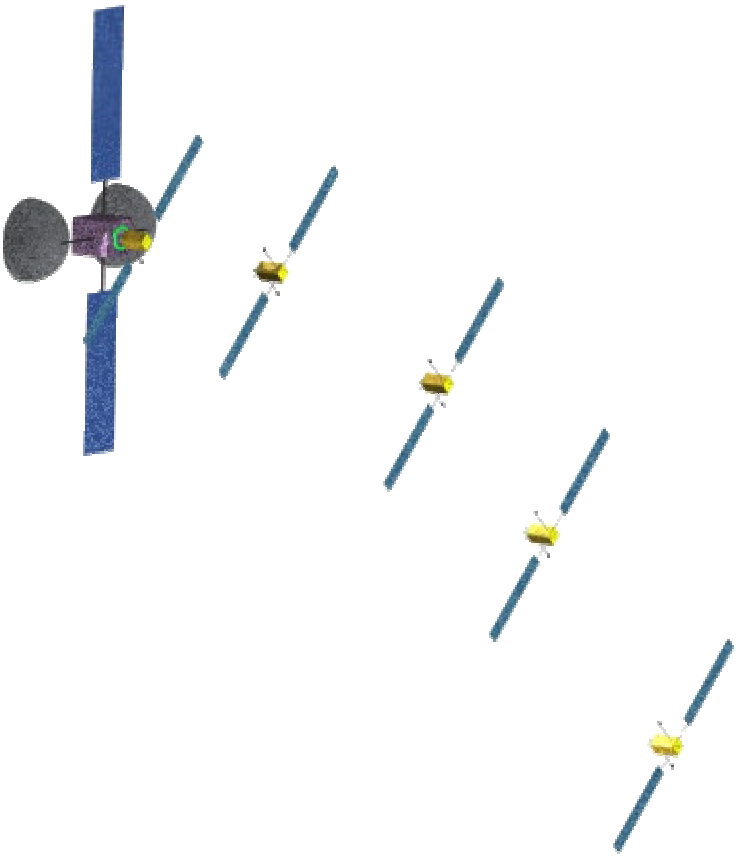
On-Orbit Servicing

OOS Corporation



Executive Summary

November 2003

Servicing

Highly Reliable Satellite Life Extension
Never again lost in space

On-Orbit Servicing
Executive Summary

The launch and operation of satellites for commercial purposes has grown exponentially since the early 1980's. The highest rate of growth is in the geosynchronous orbit, thirty-five thousand kilometers above the Earth, where satellites are 'fixed' over specific regions of the Earth. Regional coverage, demand for instantaneous communication and delivery of high-quality television programming result in the commercial communications industry's proliferation of satellites in this orbit. As commercial ventures, the generation and continuation of revenues is the overarching goal.

Satellite operators must have the appropriate assets to provide the services to meet this goal. Satellites have a fixed life based on the amount of propellant available to maintain their position in orbit. Many times, the revenue generating capability of an otherwise functional satellite ends when its onboard propellant is depleted.

The On-Orbit Servicing (OOS) Corporation will provide satellite operators a service that will extend the life of their satellites in a non-intrusive manner and thereby maximize the revenue of their on-orbit assets.

Final Proposal Contents

Volume 1 Executive Summary
Volume 2 Technical Proposal
Volume 3 Management and Financial Proposal

Executive Summary Contents

The executive summary covers the following subject areas:

Overview

The Need

Telecommunication satellites in geosynchronous orbit are the highest value tangible assets in any orbit. The value of the satellites is typically measured in the number of transponders and the broadcast frequency. Manufacturing, launch and insurance costs the satellite operators incur represent their investment that is recovered by the fees charged for services. Once the satellite operator has recovered these investment costs, the revenue, minus the operating costs, is the profit of the satellite. The revenue limiting factor for a specific satellite is lifetime, which averages 10 to 15 years for satellites in geosynchronous orbit.

The satellite's lifetime is a function of three factors:

- The design life of the equipment onboard the satellite
- The environmental effects in geosynchronous orbit
- The propellant used for stationkeeping of the satellite

Failures or diminished services are common as satellites progress through their design life. Some of these instances are consequences of the first two limiting factors. However as the design of high reliability electrical components becomes more prevalent and as more spare transponders carried on individual spacecraft to increase failure tolerance, the satellite life is limited more often by the amount of propellant onboard.

Satellite operators are forced to retire spacecraft which could continue generating revenue because fully, and near-fully, operational spacecraft have no propellant remaining. After retiring a spacecraft, the operator then must invest again in the manufacture, launch and insurance costs. This is analogous to abandoning a functional automobile when it runs out of gasoline and buying a new one to replace it.

Therefore, the OOS Corporation sees an opportunity to provide the telecommunications satellite operators a service that enhances the profit potential of existing on-orbit satellites. The operator, by deferring the investment expense for new satellites, could invest those funds until they are required thus realizing even more profit.

Geosynchronous telecommunications satellite operators will benefit from a service that enables continued operation of functional satellites that have depleted their onboard propellant.

The Objectives

In order to meet the identified need of the satellite operators, the OOS Corporation will satisfy the following objectives:

The OOS Corporation must enable the customer to continue operation of their satellites, providing telecommunications services and producing revenue. This continued operation allows the customer to **maximize the revenue potential** of the satellite.

For maximum revenue potential, the customer satellites must maneuver and perform stationkeeping within their orbital slots even when onboard propellant

has been expended. A **propulsive capability provided by OOS is required**. This capability can also be used to boost a satellite to graveyard orbit after completion of service to open the orbital slot for future revenue generating capability.

Geosynchronous satellites are complex, both operationally and technically. Their design by nature requires high reliability. **The OOS spacecraft will be designed with comparably high reliability** to ensure that any operation near or with the customer satellite minimizes the risk to the customer.

The OOS Mission Statement as derived from the needs is:

OOS Corporation provides highly reliable, non-intrusive propulsion capability to spacecraft at geosynchronous orbit to maximize the users' revenue potential.

The Services

The OOS Corporation provides the following on-orbit services to geosynchronous communication satellites:

GEO lifetime extension service:
The OOS satellite performs station keeping, attitude and orbit control for the customer satellite. The service starts with the docking in GEO and lasts until release of the customer satellite in the same orbit.

Nominally, the OOS satellite carries out the attitude and orbit control for the docked OOS/customer satellite stack. The customer may provide the attitude control during servicing if required.

Nominally, the OOS control center controls the combined satellite stack. The customer may provide the ground control during servicing if desired.

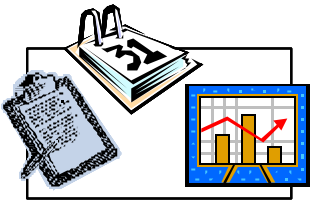
De-orbiting Service:
The OOS satellite transports the customer satellite to graveyard orbit. The service starts with docking in GEO orbit and ends with release in graveyard orbit.

Combined GEO servicing/De-orbiting Service:
The OOS system provides life extension followed immediately by de-orbiting to graveyard.

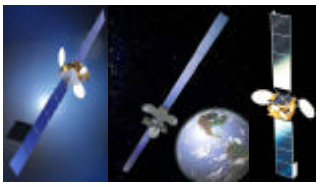
The OOS Corporation development plan and the financing are based on the standard services defined above. However, other services could be provided, such as visual inspection or re-positioning, and are already being considered for the second OOS spacecraft constellation.

The Solution

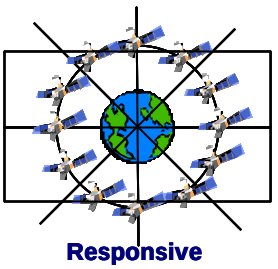
To meet the mission objectives and fulfill the Mission Statement, the OOS Corporation has designed an architecture that integrates the system elements and provides the basis for defining each of the components.



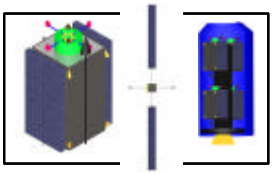
Flexible service-based contracts tailored to customer needs



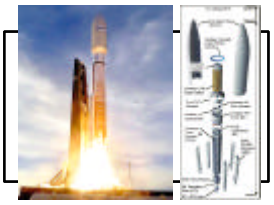
Non-intrusive capability, compatible with a wide market



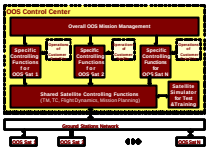
Responsive constellation



Reliable, simple satellites



Economic Launch Strategy

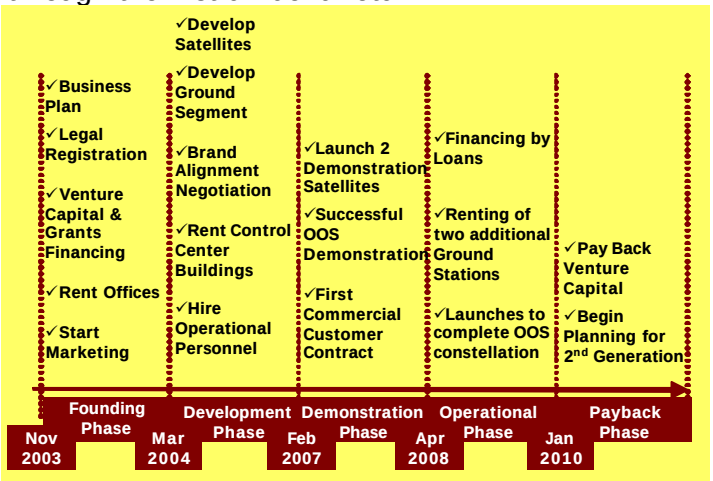


Robust, scalable, control capability

The system has the following characteristics:

- A total of 14 OOS spacecraft
  - 2 demonstrators and 12 operational spacecraft launched as the customer base and demand for service develops
- Sub-geosynchronous orbit with inherent drift rate relative to GEO
- Up to 8 years of service and 4 service events per satellite
- 1 ground control center with 3 ground stations for full GEO access
- Rapid response, within 15 days, to user requests for service
- Attitude control provided for the combined OOS-Customer satellite stack
- No adverse impact on existing customer services
- Seamless interface with customer ground station

The business is divided into five phases which encompass the business development through the first dividend return.



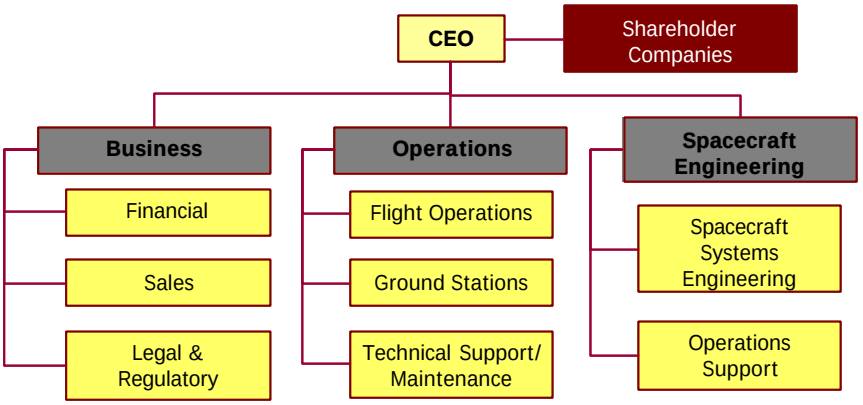
Management

Personnel

Staffing of the organization will occur as the OOS Corporation moves through the stages of product development. The initial staff will consist of a core staff of 10 engineers, scientists and business personnel who will conduct the system design, spacecraft procurement and development, and marketing/sales strategy. Staffing will incrementally increase throughout the life of the program as the spacecraft constellation builds.

Organization

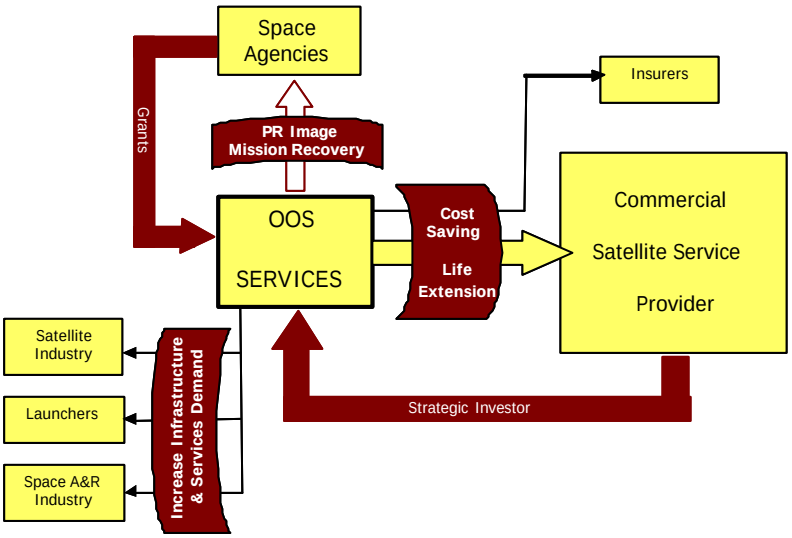
The OOS Corporation management and key personal will have a strong background in the commercial space business as well as in spacecraft engineering and operations. The staff has gained experience and insight into potential geosynchronous customers through a comprehensive market survey.



Market

Market Selection

OOS Corporation conducted systematic industrial analyses to identify stakeholders and select a target market for OOS services. The stakeholders are those entities who are interested in or impacted by OOS.

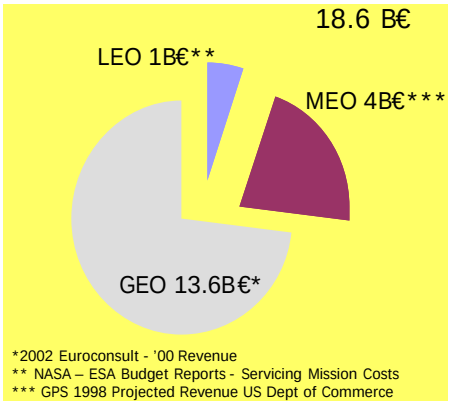


Next, the OOS Corporation segmented the potential market based on physical location of target satellites. Data for the segments are centered on the physical location of satellites, commonly referred to as ranges of altitude above the

Earth, and the total revenue in each given altitude band. The physical segments are:

- Low-Earth Orbit (LEO)
- Medium-Earth Orbit (MEO)
- Geosynchronous-Earth Orbit (GEO)

The revenues were then determined for each segment (altitude based).

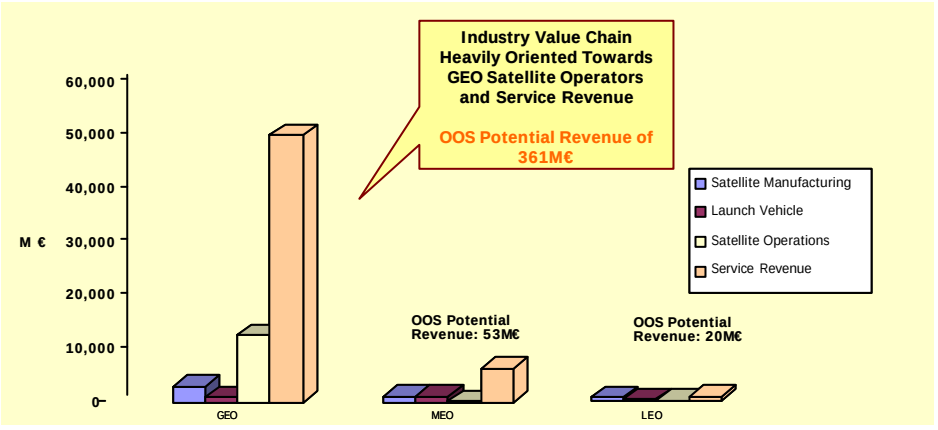


The most attractive market segment is geosynchronous orbit.

OOS Corporation researched each altitude range by analyzing specific satellite operators and developing a user/customer profile. The profile establishes the revenues for each potential customer and serves as the basis to choose specific customers as contacts for high revenue service targets for the OOS Corporation.

Value Chain Analysis

A value chain analysis complements the user/customer profile and determines the value of the individual phases in the creation of a product. The OOS Corporation has performed a value chain analysis focusing on the GEO, MEO and LEO market segments. The total revenue available per year is estimated by orbit type for the individual phases of manufacturing, launching and operating satellites. The OOS revenues were calculated by assuming a percentage of the overall orbital revenue.

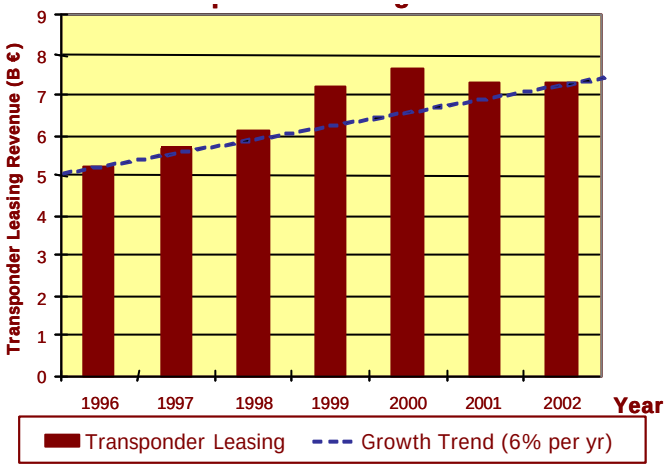


In geosynchronous orbit, telecommunications satellites offer the highest revenue potential.

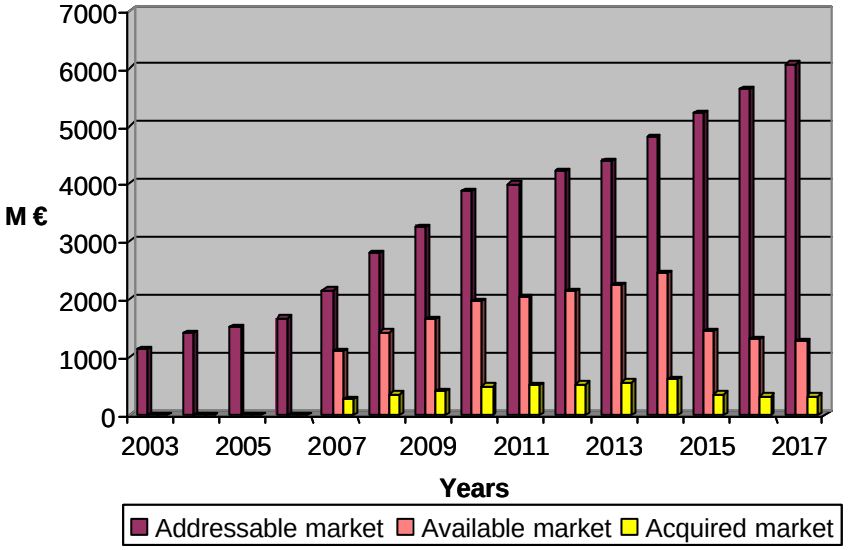
The GEO Satcom Market

In 2002 there were more than 175 telecommunication satellites in GEO. The annual average revenue of a telecommunication satellite is about **40 M€**, and the average revenue growth over the last 6 years was 6%. Due to the stagnation of the market in the last 2 years, the OOS Corporation has assumed a conservative GEO market growth of **3%** as baseline for the revenue projection.

The revenues from the fixed and mobile satellite services providers account for 86% of the transponder leasing revenues in GEO as reported by the Satellite Industry Association (SIA). The Direct-To-Home service satellites provide the highest revenues per year (700 M€ to 1 B€), however, the number of these satellites is relatively low and revenues include end-consumer subscriber fees.



The predictions of market performance/modeling were made after the target market was established. The OOS Corporation assessed the current and projected markets, with geosynchronous life extension as the focus.



The analysis contains data for the addressable, available and potential acquired market revenues. The addressable market represents those satellites that are in geosynchronous orbit, available are those satellites that are approaching the end of their propellant life and acquired are the percentage of satellites that the OOS Corporation is targeting.

The data from the market model shows that service missions targeting life extension and de-orbit are inherently profitable. Life extension and de-orbit missions do not require significant manipulation of the customer satellite or its equipment. Additionally, they do not need the complex maneuvering necessary in other rescue situations.

Based on an analysis of LEO, MEO and GEO customer requirements and opportunities, the OOS Corporation has designed a business and technical solution that delivers a non-intrusive propellant life extension for 3-axis stabilized satellites in geosynchronous orbit. Additionally, the service has been designed to provide for deorbiting of satellites.

The market model shows non-intrusive life extension in geosynchronous orbit is the primary target service with de-orbit as a secondary service.

Competitors

OOS Corporation carefully assessed individuals, companies and corporations who are currently pursuing missions or technologies in the servicing arena. These potential threats to the OOS Corporation customer satellite pool were identified to determine how OOS Corporation service offerings compare.

The OOS Corporation has defined four categories of competitors composed of civil space agencies, commercial satellite manufactures, military operators and manufacturers, and commercial on-orbit service providers. Competitors in each of the categories were evaluated against their current and past roles in orbital servicing, relevance of servicing to their existing operations, and possible benefits to pursuing servicing.

Competitor Group	Comments
Space Agencies (NASA, ESA, CNES, DLR, NASDA)	▪ May choose to provide OOS services internally leading to a market reduction for commercial OOS providers ▪ May serve as a source for developing OOS technologies
Commercial Satellite Manufacturers (Boeing, Astrium, etc)	▪ Could develop proprietary services unique to product lines ▪ May become strong competitors in long term
Military Operators and Manufacturers	▪ Closed market due to classified nature ▪ Operations could evolve to capture commercial markets
Commercial OOS Service Providers (Space Island Group, Orbital Recovery, MD Robotics)	▪ **The true competition** ▪ Planned delivery to market in near term ▪ Highly competitive ▪ Complete business-oriented approach

OOS Corporation has executed a detailed competitor analysis to explore the business strategy and capabilities of the individual commercial entities. The work has identified a single viable competitor to the OOS Corporation, Orbital Recovery Corporation (ORC).

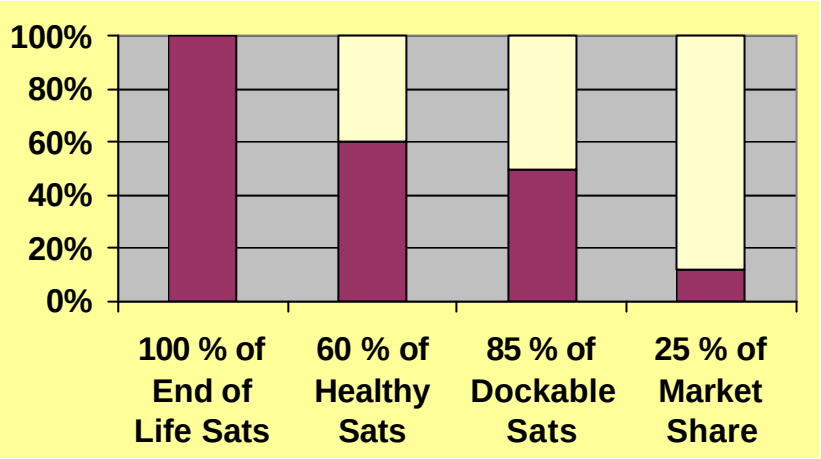
	 Target Orbit	 Start of Service	Responsiveness	Service
Highly Reliable Satellite Life Extension Never again lost in space	GEO	2008		Change in orbital velocity (delta-V), life extension, de-orbiting
Orbital Recovery Corporation (ORC)	GEO	2005		Change in orbital velocity (delta-V), life extension, de-orbiting

ORC is targeting the geosynchronous market with propulsive capability. ORC appears to be the only immediate threat to the OOS Corporation business plan. ORC has developed a launch vehicle alliance (Ariane 5) and is expected to announce a first customer soon.

The OOS Corporation competitive advantage is spacecraft poised on-orbit to service customer satellites while its competitor must wait for a launch opportunity prior to each servicing event.

Market Share

The OOS Corporation sized the projected market after having defined the target market and competitors. The data used for potential customer spacecraft was drawn from an extensive industrial database of on-orbit satellites developed by the OOS Corporation. The total number of competitors is assumed to be one. The OOS Corporation is conservatively targeting 25% of the total market.

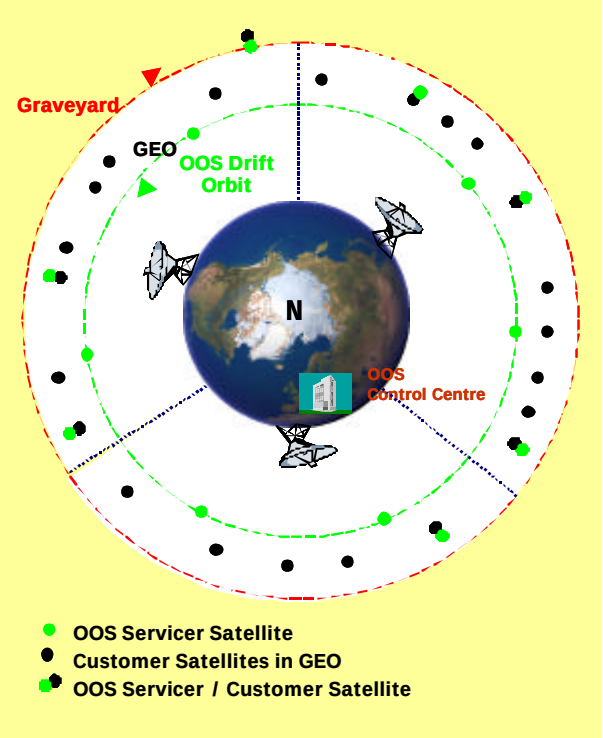


Product

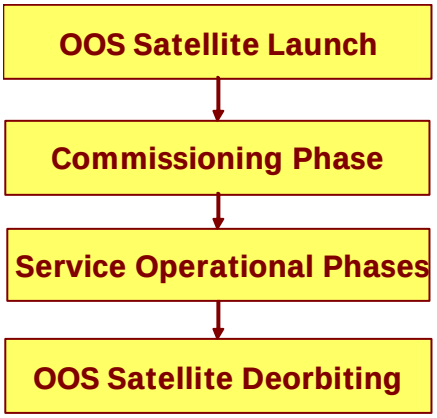
Mission Strategy

The OOS Corporation strategy centers on providing non-intrusive propulsive capability to customer satellites to extend their operational life. The mission strategy permeates all aspects of the OOS system and can be categorized into four phases.

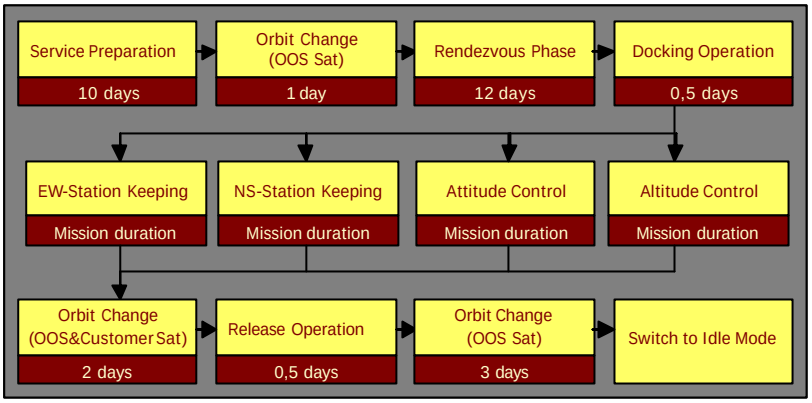
The OOS Corporation space and ground segments support a distributed constellation of spacecraft in constant transition between orbits (graveyard, GEO and drift) and ground station.



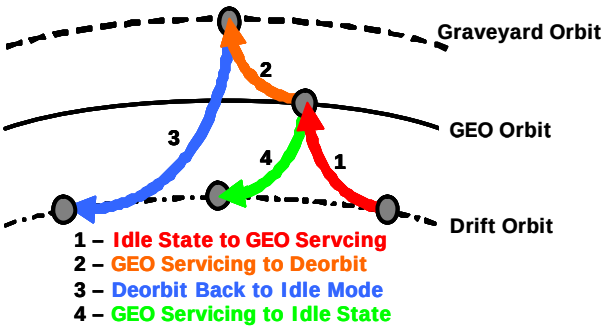
The OOS mission phases are divided into satellite and service operational phases. An OOS spacecraft passes through all phases during its lifetime.



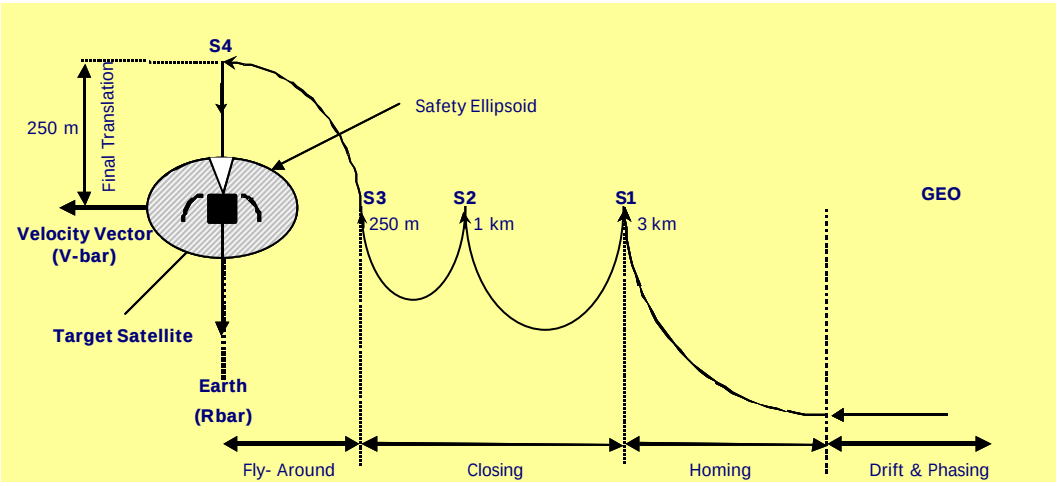
The service operational phases are passed through several times by each satellite and are dependent on the type of service being provided.



The transitions between orbits begin and end at the nominal orbit states.



The approach trajectory entails progressive movement towards the customer satellite, with a series of control points located in the geosynchronous orbit (S1, S2 and S3) to verify the relative position and velocity relative to the customer satellite.



This strategy is based on operational missions such as Space Shuttle docking with Mir and the International Space Station; and the Japanese ETS-VII mission.

Drift and phasing are ground-controlled maneuvers that move the OOS spacecraft to within 20-30 km of the target. The homing maneuver is designed to bring the OOS spacecraft to a target point (S1), on the Geo-synchronous

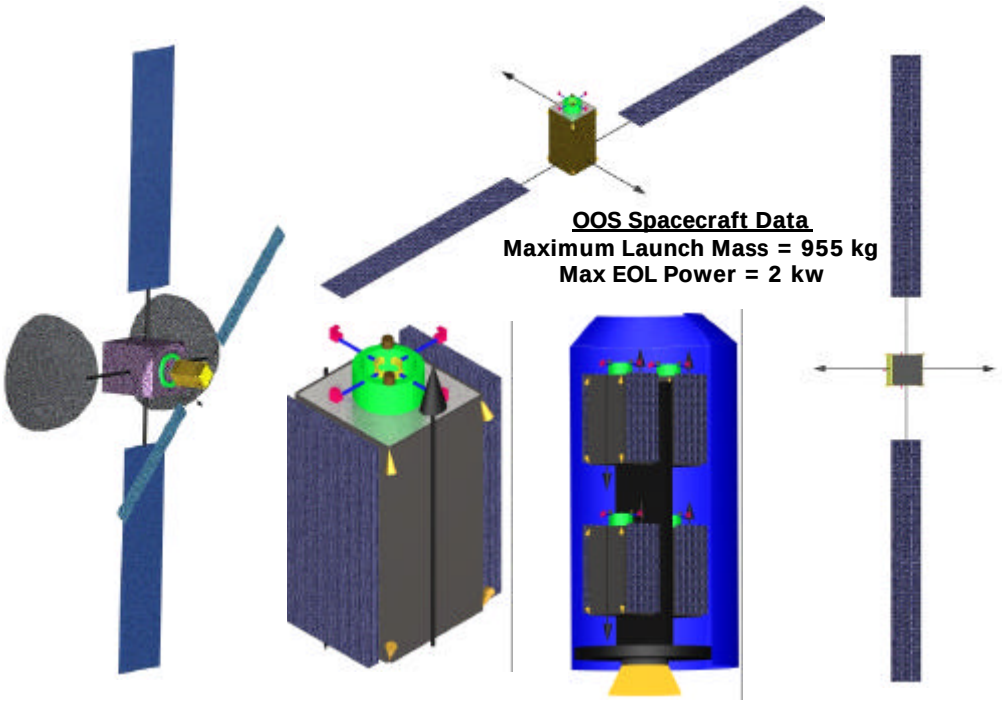
orbit, 3 km behind and coplanar with the customer satellite. The closing maneuver moves the OOS spacecraft to the point (S3), on the Geo-Synchronous orbit, 250 m behind the target. At S3, the OOS spacecraft is rotated to point the docking mechanisms toward the target, aligning its docking axis in the target direction. The final translation maneuver brings the OOS spacecraft to dock with the target, keeping the axial closure rate lower than 2 cm/s.

The key attributes of the mission are:

- Pre-positioning of spacecraft in a sub-geosynchronous orbit enables faster response time versus competitors
- No slot is required in geosynchronous orbit eliminating international coordination for obtaining a geosynchronous slot
- OOS spacecraft provide propulsive capability for station keeping and spacecraft disposal to a graveyard orbit
- OOS spacecraft are de-orbited at the end of their operational life in compliance with international guidelines
- OOS spacecraft can reliably dock with any 3-axis stabilized satellite in geosynchronous orbit, undock and repeat

Spacecraft Design

The OOS Corporation has chosen a spacecraft design that is based on simplicity, heritage technologies, and standard commercial-off-the-shelf equipment. The spacecraft design does not depend on any modification to the customer satellites.

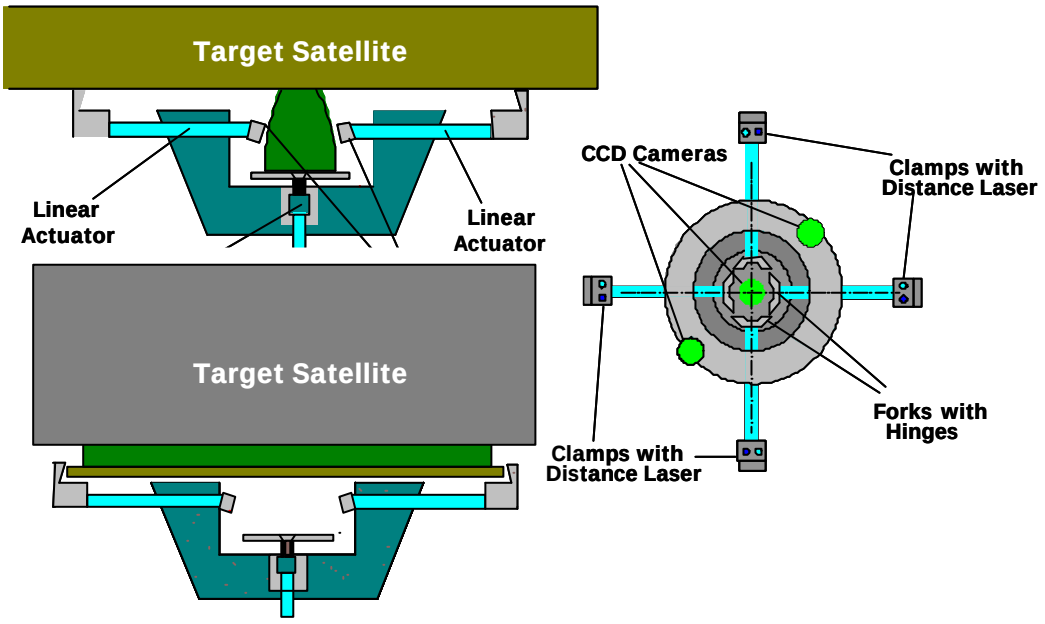


The technical design is based on a set of requirements derived from the OOS mission statement. Key design drivers are:

- The system shall provide non-intrusive docking and propulsion to maintain station keeping and attitude control for the customer satellite
- The system shall provide the capability to de-orbit the customer satellite to a graveyard orbit 350 km above the GEO ring.
- The system shall not interfere with the normal operational capability of the customer satellite.
- The cost of the OOS spacecraft (including launch) shall be less than 10 M€ per lifetime year.
- The spacecraft lifetime shall be 8 years.
- Each OOS spacecraft shall be capable of providing 4 servicing events over its lifetime.

OOS spacecraft subsystems use off-the-shelf equipment in innovative ways to meet the requirements.

The non-intrusive docking mechanism is a dual-use system. The mechanism is capable of attaching to the customer satellite at either the apogee kick motor or to the launch vehicle adapter ring. This ensures compatibility with a large number of customer satellites. The system supports docking with three cameras for alignment and distance measurements in concert with a laser ranging system.



The propulsion system is sufficient for an 8 year mission life. OOS has chosen electric propulsion to meet the propulsive requirements with a small spacecraft thereby minimizing launch costs. Pulsed Plasma Thrusters are baselined with cold gas as a backup for emergency maneuvers where higher thrust is required.

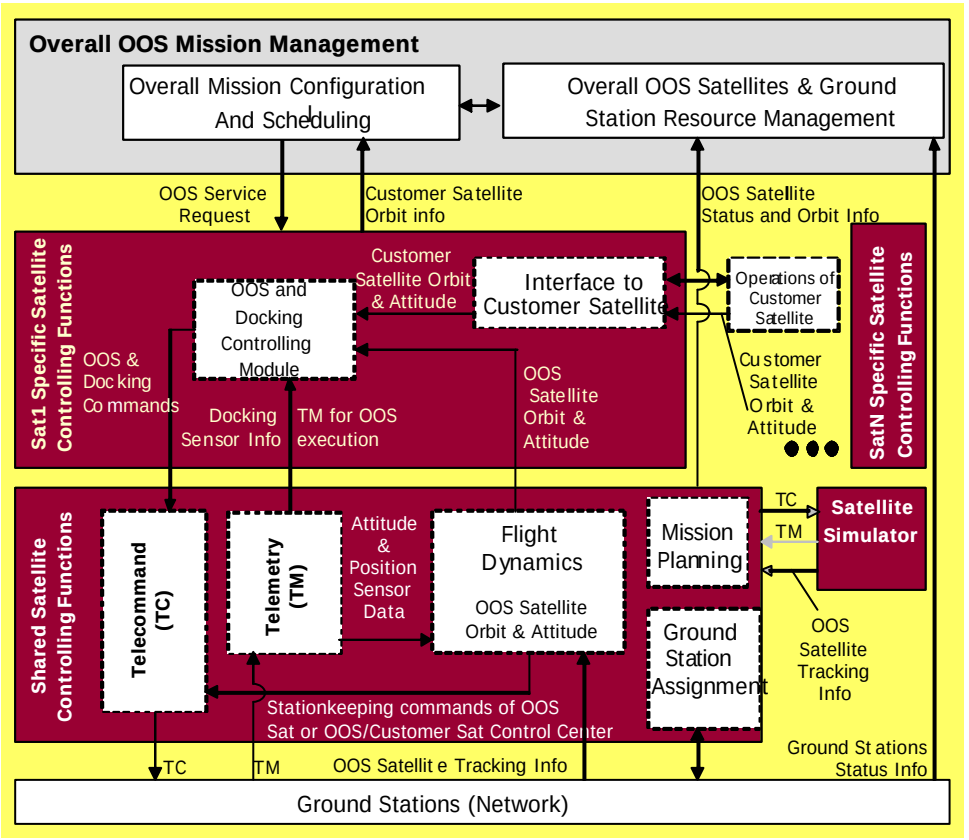
The Attitude Control Subsystem provides active control of the docked OOS spacecraft and customer satellite to meet the customer's pointing requirements. Three-axis stabilization is achieved using reaction wheels. The propulsion system described above also serves to prevent wheel saturation.

Other notable spacecraft design attributes are:

- Spacecraft configured to respect any stay-out zones around the customer satellite
- Power system sized to meet electric propulsion demands throughout the 8 year mission life
- Communication system has a spread spectrum capability designed to prevent interference with customer spacecraft
- Lightweight structure designed to be compatible with multiple launch vehicles
- Structural panels used for ease of integration
- Thermal design dissipates heat away from customer satellite

The spacecraft is designed to utilize the Atlas V launch vehicle in the 551 launch configuration with a direct injection into geosynchronous orbit. This launch strategy allows a smaller spacecraft, decreased mission complexity, and satisfies the 10 M€ per lifetime year requirement.

Mission support is provided by a distributed ground network consisting of two remote ground stations and a single control center built with off-the-shelf technology. The autonomous rendezvous and docking operations are controlled from the OOS Control Center by an automated algorithm under the supervision of the operations team.



Spacecraft design compliance to mission requirements clearly shows that the mission is technically feasible. The payload and the satellite are characterized by their simplicity, robustness, and flexibility.

Marketing

Marketing Strategy

The marketing and sales strategy is based on satisfying the needs of our target customer, the GEO telecommunication operators, and to neutralize the advantage of our competitor.

The key customer requirements are:

- Demonstrated technical qualification of the service.
- Service provider credibility, viability, strength and longevity
- The price of the service shall not impact the customer profit
- Fast response time to customer service request

The competitor advantages are:

- Introduction of on-orbit servicing 3 years ahead in schedule
- Targeting the same market segment with similar services
- A developed vision of their product capabilities

The OOS strategy is crafted to provide an optimal mix of four key elements: Product, Price, Promotion, and Placement that are properly aligned for a product which will be introduced during the late 'embryonic' to 'take off' stage of the on-orbit service product life cycle, in which there is at least one viable competitor.

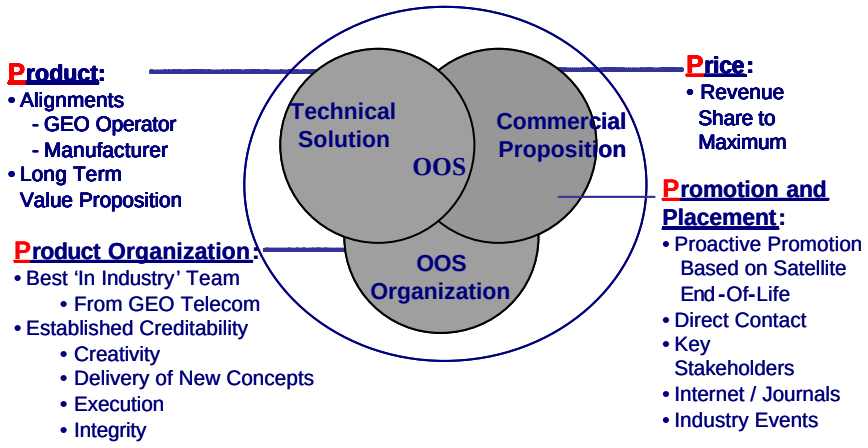
The marketing and sales strategy is based on the following fundamentals:

- ***Product differentiation***: Differentiation of the short and long-term product offering, anticipating that a second-generation OOS service will be introduced
- ***Organization differentiation*** as a secondary product feature
- ***Brand name alignment*** for higher market acceptance
- ***Equal participation*** with the competitor, but not leadership, in advertising during the concept awareness stage

The OOS Corporation will be positioned as a viable alternative focused on:

- Competitive advantages of the product
- Alignment with satellite manufacturer
- Simplicity – Priority on minimizing risk. Multi-generational product development and introduction allows qualification of servicing advancements in stages.

Marketing Mix



Product

Given the importance that the perspective customer places on the strength of the organization and its leadership; the leadership team, sponsors, and organizational characteristics will be considered as part of the service offering. Key to the organization will be the members of the leadership team who have established credibility in the GEO industry. These individuals must have a proven record for introducing new technology and concepts, with flawless execution.

An integral part of customer acceptance is the proven success of the concept.

The OOS Corporation seeks to further differentiate itself by aligning with a satellite manufacturer (possibly the manufacturer that will build the OOS servicing satellite), and providing a name-brand associated with its product. The OOS Corporation plans to co-develop with this satellite manufacturer an OOS spacecraft that is able to provide additional services to future cooperative spacecraft. This ability to co-develop a patent may effectively offset the advantage that the competitor has in its license for docking and will start to develop the future service offering.

Promotion and Placement

The OOS Corporation expects to introduce the product when the market is interested and convinced on the product due to the anticipated entry into the market of the competitor, and will work to educate potential customers on the benefits of on orbit servicing and key product offerings, focusing on differentiation, which will be made by OOS.

The OOS Corporation will utilize the press to the fullest extent possible to publicize the product and vision. The OOS Corporation will establish a robust Internet site that describes the vision of OOS, product development timeline, management team, and investor relations. Finally, OOS corporation advertising links will be placed on key industry information sites frequented by the targeted audience (i.e. general, technical, financial and risk management audience).

Sales Strategy

The OOS Corporation Sales Strategy used to achieve revenue objectives is based on an in-depth analysis of the potential clients.

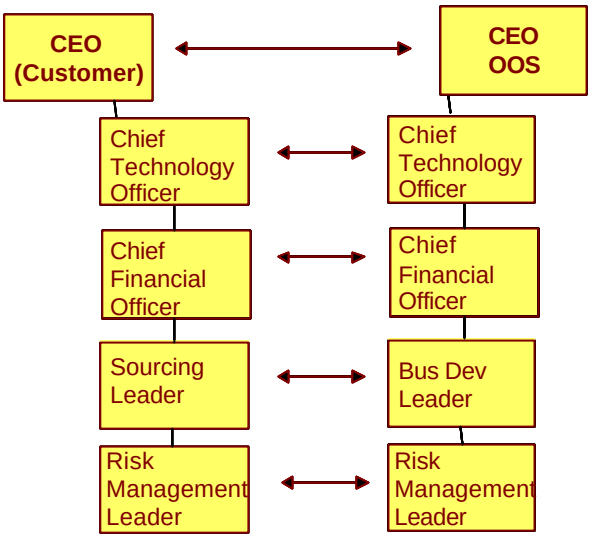
Those clients are Operators with the following characteristics and needs:

- GEO Operators with satellites approaching End of Life within 4 years.
- Operators seeking to postpone capital expenditures associated with satellite procurement.
- GEO Operators who are experiencing unanticipated fuel lifetime limitations with a spacecraft.
- GEO Operators who perform satellite redeployments as part of their fleet management plan.

The key sales message of OOS consists of two key points:

- Protect and grow Net Income through Satellite Lifetime Extension
- Financial management enhancement

Key contacts for multi-layer selling within a target organization include interfaces at multiple levels. The Technology Officers establish and track the compliance of the OOS service to the customer requirements. The Financial Officers establish the pricing structure for the customer. The Sourcing Lead and the Business Development Leaders setup and negotiate the contractual relationship. The Risk Management Leader tracks and develops mitigation strategies for identified risks to both OOS and the customer.



The OOS client list is prioritized and based on established, financially viable GEO telecommunication operators with the largest number of spacecraft nearing end of life within the next 3-4 years. Example potential clients are: SES Global, Intelsat, PanAmSat, JSAT, Eutelsat, Loral Skynet, Telesat, Hispasat, DirecTV, etc.

Revenues

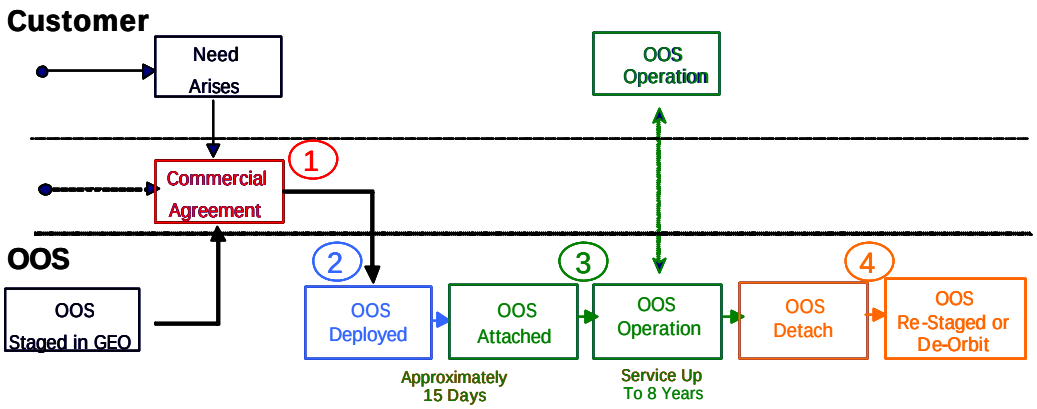
The Services

The single source of revenue for the OOS Corporation is the customer payments for OOS services. The OOS Corporation provides the following on-orbit services to GEO communication satellites:

- *GEO lifetime extension service*
- *De-orbiting Service*
- *Combined GEO servicing/De-orbiting Service*

The Service Provision Process

The OOS satellites are deployed to customers through the following sequence of events:



1) In advance of a customers' need for on orbit servicing or at the time the need arises, OOS and the customer come to agreement on the service contract Terms and Conditions.

2) The OOS Spacecraft deploys from its in-orbit position and within 15 days arrives at the spacecraft to be serviced.

3) The OOS spacecraft attaches to the customer spacecraft. The combined satellite stack control either remains with the OOS Corporation or handed over to the customer.

4) At the end of the contract period, the OOS detaches from the customer satellite and deploys to another mission, moves to an in-orbit staging area, or de-orbits.

Pricing Strategy

Three key principles of the OOS pricing strategy encourage satellite operators to use OOS services as a viable fleet management tool:

1) Maximum price of 27.5 M€ is substantially equivalent to the charges an Operator typically incurs (i.e. 23 M€ - 29 M€) in its Net Income statement for the ownership and operation of a spacecraft in GEO.

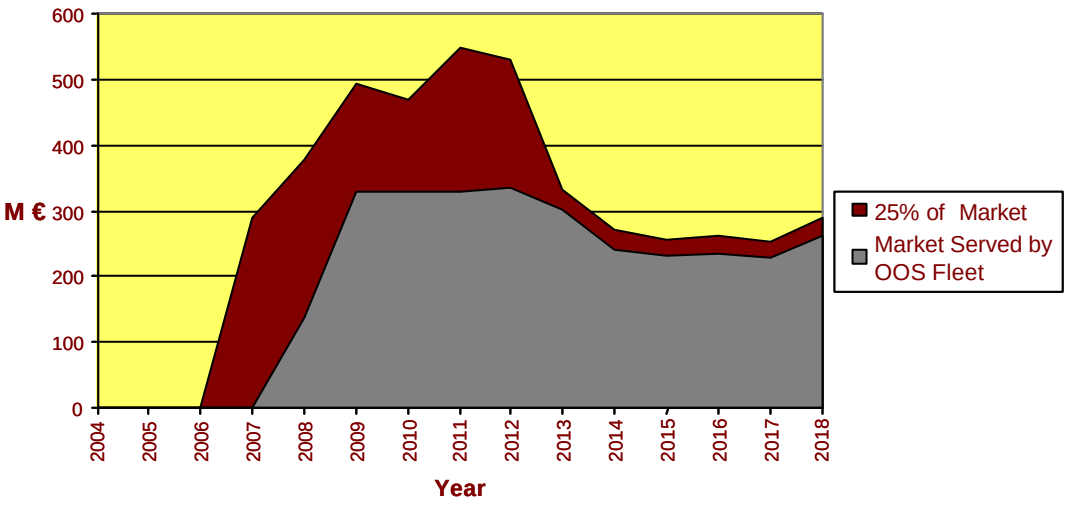
2) Minimum price of 23 M€ is equal to the revenue per OOS spacecraft required to cover the costs of the OOS Corporation operating its fleet at 90% utilization.

3) Total price charged for OOS services shall not exceed 70% of the revenue earned by the satellite being serviced.

Minimum and Maximum price will increase on an annual basis to reflect 2.2% of inflation for variable Operating Expenses of 10 M€, which also includes ongoing In-Orbit insurance costs. Prices will be adjusted on a pro-rata basis for services used less than one year, which is more attractive for the customer than the current pricing concept of our unique competitor

Revenue Projection

The Revenue projections are based on an assumed annual GEO market growth of 3% and on a fleet utilization ratio of 90%, targeting 25% of the market share. The long term number of service opportunities fully occupies the complete OOS satellite fleet.



Cost

The assets cost are directly derived from the technical system analysis. The depreciation period for the recurring investment is the OOS satellite lifetime.

Assets	
Satellite RDT&E	49.6 M€ (first constellation) 25 M€ (second constellation)
Ground Segment RDT&E	13.1 M€
Satellite Recurring	46.6 M€
Launch (Either 2 or 4 Satellites)	85 M€
Insurance (Launch & 1st Year)	73 M€

Depreciation Period	
RDT&E costs	10 years
Recurring Investment	8 years

Running Business Expenses	
Operational Expenses in 2004 (2018)	5 M€ (10 M€)
Cost of Goods Sold	0
Long Term Debts	- Interest rate: 5% - Payback in 5 years (delayed by 2 years)
Dividend Payment	Multiplied by 3 in 7 years
Taxes	40%

The equity is repaid in stages with an additional dividend payment as compensation.

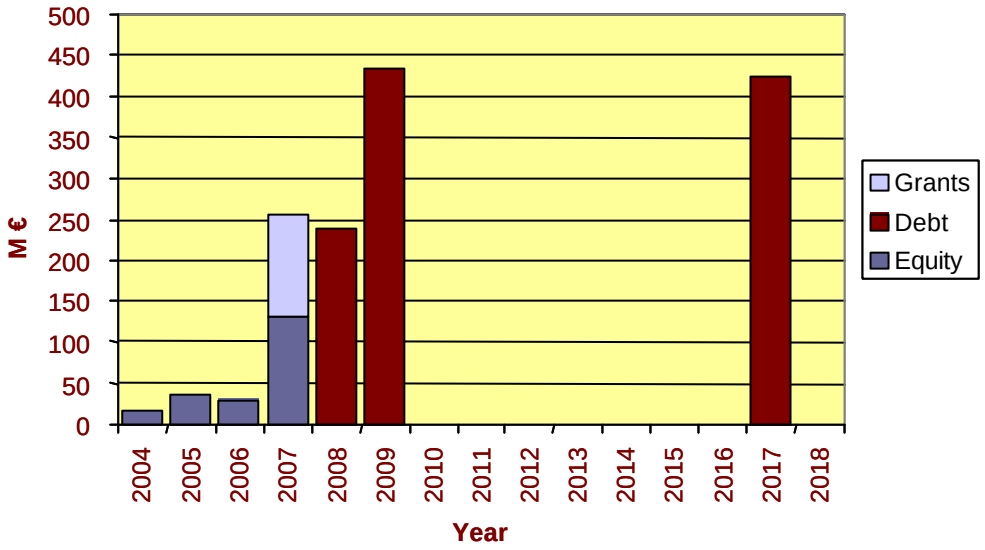
Financing

Investment Plan

The financial baseline includes equity from venture capital, grants from agencies and long term loans as showed in the next table.

Venture Capital (Equity)	210 M€
Grants	125 M€
Loans	675 M€ for the first constellation 425 M€ for the second constellation

This baseline scenario requires a strong investment from 2007 to 2009 and in 2017 corresponding to the launch of our fleet. The total amount of investment required is 1435 M€ through 2017.



In order to obtain the required investment for 2007 to 2009 the following key milestones shall be completed:

Before 2007 investment:

- Critical Design Review of complete OOS system including ground and space segment
- Brand alignment with a satellite manufacturer
- Signature of the contract with a satellite operator to provide the demonstration service

Before 2008 investment:

- First successful OOS demonstration mission

Before 2009 investment:

- Start of commercial servicing

Although the business requires significant investments, sufficient revenues are generated to cover all loans and dividends while allowing the business to grow.

The main rationale for raising funds from Venture Capitalists and for obtaining long term loans are the business credibility and relative technical simplicity, and therefore a high level of feasibility of our project. The fact that another company is already pioneering the OOS market and the brand alignment of the OOS Corporation with a well-known satellite manufacturer will give confidence to the Venture Capitalists. On top of this the dividends provided by the OOS Corporation are attractive.

The demonstration phase of the project will prove the feasibility of the OOS concept, especially the docking capability with a non-cooperative spacecraft. This is attractive to several agencies and other governmental organizations like the European Commission that could contribute to the planned grant.

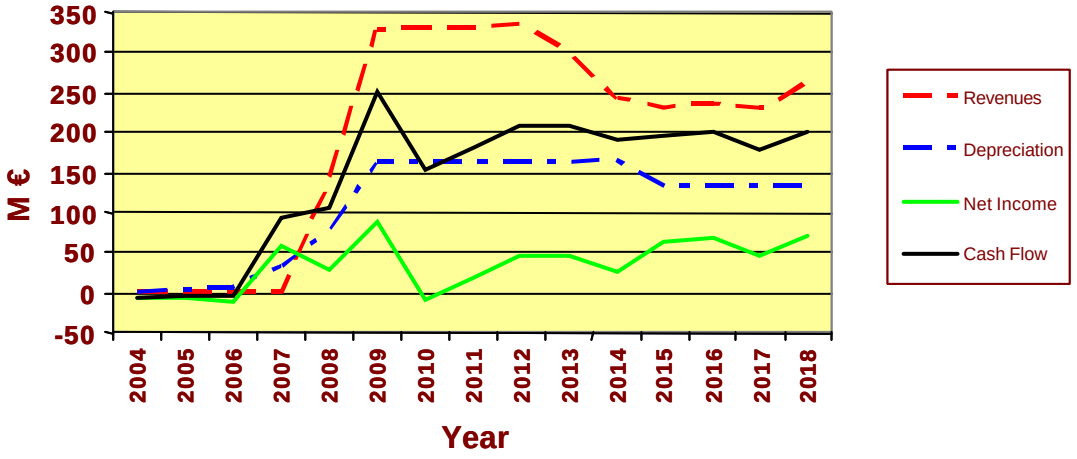
The investment required for deployment of the second constellation is partially covered by the OOS Corporation's internal equity. The loan for the remaining financing is guaranteed by the stable and ongoing business.

In the very pessimistic case of a zero growth of the GEO customer market, the investment required increases by 180 M€ and the dividends for the venture capitalists are changed from a return ratio of 3 to 2.5 in seven years.

To improve the business case still further the OOS Corporation will actively seek a strategic investor with an interest in entering the OOS market. A suitable partner could be a major GEO telecommunications satellite operator who may be interested in OOS to improve the reliability of their system or as a fleet management tool.

Profit and Loss Account

The Profit and Loss data demonstrates that the time-to-market is in 2007 and the return-on-investment is positive from 2008 onwards. The Net Income, after paying dividends to the shareholders, is around 45 M€ per year in average, increasing to 70 M€ per year after 12th years of operation. The business is robust and growing, and allows the payment of sufficient dividends to attract and capture independent investment.



Performance Indexes:

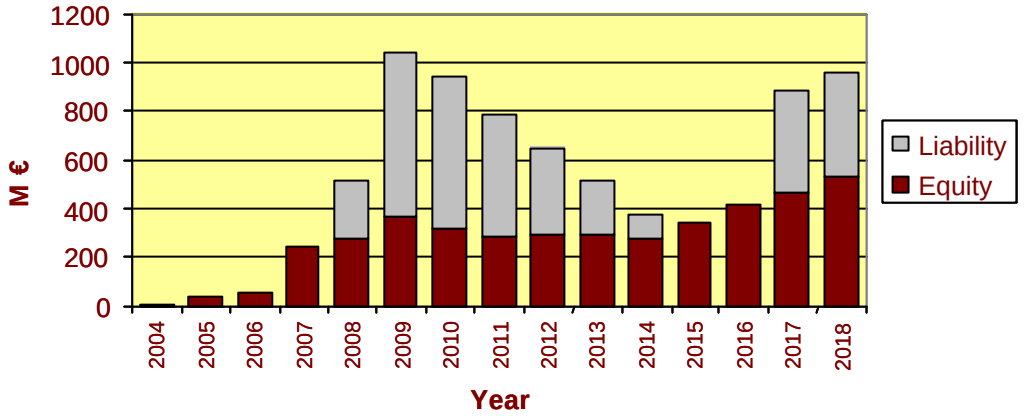
- The Profit on revenues is around 25%, and reduced to 9% during the period when dividends are paid

- Net Present Value is constantly increasing, reaching 745 M€ at the end of the 15 years analysis
- Internal Rate of Return is stable around 180%

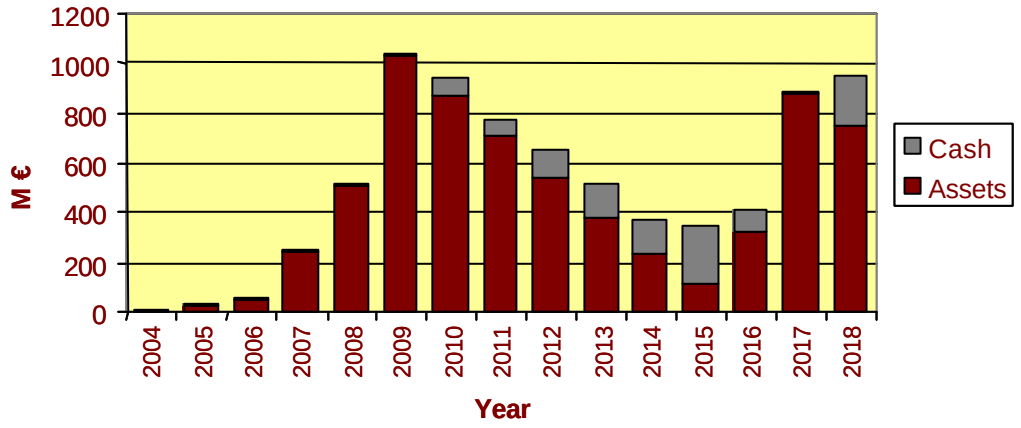
In case of a telecom market downturn, the profit is maintained through 2012, and reduced in the long term by around 20 M€ per year.

Balance Sheet Analysis

The balance sheet analysis shows a business value of 950 M€ in 2018. The equity ratio is maintained at a safe level, with a minimum of 33% in 2010 and an average value of 70% over the 15 years of analysis. The equity is maintained constant around 300 M€ during the years 2010 to 2014 when dividends are paid back to the shareholders. After this period, the business value is progressively growing with a promising long term business value of 950 M€ in 2018, and equity increasing at a rate of 15 to 20 % per year.



Sufficient cash is generated to allow payment of the dividends and partly cover the launch of the 2nd constellation of the OOS Corporation fleet starting in 2016.



Risks/ Opportunities

The OOS Corporation has identified three primary areas of risks to its business: Product and Technical, Market Evolution, and Business Strengths, Weaknesses, Opportunities and Threats. For identified areas of risk; a plan to eliminate, mitigate or transfer the risk has been identified.

As the OOS service is primarily provided to spacecraft at the end of their useful life due, the asset value of these satellites is estimated to be less than 3-7 M€, therefore it is reasonable for the OOS Corporation to require the customer to either waive liability for damage or loss of revenue, or to pay for the costs of incremental insurance to cover their insurable interest.

The key risks to the OOS Corporation are:

Risk	Impact	Risk Mitigation and Transfer Strategy
Improper technical performance of the OOS satellite	▪ Loss of revenue and possible accretion of liability associated with an in-orbit malfunction	▪ Robust technical design with key system redundancy and overrides ▪ Qualified personnel trained with simulations and in-orbit docking to available spacecraft ▪ Involvement in construction and launch of spacecraft ▪ Insurance
Loss of market share due to competition that will enter the market before the OOS Corporation	▪ Loss of revenue	▪ Key differentiation of the of the product in quality and speed of the service as well as pricing
Costs associated with the replacement of OOS spacecraft damaged during construction, transit, launch or in-orbit operation	▪ Delay or loss of revenue ▪ Monies to fund replacement	▪ Insurance to be carried by each of the responsible parties handling the OOS spacecraft (e.g. spacecraft manufacturer, launch vehicle provider, and ultimately the OOS Corporation)
Costs and liabilities arising from servicing provided by the OOS spacecraft	▪ Payment for damage to a customers satellite	▪ Customer to agree to waive liability for damage to the spacecraft or any loss of revenue
Customer does not readily accept the concept of OOS	▪ Delay or loss of revenue	▪ Provide service demonstration in first year of operation ▪ Limited deployment of OOS spacecraft in first years

This strategy will allow OOS Corporation to limit its overall liability, as well as costs of insurance for launch, in-orbit operation, and third party liability. After launch it is estimated that the insurance costs for the OOS constellation will average €3-3.5 million per year, assuming a fleet in-orbit policy rate of 1%.

The primary risk mitigation opportunities for the OOS Corporation are a flexible pricing strategy for its product, and the speed of service provided to the customer.

Summary

The OOS Corporation has identified an attractive business opportunity in on-orbit servicing of geosynchronous satellites for life extension. The OOS Corporation business case is feasible robust, even in the event of a significant downturn in the underlying geosynchronous satellite communications market.

The OOS Corporation will provide convenient and timely services to operators of geosynchronous satellites, enabling them to extend the life of their fleets thereby freeing working capital and providing a rapid response to customer satellites in need of propulsive capability.

The technical solution includes a constellation of satellites with flexible docking mechanisms, capable of servicing current and future three-axis stabilized geosynchronous satellites in a non-intrusive manner. The satellites and the ground segment are equipped with well-established technologies and standard commercial-off-the-shelf hardware, and are characterized by simplicity, robustness, and flexibility.

A risk transfer strategy has been developed to minimize the risk for the OOS Corporation, the OOS customers and third parties, thereby strengthening the marketing strategy.

The OOS Corporation will be staffed by a recognized and credible team that is known in the satellite industry for its integrity, creativity, and ability to deliver new space products on time, on specification and on budget.

With this winning combination of technical solution, commercial proposition and "best in industry team", the OOS Corporation is focused on becoming an active and contributing partner to the geosynchronous satellite operators. The business is attractive, producing long-term revenue and growth.