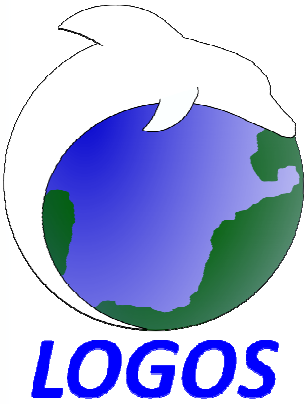
SPACETECH
POSTGRADUATE SPACE EDUCATION



Executive Summary

A Proposal to Investors

Presented on

26th June 2008

Delft University of Technology

Delft, The Netherlands

LOGOS: Land and Ocean Globally Observed System
Executive summary

Man's dominion of space has led to monitoring of Earth phenomena for the betterment of humanity. Earth is indeed a spectacular, unique element within our Solar System which has been studied extensively. Humankind has also gone on to observe other celestial bodies within our Solar System, but there is none like unto the Earth. Vast oceans and landscapes compel us to ponder and learn more, discover more. Such curiosity has led to many developments to monitor Earth for varying scientific objectives. One such development is the LOGOS System; Land and Ocean Globally Observed from Space.

Several space missions in the last decades have performed global observations of the Earth land and sea almost every day on a regular basis. Their instruments measure precisely the sunlight reflected by the earth surface in a few well-selected spectral bands, with spatial ground resolutions of around half to one kilometer.

The objectives of the LOGOS mission is to develop an operational (able to insure the continuity and permanence of the services) system to acquire, assimilate and disseminate data for land and ocean color applications. The system is required to provide consistent means of predicting the near and long term trends in global commodities such as food supplies.

For land observation, the primary need is to provide continuity of vegetation data.

For ocean color, changes in the ocean color have to be monitored in the short, medium and long term. The green plants in the ocean (the phytoplankton) are mostly microscopic and they respond to short-term changes in the environment more rapidly than do the plants on the land. Ideally, the information about the ocean is to be updated daily to provide timely and useful data for users.

The executive summary covers the following areas:

Overview

Mission

LOGOS mission is to observe land and ocean with a daily coverage. For land observation, the primary requirement is to provide continuity to the VEGETATION program flying on Spot 4 and Spot 5 (CNES) with increased performances in revisit time and spatial resolution. Changes in the ocean color have to be monitored in the short, medium and long term, observing concentration of phytoplankton to predict the presence and location of fish.

LOGOS will provide global Earth observation products which will include land and ocean monitoring.

The need

Several space missions in the last few decades have performed global observations of the Earth land and sea within few days on a regular basis.

But financial, industrial, non-governmental and governmental organizations strive to better manage both agriculture food supply and monitor land surface use. Accurate agricultural, forestry, and environmental data is required for informed decision making. No other source for this data is foreseen to be available within the next decade. LOGOS will meet this challenge.

Similarly, in the Ocean monitoring area: customers strive to better manage seafood supply and monitor coastal conditions. And here again, timely ocean condition data required for informed decision making and regulation are not available within the next decade.

Value

Using the LOGOS space-based vegetation and ocean colour observation system's superior data products and services you'll be the first to know:

How much of what is growing where

Objective

The objective of the LOGOS mission is to develop an operational space system to acquire, assimilate and disseminate data for land and ocean applications. The system is required to provide consistent means of predicting the near and long term trends in global land (ie. wheat) and global ocean (ie. fish) commodities. Providing such capabilities will put LOGOS at the forefront of the industry through its high quality services and products. The addition of global coverage each day will be quite a remarkable feat in a very vast Earth Observation field with many adept competitors.

LOGOS will provide useful information to both commercial and scientific users in fields such as agriculture, fishery and coastal monitoring. The merging of land and oceanic observations of high quality into one system is no doubt the winning aspect of LOGOS.

Market

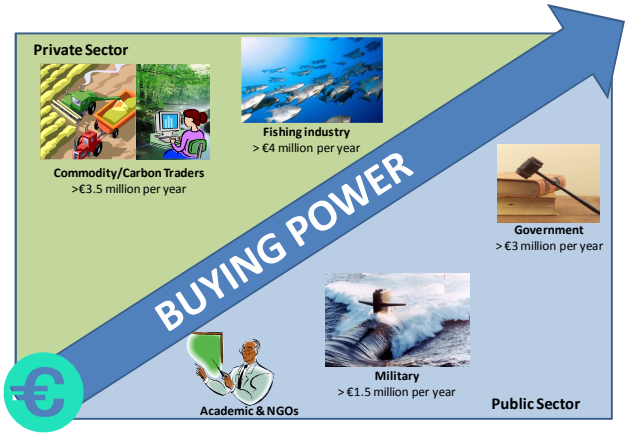
PESTLE Analysis

A Political, Environment, Scocial, Technological, Legal and Economic (PESTLE) analysis has been performed in order to identify the markets to target.

Although general results show a very healthy market, difficulties are found in private financing.

Market sectors

Customers foreseen for LOGOS products and services may be divided into two categories: government customers and corporate customers.



Government customers

Governmental customers are high buying power customers but are relatively few: European Union (EU), FAO, Ministries of agriculture and/or Ministries of fishery, and Ministries of defence. As soon as the space data is considered to be a strategically input (defense and security) or of public interest, these public customers invest on a regularly basis to be sure to get the products.

These public entities often ask to be allowed to distribute the data to their scientific community for free.

Corporate customers

All private customers are considered as medium buying power customers. LOGOS products help them to be more efficient, to reduce their operational costs and to have a better profit. As they often use estimates, these products are not indispensable for their business, and they are reluctant to invest too much in it.

In the Private sector, three particular customers are of interest for LOGOS: farming industry, fishing industry and trading companies.

Some other customer are not seen as important as the previous ones, but are seen as really useful for the LOGOS system. Academic users are in this group, they are considered as important players, to guarantee the excellent quality of the products, or to penetrate the market with huge number of users. They can also be motivated to develop algorithms for producing value added products in return for free data.

Products and services

Antecedents

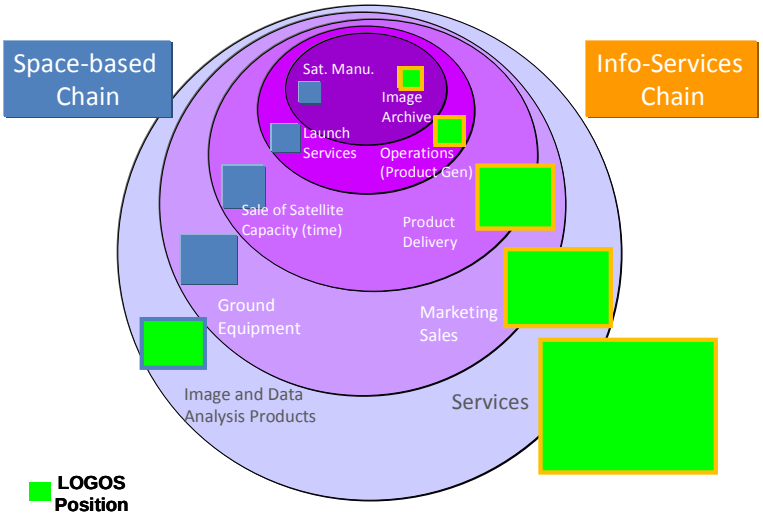
LOGOS customers have requested the ability to monitor natural resources and biodiversity. Through analysis of biosphere evolution, scientific, academic, and governmental organizations but also commodity traders gain accurate data for future predictions to maximize scientific knowledge or gains. Analysis of ocean color and temperature is critical for global fishing industry in monitoring communal movement of fish species.

Value chain

To better understand the activities through which LOGOS develops a competitive advantage and creates shareholder value, it is useful to separate the business system into a series of value-generating activities referred to as the value chain. The value chain contains primary and support activities. The primary activities are related to the value chain associated with publishing information on the Internet.

This is currently a billion Euro value chain, with the majority of the value in the services component. The primary activities generate the most revenue.

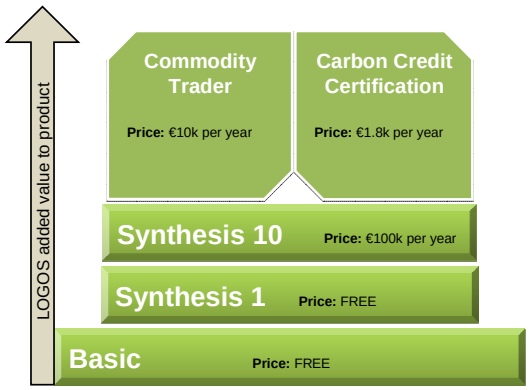
LOGOS has positioned one of its major service thrusts (eLOGOS) in the services region since this is the most lucrative part of the Internet value chain. The support activities are those related to the much smaller (few million Euro) space-based Earth observation value chain. LOGOS has positioned one of its major product thrusts (the sale of images and data analysis) in the product region since this is the most lucrative part of the Earth observation value chain.



Based on these assumptions we propose the following LOGOS key product and services.

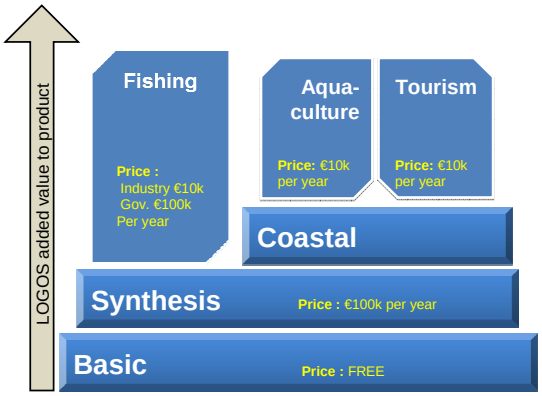
Land products

LOGOS will monitor vegetation growth over the complete Land surface of the planet. The Synthesis 10 product allows us to provide cloud free images of and land surface on the globe. This in turn allows LOGOS to be used in Carbon Offset Project certification (eg carbon neutral Bio-fuels land and sea etc.) and crop yield Prediction (Commodities trading reports) using the comparative data of plant growth.



Ocean products

LOGOS Ocean products are based on the ocean colour/transparency of the seas as monitored from space. Transparency is an indicator of water quality allowing calculation of nutrients in the water. These nutrients could be providing feed for fish stocks and algae blooms. Algae blooms are also an indication of contamination (excess of nutrients) of the coastal region as they block the light to the lower layers of the sea.



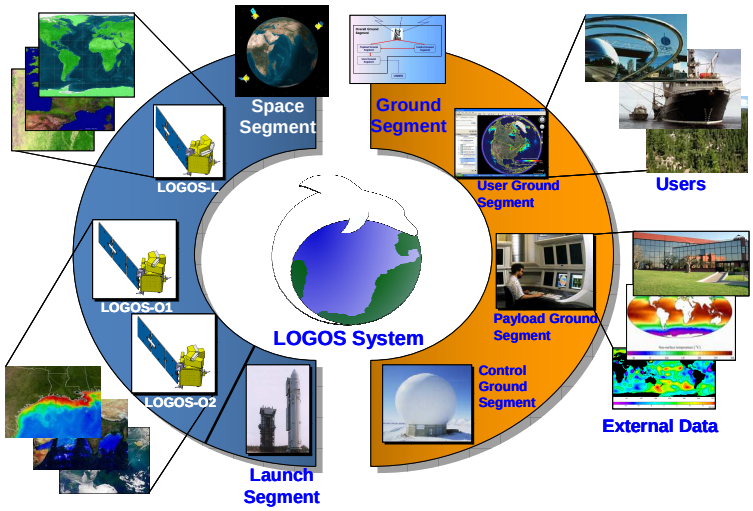
Disruptive products

Based on the aforementioned product ranges LOGOS aims to revitalise the Earth Observation Sector by provison of the eLOGOS tool and services. eLOGOS is based on Google Earth type technologies which will commoditise access to Geographical Informations Systems to a wider consumer market. Its usage will allow faster interrogation and easier analysis of the LOGOS data archive in order to create individualised tailored products. eLOGOS will also be licensed for embedding in customer end applications.

System description

Overview

The LOGOS System in its final configuration is depicted below with its main elements and external interfaces:



The Space Segment has the main function of acquiring globally, at specific optical wavelengths, the images of the Earth's surface, and to download them for further products processing. It is a constellation of three spacecrafts in Sun-synchronous Low Earth Orbit: one supports the Land monitoring mission, while the other two are dedicated to Ocean Color monitoring.

The Launch Segment is a supporting element aiming at placing in orbit the LOGOS Space Segment. The baseline is to perform a first dedicated launch carrying a Land and a Ocean Color monitoring satellites and, next, a second launch carrying, possibly as a "piggy-back", the second Ocean Color monitoring satellite.

The Ground Segment has the role to acquire and generate products, from the raw data received from the Space Segment and using also external provided auxiliary information, to control and monitor the Space Segment status and to disseminate the products to the LOGOS users. It s made of three main elements:

- Control Ground Segment: in charge of all Control and Monitoring operations of the Space Segment through the use of a remote (polar) Ground Station located in Svalbard (Norway). The Ground Station communicates with the satellites through S-band (TT&C) and receives the images in X-band.
- Payload Ground Segment: performs end to end data processing and product generation up to the required level and format. It also interfaces external data providers for acquiring additional information in support of product generation (e.g. sea surface temperature, ocean altimetry, wind speed).
- User Ground Segment: responsible for the full interface activities with the LOGOS users. It provides, through a Web-based interface, for catalogue browsing, users orders/subscription reception and delivery of the required products. Additional functions are also the provision of any necessary training and help desk support to LOGOS users.

From an Operational view, LOGOS is a "data driven" space system because the acquisition of images by the satellites is made on a systematic and pre-planned basis, not upon specific Users requests.

In the initial operational phase, when no LOGOS satellite is yet in-orbit, only externally

collected data are used to generate products.

When the LOGOS Space Segment starts to be operational the images are downloaded, archived and processed in the Payload Ground Segment. Externally provided data are still collected, and, together with the LOGOS acquired images, form the basis of the products generation.

The Users access the system with on a subscription basis. The products are then processed up to the required level. Finally the products are delivered to the users according to the specific commercial or institutional agreement.

The baseline system configuration and achieved performance summary is provided in the following table, where also a comparison to the system requirements is shown.

		Requirement		Performance	
		LOGOS-L	LOGOS-O	LOGOS-L	LOGOS-O
Orbit Type		SSO, Repeat Ground Track		SSO, Repeat Ground Track	
Period	[min]	N/A		101	
Altitude	[km]	N/A		803	
LTDN	[hh.mm]	10.00 to 11.00	10.00 to 14.00	10.30 ± 3km	
Lifetime	[years]	7		7	
Number of S/C	#	N/A		1	2
Launch baseline		N/A		- Double (L + O1) w/ Eurockot - Piggy-Back (O2) w/ Soyuz	
Launch schedule	Years	N/A		5	5 (Ocean1) 6 (Ocean2)
Revisit (average)	[h]	24		≤24h any latitude	
Swath (@equator)	[km]	N/A		2808	1404
Coverage	[+/- lat °N/S]	75°N - 75°S		75°N - 75°S	
N. of Ground Stations	#	N/A		1 @ Svalbard	
Responsiveness	[h]	24	12	13.5	11
User Interface		"easy"		Web + Helpdesk	
Standard Products		Yes		Up to level 2	
Value-Added Products		Yes		Up to level 4	

Space segment

The LOGOS Space Segment is composed by three satellites, one devoted to the Land mission (LOGOS-L) and the other two to the Ocean mission (LOGOS-O1 and LOGOS-O2).

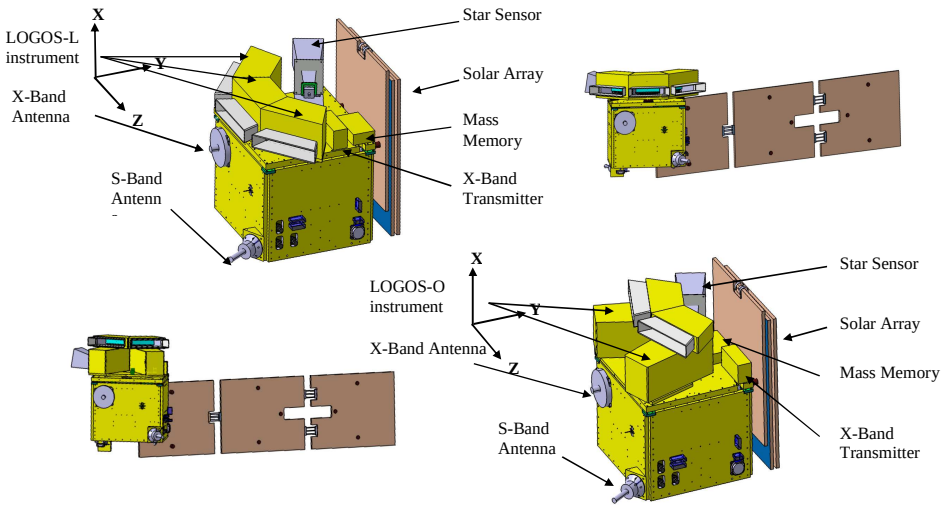
The satellites belong to the “small” class, i.e. they are below 200kg in mass and 1m3 in volume, so as to be launched with small launchers and, as piggy-back, on medium launchers.

Although “small”, their performances are quite outstanding:

- they are 3-axis stabilized, with a pointing error of < 0.05 degrees, and the capability of yaw maneuver for payload calibration
- the generated power is about 100W (orbit average)
- the payload data are stored in a 512 Gb mass memory and transmitted to ground at 155Mpbs, which allowed the system to meet its capacity and throughput requirements without the use of compression.

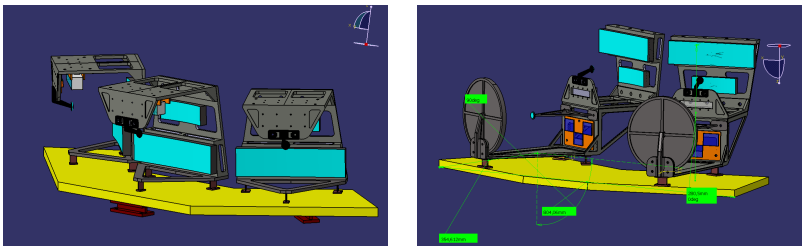
All the key budgets of the satellite shows significant margins wrt the requirements, for what regards the mass, propellant, power and energy, data link.

Each satellite comprises one payload and one platform.



Payload

For both land and ocean, the payload is a pushbroom multi-spectral imager; the payloads share a common optical design, based on the same Three Mirrors Anastigmat (TMA) telescope; this feature allows reducing the development costs and minimizing the risks.



The key features of payload design are hereafter summarized:

- the land payload detects 3 bands in VNIR and one in SWIR, while the ocean instrument detects six bands in VNIR; it is composed by 3 TMAs, so as to achieve a 120° field of view and a resolution of 300m for mos t of the Earth
- the ocean payload mounts 2 TMAs, so as to achieve a 80° field of view and a resolution below 500m for all the Earth; it is composed by 2 TMAs, so as to achieve a 120° field of view and a resolution of better tha n 500m for the whole Earth

Platform

For each satellite, the Platform provides all of the necessary support functions for the physical, electrical and thermal support of the payload, as well as the attitude and orbit control functionality and the command and control functions for the spacecraft. The Platform is derived from the existing and flight-proven Myriades platform, with specific improvements such as a third solar array panel, the mass memory and the downlink subsystems and the quality of the components.

It is anyway worth to be mentioned that, as back-up of the baseline platform, a feasible alternative has been identified in the flight-proven SSTL platform.

The following figures show the LOGOS satellites in stowed and deployed configuration.

Launch segment

At this early stage of the mission definition, it is prudent to maintain options with respect to the final choice of a launch service. To this end, the satellite will be designed to meet a design envelope comprising the ‘worst-case’ aspects of the mass, volume and environmental loads for several candidate launchers of the “small-medium” size launcher class like Eurockot, Dnepr, Soyuz (piggy-ack), VEGA, etc.

The best scored launch strategy is based on:

- A double launch of LOGOS-L and LOGOS-O1 with Eurockot
- a piggy-back on Soyuz or a single launch on Dnepr-1 for LOGOS-O2

However, other feasible alternatives are

- a triple launch on Eurockot
- three single launches on Dnepr-1

The next figures show the accommodation of the LOGOS satellites in the baseline launchers.

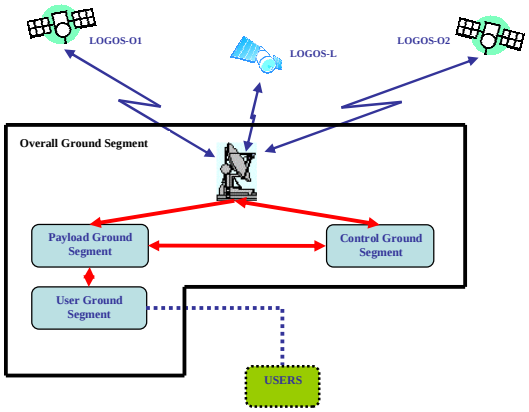
Ground segment

The main role of the Overall Ground Segment OGS is to acquire, to generate data and products from both LOGOS-L and LOGOS-O satellites and to disseminate these data to LOGOS user community. It is also responsible for the operation of LOGOS satellites.

The LOGOS OGS shall be a fully operational system able to handle data from up to 3 spacecrafts simultaneously (one LOGOS-L and two LOGOS-O satellites, phased orbit).

Very high levels of availability need to be maintained both for satellite control functions and for delivery of products to the users with an emphasis on timeliness, accuracy, quality control and validation.

This overall system context is illustrated in Figure 8.

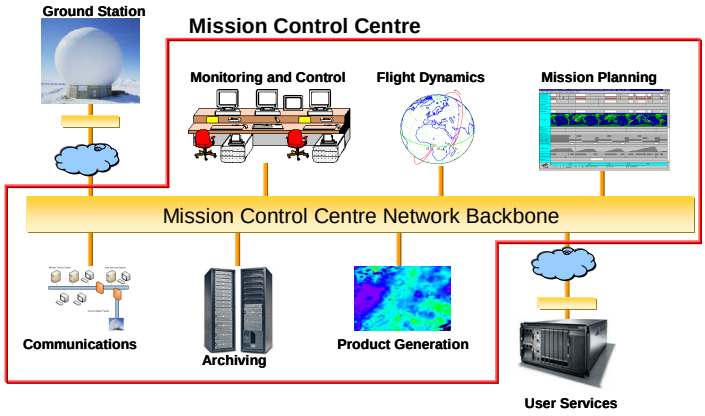


The Ground Segment is composed from the following elements:

- Mission Control Centre (MCC)
- Ground Station Facility (GSF)
- Backup Control Centre (BCC)

MCC

The MCC has the key functions of the Ground segment. It is responsible for the monitoring and control of the LOGOS satellites. It is also responsible for the processing of LOGOS-L and LOGOS-O payload data, and the generation of LOGOS products.



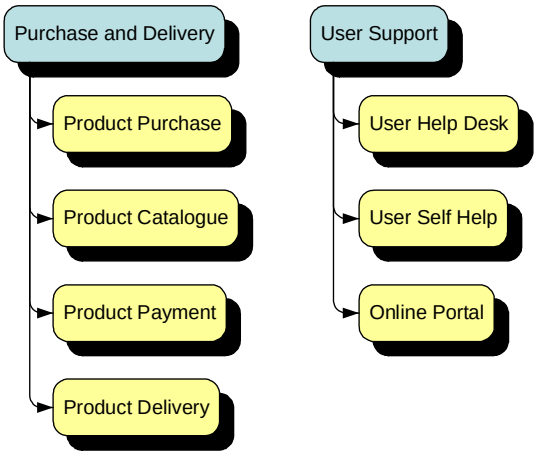
GSF The LOGOS ground segment will have its own dedicated ground station located at a polar location (e.g. Svalbard). The ground station will consist of an S/X band 11 meter antenna, as well as the necessary RF and baseband chains. The ground station will support both the TT&C and the Payload data reception simultaneously for all LOGOS satellites

BCC As LOGOS is an operational mission, a backup control centre is required to ensure the safety of LOGOS satellites in case of a major failure of the Mission Control Centre or the communication link between the MCC and the ground station. The Backup Control Centre shall provide TT&C services for monitoring and control of the LOGOS satellite.

User segment The User Segment is owned and paid by LOGOS, LOGOS business case is built on the features of the User Segment. It offers a user specific web interface to purchase products, for support and for payment of the delivered products. Delivered products are obtained from the Product Generation Environment which is located in the mission control centre.

Finally, the User Services is the portal for eLOGOS tools, the LOGOS open source software project. Here, users may find tools that aid them in locating, viewing, and interpreting Earth observation data from the LOGOS space system and other sources. In addition, software developers may submit corrections and modifications to current tools as well as new tools to the eLOGOS project.

The User Segment is comprised from 2 main functions with the appropriate sub-functions shown in ¡Error! La autoreferencia al marcador no es válida…



Purchase and delivery One objective of the User Segment is to ensure product purchases and delivery of delivery products to users. It is responsible for performing the function of product purchasing through the dedicated communication link; Internet. Distribution of products to end users will also be done online.

For product purchasing an interface for users to purchase LOGOS products with user-specific characteristics is provided. Product purchases are forwarded to the user support where, through the online portal, characteristics for ordered products are provided by user. For users that want to order archived products, there is a catalogue which can be browsed for ordering.

Product payment takes care, that every time an order is placed, the customer is charged. There are three methods of payments which include credit card, bank transfer, or an account with LOGOS.

Product delivery provides an interface which allows delivery of products. There is a requirement for users to specify frequency of delivery, method of delivery (email vs download), and hard copy requests (if any). The products are delivered mainly via internet.

User support

Another objective of the User Segment is to provide support to users. Support entails an online product purchasing service and a self-help online menu for users. The product purchase function is tightly coupled with the user support function within the User Segment. A product is purchased through the Purchase and Delivery function and through this the US function is called.

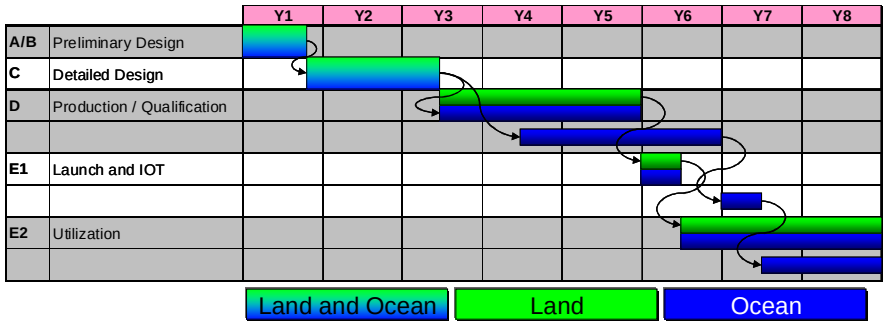
An interface for users to interact with LOGOS system will be provided. The proposed method of interaction with LOGOS is Internet. User support consists of an online portal and a help desk. These will be developed to enable contact with LOGOS and to provide support to user. User support assists the customer/user in their interaction with LOGOS to allow them to easily and conveniently make an informed decision when purchasing products. It handles all direct communication with customers form initial order placement to post delivery product support. When a product is purchased through Purchase and Delivery, the user support is called.

Phases

The LOGOS system will be developed following a standard phased lifecycle, based on the ECSS management standards:

Phase 0/A: Mission Analysis/Need Identification and Feasibility
Phase B: System Preliminary Definition
Phase C: System Detailed Definition
Phase D: System Production and On-Ground Qualification
Phase E1: System Deployment and Commissioning
Phase E2: System Utilization
Phase F: Mission Disposal

The duration of these phases is given (in months) in the following table:



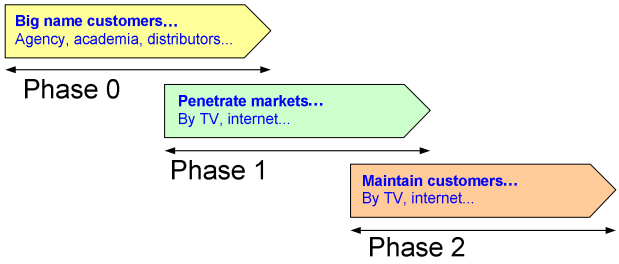
Business

Business scenario

LOGOS business comprises of land and ocean monitoring applications. The coverage provided by such global monitoring has the ability to encompass the majority of Earth observation markets. In light of this, many investors can be attracted using different market strategies depending on the context of application. Timeliness is a major requirement for LOGOS system and in combination with global coverage; this will no doubt place LOGOS at the forefront of the industry concerning market appeal.

Marketing and sales strategy

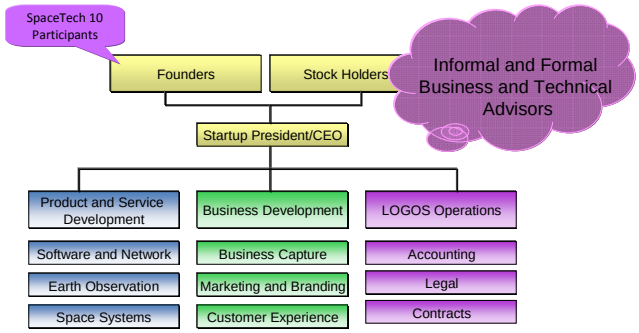
The market and sales strategy is to utilize LOGOS assets to attract and secure customers. The strategy is to split up the marketing into phases by years. Three phases have been identified ranging from year 0 to year 6 and onwards.



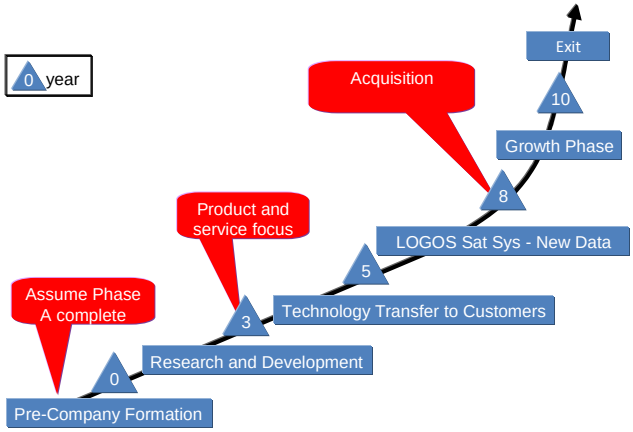
Alliances/partnerships along with marketing vehicle have been distinguished for each phase. The goal is to first market the LOGOS brand and get the name out there. When relationships have been solidified, then more focus is put on sales and the customer.

Management and organization

In the first years of the business, the company structure will be flat since the number of staff will be small, also establishing a set of formal and informal business and technical advisors to aid in navigating the start-up waters, as shown in the figure below:



LOGOS has a flexible yet solid business life cycle model that contains 6 phases from pre-company formation, research and development, growth strategies through exit strategy. LOGOS assumes that the Private Public Partnership agreement and phase A of the space system have been finalized, as shown below:



In the early years while the space system is under development, the company focus is on product and service innovation. After the space system is complete, LOGOS enters a high growth phase which may include the acquisition of a complementary company. Finally, exit strategies will be considered such as the sale of LOGOS in part or in whole to another entity such as Google or ESRI.

Partnerships

Partnerships are key for LOGOS' success. By year one, LOGOS will enter into a public private partnership with an entity that is able to specify, finance, execute and operate a space system consisting of three low-Earth orbiting small satellites. From this partnership, LOGOS will receive free use of the data and associated calibration parameters from the three satellites in return for a determined fee.

"NextGen EO Exploitation"

- **Free satellite data for LOGOS**
- **Government-owned and –operated satellite system**

Partner Contributions

Government	LOGOS
Satellite System Space Segment (2 OCEAN satellites, launch, insurance): 140 MEuro + **Ground Segment:** 9 MEuro	**Operations:** 32 MEuro + **Revenue Share:** 10% (over satellite lifetime minus operations) + **Share of Commercial Upside:** 20% (partners years 1 - 5)

During year one, LOGOS will form the next key partnership, one for automated web-based advertising infrastructure. LOGOS will then work to find partners interested in advertising on its pages. Also important are the distributors from whom LOGOS will purchase in-situ and other Earth imaging data for use by its customers.

Partnerships will be formed in new business areas where the application of Earth observation data is important. Finally, in terms of open source software, there are opportunities for partnering with Google Earth, sourceforge and others to increase LOGOS' presence in the marketplace. Over the business life of LOGOS, the management team will continue to grow its partnership base for advertising, data sources, web-presence and Earth observation data application.

Financial

Scope of business

Below, a summary of the financial for LOGOS is given.

- Innovative Earth Observation business based on disruptive services
- PPP approach, where the public agency will make the investment for the ocean satellites development (land data is to be purchased).
- Company size in year 2013: 35MEuro revenue and 43 staff
- Performance indices: 55% profit on revenues, 0.8Meuro revenue per capita, 10% NOV, 76% IRR.
- Viable exit routes

This business model deals with the saturation of the market after year 9 (see scenario above). The intention of LOGOS is to grow the business after year 9, therefore two actions are taken (as explained hereafter).

The solution to that is coming from the so-called “disruptive services”. This means that LOGOS creates a new category of services (training, consultancy, licensing, plug into Google).

Furthermore, LOGOS decided to invest on a company (year 8) in order to grow faster. It means a strategic alliance is proposed with one of the companies on the sector, with the assumption of 25MEuro LOGOS investment and an increase of LOGOS revenues by 20%.

Financing plan

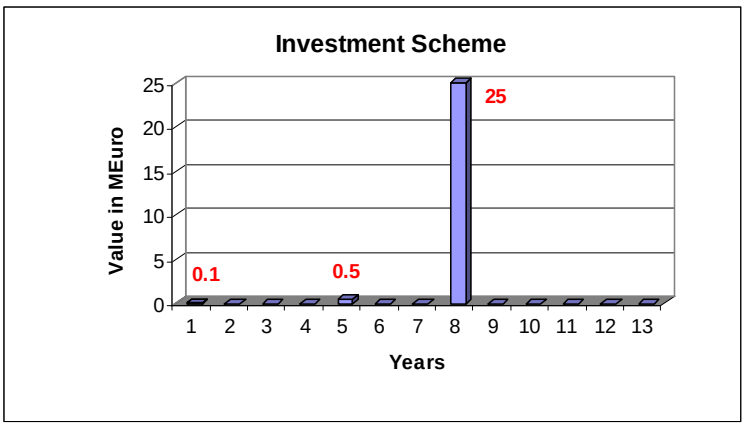
The financial plan foresees an initial financing as follows:

Year	Identity	Type	Total
1	Founders	Equity	0.4 Meuro
1	Public funds	Grant	0.2 Meuro
2	Public funds	Grant	0.3 Meuro
2	Strategic investor	Equity	0.3 Meuro
8	Bank	Debt	15.0 Meuro
		Total	**16.2 Meuro**

LOGOS will buy a company in year 8 in order to invest some money coming from revenues. The value of the company purchased will be 25Meuro.

Investment plan

Three opportunities are offered for investment:



At the beginning of the LOGOS company foundation, investment will be needed for the Value Added Services. The amount of investment is as given below:

Year 1: 0.1MEuro

As LOGOS approach the launch of the first satellite, the amount of investment in the Value Added Services area needs to grow in order to cope with the amount of new customers and products. The investment is as given below:

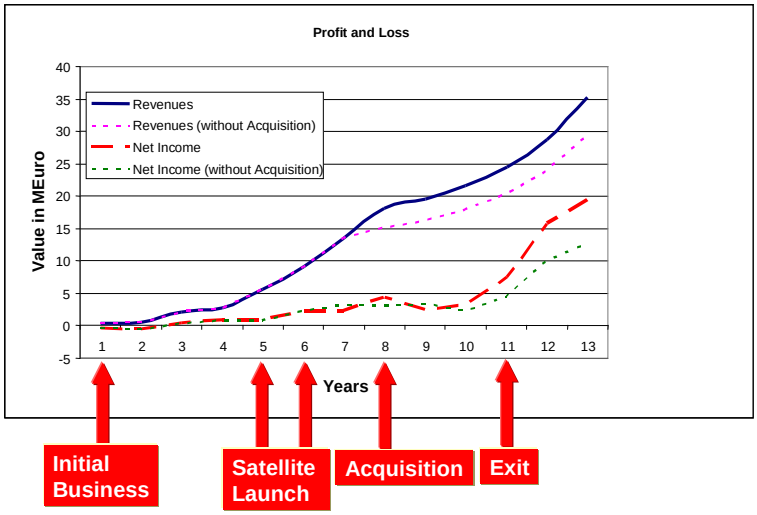
Year 5: 0.5MEuro

Three years after launch of the first satellite the amount of cash in the bank (around 12MEuro) allows LOGOS to perform a strategic alliance acquiring a company in the internet services sector, with the goal to increase revenues. The assumed investment required to buy is as given below:

Year 8: 25MEuro

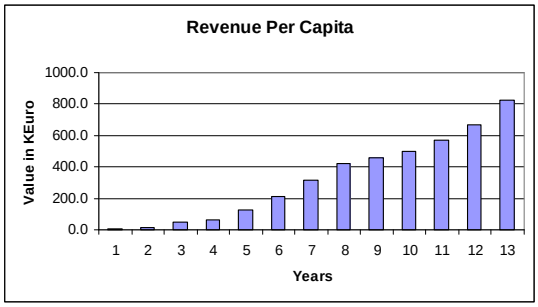
Performance

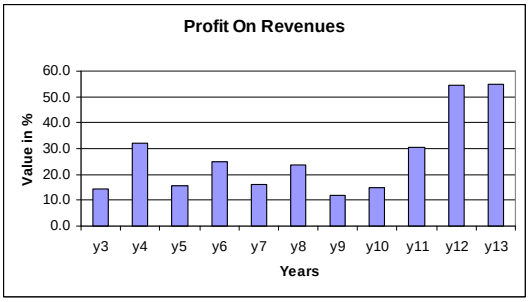
Basic performance of the business is plotted hereafter.



This new model presents a positive net income after year 3 (0.7MEuro), with a continuous growing towards the end of mission (net income is 19MEuro in year 13).

A revenue per capita of 800keuro with a 50% profit on revenues at year 13 are foreseen as shown below:





Also, by looking at NPV and IRR, it can be stated that the business looks profitable at year 13.

Parameter	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13
NPV	0.5	1.8	2.9	5.0	6.0	7.3	9.9	14.9	20.6
IRR	30	52	61	68	70	71	73	75	76

Risk

Overview

A Risk Management process has been applied to the LOGOS development in order to ensure a successful outcome of the project in terms of cost, schedule and performance. Risks are assessed by identifying their likelihood of occurrence together with their severity of consequences. Whenever a risk is considered of sufficient concern, mitigation strategies are put in place aiming to reduce either its likelihood or its consequences severity.

Risks for LOGOS have been separated into Business Risks and Design Risks and are to be monitored throughout the entire project lifecycle.

Corporation risks

LOGOS will encounter some risks due to its business approach. In this sense, two different paths for risks are identified, based on their environment: the market itself and the business management.

Regarding market, LOGOS will have to fight against competitors already settled down that can introduce themselves in the market with an already big user list and non-limited resources as LOGOS will have at start-up. Aggressive advertisement will be used to cop with that. Additionally, LOGOS must continue to innovate and provide products and services that are attractive to the users, maintaining and increasing its user share. In order to avoid such as effects, the LOGOS Company will actively invest in research and innovation during the project lifetime.

Looking at business management, some planning is required upfront. It may happen that the business takes off with greater returns than expected and thus exceeding LOGOS capacity in terms of order handling or product delivery, for instance. A reaction plan is established in order to proceed with capacity increase after certain thresholds are reached.

Also, revenue growth may decline with respect to expected or, in the contrary, the company growths healthy. For the first scenario, an action plan is establish in order to palliate in an efficient manner the crisis. In the second one, company growth will be controlled according to an early established plan ensuring a safe increase in staff, operations and financial infrastructure, and avoiding degradation in quality of LOGOS products, services and operations.

Insurance

Launching a satellite is considered always a risk, even though its probability of occurrence can be considered somewhat low, due to its extremely severe consequences on the satellite (complete destruction), which implies the manufacturing and verification of a new replacement unit.

According to LOGOS business scenarios, dependent on its own satellites after build-up and first years of the company, two launches are foreseen. The first one will carry the satellite used for land imaging and one of the two satellites used for ocean imaging. The second one will carry the second satellite used for ocean imaging.

In these terms, both launches will be insured, ensuring a full deployment of the LOGOS satellite constellation.

Design risks

LOGOS system has a very strong ground segment component with a high interaction complexity. For this reason, most of the identified risks during the design have been allocated to the ground segment. The most critical ones are listed hereafter together with the activities to be performed to cope with their potential effects:

RISK DESCRIPTION	MITIGATION
Obsolescence of ground segment **COTS**	COTS evaluation plan for use, replacement and upgrade. Effective architectural design for replacements and upgrades.
Data type **interfaces** integration	Effective architectural design for integration of systems in terms of interfaces, data and algorithms.
Tight schedule for **satellite integration** after payload delivery	Establish a management plan for platform AIV. Establish a systems engineering process for verification phase.
Overall **ground segment** development	Establish a simulation phase early in the project. Establish a systems engineering process for development phase.
Maturity of **application algorithms**	Prioritize applications to be developed by level of maturity and user need. Establish an application development program early in the project.

Legal and regulatory risks

Since LOGOS makes use of space assets, ITAR regulations are a significant risk for the business. ITAR free launchers are then only considered for LOGOS, allowing a fast satellite development. However, since ITAR are subject to changes, compatibility with different launchers is addressed.

No other specific risks from laws or regulations are foreseen. However, due to the fact that LOGOS business runs all over the world, a risk exists in the integration and management of different national laws and regulations. To cope with this, a Legal Management Plan is established, setting up the required procedures in order to ensure compliance with every law and regulation for every LOGOS product that is delivered anywhere in the world.

Conclusions

LOGOS is developing Earth Observations services and products.

This will be achieved by:

- Leveraging government satellite systems and available global Earth observation data
- A public private partnership (PPP)
- eLOGOS: open source software tools
- Web-based product request and delivery
- Services target current and future markets

Initially, an extensive market survey and analysis was conducted. Respected industry sources, market research company forecasts and consumer surveys were used to identify the most promising market sectors. The sectors selected were a combination of private and public customers having a need for land and sea observation data and services.

This research also led to the selection of LOGOS's innovative products and services, which were bundled into the eLOGOS product.

A system engineering package was completed which shows that the proposed space segment, ground segment, and infrastructure segment is both novel and technically feasible.

The key points of the space system are:

- It is based on current satellite technology
- Provides continuity of current land and ocean sensing data
- Systematic data collection
- Low-risk LEO satellite system
- Increased ocean re-visit time (1 times/ 24hrs), better resolution

The baseline business case was optimized and is strong, promising, and risk-balanced for founders and investors. This document shows that the LOGOS business case is viable, profitable and sustainable. High growth sustainable business based on PPP

- Time to profit: 3 years
- Internal rate of return: 73% (year 11)
- Valuation: 235M Euros (year 11)
- Financing: 16.2M Euros (Equity: 0.7, Grants: 0.5, Debt: 15)
- Attractive acquisition target (year 11)

Risks to the company and technology were assessed, including the case for insurance and legal and regulatory risks. The risk posture has been consciously chosen and is acceptable.

Overall LOGOS has a vision of being the market leader in developing and delivering Earth Observation services to the masses. This business plan provides the technical and business solutions based on solid systems and business engineering methods.

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