SpaceTech 9 – DID 4 Volume 1

Executive Summary

CLEPSYDRA

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Clepsydra
Executive Summary

The stress of modern life to balance the needs of business, personal, and social demands requires the average person to make more efficient use of his/her time. Also, rapid developments in mobile communications have led to a market pull for advanced mobile services. Current initiatives focus on mobile television to handheld devices. Opportunity exists for a company that differentiates itself with services, targets a real mass market, and offers low cost pricing and billing schemes.

In December 2006 the EC made available a slice of the S-Band spectrum (2170 – 2200 MHz) for use by mobile satellite services. To allow continuity of coverage, use of terrestrial gap fillers is also permitted. Applications for the frequency will begin in July 2007. This clears the way for those companies with access to suitably equipped satellites to launch services in the coming years.

The mission of Clepsydra is to provide television and radio broadcasting, time stamping and data services via satellite to handheld devices in Europe.

Clepsydra will be positioned as a low cost provider with an attractive package of seven television and eight radio channels. Clepsydra services will be available for outdoor use.

An innovative system architecture based on two satellites in Tundra orbits allows for high elevation angles to provide optimal service with a limited number of terrestrial repeaters. The system makes use of proven technology with minor modifications to ensure reliable service provision.

The business is highly profitable and offers an excellent business opportunity.

Executive Summary 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

The stress of modern life to balance the needs of business, personal, and social demands require the average person to make more efficient use of his/her time. Technological innovations in mobile telephony allow for multi-purpose use of handheld devices to provide wireless access, anywhere anytime, to multimedia services.

Current initiatives are also focusing on broadcasting mobile television services to handheld devices. The market potential is considerable, especially in Europe where the handheld market is huge and well established and mobile television already has a large market pull. The core market is comprised of the large, highly populated countries, including Switzerland, Germany, France, Italy, Austria, Portugal, Spain, UK and Ireland, where the handheld market is stabilised with 334 million users.

The availability of S-Band frequencies in Europe opens a business opportunity to serve the customers in an efficient way with satellite broadcast media all over Europe. This emerging market can be addressed with success by a company able to provide services securely and effectively in one handheld device and that can differentiate itself from the rest of the market with innovative services, pricing and different billing schemes.

The opportunity for a new business exists and can be expressed in the following need statement:

Users would like access to television and radio content anywhere and anytime

Direct broadcasting from satellite is one of the possible concepts that would respond to and fulfil the need statement and is the concept chosen by Clepsydra as the one that best suits the need existing in the market.

The Objectives

Taking into account the need statement and considering that current digital technology can be used to take advantage of precise, certified time to provide accuracy and security to the way business is done today, Clepsydra will develop a system to be used by an average person utilizing a mobile handheld device, to make a more efficient use of his/her time, balancing the daily needs of business, personal and social demands.

Therefore the mission statement for Clepsydra can be formulated as follows:

The mission of Clepsydra is to provide television and radio broadcasting, time stamping and data services via satellite to handheld devices in Europe

The Services

As the mission statement reflects, Clepsydra provides a portfolio of services. The Clepsydra services are:

Television and radio broadcasting

With the television and radio service the user can select a program from a set of predefined television and radio channels. This allows the end user to catch up on news, sporting events, or be entertained with a movie or a favourite radio station while waiting, during transit, on vacation or business travel.

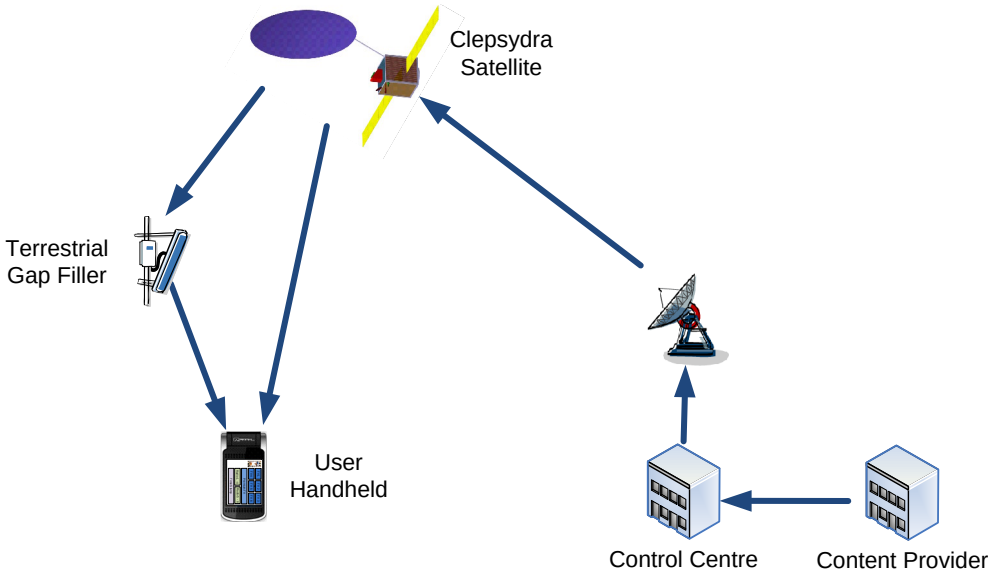


Figure 1: Mobile television and radio broadcasting service

Time stamping

With the time stamping service the user is provided with the possibility to mark certain digital information (e.g. document, transaction or general electronic record) within the handheld device with a certified time stamp. Trusted time stamping is the process of securely keeping track of the creation and modification time of a document. Security here means that no one (not even the owner of the document) should be able to change it once it has been recorded. A trusted time stamp is issued by a Trusted Third Party (TTP) acting as a Time Stamping Authority (TSA) without the possibility that the owner of the document can backdate the time stamps. Clepsydra is intended to act as a Time Stamping Authority. The time stamping service (see Figure 2) is based on a user sending a hash (digital finger print uniquely identifying a document) to the TSA and receiving back a time stamped hash.

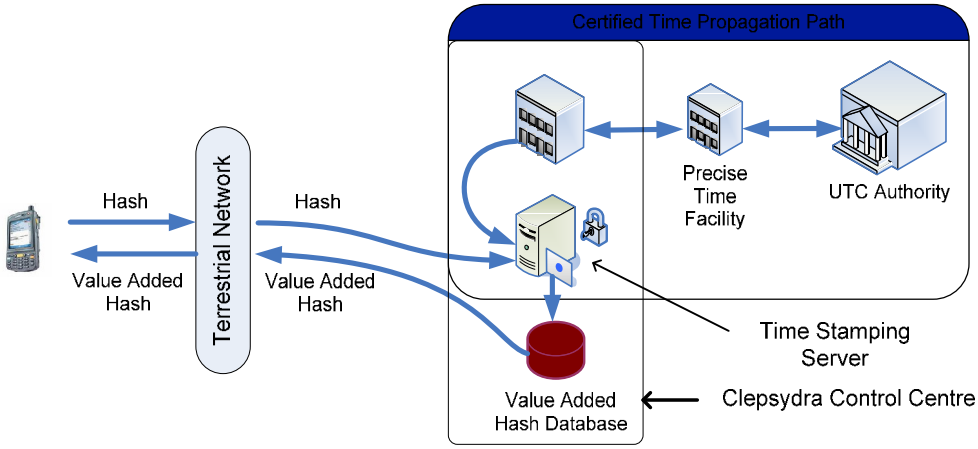


Figure 2: Time stamping service

The Solution

Clepsydra will utilize a hybrid satellite/terrestrial system to provide its services as an extension service to existing handheld devices. It will broadcast to the handheld either directly from the satellite or through the terrestrial gap filler infrastructure. A return channel is foreseen for use for the time stamping services.

The return channel will make use of terrestrial telecommunication networks.

The system is designed based on a constellation of two satellites in Tundra to provide high elevation angles thereby increasing the service availability and reducing the amount of terrestrial repeaters required. As a low cost provider, Clepsydra envisage the utilization of a limited number of gap fillers mainly addressing outdoor coverage.

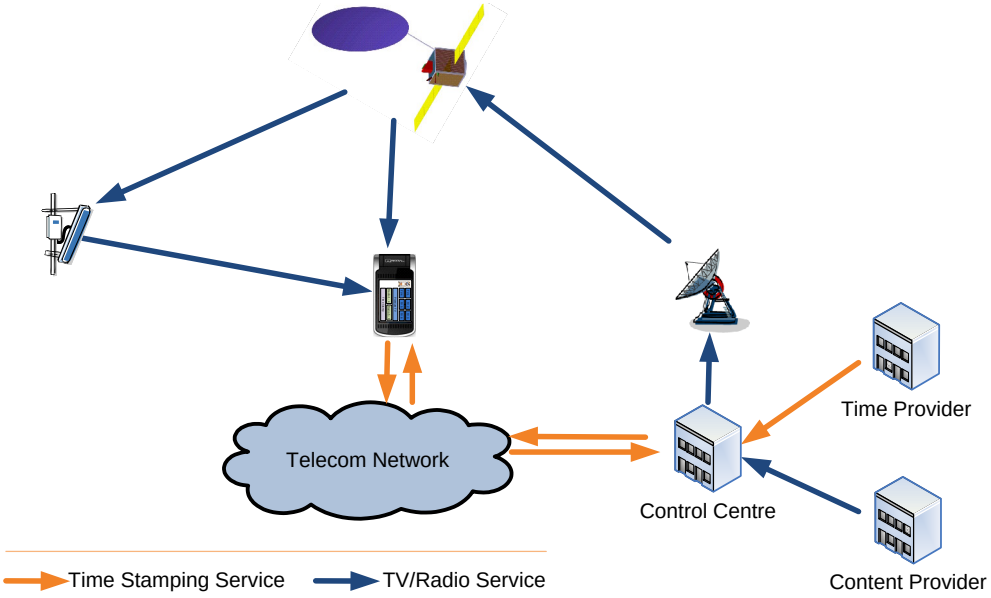


Figure 3: System overview

Market

Overview

Many research papers have indicated a clear market demand for mobile television and radio services to handhelds in Europe. This is a new market, which will grow rapidly. Customers of this service are typically consumers who are willing to pay an attractive amount for this service.

The time stamping service aims at the business users including accountants, lawyers, doctors, photographers, scientists, public administration, etc.

Value Chain

In Figure 4, we show the specific value chain for the Clepsydra television and radio service. The end user buys our services through the cellular network provider acting as a reseller and performing the billing.

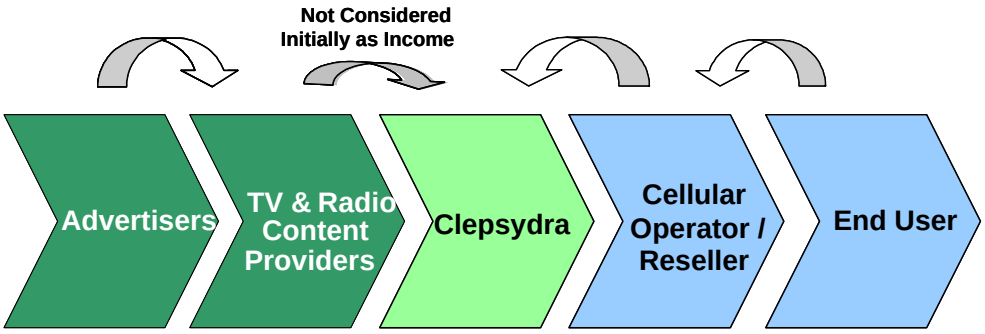


Figure 4: Value chain for mobile television and radio broadcasting

Clepsydra revenues are coming from two main sources:

- End Users are charged through a reseller or cellular network operator who receive a margin on the revenues. Clepsydra behaves as service provider to the cellular network operators and resellers.
- Television/radio content providers are charged for broadcasting their content to a larger customer base through satellite broadcasting. Clepsydra is the broadcaster, using satellites and a terrestrial gap filler infrastructure. Initially, Clepsydra will broadcast the television/radio content for free – content providers will be charged after it has been demonstrated that the content providers have established a bigger business base through Clepsydra. Content providers revenues are based on advertising.

The time stamping service has a similar value chain. This in indicated in Figure 5.

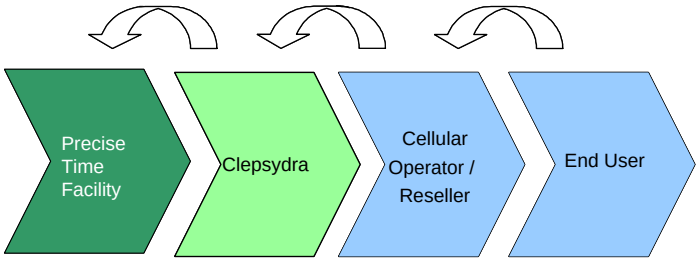


Figure 5: Value chain for time stamping

Analysis of Selected Market

Market research has shown that there is a large addressable market for mobile television and radio in Europe. Clepsydra provides outdoor coverage. The outdoor addressable market is found to be 30-50% of the total addressable market. Clepsydra conservatively estimates that it will acquire 40% of the outdoor addressable market. The graph below shows the available, outdoor addressable and acquired market for Clepsydra.

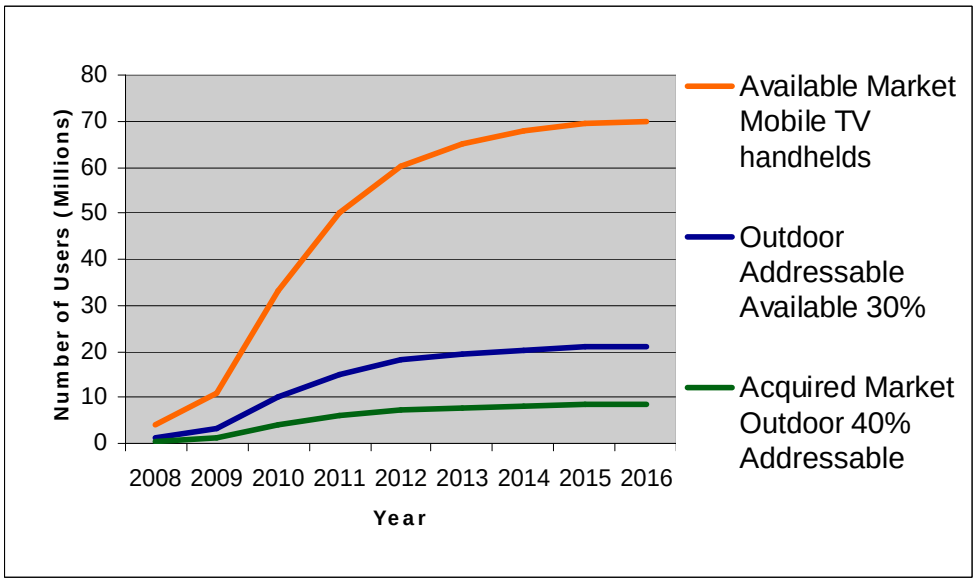


Figure 6: Market size and share

Competitors

Competitor Analysis

Clepsydra competes for market share in the market of mobile television, radio and time stamping services to handhelds. The competition can be categorised as follows:

- Satellite Broadcasters
- Terrestrial Broadcasters
- Cellular Operator Unicasters

Satellite Broadcasters are very similar to Clepsydra in terms of system physical architecture. The services are provided to multiple countries by a satellite augmented by terrestrial repeaters. At present there are no operational competitors in this category. SES-ASTRA and Eutelsat have announced a joint-venture proposing to launch mobile television services. Another company, ONDAS, aims to provide digital audio broadcasting services from 2009 to receivers mounted on vehicles. In the future, ONDAS may add video broadcasting but this is uncertain at this point.

Terrestrial Broadcasters use a ground-based broadcasting network (mostly based on DVB-H standard). They typically provide services to a single country but usually do not have 100% coverage.

Cellular Operator Unicasters use the ground-based cellular network to provide the services (ie via UMTS). Unicasting is by definition different to broadcasting, and is unable to provide services to an unlimited number of users (due to limited resources of the cellular network).

SWOT

A comparison of the competition with Clepsydra is indicated in Figure 7. Competitors are compared per category. Clepsydra has sufficient unique selling points to compete in the market and claim the targetted market share.

	Satellite Broadcasters	Terrestrial Broadcasters	Cellular Operators	Clepsydra Satellite Broadcaster
Main Companies	eutelsat COMMUNICATIONS, ONDAS, SES ASTRA	3 X-Series, MFD, kpn, tdf	vodafone, orange, T-Mobile	
Television Service		High		Medium
Radio Service			Low	
Time Stamping	Not Available			
European coverage				
Urban Coverage				
Rural Coverage				
Indoor Coverage				
Quality of Service				
Price				
Premium Channel				
Flexible pricing				

Figure 7: Comparison with competitors

System Description

Overview

The main segments composing the Clepsydra system are shown in Figure 8:

- The user segment will consist mainly of the handheld device. It will allow the reception of television and radio signals from the space segment or from the terrestrial repeaters and will support the time stamping service.
- The space segment of Clepsydra will initially consist of two satellites in Tundra orbits with orbital planes having the nodal lines separated by 180°. The purpose of the space segment is to broadcast the television and radio channels to six European service areas. This is shown in Figure 12.
- The Ground segment of Clepsydra will consist of the mission control and the infrastructure sub-segments including the terrestrial repeaters.

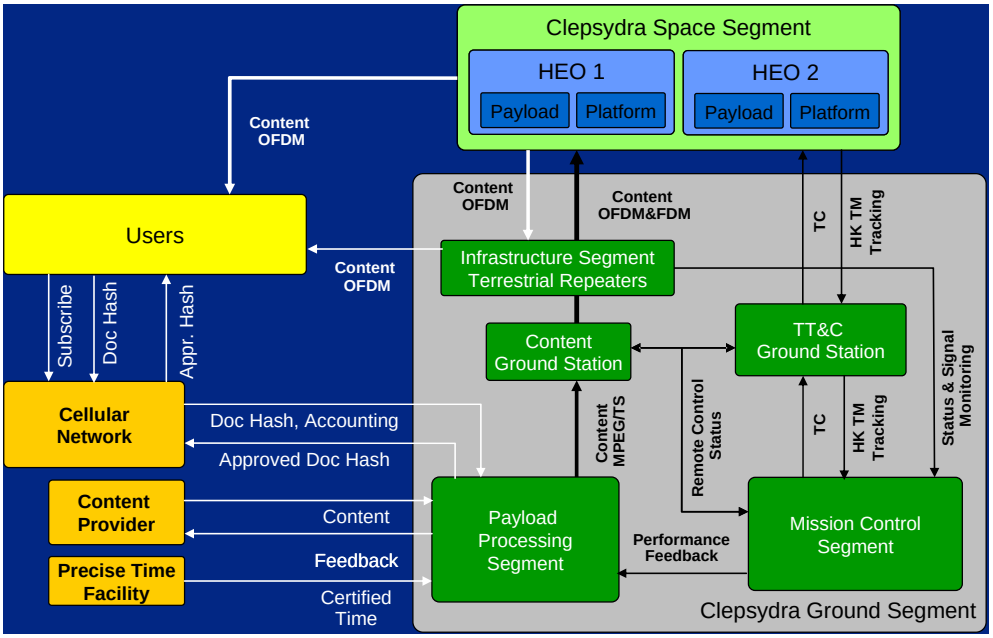


Figure 8: Clepsydra system overview

User Segment

The User Segment for the Clepsydra system consists of a handheld and a Clepsydra software package. The key requirements driving the selection of the user segment are:

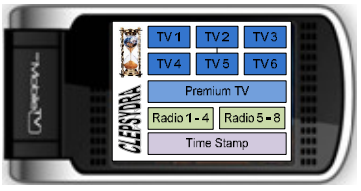


Figure 9: Clepsydra handheld

- Single software application for all services
- No major modifications to existing handhelds
- Availability of handhelds at launch of service

For ease of use, a single software application will be developed to make use of the Clepsydra services.

Clepsydra requires a handheld with the capability to receive DVB-SH signals. Such a device is currently not available. However, there are a number of DVB-H handhelds available. Figure 10 shows the modifications required to make these

devices compatible with the DVB-SH standard. No major modifications are required.

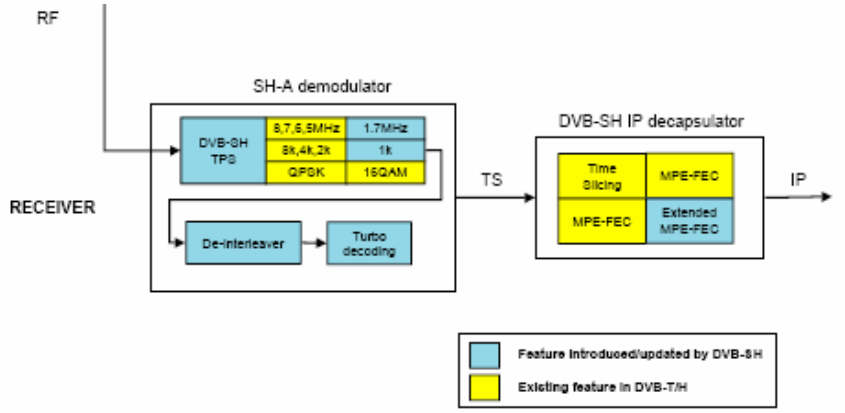


Figure 10: Modifications to DVB-H handhelds to support DVB-SH

It is expected that handheld manufactures will follow the trend of DVB-SH and update the current handheld characteristics to take advantage of the market opportunity for satellite to handheld communications.

Space Segment

The space segment consists of a constellation of two satellites in Tundra orbits with right ascensions of the ascending node separated 180°. The main advantage of this type of orbit is the guaranteed relatively high elevation profile, even for users at high latitudes, which can be directly translated into higher availability of service, better performances and savings in the number of terrestrial repeaters.

The spacecraft consists of a platform and of a communications payload discussed separately in the following sections.

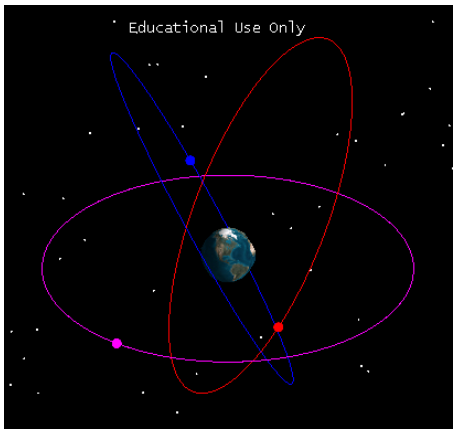


Figure 11: The Tundra orbits

Communication Payload

The coverage area selected for Clepsydra service provision is Europe. The Clepsydra system will provide broadcasting services over the main linguistic and cultural European areas through the generation of six linguistic beams. The limited amount of 15 MHz band available (assumed as half of the total one) is exploited utilising a three colour frequency reuse scheme, as shown in Figure 12, with beam pair #1 (UK) and #5 (IT) operated on the same band F1, pair #3 (SP) and #4 (D) operated on the same band F2 and with pair #2 (FR) and #6 (SC) operated on the same band F3.

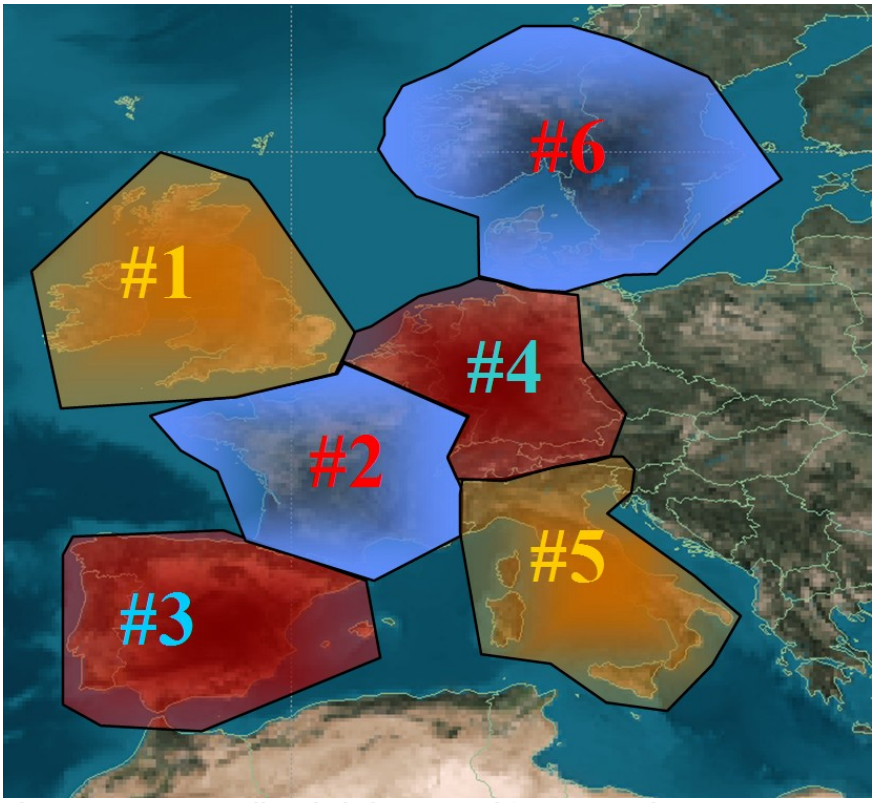


Figure 12: European linguistic beams and frequency plan

The payload shown in Figure 13 is composed of a Ka-band feeder link receive section, a frequency down-conversion section, a phase only beam forming network section and a high power section.

The Ka-band feeder link signal consists of six carriers corresponding to the six user linguistic beams. Each carrier in the uplink has 5 MHz bandwidth, while at the downlink transmit S-Band section output, the signal consists of three carriers (F1, F2 and F3) with a bandwidth of 5 MHz each and performing the frequency reuse scheme on the user coverage.

In the Ka-band receive section of the payload, the feeding signal is amplified, converted to IF and separated to six parallel branches. Each branch signal is appropriately filtered and converted to one of the S-band frequency slots in the frequency conversion section of the payload.

The feeding signals are combined in the beam forming network in order to correctly shape on ground the linguistic beams. The required RF power amplification is then obtained by the high power section that represents the core part of the payload.

Each linguistic beam is obtained combining the power of different feeds basing on the reconfigurable phase shifters of the beam forming network.

The beam forming network is reconfigurable in order to compensate for the effects due to satellite motion along the orbit and to the satellite variable attitude for solar panel pointing. Beam forming is therefore reconfigured according to the satellite position and attitude along the orbit.

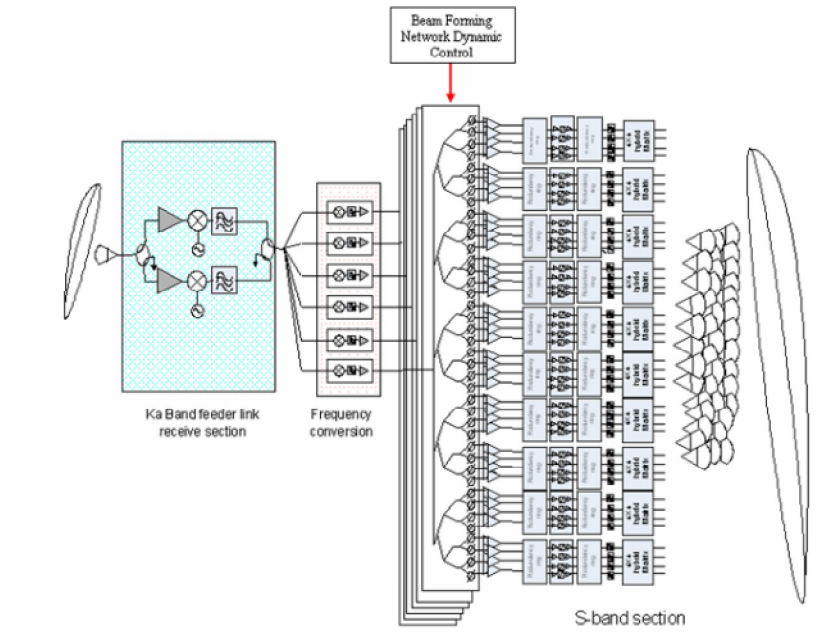
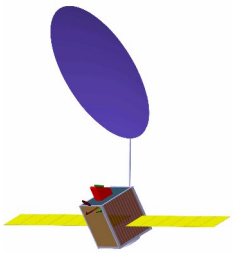


Figure 13: Payload design

The main composing elements of the S-band section of the payload are:

- A low signal to noise level phase-only Beam Forming Network
- A fully shared stack of 40 TWT amplifiers in a power pooling configuration.
- A stack of 10 Hybrid Butler-like matrices (4x4)
- An array of 40 feeds appropriately connected to the hybrid matrices
- An Large Deployable Reflector S-band of 12 meters projected aperture

Platform



The space segment will be made up of two identical spacecraft each in Tundra orbit. The challenge for the space segment design is to take a regular geostationary platform product and make it mission capable in the required Tundra orbit while minimizing cost and potential schedule risks. The adaptation of the geostationary platform needs to perform in response to numerous differences in the orbits. These can be defined as being:

- Different sun and moon angle geometry
- Varying orbit rate throughout the orbit
- Varying apparent Earth size and view angle throughout the orbit

The two identical spacecraft contain the following subsystems:

- Attitude & Orbit Control Subsystem (AOCS)
- Power Subsystem
- Thermal Control Subsystem

- Structure & Mechanisms
- Propulsion Subsystem
- Communications Subsystem (TT&C)
- Data Handling Subsystem

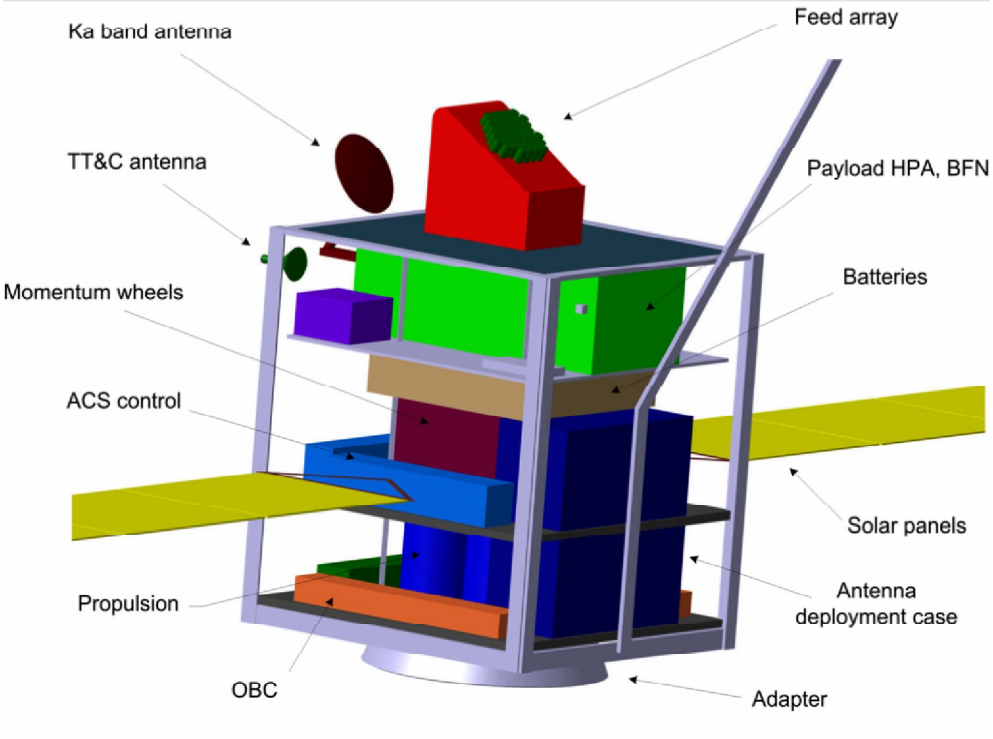


Figure 14: Clepsydra spacecraft

The spacecraft has a design life of 15 years and a total dry mass of 2,324 kg (including margin). Adding propellant the total mass at launch is 4,627 kg (including margin). The spacecraft has an end-of-life power of 15 kW.

Launcher

The launch vehicle selection depends on many factors, such as performance, size and shape of the fairing, availability, reliability and cost. The injection of the Clepsydra satellites into the Tundra orbit requires a heavy launcher with a restartable upper stage (to achieve the required argument of perigee of 270°).

The Proton launcher with a Breeze M upper stage launcher (see Figure 15) has been selected.

A dedicated launcher is used for each of the Clepsydra satellites in order to inject the satellites into their respective orbital planes.

Figure 15: Proton launcher

Ground Segment

The Ground Segment architecture consists of a Payload Processing Segment and a Mission Control Segment (see Figure 16). The communication network and the infrastructure segment complete the Ground Segment. As an important

element of the communication network, the ground stations for the TT&C and the content upload constitute the links to the space segment.

The Ground Segment is based on two main sites:

The Mission Control Centre in Usingen, Germany:

- Mission Control Segment
- Payload Processing Segment
- Content Ground Station
- Backup TT&C Ground Station

The TT&C Ground Station in Malindi, Kenya

- Primary TT&C Ground Station

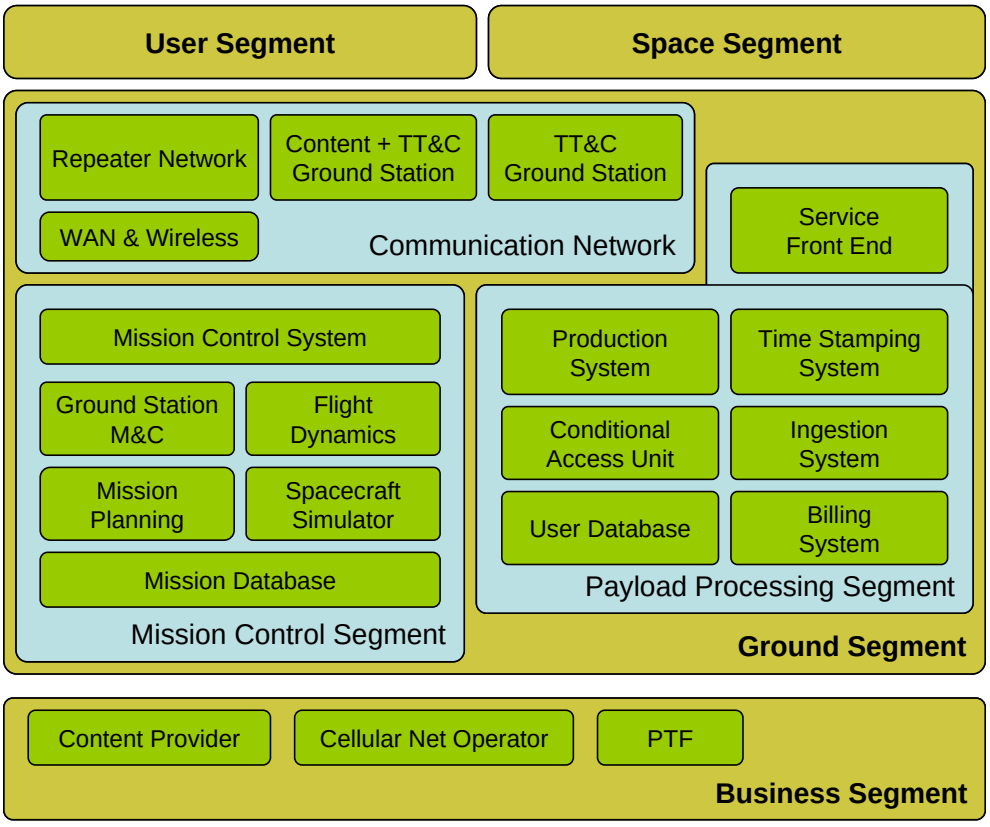


Figure 16: Clepsydra Ground Segment

Terrestrial Repeaters

The signals broadcasted by the satellite have a very low strength when received on-ground.

The terrestrial repeaters are broadcast infrastructure transmitters which complement the Clepsydra signal reception in areas where direct satellite reception is difficult, especially in urban areas; they will be collocated with mobile cellular network sites in order to make use of the cellular transmitting equipment.

Complementary personal gap-fillers of limited coverage are also applicable. Typical application is indoor enhancement under satellite coverage.

Since UMTS is located in the S-band immediately adjacent to the L-band the 3G antenna infrastructures are perfectly suitable for the Clepsydra purpose of repeating the satellite signal. Hence the reuse of the existing site, the existing cabinets and the existing antennas is possible. This helps Clepsydra to minimise the high investment for the terrestrial repeaters and also exempts Clepsydra from the mostly long lasting, complicated site acquisition process.

Key requirements for the repeaters are:

- Dual use of the UMTS equipment of 3G network provider
- Gap filling goal only, no deep indoor coverage pursued

The Clepsydra architecture utilises on channel repeater to build up a so called single frequency network (SFN). The on-channel terrestrial repeater receives the DVB-SH signal from the satellite. After amplification, the signal is transmitted in the same frequency band and in the same modulation scheme (OFDM). See Figure 17.

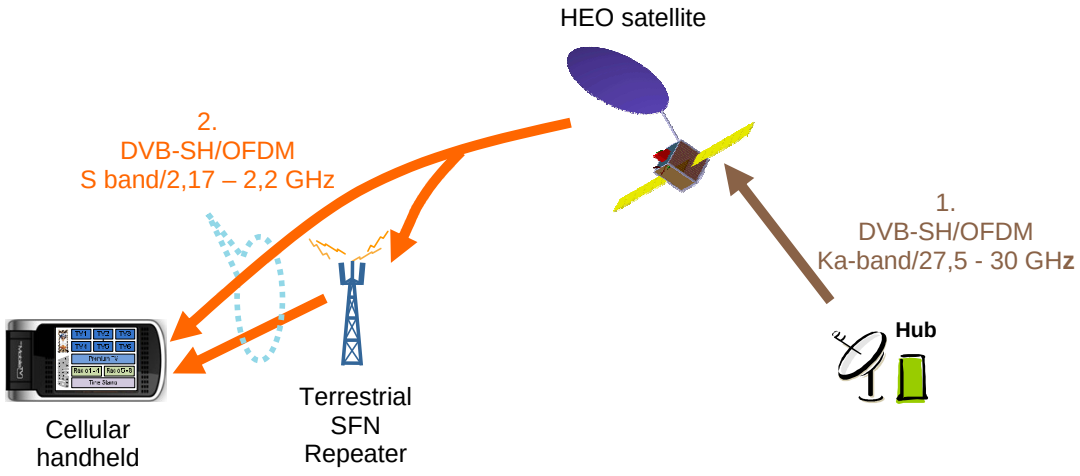


Figure 17: Single Frequency Network (SFN)

Clepsydra will make use of 1100 terrestrial repeaters that are co-located at existing 3G sites.

Business

Business Concept

Clepsydra will not sell directly to end users. Instead, Clepsydra owns the space segment and sells broadcast content via the cellular network operators or resellers, which bundle Clepsydra services with other handheld services. The end user will subscribe to the cellular network operator or a reseller. The reseller or network operator will do accounting and billing for sales to the end user. The cellular network operator owns the terrestrial telecommunications network.

The business concept is illustrated below in Figure 18.

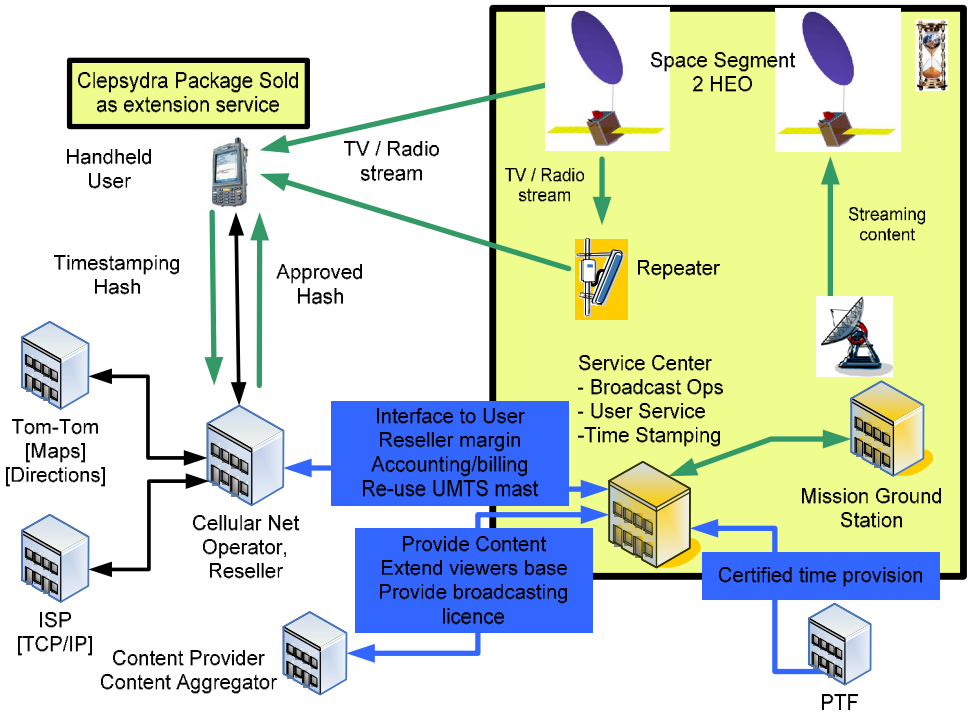


Figure 18: Business Concept

Business Implementation

The business implementation roadmap Figure 19 shows the schedule and the key milestones in the first years of Clepsydra.

Figure 19: Business implementation roadmap

The following assumptions are moreover considered:

- Set-up of the company in year 2008 (Year 1).
- Launch of the constellation in year 2011 (Year 4).
- Set-up of the ground station in year 2010 (Year 3).
- Deployment of the terrestrial repeater network in year 2011 (Year 4).
- Service start-up in year 2011 (Year 4).

Revenues

Clepsydra differentiates itself from its competitors by providing customers the option to purchase prepaid services, in addition to a monthly flat fee. The prepaid service requires no contracts, as the customer can purchase a specific amount of time. This increases our customer base to include vacationers and business travellers.

Television/radio

- Flat Fee: € 4.99 per month.
- Prepaid: € 0.30 per 2 hours.
- Prepaid users will access the service in average for 10 hours per month.

Time stamping

- Flat Fee: € 0.50 per month.
- Prepaid: € 0.10 per stamp.
- Prepaid users will use the service in average 20 times per year.

It is worth highlighting that:

- Revenues coming from television/radio broadcasters (fees for channel broadcasting) are not considered in the optimization process.

- Revenues coming from car market are not considered in the optimization process.

The approach is therefore very conservative from the revenues point of view. The market penetration curve of Clepsydra assumes a three year ramp up and remains relatively constant thereafter.

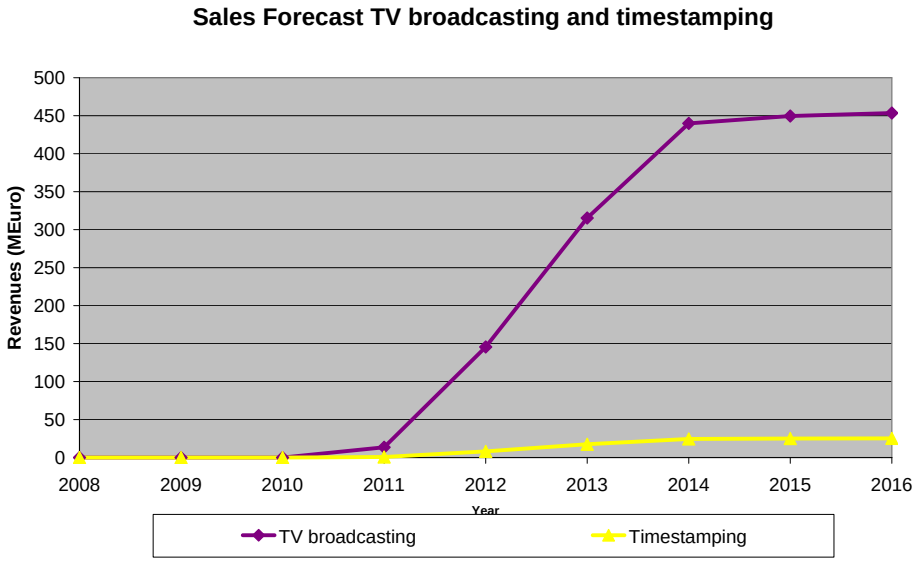


Figure 20: Clepsydra revenues

Management and Organization

The Clepsydra organization is based on two main facilities, a Mission Ground Station and the Headquarters. The organization of the Clepsydra company is shown in Figure 21.

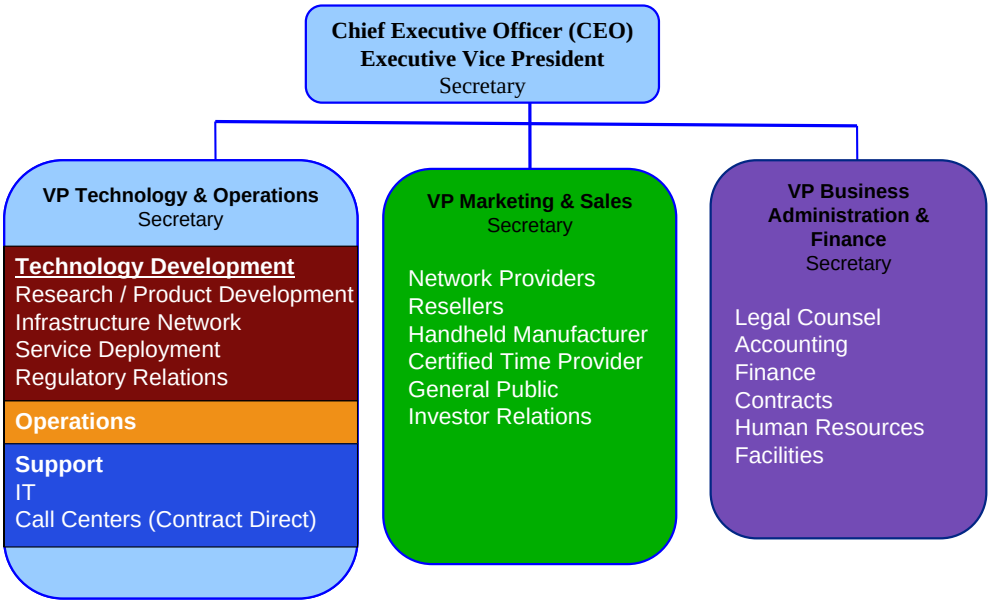


Figure 21: Clepsydra organisation

The staffing plan in the figure below indicates the resources for development, operations, marketing and sales and support and IT.

In addition to the CEO Office, the Clepsydra organization is comprised of three divisions: Technical & Operations; Marketing & Sales; and Administration & Finance. Clepsydra phased staffing plan by each department is provided in Figure 22 below. Technical & Operations department is the largest in the Clepsydra Company; therefore, in the figure below, we show staffing for the Technical & Operations in 3 parts: Technology Development, Operations, and Support. Technology development includes research, product development, space segment, ground segment, terrestrial gap filler network infrastructure, services deployment and regulatory relations. Operations group is responsible for command & control of the space segment, as well as payload operations. The support group will provide company IT, Call Centres to support the end users and administrative support for the Technology & Operations Division.

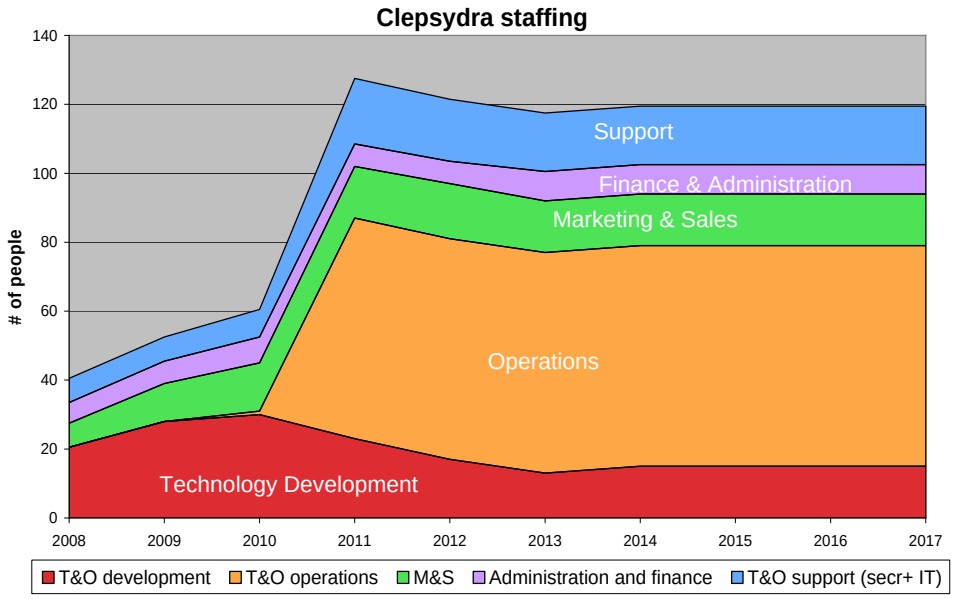


Figure 22: Staffing plan

Clepsydra will be headquartered on the Isle of Man for two reasons. First, the Isle of Man features zero corporate income tax for space and satellite companies. Second, the Isle has established partnership with Mansat Limited to assist space and satellite companies in filing for and obtaining spectrum and orbital slots.

Legal

European Community (EC) Opens a New Market.

In December 2006 the EC made available a slice of the S-Band spectrum (2170 – 2200 MHz) for use by mobile satellite services. To allow continuity of coverage, use of terrestrial gap fillers is also permitted. Applications for the frequency will begin in July 2007.

ITU – Provides Spectrum for Space Segment

The international regulatory environment established under the ITU, a specialized agency of the United Nations, provides a broad framework for the approval process for obtaining orbit positions and authorization to transmit to and from satellites. Obtaining spectrum authorization through the ITU requires approximately 18 months.

The Clepsydra payload design is based on obtaining 15MHz bandwidth of S-Band. In order for Clepsydra to be a viable business, it is imperative that it obtains authorization to use this spectrum. At its founding, Clepsydra staff will work with regulators to obtain this frequency.

National Regulatory Authority (NRA) – Provides Spectrum for Terrestrial Gap Fillers

In order to improve coverage in urban areas, Clepsydra requires the use of approximately 1100 terrestrial gap fillers, distributed over Europe. These gap fillers will receive and transmit in S-band. Spectrum authorization for these gap fillers must be obtained from the national regulatory authority of each country. Therefore, it is imperative that Clepsydra work with the European national regulators to obtain authorization to use the same spectrum in all of the countries.

Spectrum Price

In accordance with the EU licensing directives, the National Regulation Authorities price the spectrum so as to achieve certain developmental objectives and not to maximize license revenue. Clepsydra believes that the licensing fee for S-band will be based on the administrative pricing scheme.

The Clepsydra regulations team, with the Vice President of Business Administration will work with the ITU and each European National Regulation Authority to understand the license pricing structure of each regulatory authority and develop a detailed cost estimate.

The cost of spectrum in a country coupled with how it applies the regulations will be paramount in our roll-out strategy.

License Requirements

Clepsydra requires two types of licenses: first, to use spectrum and operate as a broadcaster; and second, license for content.

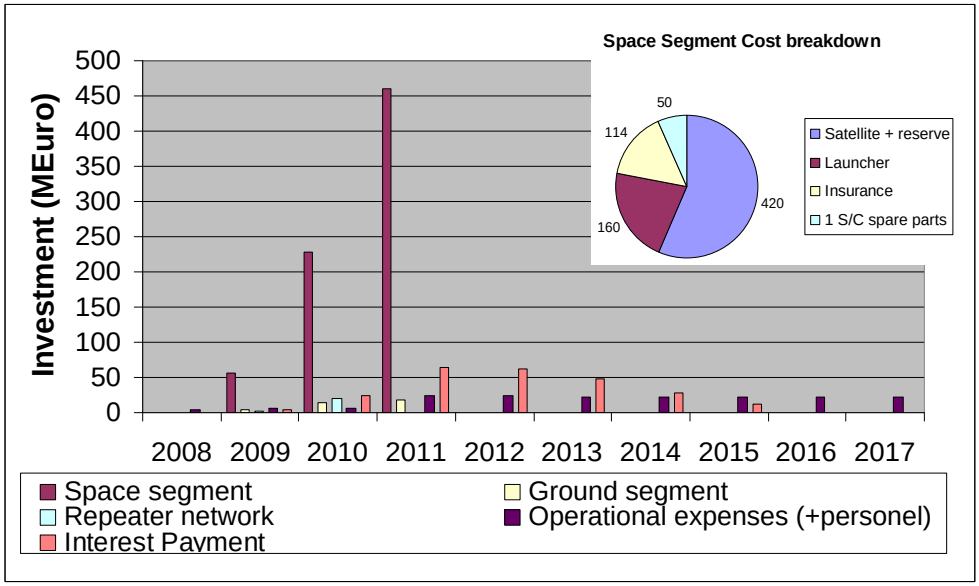
A European broadcast company, such as Clepsydra, must obtain spectrum license from the ITU for space segment, the National Regulation Authority of the country hosting the Ground Control Centre for the ground segment, and the European National Regulation Authorities for the terrestrial gap fillers. The Clepsydra regulations team will begin work on obtaining the spectrum licenses at its founding.

Clepsydra's conversations with other broadcasters, such as SES-ASTRA, indicate that the content providers obtain licenses for their content. Therefore, Clepsydra will follow this model.

Financial

Investment Plan

The investments consist of the space segment (744 M€), ground segment (38 M€) and repeater network (22 M€). The repeater network re-uses part of the UMTS repeaters, which makes the partnership with Cellular Network Operators (discussed later on as strategic investors) as more interesting. The cost of the satellites is based on comparative analysis with similar Spacecraft of established companies like Alcatel and Loral and is shown in the figure below in the breakdown of the space segment. The investments consider a milestone payment plan consistent of the development stages of the investments. The investment plan is shown in the figure below together with the operational expenditures and the interest payments.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total Investments	0	63	263	478	0	0	0	0	0	0
onal Expenses (incl per	4	6	7	24	23	23	23	23	23	22
Interest Payments	0	4	25	65	63	48	28	13	0	0

Figure 23: Investment plan

Financing

The financing plan proposed for Clepsydra is reported in Figure 24 foresees four rounds of finance involving bank loans (debts) and equity from founders, strategic and financial investors.

	'08	'09	'10	'11	'12	'13	'14	'15	'16
Equity	5	33	86	155	0	0	0	0	
1 Clepsydra Founders	2								
2 Handheld Manufacturer	1	3	6						
3 Mobile Operator		15	30	55					
4 Venture Capitalist (VC)	2	15							
5 Private Equity (PE)			50	100					
Debt	0	40	210	400	0	0		0	0
Debt Repayment	0	0	0		25	150	200	150	125

Figure 24: Financing plan

Total bank financing of 650 M€ is paid back in 2016, and equity financing of 279 M€ is provided as follows:

- Clepsydra founders: 2 M€
- Handheld manufacturer : 10 M€
- Mobile Operator : 100 M€
- Venture Capitalist : 17 M€
- Private Equity : 150 M€

Profit & Loss

It can be seen that the curve of the business becomes profitable in the year 2013 (Year 5). The pay back period is six years.

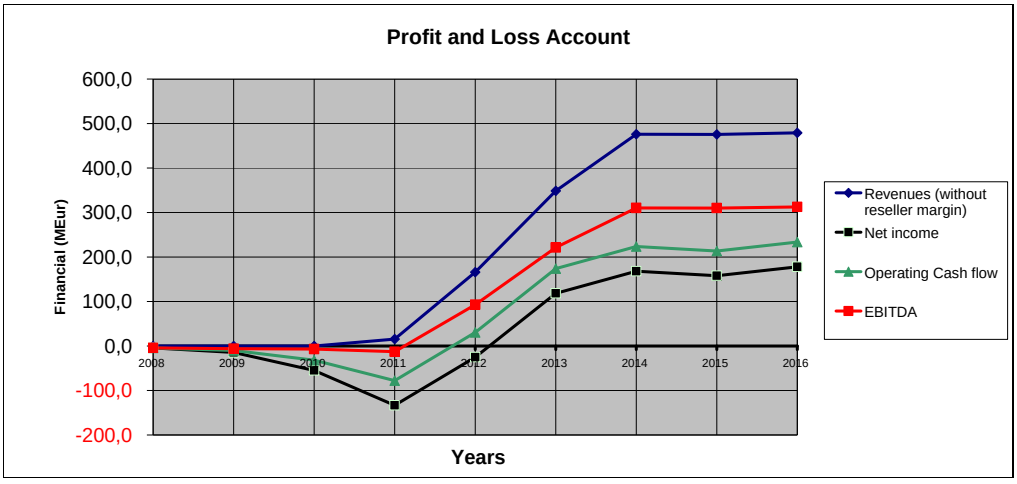


Figure 25: Profit and loss account

Financial Performance

Below important financial indices after 15 years are shown:

Financial Indices	15Years
Investment (M€)	803,55
Equity (M€)	279,00
Debt (M€)	650,00
IRR (operational cash flow)	71%
Cost of Goods sold (reseller margin)	30%
Profit on revenue	35%
EBITDA margin	65%
Revenue per capita (M€)	3,91
NPV (operation cash flow) (M€)	628,18
Cumulated Net income (M€)	1429,31
Cumulated cash flow (M€)	2107,43
Time to Profit (year)	5
Pay Back Period (year)	6
Terminal Value	2107,95

Figure 26: Financial indices

Indices for the Clepsydra business show a good performance and match industry benchmarks.

Investment Opportunity

The investment opportunity from the Clepsydra Company Perspective is reflected with the Net Present Value (NPV) and Internal Rate of Return (IRR) values. They are very appealing values and they consider that in 2014 Clepsydra starts to pay 50% of the profit as dividend to the shareholders.

Clesydra offers an interesting investment opportunity for both financial and strategic investors. From the outset, partnerships with the handheld manufacturer and the mobile operator as well as their optional takeover of the shares of the financial investors in 2013 are strategic assets of the Clepsydra business development. This strategy represents an appropriate exit route for the financial investors and reduces the risk of the strategic investors, who can develop synergies with their core business combined with attractive financial asset as the Clepsydra business deveopes. Furthermore, dividends of 50% of the profits will be paid to shareholders from year 2014. This scenario leads to the following shareholder structure, by which the founders will be diluted down to 3,4%:

Shareholders structure	'08	'09	'10	'11	'12	'13	'14	'15	'16
Valuation (M€)	5	48	158	392	1433	1897	2029	2035	2079
1 Clepsydra Founders	40%	12%	6%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%
2 Handheld Manufacturer	20%	12%	10%	5.6%	5.6%	5.6%	14%	14%	14%
3 Cellular Network Operator		32%	33%	34%	34%	34%	83%	83%	83%
4 Venture Capitalist (VC)	40%	44%	20%	12%	12%	12%			
5 Private Equity (PE)			32%	45%	45%	45%			

Figure 27: Shareholder structure

The Strategic investors buy the shares of the financial investors at a predefined price. With the before mentioned approach 57% of the shares will be acquired for a price of 1076 (MEuro) by the strategic investors as follows:

	Share value buyout 2013	Extra Shares obtained
2 = Handheld manufacturor	155	8%
3 = Mobile operator	921	46%

Figure 28: Share price

Valuation, based on the price-earnings-method takes into account a p/e ratio of 20 and a discount factor of 40%.

The return potential for investors is attractive. The strategic partners can realize a net return above 10% p.a. at relatively low risk, and in parallel can support their core business by significant Clepsydra-based sales. The financial investors have a return potential of an order of magnitude of 100% p.a. within a timeframe of 5 years with a clear exit route.

Several Key return values for the investors are illustrated in the table below.

	investment (M€)	divestment (M€)	capital gain (M€)	Terminal value (M€)	multiple	IRR pa
1 = Clepsydra Founders	2	25,6	23,6	72,6	49,1	37%
2 = Handheld manufacturor	165	103,3	-61,6	293,1	2,4	11%
3 = Mobile operator	1021	614,0	-406,7	1742,3	2,3	10%
4 = Venture Capitalist	17	228,7	211,7	0,0	13,5	87%
5 = Private Equity	150	847,0	697,0	0,0	5,6	105%

Figure 29: Return on investment

The divestments of the founders and strategic investors shown in the above table represent didvend payments to them over the planning period. In addition, each of them maintains a stake in the company acoording to the terminal value stated. The pro rata terminal value is shown after the booking period of 15 years.

Cash-on-cash multiples of the financial investors translate into good investments. The early-stage venture capital investor would realize a multiple of 13.5 in 4.5 years and the midcap private equity fund would realize a multiple of 5.6 in over 2.5 years.

Risk Management

Overview

Clepsydra has identified risks of technical, market and business nature. For each of the risks the severity and likelyhood has been assessed and actions have been taken to reduce the risks. Figure 30 gives an overview of the top 10 risks and their risk levels.

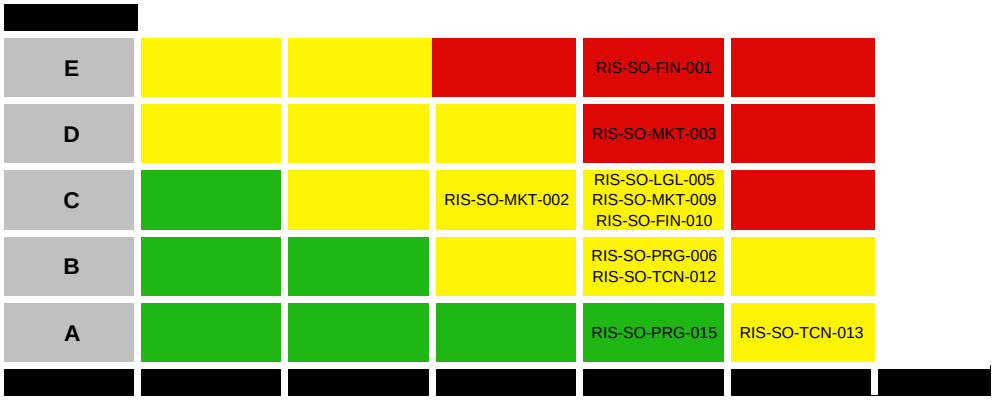


Figure 30: Risk management matrix

Main Risks

The main risks to Clepsydra are:

Number & Description	Impact	Mitigation Actions & Status
RIS-SO-FIN-001 High Entry Barrier	* Insufficient funds for founding or development phase.	Lower cost scenario's have been investigated. System Engineering has performed analysis to lower cost. While the cost have been estimated with more certainty, the total cost remains substantial and a high risk to raise those funds.
RIS-SO-MKT-002 Direct competition of other satellite broadcasters	* Loss of revenue	System differentiated significantly from main satellite-based competitor: Main differentiator is low pricing strategy and usage of timestamping service.
RIS-SO-MKT-003 Indirect competition from terrestrial broadcasters	* Loss of revenue	DVB-H terrestrial broadcasters expected to become the biggest threat. UMTS will in the end be limited for mass applications. In some countries partnerships with terrestrial DVB-H providers can be established, especially when other broadcast frequencies are limited (ie no UHF available)
RIS-SO-LGL-005 Content broadcasting regulatory issues	* No coverage in some countries	Risk reduced to acceptable level at this stage, no own content is planned to be generated. Information from ZDF and SES ASTRA has decreased the likelihood.
RIS-SO-PRG-006 Available bandwidth allows not enough services	* Insufficient revenues	Comparitive check with SES ASTRA suggests that with 10 to 15 MHz a service can be achieved. Assessment of number of channels with 15 MHz has been calculated by System Engineering. We can have a nice package with this limited bandwidth considering our pricing strategy.
RIS-SO-MKT-009 Availability of service is too low without repeaters	* Loss of revenue	Business concepts are traded in financial analysis report. Market share assumptions are taken worst case. Service with a limited number of terrestrial repeaters is possible. This way only outdoor service is guaranteed. For 30% of the users this is acceptable. Business plan assumes this solution providing a low cost solution for the outdoor market.
RIS-SO-FIN-010 Revenue assumptions are wrong	* Loss of revenue	Risk reduced to acceptable level. Market analysis document updated to reflect latest information on market predictions. Premium channel allows additional income. Pessimistic assumptions allow for some margin.
RIS-SO-TCN-012 Availability of handheld devices for DVB-SH	* Delay of revenue * Delay of time to profit	Several DVB-H handhelds are already available. For DVB-SH only minor modifications needed. The chip required is already available at low cost and this costs is decreasing when produced in larger quantities when the service picks up.
RIS-SO-TCN-013 HEO with 2 satellites might not work	* Low service availability * Loss of revenue	HEO with two satellites can work as system concept as it guarantees coverage of high latitude regions in Europe at high elevation angles 24 hrs/day. The constellation needs to be augmented with terrestrial repeaters for urban areas to provide full outdoor coverage.
RIS-SO-PRG-015 Launch failure	* Delay of revenue * Delay of time to profit	Proton M breeze has been selected as launch vehicle for Clepsydra. Launch record indicates that this launcher is reliable. Satellites are insurred sufficiently to cover rebuilding, relaunching and guarantee operational expenses during that period.

Conclusion

The current developments in services to handhelds lead to a **market pull for mobile television and radio**. The total addressable market for mobile television will grow to 70 million users in 2016.

The **availability of the S-band frequencies** for satellite to handheld communications gives an opportunity for Clepsydra to provide its services in Europe.

With a **low-cost pricing strategy** of € 4.99 per month Clepsydra will claim the market share needed for highly profitable business.

Clepsydra uses an innovative system design based on a constellation of two satellites in highly elliptical orbits augmented by a limited number of terrestrial repeaters. This provides **high service availability** and full European coverage to users outdoors.

The system is designed to make use of proven technologies with minor modifications. This ensures **reliable provision of services**.

With internal rates of return per annum between 10% and 100% Clepsydra offers an attractive investment opportunity to financial and strategic investors.

Clepsydra addresses the current trends in mobile broadcasting. The business is highly profitable and offers an excellent business opportunity.

The Clepsydra Team

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