



GS EASYSPACE

A Low Cost Space Company

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1. Presentation

1.1. Vision

In recent years the space sector worldwide is undergoing a paradigm shift. With the U.S. as the epicentre of change, since the Augustine report, the governments reorganize its resources to be directed towards more remote missions, leaving other aspects, such as the Low Earth Orbit access, to private companies. Other important factors will join this to help reducing costs of certain missions. Furthermore, there will grow a market of new players (small countries, universities, private sector ...) and new applications (search, navigation, Earth observation, communications, interplanetary mining...), which require smaller, cheaper satellites.

The result is a market opportunity that can be filled in by new dynamic companies, which will develop space missions with a low cost philosophy, reducing budgets and time with jeopardizing safety, a concept which can only applies to unmanned missions.

1.2. Mission

GALACTIC SUITE EASY SPACE aims at **developing, building and launch to orbit payloads at a very low cost**. As a first step in its business development, Galactic Suite Easy Space is commercializing payload transportation, after which the company will go on with the design and construction of the payload for those customers.

GALACTIC SUITE EASY SPACE is a filial company of the Galactic Suite Group, which objective is creating opportunities around technology and people to promote the private access to space. Founded in 2007 by Xavier Claramunt, the group creates cutting edge concepts and promotes them through industrial joint ventures, together with technology centres and universities. The projects developed by the group include:

- Galactic Suite Space Resort is the company that promotes the construction of the first space hotel based in the technology of the European builder EADS Astrium
- Galactic Suite Design offers conceptualization and design concepts in the space sector, and it is member of the Barcelona Aeronautics and Space Association (BAIE) since 2009.
- Barcelona Moon Team, the only registered Spanish team in the international technology competition Google Lunar X Prize to land a private robotic mission to the Moon before the end of 2015.

1.3. Competitive Advantage

GALACTIC SUITE EASY SPACE's competitive advantage is based in its particular low cost philosophy that allows reducing the mission costs in an order of magnitude of that of a governmental mission. Within the factors that make this possible we can highlight:

Global market

The company analyzes all current and under development launch suppliers to get the best price through volume purchasing, also setting a regular schedule of launches.

Fordization

The new company will base its design and production in standardization, volume purchase and mass production to reduce costs.

Reutilization

The low cost company will base its commissions, whether they are mission analysis or hardware/software production in the use of amortized designs.

De-regulation

By expanding the market to customers who are not national agencies, regulatory standards will be relaxed, which will reduce also the costs.

Reliability

The cost /reliability ratio is exponential, which means that most of the cost of missions are currently located in the attempt of reaching 99,9% reliability. Reducing the reliability of the mission to 95% will reduce the cost of the mission to a fifth. The company could even launch two missions at half of the current price and get the reliability close to 100%.

1.4. Milestones Achieved

In the last years, Galactic Suite Easy Space has achieved a number of strategic goals that are a major competitive advantage over potential competitors:

Commercial Agent agreement with China Great Wall Industry Corporation

Galactic Suite Easy Space has signed with the state-owned China CGWIC an agreement to market their launchers in Europe with an area of exclusivity that will expand along with the missions completed together.

Spanish Industrial Consortium

Galactic Suite Easy Space has joined the leading companies in the Spanish space industry, meeting between them the skills to carry out the construction of the additional equipment to launches the payloads.

Barcelona Moon Team

Galactic Suite Easy Space is leading since 2010 the only registered Spanish team in international competition Google Lunar X PRIZE endowed with \$30M. The team is funded entirely with private companies sponsorships.

2. Strategical Partners

To lead this new market and support the company, it has been created an industrial consortium with China Great Wall Industry Corporation (launch service technology partner in China), Altran (as technology and business development partner in their offices both in Spain and China), GMV, EADS Astrium, Thales Alenia Space and the support of the National Institute of Aerospace Technology – INTA. This consortium will look after the design and construction of the payload interfaces and complementary equipment.



2.1. China Great Wall Industry Corporation

Established in 1980, China Great Wall Industry Corporation (CGWIC) is the sole commercial organization authorized by the Chinese government to provide satellites, commercial launch services and to carry out international space cooperation.

CGWIC is devoted to the internationalized development of China's space industry by providing comprehensive solutions for commercial launch services, satellite export, satellite ground tracking and control station construction, satellite applications, project financing, project insurance and technical training, etc.

2.2. Altran Technologies

Altran Technologies is a multinational company for technological and innovation consultancy, with more than 17.000 advisors all around the world. It has been part of many European space projects such as the Ariane 5 launcher, the International Space Station (ISS), the Automated Transfer Module (ATV), large communication satellites and science projects such as the Mars and Venus Express probes, the Herschel-Planck space telescope or the SMOS-MIRAS mission.

Altran is an strategic partner of the EADS group for the engineering and R+D development of their products. Within the Altran Group, its Spanish filial company has an special relevance with close to 2000 advisors and a growing participation in the space sector.

2.3. GMV

GMV is a privately owned technological enterprise group with an international presence. The group employs more than 1,000 staff, most of whom work in the Space business (about 550) and have outstanding experience and capabilities, including consultancy, system engineering, software development and turn-key systems integration, characterized by the common denominator of innovation for the areas of global navigation satellite systems and applications, flight dynamics, satellite control centres, mission analysis, mission planning and scheduling, payload data segments, science operations centres, user segments and space segment, satellite communications, simulation, systems engineering and GNC, and on-board and embedded software.

2.4. EADS CASA ESPACIO

EADS Casa Espacio is a company part of Astrium. Located in Madrid, it is composed of more than 400 qualified workers dedicated for more than 30 years to Space Systems, including satellites, platforms, payloads and launchers. The Company has special strength in System Engineering tasks and Assembly, Integration and Verification (AIV) activities for the different payloads and platforms. It is also a reference point for thermal control, mechanisms and structure subsystems design and for antennas design and manufacturing. It has been Prime Contractor of several projects (Minisat, PAZ, INGENIO, SMOS and Spainsat payloads among others) having as customers ESA, HISPASAT, Arianespace, INTA and NASA and standing out for the quality of the results provided.

2.5. THALES ALENIA SPACE España

Thales Alenia Space España is a Spanish company devoted to the development of space systems and equipment for telecommunications, Earth observation, scientific research, exploration of the universe, navigation and space vehicles and infrastructure for commercial and institutional programs both civilian and military. The company is a global leader in telecommunication systems and repeaters and Telemetry, Tracking and Command (TTC) data communications equipment in S-band for satellites and spacecraft, with a share of 50% of the world accessible market. Thales Alenia Space España has been working for over 20 years in scientific and Earth observation programmes, providing communications equipment and data processing and mechanism control units for space agencies around the world. It also develops RF and optical sensors for formation flying with application in future scientific and exploration missions.

2.6. National Institute for Aerospace Technology (INTA)

INTA is a public research organization specialized in aerospace research and technology development. Its main functions include: acquisition, maintenance and continuous improvement of all those technologies for aerospace application; the realization of all kinds of tests to verify and certify materials, components, equipment, subsystems and application systems in aerospace; the technical advice and services to institutions and government agencies as well as industrial and technology companies; act as a technology centre of the Ministry of Defense.

2.7. Aerospace Technology Center (CTAE)

CTAE is a not-for-profit private foundation that provides technology services to local industry, while also participating in national level and European research programs. It comprises a multidisciplinary group of specialists who work directly for private clients, or as members of integrated project teams with clients including the European Space Agency, the Galileo Supervisory Authority, the regional government of Catalonia, the national government of Spain, and the European Commission, in addition to many industrial customers. Recently it has integrated into the larger ASCAMM technology centre.

2.7. Barcelona Tech – Technical University of Catalonia (UPC)

The UPC is a public institution of higher education and research, specializing in the fields of architecture and engineering sciences and involved in technology development. UPC develops quality research, and its high level of technology transfer to society generates knowledge, research, innovation and technological advancement.

To assist the project the University has created a chair with participation of several departments, including the Engineering Department of Automatic Control and Industrial Informatics (ESAI), the Research Centre in Nanoengineering (Crne), or the Department of Applied Mathematics

2.8. Stardust Consulting

Stardust Consulting is a legal advisory firm specialized in space. It advises both private companies and public institutions, including the issue of space tourism. Its members are part of the International Institute of Space Law (IISL) and the European Centre for Space Law (ECSL) of the ESA. Its activities aim at developing the Spanish space sector regulation because, unlike other countries around Spain, there is no Spanish Space Law regulating space activity and encouraging its access to the private sector

2.9. International Space Brokers

International Space Brokers (ISB), part of AON Risk Solutions, is the world's only insurance broker dedicated exclusively to the space industry. We harness our insurance and space industry expertise to make complex situations simple, developing innovative responses that bring value to our clients.

The ISB team brings together experts in space engineering, contract negotiation, finance, risk management and insurance. In less than two decades we have become one of the most respected names in space insurance, with a client list that includes eight of the world's top 20 satellite companies. We currently place over 35% of the world's space insurance premium.

3. Products

GALACTIC SUITE EASY SPACE offers its products at ultracompetitive prices in its two activity areas:

3.1. Low Cost Transportation

GALACTIC SUITE EASY SPACE **launch of payloads into orbit**, within a particular range of mass, mission typologies and orbital destinations, which will optimize the costs dedicated to the launch. In collaboration with its launch provider China Great Wall Industry Corporation, the company offers the following destinations with the associated prices:

3.1.1. Lunar transportation

GALACTIC SUITE EASY SPACE offers lunar transportation with 40kg of payload landed on the surface of the Moon at a price of **54MEur**, equivalent to **1.35MEur/kg**, a tenth of the equivalent cost in a governmental mission.

3.1.2. Payload transportation to GEO

GALACTIC SUITE EASY SPACE offers payload transportation up to 1000kg to geostationary orbit at a price of **30 million of Euros**, equivalent to **30.000Eur/Kg**, in dedicated launches especially for smaller communication satellites.

3.1.3. Payload transportation to LEO

GALACTIC SUITE EASY SPACE offers payload transportation up to 2000kg to low Earth orbit at a price of **27 million of Euros**, in dedicated or dual launches, equivalent to **13.500Eur/Kg**.

3.1.4. Small payload transportation to LEO

GALACTIC SUITE EASY SPACE offers the launch of small payloads integrated in a precise and regular calendar, as an alternative to the opportunity and *piggy back* launches, very imprecise in terms of scheduling. In collaboration with China Great Wall Industry Corporation, GALACTIC SUITE EASY SPACE analyses the viability of an optimized launcher for small payloads to LEO. The company estimated a price to LEO of **4MEur** for **50kg** total payload, equivalent to a price per kilogram of **80.000Eur/kg**.

In addition, customer may select the purchase of the transportation for a payload with or without insurance. The table hereunder summarizes the destinations, maximum capacity, price per kilogram and price per kilogram insured, meaning that in the event of launch failure bringing the loss of the payload, the cost of the launch would be returned (although not the cost of the payload itself).

DESTINATION	MAX. CAPACITY	PRICE/KG	PRICE/KG. Insured
Lunar Surface	40 Kg	1,35 MEur/Kg	1,8 MEur/Kg
Geosynchronous orbit GSO (incl.GEO)	1000 Kg	30KEur/Kg	40KEur/Kg
Low Earth orbit (LEO)	2000 Kg	13,5KEur/Kg	18KEur/Kg
Low Earth orbit (LEO) Small payloads	450 Kg	80KEur/Kg	105KEur/Kg

Fig. Table summarizing the transportation services of GSES

3.2. Low Cost Payload Construction

GALACTIC SUITE EASY SPACE services its customers with the design, development and construction of space hardware and software to meet the low cost philosophy in the standardisation, the reusability, the statistic risk palliation. Initially all the company's products are specific, developed and built under customer's requirements, but as times goes by the company will optimize these products to be recurrent, decreasing its costs by bringing them to mass production.

Space hardware is then categorized regarding its orbit/function/mass as follows:

3.2.1. Construction of payload to the Moon

Galactic Suite Easy Space and its providers, based in the experience gained in its participation in the Barcelona Moon Team, within the international competition GLXP, offers complete missions to the Moon surface. Customers can purchase a slot in the lunar lander to bring a self-built payload. They also can order to GSES the construction of the payload to occupy that slot. These payloads can be demonstrators, scientific experiments (in collaboration with scientific teams), or a lunar rover to travel on the lunar surface.

The company quantifies the cost of the construction of the lunar rover or other moon hardware in **300KEur/kg** as a payload itself (To which it should be added the price of the transportation – as for point 3.1.1).

3.2.2. Construction of payload to GEO

Geostationary (GEO) or geotransfer (GTO) missions are very common, especially for telecommunication satellites. This allows that the satellite platforms (bus) can be very standardized (recurrent), allowing for a cost reduction.

Galactic Suite Easy Space operates GEO and GTO missions for payloads up to 1.000kg. Customers of these flights can purchase the slot in a dedicated or dual flight (as for section 4.1.2) or, on top of this, order to GSES and its partners the construction of the satellite they require. GSES estimates that 50% of the payload will be provided by the company, 500kg. The company quantifies the construction of the satellite to GEO and GTO in **100kEur/kg** as a construction cost (to which it should be added the cost of the transportation itself – as for point 3.1.2).

3.2.3. Construction of payload to LEO

Low Earth Orbit (LEO) or Medium Earth Orbit (MEO) missions are mainly used for Earth observation and geopositioning satellites. New possibilities offered by miniaturization, and the current trend for satellite constellations, allow for a cost reduction of such recurrent equipment.

Galactic Suite Easy Space operates LEO and MEO missions for payloads up to 2.000kg. Customers of these flights can purchase the slot in a dedicated or dual flight (as for section 4.1.3) or, on top of this, order to GSES and its partners the construction of the satellite they require. GSES estimates that 50% of the payload will be provided by the company, 1.000kg. The company quantifies the

construction of the satellite in **100kEur/kg** as a construction cost (to which it should be added the cost of the transportation itself – as for point 4.1.3).

3.2.4. Construction of small payloads to LEO

It is very likely that customer of the small payload transportation are mainly universities and private companies that build their own equipment for research and testing. GSES offers for them the slot to multiple payload launches (as for section 4.1.4). However the company also offers, together with its preferred partners, the construction of the mini satellite required by them.

The company quantifies the construction of the satellite in **100kEur/kg** as a construction cost (to which it should be added the cost of the transportation itself – as for point 3.1.3).

Customer may select the purchase of the construction of a payload with or without insurance. The table hereunder summarizes the type of payload depending on its destination, with a price per kilogram and price per kilogram insured, meaning that in the event of a launch or payload failure bringing the loss of the payload or service, the cost of the payload construction would be returned.

CONSTRUCTION	PRICE/KG	PRICE/KG.AS
Lunar Surface	300 KEur/Kg	400 KEur/Kg
Geosynchronous orbit GSO (incl.GEO)	100KEur/Kg	135KEur/Kg
Low Earth Orbit (LEO)	100KEur/Kg	135KEur/Kg

Fig. Table summarizing the construction services and pricing of GSES

4. Customers

4.1. Barcelona Moon Team

The Barcelona Moon Team is the first customer for GALACTIC SUITE EASY SPACE. This is a mission opportunity for the national industry to win an international technology competition and demonstrate the feasibility of a low cost industry in this new stage.

The \$30 million Google Lunar X PRIZE is an unprecedented competition to challenge and inspire engineers and entrepreneurs from around the world to develop low-cost methods of robotic space exploration. To win the Google Lunar X PRIZE, a privately-funded team must successfully place a robot on the Moon's surface that explores at least 500 meters and transmits high definition video and images back to Earth.

Barcelona Moon Team has set a launch service contract with GALACTIC SUITE EASY SPACE to launch on December 2014 with a Long March 2C CTS2, a very reliable Chinese launcher with two liquid stages and a solid upper stage that will bring a payload of 660kg to a lunar transfer orbit.

4.2. Governments and National Space Agencies

In recent years the space sector worldwide is undergoing a paradigm shift. With the U.S. as the epicenter of change, since the Augustine report, the governments reorganize its resources to be directed towards more remote missions, leaving other aspects, such as the Low Earth Orbit access, to private companies. Other important factors will join this to help reducing costs of certain missions.

As a consequence, the national agencies will largely be, first in the U.S., then in Europe, in the main customers of launch services for low and medium earth orbit, where GSES partially develops its activity.

4.4. New Actors

GALACTIC SUITE EASY SPACE estimates the growth of a new players market (small countries, universities, private sector...) who will require smaller, cheaper satellites to service with new applications (search, navigation, Earth observation, communications, interplanetary mining...).

The Company offers this service in particular to the customers that don't have a National Space Agency or an easy access to the manufacturing and launching of payloads.

5. Launch Calendar

GALACTIC SUITE EASY SPACE will establish, accordingly to the demand, a launch schedule with selected flights within the possibilities offered by its preferred launch service partner, China Great Wall Industry Corporation.

Companies in the consortium will develop the engineering of the complementary equipment to adapt the customer's payload to the selected launcher and, if necessary, the dispensers that release the payloads simultaneously.

GALACTIC SUITE EASY SPACE will receive the customer's payload to be integrated to the complementary equipment, adapters and dispensers, which will be assembled to the launcher already in China. Given the current restrictions imposed by the American regulation "International Traffic in Arms Regulation" (ITAR), only ITAR free payloads will be accepted, thus without American components.

Setting regular launch calendars, the company will largely facilitate the organization of the builders and the operators of satellites, minimizing the times with no activity between the construction of a satellite and its launch. These times represent high costs to the operator for he has to keep paying the teams that will conduct operations after launch.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Lunar Mission	0	1	0	1	0	1	0	1	0	1	0

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
GEO Missions	0	0	1	0	1	0	1	0	1	0	1

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
LEO Missions	0	1	0	1	0	1	0	1	0	1	0

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Small LEO Missions	0	0	1	0	1	0	1	2	2	2	2

Fig. Table summarizing the estimated GSES launches in the next years

6. Commercial Agents

In parallel to the services offered by Galactic Suite Easy Space, both in the transportation area and the construction area, the company also is the commercial agent of some of the firms in the consortium, offering a proactive and fluid relationship between the two parts allowing a faster and more reliable relationship with the customer. China Great Wall Industry Corporation is one of the companies offering its products (both Long March launch services and satellites and satellite services) through Galactic Suite Easy Space.

6.1. China Great Wall Industry Corporation

Since the decade of 1980's, the Long March family of rockets commercializes launches to multiple payloads with higher reliability and a very competitive cost. During the 90's the Long March launchers put into orbit 21 American and European satellites. Since 1999, due to US export control policy, Long March are unable to launch ITAR restricted satellites. Along with Galactic Suite Easy Space other companies have seen a business opportunity in this strict American regulation and since 2005 several unrestricted satellites built in Europe have been launched by Long March.

In this way, Long March launchers have capability for satellite flight missions of various purposes, different masses and diversified orbits:

Low Earth Orbit (LEO) capability up to 9.500 kg

- Depending on the desired orbit and inclination several launchers can be used to provide this service.

Standard Geotransfer Orbit (GTO) capability up to 5.500 kg

- LM-2C: 1.250kg;
- LM-3A: 2.600kg;
- LM-3B: 5.100kg;
- LM-3B/E: 5.500kg;
- LM-3C: 3,800kg;
- LM-4C: 1.400kg

LM-2C

LM-2C is 2-stage launch vehicle designed for LEO or SSO Mission. Based on flight proven technology of LM-1 and LM-2, the development of LM- 2C launch vehicle was started in 1970. Since 1975 it has carried out more than 35 successful missions

- Fairing Diameter: 3,35m
- LEO Capability: 3.850 kg (I=63°, h=200km)
- SSO Capability: 1.400 kg (H=600km)

LM-2C/SMA, is a three stage LV, basic LM-2C with three-axis stabilized upper stage, for LEO or SSO Mission

- SSO Capability: 1.900 kg (H=600km)

LM-2C/CTS2, a three stage LV, basic LM-2C with a self-spin stabilized upper stage for GTO Mission.

- GTO Capability: 1.250 kg ($i=28^\circ$, $H_p=200\text{km}$, $H_a=35786\text{km}$)

LM-2D

LM-2D is a launcher developed starting in 1990 to meet the demand of LEO and SSO satellites. Starting from 2002, it has demonstrated high reliability, wide application and mature technology, with a total of 11 missions up to 2009, all of them successful.

- Lift-off Mass: 250 tones
- Fairing Diameter: 3,35m
- Length: 41m
- SSO Capability: 1.300 kg ($H=645\text{km}$)

LM-2F

LM-2F is a launcher based on the LM-2E starting in 1986 and it is mainly used for manned flight. Its non manned maiden flight was in 1999. In October 2003 launched the Shenzhou 5, the first manned Chinese space craft. In September 2008, Shenzhou 7 saw China's first space walk.

LM-3A

LM-3A is a 3-stage launch vehicle developed on the basis of LM-3 and LM- 2C. Its third stage is powered by cryogenic propellants --- liquid hydrogen and liquid oxygen. It is mainly used for launching spacecraft to GTO missions. Since then it has successfully accomplished 17 launches.

- Lift-off Mass: 241 tones
- Fairing Diameter: 3,35m
- Length: 52,5m
- GTO Capability: 2.600kg

LM-3B

LM-3B is the most powerful launch vehicle in Long March fleet based on LM- 3A as its core stage with four liquid boosters strapped on the first stage. The development of LM-3B has been made upon good heritage of mature and flight proven technology of Long March family of launch vehicles. Its GTO capacity is 5,100kg.

LM-3B/E launch vehicle is developed on the basis of LM-3B, increasing the GTO capacity up to 5,500kg. LM-3B/E has nearly the same configurations with LM-3B except its enlarged core stage and boosters. On May 14, 2007, the flight of LM-3B/E was performed successfully, accurately sending the NigcomSat-1 into pre-determined orbit.

LM-3B (*LM-3B/E)

- Lift-off Mass: 426 tones (*459 T)
- Fairing Diameter: 4,00m (*4,20m)
- Length: 54,8 m (*56,3m)
- GTO Capability: 5.100kg (*5.500 kg)

LM-3C

LM-3C is a three-stage launch vehicle, which takes the mature LM-3A as the core stage with 2 strap-on boosters. The only difference between LM-3C and LM-3B is the number of the strap-on boosters. It did its first flight in 2008. Since then it has accomplished 6 launches, all of them successful. It is mainly used for launching spacecraft for GTO mission.

- Lift-off Mass: 343 tones
- Fairing Diameter: 3.35 m
- Length: 54.8 m
- GTO Capability: 3.800 kg

LM-4

LM-4 served as a back-up launch vehicle for LM-3 to launch China's communications satellites. After the successful launch of China's first DFH-2 communications satellites by LM-3, the main mission of the LM-4 was shifted to launch sun—synchronous orbit meteorological satellites.

- Lift-off Mass: 249 tones
- Fairing Diameter: 3.35 m
- Length: 41,9 m
- SSO Capability: 1.500 kg

7. Contact

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