LEO-Space Business Plan

Ty Yiu, Linos Mueller, Daniel Harkjaer, Joost Jannssen, Anastasia Moiseeva

2018-10-22

LEO-Space

> The business idea of LEO-Space is to offer accessible, affordable and sustainable Low-earth-orbit satellite deployment.

The rocket industry market nowadays is higher than ever competitive with private institutions, though few to none offer a service for bringing small objects to orbit.

LEO-Space fills the market gap between temporary Low earth orbit objects such as weather balloons or similar and the big rocket industry, mainly focused on Outer Earth Orbit. The market gap to exploit, is to serve customers with small payload deployment, such as communication satellites, camera satellites or science payloads. The potential customer segment is bigger than for the big rocket industry in count. More states, intelligence agencies, universities, firms and hobbyists desire access to rocket launches into orbit. The mean cost for a rocket launch lies above several millions, thus not being affordable for these potential customers.

To make the industry affordable for smaller launches, it is necessary for sustainable development, especially in the rocket industry. Efforts from firms like SpaceX to re-use the first stages is a good example of such sustainable usage. The way to overcome even such achievements, is to eradicate the concept of stages completely and build SSTO's - *"Single Stage To Orbit"*. The concept was picked up several times in the time period of the space race. Actual working prototypes were built, but due to bad budgeting never launched. Approaches like *"The Vertical Aero-spike engine"* is a perfect implementation example. It allows SSTO, as well as potential VTOL (Vertical take-off and landing). The bell shaped rocket nozzle is inefficient relative to a aero-spike engine as pressure adaptations are made by the engine itself during ascend, thus saving fuel, reducing overall operating cost. Not only the higher efficiency, but also the fact, that there is no stage to land or re-use. Nothing that would need to be replaced before a new flight, but the fuel, essentially becoming as accessible as a plane.

Another aspect for innovation and research & development, is the use of HTP (High test Peroxide) H_2O_2, hydrogen-peroxide.

NASA propulsion resources
Nasa points out the flexibility of HTP in terms of usage for different use cases due to circumstances.

Hydrogen Peroxide offers versatility, but is also affordable relative to carbon based fuel, such as kerosine. The production can be 100% percent clean nowadays, relying on solar to enrich the water with oxygen, turning it into H_2O_2. Et voilà, rocket fuel. Another potential impactful aspect, is the fact, that the byproduct of such fuel is essentially environmentally non-harmful with certain liquid rocket engine based mixtures.

> "Hydrogen peroxide could be the key element in a new class of eco-friendly rocket propellants and highly efficient fuel cells." - Stephen Heister, Purdue professor of aeronautics and astronautics.
> ABC science article
> Also saying: "Such a propulsion system would provide an inexpensive alternative to today's nonrenewable hydrocarbon fuels that are processed from crude oil" - Heister

Marketing Plan

The competitive analysis of the accessible rocket industry is rather plain. Electron Rocket Labs

Electron Rocket Labs is the only real competitor in the market, offering the electron rocket for launching a maximum payload of 150kg, coming in at 17m height. They are the only current firm to use carbon fibre in conjunction with liquid hydrogen propulsion. The fuel that is being used is also an important point in term of marketing if the project. That makes their rocket very lightweight, movable by hand on a trolley. This fuel only exerts water as the pollution, so is good for the environment. This could bring customers over who were unsure about the company due to environmental reasons

Operational Plan

The operations of such a business would be very labour intensive. The machines used in the production of the parts are essential, as the needed parts are non-existent. Thus, Research and development costs will be high. Luckily, detailed plans and journals are available, as several tests with the technologies mentioned were conducted in the 90's. The deviation from current rocket engineering are moderate. The implementations into the design make engineering essentially less complex, as less parts are involved. The Vertical Aero-spike engine and non-stage system allow the chassis of the rocket to be less partial and more thorough. No stage separation means no controlling of such. That simplifies the

controlling to solely maintaining course. These facts, reduce overall research and development cost as fewer aspects need to be ticked off.

Timings include the research and development stage for a thorough and beginning time period. That would be assumed to be at least half a year of full-time physical engineering R&D, with prior preparations like theoretical concepts, chemical compositions, route correction, software, engine design, done. After successful trials, customers can possibly already be started to be acquired. The beginning stage would be investment intensive and financing plays a big role of the success of that stage. The upside to investors is always the new technology and completely different approach. The UVP would clearly rely on that technology and technique being innovative.

The Resources needed include heavy machinery, though standard. CNC machines, 3D printers, a standard workshop equipment, heavy lifting machines are only those required for R&D and assembly. Aspects such as space, thus rent etc., are also to be considered. Labour, engineers are a big aspect of this business. The concepts are fairly easily, but the implementation and construction is tedious, not even considering testing of prototypes.

IP and Legal issues are not that big of an issue, considering the technologies used are mostly open source, but prior research done on the subject may become an issue. The IP generated on the other hand, is contributing a lot to the worth of the company as a whole. The technologies used itself are not new, but the conjunction of them in the proposed arrangement, has never been physically done.

Risk analysis is bigger of an issue. The fact of new technologies being developed makes the circumstance very risky. Developments could potentially fail, but fall-backs can nearly be pre-anticipated. The risk factor of this business is thus a big issue, not only for operations, but also for investors. The elementary of engineers for this undertaking cannot be understated.

The market entry itself does not oppose great barriers. The field of competition is small and the demand for the service high, simplifying entry.

Scaling

The scaling of this business is a very interesting topic, as expansionary plans are nearly endless. Long-term prospects could include expansion into big payload business, small-payload transportation of resources from and to different locations on earth, using LEO to allow any delivery to any target on earth within an hour or even human transportation, just to name a few growth strategies. The fact of these technologies being used makes the scaling process nearly complete, thus efficiency is the biggest aspect to focus on for benefiting from scaling. Scaling in terms of efficiency optimisation allows lower costs and higher payloads.

The scaling aspects would attract investors in terms of portfolio diversification, serving multitudes of customers, penetrating different industries et. Also the IP worth's growths as efficiency aspects are improved.

Having more launch/land sides would be a good example of using economies of scale, as fuel necessary to land could be reduced, if a closer landing pad is available. Having left over fuel for the landing sequence can thus be minimised. Another example would be the fuel generation plants that could provide a self-sustainable fuel supply. As above described, the fuel proposed can be clean in production. Not only that, but also the fact, that the same fuel could be used for fuel cells for other applications, makes this aspect attractive to investors. Also potential for a complete energy infrastructure business, created simply from the need for green fuel production for rockets, would be an attractive.

Financial Stategy

—	Year 0	Year 1	Year 2
Clients	-	2	4
Revenue (pounds)	-	-	
Net Revenue	0	2m	4m
Operating Cost	-	-	
R&D	3m	4m	4m
Sales & Marketing	400k	500k	1m
General & Administrative	1m	1.5m	2.5m
Other	500k	400k	500k
Total Cost	-	-	
Net Income	-	-	
Total Investment	10m	8m	15m

For the base year we will require a lot of investments to get the whole project started. As the research and development costs will be relatively high, in comparison to the other costs. Since the research is the main focus, in terms of the project, because only the development allows us to keep up with the competition, in a world where ever evolving technologies don't take any breaks and especially not the competition. In terms of investors, they will need to be found, no doubt. However due to the high risk which might make this unattractive to people, makes it also highly rewarding, which our target investors are looking for. As this is a purple ocean to still be explored and although the competition is there, it is not that populated yet and is fighting with the same difficulties as we are.

In terms of marketing costs, they are supposed to be kept low in the beginning, however as we are able to develop and improve the project, marketing expenses will rise, since we want more attention, due to an improvement in the project.

The better it gets, the more compelling it is to future clients and investors. Therefore investing more into a service and product that is improved seems more beneficial. General and administrative costs are supposed to be kept relatively low, however the work that is done is highly demanding and it is not easy to get talented enough employees for such a project. As well as that, as we are expanding and research is increasing, indirect costs will also rise, such as rent, since more space will be needed and more employees have to be found. We are expecting in the first 2 years to get a 100% increase in clients, each year, due to our marketing strategies and still, uniqueness of the project.

Exit Strategy

Leo-Space's exit strategy involves a few simple steps in order to liquidate all current assets.

Firstly Leo-Space would sell all relevant assets under research & development, Leo-Space's R&D can be sold to any other rocket company looking to understand an innovative approach to rocket engineering. This could involve lower tier aeronautical companies or perhaps national space agencies which are looking to grow or expand their horizons and grasp.

The machinery involved in our production could be sold to a similar company given that the machinery will be of high industry standard as they will provide Leo-Space with fully functioning prototypes. Again, companies seeking to utilize alternative fuel sources in their rocketry, as opposed to kerosine based rockets, would be very intrigued in purchasing such machinery.

In terms of intellectual property and other intangibles of similar nature such as: patents, copyrights, publicity rights, rocket industry specific trademarks and so forth. These intangibles would be sold equally to buyers of R&D.