

Suborbital Space Tourism: Business Plan Elements

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List of Acronyms

AST	Office of Commercial Space Transportation (within the FAA)
FAA	Federal Aviation Administration
GDP	Gross Domestic Product
HTHL	Horizontal Takeoff, Horizontal Landing
HNWIs	High Net Worth Individuals
ISS	International Space Station
NASA	National Aeronautics and Space Administration
RLV	Reusable Launch Vehicle
VTVL	Vertical Takeoff, Vertical Landing

Introduction

Recent years have seen the emergence of the private individuals and former astronauts following the world's first paying orbital tourist of \$20 million trip by Dennis Tito to the International Space Station (ISS) in 2001. Although this is the preserve of the hyper-elite, within the next decade it is likely that there will be more affordable opportunities on sub-orbital reusable vehicles. Terrestrial space tourism has been underway for many years, and touristic travel to outer space has been anticipated for some time.

In October 2004, Scaled Composite, a company founded by famed aerospace designer Burt Rutan and financier Paul Allen led the first private team to build and launch a spacecraft capable of carrying three people. Space Ship One was successfully launched from its mother ship plane, white knight and completed its second return orbit round earth twice within two weeks at an altitude of at least 100 km. They won and were awarded the \$10 million Ansari X PRIZE.

This goal was selected to help encourage the space industry in the private sector and the entries were not allowed to have any government funding. It is perceived that humans tap into their potentials when they are made to compete and this was confirmed by the twenty six teams from seven different nations that competed for the prize. It aimed to demonstrate that spaceflight can be affordable and accessible to corporations and civilians, opening the door to commercial spaceflight and space tourism. It was believed that the competition will encourage innovation and also the use of existing technologies in a new way in with different launching and landing configurations, introducing new low-cost methods of reaching Earth orbit, and ultimately pioneering low-cost space travel and unfettered human expansion into the solar system. As a result of the success of the Ansari X PRIZE, Peter Diamandis and the rest of the X PRIZE Foundation were inspired to create more prizes that would spur innovations in other industries and has an ongoing goal of creating a dozen new prizes over the next seven years worth an estimation of \$300 million. (X-Prize Foundation, 2011)

Extensive travel by air, sea, and land for pleasure and business is available to everyone while in contrast, travel in space is only available, essentially, to a small number of highly trained government astronauts. The perception of the general public is that travelling to space for pleasure cannot be achieved. Sub-orbital flights offer an incremental approach to develop the market and the infrastructure, demonstrate the safety of space flight, obtain real flight information regarding the needs of general public passengers and demonstrate the profitability of space tourism. (Goehlich, 2002)

There is much to be learned about how the general public will respond to space flights and what physiological and psychological needs must be met to ensure a pleasurable as well as adventurous experience. The first passenger flights to space could begin 10 years from the start of serious development - the key issues being provision of adequate funding, legal issues and political/ commercial support.

This assignment briefly overviews the current status of space tourism, summarizes a number of space tourism market research studies, identifies market research challenges , operations, and financial aspects of creating a sub-orbital space tourism business as a stepping-stone to public space travel

Adventure Activities and Luxurious Vacations

Many people have begun to develop pleasure and skills in a range of activities that some refer to as extreme sports or activities. Some companies are taking advantage of this to offer adventure sports vacations and some of them are listed below

	Survey query	Respondent Experience
Quantified Data	Mountain Climbing	30%
	Car Racing	28%
	Sky Diving	22%
	Fighter Jet Flight	12%
	Zero-g flight	7%
78 other activities listed, but not quantified, including:		
Scuba	Paragliding/Hang-gliding	Rope climbing
Caving	Motor rallying	Roller derby
Snow Skiing	Motorcycle Stunt Driving	Gymnastics
White Water Rafting	Drag racing	Zorbing
Parasailing	Street Luge	Horse racing
Air Racing	Go-Kart Racing	Canyoning
Mountain Bike Racing	Offroad 4X4	Stunt driver
Bungee Jumping	Sea Kayaking	Long distance racing
Base Jumping	Submarine adventures	Powered parachute
Sailplane/ Glider	Distance Swimming	Bull riding
Paint Ball	Quad Biking	48hr D&D Marathon
High Power Rocketry	Power Lifting	Aircombat adventure
Jet Ski	Cliff Diving	Visiting active volcanoes
Aerobatics	Wind Surfing	Civil Air Patrol
Snowboarding	Water Skiing	
Rock climbing	Wildlife Trecking	
White Water kayaking	Hot air ballooning	
Ocean Yacht Racing	Helicopter rides	
Motocross	Luge/Bobsledding	
Private Pilot	Dog sledding	
Microlight	Jousting	

Table 1: Adventure Tourism Survey

Credit: Spaceport Associates

In an Adventurers' survey in which there were a thousand respondents, the table above indicates the activities that the respondents have participated in. Also in the survey, it was concluded that more people die from domestic accidents in the home than in adventure tourism. (Webber and Reifert, 2006)

People are willing to pay a certain amount of money to go on a dream vacation at least once a year or save to go on a vacation that they would normally be unable to afford and are willing to pay the amount for the memories of such vacation or activity as a once in a lifetime experience. It can be recurring activity for those that can afford it. Example of luxury vacations or activities people engage in includes;

- Renting a private island like Necker Island owned by Sir Richard Branson for \$371,000 per week (privateislandonline 2011)
- Boat Cruise on Alysia or Annaliesse at €94,500 a day or €661,500 per week (cruises fun 2011)

- 22 days around the world in a private jet at \$62,950 per person (Travel wizard 2011)
- Bridge Suite at the Atlantis, The Palm Hotel in UAE at \$25,000 per night (tip top ten 2011) etc.

Terrestrial Space tourism

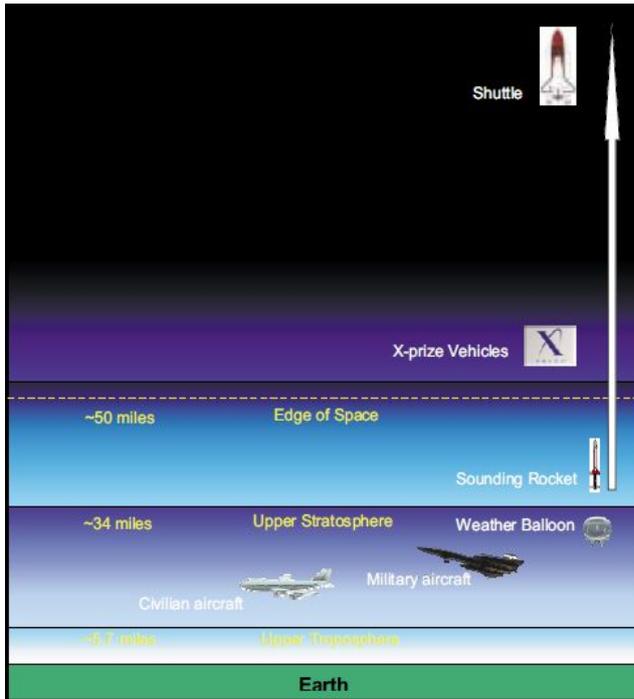
Entrepreneurs have been utilizing the opportunities apparent in people's fascination with space for some time in terrestrial space tourism market. Terrestrial Space activities include;

- Experiencing the eclipse of the moon or sun, Northern Lights, visiting space themed parks, Observing the eclipse of the Sun or Moon;
- Taking part in organised tour to various facilities in or near Washington, D.C., including the Air and Space Museum, the Space Systems Laboratory at the University of Maryland, and NASA's Goddard Space Flight Centre
- Mars Robotics Seminar which is a hands-on course involving participants in the design of the Mars Sample Return Rover

An example of such company is Space Adventures Ltd who played a part in negotiations between Tito and the Russian space agency in his visit to the International Space Station. Terrestrial space tourism is likely to continue to grow in these directions satisfying at least some of the dreams of the many people fascinated by space

Suborbital Space tourism

In theory, an object can be in orbit around the Earth at any altitude, as long as it is imparted with enough velocity. The term "suborbital" refers to an object that is not imparted with enough velocity to reach orbit. Approximately 115 mile (approximately 185km) is the minimal altitude at which objects are placed in orbit. The U.S. Air Force grants astronaut wings for altitude flown beyond 50 miles (about 80 km) but the altitude at which space begins has been and is still a topic of debate. Just beyond the edge of space, at 62 miles (100 km), is where the X-prize competition has set its goal for sending civilian passengers to space. As a comparison, commercial aircraft operate at altitudes below 18 miles. Even high performance military aircraft and high-altitude weather balloons do not travel past the upper stratosphere (approximately 34 miles or 55 km).



Credit: Martin and Law 2002

Figure 1: Operational altitudes of various aircraft and Spacecraft

The Future Space passengers expect to experience the following on a suborbital space flight (Peeters, 2010);

- Fly into space, 62 miles (100 kilometres) above Earth
- Viewing the earth from space e.g. the curvature of earth, the atmosphere
- Experience weightlessness
- Participate in the birth of space travel industry and inspire future generations of explorers
- Experience astronaut like training, documentation and memorabilia etc

Point to Point

This refers to moving humans and cargo from pt.A to pt.B with the use of supersonic jet or space craft. The idea behind the point to point is to minimize the time spent in travelling especially from one continent to another. This is intended to be achieved by spending some time in space while moving one point to another. This idea is still largely theoretical as this can be achieved through the use of hypersonic which is yet to be operational.

Before now, the only aircraft that could transport humans and cargo while at the same time reduce the time of travelling was the Concorde. It could take off at 220 knots (250mph) compared with 165 knots for most aircraft and it cruises at around 1350mph at an altitude of up to 60,000 ft. A typical London to New York crossing would take a little less than three and a half hours as opposed to about eight hours for a subsonic flight thereby saving 5 hours which is a lot to business executives or people with deadlines to meet. The Concorde was used commercially for about 27 years and was retired in 2000. (British Airways, 2010)

Development of Reusable Launch Vehicles (RLV)

This refers to the reusable launch vehicles that are currently being developed and tested for transfer of humans and cargos. The development of RLV precedes a new era for space tourism as the potentials to the space industry is immense compared to the Expendable Launch Vehicles that has to be disposed after each launch.

The term “RLV” refers to a launch system that can be re-used for multiple launches, instead of being disposed of after each launch like an ELV. Operationally, orbital RLVs could offer a number of advantages over ELVs. These could include greater reliability and safety, quick turnaround time, more versatile performance, high flight rate capability, and lower operating cost. Since ELV hardware is disposed of after each launch, ELVs have a very high operating cost (i.e., a new system is manufactured for each launch). By contrast, RLVs, for sufficiently high flight rates, should be less expensive to operate. Given the potentially significant operational advantages of RLVs, a number of effective applications become evident. For example, NASA could carry out its research missions at lower cost and new commercial markets such as space tourism, fast package delivery, or microgravity processing could be developed. (Martin and Law, 2002)

Space Ports

Commercial spaceports are in operation in various locations and include coastal, inland and sea based spaceports. Spaceports, like airports, vary as to the types of commercial space operations they can support. Spaceport infrastructure, noise abatement concerns hazard risks, launch and re-entry concepts, determine the types of space vehicles that can be accommodated at a given spaceport. Spaceports rely primarily on space-based surveillance to support the mission. For suborbital Space flight, the same space port is for takeoff and landing. Additional support services provided by spaceports include telemetry and communications (i.e. voice, data link etc.) These services are provided for launch/takeoff, re-entry, and landing phases.

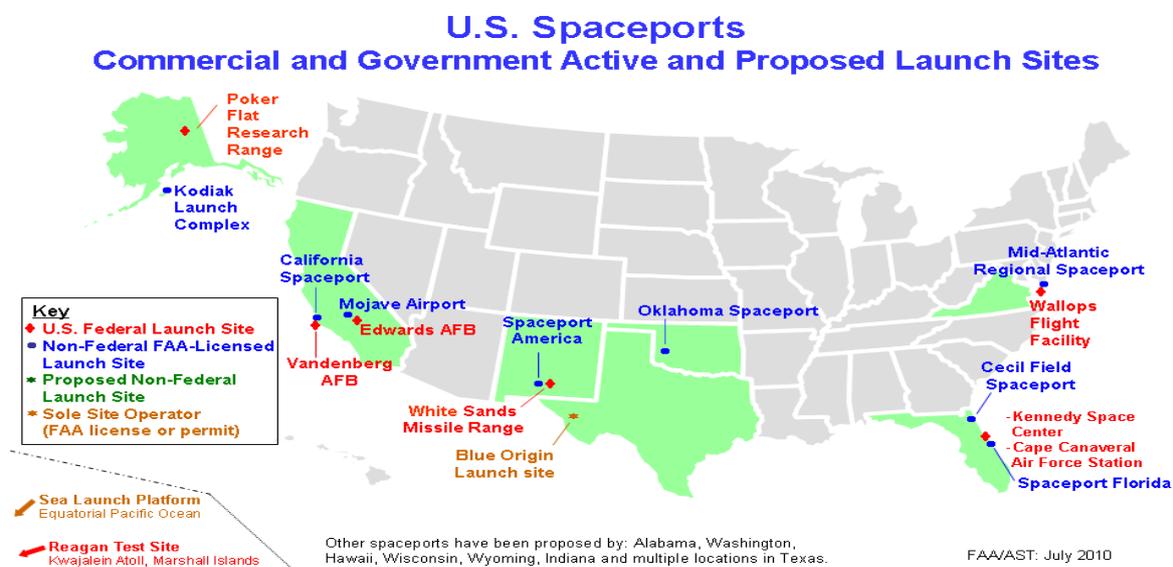


Figure 2: Various Spaceports in the United States

Credit: FAA

As the space tourism industry begins to grow, some basic amenities and facilities will be expected to be in place around the space port for the prospective passengers and general public who are there for sightseeing (Weber, 2007). These facilities include;

a) Easy Access and Communication

As a result of the remote location of the Space ports, it is imperative to have easy access to major airports for passengers. Also, communication will be very important to the people participating in the sub orbital space flights and anyone interested in being at the space port at anytime. The success of this industry will increase the number of tourists that will be at this space ports so the need for good and effective means of communication cannot be over emphasized. As Communication here refers to cell phones, internet access etc

b) Accommodation

This will have to be in terms of building hotel and residential homes near the commercial space port or attached to it. This is for the prospective travellers and their friends or loved ones which should have basic amenities like swimming pool, games etc or a resident facility for the workforce of the space port

c) On site Medical Facilities

Due to the nature of the training that will be required as a prerequisite for participating in the suborbital space flight, an onsite medical facility will be required and in the case of any other emergency as a result of the strenuous nature of some of the training. Some wealthy people engage in exercises with the aid of personal trainers while some are older and are not as healthy as the average passenger. There will also need to fitness facilities to maintain the conditioning of candidates throughout the training process.

d) Training Facilities

Spaceports will require training facilities, and they can be co-located at the spaceports. At Present, because the industry is at an early stage the only tourist flights were conducted from Russia and most of the training was conducted there. For sub-orbital flights, it is likely that the training duration will be much reduced to about a week, or a few days. Before now, there has been no dedicated tourist training in place and the first private tourists had to spend about 6 months in Russia for training. As the wealthy individuals that have signed up for space tourism would hardly take 6 months off their business or schedule to train for a suborbital flight, the duration of the flight will have to be reduced to a few days or a week. The training facilities can generate revenue for the spaceport operators. An example of training can be the use of Simulators for training and entertainment purpose as part of a Space Camp architecture, or space theme park experience.

e) Entertainment/ Educational Facilities

Family and friends who accompany the space tourist will need entertainment to occupy them during the training period or before the suborbital flight. The facilities should so well designed that it will be a destination on its own without any suborbital flights necessarily taking place. They will create an attraction for the general public to journey to the spaceport while at the same time generating more revenue for the Spaceport operators. Examples will include; a theatre, simulators, and space themed events, Space Academy wherein children at

the Spaceport will have an opportunity to learn about the experience, so preparing the next generation of travellers.

f) Restaurants, Shops

With the amount of humans that will be flooding the spaceports when it becomes fully operational, the need for restaurants to serve such people will be great and this will be a huge source of income. Also shops over time will be needed especially sales of need of souvenirs or memorabilia to individuals that are interested. Example could be a toy WhiteKnight2 etc

Training

While the Selection of professional astronauts is through a rigorous process of exclusions through a series of disqualifying conditions, medical risks etc and various trainings which last for at least a year, the selection of passengers on a suborbital flight is not as cumbersome. In fact, the Operator would want to maximize the amount of passengers as possible, ensure their safety as they are mostly one time fliers. Despite this, the passengers still have to through some training for at least a week and they have to be duly informed of the risks involved in the suborbital flights.

Types of training and the cost implications according to space adventures are in a table below

S/N	Activity/ Training	Amount
1	Cosmonaut Overview Training	\$89,500
2	Soyuz Simulator	\$15,950
3	Centrifuge	\$9,750
4	Neutral Buoyancy Training	\$33,750 for 2
5	EVA Training	\$7,650

Table 2: Cost of training

Credit:Space Adventure

Other activities that has been carried out in zero g was a wedding organised by ZeroG Corporation. The ceremony lasted 8 minutes in total, spread out over 15 climb-and-dive combinations in a parabolic flight of 30 seconds each and it cost \$60,000. Virgin Galactic engaged 81 customers in a centrifuge training to replicate the G-force that will be experienced in flight. Their age ranged from age 22 to 88 and 93% of the participants was successful in the training. (Virgin Galactic, 2010)

Role of Business Angels and HNWI in the development of Space tourism

A number of wealthy individuals are showing a lot of interest in the space industry and some are going a step further in participating either through setting up funds for competition that would lead to advancement of the space industry , signing up for the space experience while some are working with professionals in the industry to break new grounds. Funding for Space tourism is a niche market with a high level of risk and while Venture Capitalists are known for their interest in high risk business, there are no Venture Capitalists involved in Sub orbital Space tourism or Space tourism as a whole. There are other means of funding like Equity funding, debt financing but due to the amount of risk and capital involved, corporations are unwilling to partake in the business at this stage, so the primary source of funding for space tourism at the moment are business angels and high net worth individuals. These individuals participate in this business for various reasons; the thrill, the experience or just because they

want to open up space frontiers and not mainly for the returns. Find below a table of projects and business angels associated with them

S/N	Project	Business Angel/HNWI
1	Virgin Galactic	Richard Branson/Paul Allen
2	Space X	Elon Musk
3	Space Ship One	Paul Allen
4	Armadillo Aerospace	John D. Carmack
5	Blue Origin	Jeffrey Benzos
6	Bigelow Aerospace	Robert T. Bigelow
7	Xcor Aerospace	Jeff Greason

Table 3: List of projects and HNWI

Credit: (Virgin Galactic 2011, SpaceX 2011, Scaled 2011, Armadillo Aerospace 2011, Blue Origin 2011, Bigelow aerospace 2011, Xcor 2011)

Incentive travel market

Major corporations are indicating interest in the Space industry through market campaigns that have space themes and some are currently using Space flights as a means to boost the morale of employees by organizing team building activities or as a form of reward for outstanding performances and also promotional prizes in marketing campaigns. The use of logo or corporate image of a company can be utilized to show support for the suborbital space tourism; Examples of such Corporations include Pepsi in 1998 offering seats in a future space flight, Hard Rock Cafe in UAE, Volkswagen, Oracle and IBM. (Space Adventure, 2011)

Current Players in the Suborbital Space tourism Industry

Virgin Galactic

Virgin Galactic can be said to be part of the fore runners of Suborbital Space tourism at the moment. After Sir Richard Branson showed his support for the X-Prize winners by having his logo on the Space Ship One, He had since partnered with Burt Rutan announce the formation of The Spaceship Company, a Virgin Galactic majority owned joint venture with Scaled Composites which will be the manufacturing company for the new fleet of spaceships (SpaceShip Two) and launch aircraft (WhiteKnight Two). The new spaceships will be able to accommodate six passengers and two pilots and be big enough to allow for an out of seat zero gravity experience of 5 minutes out of a flight of one hour as well as lots of large windows for the amazing views back to Earth.

In July 2002, Virgin agrees with Paul Allen’s company, Mojave Aerospace Ventures, to licence the key Spaceship One design technologies with a view to building and operating a commercial version should the Tier One project win the X Prize. At press conferences in London and New Mexico, Virgin Galactic and officials from the State of New Mexico announce an agreement which will see the building of a State funded \$200m spaceport in the southern part of New Mexico on a 27 square mile area of State land to be named Spaceport America and it was commissioned on 22nd October, 2010. Virgin Galactic will locate its world headquarters and Mission Control at Spaceport America in a landmark architecture facility.

Virgin Galactic is charging a starting price for flights of \$200,000 with refundable deposits starting from \$20,000 and has over 400 people on the waiting list. (Virgin Galactic, 2010)



Figure 3 Spaceport America; Artistic Impression and Construction so far

Credit: Spaceport America, 2011

Armadillo Aerospace

Space adventures signed an exclusive marketing agreement with Armadillo Aerospace to market and sell commercial passenger experiences on Armadillo Aerospace's future suborbital spaceflight vehicles that are currently in development. Space Adventure is known for its participation in arranging transportation of tourists to the International Space Station (ISS) and this partnership with Armadillo is to continue to secure its place as a leader in the private spaceflight industry that it began in 2001 with the flight of the world's first space tourists.

Armadillo Aerospace was founded in 2000 and is a developer of reusable rocket powered vehicles. It achieved a major milestone in the space competition that took place in 2008 when Armadillo Aerospace won first prize in Level One of the Northrop Grumman Lunar Lander Challenge (NG-LLC). Armadillo Aerospace has its focus on vertical takeoff, vertical landing (VTVL) suborbital research and passenger flights. They have worked for NASA and the Air Force, and flown vehicles at every X-Prize Cup event and have experience base with over two hundred flight tests spread over two dozen different vehicles. Armadillo aerospace performed the very first flight under the new FAA/AST experimental permit regulatory regime, and we have made over two dozen more permitted flights since then, all fully insured and observed by on-site AST personnel. They also flew the first flight under the Class III waiver, and have flown over 25 waived flights since then.

Space Adventures offers a variety of programs such as the availability today for spaceflight missions to the International Space Station and around the moon, as well as terrestrial training in preparation for orbital and suborbital flights. The Advisory board of the company includes Shuttle astronauts Sam Durrance, Tom Jones, Byron Lichtenberg, Norm Thagard, Kathy Thornton, Pierre Thuot, Charles Walker, Skylab/Shuttle astronaut Owen Garriott and Russian cosmonaut Yuri Usachev.

The Price that is being offered for suborbital flights is \$102,000 (Armadillo, 2010)

XCOR Aerospace

Xcor Aerospace is proposing a two-seat, piloted space craft called Lynx, horizontal takeoff and horizontal landing vehicle. The space craft will take humans and payloads on a half-hour suborbital flight to 100 km with about 4.6 minutes to be spent in weightlessness and then return safely to a landing at the takeoff runway. A spaceflight participant will sit to the right and just aft of the pilot. Lynx will have a pressurized cabin, and pilot and participant will wear full pressure suits during flight for safety in case of an emergency. Prior to a Lynx flight, potential spaceflight participants will go through a screening process, which will take place over five days and four nights and includes familiarizing the participant with all aspects of the suborbital flight experience. To make their flight safer and more enjoyable, spaceflight participants will engage in medical screenings, seminars, altitude chamber training, and a g-force experience.

Xcor Aerospace is now partnering with KLM to sell tickets for its Suborbital flights for about \$95,000 (Thisdell, 2010)

EADS

EADS is looking more into going into partnership with Singapore to manufacture and test a fleet of space planes for suborbital space tourism. This was announced at a Global Space & Technology Convention in Singapore. The unique attribute of this proposed Space plane is that it will take off and land at a commercial airport. (Leithen 2011)

Promotion

Virgin Galactic has a stand at the International Luxury Travel Market (ILTM) which targets luxury holiday makers and claims to be leading 'by invitation only' showcase for the global luxury travel community. Bringing together the world's most sought after collection of luxury experiences for the most discerning luxury travel buyers (ILTM, 2011). Other means of Promotion that has been identified for Suborbital Space tourism are

- Press Releases
- Conferences
- Word of Mouth
- Advert in Magazines, Television
- Pamphlets
- Outreach

Market Analysis

For the purpose of this analysis, High Net Worth Individuals (HNWIs) refer to those having investable assets of US\$1 million or more excluding primary residence, collectibles, consumables and other consumer durables. In 2009, the world's population of HNWIs increased by 17.1% to 10 million and their wealth increased by 18.9% to US\$39.0 trillion.

(US\$ Trillion)

CAGR 2006-2008 **-6.2%**

Annual Growth 2008-2009 **18.9%**

37.2 40.7 32.8 39.0

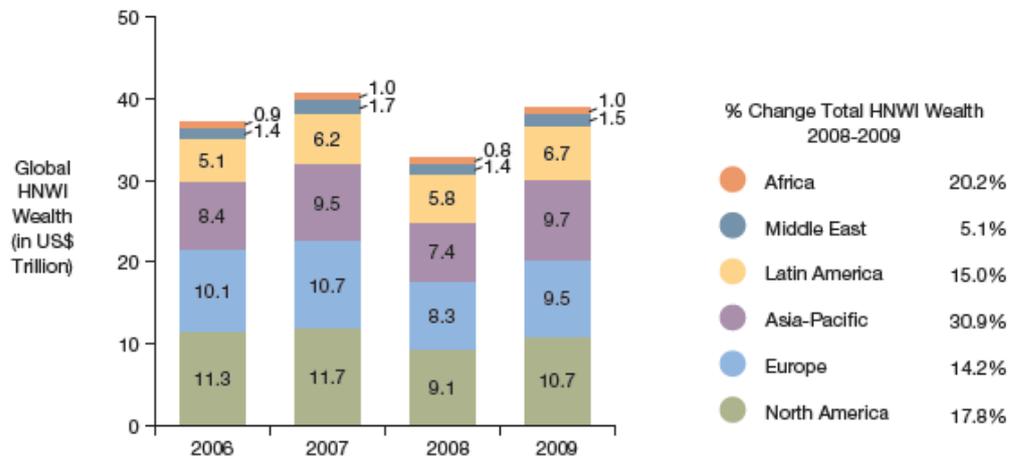


Figure 4 'World Wealth Report 2010' Merrill Lynch/Capgemini 2010

Credit: Capgemini 2011

The bar chart above shows the number of high net worth individuals that earns at least one million US Dollars from 2006 to 2009 according to continents.

From the bar chart above, North America has consistently had the highest percentage of HNWI in the world and it was increasing until 2008 when there was a reduction by 2.6% and a total reduction in HNWI globally to US\$32.6 trillion. However in 2009, there was an increase in wealth as hedge funds were able to recoup their losses and commodities prices that dropped early in the year increased by 19%.

In 2009, the Asia-Pacific Market, Hong Kong and India's economy has seen continuous growth in both economic and market drivers of wealth despite the 2008 Global recession. Over all the Asia-Pacific rose by 25.8% to 3.0 million.

Governments around the world implemented a lot of measures in a n effort to stimulate economic recovery and support the financila system epecially in the US and China.

Forbes List of Billionaires

HNWIs in this analysis represent individuals that have at least US\$ 1 billion calculated by individuals or persons with publicly traded fortunes using share prices and foreign exchange.

Continent	2005		2006		2007		2008		2009		2010	
	%	HNWI	%	HNWI	%	HNWI	%	HNWI	%	HNWI	%	HNWI
N.America	53.4	374	51.1	403	47	448	45	505	48.9	388	44	437
Asia	14.7	103	22.6	178	22	208	25	278	21.1	167	27	271
Australia	0.9	6	1.1	9	1.6	15	1.6	18	1.6	13	1.4	14
Europe	28.1	197	21.7	171	25	240	26	286	24.7	196	24.1	242
S.America	2.3	16	2.9	23	3	28	2.4	27	2.7	21	2.7	27
Africa	0.6	4	0.6	5	0.7	7	0.8	9	1	8	0.8	8
Total	100	700	100	789	100	946	100	1123	100	793	100	999

Table 4 List of World's Billionaires

The table above was derived from the data on the Forbes list of billionaires from 2005 to 2010 (Forbes 2011) and it shows a list of Ultra High Net Worth Individuals that have at least a billion US dollars in different continents. As a result of some countries sharing boundaries with two continents, turkey was classified with Asia as well as the Middle East. This analysis refers to the numbers of these individuals as against the previous bar chart that is more detailed with the amount.

North America

A great number of the HNWIs are in the United States, Mexico and Canada. In 2005, the total numbers of HNWIs were 374 and it is increased by 7.75% to 403 in 2006, then by 12.7% to 505 in 2008. After the financial Crisis in 2008, the HNWIs were reduced by 23.2% to 388 and is gradually picking up. As at 2010, the Individuals that have at least US\$ 1 billion are 437 in total.

Asia

In 2005, the numbers of HNWIs were 103 and it increased to 178, 208 and 278 in the year 2005, 2006 and 2008 respectively. Asia was one of the regions that were hit really hard by the recession but by 2009 the Gross Domestic Product (GDP) increased by 4.5% excluding Japan. Europe used to have a high amount of HNWIs after North America but as after the Global Financial Crisis and the Dubai Real estate crisis in 2009, Asia has taken over with a significant increase in its HNWIs compared to Europe.

Australia

In 2005, the numbers of HNWIs were 6 and it increased to 9 by 50% and it kept increasing till the 2008. It is recovering from the financial crisis as the numbers of billionaires are slowly increasing.

Europe

In 2005, the amount of HNWIs is mainly from Germany, France, United Kingdom and Russia. Due to the global financial crisis, Gross Domestic Product (GDP) shrank by 4.1% and the number of billionaires in the region reduced by 90. In 2010, the individuals increased to 242 which is still a far cry from the 286 in 2008.

Africa

The HNWIs in Africa has been fairly consistent in the number of HNWIs in its region. They are mostly in Egypt, Nigeria and South Africa. From the table above, there has been no significant growth in the HNWIs. Since 2005, the increase has been about 50% from 4 to 8.

Africa is an emerging market but its people engage in activities that would engage in prestige and not necessarily out of need. This can be seen in the amount of luxurious goods they buy e.g. they are a lot of private jet owners in this region and they engage in various luxurious vacations.

Space tourism can be a viable market in Africa. There are a number of individuals who have not been listed in the Forbes's list of world's richest people mainly because their wealth could not be properly accounted for. This can be seen in the case of Late General Abacha of Nigeria, Hosni Mubarak of Egypt whose wealth is estimated to be about \$40 billion to \$70 billion (Economic Times 2011) who were all acclaimed billionaires but was never in the Forbes list of world's richest people.

Regulatory Issues and Legal Implications of Suborbital Space tourism

The prospects for suborbital space tourism give rise to some difficult legal questions; it also opens up an opportunity to develop a system of legal regulation to properly deal with these activities. This is because the existing international legal regimes covering air and space activities are not well suited to large scale commercial access to space, largely because they were developed at a time when such activities were not a principal consideration. The lack of legal clarity represents a major challenge and must be addressed promptly so as to provide for appropriate standards and further encourage such activities.

The treaties governing outer space activities: the Outer Space treaty (1967), the Rescue agreement (1968), the Liability convention (1972), the Registration convention (1975) and the Moon treaty (1979) but the moon treaty has not been signed and ratified by the United States

Some of the articles of the Outer Space Treaty contain provisions directly relevant to terrestrial spaceport operations. Thus, Article II prohibits spaceport activity as a means to claim national appropriation over outer space. Article IV prohibits spaceports from serving as launch sites for placing nuclear weapons.

With the retirement of the shuttle approaching, it will become essential to develop international regulations concerning the crew of a space vehicle, and, more specifically, for the benefit of the spacecraft commander on the following matters:

- the responsibility for the preservation of the spacecraft and the welfare of its crew, the preparation for the flight and its successful completion;
- the right of the commander to issue binding orders to crew and passengers,;
- the authority of the commander to take all necessary measures to assure the safe execution of the mission and also in the case of unruly passengers;
- the authority to perform administrative and legal acts (for example registration of deaths on board);
- The issue of liability.

Even after the technologies needed to make travel and tourism service affordable have matured and the systems have been developed, tested and deployed, uncertainties and risks will remain. Passenger, crew and vehicle insurance could become available, but would be expensive until transports are proven to be reliable by repeated usage over time. The third

party liability issue must be addressed by both the vehicle developers and operators, and mainly by the governments: an important additional issue, which needs to be addressed, is the revision of relevant space law. (Spad, 2004)

There are regulatory bodies like FAA and ICAO that have guidelines that operators are to follow for human space flight. Some of the FAA guidelines (Clement, 2011) include the following

- Medical Requirements
 - Crewmembers: those with a safety-critical role must possess and carry an FAA second class (Class II) airman medical certificate
 - Space Flight Participants: nothing
- Space Flight Participants must:
 - Sign informed consent after education about the risks
 - Sign waiver of claims against the U.S. Government
 - Have training for emergency situations – smoke, fire, depressurization, emergency exit
 - Meet security requirement – the participants may not carry on board any explosives, firearms, knives, or other weapons

Recommendation

With the Interest of the Space Industry as a whole in Asia and the middle east especially in Human Space flight activities that is being looked into by Japan, China etc, The proposed spaceport in Singapore and UAE indicates an interest in participating in human space flights or sub orbital space tourism in the future . A lot of people in African continent are business men that have interest in a range of diversified areas in which space tourism could be an area of interest in the nearest future.

Organising Outreach and Aggressive marketing in these regions will help to create more awareness for the thrill of suborbital space tourism. Also more market research and surveys should be conducted as most survey that has been conducted are quite old.

Conclusion

While considering the various RLVs that will take passengers into orbit and the amount that can be generated for this niche industry, a special attention has to be paid to the reduction of risks and safety features. In time, Sub orbital space tourism will eventually be available to every member of the public and the success of the industry will encourage more stakeholders to participate in its funding.

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