Insight

Qi3 Insight:

‘Space – The New Frontier’ Growth Opportunities for Non-Space Companies

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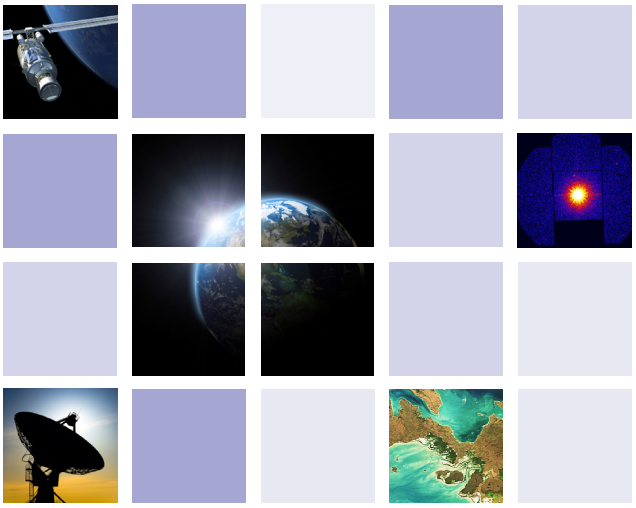

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Executive Summary

A range of recent articles, including two by the Institute of Directors [1] [2], have highlighted the strong prospects for the UK space industry over the next few years. The global space market is forecast to grow from £184 billion in 2010[3] to £400 billion by 2030[4]. At the same time the UK space industry, supported by government, has plans to double its market share from 5% to 10%, growing revenues from £7.5 billion in 2009[5] to £40 billion by 2030.

This is good news for companies which are already part of the European space sector, but can non-space companies exploit this market opportunity? The challenge for such companies is to understand:

- What is the structure of the industry?
- How will market drivers create new opportunities?
- Which parts of the space industry should they focus on?

This article provides an outsiders' guide to the space sector, enabling companies to match their expertise to relevant parts of the sector and identify where important opportunities may be.

Structure

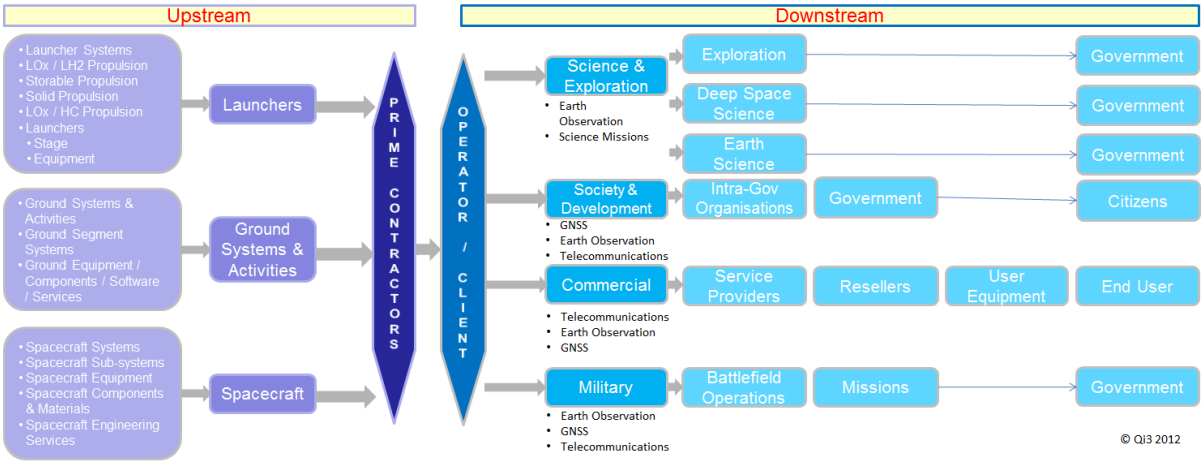
The global space sector is split into two segments – upstream and downstream with very different characteristics and market drivers.

The *upstream segment* consists of manufacturers of space hardware and providers of services that enable the launch of systems into space. Typically, these are launch vehicles and services, ground control stations, and space payloads (satellites, manned spacecraft, space stations).

The *downstream segment* includes products and services which are delivered through the use of space assets such as telecommunications, television, earth observation (EO) and satellite navigation (sat nav).

Whilst the downstream segment delivers a greater revenue share of the space sector and enjoys higher profitability (particularly in the operation of satellites), we have found potentially profitable entry points in both the upstream and downstream segments for our clients depending upon their technical, market and commercial capabilities.

The space sector uses a wide range of technologies, and supplies a wide and growing range of services, making the supply chain very complex. Figure 1 summarises the elements from component input to service output.



Source: Qi3 Ltd

Figure 1: Structure of the Space Industry Supply Chain

1 Director March 2012 Institute of Directors

2 IOD Big Picture Spring 2012

3 The Space Report 2011: The Authoritative Guide to Global Space Activity, The Space Foundation

4 A UK Space Innovation and Growth Strategy 2010 to 2030

5 Size & Health of UK Space Industry Nov 2010

Market Drivers

The *upstream segment* is split between commercial satellite operators and government funded missions. Key drivers include:

- Russia & China dominating new satellite launches requiring technology capabilities that are non-dependent on the USA (free of defence export regulations)
- Cost reduction across the delivery and operation of space systems – for example the transfer of mission proven technologies from the defence sector into the commercial sector
- New science missions & space platforms that require new technologies
- Smaller players withdrawing from space market leaving gaps in the supply chain

The *downstream segment* has a very different set of drivers, turning data (GNSS or earth observation) and infrastructure (satellite communications) into a wide range of services for terrestrial end-users. Whilst satellite broadcast which has driven this segment for the last decade is expected to flatten, there are a number of high growth areas including:

- Satellite broadband and mobile communications becoming more cost effective
- Increasingly sophisticated, niche & bespoke precision, navigation and timing (PNT) applications beyond satellite navigation
- Earth Observation (EO) and climate services for the mass market rather than scientific research (e.g., Google Earth)
- Security and defence applications

A plethora of new, niche applications are expected to emerge over the next few years.

Across the upstream and downstream segments, the UK National Space Technology Strategy[6] has identified five areas where innovative new technologies are needed to support these market opportunities:

- Telecommunications
- Sensing
- Position/navigation/timing
- Robotics & exploration
- Access to space

Which part of the supply chain to enter?

The space supply chain is extensive and requires a wide variety of technologies and capabilities. The market opportunities and market entry points will be very dependent on the capabilities of each individual company. The supply chain can be split into four market entry areas:

- Materials, components and small sub-systems
- Prime contractors
- Space asset operators
- Downstream applications

The front end of the supply chain, i.e. materials, components and small subsystems, is a sensible market entry point for specialist technology companies with appropriate capabilities. However, it is important to match those capabilities to the technology needs of the space sector, particularly to areas where new solutions are needed.

6 The UK National Space Technology Strategy, National Space Technology Steering Group.

The prime contractor and space asset operator segments of the market are unlikely to be viable market entry points for most companies due to market concentration (small number of large incumbent suppliers) and the degree of investment required. Nevertheless, some new players are entering this market with ambitious ventures in space tourism and shuttle replacement vehicles.

For downstream applications, the types of companies able to capitalise on the emerging opportunities are very different from those further up the supply chain. This market entry point is suitable for data and information service providers, consultancies, data centres, and systems integrators. An intimate knowledge of their customer needs combined with a deep understanding of the capabilities that space assets can provide will open up a wide range of new markets for these companies.

So, for companies with an interest in exploiting new opportunities in the space sector, the key steps are:

Source: Qi3 Ltd

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1. Space – A High Growth Market Opportunity

A range of recent articles, including two by the Institute of Directors[7] [8], have highlighted the strong prospects for the UK space industry over the next few years. The global space market is forecast to grow from £184 billion in 2010[9] to £400 billion by 2030[10]. At the same time the UK space industry, supported by government, has plans to double its market share from 5% to 10%, growing revenues from £7.5 billion in 2008/9[11] to £40 billion over the 20 years.

This is good news for companies which are already part of the UK space sector, but the challenge for non-space companies is how to exploit this market opportunity? The challenge for such companies is to understand:

- What is the structure of the industry?
- How will market drivers create new opportunities?
- Which parts of the space industry should they focus on?

This article provides an outsiders' guide to the space sector, enabling companies to match their expertise to relevant parts of the sector and identify where important opportunities may be.

2. Space – What Does the Market Look Like?

For those new to the space sector it is useful to start by discussing briefly its structure. There are considerable differences across segments and companies and the sector is typically split into two segments – upstream and downstream.

Upstream Segment

The upstream segment consists of manufacturers of space hardware and providers of services that enable the launch of systems into space. Typically, these are launch vehicles and services, ground control stations, and space payloads (satellites, manned spacecraft, and space stations). The suppliers are prime companies and systems integrators, which in turn build on the contributions of subsystem and component suppliers.

Downstream Segment

The downstream segment includes products and services which can only be delivered through the use of space assets. It also includes services which are only consumed by public sector institutions, such as defence or emergency information and communication services, and services which are designed with the specific objective of advancing scientific knowledge about Earth and space itself.

To give some examples, the satellite communications segment has two parts, fixed satellite services (TV Broadcast (e.g. Sky[12]), internet backhaul, telecommunications backhaul,) and mobile satellite services (marine, land, air, using satellite phones or small notebook-size broadband devices).

The global navigation satellite systems or GNSS segment provides location and timing services to a wide range of industries and applications. It is best known for satnav applications, but other applications include, for example, timing signals for mobile phone networks and to synchronise the UK electricity distribution grid (without which they could not function).

While readers will be familiar with the use of earth observation images in products such as Google Earth[13], a wide range of other capabilities, current being used for scientific research, will find their way into commercial applications in the coming years.

7 Director March 2012 Institute of Directors

8 IOD Big Picture Spring 2012

9 The Space Report 2011: The Authoritative Guide to Global Space Activity, The Space Foundation

10 A UK Space Innovation and Growth Strategy 2010 to 2030

11 Size & Health of UK Space Industry Nov 2010

12 Trademark of British Sky Broadcasting Group plc

13 Trademark of Google Corporation

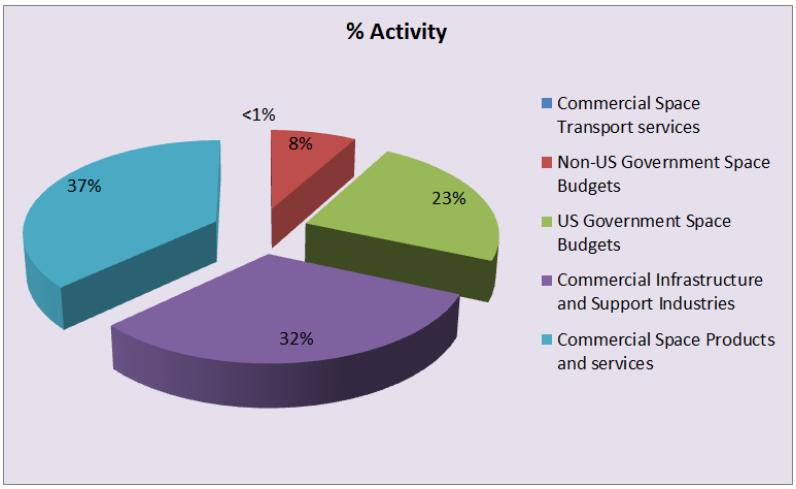
3. Space – A Recession Proof Market

The Global Space Market

The space sector has continued to grow through the recent years of financial and economic turmoil, from sales of $187 billion (USD) in 2005 to $276 billion in 2010[14].

Major activity is currently split (almost equally) between:

- Government (US & Non US) Space Budgets
- Commercial Infrastructure & Support Industries
- Commercial Space Products and Services



Source: The Space Foundation
Figure 2: Global Space Market by Activity 2011

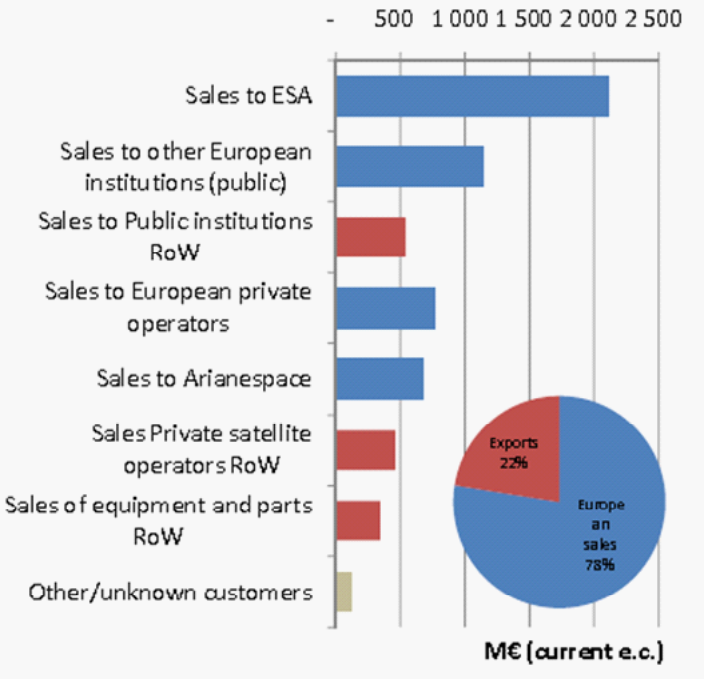
While the USA spends the largest amount of money on space activities (over 80%), the market is a truly global one. 50 countries are operating or planning to launch national satellites by the end of 2012. Interestingly, the USA is not dominant across all parts of the space sector. It supplies over 80% of satellites, but Russia is the largest provider of space launches, with 42%, followed by China and the USA at 20% and Europe at 8%.

European Space market

The European Space market was worth €6.2 billion in total in 2010, with an additional €1 billion in space defence spending mainly in France, Germany, Italy and the UK. Approximately 50% of European space spending comes from governmental institutions such as the European Space Agency (ESA), national governments or the European Commission.

The upstream segment is dominated by the European Space Agency (ESA), which is funded by 19 European states, and has cooperation agreements with Canada and other European states. ESA accounts for 45% of European sales, while 33% of sales are to commercial operators and 22% is exported outside of Europe.

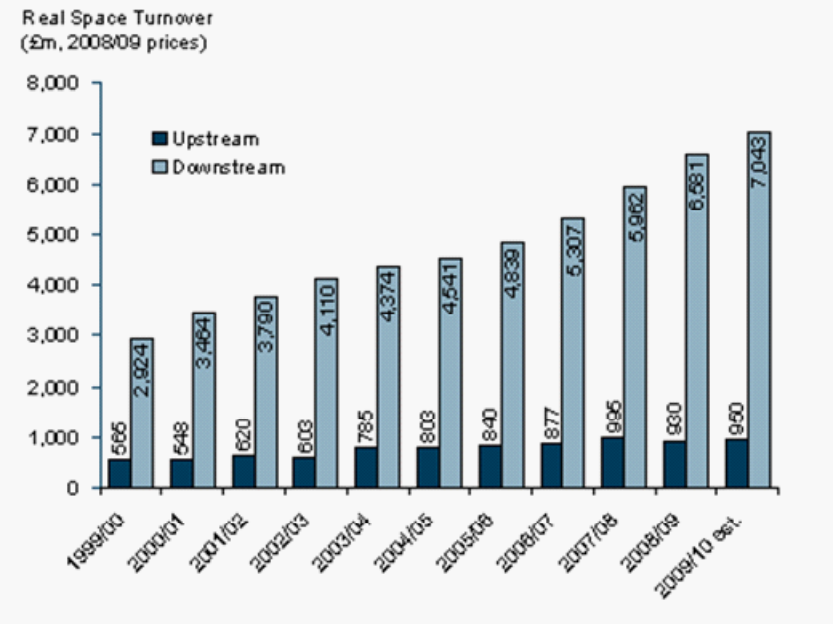
14 The Space Report 2011



Source: Eurospace Report 2010, ESA Budget 2012
Figure 3: European Space Market Activity

UK Space Market

The UK Space market was worth £8bn[15] in 2010 and there are plans to double its market share, growing to £40bn of sales in 2030. The UK Space sector is dominated by downstream services.



Source: Size & Health of UK Space Industry Nov 2010
Figure 4: UK Space Market Activity

The dominance of the downstream sector reflects the success of TV broadcast services (Sky TV), commercial services in the telecom sector (e.g. Inmarsat[16], Avanti[17]), and a thriving satnav industry.

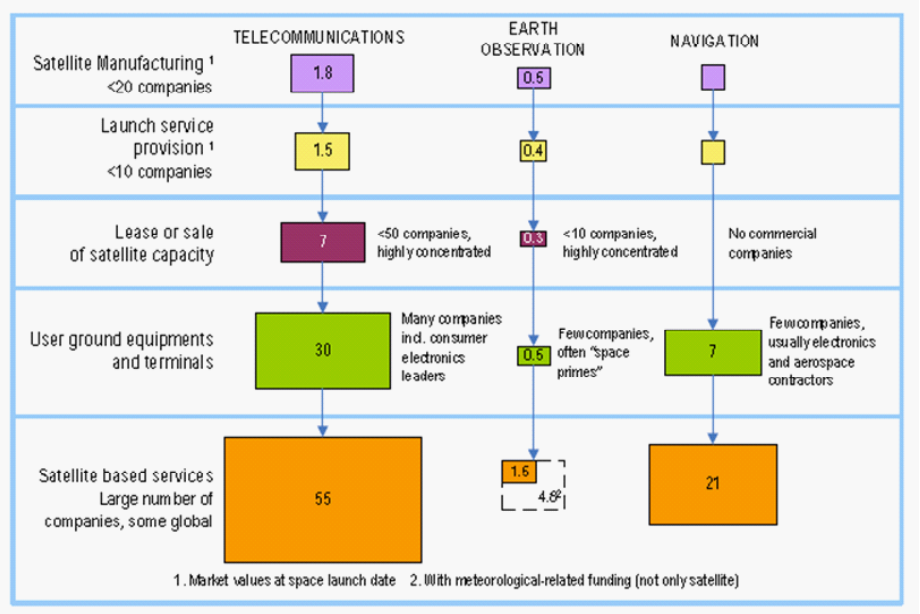
15 Size & Health of UK Space Industry Nov 2010

16 Trademark of Inmarsat Corporation

17 Trademark of Avanti Corporation

4. Space Value Chain – Where is the Money?

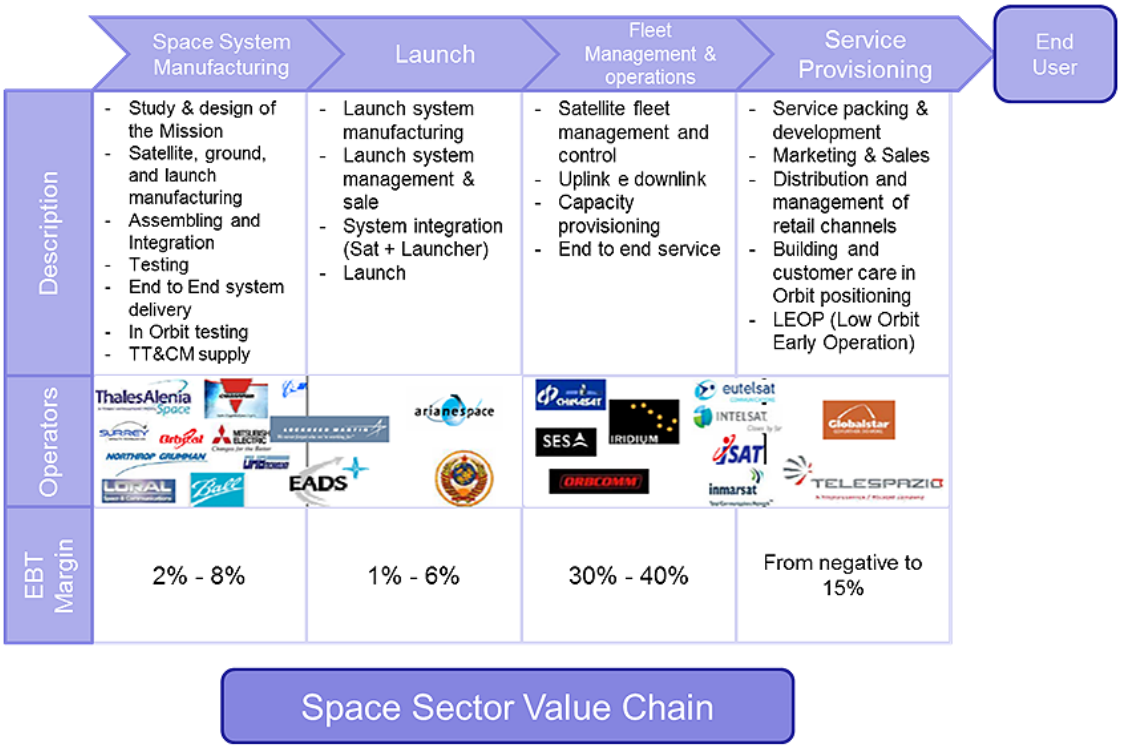
Figures 5 and 6 show two different views of the space market value chain. Figure 5 shows the space value chain, the largest proportion of which lies in the downstream services. However, it should be noted that, currently, satellite communications and direct-to-home television accounts for 78% of telecommunications revenues, and satnav accounts for 89% of GNSS revenues[18].



Source: Euroconsult Value Added Services study for ESA cited in Relationship of UK Space Industry Upstream & Downstream Sectors, Sunwynd Nov 2009

Figure 5: Services Value Chain in the European Space Market

Figure 6 shows the value chain by profitability. The majority of the value lies in the operation of satellites and provision of downstream services, once again demonstrating the importance of this segment to the space industry.



Source: Thales Alenia Space

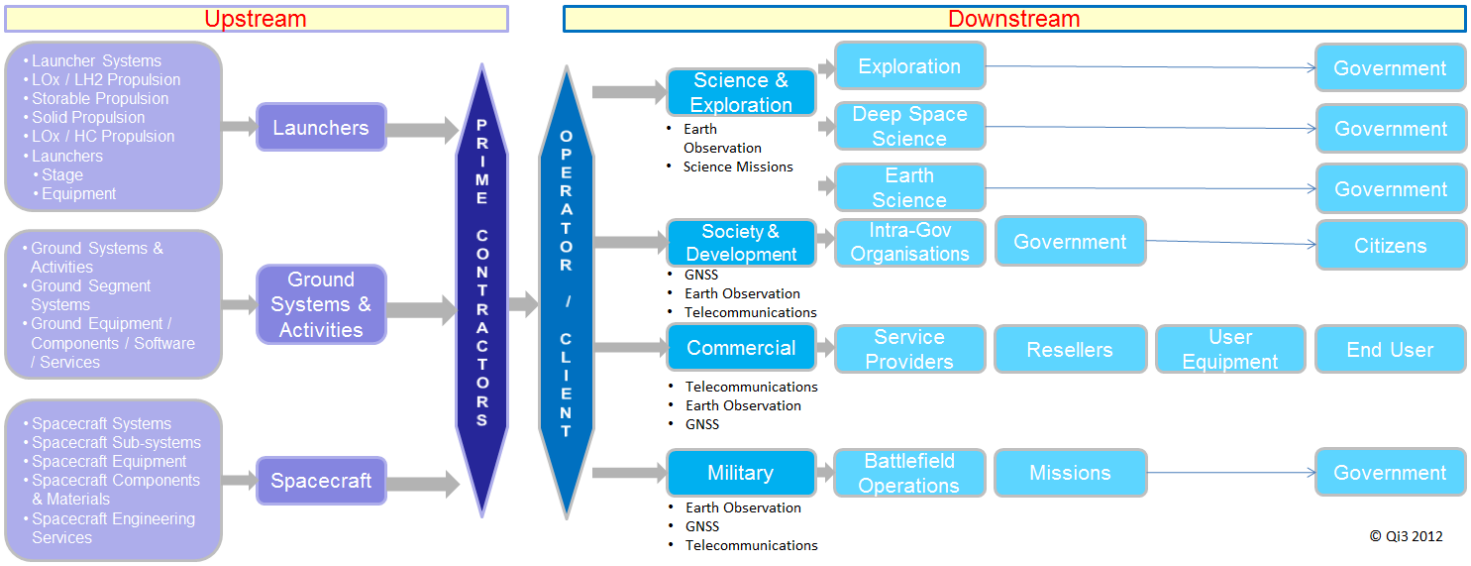
Figure 6: Space Sector Value Chain

18 Source: The Space Foundation

5. Space Supply Chain – Where and What are the Opportunities?

So far, we have discussed the top level segmentation of the space market, but how is the sector structured in detail, and what does the supply chain look like?

The space sector utilises vast range of technologies to achieve its objectives, but fortunately they can be easily structured under the two segments already discussed. The Upstream supply chain mainly consists of hardware, software systems, programme management, etc, while the downstream sector consists of services, data, software tools, and appropriate hardware for the end user. The structure of the sector is laid out in Figure 7 below.

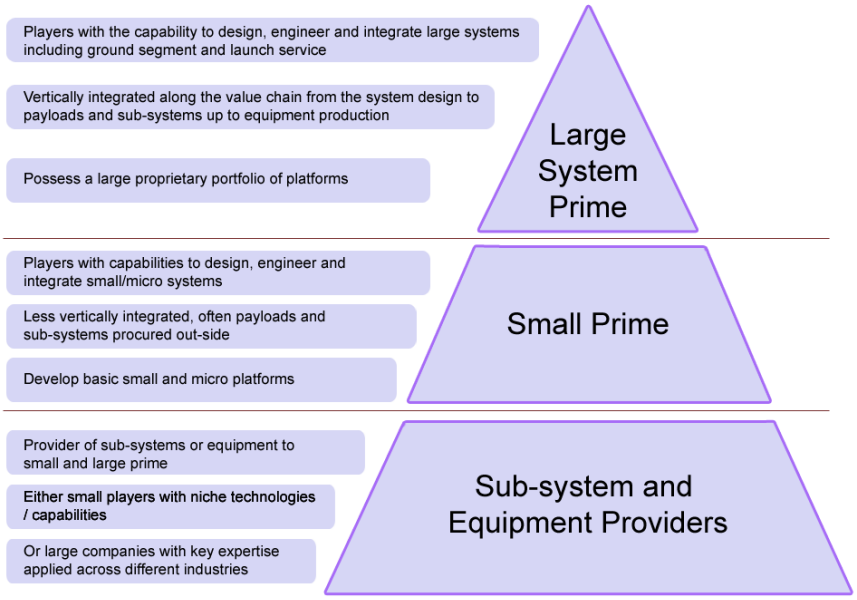


Source: Qi3 Ltd

Figure 7: Structure of the Space Industry Supply Chain

5.1 Upstream Space – Segmentation, Market Drivers and Needs

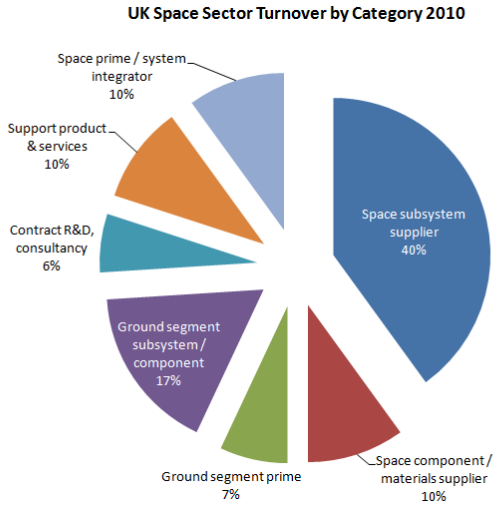
Figure 8 shows the segmentation of the upstream segment by supplier type.



Source: International Telecommunications Union, Geneva, Switzerland
Figure 8: Vertical segmentation of the Upstream Space segment

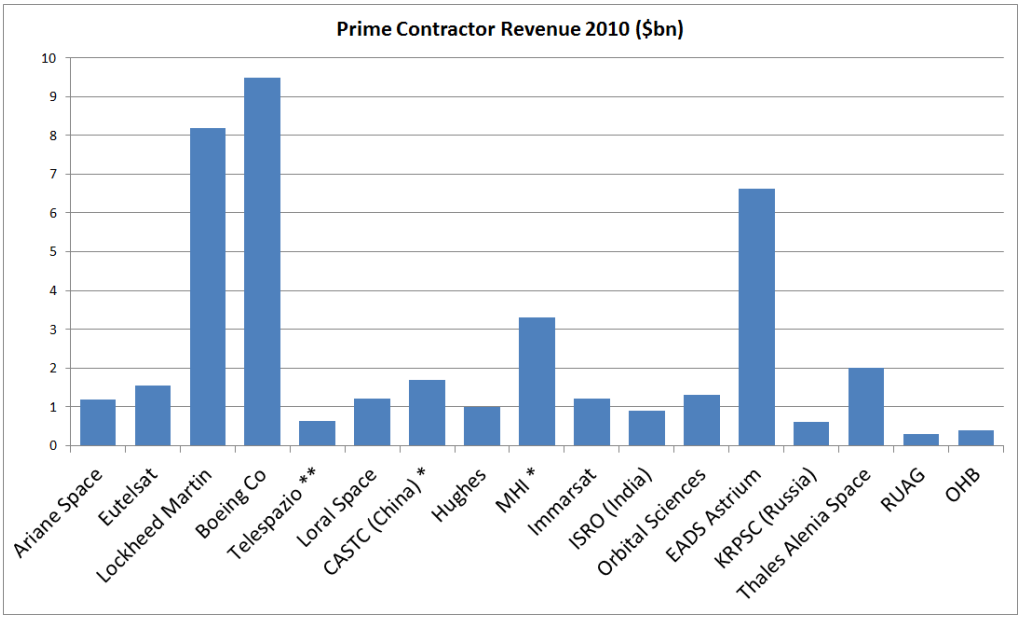
While the large and small prime segments are dominated by a small number of well entrenched companies, a large number of companies supply the wide variety of components, sub-systems and equipment used by the space sector. The 22 subsystem areas highlighted in Figure 6 are further segmented by ESA into 132 component and assembly areas, providing many opportunities for a wide range of companies to engage with the space sector at this level.

Space sub-systems are also the largest part of the supply chain, as seen in Figure 9. This and the components sub-segment account for half the upstream market value. The diversity of technology requirements and the large number of companies in the supply chain make this part of the market the obvious entry point for companies considering the space market.



Source: UK Space Agency Report 2010
Figure 9: Segmentation of the UK Upstream Space Segment by Revenue

The structure of the large and small prime sub-segments of the market is radically different and very concentrated, being dominated by a small number of global companies. Figure 10 shows the key global prime contractors. It is interesting to note that different companies dominate the prime sub-segments in different geographical regions. This reflects the importance of governments as the main customers / funders and their desire for national or regional space industries. Since 2008, two major new players have emerged, RUAG (CHF 283m in 2010) and OHB (€368m in 2011). Both companies have grown rapidly through acquisition.



Sources: Annual Reports, Frost & Sullivan 2008 report
*Note: * 2008, ** 2011*

Figure 10: Global Space Sector Prime Contractors Revenues 2010

There are a number of market needs and drivers which will slowly reshape the upstream sector over the coming years. These include:

New Technologies

The next generation of space platforms, new science missions, reduced launch and operating costs all require improved or new technical solutions. Proven technical solutions from other sectors will have strong attraction for space projects (see Section 5.3).

Critical Technology Capability

There is a strong driver in Europe and other parts of the world to develop or adopt critical technologies that are independent of the USA. The US technology export restrictions (ITAR) provide a significant limitation on their use by the European space sector and independence is a major issue.

Improving Delivery and Operation of Space Systems

Developing technologies, techniques & tools that significantly reduce time and cost of developing and operating space missions is of major interest.

Security of the Supply Chain

Gaps continue to appear in the space supply chain as technologies become obsolete, or companies stop production due to low demand. Rationalisation is also taking place, albeit slowly, opening opportunities for new suppliers who can maintain security of supply.

5.2 Downstream Space – Segmentation, Market Drivers and Needs

The downstream segment has a very different set of drivers, turning data (GNSS or earth observation) and infrastructure (satellite communications) into a wide range of services for terrestrial end-users.

Three major applications have developed to date and dominate the sector: TV broadcast (satellite communications), telecommunications infrastructure (satellite communications), and satellite navigation (the ubiquitous satnav). These markets are dominated by major international companies, and while they have seen major growth in the past, future revenues are projected to stagnate as they become mature.

However, a whole range of new opportunities are opening up and the market is starting to fragment into a plethora of new, niche and bespoke applications. In consumer markets, Google has been extending services such as Google Earth, while mobile phone software developers are rapidly incorporating satnav and satellite imaging capabilities into new Apps. In May 2012, there were over 1000 Apps using satellite capabilities each on Google Play and the iPhone[19] Apps Store.

A similar picture is emerging in B2B markets. Traditionally dominated by companies selling telecommunications bandwidth (e.g. Inmarsat, Eutelsat, Intelsat) or satellite navigation systems, new markets are now emerging for applications that solve pressing commercial and societal problems. Aimed at addressing issues with significant economic value, these new B2B applications are lower volume, but much higher unit value, than consumer applications.

In the B2B sector, a rapidly developing area is the emergence of mixed modality applications (combinations of satellite communications, GNSS, and Earth Observation). A good example is the IRISS[20] project, part funded by the European Space Agency Integrated Applications Promotion programme[21] (ESA IAP), and led by Nottingham Scientific Ltd. This new capability will allow Train Operating Companies to communicate with their assets irrespective of location and status, enabling data to be uploaded and offloaded in real time to support decision making processes and to improve the management of operations and incidents. It will generate savings for the train operators through energy efficient driving, maintaining timetable performance, enhanced safety & comfort, brand promotion and improved customer satisfaction.

New products and applications are also being developed to address national and international issues for governments. Many are being championed by the ESA IAP programme, and include sustainable water management, remote medical assistance, carbon capture & storage, vegetation monitoring, and demining.

A wide range of potential commercial opportunities have been identified in emerging markets that are as diverse as:

- Development
- Disasters
- Energy
- Environment
- Maritime
- Natural Resources
- People
- Telecommunications
- Defence
- Security

Addressing significant commercial and economic opportunities, products and services will need a combination of elements to be successful, including electronics & hardware, software, data, and expertise. In essence, they are about transforming data through information and knowledge to answers for the user.

19 Trademark of Apple Corporation

20 IRISS (Intelligent Railways via Integrated Satellite Services) http://iap.esa.int/projects/transport/iriss

21 http://iap.esa.int/

5.3 UK National Space Technology Strategy – Key Needs

The UK National Space Technology Strategy[22], updated in March 2012, has identified a number of new technology capabilities required over the next five years. Covering both upstream and downstream sectors, they have been grouped into five areas, and examples are:

Telecommunications

- Next generation communications satellite platforms
- High throughput payloads for broadband, broadcast, fixed services
- Transparent and regenerative digital processors
- Advance antenna solutions for broadband applications
- Low cost terminals for business and consumer applications

Sensing

- Low cost radar systems
- Detectors – Infrared(IR) with short / mid-wave & thermal capability
- Low cost imaging spectrometers for atmospheric greenhouse gas monitoring
- Detectors (IR & Visible) for Earth Observation, defence, surveillance
- High performance computing, data mining, image processing for improved downstream applications

Position, Navigation, Timing

The roadmap discusses a range of programmes in which the UK should invest in order to maintain its leading position in GNSS.

Robotics and Exploration

- Autonomous / intelligent vehicles
- Robotic manipulators
- Penetrators
- Novel locomotion technologies
- Novel power systems
- Robotic support for manned exploration

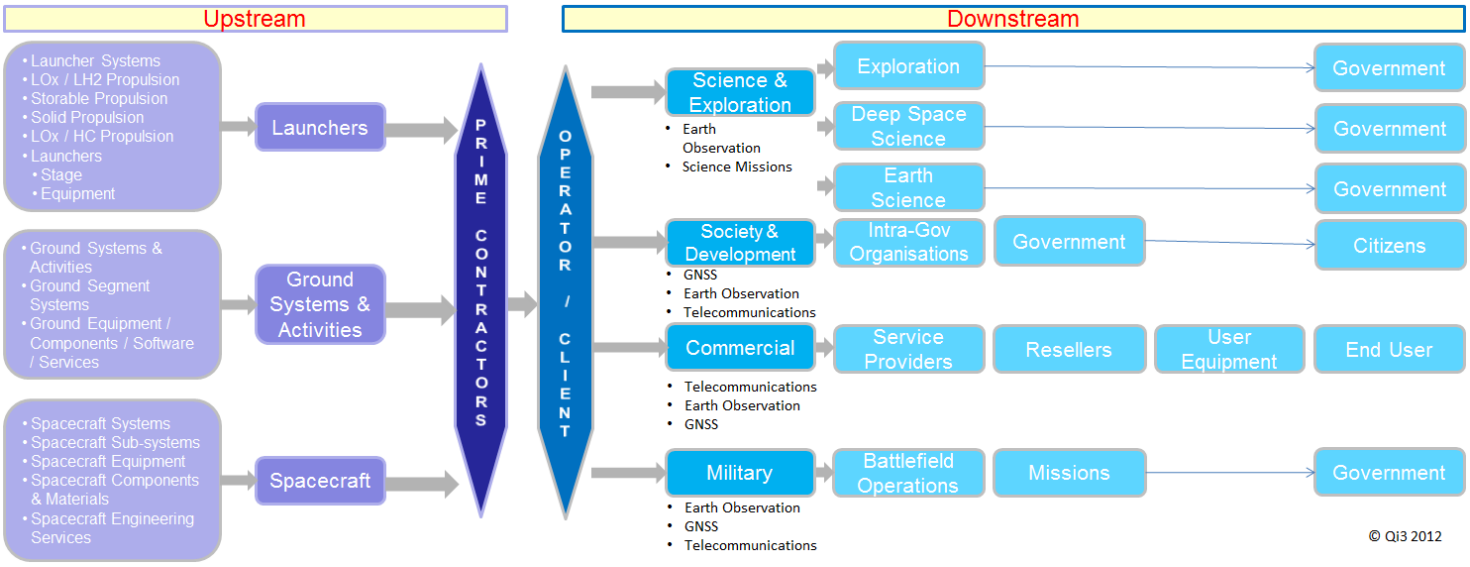
Access to Space

- Reusable launch vehicles
- Avionics for launch vehicles
- Conventional chemical propulsion
- Spacecraft platform designs

22 The UK National Space Technology Strategy, National Space Technology Steering Group.

6. Space – Is it an Opportunity for your Company?

As we have seen, the space supply chain is extensive and requires a wide variety of technologies and capabilities. The market opportunity and market entry point will be very dependent on the offering of each individual company.



Source: Qi3 Ltd
Figure 11: Structure of the Space Industry Supply Chain

The supply chain can be split into four market entry areas:

- Materials, components and small sub-systems
- Prime contractors
- Space asset operators
- Downstream applications

Each of these has very different characteristics and is relevant to different sorts of company.

Materials, Components, and Small Sub-systems

The needs and drivers occurring within this segment of the market are discussed in Section 5.1 and are opening up opportunities for new entrants. They include new technologies, critical regional technology capability, improved delivery and operation of space systems, and security of the supply chain.

However, there are a number of factors which must be addressed if the space market is to be successfully penetrated. These include quality assurance and control, environmental and functional testing, and security of supply. Space testing is a major consideration for new entrants and will almost certainly need partnering with prime contractors, who often take the responsibility for space validation.

This market entry point is suitable for specialist technology companies that address the early sub-segments of the supply chain, such as:

- Materials
- Components
- Small sub-assemblies
- Software sub-systems

Space Prime Contractors

Traditionally large primes such as Boeing, EADS and Lockheed Martin have dominated the space landscape in terms of their ability to design, launch and operate spacecraft.

More recently with the greater commercialisation of space a number of new space "actors" have appeared on the scene. The demise of the space shuttle in the USA has opened up the market for commercial launch vehicles and several new companies have been set up in recent years. Examples in the USA are SpaceX and Orbital Sciences, which are both developing unmanned space transports for the International Space Station, and Virgin Galactic and Bigelow, who are developing manned spacecraft for space tourism. In the UK, Reaction Engines (sponsored by the European and UK Space Agencies) is developing a new, re-usable launch vehicle called Skylon.

However, this sub-segment of the space supply chain remains an unlikely entry point for most companies due to market dominance by large companies and the level of investment necessary.

Space Asset Operators

Space assets are primarily satellites, but also include the International Space Station, manned space craft, deep space science missions / landers (e.g. Mars Express) and the Hubble Space Telescope. Again, there are a small number of companies, institutions, governments involved in operating space assets, and is this sub-segment of the supply chain is unlikely to be a viable market entry point for most companies.

As with prime contractors though, there are notable exceptions. Avanti Communications was formed in 1995, launched its first satellite in 2010, and plans to launch a second satellite in 2012. The company sells satellite broadband services to telecoms companies which use them to supply residential, enterprise and institutional users.

Downstream Applications

The majority of the growth predicted over the next 20 years for the space sector is forecast to come from downstream applications. The major part of this growth is likely to come from B2B applications and will be products or services providing support and solutions to a wide range of business sectors.

The types of companies able to capitalise on these emerging B2B opportunities are very different from those further up the supply chain. The market entry point is suitable for:

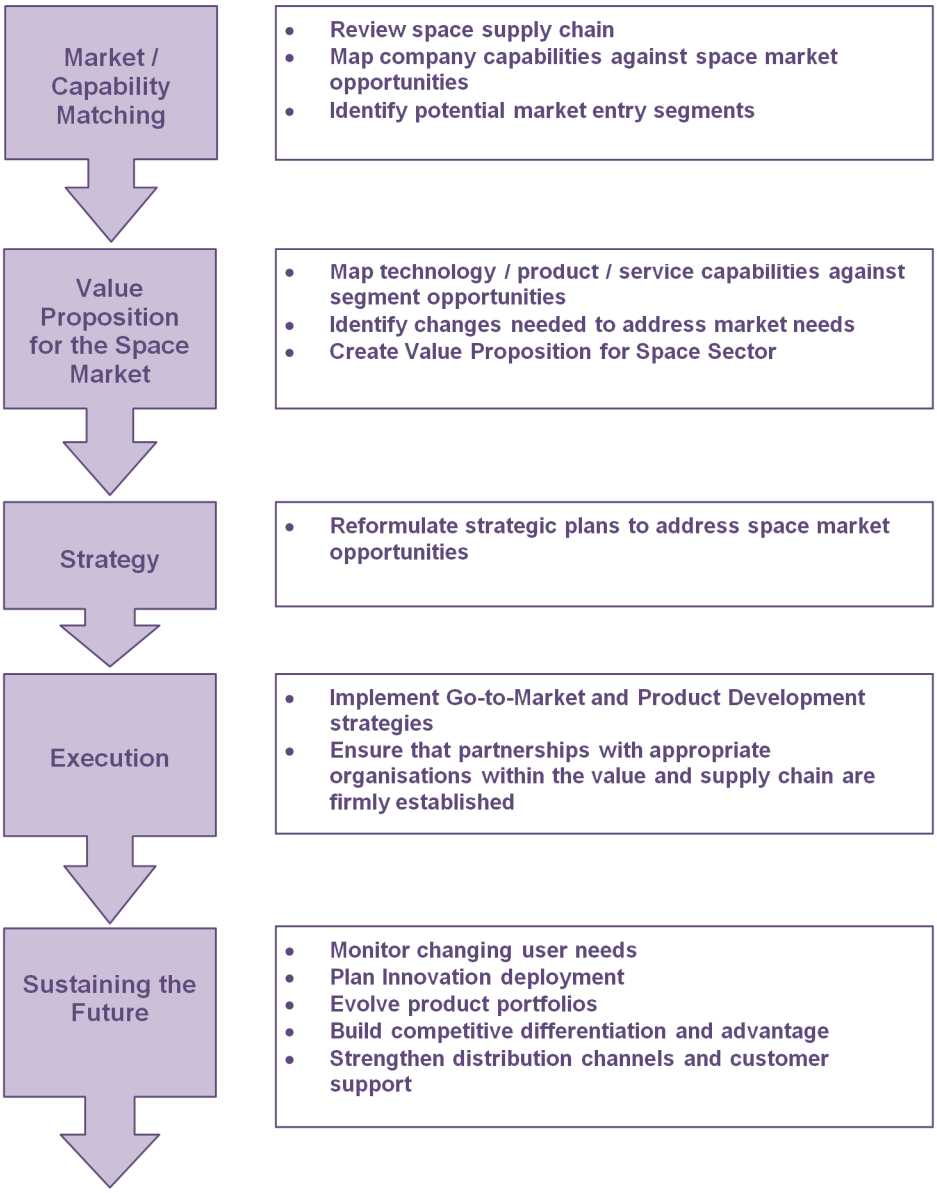
- data and information service providers (e.g. to the oil and gas sector)
- consultancies (e.g. to the environment sector)
- data centres (e.g. for earth observation)
- systems integrators (e.g. for precision farming systems)

Opportunities are already emerging in the defence, development, disasters, energy, environment, maritime, natural resources, people, security, and telecommunications sectors. An intimate knowledge of their customer needs combined with a deep understanding of the capabilities that space assets can provide will open up a wide range of new markets for these companies.

Opportunities in downstream consumer markets are more difficult to predict. Without doubt, many more mobile phone and tablet apps will be developed using satellite capabilities. Whether they generate significant new markets and revenue streams depends on the creativity of their developers and their understanding of consumer interests.

7. What Next

For companies wishing to take advantage of the growth opportunities developing in the space sector, a five stage approach is recommended:



8. About Qi3

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