Qi3 Insight:

Unmanned Aerial Vehicles

Growing Markets in a Changing World

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1. Executive Summary

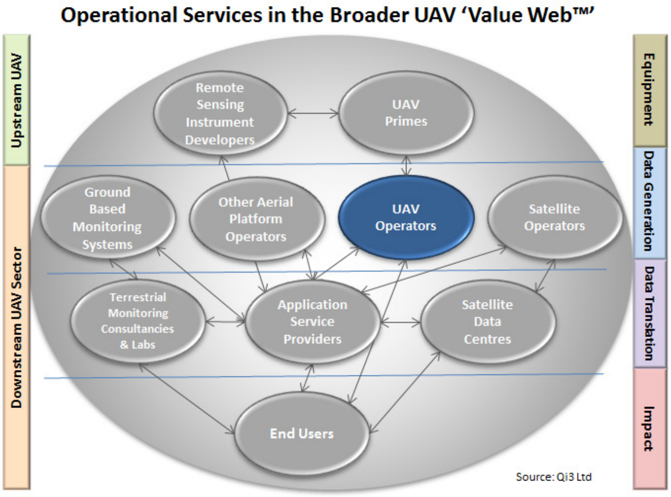
The global market for Unmanned Aerial Vehicles - UAVs (which includes Unmanned Aerial Systems - UAS and Autonomous Remotely Piloted Aerial Systems - ARPAS) has grown substantially in the past decade, primarily driven by US military demand. Technical capabilities of UAVs have matured over this period, from lab concepts to battle-tested proven systems, which will continue to underpin growth in military applications.

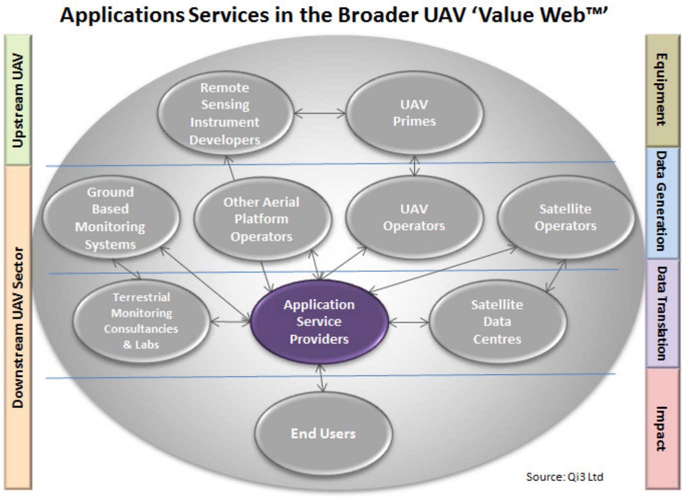
In parallel, these technical developments are also enabling new markets and driving high growth rates in civil applications. Emerging markets include police, border security, agriculture, forestry, and maritime, while future markets will be driven by the need to manage the earth's scarce resources, from urban development, through natural resources and disasters, to energy and people. However, commercial exploitation will not be plain sailing, with competitive challenges arising from different types of aerial platforms, and image / privacy issues creating community resistance to their use.

The growing diversity of markets and applications creates substantial opportunities for UAV vendors, from large defence contractors to small service companies. It creates challenges for these companies and opportunities for new entrants. Civilian customers increasingly want to purchase data and information services rather than invest directly in the equipment. For capital equipment companies, especially those used to servicing military markets, this change in business model is a major challenge. Equally, service and data companies wishing to extend their product offerings now need to incorporate unfamiliar, expensive and challenging technologies into their business models. In this changing and unfamiliar world, fortune may well favour the brave, and success is likely to be built on innovative and new business models.

The UAV market is emerging into a very competitive landscape. The primary role of the UAV is as an airborne mobile platform, and UAVs face competition from other competitive platforms such as space, aircraft, terrestrial and maritime platforms. When analysing the different application and market needs, the strengths and weaknesses of UAVs and satellite capabilities are complementary, creating opportunities for applications and products which utilise the capabilities of both.

UAVs sit in a complex 'Value Web' (a term we use rather than a 'Value Chain'). Positioning a company within this Value Web is challenging, leading to implications for the choice of appropriate business models.





However, the 'Value Web' enables flexibility in positioning and business model selection, providing niche players with potential routes to become global, market dominant applications providers.

Finally, the applications enabled by UAVs can be seen in the wider context of the emerging markets for 'Big Data'. Data and its interpretation into knowledge is rapidly increasing in value, presenting a range of wider market and business model opportunities.

2. Market Overview– Existing, Emerging, and Future

Several market forecasts[1, 2, 3], have been published recently sizing the 2012 UAV market at around $7bn and predicting significant growth over the next ten years to $8.2bn in 2018, and approximately $10bn in 2023. However, anecdotal evidence indicates that these forecasts may be too conservative. While the market to date has been primarily military, the future growth will be driven by the development of both military and civilian applications, leading to significant changes in the structure of the market. New civilian markets are already emerging, while a range of future markets can be postulated with confidence based on challenges foreseen in managing global resources in the future.

a. Existing Markets & Applications – Military & Surveillance

Military UAV development has been through a quantum leap, from lab prototype to battle-tested proven technology. Forming the large majority of the market to date, military expenditure is expected to decline gently over the next decade[4]. The US market accounts for the majority of global military demand and has witnessed meteoric growth over the past decade. Other major markets for military UAVs include Israel, France, Germany and the UK. Reductions in US budgets are forecast to be partly offset by increased UAV procurement in these other countries and the development of new applications.

The military market can be broken into 7 segments[5] - R&D tests and evaluation / UAVs / Payloads / Ground Control Systems / Service, support and maintenance / Training / Data management. The global payload market for UAVs is currently valued at $4bn[6] and is forecast to grow to $6bn over the next 10 years. There is a widening gap between growing UAV fleet and UAV infrastructure development, especially in the training; service, support and maintenance; and data management sectors. This gap creates opportunities for UAV vendors[7].

b. Existing Markets & Applications –Environmental Research

UAVs have been used in scientific and environmental research for many years, but demand from this sector has been a small fraction of that of the military. Civil aviation regulations will continue to act as a brake on the use of UAVs in scientific research until new operating guidelines for UAVs are agreed.

c. Existing Markets & Applications – Security

UAVs are already being used extensively for border patrol and by police and paramilitary units to fight drug trafficking, illegal immigration, human trafficking and other crimes[8]. Over the next decade, countries around the world are expected to strengthen their border surveillance and security activities. However, a growing trend for local communities, particularly in the USA, to ban the use of UAVs[9] will limit the migration of UAVs into community policing and emergency services.

1 MarketsandMarkets - Unmanned Aerial Vehicle Market report (2013-2018)
2 ICD - "The Global UAV Market 2011-2021"
3 Teal Group - 2013 World Unmanned Aerial Vehicle Systems Study
4 UAV Roundup 2013 American Institute of Aeronautics and Astronautics
5 Market Research Media Ltd – "U.S. Military Unmanned Aerial Vehicles (UAV) Market Forecast 2013-2018"
6 Strategic Defence Intelligence - The Global UAV Payload Market 2012-2022
7 Market Research Media Ltd – "U.S. Military Unmanned Aerial Vehicles (UAV) Market Forecast 2013-2018"
8 http://ec.europa.eu/enterprise/policies/security/files/uav_study_element_2_en.pdf
9 http://www.slate.com/articles/technology/future_tense/2013/02/domestic_surveillance_drone_bans_are_sweeping_the_nation.html

d. Emerging Markets & Applications - Civilian

To date, demand for civilian UAVs has been restricted to imaging and survey, mainly due to the constraint of regulation. The US and EU have made initial efforts to evolve regulations in order to facilitate the introduction of UAVs in their civilian sectors. As a result the market for civil UAVs is expected to grow substantially over the next decade. Many applications are already nascent in the civilian sector. These include:

- Fire & Rescue
- Policing
- Drug Enforcement
- Marketing
- Precision farming
- Crop dusting
- Fire detection
- Flood monitoring
- Inspection of oil & gas rigs
- Pipeline security surveillance
- Inspection of critical infrastructure
- Geo-physical surveys

e. Future Markets & Applications - Civilian

A 2007 EU study of future market opportunities for UAVs[10] identified a number of future markets:

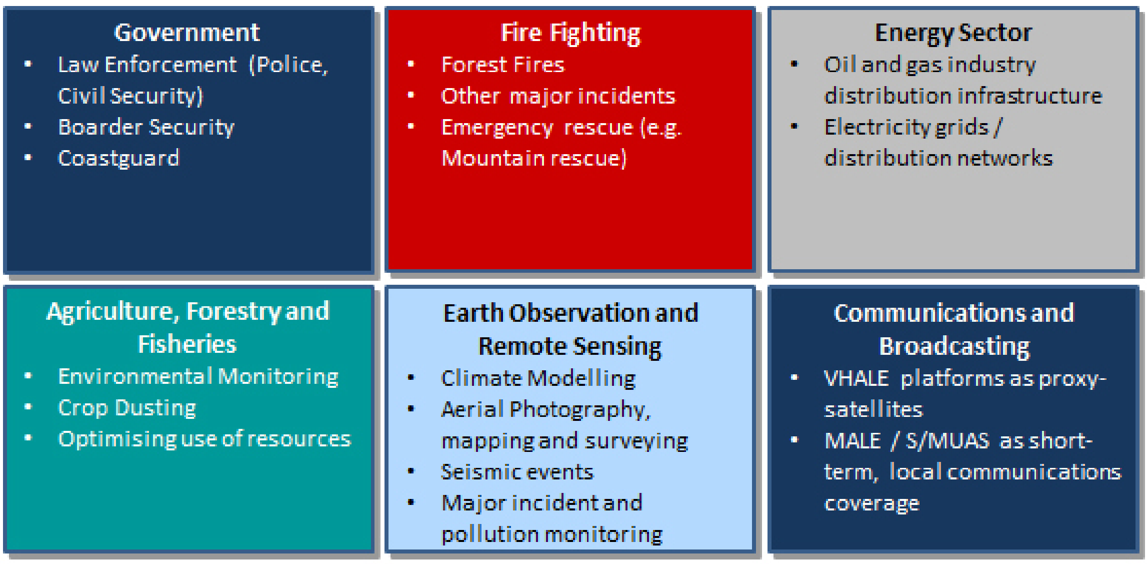


Figure 1 Future Markets for UAVs (source: EU)

Remote sensing projects undertaken recently by Qi3 have also uncovered a wide range of future applications in the following markets which can be addressed by UAVs:

- Development
- Natural Resources
- Disasters
- Environment
- Energy
- People
- Communications

These markets are not expected to emerge simultaneously and different sectors will exchange knowledge and experience as UAVs are increasingly used, enabling diffusion from more to less familiar applications. Government users and large organisations such as oil & gas companies are already first adopters within the civilian market, using UAVs in several of the applications discussed.

10 http://ec.europa.eu/enterprise/policies/security/files/uav_study_element_2_en.pdf

f. Market Forecast

A five year forecast[11] for the overall UAV market predicts a rise from $7bn to $8.2bn with a decline in the military market being offset by growth being offset by growth in the civil and security markets.

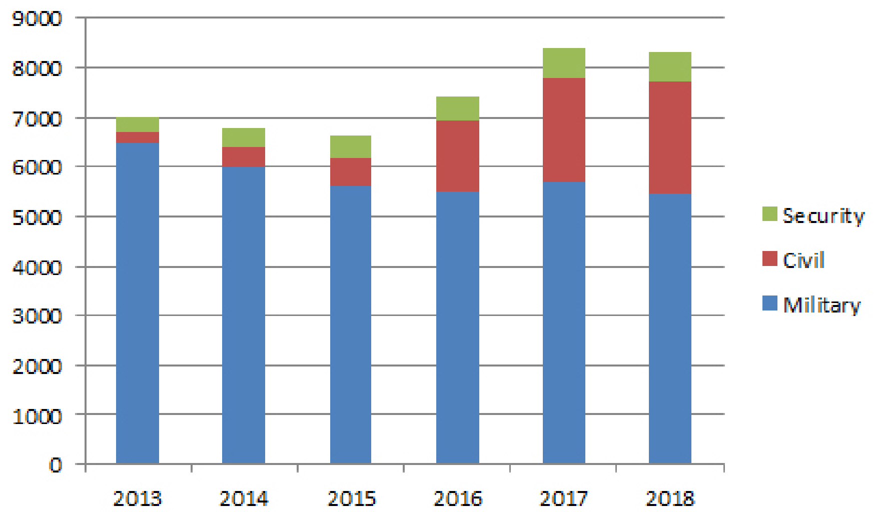


Figure 2 UAV Market Forecast

3. Technology Developments Underpinning Market Emergence

Civil and commercial UAVs, regardless of type, perform one or more of the following functions:

- Carry Sensors (for example: video, infrared, radar, and bio-chemical)
- Carry Communications Relays
- Carry Cargo (for example, insecticides)

The majority of UAVs are currently used for photography and filming, requiring a limited range of technical capabilities to enable effective operation.

However, there are six key technology trends and research areas that will enable the emergence and growth of new markets and applications.

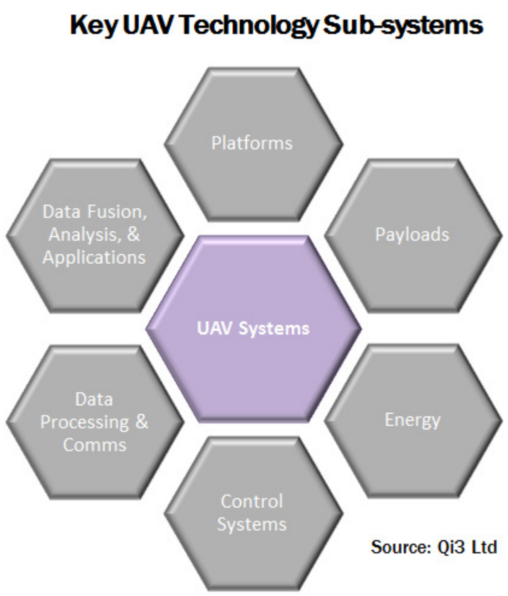


Figure 3 Key UAV Technology Sub-systems

11 MarketsandMarkets - Unmanned Aerial Vehicle Market report (2013-2018)

Platforms

The diversity of applications has resulted in the development of a wide range of different types of UAV. These are typically grouped into 3 categories:

Category	Sub Category
Long Range	■ HALE (High Altitude Long Endurance) ■ MALE (Mid Altitude Long Endurance) ■ VTOL (Vertical Take Off & Landing) ■ Other
Mid-Range	■ TUAV (Tactical UAV) ■ VTOL (Vertical Take Off & Landing) ■ Other
Short Range	■ UAVs (Small UAV) ■ MUAVs (Micro UAV) ■ VTOL (Vertical Take Off & Landing) ■ Other

Key improvements that will facilitate their wider deployment and enable new applications include:

- Semi-autonomous and autonomous operation
- Inter-vehicular collaboration
- Sense and avoid capabilities
- Smaller systems and lower cost

Payloads

The majority of payloads currently in civil applications are remote sensing systems, especially optical imaging systems such as cameras. They have enabled civil applications to emerge in areas such as surveying, surveillance, observation and media.

However, both environmental scientists and military users are developing and miniaturising a range of remote sensing technologies that will transform the capabilities of UAVs[12,13]. These include new instrument concepts, increased performance / operational endurance, miniaturised systems, and new applications, providing technical capabilities that will enable the emergence of new markets.

Imaging sensors currently under development and their applications include:

- Passive Microwave and Millimetre wave
  Meteorology (for atmospheric profiles, water and ozone content in the atmosphere), hydrology (for soil moisture), oceanography (for mapping sea ice, currents, and surface winds as well as detection of pollutants, such as oil slicks), and ground monitoring (for vegetation conditions, snow cover, traffic control at land and sea, and sensing of road conditions).

- SAR and Radar
  Topographic mapping, geology and mining, oil spill monitoring, sea ice monitoring, oceanography, agricultural classification and assessment, and land use monitoring.

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12 Centre for Earth Observation Instrumentation
13 http://www.nottingham.ac.uk/eotechcluster/documents/events/uavsrspsocbournemouth.pdf

- THz and Thermal IR
  Land and sea surface temperature dynamics, urban heat island effects, forest fires, volcanic eruption precursors, underground coal fires, geothermal systems, soil moisture variability, and temperature-based mineral discrimination.

- Hyperspectral Imaging
  Atmosphere (water vapour, cloud properties, aerosols), ecology (chlorophyll, leaf water, cellulose, pigments, lignin), geology (mineral and soil types), coastal waters (chlorophyll, phytoplankton, dissolved organic materials, suspended sediments), snow/ice (snow cover fraction, grain size, melting), biomass burning (sub-pixel temperatures, smoke), commercial (mineral exploration, agriculture and forest production).

- Optical and IR Imaging
  Fire & rescue, policing, drug enforcement, marketing, precision farming, crop dusting, fire detection, flood monitoring, inspection of oil & gas rigs, pipeline security surveillance, inspection of critical infrastructure, geo-physical surveys.

A range of non-imaging sensors can also be flown on UAVs, acquiring data on temperature, pressure, relative humidity, aerosols, pollution, and gravity gradiometry (used in mineral and oil & gas surveying). It is important to note that, in contrast to working with remote sensors on aircraft, where an operator can be on hand, payloads on UAVs, as with satellites, must be highly autonomous[14].

Energy

Currently, the mission time and range, especially for smaller UAVs, is limited by power sources, e.g. Li-ion batteries. New developments in fuel cells and in battery technologies will transform the operational capabilities of UAVs in the next few years. For example, new lithium – sulphur batteries[15] are being developed that will increase power fourfold, while wide availability of fuel cells is rapidly approaching.

Control Systems

UAV control systems require substantial levels of autonomous operation, even when being flown remotely by ground based operators. As a result, autonomy is considered an extension of the control environment. Autonomy technologies important to UAV development fall under the following categories:

- Sensor fusion – Combining information from different sensors for use on board the vehicle
- Communications – Handling communication and coordination between multiple agents in the presence of incomplete and imperfect information
- Path planning – Determining an optimal path for vehicle to follow while meeting certain objectives and mission constraints, such as obstacles or fuel requirements
- Trajectory Generation – Determining an optimal control manoeuvre to take in order to follow a given path or to go from one location to another
- Trajectory Regulation – The specific control strategies required to constrain a vehicle within some tolerance to a trajectory

14 NERC Scoping Study R8-H10-71 Environmental and Earth Science Using Next Generation Aerial Platforms
15 http://en.wikipedia.org/wiki/Lithium%E2%80%93sulfur_battery

- Task Allocation / Scheduling – Determining the optimal distribution of tasks amongst a group of agents within time and equipment constraints
- Cooperative Tactics – Formulating an optimal sequence and spatial distribution of activities between agents in order to maximize the chance of success in any given mission scenario
- Operational Safety – Developing the optimal solutions to get a UAV home or safely on the ground in the event of communications failure and/or aircraft malfunctions.

In additional to the improvements in UAV control capability being developed by the aerospace and defence companies, major advances in performance will come from the space sector, especially from the autonomous systems being developed for Mars rovers by the USA (Curiosity) and Europe (ExoMars)[16,17].

Data Processing & Communications

New imaging and sensing systems are providing a quantum leap in the quantity of data, creating challenges for data processing and data communications. Improvements in on-board processing, data compression, communications bandwidth, and data management are all underway.

Data Fusion and Analysis

A challenge for any application is the extraction of meaningful knowledge from large datasets. Research programmes are developing new approaches in data mining, multi-sensor data fusion, multi-sensor time series, modelling, and data visualisation[18,19]. As a result, applications enabled by UAVs can be seen in the wider context of the emerging markets for 'Big Data'. Data and its interpretation into knowledge is rapidly increasing in value across a wide range of government and industry sectors.

4. Aerial Platforms – UAVs within the Competitive Landscape

The UAV market is emerging into a very competitive landscape. The primary role of the UAV is as an airborne mobile platform, mainly for remote sensing instruments, but also to carry cargo, such as insecticides or post, and communications relays. In addition to other competitive aerial platforms, UAVs also face competition from space, terrestrial and maritime platforms, especially for remote sensing instruments. This multi-level competitive environment is mapped out in Figure 4.

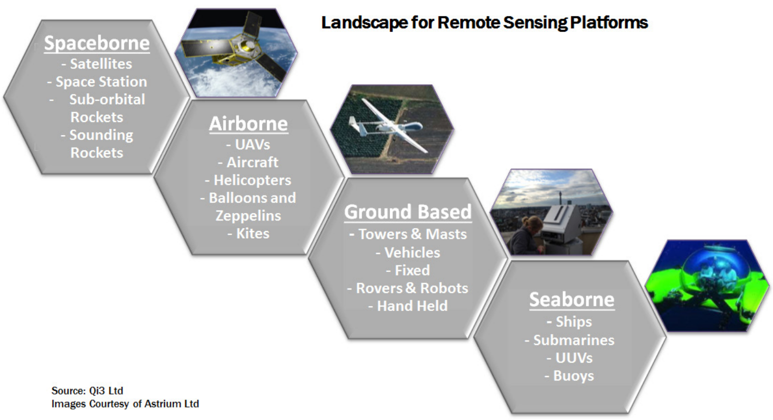


Figure 4 Landscape for Remote Sensing Platforms

16 http://exploration.esa.int/mars/45084-exomars-rover/
17 http://mars.nasa.gov/msl/mission/technology/insituexploration/planetarymobility/
18 van Leeuwen University of Arizona - New Trends and Applications in Remote Sensing
19 http://www.nerc.ac.uk/research/programmes/virtualobservatory/

UAVs have several competitive advantages over other airborne platforms such as aircraft and helicopters. The most significant is economics, with the cost of a UAV mission for imaging often being a tenth of that of an aircraft or helicopter mission. They also have advantages in 'dull, dangerous, and dirty' tasks where removal of the pilot is desirable.

Satellite based earth observation instrumentation (EO) is developing rapidly and could provide a serious competitive challenge to UAVs, both in capability and in scale of deployment. The European Union is deploying the GMES satellite constellation which will provide capability for EO instrumentation to address many of the applications and markets currently being targeted by UAVs, especially those in climate change and civil security.

In addition, the European Space Agency has a programme specifically to stimulate downstream applications of space assets such as EO, location & timing, and satellite communications[20]. This is supported by national programmes such as the UK Satellite Applications Catapult[21].

However, each has limitations which restrict their ability to fully meet market and application needs. For satellite services, these include:

- Spatial Coverage – EO satellite coverage is in swathes, and is often not geographically complete.
- Temporal coverage – EO satellites are in predetermined orbits, and for many geographical locations they will revisit on a regular time schedule which may vary from daily to monthly.
  – In addition, many satellite observations are limited by night-time (imaging) and cloud cover.
- Data resolution (x/y axes) – for many forms of earth observation using satellites, the data resolution may be from the 100m to kilometre scale. For large scale monitoring in research programmes this may be adequate, but may not be for emerging commercial applications.
- Data resolution (z axis) – for several EO modalities, their sensitivity becomes progressively more limited as the atmosphere thickens towards the surface of the earth. As a result, intermediate and 'ground-truth' measurements are often needed to meet application needs.

As a result of these constraints, satellites have limited capability in addressing the needs of many of the applications and markets identified above.

Limitations of UAVs include:

- Limited operational range – high altitude UAVs can operate for extended periods of time, but tactical range, short range and micro UAVs can have severely limited operational ranges (time and distance).
- Limited payloads – smaller UAVs are extending their applications potential at the same time as the number of sensing modalities is increasing. Without a commensurate reduction in payload sizes, the full potential of UAVs will not be realized.
- Civil Aviation Regulations – these currently limit severely the deployment of UAVs; upcoming positive changes are discussed later in this paper.

When analysing the different application and market needs, the strengths and weaknesses of UAVs and satellite capabilities turn out to be very complementary, creating opportunities for applications and products which utilise the capabilities of both.

20 http://iap.esa.int/
21 https://sa.catapult.org.uk/

Given the inherent capabilities of ground and marine based platforms, they may well provide significant competition in certain applications and can't be dismissed, especially as these platforms are cheaper and easier to deploy in many cases. However, they also have a number of limitations such as a limited field of view, slow travel speeds, and restricted access to some geographic areas. Therefore, as with satellites, they are likely to be as complementary to UAVs as they are competitive, especially with their ability to provide 'ground truth' in order to validate UAV observations.

5. Value Chains and 'Value Webs' for UAVs

To date, the UAV market has been dominated by the military, resulting in the traditional military value chain and supply chain structures being used. This customer base is very knowledgeable about the applications and technology and is able to use the systems with little external help.

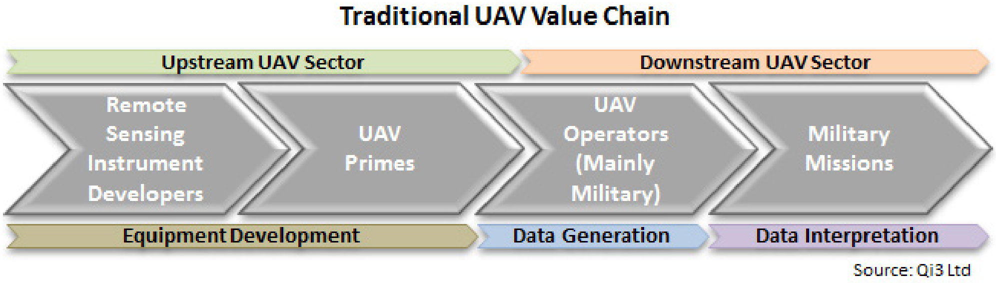


Figure 5 Traditional UAV Supply Chain

In civil markets, UAVs sit within a far more complex value chain, with the solution to the user need requiring several enabling technologies, of which the UAV (aerial platform) is just one. The others include remote sensing instrumentation, operations, and data acquisition / interpretation. This results in a fragmented value chain in civil markets.

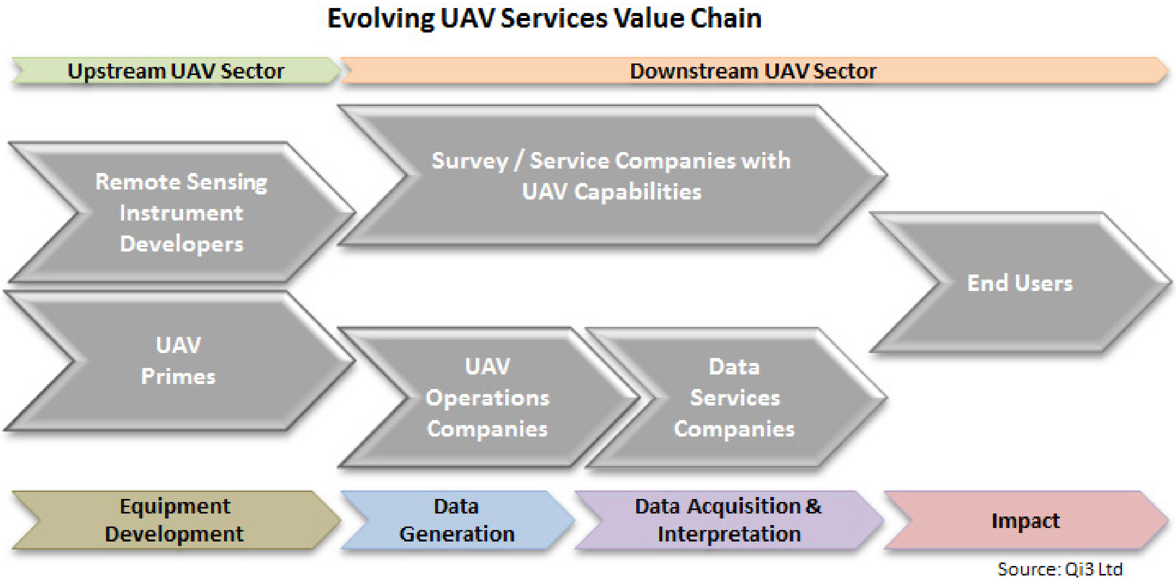


Figure 6 Emerging Civil UAV Value Chain

From the civil user's perspective the most important element is the data acquisition and transformation. This provides the knowledge on which the user can make decisions and take action. However, this requires the availability of appropriate remote sensing instrumentation. As a result, the most profitable elements of the value chain will be at the beginning (remote sensing instrumentation) and end (data acquisition and transformation) of the value chain. This leaves UAVs in a difficult position in terms of capturing a significant share of the value chain, which needs to be addressed in any business model.

Section 4 discussed the advantages and disadvantages of different aerial platforms, and predicts that markets and applications will emerge that jointly use UAV, space, and/or ground based platforms for remote sensing. In this case the number of capabilities contributing to the application becomes significantly larger, and the value chain becomes more of a ‘value web™’, enabling different combinations of capability to come together to meet customer needs.

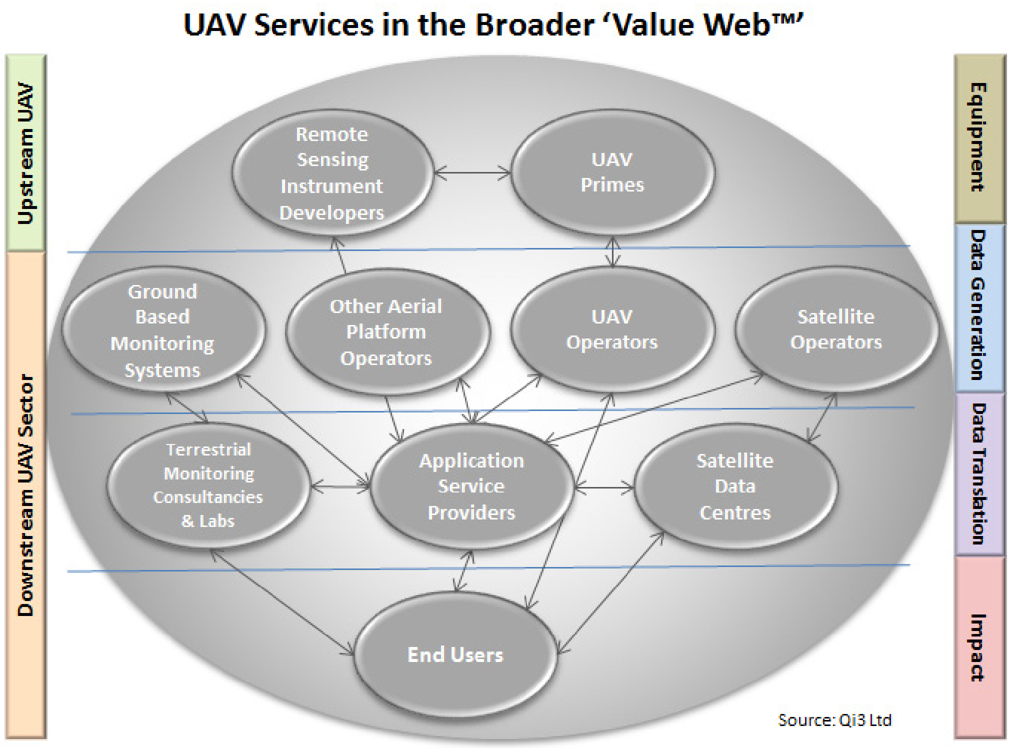


Figure 7 UAV Services in the Broader ‘Value Web’

6. Business Models for the UAV ‘Value Web’

Developing business models for a complex value chain is fairly straightforward with experience. There are numerous tools available, such as the Business Model Canvas[22], to help companies do this. Successful business models will focus on positioning the company to best effect within the value chain and maximising the amount of value that it can capture.

Creating business models that successfully exploit a complex value web, such as those that will develop in the market opportunities for UAVs, will be far more challenging. While this White Paper does not present a generic solution to this challenge (every market and application will have a different type of value web) there are a couple of exemplars that can stimulate creative thinking about the challenge.

One approach is to focus on the inherent strengths of UAVs (operational flexibility, cost, deployability) and focus on markets / applications where these strengths provide major competitive advantage. Many niche technology companies have created successful business models based on this type of strategy.

22 http://www.businessmodelgeneration.com/canvas

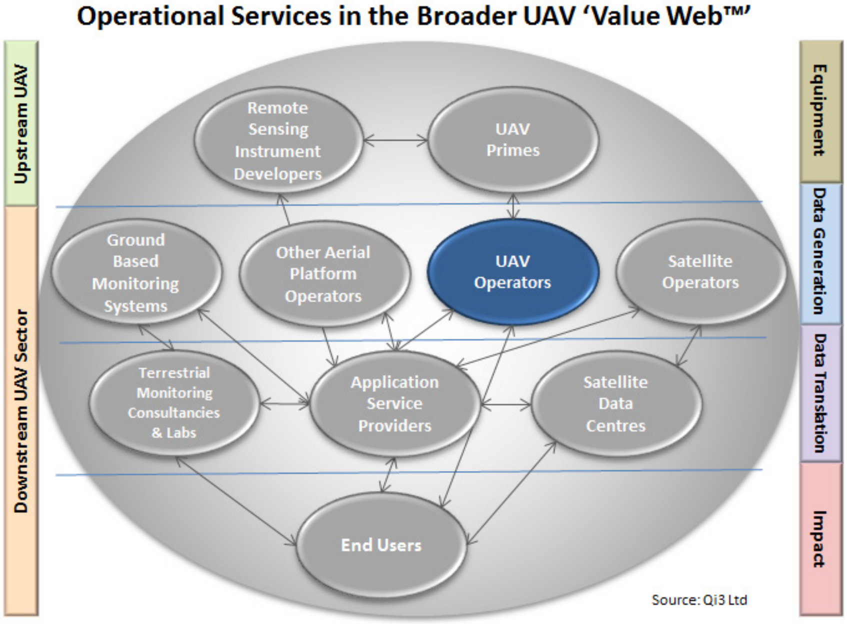


Figure 8 Operational Services in the Broader UAV 'Value Web'

However, the growing diversity of the market opportunities will create major challenges for UAV companies. Civilian customers will increasingly want to purchase data and information services rather than invest in the equipment themselves. For capital equipment companies, especially those used to servicing military markets, this change in user requirement poses a major cultural challenge. Equally, application service providers wishing to extend their product offerings will have to incorporate unfamiliar, expensive and challenging technologies into their business models. In this changing and unfamiliar world, fortune may well favour the brave, and success is likely to be built on innovative and new business models.

A more ambitious approach is for UAV companies to combine the inherent operational strengths of UAVs with other enabling technologies, such as remote sensing, and a deep understanding of the customers' needs to become an Applications Service Provider. This business model has been used with particular success by the oilfield services companies such as Schlumberger[23] and Halliburton[24], resulting in very large and highly profitable corporations.

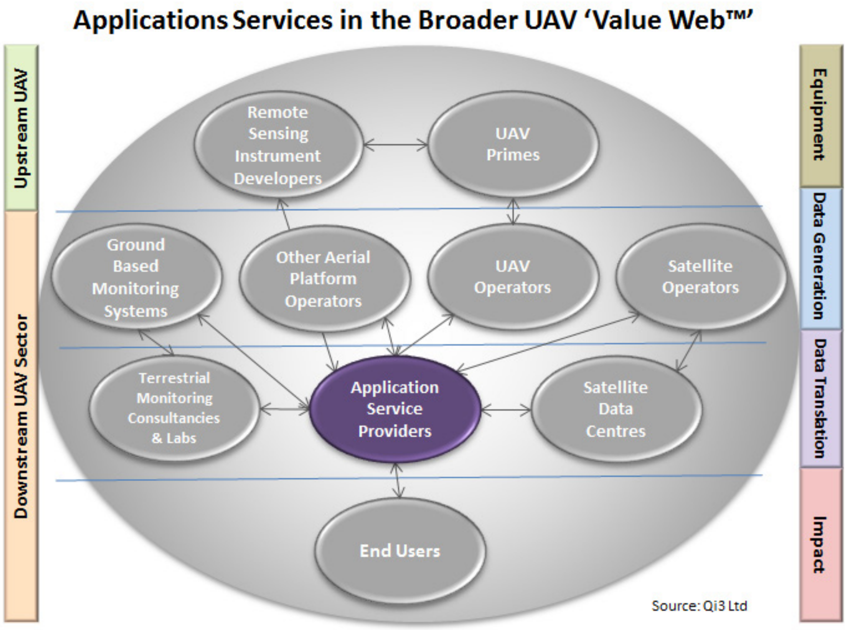


Figure 9 Applications Services in the Broader UAV 'Value Web'

23 http://www.slb.com/
24 http://www.halliburton.com/en-US/default.page

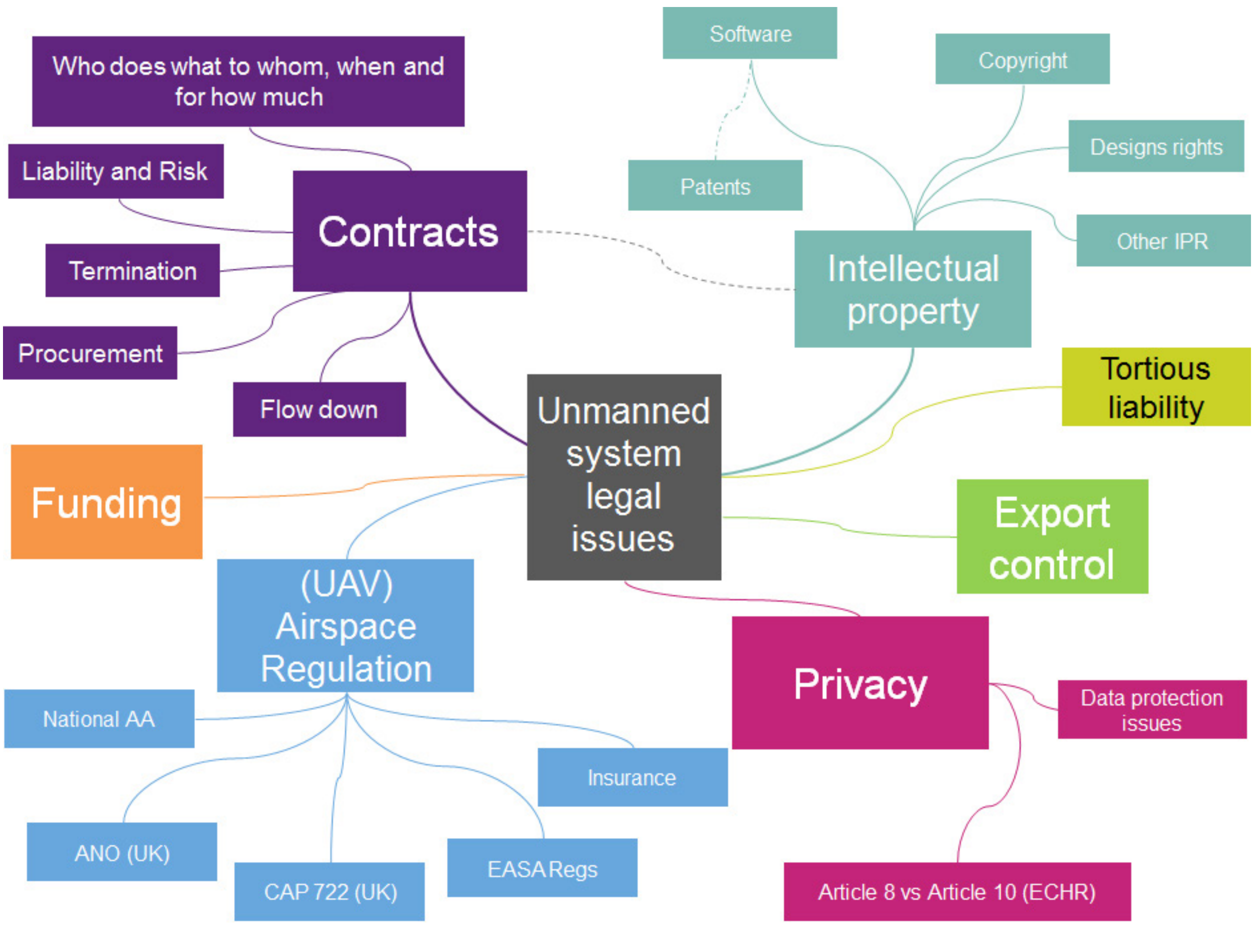
Business models based on this approach have a number of advantages:

- Companies control access to the customer (by providing the complete solution) creating high barriers to market entry and significant competitive strength
- Products can be rapidly reconfigured to capitalise on new market opportunities, new technology developments and competitive threats
- By bringing in-house the technologies and services across the 'value web', companies can control large parts or all of the value chain, maximising profit generation

Emerging markets will provide civil UAV companies with a wide range of opportunities. The scale of their success will be determined as much by the business model they chose as by market understanding, technical innovation, and operational excellence

7. Barriers to Success – Regulatory, Legal and Risk

There are various legal and regulatory matters for users of UAV to consider. The impact of such issues will depend upon the intended use of both the platform and data collected, as well as the geographical location of any operation. The diagram below sets out some of these key legal considerations.



Despite the myriad of legal touch points the overriding concern of any aviation operator must be to focus on physical safety (whilst mitigating his exposure to contractual and tortious liability where possible). Nevertheless, any user of UAV technology would be naive to ignore the impact that the use of such systems may have on privacy, data protection and intellectual property rights as well its contractual risk positions.

A key consideration for operators of UAVs is the limitations imposed by airspace regulations - the challenges of flying UAVs in regulated or controlled airspace and around people. In Europe platforms of less than 150kg are regulated by national aviation authorities and most states have taken positive steps toward integrating UAV into their airspace. The UK is a good example of a state that has adopted a pragmatic mechanism for such integration. The UK's principle regulations for UAV use are CAP 722 [25] (Unmanned Aircraft System Operations in UK Airspace - Guidance) and CAP 393 (Air Navigation Order 2009)[26]. In summary, unless permission has been given to an operator by the UK's Civil Aviation Authority (CAA), these rules prohibit unmanned aircraft from flying in congested areas, close to people or property, for aerial work purposes or beyond visual line of sight. The CAA can issue a permit to fly if the operator can demonstrate an airworthiness certificate, design and construction certificate, a pilot qualification, insurance and organisational approval. For certain tasks qualified operators may obtain special dispensation from the CAA to operate within the standard flight restrictions. The CAA has been actively engaged with the unmanned system community for a number of years. This approach has led to a safe, reasonably flexible and evolving regulatory framework which continues to develop as the technology improves and makes more sophisticated automation and beyond line of sight sorties possible. A more complex matrix of laws govern flights between and across different states which include the Chicago Convention[27] provisions and the ICAO[28] rules.

Insurance requirements must be factored into any UAV business plan. EC Regulation 785/2004[29] makes it a requirement for UAV operators in European states to have third party liability insurance. Primary goals of insurance should be to protect the organisation's balance sheet, to meet the requirement of 785/2004 and to establish the risk parameters for negotiations. Well established insurance solutions should consider third party liability, physical damage, transit, war risks liabilities and ground risks.

Privacy violations and the effect of UAV use on citizens' right to "respect for his private and family life, his home and his correspondence" have been widely debated in the media and academia. Whilst the Stanford Law Review has suggested that "[UAV] may help restore our mental model of a privacy violation. They could be just the visceral jolt society needs to drag privacy law into the twenty first century."[30], the impact of the laws of privacy upon a UAV user's freedom to operate is largely dependent upon how the UAV technology is deployed. If, for example, the platform is used in a surveillance role against human activity then the privacy impact (and any related legal challenge by a concerned party) is likely to be higher than if a platform is to be used to analyse crop damage or isolated offshore oil platforms.

Data captured and processed by the use of UAV can be valuable and may be protected by intellectual property rights, including copyright and database rights. If a living person can be identified from the data captured then that data may be subject to the laws of data protection and the obligations they impose on the controllers and processors of that data. Developing a coherent strategy for managing and exploiting these rights is often an important consideration for companies using this technology.

Despite these apparent legal and regulatory restrictions, some of the world's most innovative organisations are exploiting UAV technology to their advantage; they are embracing the restrictions, working creatively and safely within them and in doing so are intelligently turning them to their competitive advantage.

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25 CAP 722 Unmanned Aircraft System Operations in UK Airspace – Guidance, Fifth Edition – 10 August 2012, ISBN 978 0 11792 722 3
26 http://www.caa.co.uk/docs/33/CAP393.pdf
27 http://www.icao.int/publications/pages/doc7300.aspx
28 http://www.icao.int
29 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:138:0001:0006:EN:PDF
30 R. Calo (2011) "The Drone as Privacy Catalyst" Stanford Law Review Online at 29

8. Conclusion

A wide range of civil markets and applications are likely to emerge over the next few years for UAVs presenting a huge commercial opportunity for the companies involved. However, commercial exploitation will not be plain sailing, with competitive challenges arising from different types of aerial platforms, and image / privacy issues creating community resistance to their use.

UAVs sit in a complex 'Value Web' and positioning a company within it will provide serious challenges and opportunities. These will also have strong implications for the choice of appropriate business models. However, the 'value web' also provides flexibility in how companies position themselves and in the business models they can choose, which range from niche players to global, market dominant applications providers.

About Us

Qi3 offers in-depth, hands-on expertise across the whole spectrum of marketing and sales activities to help our clients achieve competitive advantage and commercial success. Our staff has decades of experience between them across many different segments of the remote sensing, instrumentation and space sectors and in the markets they serve. We have developed proprietary working models and methodologies that enable us to uncover critical changes in user needs, develop differentiating market and product strategies, and implement highly effective 'Go–to-Market' programmes.

Qi3 works with its associate company, Kestrel Associates Ltd, in providing aerospace and defence advice. Kestrel Associates specialises in delivering thought leadership and strategic advice to a wide range of companies on civil and military aerospace, defence and homeland security matters. It also provides management, governance and investment advice to SMEs breaking into these sectors.

So whether you want to investigate new markets for a technology, or find out how to add value to your organisation's current marketing competencies, we can provide a range of services, carefully tailored to suit your business needs. For further information, contact Robin Higgons at robin.higgons@qi3.co.uk.

Taylor Vinters is an international law firm with a market leading unmanned systems practice. Companies and organisations that use unmanned technologies instruct us because we have the skills and experience to help deliver their unmanned systems strategies; we understand their technical, legal and regulatory issues (including airspace management) and public policy challenges (such as privacy matters). We have experience of the defence and commercial markets in several sectors with complex legal and regulatory environments including oil and gas, border patrol and agriculture among others. For more information contact Peter Lee at peter.lee@taylorvinters.com.