Study of Strategic Drivers and Patterns that Change Planet's Business Model CANVAS

Bachelor's Degree Thesis

Bachelor's Degree in Aerospace Technologies Engineering

APPENDIX

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CHAPTER

A

INTRODUCTION TO CANVAS BM

Before describing what a CANVAS Business Model is, perhaps it is wiser to define what a business model is.

A *Business Model* is a tool that describes the rationale of how an organization creates, delivers and captures value.

Concretely, a CANVAS Business Model is an easily understandable business model, firstly proposed by *A. Osterwalder and Y. Pigneur.* It is simple and intuitive, and at the same time, it is not oversimplified as to distort the results.

The CANVAS is described though 9 building blocks that show the logic of how a company intends to succeed. In Figure A.1, the blocks are graphically plotted, and in addition, each of this building blocks is to be presented in the following lines: [1]

1. *Customer Segments:* Groups of people or organizations with different needs that an enterprise aims to reach. The different kinds of Customer Segments that exist are:

   - Mass Market: It does not distinguish between different customer segments.

   - Niche Market: Focuses on specialized customer segments.

   - Segmented Market: Distinguishes between customer segments with slightly different needs.

   - Diversified Market: Serves two unrelated Customer Segments.

Figure A.1: *9 building blocks of a CANVAS model.*

2. *Value Propositions:* Products and services that create value for a specific Customer Segment. The elements contribute to customer value creation, are mainly:

- Newness: By satisfying an entirely new set of needs.

- Performance: By improving a product's service in comparison with how it traditionally was.

- Customization: Tailoring products and services to the specific needs of each customer segment.

- "Getting the Job Done": Helping a customer get a certain job done.

- Design: When the product stands out because of a superior design.

- Brand/status: When customers might find value in the simple act of using and displaying a specific brand.

- Price: Offering similar products at a lower price.

- Cost Reduction: Helping customers reduce costs by using a specific product.

- Risk Reduction: Reducing the risks the customers incur when purchasing products or services.

- Accessibility: Making products available to customers who previously lacked access to them.

- Convenience/usability: Making things more convenient or easier to use.

3. *Channels:* They describe how a company communicates with and reaches its customer segments. Channels can be direct or indirect, as well as owned or partnered. In addition, the channels have 5 phases: Awareness, evaluation, purchase, delivery and after-sales services.

4. *Customer Relationships:* They describe the types of Relationships a company establishes with each specific customer segment. The existing types of relationships might be:

   - Personal Assistance: Based on human interaction.

   - Dedicated personal assistance: It involves dedicating a customer representative specifically to an individual client.

   - Self-service: It involves no direct relationship between the company and the customer.

   - Automated services: It mixes a more sophisticated form of customer self-service with automated processes.

   - Communities: Online platforms that allow users to exchange knowledge and solve each other's problems.

   - Co-creation: The companies co-create value with customers.

5. *Revenue Streams:* The cash a company generates from each customer segment. There are two kinds of pricing mechanisms: fixed or dynamic. In addition, some of the ways that exist for generating revenue streams are:

   - Asset Sale: Selling ownership rights to a physical products.

   - Usage fee: Generated by the use of a particular service. The more the service is used, the more the customer pays.

   - Subscription fees: Selling continuous access to a service.

   - Lending/Renting/Leasing: Temporarily granting someone the exclusive use to a particular asset.

   - Licensing: Giving customers permission to use protected intellectual property in exchange for licensing fees.

   - Brokerage fees: Intermediation services performed on behalf of two or more parties.

   - Advertising: Fees for advertising.

6. *Key Resources:* They describe the most important assets required to make a business model.The key resources might be:

   - Physical: Manufacturing facilities, machines, points of sales...

- Intellectual: Such as brands, proprietary knowledge, patents and copyrights.

- Human: Essentially workers.

- Financial: Such as cash, credit or stock.

7. *Key Activities:* They describe the most important things a company must do to make its business model work. There are three main blocks of key activities: Production, problem solving and Platform/network.

8. *Key Partnerships:* They describe the network of suppliers and partners that make the business model work. Three motivations for creating partnerships can be found: Optimization and economy of scale, reduction of risk and uncertainty and acquisition of particular resources and activities. In addition, four different types of partnerships can be distinguished: Strategic alliances between non-competitors, coopetition, joint venture and buyer-supplier.

9. *Cost Structure:* It describes all costs incurred to operate a business model. Cost structures might have the following characteristics: fixed costs, variable costs, economies of scale or economies of scope.

This described 9 building blocks can be categorized into 2 major blocks, represented in Figure A.2
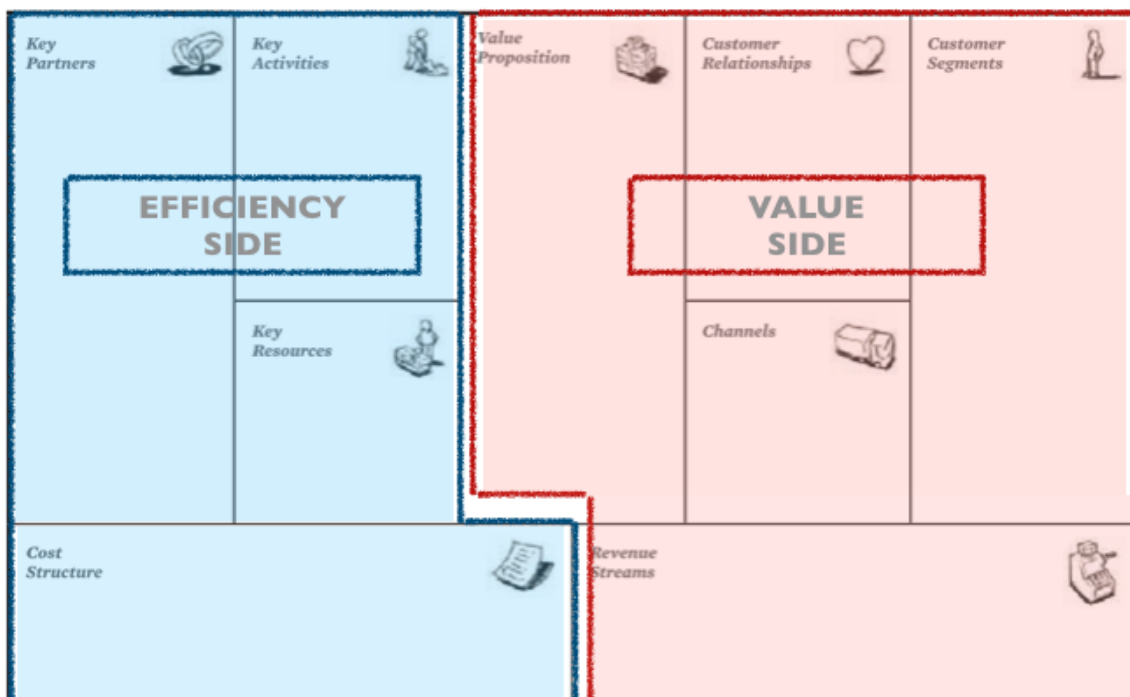
Figure A.2: *2 major blocks of a CANVAS business model.*

The **Efficiency Side** contains the internal traits of the company, while the **Value Side** contains those items from the company which are visible from exterior individuals.

The correct identification of each of this 9 building blocks, and the way that hey are related one to each other, contribute to a correct definition of the Business Model and the company itself.

CHAPTER

B

BUSINESS MODEL PATTERNS AND
DRIVERS

B.1   Unbundling Business Model

The concept of Unbundling Business Model, first proposed by *Hagel and Singer* in
1999 [1], supposes that 3 fundamentally different business exist within a company:
The *Customer Relationship Business*, the *Product Innovation Business* and the *Infrastructure Business*. On an ideal concept, this three blocks need to be separated,
even though, in some exceptional cases, some of the blocks might coexist.

As an extension of this pattern, *Tracey and Wiersema* suggest that corporations
should focus on 3 value disciplines: *Operational Excellence, Product Leadership or
Customer Intimacy.*

The relationship between the three blocks proposed by *Hagel and Singer,* and the
extensions proposed by *Tracey and Wiersma,* define the growth strategy of a concrete
company. The key of the success for the companies that follow this pattern is to try
keeping the three blocks as separated as possible. Figure B.1, extracted from [1],
reflects how to analyse an unbundled company.

Some examples of corporations that adjust to this kind of business models are the
Swiss bank *Maerki Baumann* or the vast majority of telecommunications corporations.

	PRODUCT INNOVATION	CUSTOMER RELATIONSHIP MANAGEMENT	INFRASTRUCTURE MANAGEMENT
ECONOMICS	Early market entry enables charging premium prices and acquiring large market share: speed is key.	High cost of customer acquisition makes it imperative to gain large wallet share; economies of scope are key.	High fixed costs make large volumes essential to achieve low unit costs; economies of scale are key.
CULTURE	Battle for talent: low barriers to entry; many small players thrive.	Battle for scope; rapid consolidation; a few big players dominate.	Battle for scale; rapid consolidation; a few big players dominate.
COMPETITION	Employee centered; coddling the creative stars.	Highly service oriented; customer-comes-first mentality.	Cost focused; stresses standardization, predictability and efficiency.

Figure B.1: *Three core business type.*

B.2   Long Tail Business Model

The Long Tail Business Models, coined by *C. Anderson*, are about selling less of more: They focus on offering a large number of specific and rarely sold products (see Figure B.2).

This kind of business models require from strong platforms so that the content might be available to all potential buyers. This model describes quite accurately the modern media business (streaming platforms).

Three key aspects are believed to have helped in the development of this business model: the *Democratization of tools of production,* the *Democratization of distribution* and the *falling search costs that connect supply with demand.* [1]
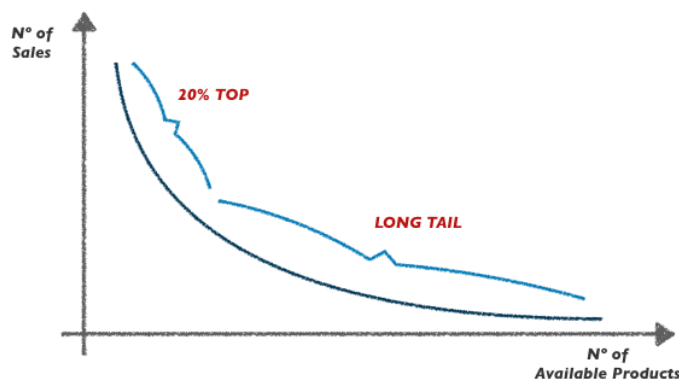
Figure B.2: *Visual description of the Long Tail Business Model.*

B.3 Multi-sided Platforms

The Multi-sided Platforms bring together two or more distinct and independent groups of customers. This platforms are of value to a customer segment only if the rest of the customer groups are present. It creates value by facilitating the interaction between the different groups. They act as intermediaries.

The key in the success of this model is that the platform must attract and serve all groups simultaneously.

An example of a company that adheres to this business model is *Google*, which, through a service called *AdWords*, connects advertisers and potential customers by the use of sponsored links on *Google's* search pages. The more people *Google* attracts, the more ads it can display, and the greater the value created for advertisers. [1]

B.4 FREE as a Business Model

In this kind of model, at least one substantial Customer Segment is able to continuously benefit from a free-of-charge offer. This can be achieved since this services are financed by another part of the model or another Customer Segment.

There are several patterns that adhere to this model [1]:

1. *Free Advertisement:* The service is free to the customer in exchange of visualizing certain advertisements. This advertising companies are, indeed, financing the services.

2. *Freemimum:* The basis service is free. However, the premium services need from payments, which eventually finance the entire business structure.

3. *Open Source:* The product is created by a group of customers, which, at the same time, pay a fee to gain access to the totality of the service.

4. *The Insurance Model:* A large number of customers pay small regular fees to protect themselves from unlikely but devastating events.

5. *Bait and Hook:* Characterized by an attractive inexpensive or free initial offer that encourages continuing future purchases of related products or services.

B.5 Open Business Models

This business models, coined by *H. Chesbrough*, can be used by companies to create and capture value by systematically collaborating with other partners. This may happen from two different ways: [1]

1. *Outside-in Innovation:* When an organization brings external ideas, technology or intellectual property into its development.

2. *Inside-out Innovation:* When an organization license or sell their intellectual property or technologies.

B.6   Democratising Business Model

This business model was proposed by DISCOVERER student C.M. Pascual Canyelles [2], and is characterized by:

1. Reaching as many customer segments as possible.

2. Lowering the price and increasing the quality of the service.

3. The use of automated delivery channels and customer relationships.

4. The need of establishing key and strategic partnerships for the development of highly customized services.

5. The aim of reducing the cost structure.

B.7   Description of Business Model Drivers

Drivers of Change in the analysis of a Business Model are either internal or external factors that affect and shape the performance of a company. This key drivers and the capacity to extracting profit from them might define the success or failure of a company. [3]

Within the development of the Report, drivers have only been categorized into two classes: Internal or External[1] **Internal Drivers** regard all those factors of change which come from the very same decisions and activities from the company. On the contrary, **External Drivers** come from parameters such as market behaviour or external pressures and changes in general. Even though they do not necessarily have to come from the company which is being affected, they end up shaping it.

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[1]Other classifications could have been: Long Term, Mid Term or Short Term Drivers.

CHAPTER

C

STATE OF THE ART

C.1 Justification
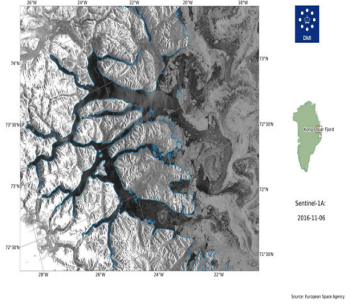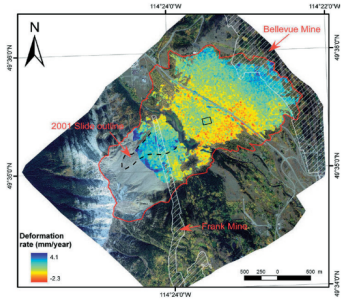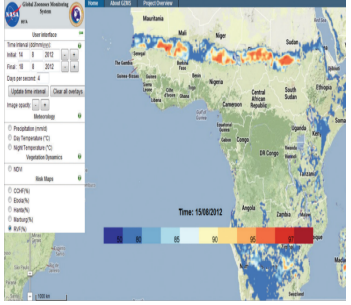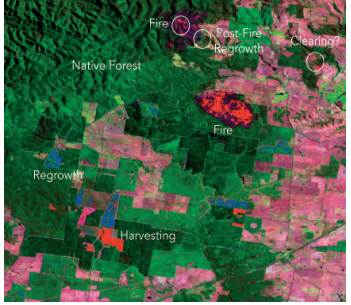
The aim of the State of the Art is to present a clear view of the importance of the EO, and the perspectives of growth of this business in the following years. Moreover, a clear picture of the current situation of the Earth Observation business is aimed to be achieved, therefore, allowing a better comprehension of how *Planet* is affected by this environment and how its competitors may influence the behaviour of the analyzed company.

In summary, this State of the Art, is the first tool that is going to be used in order to comprehend the Earth Observation environment in which *Planet* develops its activity, so that better and more precise conclusions may be reached.

C.2 Earth Observation Applications

Once the main uses of the Earth Observation imagery and data have been presented in the Report, in the following lines, some extra information that has been consulted to develop the results showed in the report is shown through Table C.1 and Table C.2. In order to give an idea of the reach of the Earth Observation business, this series of representative missions, devoted to very different purposes are going to be presented.

EXAMPLES OF EO MISSIONS			
Satellite	Agency/Company	Activity	Image
Sentinel-1	ESA (Copernicus)	Ice Monitor	
RADARSAT-1	CSA	Landslide Monitor	
TRMM	NASA	Health	
Pléiades	Airbus DS	Oil Pipes Positioning	
LandSat	USGS	Carbon Accounting	

Table C.1: *Example of Earth Observation missions*

EXAMPLES OF EO MISSIONS			
Satellite	Agency/Company	Activity	Image
Aqua	NASA	Agriculture Monitor	
ALOS	JAXA	Forest Monitor	

Table C.2: *Example of Earth Observation missions*

CHAPTER

D

OLD CANVAS MODEL

D.1   Introduction

Planet used to describe itself as a company that follows the *Agile Manifesto* statements. With the aim of having a better knowledge about what this means, and subsequently, about how the company is describing itself, the main points of this statement are presented in the following lines:

- *Individuals and interactions over processes and tools:* Which leads to an agile development methodology and a process of learning with every mission. Nevertheless, the first mission that Planet deployed from the ISS the 09/01/2014, the first 28 Doves in Space, not only was an internal demonstration of the Doves capabilities, but it also was a test field for the company, since they performed in-situ tests about the functioning of the Ground stations network, about the imagery systems, and they collected real data about the real thermal gradients to which the Doves were exposed, as well as the drag phenomena that they would experience [4].

- *Working software over comprehensive documentation:* This was done by focusing on building and testing in space environment rather than on an on-ground environment. Also achieved by the agile development approach.

- *Customer collaboration over contract negotiation:* Which decreases the risk in uncertainty when direct and regular communication between provider and customer is achieved.

- *Responding to change over following a plan:* Translated into, instead of devoting resources into a highly elaborate manufacturing planning, elaborate a

simpler strategy and respond to the real challenges and changes that may occur during the development of the activities.

D.2   Customer Segments

In the following lines, the explanation of the activity to which each of the most representative companies that *Planet* serves is explained. Through this data, the final classification of the customer segments has been performed.

Geoplex

Geoplex is a company, based in Australia and with headquarters in Melbourne, Canberra, Sydney and Adelaide. This company uses high resolution satellite data, provided by Planet, with the aim of providing the Australian Department of Natural Resources and Mines with imagery of the Queensland region. [5]

Geoplex is part of the Nova Group, a provider to industries and governments of expertisment in engineering and management systems.

Some of the activities that Geoplex develops are [6]:

- System Development.

- Geospatial Cloud Services provider.

- GIS Infraestructure builder.

- Geospatial Analysing.

- Project Advisory Services.

- Defense and Security matters.

Descartes Labs

North American Corporation that refines data on a cloud-based supercomputer for the application of machine intelligence to massive data sets.

Through exhaustive analysis of the received data, Descartes Labs is capable of observing and predicting change in diverse parameters. This is the product that they finally sell, the predictions that the corporation has been able to compute, with which, they advise distinct industries from energy and agriculture ones to governments.[7]

Woolpert

Woolpert is a North American company which devotes its activities to architecture, engineering and geospatial activities in order to deliver engineering and technological geospatial applications and advisory services.

From the company, they acquire and interpret data about Earth, both from what is on Earth's surface and what lies beneath it, to eventually monitor it and export results. This results are later sold to their customers, which go from private sector players to governments. [8]

GPC Group

The Geographic Planning Collaborative Group provide government and private institutions with results (based on data analysis) in order to understand the changes from different parameters. They perform this tasks by using advanced spatial data solutions and emerging technologies.

GPC provides consultancy and services specialized in Geographic information Systems. The services that the company offers are [9]:

- Spatial Data Infrastructure Activities.
- GIS Rapid Assessment and Planning.
- Outreach and Communication Activities.
- Applications Programming activities.
- Database Development.
- Web Based Mapping.
- System Design and Implementation.
- Project Management.
- Resource Management.

SNET

Stated for *Servicio Nacional de Estudios Territoriales*, is a organization, which belongs to the Ministry of Environment and Natural Ressources from El Salvador, and whose aim is to predict and observe natural disasters (such as volcanic activities or hurricaine phenomena) in order to help, as much as possible, their population, as well as monitor Geologic development. This organization uses the data provided by Planet with the aim of having a constant update of the parameters that might be of interest to the Salvadoran community. [10]

C-CORE

Founded in 1975, C-CORE provides advisory services and technology solutions to help clients with operational risk and with matters such as efficiency or challenging environments worldwide. They also address the resource development, transportation and defense sectors.

The company counts with three key areas of technical expertise: ice engineering, geotechnical engineering and remote sensing (in applications and systems development). [11]

Pro-Gea Consultive

Pro-Gea is a company which provides environmental and sustainability consulting services. They asses their client's exposure to environmental, heath and safety, reputational, social and sustainability issues and help to mitigate environmental risks and liabilities.

This company uses the satellite imagery in order to develop plans of environmental impact mitigation for the companies which assesses, as well as providing them with the best and safest options in order to undertake the plans that they need to. [12]

Envision Innovative Solutions

Founded in 2006, this company supports critical operations and delivers systems and services that modernize legacy systems, protect networks and assets and improve the effectiveness and efficiency of mission-critical functions for its Government customers. Amongst others, Envision also provides program and software acquisition management, systems engineering and technical assistance and Air Traffic Control (ATC) systems.[13]

Farmers Edge

Farmers Edge is a company, founded in 2005, which provides the agriculture sector, more concretely, the new generation agriculture sector, with data analysis and data-driven technologies that might help farmers run efficient operations while producing more food for a rapidly growing global population. [14]

Wilbur-Ellis

Wilbur-Ellis, a company founded in 1921, is, as Farmers Edge, a company which helps the development of crops growth and control. They use data provided by satellites which is later processed and analysed in order to determine the health of

crops and the best strategy that large farmers might use in order to extract the best profit from them. [15]

United Nations

Concretely, the **REDD** program, from the United Nations. It is a program which focuses its efforts on reducing emissions from deforestation and forest degradation in developing countries. It is sustained by 65 partner countries, distributed all over Africa, Asia-Pacific and Latin America. The REDD program, takes profit from the captions provided by Planet in order to monitor key activities in this developing countries, helping them to control certain environmentally dangerous practices and on the other hand, helping them to undertake sustainable development. [16]

Amazon Conservation Association

Amazon Conservation Association is a nonprofit organization that devotes its activities to protecting the western Amazon from illegal deforestation practices. This NGO uses the images provided by Planet in order to periodically monitor the region of the Amazon that they are protecting, with the aim of having quick response if any suspicious practice is detected. [17]

International Space Charter and Major Disasters

This organization is a consortium of international space agencies that provide rapid access to satellite data in the event of a natural or man-made disasters, going from hurricanes to floods. This way, the charter allows resources and expertise to be coordinated for rapid response to major disaster situations, helping civil protection authorities. [18]

Planet Labs provides timely access to daily-high resolution imagery with the aim of helping this organization in the development of their activity during the response to a catastrophic situation. [19]

Rockefeller Foundation

Rockefeller Foundation is a NGO, which, alongside with Sida and USAID forms the Global Resilience Challenge, which aims to develop novel solutions to some of the most complex humanitarian problems, affecting the Sahel, Horn of Africa and the Southeast Asia. This NGO is provided with high-cadence imagery data and technical assistance from *Planet*, in order to tackle everything, from crowd sourcing crisis response to monitoring fragile ecosystems. [20]

Sarawak Information Systems

SAINS is a company which focuses its activities on government improvement. They work together with government organizations to improve service delivery to the public through the implementation of government IT systems that have bettered government management. Amongst others, this company also offers services in cybersecurity, infrastructures and cloud computing. [21]

FarmDrive

This corporation provides smallholder farmers with information and management tools about their crops and their fields, which can be accessed through mobile phone applications. Planet data is used in order to obtain the results that the farmers need about their fields. [22]

ESA

The European Space Agency, was formerly a customer of Blackbridge, the operator of the RapidEye satellites that were eventually bought by *Planet*. ESA has used Planet services in completing the observations of the Sentinel-2 satellite, and more recently, in order to help with the Copernicus Program. [23]

Orbital Insight

Private company which turns millions of images into a big-picture, in order to understand a certain parameter of Earth. They map out and quantify the world's complexities so that organizations can make more informed decisions. They can undertake their purposes by applying artificial intelligence to geospatial data sources (one of which is the *Planet's* imagery) to quantify societal and economic trends on Earth. [24]

Minor Customers

This last, and vast, customer, would be composed by all those individuals who access the already processed data and images, provided by *Planet*, in order to help them with individual activities. Some of this customers would be retailers, seeds or agrochemical companies, crop insurers and large-scale growers, or even regular people who want to have concrete information about their lands.

D.3 Value Proposition

D.3.1 PlanetScope Basic Scene

This first lines are equally valid for all the PlanetScope products, therefore, they will be only explained in this first subsection.

Each PlanetScope satellite is a CubeSat 3U (10cm by 10cm by 30cm), and working together with around 120 other twin satellites, they compose the PlanetScope constellation. Two different orbits are covered: the ISS Orbit, and the Sun Synchronous Orbit. The specifications from each orbit and sensor characteristics are presented in figure D.1, extracted from [25].

Mission Characteristic	International Space Station Orbit	Sun Synchronous Orbit
Orbit Altitude (reference)	400 km (51.6° inclination)	475 km (-98° inclination)
Max/Min Latitude Coverage	±52°	±81.5° (depending on season)
Equator Crossing Time	Variable	9:30 - 11:30 am (local solar time)
Sensor Type	Three-band frame Imager or four-band frame Imager with a split-frame NIR filter	Three-band frame Imager or four-band frame Imager with a split-frame NIR filter
Spectral Bands	Blue 455 – 515 nm	Blue 455 – 515 nm
	Green 500 – 590 nm	Green 500 – 590 nm
	Red 590 – 670 nm	Red 590 – 670 nm
	NIR 780 – 860 nm	NIR 780 – 860 nm
Ground Sampling Distance (nadir)	3.0 m (approx.)	3.7 m (at reference altitude 475 km)
Swath Width	24.6 km x 16.4 km (at reference altitude 475 km)	24.6 km x 16.4 km (at reference altitude)
Maximum Image Strip per orbit	8,100 km²	20,000 km²
Revisit Time	Variable	Daily at nadir (early 2017)
Image Capture Capacity	Variable	150 million km²/day (early 2017)
Camera Dynamic Range	12-bit	12-bit

Figure D.1: *PlanetScope Constellation and Sensor Specifications.*

Now, enternig inside the first product offer from Planet, the **PlanetScope Basic Scene** is multispectral data obtained from the satellite constellation. The imagery provided by this product is calibrated multispectrally and firstly processed, in order to allow analysts to extract information products for data science and analytics. The product is minimally processed, only with the aim to remove distortions caused by terrain; therefore, it eliminates the perspective effect on the ground, restoring the geometry of a vertical shot. The following corrections are applied to the product:

- *Radiometric:* Correction of relative differences of the radiometric response between detectors.

- *Geometric:* Optical distortions caused by sensor optics and co-registration bands.

The PlanetScope Basic Scene has a 3-band natural color (red, green, blue) or a 4-band multispectral image (blue, green, red, near-infrared), in addition, it has a ground sample distance of 3.7m and a positional accuracy of less than 10m. [25]

The PlanetScope Basic Scene is designed for customers which posses advanced image processing capabilities and desire to geometrically correct the product themselves. It is designed for applications (amongst others) that require an accurate geolocation and cartographic projection. [25]

D.3.2   PlanetScope Ortho Scenes

The data and imagery used for this specific product is collected as a series of overlapping framed scenes, which are not organized to any particular grid system. This way, customers can create imagery at their will. Ortho Scenes are geometrically and radiometrically corrected.

The **Visual Ortho Scene Product**, a suboption of the regular ortho scene, is orthorectified[1] and color-corrected, with the aim to optimize the colors and make them appeal to the vision that the human eye would have if he could view the images from the satellite perspective. In addition, a sun angle correction is also performed (in order to minimize the differences for latitude and time of acquisition between every image), and also are geometrically corrected, so that the distortions caused by terrain may be obviated. This kind of product is optimal for simple and direct use of an image, since it is made for being visually appealing. Some of the needs that this product might satisfy are the ones required by the Geographic Information Systems, as well as cartographic and mapping purposes. The visual Ortho Scene Product has a ground sample distance of 3.7 m. [25]

The **PlanetScope Analytic Ortho Scene Product** is orthorectified, multispectral data from the satellite constellation. It has been calibrated multispectrally and processed in order to allow analysts to extract correct information from data. This kind of product (just as the visual one), has a ground sample distance of 3.7 m, and is optimal for value-added image processing in land cover classifications. [25]

D.3.3   PlanetScope Ortho Tile Product

This product consists on individual square tiles of 25 km^2, referenced to a fixed tile grid system. The offered data is processed in order to remove distortions caused by terrain. The obtained imagery is collected from a series of overlapped framed scenes

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[1]Processed to apply corrections for optical distortions from the sensor system, and apparent changes in the position of ground objects caused by the perspective of the sensor view angle and ground terrain.

from a single satellite in a single pass. The process of creation of the tile can be seen in figure D.2, extracted from [25]. When acquiring this product, the following
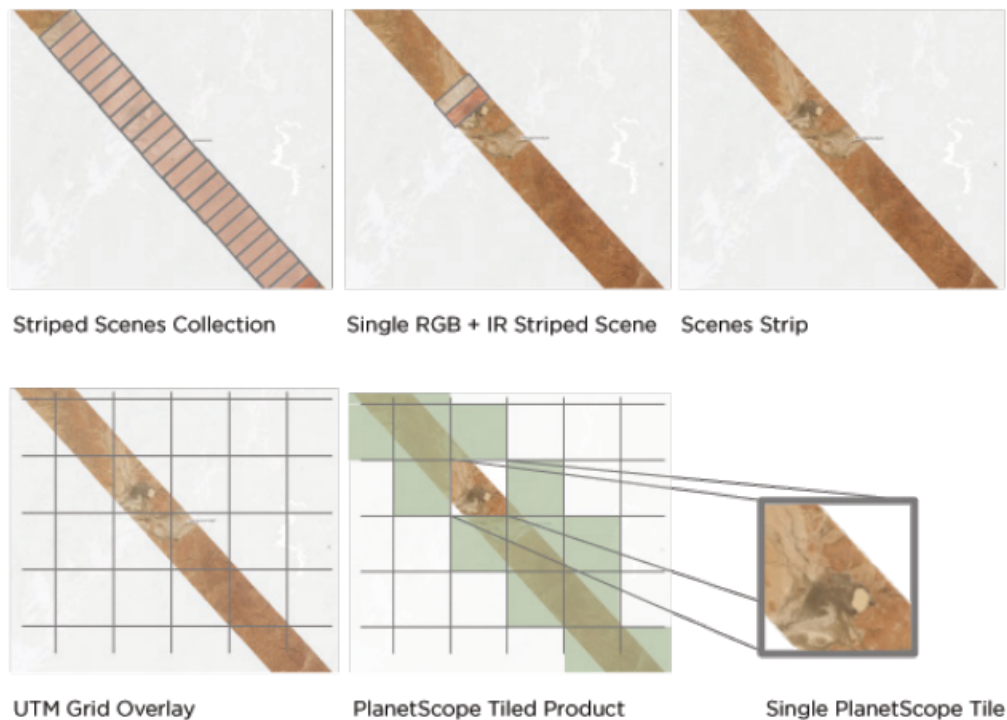
Figure D.2: *PlanetScope Scene to Ortho Tile Conversion.*

components are obtained:

- *Image File:* GeoTIFF file that contains image data and geolocation information.

- *Metadata File:* XML format metadata file and GeoJSON metadata available.

- *Thumbnail File:* GeoTIFF format.

- *Unusable Data Mask (UDM) file:* GeoTIFF format.

The first sub-option of this product is the **PlanetScope Visual Ortho Tile**, which is a orthorectified and color-corrected tile, with a ground sample distance of 3.7m. The purpose of this product is to generate images similar to what the human eye would see from the satellite perspective. This option is addressed to a simple and direct use of the image, therefore, it is designed for applications which require of visually appealing images (FE: mapping or cartography).

The second sub-option for the ortho tiles is the **PlanetScope Analytic Ortho Tile**, which is orthorectified, multispectral data from the satellite constellation. This products have been processed in order to allow analysts to derive information products for data science. This kind of product is optimal for value-added image processing, which may include the development of vegetation indices or land cover classifications, amongst others. The provided product can be visually seen on Fig. D.3, extracted from [25].
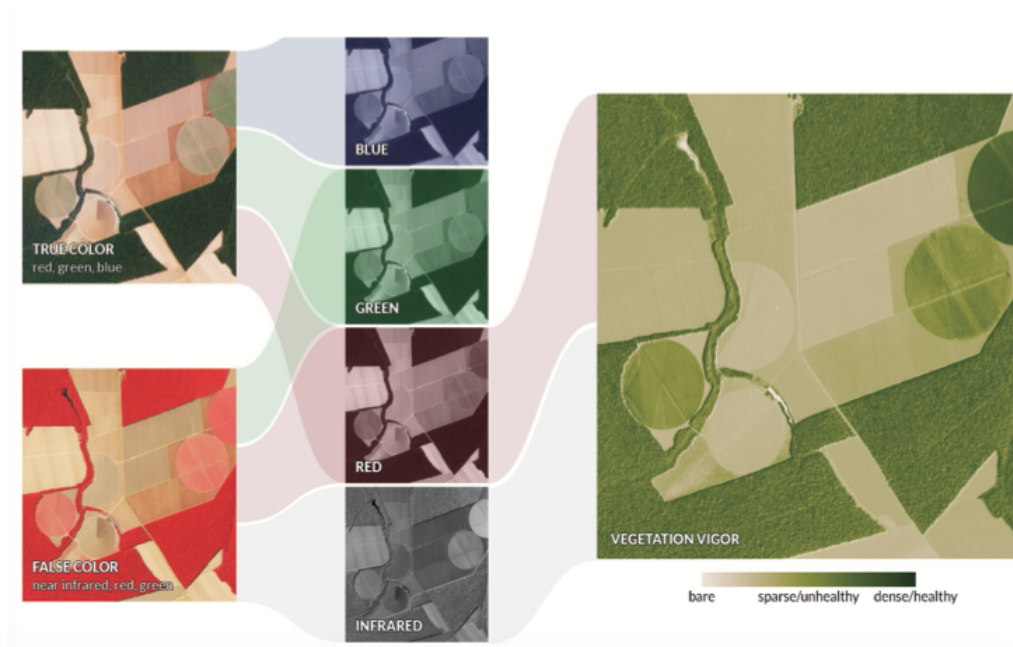
Figure D.3: *PlanetScope analytic bands.*

D.3.4   RapidEye Basic Scene Product

Just as in the PlanetScope subsection, this first lines are equally valid for all the RapidEye sub-products, therefore, they will only be explained in this first subsection.

The RapidEye constellation is composed by 5 satellites, each of them having a volume of around 1 m^3 and weighing about 150 kg. The specifications of the constellation and its satellites can be easily seen on Fig. D.4, extracted from [25]. Now, starting to describe the Basic Scene Product, the first thing that can be said is that this is a Level 1B product, which provides radiometric and sensor corrections applied to the data with on-board spacecraft attitude taken into account when applied to data. Since this product is a Level 1B, it is the least processed option available from the RapidEye imagery possibilities.

This product, with a resolution of the images of 6.5m at nadir, is radiometrically and sensor corrected, providing imagery as seen from the satellite without geometric distortions. As this imagery is not mapped to a cartographic projection, it is accompanied by all spacecraft telemetry necessary for the correct processing of the data.

When this product is acquired, the following attributes are obtained:

- *Image File:* Image product delivered as a group of single-band NITF or Geo-TIFF files with associated RPC values.

- *Metadata File:* XML format metadata file, which contains additional information related to spacecraft attitude, temperature measurements, line imaging times, camera geometry and radiometric calibration data.

Mission Characteristic	Information
Number of Satellites	5
Orbit Altitude	630 km in Sun-Synchronous Orbit
Equator Crossing Time	11:00 am local time (approximately)
Sensor Type	Multispectral push broom
Spectral Bands	Blue 440 – 510 nm
	Green 520 – 590 nm
	Red 630 – 685 nm
	Red Edge 690 – 730 nm
	NIR 760 – 850 nm
Ground Sampling Distance (nadir)	6.5 m
Swath Width	77 km
Maximum Image Strip per Orbit	Up to 1500 km of image data per orbit
Revisit Time	Daily (off-nadir) / 5.5 days (at nadir)
Image Capture Capacity	>6 million km²/day
Camera Dynamic Range	12-bit

Figure D.4: *RapidEye constellation and sensor specifications.*

- *Thumbnail File:* GeoTIFF format.
- *Unusable Data Mask (UDM) file:* GeoTIFF format.

This kind of product is addressed to customers which posses powerful data processing tools.

D.3.5   RapidEye Ortho Tile Product

The orthorectified products that Planet offered back in 2017 were squared images of 25 km^2, each of them processed with the purpose of removing disortins caused by terrain, as well as radiometrically (sensor) and geometrically corrected and aligned to a cartographic map projection. This products are catalogued as Level 3A, and can be obtained as two different sub-products.

First of all, the **RapidEye Visual Tile Product**, which is orthorectified and color-corrected, in order to optimize colors and adjust them to what the human eye would see if placed on the satellite. This kind of product is optimal for simple and direct use of the image, and therefore can be used in cartographic applications.

The second sub-product is the **RapidEye Analytic Ortho Tile Product**, which is orthorectified, multispectral data from the constellation. The product has been processed to remove distortions caused by terrain.

The RapidEye Analytic Ortho Tile is the most suitable for value-added image processing, including vegetation indices and land cover classifications. [25]

D.4   Channels

The owned channels, devoted to the delivery process that *Planet* had in the beginning of 2017, were composed by the following tools:

D.4.1   GUI

Consists on a set of web-based tools that can be used to search *Planet's* catalog of imagery, view metadata and download full-resolution images. *Planet's* GUI, allows users (customers) to: [25]

- *Search:* For any location.
- *Save Search:* Save search criteria based on place, dates or filters.
- *Filter:* By date range or customize parameters.
- *Zoom and Preview Imagery.*
- *View Imagery Details.*
- *Download:* Based on subscription type.
- *Draw Tools:* In order to specify an area to see imagery results.
- *Imagery Compare Tool:* Compare imagery from different dates.

D.4.2   Planet Account Management Tools

This tools are an extension of the GUI, used to change user settings and to see past data orders by administrator users. Some of the extra tools that it provides are: User accounts overview, organization and sub-organization overview, account privileges and orders and usage review.

D.4.3   Bulk Delivery Folder Structure

Sets of imagery can be ordered through the Planet API. Bulk deliveries are delivered in a .zip folder format, which contains: [25]

- A README file with information about the order.
- A subfolder for each scene requested named with the scene id.
- The TIFF of GeoTIFF requested and associated metadata file.
- Under basic data request, an RPC text file.

D.5 Revenue Streams

In the following lines, the characteristics of the data licensing of *Planet* can be seen.

1. The user might be an individual, a company or corporation (not including affiliates), an office or department (either civilian or military), a branch of national agencies or nongovernmental organizations. Each of them specified in the contract and depending on the customer, the provided license may change.

2. The licensing terms are automatically accepted when accepting the quote for the supply of the content.

3. This licenses are non-transferable.

4. The license may be single-user (1 user), multi-user (5 users), enterprise (10 users) or expanded (11+ users).

5. The available government licenses are:

   - ALL-CIV: All civilian government agencies or ministries.
   - ALL-GOV: All civilian and military government agencies or ministries.
   - FED-CIV: All federal civilian government agencies or ministries.
   - MOD/Title50: All defense agencies or ministries.
   - STATE-CIV: All state, provincial and local agencies or ministries from a single government, state or province.

6. User may make copies, alter content, display content and publish content for either internal use or noncommercial purposes in research reports or similar publications with the proper copyright displayed.

7. Customer is always able to update its license.

D.6 Key Resources

D.6.1 Physical Resources

As part of the physical resources, *Planet* used to contract the services of different launching companies, which, up to the beginning of 2017 performed the following launches:

D.6.2 Financial Resources

The basis of the Financial Resources of *Planet* used to be its investment rounds, which, up to 2017 had been the following ones:

Name	Nº of Satellites	Launch vehicle	Launch date	Launch Status
Flock 1	28	Antares (Cygnus)	09/01/2014	Successful
Flock 1c	11	Dnepr	19/06/2014	Successful
Flock 1b	28	Antares (Cygnus)	13/07/2014	Successful
Flock 1d	26	Antares (Cygnus)	24/10/2014	Failed
Flock 1d'	2	Falcon 9 (Dragon)	10/01/2015	Successful
Flock 1e	14	Falcon 9 (Dragon)	13/04/2015	Successful
Flock 1f	8	Falcon 9 (Dragon)	28/06/2015	Failed
Flock 2b	14	H-IIB (HTV-5)	19/08/2015	Successful
Flock 2e	12	Atlas V (OA-4)	06/12/2016	Successful
Flock 2e'	20	Atlas V (OA-6)	23/03/2016	Successful
Flock 2p	12	PSLV	22/06/2016	Successful

Table D.1: *Launches up to November of 2016.*

Transaction Name	Date	No. of Investors	Raised Money ($)
Series A	25/06/2013	7	13.1M
Series B	18/12/2013	12	52M
Series C	20/01/2015	16	70M
Debt Financing	20/01/2015	1	25M
Series C	14/04/2015	6	23M

Table D.2: *Investment ventures up to January of 2017*

D.7 Key Partnerships

Now, in order to expand the description of the key partnerships of the company, some of the commercial partners are going to be presented:

- *C-Core: Planet* and this company aim to develop products and services together by using *Planet's* satellite imagery data. For this reason, its partnership could be seen an a joint venture one, with the aim of reducing the risk of the project that they undertook together. [26]

- *Farmers Edge:* The companies accorded to deliver the vanguard of remote sensing driven and analytics-based agronomy services to growers worldwide; *Planet* would take the images, and *Farmers Edge* would distribute them. This partnership would be an strategic alliance with the aim of optimize the range of the products offered by *Planet.* [27]

- *BITS:* Which is also a distributor of the *Planet* imagery in the nation of Mexico, in this case, as with Farmers Edge, the partnership would be an strategic alliance with the aim of optimize the range of the products offered by *Planet.* [28]

D.8   Cost Structure

As an expansion of the developed analysis and in order to have an idea (also quali-tative) of how much do this costs represent, each of the satellites (PlanetScope) has a price of around $20,000. [29] And the established launching price for a 3U satellite is of $295,000, however, the price when more of one satellite is launched is variable. [30]

When it comes to the salaries, in the beginning of 2017, *Planet* had between 300 and 350 workers. Knowing that the average salary for an IT engineer in the US was of around $79,000 per year, and the average salary for an office worker was of around $39,000 per year, an idea of this costs can be achieved.

Now, focusing on the installations, the average price for a Yagi aerospace antenna is of about $1,500 [31], and when it comes to the installations, the rental price per square foot in San Francisco was of around $75, knowing that there usually are 170 square foot per worker in the office, a primary idea of the rental price for the six offices can be made. Regarding the manufacturing installations, the rental price decreases to $27 per square foot, for a 2,000 square foot installation.

D.9   Results and Relationships over Old CANVAS Model

First of all, the relationships between each of the customer segments and the re-sources from the CANVAS value side are going to be presented and briefly ex-plained. Following this explanations, the relationships, starting from the Key Activi-ties, from the Efficiency Side are going to be presented and explained as well. Only the most representative models are going to be presented, since, a huge amount of sub-relationships could be found.

D.9.1   Engineering and Defense Data Analysts

To begin with, the relationship of the Engineering and defense private sector with *Planet* is presented in Fig. D.5. This kind of companies, are usually specialized, therefore, they require from specialized products. Even though the price may be important, this companies prioritize the product over the price (usually they are big corporations with wide resources). For this very same reason, they might be attracted by the proposal of highly frequent images from the same spots of Earth, with only one day of difference, and with at least, medium precision; as well as obtaining them with the lowest possible risk of errors and distortions. On the other hand, since they probably have they own means of data analysis and processing, they will rather access raw data, instead of already processed one.
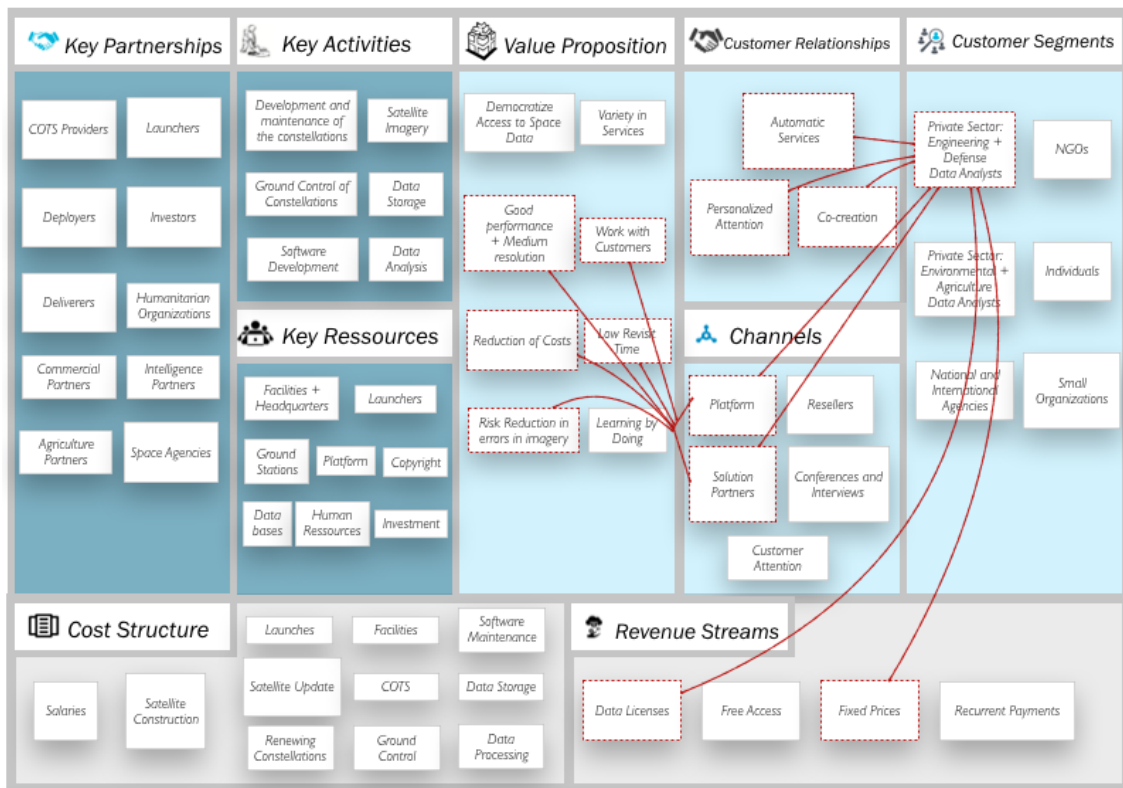
Figure D.5: *Design of the CANVAS model for Planet in 2017 focusing on the Agriculture and Environment Customers.*

This sort of customers might need to have a relation of co-creation with *Planet*, since they require from very specific services. In addition, they might also reach the company through resellers or solution partners. When it comes to obtaining the product, they are more prone to obtain it through extensive licensed, which its workers might have access to. Therefore, they obtain data licenses, payed at already fixed prices, which are delivered though the *Planet's* platform.

D.9.2 Agriculture and Environment Data Analysts

Moving on to the Agriculture and Environment private companies, as it can be seen of Fig. D.6, this customers aim to obtain images of wide extensions of land on a very regular basis. This sort of companies need to monitor great areas of vegetation, sea or land, in order to observe changes and to predict its evolution, which finally leads them to obtaining optimum results. For this reason, they do not need very high resolution, with moderate it is enough, but they need almost daily imagery with the minimum errors. Since this companies are not devoted to data analysis, they are more prone to access pre-processed imagery.

Agriculture and Environment companies usually reach the *Planet* products through resellers or service providers, which eventually gain them access to the *Planet's*
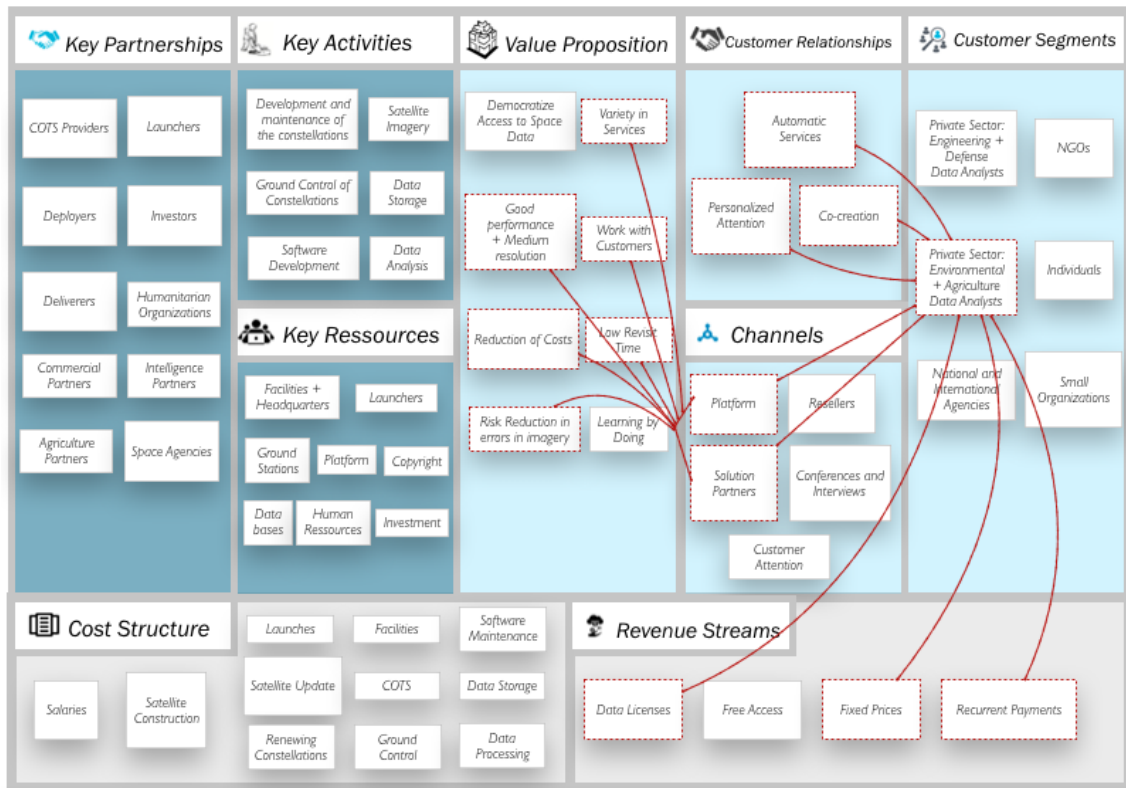
Figure D.6: *Design of the CANVAS model for Planet in 2017 focusing on the Agriculture and Environment Customers.*

platform, where they obtain imagery licenses in exchange of payments.

It is worth mentioning that some of this companies, have helped *Planet* developing specific products which are later sold to smaller companies with similar needs (see the partnership with Farmers Edge).

D.9.3   National and International Agencies

When it comes to the National and International Agencies, the CANVAS (as it can be seen on Fig. D.7) has representative similarities with the one concerning the Engineering and Defense private companies. They need access to very specific services, and are usually attracted by the proposal of low revisit time at good resolution. This sort of customers, also require from a certain degree of co-creation with the company, due to their specialized needs.

This customers, usually dispose of wide resources, therefore, they will usually be more interested in raw imagery, in order to analyze it by its means and obtain more precise and concrete results, rather than obtaining pre-processed and pre-established imagery.
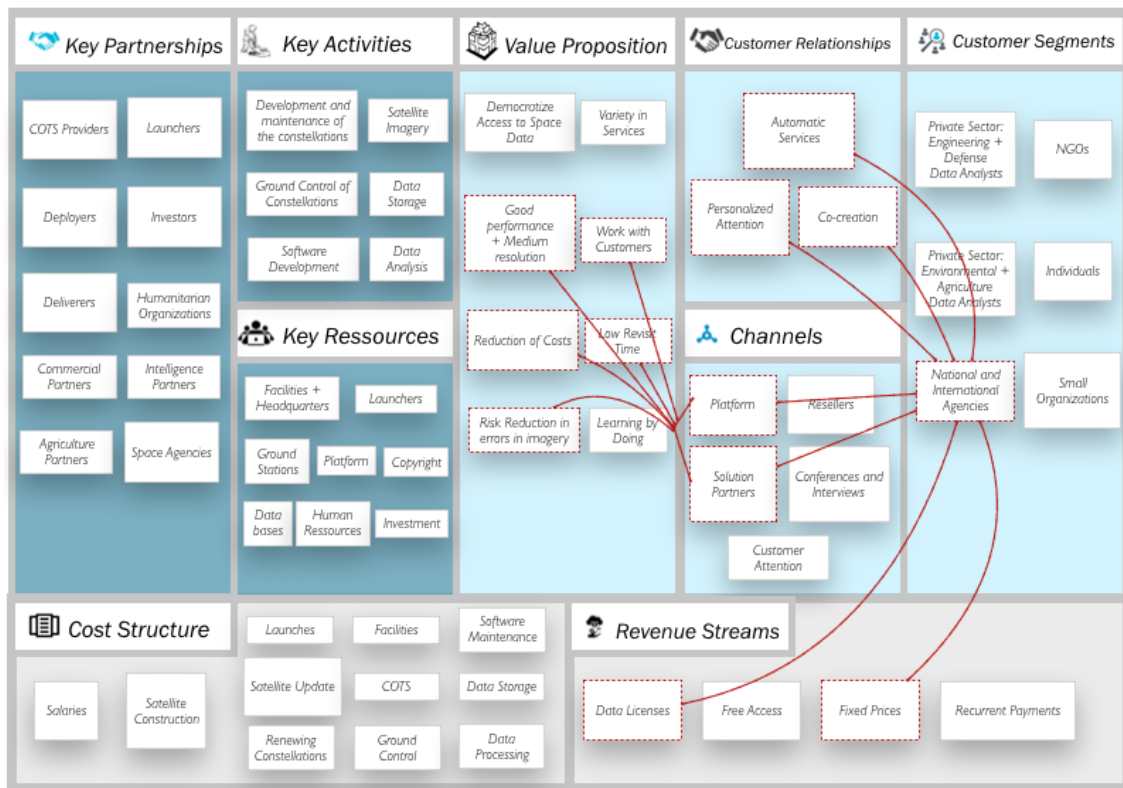
Figure D.7: *Design of the CANVAS model for Planet in 2017 focusing on National and International Agencies.*

Another important point in attracting the attention of this agencies is the reduction in costs. Traditionally, this organizations would develop great missions, with extreme high costs, however, depending on the results that they need, it has become more convenient for them to contract the services of *Planet.*

Usually, the agencies contact with *Planet* directly and establish big contracts of co-operation, however, some of them may reach the company through solution partners. Anyway, all products are always delivered though the platform, and the obtained imagery is licensed to the customer.

As it has been said before, the agencies establish contracts with the company, were the payments are reflected.

D.9.4   NGOs, Individuals and Small Organizations

The last group of customers is composed by the NGOs, the individuals and the small organizations (Fig. D.8); even though they have slightly different needs, they can be explained all together. This groups of customers are mainly attracted by the price of the service, which gives them the possibility of accessing the service, and therefore develop certain activities. In this case, the price prevails over the product.
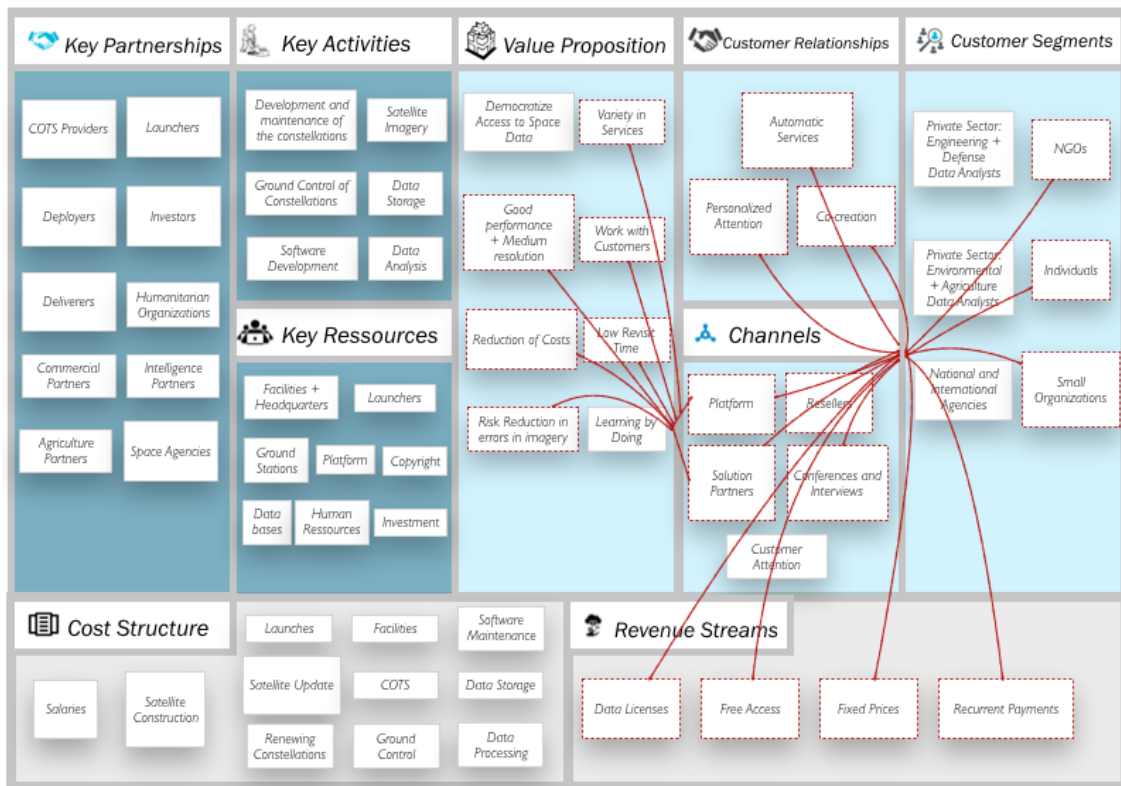
Figure D.8: *Design of the CANVAS model for Planet in 2017 focusing on NGOs, individuals and small organizations.*

This customers are reached through the conferences and the resellers, and are granted with services that might go from punctual collaborations to a free access to some of its imagery. Except for some NGOs which establish long term relationships with *Planet*, specially in order to monitor certain areas which need constant control (human migrations, climate change, environmental catastrophes...).

All this customers access the services though the *Planet's* platform and acquire already processed data and imagery, since they do not usually have resources for advanced analysis. The payments, are performed in order to acquire this licenses.

Regarding the free access to imagery, which is usually the one which is obtained by individuals, is granted to imagery from areas which have been affected by natural disasters or general imagery.

D.9.5   Obtaining Imagery

When obtaining the imagery assets, three Activities are the indispensable , and the whole process of obtaining the imagery could summarize into these three tasks: Develop and maintain the constellations, monitor the constellations, and down-linking the imagery from them. To develop this activities, key partnerships and key re-
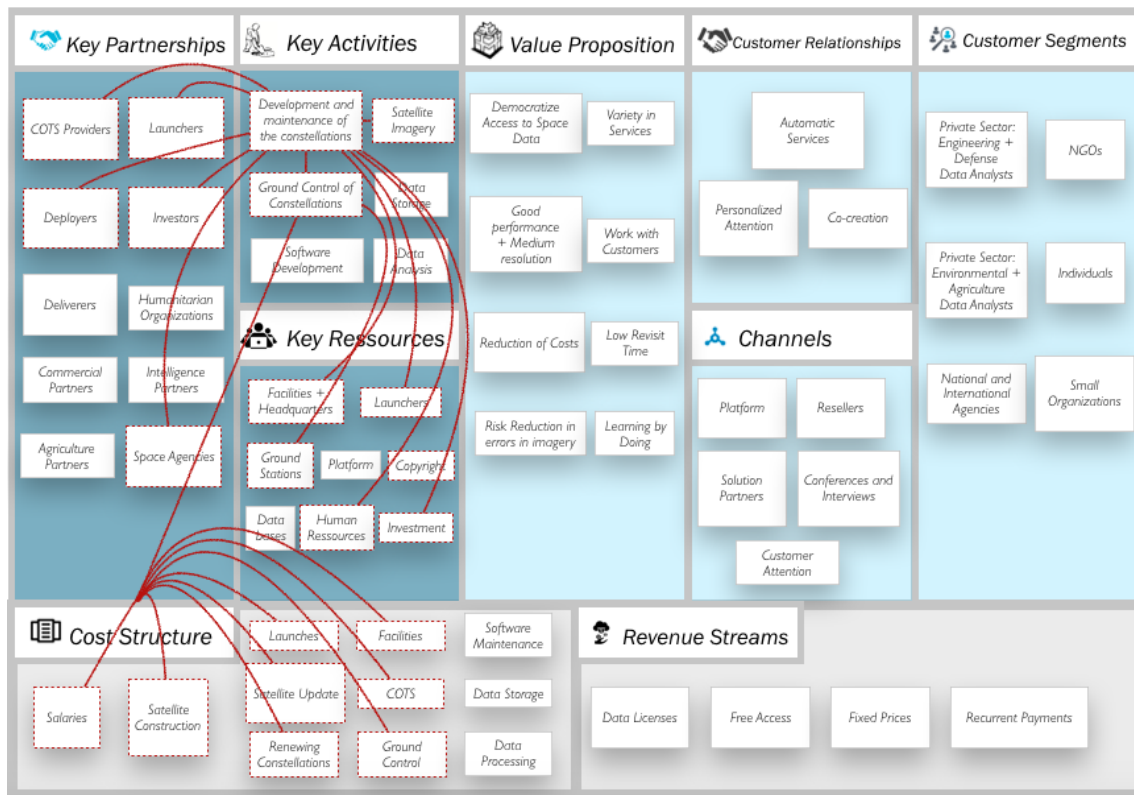
Figure D.9: *Design of the CANVAS model for Planet in 2017 focusing on the process of obtaining the Imagery.*

sources need to be accessed. The first ones could be seen as intelligence resources, and the second one, as physical resources. Each of this stages implies, as well, a related cost.

Regarding the process of designing, assembling and deploying the satellites, *Planet* needs from the COTS suppliers, which provide the hi-tech components of the satellites, as well as proper facilities to assemble the final satellites. On the launching side, launchers and deployers are needed as well. Once the satellites are launched, they need to be monitored, so a network of antennas and personnel to operate them, is needed. All this operations, require from investments and imply direct costs, those plotted in Fig. D.9.

D.9.6 Processing Imagery and Creating Value

After the imagery is obtained, it needs to be transformed into a valuable product which might be marketed. This process includes all the software and data related activities. Which might be seen as *Soft Activities*. This activities respond to creating services and products, protected under strict copyright, by means of data storage and analysis. The final products are commercialized through an online platform, therefore, software engineering is needed as well. All partners which are at the same time customers (related through co-creation relationships with *Planet*) help

developing the valuable products, by applying concrete data analysis procedures to the same data assets, so that different and specialized products are obtained.

The higher costs that this activities imply are related to human resources and salaries, which are financed mainly through investments and part of the revenues of the company.
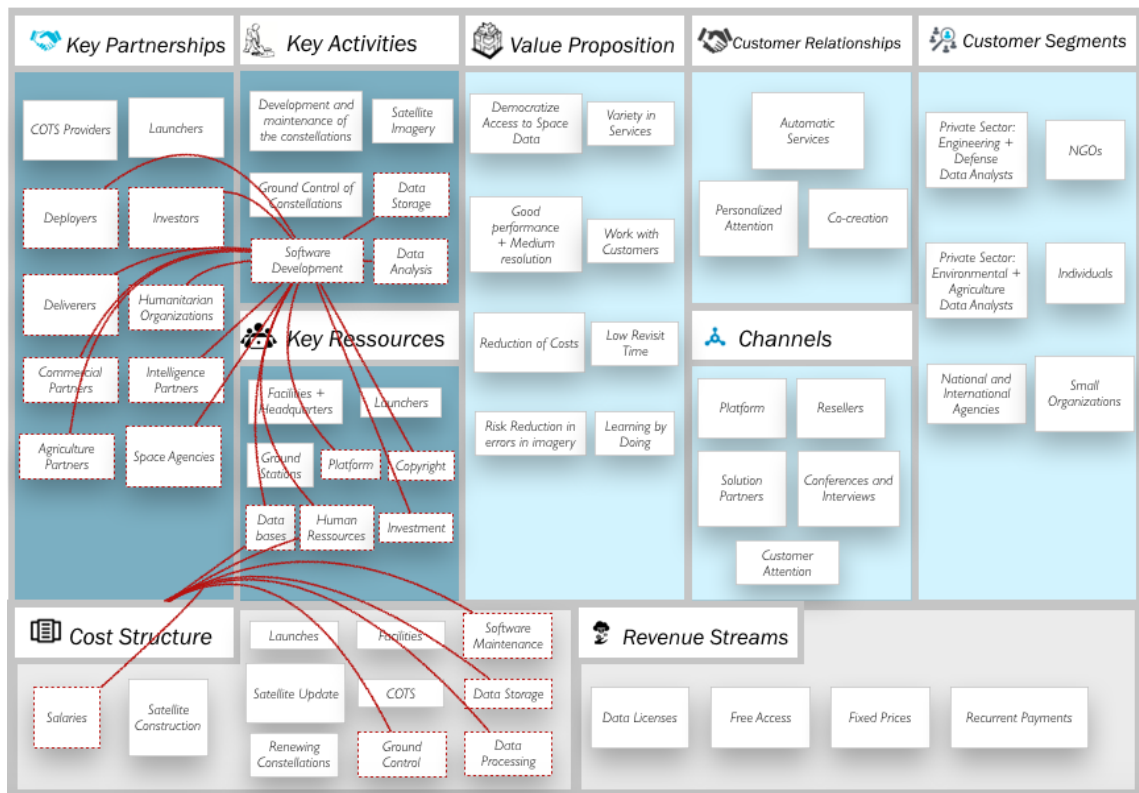
Figure D.10: *Design of the CANVAS model for Planet in 2017 focusing on the process of processing the imagery and creating value.*

CHAPTER

E

NEW CANVAS MODEL

E.1   Customer Segments

This sub-appendix is to be seen as a continuation of point A.1.1, presenting a brief image of the new customers that *Planet* is serving, yet, not reexplaining the customers that have already been presented. This lines of analysis of the different companies are the ones that have been used in order to classify the different customer segments in the Report.

Department of Natural Resources and Mines of the Queensland Region

Back in February of 2017, *Planet* partnered with *Geoplex* to deliver timely, high resolution satellite image data to this Regional Australian Department. This Department buys regular imagery from the region, in order to monitor natural resources, to *Geoplex*, a deliverer of the *Planet* imagery. [32]

Google

As part of the acquirement of the Terra Bella constellation, *Planet* also established a multi-year contract with the Internet company. As part of the deal, Google will be provided with the *Planet's* imagery and Earth-imagery data, for as long as the deal lasts. Some of the services that Google offers with this constant flow of imagery, are as known as Google Earth. [33]

Cesium Community

Cesium is and open-sourced 3D mapping software, specially known in the aerospace community. After a deal made back in May, 2017, *Planet* imagery became available in this platform, from which, this imagery can be updated on top of 3D terrain data to create compelling and up-to-date visualizations.[34]

Academic Community

Which can be seen as a general customer which has free access to the *Planet's* data. Any college student, researcher or professor can gain access to the company's dataset for non-commercial research purposes. When registered, the researcher is provided with access to imagery from an area of up to 2000 square kilometers and the possibility of downloading up to 50 items a day.[35]

Farmers Edge - Update

Back in October of 2017, *Planet* expanded the economic deal which was already maintaining with the already explained agriculture data provider.

Through this new deal, Farmers Edge was provided with high quality field imagery, more frequently updated than in the past, and gains the possibility of re-distributing it to minor agriculture customers, as a *Planet's* deliverer. The data provided by *Planet* will be the basis of the daily field monitoring, in-field analytics and predictive modeling that Farmers Edge provides.[36]

DowDuPont

Though its agriculture division, Corteva Agriscience, DowDuPont stablished a multi-year contract with *Planet* in order to obtain key imagery and data to provide its customers with cutting-edge agriculture solutions, such as crop management. [37]

European Comission

By partnering with Airbus, *Planet* fulfilled a deal with the ESA and the European Comissison to collaborate with the Copernicus missions and help monitoring the European soil, in fields such as biodiversity or wetland restoration, and to provide high quality images of areas historically hard to cover, such as the Scandinavian countries or the Alps. [38]

In September, 2018, the contract was expanded and *Planet* agreed to provide data to the Copernicus Emergency Management Service, the Copernicus Land Monitornig Service and the Copernicus Security Service. [39]

National Geospatial-Intelligence Agency - Updates

Back to May of 2018, *Planet* signed an agreement with the NGA, which initially was supposed to last 5 years, in which *Planed* granted access to NGA to analytics for the purpose of understanding how the information feeds can be integrated into the agency's workflows, with the aim of offering alert points to NGA analysts to relevant changes on Earth. [40]

A few months after reaching this agreement, in October, 2018, *Planet* was awarded a new contract of $ 5.9 million with the NGA, in order to provide geospatial intelligence and analytics to the National System for Geospatial Intelligence. [41]

Paul G. Allen Philanthropies

This partnership with this organization aims to monitor the coral reefs, and to show the composition and structure of five important reefs located throughout the world, including the Great Barrier Reef. With the information that will be provided, communities will be able to plan more precisely conservation and restoration interventions. [42]

NASA

In October of 2018, *Planet* was awarded an agreement with NASA's Earth Science Division. The agreement included data for scientific evaluation for 12 months with the possibility of extending the contract up to 3 years. [43]

The agreement was expanded in April, 2019, to provide NASA with Earth observation data for the identification and tracking of Essential Climate Variables. [43]

E.2   Value Proposition

As it happened in the last subsection, this explanation of the products that compose the value proposition of *Planet* is to be seen as a continuation of what was being offered back in 2017, presented in Section A.1.2, and therefore, for the sake of simplicity, only innovations and changes are going to be introduced, leaving, as logical, the products that have already been explained aside.

E.2.1   SkySat Basic Scenes

This first lines are going to be valid for any of the SkySat products, since they address the specifications of the constellation that takes the imagery, not the specifications of the imagery itself.

Currently, SkySats are on its C-generation, and by the beginning of 2019, thirteen satellites were on orbit, with immediate plans of launching 3 more of them, therefore, by mid-year, a total of 16 SkySats were orbiting the Earth.

This satellites, unlike the rest of *Planet's* satellites, are 3-axis stabilized and agile enough to slew between targets of interest. In addition, each of the SkySats is provided with 4 thrusters for orbital control, 4 reaction wheels and 3 magnetic torquers for attitude control. Regarding the imagery technology, satellites are equipped with a Caddegrain telescope, with a focal length of 3.6m, with three 5.5 megapixel CMOS imaging detectors.

On the side of structural characteristics, the SkySats have a mass of 110 kg each, and a volume of 60 x 60 x 95 cm. Their orbit is located at around 500 km, which means a revisit time of 4-5 days, and they have an estimated lifetime of about 6 years.

Starting with what the **Basic Scene** offers, imagery that might be obtained may be Analytic, Analytic DN and Panchromatic. Any of this imagery packs are not corrected for any geometric disortions. Therefore, data is accompained by Rational Polynomial Coefficients to enable orthorectification. This kind of product is designed for users with advanced image processing capabilities, which can undertake the procedures of imagery processing by themselves. To finally understand how this kind of images are, figure E.1 is attached, where the framing of each of the images that this satellites take can be seen. [44]
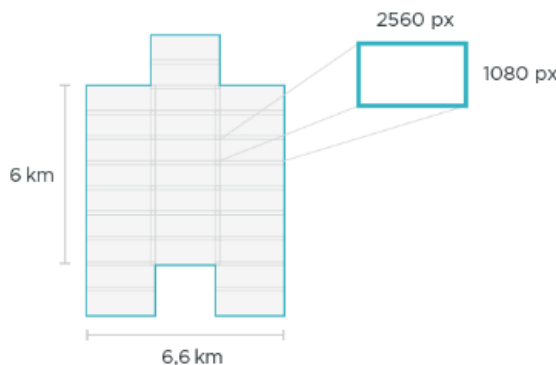
Figure E.1: *Representation of each scene that an SkySat takes.*

E.2.2   SkySat Ortho Scene

This subdivision of products, include visual, analytic DN, panchromatic and pansharpened multispectral imagery. The Ortho Scene is sensor and geometrically corrected, and projected to a cartographic map projection. Ground control points are used in the creation of every image, therefore, the quality of the product will vary

from region to region based on the available Ground control points. In the following lines, all the variations of this product will be introduced.

The **Visual Ortho Scene** is a product which is orthorectified, and color corrected (using color curve), it is a 3-band RGB imagery.

The **Pansharpened Multispectral Ortho Scene** is orthorectified, pansharpened and a 4-band BGRN producto of imagery.

The **Analytic DN Ortho Scene** is orthorectified and multispcetral data from the SkySat constellation. This product is uncalibrated, and designed for applications that require imagery with accurate geolocation and cartographic projection. This product has been processed to remove disortions caused by terrain.

The **Panchromatic DN Ortho Scene** is orthorectified, panchromatic data from the SkySat constellation. It is uncalibrated and it posessed a finer GSD than the Analytic Product, due to NOAA license restrictions. This product is useful for visual interpretation.

Fianlly, the **Analytic Ortho Scene**, calibrated multispectral imagery products that have been processed to allow analysts derive information products for data science and analytics.

E.2.3   SkySat Ortho Collect Product Specification

This product is created by composing SkySat Orthotiles along imaging strips, unifying around 60 SkySat Ortho Scenes. This result, which may be seen in Fig. E.2, extracted from [44], is created with the overlapping strips, captured by the 3 cameras of each SkySat.
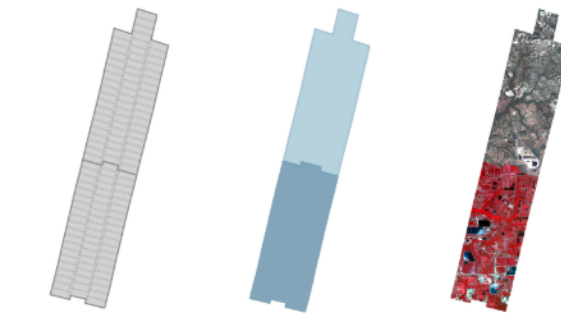
Figure E.2: *Representation of strips created with SkySats captures.*

E.2.4   SkySat Basemap Mosaic Tiles

This basemaps can be viewed through the *Planet* platform, and they possess a maximum resolution of 0.6 m at the Equator. This kind of product is thought to match what is typically used in web mapping applications.

E.2.5   Landsat 8 and Sentinel-2

Planet, nowadays, also offers access to imagery from other partner satellites, which are the Landsat 8, from NASA, and the Sentinel-2, from ESA, by allowing this, *Planet* has widened its offers to the customers, providing an increasing variety of products.

E.3   Key Resources

E.3.1   Physical Resources

The launches that *Planet* contracted between 2017 and 2019 are presented in the following Table, which gives an idea of the contracted launching companies.

Name	Nº of Satellites	Launch Vehicle	Launch Date	Launch Status
Flock 3p	88	PSLV-C37	15/02/2017	Successful
Flock 2k	48	Soyuz	14/07/2017	Successful
SkySat 8-13	6	Minotaur-C	31/10/2017	Successful
Flock 3m	4	Minotaur-C	31/01/2017	Successful
Flock 3p'	4	PSLV-C37	12/01/2018	Successful
Pioneer	1	Atlas-5	20/01/2018	Successful

Table E.1: *Launches up to July 2018*

E.3.2   Financial Resources

The only transaction that has been made, which is an investment round, has been the closure of Series D investments. [45]

Transaction Name	Date	Nº of Investors	Money Raised ($)
Series D	20/02/2019	35	168M

Table E.2: *Investment ventures up to February 2019*

E.4   Key Partnerships

Company	Sector	Type of Partnership	Motivation of Partnership
Upstream PBC, Inc.	Intelligence	Solution Partner Strategic Alliance	Reduction of Risk
Farm Logs	Agriculture Analytics	Solution Partner Strategic Alliance	Reduction of Risk
Beam IO	Intelligence	Solution Partner Strategic Alliance	Reduction of Risk
Live EO	Intelligence	Solution Partner Strategic Alliance	Reduction of Risk
Trimble	Software Development	Solution Partner Strategic Alliance	Reduction of Risk
FeatureX	Artificial Intelligence Development	Solution Partner Strategic Alliance	Reduction of Risk
GeoSpark Analytics	Data Analysis	Solution Partner Strategic Alliance	Reduction of Risk
Agrian Inc.	Agriculture Analytics	Solution Partner Strategic Alliance	Reduction of Risk
AGI	Intelligence, Software	Solution Partner Strategic Alliance	Reduction of Risk
Bird.i LTD	Data Analysis	Solution Partner Strategic Alliance	Reduction of Risk
BAZEAN	Natural Resources Intelligence	Solution Partner Strategic Alliance	Reduction of Risk
Anglo Gold Ashanti	Data Analysis	Solution Partner Strategic Alliance	Reduction of Risk
Farm Drive	Agriculture Analysis	Solution Partner Strategic Alliance	Reduction of Risk
SlingShot	Artificial Intelligence Signal Processing	Solution Partner Strategic Alliance	Reduction of Risk
AllSource Analytics	Data Analysis	Solution Partner Strategic Alliance	Reduction of Risk
PCI Geomatics	Desktop Software	Solution Partner Strategic Alliance	Reduction of Risk
Beth & Bessi Inc.	Agriculture Analysis	Solution Partner Strategic Alliance	Reduction of Risk
Crowd AI	Artificial Intelligence Data Analysis	Solution Partner Strategic Alliance	Reduction of Risk
Orbital Insight	Imagery Processing	Solution Partner Strategic Alliance	Reduction of Risk
Boundless	Data Analysis	Solution Partner Strategic Alliance	Reduction of Risk
Windward	Data Analysis	Solution Partner Strategic Alliance	Reduction of Risk

Table E.3: *Main partnerships by 2019 - Part 1*

Company	Sector	Type of Partnership	Motivation of Partnership
Azavea	Software Analysis	Solution Partner Strategic Alliance	Reduction of Risk
RMSI	Software Development	Solution Partner Strategic Alliance	Reduction of Risk
FarmShots	Agriculture Analysis	Solution Partner Strategic Alliance	Reduction of Risk
PIXIA	Data Access Solutions	Solution Partner Strategic Alliance	Reduction of Risk
Bae Systems	Defense Intelligence	Solution Partner Strategic Alliance	Reduction of Risk
Tanka	Agriculture Analysis	Solution Partner Strategic Alliance	Reduction of Risk
Ecopia Tech	Agriculture Analysis	Solution Partner Strategic Alliance	Reduction of Risk
Airbus	Space and Defense Technology	Coopetition	Optimization of Resources
ESA	Space Agency	Coopetition	Optimization of Resources
NASA	Space Agency	Coopetition	Optimization of Resources
BITS	Data Analysis	Strategic Alliance	Reduction of Risk
COTS Providers	Providers	Buyer - Supplier	Acquisition of Resources
Geoplex	Data Analysis and Intelligence	Strategic Alliance	Reduction of Risk
Harris ENVI	Geospatial Analytics Software	Strategic Alliance	Reduction of Risk
SpaceX	Launchers	Joint Venture and Buyer - Supplier	Acquisition of Services and Reduction of Risk
Rocket Lab	Launchers	Strategic Alliance	Acquisition of Services
Google	Data Storage and Data Engineering	Joint Venture	Reduction of Risk
ISS	Deployer	Buyer - Supplier	Acquisition of Services

Table E.4: *Main partnerships by 2019 - Part 2*

The key partnerships that have been analyzed in order to reach the results of section 4.2.7, can be seen in Table E.3 and Table E.4.

E.5   Cost Structure

Starting from the first phases of the projects that *Planet* is developing, and by now, focusing on the production, the first costs that one finds are those related to the design of the satellites of the PlanetScope and TerraBella constellations. This design costs include the salaries of the engineers and workers as well as the cost of the licenses of the specialized software required for the designing process. In addition, there would also be the costs of the offices rent and the costs of the development of the test benches.

In the assembly field, the company needs to acquire the different materials and necessary components to make the satellites operative, which translates into COTS and materials costs. In addition, machinery and precise tools also need to be acquired. The final costs of this production step would be the salaries of the workers and engineers and the rent and maintenance of the manufacturing facilities.

On the transport side, two additional costs appear, firstly, the costs of transporting the satellites to the launching fields, and secondly, the price of the launching. In some cases, a third cost may appear, when the company needs to contract the services of launching brokers, which act as intermediaries between *Planet* and the launchers. When the satellite needs to be deployed, the company will also have to assume either the cost of a built deployer (such as a P-POD), or the payment that second companies require for the deployments (this company would be for example the ISS).

Once the satellite is orbiting, and this costs are applicable to all the constellations, *Planet* needs to establish constant communication with them, either to transmit orders as to receive information. For this reason, the company counts with a network of ground stations and antennas, which need to be acquired and maintained, which implies costs of maintenance, renting, acquisition and the salary of that people which work in and for the ground stations.

In the interpretation of the received data, *Planet* needs prepared workers for it, as well as appropriate software, this interpretation and analysis of data, entails costs of salaries, software licensing and the renting and maintenance of the headquarters.

When the data has been transformed into a salable product, the sales teams start their work. This sales work implies costs of salaries, software development and the typical costs of an office.

All this plotted costs are related to the products that *Planet* is already selling nowadays; however, there also have to be added the costs of the products that are currently on a development stage, awaiting to be ready to be commercialized as well. This projects in development are those related to the Queryable and the MegaSats projects, and, by now, they only imply more designing costs.

E.6   Results and Relationships over New CAN-VAS Model

On an identical way as in Appendix D.9, deep analysis of the most representative relationships between the building blocks of the new CANVAS model is going to be performed. Firstly, regarding the Value Side, taking as staring point the customer segments, and secondly, regarding the Efficiency Side, taking the Key Activities as starting point.

## E.6.1   Engineering and Defense Data Analysts

This specific Customer Segment is probably the most exigent sector that *Planet* is providing. It is, as well, one of the segments which generate the highest incomes to the company. The product in which this companies are interested in, is satellite imagery (mainly obtained as raw data, that this very same companies will analyze by their concrete and owned means), with high resolution. In addition, the reason for which they chose *Planet* instead of other companies, is the low revisit time that *Planet* provides. It is also worth mentioning the fact of the multiple options of services and the opportunities that the commercialized imagery has to be adapted to various uses (sea vigilance, borders vigilance, air traffic control...).

Since this are powerful companies, they are granted personalized attention, and a certain degree of co-creation. Ensuring that the product that is being acquired is exactly what the customer was needing. The channels that this customers have to communicate and relate with *Planet* consist on either the Solution Partners, which take care of making arrive the imagery to this customers (typical of smaller companies), or the Negotiating Teams, which take part in the communications between the company and those bigger Defense companies. In addition, this customers are granted access to the general Platform, through which most of the data packages and raw imagery are obtained.

When it comes to the Revenue Streams, because of the size of the contracts that are established with companies from this customer segment, certain amounts of revenues are pre-accorded in exchange of certain amounts of also pre-established data. The licenses that this companies have access to are Data Licenses, meaning that once the contract has been signed, this companies have absolute control over the imagery (under *Planet's* terms. Finally, and obviously, the price that these companies pay for the data assets depend on features such as resolution or frequency with which the imagery sets are renewed.

E.6.2   Agriculture and Environment Data Analysts

The customers that come from Agriculture and Environment Monitor environments could be seen as those who have benefited the most of the Space Democratization.
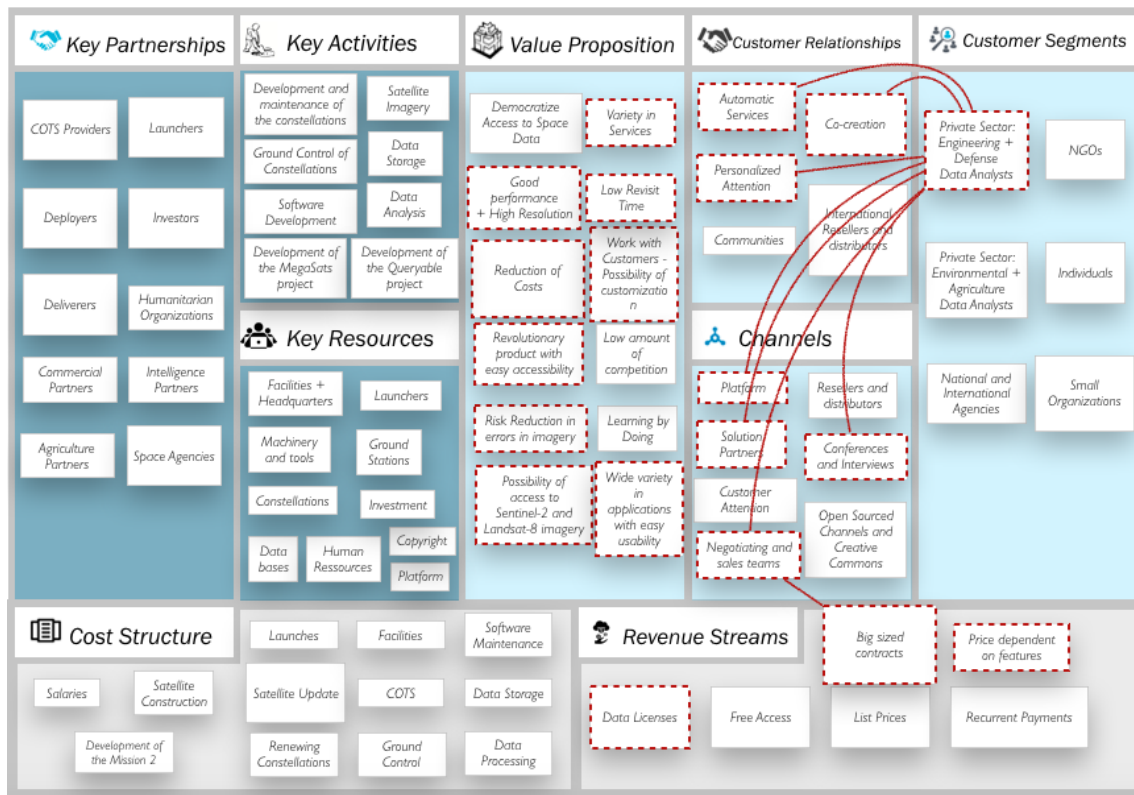
Figure E.3: *Design of the CANVAS model for Planet in 2019 focusing on the Engineering and Defense Customers.*

This kind of customers have also been the customers that sustained *Planet* on its beginnings and that were reached from the company to maintain Co-creation relationships, and which helped *Planet* developing certain newly created and highly customized sub-products from the satellite imagery which concerned crops or forests monitoring.

For the previous reasons, the relationships that this company established with *Planet* were of co-creation, requiring from personalized attention as well. The most recent clients, which were smaller and most numerous as well, accessed the products through the regional networks of resellers and distributors, and required from less personalized attention.

This segment was specially attracted to the competitive prices of the high-tech imagery, and could take real profit of the fact that daily imagery from the same spot could be taken. The combination of this facts with the wide variety and the possibility of obtaining already pre-processed results (specially for smaller farmholders) as key in the development of the value proposition targeting this customer segment.

When contacting with the company, bigger companies would do it directly, and smaller, through distribution partners. All of them would finally access the contracted services through the company's platform.

Regarding the revenue streams, this companies would rather provide recurrent payments rather than big transactional movements.
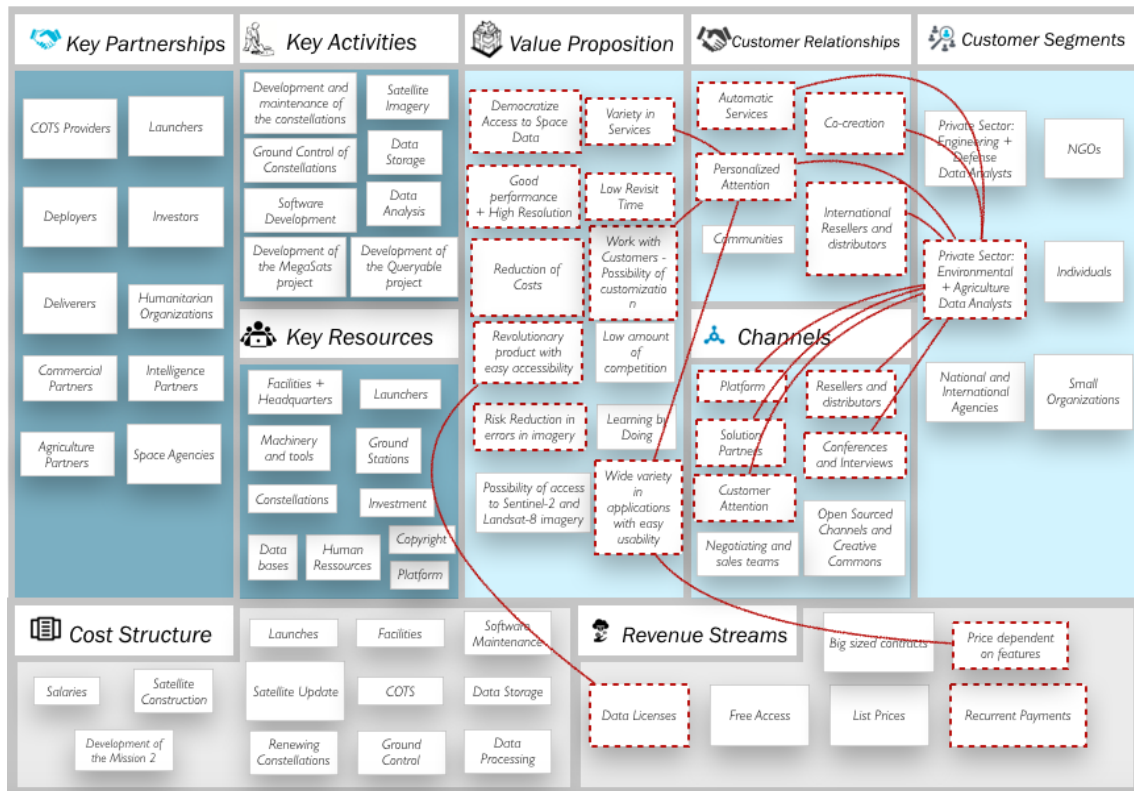
Figure E.4: *Design of the CANVAS model for Planet in 2019 focusing on the Agriculture and Environment Customers.*
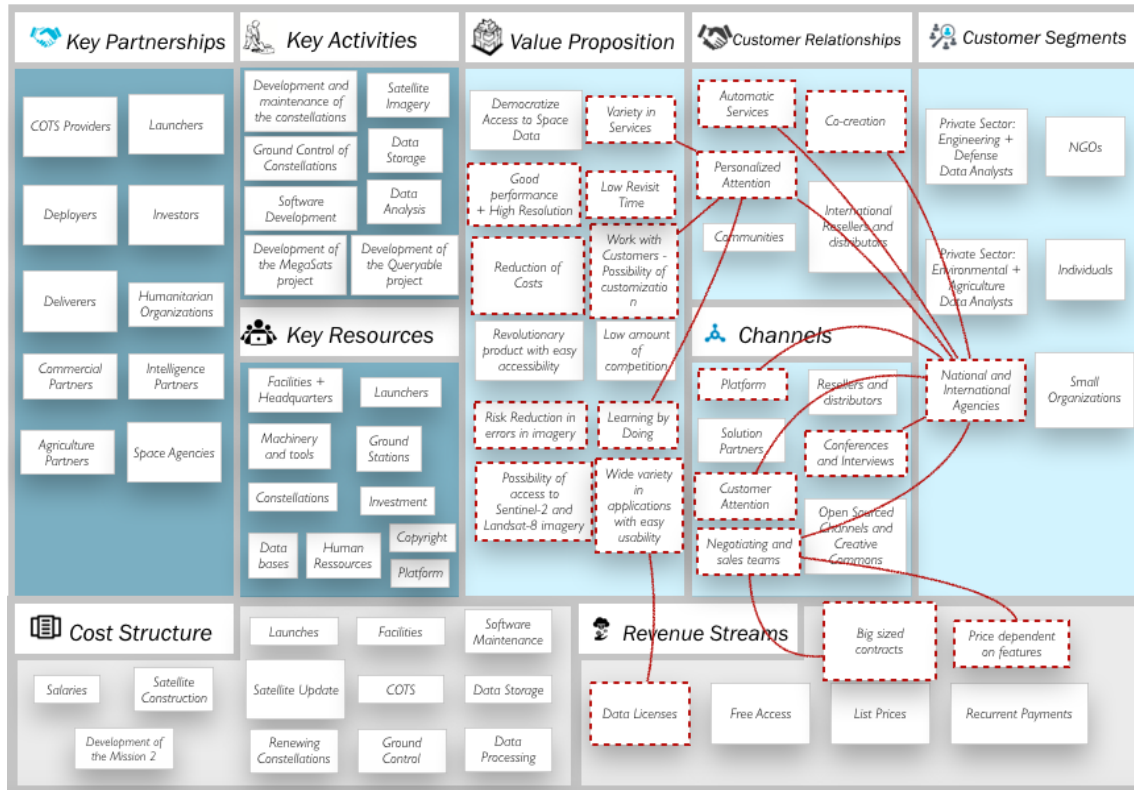
E.6.3   National and International Agencies

This is the customer segment that has increased its commercial relationships the most between 2017 and 2019. Represented by the contracts signed with NASA, ESA and NGA. And has eventually become more significant in the economical field of the company.

Since this Agencies represent a high volume in the sales of the company, they in exchange need from highly personalized attention. Additionally, most of them have established co-creation relationships with *Planet* and are now developing services jointly.

They have been attracted by two main features from the company, the increase in the resolution and quality of the data sets, and the possibility of obtaining imagery on a highly frequent way. If the fact that *Planet* was willing to establishing co-creation relationships, collaborations and specific products for this agencies is added up, the results are a highly attractive product for the Agencies.

From this so called collaborations, *Planet* has obtained benefits as well, the most representative one is the access to the Sentinel-2 and Landsat-8 data sets, which the company can now add to its owned services.

Figure E.5: *Design of the CANVAS model for Planet in 2019 focusing on National and International Agencies.*

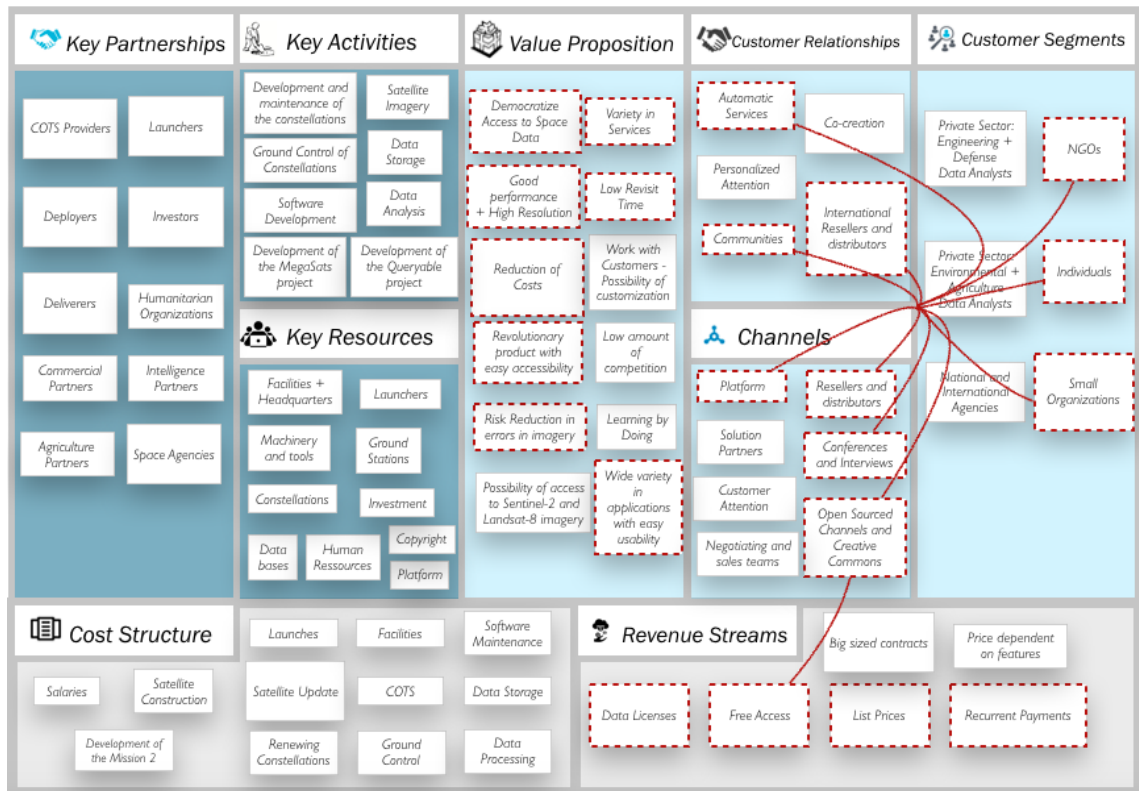## E.6.4 NGOs, Individuals and Small Organizations

The last group, as for the old CANVAS model, is composed by three sub-groups of customers. This customers would represent the least powerful segment, regarding the individual economical power. Nevertheless, since it is quite numerous, it provides back benefits to the company, not only economical, but most importantly, on the reputation spectrum.

This customer segment is the one which establishes the least direct relationships with the company; they are already interested in pre-processes data sets, which give them answers to their concrete requests; they are the best example of the democratization of the space; this segment is attracted by the variety of services and the low price to accessing a service that up to the present time had been limited to corporations with important acquisitive power.

On the aspect of the Individuals and NGOs, this two subgroups have free access to some of the free packages of imagery, providing *Planet* back with either good

publicity or results on specific areas (regarding the researchers work).

As it has been said, this segment does not have close relationships with the company, therefore, they keep contact through automated services, through the platform. On the revenue streams side, this companies usually choose to make regular payments for as long as the services are needed.

Figure E.6: *Design of the CANVAS model for Planet in 2019 focusing on NGOs, Individuals and Small Organizations.*

E.6.5   Image Capturing Process

Beginning from the Process of capturing the imagery, three activities take importance: the development of the constellations that will take this imagery, the assembly of a solid ground control network, that will receive the imagery, and the process of receiving the imagery itself.

So that the satellites can be put into orbiting (leaving the RapidEye constellations aside), a team of engineers and workers is needed to design and assemble the spacecrafts; additionally, the materials, tools and machinery are also needed, as well as some specialized facilities where the satellites might be assembled. Once this satellites are ready, they need to be put in orbit, to do so, launchers are also needed, and the entire process needs of the investment resources. Once the satellites are

operative, the ground control stations (and the human resources that will operate them), are needed.

This key activity represents the highest cost for *Planet*, expensive COTS are required, the weight of specialized personnel also needs to be taken into account, as well as the launching costs, which are usually one of the most expensive processes from the satellites operations.
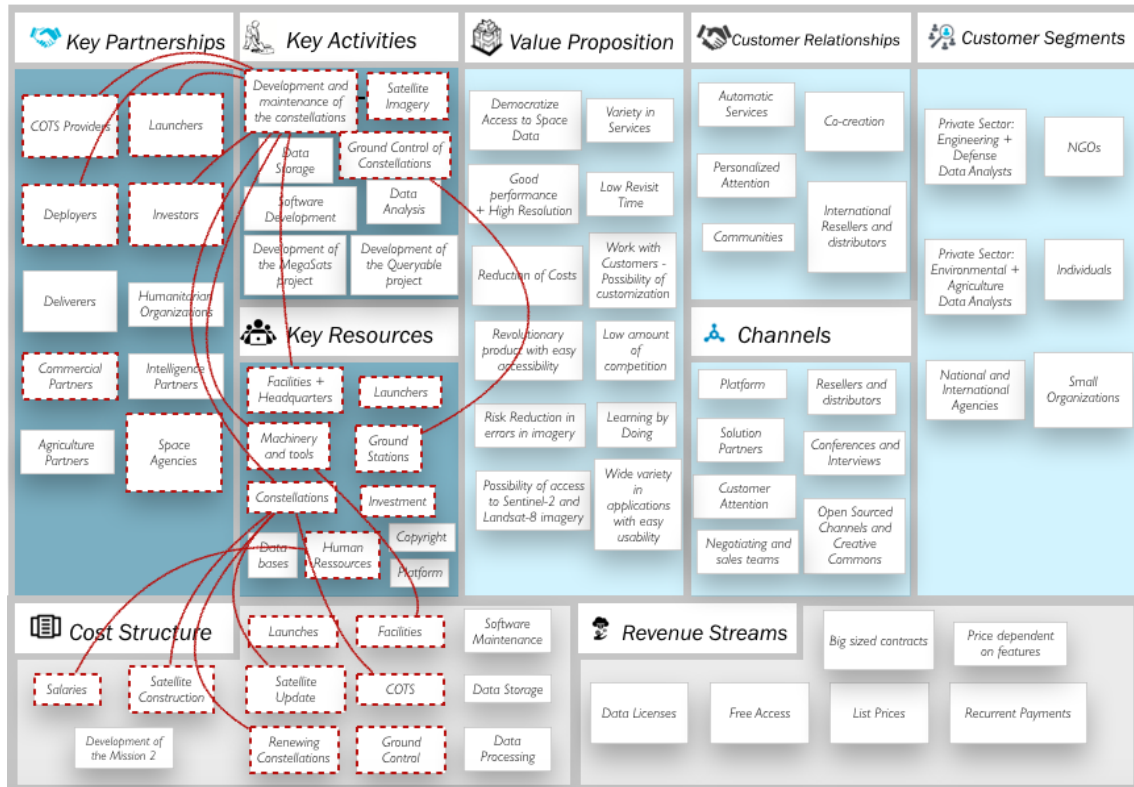
Figure E.7: *Design of the CANVAS model for Planet in 2019 focusing on the process of taking the satellite imagery.*

E.6.6   Valorization Process

When satellite imagery and data is collected, it is of low value to most of the customers (leaving specialized customers who self-process the data assets), therefore, there needs to be a process in which it is transformed into a value proposition.

To do so, data needs to be analyzed and processed, as well as nicely presented through a platform which eases the process of understanding results. To develop this already processed data sets, *Planet* has established relationships of collaboration with companies from various fields with which specific products for each of this fields have been developed though data analysis engineering.

Human resources are key in this section, since most of the jobs that have to be performed need from human teams that develops them. For this reason, human resources, combined with data storage resources (due to the huge amount of daily data that is stored) represent the highest costs of this sub-group of activities.
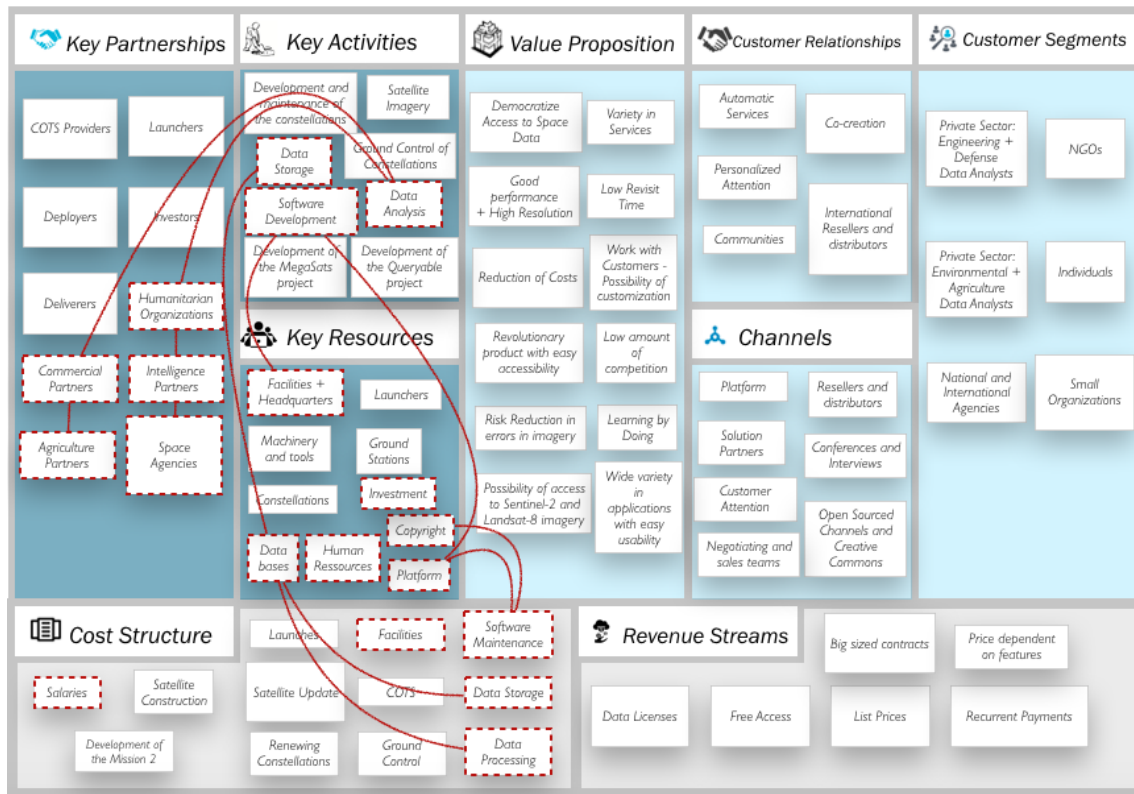
Figure E.8: *Design of the CANVAS model for Planet in 2019 focusing on the process of developing the value product.*

E.6.7 Innovation

It has been considered to be of interest including this innovation activities in the Efficiency Side of the new CANVAS models, since this are projects that are being developed in the project, and that require from resources from *Planet*, even though they have not been yet commercialized.

Since no construction is already implied in this processes, the only costs of development are the salaries of the researchers and engineers. Once the product is ready to be tested, the costs of the prototypes and facilities will also have to be taken into account. To sustain this contest, the investment (both from external investors and *Planet*) is highly needed.

Key partnerships are also fundamental in the innovation projects; SpaceX is collaborating hand to hand with *Planet* to develop the MegaSats, which would be launched

with MegaLaunchers developed by SpaceX. And Google is collaborating with *Planet* to help developing the Artificial Intelligence and the Machine Learning Methods that are going to be necessary to make the Queryable Project a reality.

Within the next years, the reliability of this innovation products will be able to be proven.
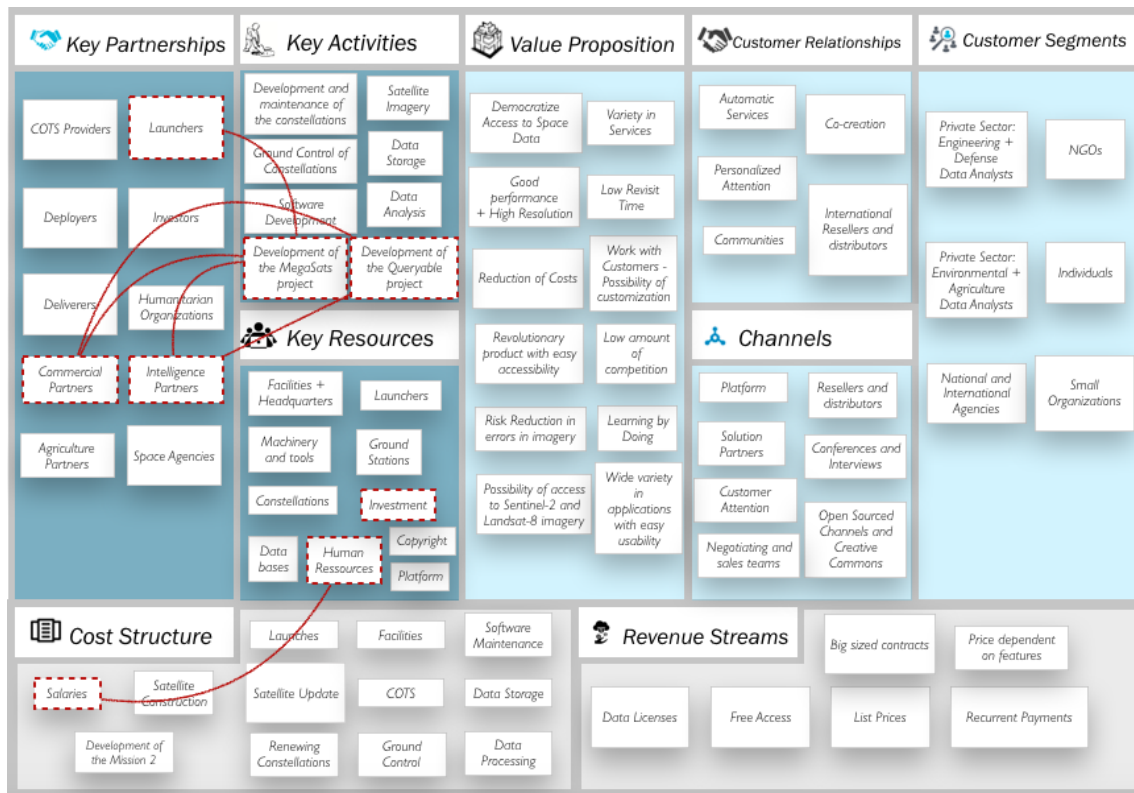
Figure E.9: *Design of the CANVAS model for Planet in 2019 focusing on the process of innovation.*

CHAPTER

F

FORECAST AND FURTHER STUDIES

It would be of special interest developing further studies regarding the previsions of future for *Planet's* business trajectory, and to expand this analysis to developing similar studies on more Earth Observation Companies. By doing this, the results of each of this studies could be extrapolated to generate a precise image of how the Earth Observation markets are behaving.

Since it was out of the scope, this extensions of the project have not been treated; however, they would be of high interest to the DISCOVERER project, since they could give a clear image of the current and future situation of the Earth Observation Industry and how the new space technologies and philosophies are shaping it.

Some ideas can be extracted from the results plotted in the Report, regarding two special areas: the identified external drivers, and the concordance of the obtained results with the results achieved by former DISCOVERER student Catalina M. Pascual Canyellas, in her *Study of Earth Observation Business Models by Means of Business Models Methodologies*.[2]

When comparing the achieved results in this Project, and those which were achieved by C.M. Pascual, it gains strength the idea of the existence of a pattern which all the New Space Earth Observation companies share. The analyzed companies (including the results obtained for *Planet*) have some keystone aspects which define them:

1. *The aim of reducing the cost structure:* Usually achieved by re-inventing the philosophy to reach the space: using cheaper technologies, priorizing the general quality of the constellations instead of the individual quality of each of them, or by developing new work philosophies, such as learning by doing. This

aim of reducing costs leads to the following shared trait.

2. *Reaching as many Customer Segments as Possible:* Since the cost of the structure is reduced, the price to accessing the product might be reduced as well, allowing that more customers might have access to the service, and opening the service to more and more areas. All in all, contributing to the expansion and settlement of the proposal.

3. *Lowering the Price and Increasing the Quality of the Service:* Specially linked to the philosophy of learn by doing. When the building costs of the satellites is low, the company might afford this philosophy: the satellite is launched, and the test ground is the space itself. Results are more reliable, and quality might be exponentially increased after every launch.

4. *Use of Automated Delivery Channels and Customer Relationships:* Since this companies aim to have as many customers as possible, if costs want to be maintained at minimum, services have to be automated; they are perfectly tailored to each of the customers, and at the same time, they keep the company's structure as simple as possible.

5. *Importance of Key Partnerships:* Part of the key to success of this companies has been the ability to develop a very large number of sub-products related to the Earth Observation Data Analysis, which are delivered to very specialized customers. If key Relationships are established with important companies of each of this segments, a win-win relationship is achieved: the partner receives precious results, and the Earth Observation company the possibility of developing a product which might be later sold to a wider number of customers.

In addition, in the case of *Planet*, an extra trait has been observed, the aim of innovating. The company seems to want to ensure its importance in the future by investing in innovation to try pioneering in some fields related to the Earth Observation services yet to be exploited.

A disruptive between two paths of the future, regarding the Earth Observation Industry has been found: either the current situation is just a mirage, and eventually the interest of the markets will fade away and the entire structure will collapse, or the trend is to be confirmed, and it can be stated that this industry is in its early stages of a great success which is to come in the following years.

In accordance with the External drivers plotted in the Report, it seems that the most probable option is the one which leads to the success of the Earth Observation Industry. Apparently, there is a growing interest for the New Earth Observation Industry of the Governments and Agencies; since this interest is related to durable and economically favorable contracts, it seems that the consolidation of the industry is a reality. If the market is as well consolidating, expanding and opening (by looking and the evolution of the yearly incomes and EO related launches of satellites), and the services might reach a wider public (which would mean that the service is starting to be seen as a commodity), it all seems to point towards a same direction, the success of this Industry and its companies.

As it has been previously said, if this hypothesis are to be confirmed, further studies need to be made. By analyzing more Earth Observation related companies, by developing analytical forecasts for each of them, by studying the trends of the Earth Observation Markets and by extrapolating each of the results of this studies into an ultimate study which summarizes them all.

Proposal for further studies would include the analysis of companies from *Planet's* environment and which are attached to the Democratization of Space philosophy. Some examples of this companies would be *Urthe Cast, GeoEye, Astrium, Black-Bridge, Satellogic, BlackSky, Hera Systems or AxelSpace* amongst others. In addition, a general study of the behaviour and trajectory of the entire Earth Observation Industry since 2010 (when the Democratization of Space started being evident) should be performed. It would be of interest comparing as well the model of the Earth Observation Industry before and after the Democratization of Space movement.

BIBLIOGRAPHY

[1] Y. Pigneur A. Osterwalder. "Business Model Generation." In: (2010), pp. 1–56.

[2] C.M. Passcual Canyelles. "Study of Earth Observation Business Models by means of Business Modells Methodologies." In: (2019), pp. 1–79.

[3] Study.com. *Key Drivers: Definition and Analysis*. URL: {https://study.com/academy/lesson/key-drivers-definition-analysis.html} (visited on 06/08/2019).

[4] P. Klupar S. Spanhake C. R. Boshuizen J. Mason. "Results from the Planet Flock Constellation." In: (2018), pp. 1–91.

[5] Planet. *Planet and Geoplex Partner to Deliver the Latest Satellite data to the Queensland Government*. URL: https://www.planet.com/pulse/planet-and-geoplex-partner-to-deliver-the-latest-satellite-data-to-queensland-government/ (visited on 03/22/2019).

[6] Geoplex. *Geoplex Services*. URL: https://geoplex.com.au/services (visited on 03/22/2019).

[7] Descartes Labs. *About Descartes Labs*. URL: https://www.descarteslabs.com/about.html (visited on 03/22/2019).

[8] Woolpert. *About Us - Woolpert*. URL: https://woolpert.com/About-Us/ (visited on 03/22/2019).

[9] GPC Group. *GPCGroup Services*. URL: https://thegpcgroup.com/our-services/ (visited on 03/22/2019).

[10] Ministerio de Medio Ambiente y Recursos Naturales de El Savador. *Decreto de Creación*. URL: http://www.snet.gob.sv/ver/snet/decreto+de+creacion/ (visited on 03/22/2019).

[11] C-CORE. *C-CORE: Our Expertise*. URL: https://www.c-core.ca/about-us/ (visited on 03/22/2019).

[12] Progea. *Progea: Taking Stock of the Risks*. URL: `http://www.progeaglobal.com/environmental-sustainability-consulting-service` (visited on 03/22/2019).

[13] Envision Innovative Solutions. *About Envision Innovative Solutions*. URL: `http://envision-is.com/about/#` (visited on 03/22/2019).

[14] Farmers Edge. *About Farmers Edge*. URL: `https://www.farmersedge.ca/about-us/` (visited on 03/22/2019).

[15] Wilbur-Ellis. *History in the Making*. URL: `https://www.wilburellis.com/history/` (visited on 03/22/2019).

[16] UN-REDD Programme. *Our Work*. URL: `https://www.un-redd.org/how-we-work-1` (visited on 03/23/2019).

[17] Amazon Conservation Association. *ACA Programs*. URL: `http://www.amazonconservation.org/ourwork/index.html` (visited on 03/23/2019).

[18] International Space Charter and Major Disasters. *About the Charter*. URL: `https://disasterscharter.org/web/guest/about-the-charter` (visited on 03/23/2019).

[19] Planet. *Planet Becomes First Private-Sector Data Provider to Directly Support the International Charter on Space and Major Disasters*. URL: `https://www.planet.com/pulse/planet-international-charter-space-and-major-disasters/` (visited on 03/23/2019).

[20] Planet. *Joining the Challenge: Planet Labs Partners with the Rockefeller Foundatoin*. URL: `https://www.planet.com/pulse/grc/` (visited on 03/23/2019).

[21] SAINS. *What We Do*. URL: `https://www.sains.com.my/home/article/view/59` (visited on 03/23/2019).

[22] FarmDrive. *The FarmDrive Story*. URL: `https://farmdrive.co.ke/about-us` (visited on 03/23/2019).

[23] Planet. *Planet to Provide High-Ressolutoin Imagery to Copernicus Programme as Part of the Airbus-Led Consortium*. URL: `https://www.planet.com/pulse/esa-vhr-high-resolution-europe/` (visited on 03/23/2019).

[24] Orbital Insight. *Transform Decision Making*. URL: `https://orbitalinsight.com/company/#slider-5` (visited on 03/23/2019).

[25] Planet Labs. "Planet Imagery Product Specification: PlanetSocpe & RapidEye." In: (2016), pp. 1–52.

[26] Planet Labs. *Planet Labs Partners with Canadian Remote Sensing Giant, C-Core*. URL: `https://www.planet.com/pulse/c-core/` (visited on 03/30/2019).

[27] Precision AG. *Farmers Edge, Planet Labs Announce Multi-Year Exclusive Imagery Distribution Agreement*. URL: `https://www.precisionag.com/industry\-news/farmers\-edge\-planet\-labs\-announce\-multi\-year\-exclusive\-imagery\-distribution\-agreement//` (visited on 03/30/2019).

[28] Planet Labs. *BITS Joins Planet Labs as Alliance Partner in Mexico*. URL: `https://www.planet.com/pulse/bits-joins-planet-labs-as-alliance-partner-in-mexico/` (visited on 03/30/2019).

[29] Reuters Institute Fellowship Paper. *Satellite Journalism – The Big Picture*. URL: `https://reutersinstitute.politics.ox.ac.uk/sites/default/files/2018-10/Mark\%20Corcoran\%2C\%20Satellite\%20Journalism.pdf` (visited on 03/31/2019).

[30] Spaceflight. *Pricing Information*. URL: `http://spaceflight.com/schedule-pricing/\#pricing` (visited on 03/31/2019).

[31] Innova Antennas. *Yagi Antenna*. URL: `https://www.innovantennas.com/index.php?option=com_virtuemart&view=productdetails&virtuemart_product_id=550&virtuemart_category_id=4&lang=en`.

[32] Planet. *Planet and Geoplex Partner to Deliver the Latest Satellite Data to Queensland Government*. URL: `{https://www.planet.com/pulse/planet-and-geoplex-partner-to-deliver-the-latest-satellite-data-to-queensland-government/}` (visited on 04/12/2019).

[33] Planet. *Planet to Acquire Terra Bella from Google, Sign Multi-year Data Contract*. URL: `{https://www.planet.com/pulse/planet-to-acquire-terra-bella-from-google/}` (visited on 04/12/2019).

[34] Planet. *Planet Imagery Available To Cesium Community*. URL: `{https://www.planet.com/pulse/planet-imagery-available-to-cesium-community/}` (visited on 04/12/2019).

[35] Planet. *Planet Offers Broader Data Access To The Academic Community*. URL: `{https://www.planet.com/pulse/planet-offers-broader-data-access-to-the-academic-community/}` (visited on 04/12/2019).

[36] Planet. *Planet and Farmers Edge Redefine Precision Ag With Landmark Agriculture Deal*. URL: `{https://www.planet.com/pulse/planet-farmers-edge-agriculture-deal/}` (visited on 04/12/2019).

[37] Planet. *DowDuPont's Granular Taps Planet Fro Multi-Year Deal For Agriculture*. URL: `{https://www.planet.com/pulse/dowdupont-granular-tap-planet/}` (visited on 04/12/2019).

[38] Planet. *Planet To Provide High-Resolution Imagery to Copernicus Programme as Part of the Airbus-Led Consortium*. URL: `{https://www.planet.com/pulse/esa-vhr-high-resolution-europe/}` (visited on 04/12/2019).

[39] Planet. *Planet Expands Contract with European Union's Copernicus Programme*. URL: `{https://www.planet.com/pulse/planet-european-commission-contributing-missions/}` (visited on 04/12/2019).

[40] Planet. *NGA and Planet Sign Five-Year Research Agreement on Analytics*. URL: `{https://www.planet.com/pulse/nga-and-planet-sign-five-year-research-agreement-on-analytics/}` (visited on 04/12/2019).

[41] Planet. *Planet Awarded New Contract With National Geospatial-Intelligence Agency*. URL: {https://www.planet.com/pulse/planet-nga-contract/} (visited on 04/12/2019).

[42] Planet. *Planet Powers a New Chapter in Global Coral Conservation with the Launch of Allen Coral Atlas*. URL: {https://www.planet.com/pulse/planet-powers-allen-coral-atlas/} (visited on 04/12/2019).

[43] Planet. *NASA Enters into Blanket Purchase Agreement with Planet*. URL: {https://www.planet.com/pulse/nasa-blanket-purchase-agreement/} (visited on 04/12/2019).

[44] Planet Labs. "Planet Imagery Products." In: (2018), pp. 1–91.

[45] Planet. *Planet Closes $168M Series D Financing*. URL: {https://www.planet.com/pulse/planet-closes-168m-series-d-financing/} (visited on 04/21/2019).