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Paper Session I-A - Value Chain Analysis of the Ariane-4 Launch Campaigh

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Value Chain Analysis of the Ariane-4 Launch Campaign

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Abstract

This paper discusses the concept of Value Chain and proposes the use of this philosophy to analyze the Ariane program. The objective of analyzing this concept is to clearly identify the competitive advantages of this European vehicle over its competitors. This paper also provides a description of the method followed to formulate a value chain analysis. Furthermore, it links the Ariane program, to the concepts of value chain analysis and competitive advantage. What's more, the explanation of the methodology presents the possibility of its application in other fields. This document presents a brief report of the entire Ariane program, emphasizing the description of the Ariane-4 (A-4) rockets, the launch campaign and the performance of the A-4 vehicles. Finally, Arianespace's (A-Space) short-term plans for the 21st century are presented and conclusions are established.

1. Introduction

NASA-Kennedy Space Center (NASA-KSC) clearly realized the need to determine where the A-4's competitive advantages rest. A-Space, the entity in charge of managing the Ariane program has a leading position as a launch provider in the world market of commercial satellites. A-Space has demonstrated its flexibility and responsiveness to customer payload scheduling in 1998. They even accelerated its mission pace when payloads became available. Furthermore, A-Space performed three launches in the month of October (two A-4s and one A-5). Moreover, A-Space holds more than 50% of the global market share. A-Space used all six versions of the A-4 family in missions during the year, demonstrating a capability to tailor the A-4 to the specific payload requirements of each flight. This paper offers a method that identifies the cost effectiveness of the Ariane program despite the logistics involved, and explains how they have been able to maintain the costs at the level they are now. The value chain analysis is considered an alternative in the analysis of the Ariane program because it reflects the value added by every step involved in the mission. The activities involved are transportation, erection, verification, and assembly of the launch vehicle. Moreover, the value chain analysis also takes into account other aspects that could affect competitive advantage, such as marketing and geographical location.

2. Value Chain

Professor Michael E. Porter from Harvard Business School initially used the term "value chain" in his book "Corporate Strategy and Competitive Advantage".[1] He defines "value chain" as the sequence of activities organized to manufacture a company's product. According to Porter all these internal activities such as: design, market, delivery, and technical support done by a firm represent the company's approach when implementing strategies. Shank and Govindarajan[5,6] later extended this definition to include all the external activities performed by a company involving suppliers and customers. Porter[1] also states that even if companies may have similar chains, the value chains of rivals may differ. It is this difference in the competitor's value chains that assertively induce a competitive advantage. Furthermore, a company's value chain in a sector of commerce may vary slightly for different items in its line of products, or for different buyers, geographic areas, or distribution channels. Moreover, Porter [1] classifies value activities as "the discrete building blocks by which a firm creates a product valuable to its buyer."[1] He also considers value activities as the competitive advantage a company has over another. Value activities can be categorized as primary and support activities. Primary activities are the tasks involved in the physical creation of a product.

2.1 Value Chain Methodology

According to Shank and Govindarajan,[5] the methodology to construct and use a value chain involves the following steps: (1) "Identify the industry's value chain and assign costs, revenues and assets to value activities, in addition to determining which activities are strategic,

(2) diagnose the cost drivers by regulating each value activity and (3) develop a sustainable competitive advantage, by controlling cost drivers rather than controlling competence or by re-configurating the value chain". [5] The value chain breaks up the industry into distinct strategic activities, which are the elements by which organizations in the business make a product attractive to consumers. The activities should be isolated or separated if: "(1) these activities represent a significant percentage of operations costs; or (2) the cost behavior of the activities or the cost drivers is different; or (3) they are performed by competitors in different ways; or (4) they have a high potential for creating differentiation". [5]

Each value activity incurs costs but also generates revenues and ties up assets in the process. The cost drivers explain variations in costs in each value activity. Cost drivers are broken into two categories:

1. Structural cost drivers: are related to the strategic preferences held up by the organization, and concern the core economic structure that drives cost position for any given product category. These cost drivers are: (a) Scale, defined as "the investment to make in manufacturing, Research and Development (R&D) and marketing resources."[5] Scale was a major factor in investments early in the century. (b) Scope, defined as "degree of vertical integration."[5] The economies of vertical integration are in some cases used to control distribution. For example, the food industry used scope to control the delivery of supplies from the farms, food treatment factory, and truck fleets to stores. (c) Experience, defined as "how many times in the past the firm has already done what is doing again." [5] For example Boeing[7] developed learning curves for every major work center. Using the learning curve gave them the possibility to estimate the average number of days to complete an assignment. Learning curves takes in consideration that repetition of complex tasks result in a reduction of time required to complete the assignment. (d) Technology, defined as "what process technologies are used at each step of the firm's value chain."[5] Some industries evaluate the available technology according to what the market desires. However, in some instances this is not possible due to the state of knowledge. (e) Complexity, defined as "how wide the line of products or services offered to the customers is."[5] This has direct influence in cost reduction. In some companies the products or services having a detrimental effect on the management of cost are eliminated or replaced by another line of products.

2. Executional cost driver: "Are those determinants of a firm's cost position that hinge on its ability to execute successfully."[5] The executional cost driver focuses on the concept that "more is not always better."[5] For example in the case of complex structural drivers, a more complex manufactured line of goods is not essentially better or necessarily worse than a less complex line. The executional driver expands its perception considering that too much experience can be as bad as too little experience.

Once the firm has diagnosed the cost drivers of each value activity, the firm has two different options in order to obtain competitive advantage. The choices involve controlling "the cost drivers better than competitors or re-configuring the value chain" [5].

2.2 Value Chain as a Competitive Advantage

The method of stratifying the firm into strategically important activities and the understanding of the impact on cost behavior and differentiation, provides the managers with the tools to measure services and products valued by customers. Therefore, a competitive advantage is created since the performance of discrete activities such as planning, manufacturing, and marketing contribute to the firm's strategy. Furthermore, the value chain helps analyze each particular operation as a whole different entity yet interdependent element, and can help the corporation recognize opportunities for optimization and problem coordination between activities within the chain. The three sources of competitive advantage also known as generic strategies, are:

(a) Cost leadership - Can be summarized as a company's desire to become a low cost producer in its industry. Depending on the industry, the sources of cost advantage vary and they may include the pursuit of economies of scale, proprietary technology, and preferential access to raw material and other factors. Using the cost leadership approach companies have to commit to a number of factors in order to ensure the success of this type of strategy and to gain competitive advantage. These factors include the adoption of a formal cost reduction program, a constant pursuit in automation, and a strong belief in learning curves.

(b) Differentiation - A strategy where the firm seeks to be unique in its industry by employing dimensions that are widely valued by buyers. The firm selects one or more attributes that many buyers in the industry perceive as important, and uniquely positions these attributes to meet the needs of the customers.[5] Differentiation allows the firm to command a premium price, to sell more of its product at a given price, and to gain equivalent benefits such as greater buyer loyalty. There are different sources of differentiation. For instance, the logistics of transporting parts of the A-4 from France to French Guiana, can influence the performance of the vehicle, thereby affecting it's differentiation. Other differentiators create distinctiveness through other primary and support activities such as technology development, which can lead to designs that have exclusive product performance. Operation activities can also affect such forms of individuality as conformance to specifications and reliability. A firm can also differentiate itself through the concept of extensiveness; that is, offering a wide range of services. Integration can also result in differentiation since the firm would be able to control the performance of value activities or coordinate them with other activities. Furthermore, links between integrated activities lead to uniqueness; meaning that the way one activity is performed affects other activities.[1] The cost of differentiation is usually high because uniqueness requires that the company perform value activities better than the competitors. The fact that a firm is exceptional at an activity does not necessarily mean it is differentiated. Uniqueness does not lead to differentiation unless it lowers buyer costs or raises buyer performance as perceived by the buyer. Too much differentiation or unnecessary differentiation can also prove negative. If for instance a product quality or service level are higher than the buyers' need, a firm may result vulnerable to competitors with the correct level of quality and a lower price.[1]

(c) Focus - A strategy that rests on the choice of a narrow competitive scope within an industry. The individual using the focus strategy selects a segment or a group of segments in the industry and tailors its strategy in order to serve the buyer. By optimizing its strategy for the target segments, the company using the strategy seeks to achieve a competitive advantage in its target segments even though it does not possess an overall competitive advantage. Focus strategies can also encompass more than one segment and includes several segments with strong interrelationships.[1]

3. The Ariane Program

Ariane is Europe's current operational launcher. There are three organizations involved in the development, operation, and management of Ariane, these are The European Space Agency (ESA) [9], Centre National d'Etudes Spatiales (CNES) [10], and Arianespace (A-Space). [8] The ESA was formed with the objective of promoting cooperation in space research and technology as well as to promote their space applications among European countries. A-Space is the agency responsible for the production, marketing, and launch of the Ariane vehicle. The Ariane family of vehicles (Figure 1) was designed in 1973 to achieve geostationary transfer orbit (GTO) lift capacity for satellites of up to 1850 Kg. In the first years, A-Space worked to develop stage components such as engines, structures, and equipment. Later they performed the proper modifications in order to perform their first launch in 1979. As soon as the developments were complete for the A-1, they added further capabilities to the vehicle in the effort to stay competitive. Some of the enhanced capabilities included an increased lift capacity, as well as a modification to the center's infrastructure that allowed double payload launches. Systeme de Lancement Double Ariane (SYLDA) was the adjustment made to the Ariane in order to launch two satellites at once. This adjustment consisted of a 200-kg carbon fiber bearing structure known in English as the Ariane Dual Launch System. A-1 was capable of placing 1.7 ton of payload, into GTO. However, the lift capability began to prove insufficient as the market trend shifted in favor of 1 to 1.2 ton satellites. Therefore, ESA decided to develop more powerful versions of the Ariane. The outcome of the upgrade resulted in the A-2 and the A-3. [3]

Figure 1: The Ariane Family[12]

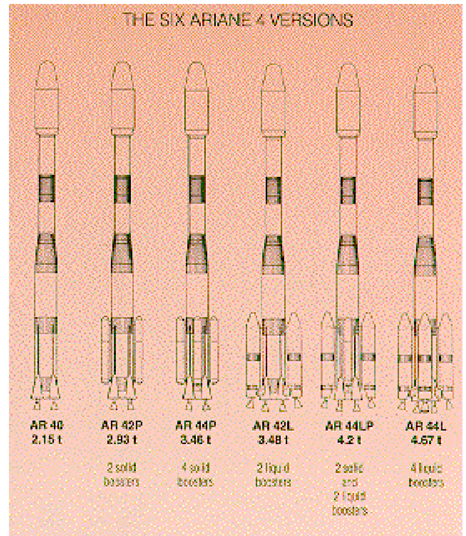

Figure 2: Six Versions of A-4 [14]

The decision to develop the A-4 was made, when a need for an even more powerful and more flexible vehicle was evident to match the trend in the payload market. The program's objective was to achieve a significant increase in launch capability, maintain the capacity of multiple launches, create a range of mission adaptable configurations, and improve the flexibility of launch operations.[3] A 90% performance increase was accomplished in the A-3 due to the Structure Porteuse Externe pour Lancements Doubles Ariane (SPELDA) or the Ariane Dual-Launch External Bearing Structure. The SPELDA increases the first stage propellant mass and the attachment of powerful solid or liquid boosters[13]. The increased payload space permits the transport of up to four satellites. The diameter of the payload fairing was also increased to accommodate bigger payloads. The fairing consists of two lightweight half shells that protect the launcher's satellite passengers during flight through the atmosphere. For multiple payloads, the fairing can be used in conjunction with the SPELDA adapter structure.[8]

The interval between launches was reduced to one month due to the construction of the "Ensemble de lancement Ariane", known as the ELA-2 or the launch facilities for the A-4 vehicle. The A-4 is equipped with four liquid boosters and can transport payloads of up to 4.2 tons to GTO. The launching takes place in Kourou, French Guiana, at the Guiana Space Center (CSG). The French space center was set-up in an area of the Atlantic coast and close to the equator, approximately at latitude 5.23° north. This facility is well located since it enables launches in a wide sector over the Atlantic Ocean extending from North to East (-10.5° to + 93.5°). It is well suited to launch satellites into a GTO because it allows a payload mass gain since launching near the equator reduces the energy required for orbit plane change maneuvers. As a consequence, A-Space has substantial savings of fuel; this enables an increased and improved return on investments for the spacecraft operators. The CSG is responsible not only supplying the overall logistic support during launch activities, but also for the operation of the tracking and telemetry networks.

3.1 Description of the Ariane-4

A-4 is available in six versions (Figure 2); one "bare" and the others fitted with two or four solid or liquid boosters strapped onto the first stage, depending on the mass of the satellite(s) to be sent into orbit. There is also a combination of two liquid and two solid fuel boosters, which lead to a payload capacity of 3.7 tons. The designations of the different versions indicate the type of fuel used and the number of boosters strapped on to the rocket. "P" denotes solid or "poudre" and the "L" denotes liquid or "liquide." The second numbers (0, 2 and 4) represent the number of boosters.

The first stage (Figure 3), also known as the L220 consists of two identical, cylindrical, steel propellant tanks connected by an inter-tank skirt of the same diameter. It also has a water tank supplying the main engines, composed of four Viking-V engines, each independently assembled and supplied with water and propellant via its own valves. Moreover, the first stage includes a conical interstage skirt that connects the first and second stages and a cylindrical thrust frame, the upper part of which is connected to the propellant tanks while the lower part has the four engines mounted. The propellants used are UH25 (a mixture of 75% unsymmetrical dimethylhydrazine and 25% hydrazine hydrate) as a fuel and N_2O_4 (nitrogen tetroxide) as the oxidizer. Stage two (Figure 3), known as L33 has one Viking IV engine, carries storable propellants in aluminum alloy tanks and 560 Kg. of water. The tanks form a cylindrical structure with hemispherical bulkheads divided into two chambers. Both tank compartments are pressurized by helium gas stored in spherical bottles. The third stage (Figure 3), called H10 has one HM-7B engine. The two tanks holding the cryogenic propellants, (liquid hydrogen and liquid nitrogen) are made of an aluminum alloy. Both tanks are pressurized during flight. The hydrogen tank is pressurized by gaseous hydrogen while the oxygen tank is pressurized by cold helium. Externally, the tanks are coated with thermal insulation to avoid rapid heating of the cryogenic propellants.

Figure 3: Stages of A-4 [15]

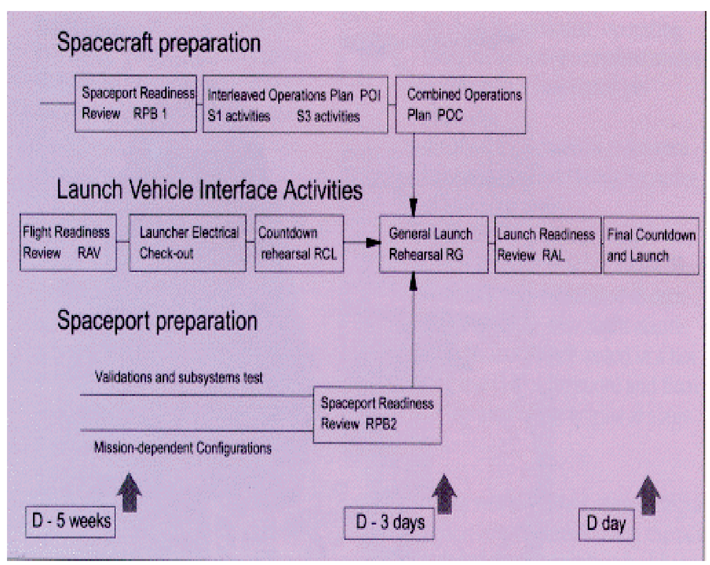

Figure 4: Preparation of the activities. [18]

The liquid strap-ons (called L40) are essentially Viking-VI engines with two identical separate steel tanks. Water for the Viking engine is supplied from the first stage's central tank.

After burnout, the strap-ons are released by pyrotechnic cutting devices and jettisoned by small rockets. The solid strap-ons called P9.5 are derived from the A-3 solids by increasing propellant mass by 30%. Each strap-on is jettisoned after burn-out by a system of four strong springs. Explosive cords fitted into the rear skirts of the second and the third stages separate the A-4 stages. The stages are moved away from each other by retrorockets mounted on the lower stage. Acceleration rockets fitted to the upper stage maintain a small acceleration in order to ensure homogeneous propellant flow to the engine during ignition. The inboard computer initiates separation of the first and second stages, when the inertial guidance platform detects half-thrust decay in the first stage due to depletion of one of the propellants. The inboard computer also initiates separation of the second and third stages, when the increase in velocity (due to the second stage) thrust has reached a pre-determinated value. Approximately 100 European industrial companies manufacture the A-4 launcher. Seven firms under the supervision of A-Space play the role of main technical contractors. The firms are Aerospatiale, Daimler-Benz Aerospace, SEP a division of Snecma, Fiat Avio, Matra Marconi Space, CASA and Oerlikon Contraves. It is important to point out that French manufacturers are assigned the largest portion of work, a 46.2% share. Germany is the second largest A-4 program participant, with 22.76% share. Other countries involved in the A-4 production are Italy (15.02%), Spain (3.66%), the United Kingdom (3.57%), Switzerland (3.05%), Finland (2.23%), Belgium and The Netherlands (with 1.54% each), Sweden (2.0%), Norway (0.6%), Austria (0.4%) Denmark (0.34%), and Ireland (0.2%).

3.2 Launch Campaign of the Ariane-4

From the moment a vehicle is ordered to the end of the mission, a launcher has a lifetime of about three years. In fact the manufacturing of the three stages takes about 30 months, the liquid boosters take 20 months and the solid boosters take 18 months. It takes 22 months to build the vehicle equipment bay and 28 to build a Viking or a HM7 engine. The launch campaign can be defined as "the art of tuning three different instruments: the satellite preparation activities, the spaceport support and the launch vehicle preparation."[18] (Figure 4). The responsibility of preparing a satellite for orbit ultimately falls on the launch service customer, which uses several logistic and technical supports from the spaceport. The launcher is assembled and checked by industrial teams under A-Space management. A typical launch campaign starts about nine weeks prior to the launch. It begins with the transportation of the vehicle's parts, from France to French Guiana. All vehicle hardware and propellants are stored in special containers and loaded on board at Le Havre. It takes ten days for the ship to cross the Atlantic from to Cayenne. Upon arrival the launcher and propellants are transferred by road to the launch site. At the CSG, the campaign activities start approximately six weeks before launch with the arrival of the satellite and of the launcher parts.

3.2.1 Erection, Verification and Assembly

The complete stages are integrated and checked out step by step during the launcher preparation campaign. In the Vertical Assembly Building (VAB) the vehicle is erected on the mobile launch table and liquid strap-ons are attached, if required. This process takes about four weeks. Payload processing occurs at the payload preparation complex known as EPCU, which consists of a number of geographically dispersed buildings: (a) Building S1A and S1B located at the CSG technical center, provides clean room facilities for satellite preparation. A-4 is topped off with the payload fairing; prepared in this condition to avoid any risk of contamination to the payload. (b) Building S2 and S4 are designed for solid kick-motor preparation and X-ray operation. (c) Building S3A and S3B are assigned for satellite propellant filling operations and final integration, assembly of the satellites on a SYLDA or SPELDA, and satellite encapsulation into the A-4 nose fairing. The Combined Operations Plan (POC) takes place. (d) Building S3C is used to monitor and control hazardous operations conducted in S3B.

The VEB structure, the SPELDA, the payloads, and the fairing in the case of a dual launch, are transported to the launch pad, and installed on top of the vehicle five working days before launch. Two weeks before launch the assembled vehicle is rolled out to the launch pad. The vehicle is mounted on a mobile table and pulled by a truck for about 50 minutes along a rail track 1 Km. long to the pad. A-Space executes this operation with support from the CSG services, which include security and transport coordination. Once the vehicle reaches the pad solid strap-ons are attached if required.

The Mission Control Room (MCR) monitors information coming from remote, specialized center (launcher firing room, spacecraft checkout, meteorology, safety, tracking and telemetry stations, telecommunications) and assigns the final launch authorization. Two days before launch, the Launch Readiness Review (RAL) authorizes the start of the countdown.[18] The launch countdown involves filling the stages with propellants, taking approximately 38 hours, distributed over three days. Several radio and electrical interface tests with the Spaceport systems (tracking, telemetry, and flight safety) are also performed to verify the correct operation of all launcher-to-ground links. A launcher countdown rehearsal (RCL), including filling the third stage with cryogenic propellants, is performed on the launch pad. Table 1 shows how these activities are distributed.

Table 1: The Launch Campaign Day by Day [19]

Days Before Launch	Activity
31	Start of the launch campaign per se. Erection of first stage.
30	Erection of second stage
29-26	Erection of liquid boosters
25	Erection of third stage
13	Transfer of launcher to launch zone
9	Launcher countdown rehearsal
4	Final preparation of the launcher, the Satellites, of the launch facility ELA-2 and the CSG
3	Filling of first stage, second stage, and liquid boosters. Dress rehearsal
2	Launcher readiness review and arming of launcher
0	Launch countdown

During the last six minutes before launch initiation, the ground checkout system verifies the proper functioning of the vehicle. It also separates the propeller transfer arms from the third stage five seconds before the end of the sequence, and finally commands ignition of the first four first stage engines and of the liquid propellant boosters. This synchronized sequence at six minutes before the launch is also used for final operation and flight configuration of the launcher. The sequence is fully automatic, and is controlled in parallel, up to five seconds before the launch, by two computers in the Ariane Launch Center (CDL). One computer configures fluids and propellants for flight and performs associated checks. The other computer executes final preparation of the electrical systems and corresponding checkout operations. Any hold in the synchronized sequence before the countdown reaches five seconds to lift off, will automatically reset the launcher to the six minutes configuration.

Table 2: Launch countdown [19]

Hours Before Launch	Activity
16h 40m	Start of launch countdown
5h 30m	Withdrawal of servicing tower
3h 35m	Start of third stage filling operations
1h 5m	Actuation of telemetry, radar and launcher telecommand systems
6m	Start of synchronized sequence
3m 30s	Satellite on-board power supply on
1m	Launcher on-board power supply on
9s	Unlocking of inertial platform
5s	Unlocking of cryogenic arms
0	Ignition of first stage and liquid booster engines

During lift off, the CSG (Table 3) keeps track of a group of events in order to guarantee the success of the mission. After the cryogenic arm is retracted from the launcher, the synchronized sequence delivers the main timing pulses for first stage and liquid boosters engine ignition as the engine parameter checkout is conducted in parallel by the two computers, starting at + 2.8 seconds. Opening of the launch table clamps occurs between + 4.1 and + 4.6 seconds as soon as engine parameters are found nominal by one of the computers.

Table 3: During Flight [19]

After Launch	Activity
4.4s	Lift-off
16s	End of vertical climb and beginning of tilt
2m 29s	First liquid booster jettison
2m 30s	Second liquid booster jettison
3m 33s	First stage separation
3m 36s	Second stage ignition
4m 8s	Fairing jettison
5m 44s	Second stage separation
5m 49s	Third stage ignition
6m 20s	Acquisition by Natal ground station (Brazil)
12m 10s	Acquisition by Ascension Island ground station
16m 45s	Acquisition by Libreville ground station (Gabon)
17m 50s	Third stage burn-out
17m 52s	Injection into geostationary orbit
20m 53s	First satellite separation
21m 58s	Separation of Spelda top
25m 19s	Second satellite separation
25m 26s	Third stage satellite-avoidance maneuver
28m 10s	End of mission

3.3 Performance of the Ariane Vehicles

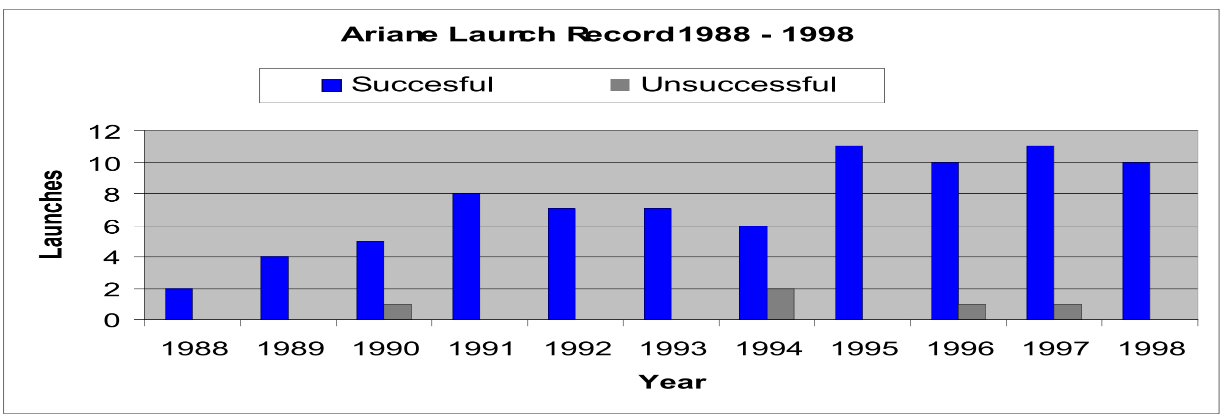

Figure 5 : Ariane Launch Record from 1988 to 1998

A-Space is the international leader in commercial launch services, and today holds more than 50% of the world's market in satellites launched to (GTO). Since the first flight of an Ariane in 1979, the program has successfully launched into space more than 150 satellites and 25 auxiliary payloads into orbit. The A-4 has proven to be a very reliable launcher and is considered a reference for the aerospace industry. A-4 continues to be A-Space's primary vehicle. A-4 (Figure 5 and Table 1) has a launch success rate of 96%. In 1995, the program had one of its best years ever, with a total of 11 A-4 successful launches. This was virtually repeated in 1996 and in 1997 since A-Space again reached its highest level of successful launches, with 11 in total. Eleven launches were forecasted for this year; table 4, indicates launches of the A-4 Vehicle during 1998. Table 4 also exhibits a wide range of customers using A-Space's service. Companies from all over the world have contracted the services of A-Space.

Furthermore, this table indicates that all six version of the A-4 have been used to satisfy customer's needs.

Table 4: Performance of the Ariane from 1/98 to 12/98 [16,17]

Date	Vehicle	Site	Payload	Mass (Kg.)	Note
2/4/98	Ariane 44LP	Kourou ELA-2	Brazilsat B3 Inmarsat 3-F5	1,750 1,980	Telecommunications satellite produced by Hughes Space and Communications for Embratel of Brazil. Mobile communications satellite produced by Lockheed Martin telecommunications for Inmarsat.
2/27/98	Ariane 42P	Kourou ELA-2	Hotbird-IV Skyplex (Eutelsat)	3,000	Matra Marconi Space-produced direct-to-home television broadcast satellite for the European Telecommunications Satellite Organization;
3/24/98	Ariane 40	Kourou ELA-2	SPOT-4	2,755	Built by Matra Marconi Space for the CNES for earth observation
4/28/98	Ariane 44P	Kourou ELA-2	NILESAT 101 and BSat-1b	3,096 (both)	The NILESAT is a communications satellite built by Matra Marconi Space to provide direct-to-home television and radio services to Egypt and its neighboring states. Hughes Space & Communication manufactured the BSat-1b which will be used for the broadcast of digital TV for NHK, Japan
8/25/98	Ariane 44P	Kourou ELA-2	ST-1	Not provided	ST-1 satellite built by contractor Matra Marconi Space, is a communications satellite to serve Asia
9/16/98	Ariane 44LP	Kourou ELA-2	PAS-7	3,838	PAS-7, is a SS/Loral FS-1300 satellite built for PanAmSat to broadcast digital television to Europe, Africa, and Asia.
10/05/98	Ariane 44L	Kourou ELA-2	W2 and SIRIUS-3	2,950 1,420	W2, EUTELSAT's telecommunications, and television satellite built by Alcatel Space Industries. The Sirius-3 is a Hughes Space & Communication satellite and built for Nordiska Satellitakttiebolaget (NSAB) from Sweden.
10/21/98	Ariane 5	Kourou ELA-3	ARD and MaqSat-3	2,730 (Total)	Qualification flight for the A-5. It carried the Atmospheric Reentry Demonstrator (ARD) used to test new technologies and flight control capabilities during atmospheric reentry. MaqSat-3, is a mock-up satellite, fully representing a real communications spacecraft.
10/28/98	Ariane 44L	Kourou ELA-2	AFRISTAR and GE-5	2,739 1,719	AfriStar a WorldSpace digital radiobroadcast satellite built by Alcatel Space Industries. AfriStar will provide digital audio, text, and image transmission services to Africa and the Middle East. GE-5 satellite provides television coverage and wide-band data services to the continental U.S. and southern Canada
12/06/98	Ariane 42L	Kourou ELA-2	SATMEX-5	4,144	SATMEX 5 is a satellite built by Hughes Space & Communications to provide telecommunications services for the private Mexican company SatMex S.A. de C.V.
12/22/98	Ariane 42L	Kourou ELA-2	PAS-6B	3,674	The PAS-6B, is a communications satellite built for PANAMSAT. This is the 41st successful mission in a row and also sets a record for the most satellites (16 in total) launched into orbit in one year.

The A-4 program has also experienced launch failures, the most recent failures occurred in 1994, one in January and the other in December. The first one used an Ariane 44LP and carried the Eutelsat 2-F5 and Turksat 1 satellites. In the second mission they used a 42P and carried the PAS-3 communications satellite, in both missions the payloads were lost.

4. Ariane-5, The Launcher for the 21st Century

Despite A-4's remarkable performance, A-Space has begun testing a new launch vehicle, the A-5 (figure 1). This new vehicle was designed to gradually replace the A-4 launcher, which is not large enough to continue achieving dual launches. The objective of this launcher is to make the Ariane series more competitive by improving performance, reducing launch costs, raising the reliability rating, and by increasing the diameter of the space available for satellites under the fairing. Furthermore, A-Space has another goal they wish to accomplish that is to use this new vehicle to launch Hermes, which is ESA's version of the shuttle. An A-5 launch will actually cost less than a launch performed by A-4. What's more, the new launcher can carry heavier satellites while providing reliability. A-5 will also provide Europe access to low Earth orbit for service missions to space infrastructures like the international space station.[09] A-5 is designed to carry single or multiple payloads, just like the A-4. For multiple satellite missions, A-Space has designed an additional structure called the "Structure porteuse externe pour lancements triples Ariane" (Speltra). This structure is a large unit that accommodates a big spacecraft, typically in the 3,000 to 4500 kg. Speltra is a cylinder with a usable interior diameter of 4.57 meters for the payload. A truncated cone on which another satellite payload is installed tops the Speltra. A short version of Speltra is also available. On missions when the Speltra is used, the unit is installed on top of A-5's vehicle equipment bay. The Sylda-5 also is offered as an A-5 multiple payload structure. The Sylda-5 is smaller than Speltra, and is sized to accommodate satellites with lower mass.[8]

5. Conclusions

The Value Chain Analysis is an instrument that can be used to study where the competitive advantage of a specific product manufacturer rests. This tool not only allows the evaluation of every activity carried in the production of a launcher (as in the case of the Ariane program), but also has the capability of evaluating other factors not directly related to the manufacturing process; such as: marketing strategies, geographical location and performance. Furthermore, the Ariane program has managed to keep a large share of the market despite the intense competition to conquer this market of communication satellites placed into GTO. The dominance and success of the Ariane Program is evident in their wide variety of customers (from every part of the world) who require their services. It can also be concluded that ESA is preparing for the future; A-5 and the other projects they have engaged in are geared to comply with the needs (of the segment) of the market they represent.

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