



Toulouse Business School  
MSc Aerospace Management  
Promotion 2022

# **The entry of GAFAM in the New Space**

End of study dissertation presented by

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## **Acknowledgments:**

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I would like to express my gratitude to all the people who invested in this thesis, I would like to thank them for their valuable help, advice and the time they spent with me.

I would also like to thank all the participants in my research and for the attention they have given to it.

And finally, a big thank you to my family and friends for their help and support throughout this thesis.

Thank you

## **Executive Summary:**

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This paper presents each actor within GAFAM and their different ways of entering New Space.

Strongly regulated, expensive barriers to enter and a primary area for scientists, military and governmental companies, space was always coveted by the most brilliant minds but only a few ever had the privilege to experience space.

Today, we are shifting from this perspective as more and more private companies from all around the globe are entering the New Space and developing new business ideas and sustainable methods.

We are shifting from a linear economy to a circular economy with a cooperation between public and private companies.

In this thesis, we will, at the very first, define what we mean by New Space and GAFAM. Then we will understand why space was dominated by public firms, which the barriers were in place and new applications like reusable launchers and satellite constellations.

Secondly, our focus will be on the five main American companies that are entering the New Space, the GAFAM. To establish themselves as world leading companies, GAFAM are using many methods like acquisitions, the use of patents and donations to gain political favours.

Thirdly, and this is the focus of our research question, that we will answer: what are the different approaches that GAFAM are using to enter the New Space?

From satellite constellations like Kuiper, the use of ground stations for AWS or Azure Orbital and collaborations with Airbus, Boeing, Space X and many more.

And lastly, we will compare our results with few European Space Agencies to understand what their vision of space is. From there we will draw a conclusion, observe any limitations and find managerial recommendations and innovative future applications.

## **Key words and abbreviations:**

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GAFAM / Big Five:	Google, Amazon, Facebook, Apple, Microsoft
New Space:	Private space industry driven by commercial motivations
NASA:	National Aeronautics and Space Administration
ESA:	European Space Agency
CNES:	Centre National d'Etudes Spatiales
USD:	U.S. Dollar (all numbers are in USD)
DSA:	Digital Service Act
DMA:	Digital Markets Act
OSMA:	Office Safety and Mission Assurance
LEO:	Low Earth Orbit
ISM:	In-space manufacturing
AI:	Artificial Intelligence
Big Data:	Useful Grey Data
IP:	Intellectual Property
EO:	Earth Observation

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# **Introduction**

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## **I.1 Problematic**

*“It's a very sobering feeling to be up in space and realize that one's safety factor was determined by the lowest bidder on a government contract.”*

-Alan Shepard (1961)<sup>1</sup>

Alarming words from the first American to travel in space and walked on the moon as Commander of Apollo 14.

Safety and security standards are a priority to every space mission with a meticulous training of the astronauts and multiple checks of the equipment with strict standards. The agency's Office of Safety and Mission Assurance (OSMA) is doing their best to ensure the safety and enhance the success of every NASA activity.

Nonetheless, what Alan means is, those missions are always on the edge of a critical failure.

Even with the best intentions and regards, we are not only limited by what is technological feasible and doable but also crippled by the mercantile approach of space.

In the 1980's, the early days of shuttle flights, the risk of a catastrophic disaster during a space shuttle flight was 1 to 9.<sup>2</sup>

In 2011, when the shuttle was retired, the risk dropped to 1 to 90.

Space X Dragon Crew Capsules is 3 times safer than the shuttle in its final year.

To enhance the chances of survivability and reduce the risk of a catastrophic disaster, NASA has created the Agency level Apollo Challenger Columbia Lessons Learned Program (ACCLLP). This program is to ensure that previous errors do not only get forgotten but also actively and innovatively integrated into its future endeavours.<sup>3</sup>

NASA is sharing their results not only with the aerospace community but also with diverse players beyond that line.

But what if a company does not share all their results? What if a company has such a political and economic might that it does not need to bend and address certain privacy issues? What happens when superpowers like GAFAM are entering the New Space?

The entrance of the giants of the telecommunications and navigations, the GAFAM, is giving a new vision and direction of the space economy. With huge investments in research and development and vertical/horizontal integration, the GAFAM, are stepping in fast in the space sector.

But what could be the reasons for the GAFAM to enter the space sector ? Far from their niche, what did push the GAFAM to do it now, knowing that there are huge barriers to enter ? And the most important, which different approaches are GAFAM using to enter New Space ?

## **I.2 Purpose and structure**

My interest for this thesis is to know and understand which approach the GAFAM used to enter New Space and why ?

There are many master dissertations about the entry of GAFAM in the New Space but barely one thesis discusses about the different tools and methods used to enter New Space.

This will help to understand not only why GAFAM are entering exactly now at that time which can be helpful for other companies and managers to jump on the train and profit from the relatively early stage of this market.

But also, to understand which mechanism GAFAM are using to avoid or limit the barriers of entry and huge implementation costs of the space sector. Other companies could do the same and like NASA's ACCLLP, avoid previous errors and trust issues the GAFAM could create.

In this thesis, we will, at the very first, define what we mean by New Space and GAFAM. Also, we will have a brief insight of how humans operated in space, before the era of New Space.

Secondly, our focus will be on the five main American companies that are entering the New Space, the GAFAM. We will have an in-depth analysis of how the GAFAM proceeds to establish themselves as world leading companies.

Thirdly, and this is the focus of our research question, that we will answer: what are the different approaches that GAFAM are using to enter the New Space?

From the tools used to the different business models and methods, the GAFAM have a very different approach to enter space.

And lastly, we will compare our results with few European Space Agencies to understand what their vision of space is. From there we will draw a conclusion and find innovative recommendations for the future.

## **1. New Space: explanation and definitions**

### **1.1 Definitions**

First things first, we have to understand exactly what is meant in the subject. So, I will give a definition for the two main points

GAFAM:

*The term GAFAM is used in the field of economics. It is an acronym formed from the initials of the names of five large American companies, often referred to as web giants: G for Google, F for Facebook, M for Microsoft and the two A's for Apple and Amazon.*

*The GAFAMs are global companies, reaching billions of users and processing a phenomenal amount of data. They also play a significant economic and financial role on a global scale.*

*They own and control several widely used social networks and web services, such as LinkedIn (owned by Microsoft), YouTube (owned by Google), Instagram and WhatsApp (owned by Facebook).*



- Le dictionnaire Orthodictate<sup>4</sup>

New Space:

*The New Space refers to a space industry born in the United States. Its development is favored by an American legal framework adapted to commercial space activities which considerably increases the accessibility and attractiveness of space. Contrary to what it suggests, the expression "new space" does not designate a renewal but an opening up of space to new players and an extension of the field of application of space technologies.*

*In fact, it translates into the privatisation of access to space and the arrival in the space economy of players from Silicon Valley and the GAFAM (Google, Apple, Facebook, Amazon, Microsoft). These new entrants in a sector of activity that was previously reserved for States and public institutions are bringing innovations and technologies from other sectors such as digital, Big Data or aeronautics to the traditional space sector.*

- Futura sciences<sup>5</sup>

## **1.2 Previous market leaders**

Why is the entry of GAFAM in the new space such a thing ?

To understand the importance of this shift of power in space, we have to take a look at how it was before. How space was managed and how corporations and countries wanted to conquer space.

The main difference, is that space was dominated by a legacy of combat. Space was reserved for the military and scientists, which left little room for innovation.

Starting from the cold war, in a time of political hostility between the Soviet Union and the United States, the two superpowers have been competing to develop intercontinental ballistic missiles (ICBMs) who could carry nuclear weapons between continents.

With the launch of Spoutnik, the U.S. realized that the U.S.S.R. had capabilities that could exceed U.S. technologies and endanger American citizens.

In 1958, American space exploration activities were consolidated and the National Aeronautics and Space Administration (NASA) was created.

President John F. Kennedy challenged the United States to an ambitious goal by declaring:

*"I believe that this nation should commit itself to achieving the goal, before the decade is out, of landing a man on the moon and returning him safely to Earth."*<sup>6</sup>

This is the beginning of the space race and the emergence of public governmental entities that have been created over the years.<sup>7</sup>

Those entities are NASA (1958), ESA (1975), CNES (1961), ROSCOSMOS (1992), DLR (1959) and CNSA (1993), by naming the biggest ones.<sup>8</sup>

Still, there were long lead times to innovate new launchers or satellites.

With the arrival of private companies, the sector underwent a change that accelerated efficiency by breaking out of its niche, even its compartmentalization.

But, the idea of space entrepreneur is not new, it has just seen now a rise in success.

In the 1990's there were already many companies trying to establish themselves in the aerospace sector. Kistler Aerospace and Space Island Group were one of those companies that tried to create business in space. But at that time, the space industry was not ready as there were no legal or governmental processes / frameworks in place to support space entrepreneurship.

In the 2000's, Space X with its ingenious rocket launchers was a good system, NASA opened new contracts for Space X.

The good lobbying methods and tactics of Space X did push and forced NASA to implement new procurement processes and competitions which supported space entrepreneurship in way

which had not been done before. This allowed Space X to enter the sector and rival decades old incumbents such as United Launch Allianz (ULA) and Arianespace in only a few short years.

In the 2010's, the influx of money from the Silicon Valley was astonishing and it marked a new shift in the mentalities. Companies are learning quickly how to shift their approach from one of caution and step by step certification to that of rapid prototyping and "failing fast".

And finally in the 2020's, those mentalities and technological advancements have seen a normalization. What seems to be impossible 30 years ago, is now doable at a fraction of the original price. NASA has created a business push by being a start-up and business friendly organization. With new business incubators centres and loosening up regulations and requirements that were too much time consuming, NASA made the whole environment way more favourable for innovation and gave a huge momentum to the New Space.

And this leads to the point we are now, barriers that are not insurmountable anymore which are leading to the entry of GAFAM in the New Space.

But what could be the interest of GAFAM in space? Which new applications and usages are now in space?

### **1.3 Future applications in space**

Each year, earth is facing more droughts, extreme weather phenomena's, economic insecurities and the biodiversity is getting reduced at an alarming rate. It's getting clear that humanity's situation on earth is becoming more and more precarious.

We have massive issues on the ground and going to space is expensive, so it is legitimate to ask the obvious question: why do we spend all that money in space ?

The nature of humanity, the drive to excel and that made us the dominant species on earth, pushing the boundaries to the imaginable. If we want it to stay that way, space exploration is vital.

*“Space exploration isn’t simply a sign of humanity’s hubris or a brazen desire to find new places to live and new sources of wealth. If we take the risk of venturing beyond our terrestrial home, it’s also to learn more about ourselves and our planet, improve life on Earth, and maybe, just maybe, find or create a new future for our children”<sup>9</sup>*

-Walter Cugno, Vice president in exploration and science domain, Thales Alenia Space

Space exploration helped us to test scientific theories developed on earth. The studies on our solar system have brought us insights on gravity, the atmosphere and the geological evolution of other planets to name a few.

Space exploration has led to innovations ranging from metals and alloys to biology and medicine. With unique conditions that are difficult to replicate on earth, many materials are tested in space to develop and manufacture stronger, lighter and high-performance products that we use nowadays during our daily life. Smoke detectors, purification systems, ceramic coatings and scratch resistant glass are all results of space exploration.

And at last, we are explorers.

*“Exploring space is an opportunity not only to discover new worlds and build advanced technologies, but to work together toward a larger goal irrespective of nationality, race, or gender. If we stop exploring, we stop being human.”*

-Ryan Whitwam, Science and technology journalist

But still, why are the GAFAM interested in space ?

Let’s have a look on the milestones that are already in place and those that will be, for a smoother and cheaper exploration of space and in the same time, the monetization of space and the profit of up- and downstream industries.

Let's begin with the launchers and the launch costs. Reusable rockets have drastically reduced the price of putting a satellite into orbit. To keep up with the high demand of launches for satellite constellations and small-sats, launchers are now produced on an industrial scale and the launch costs are expected to decline even further by 40% with reusable vehicles.<sup>10</sup>

The development of superheavy launchers by major players designed for moon or mars missions will accentuate an even easier accessibility to space for new entrants. It goes the same for the other way around. The development of micro launcher systems by new entrants is being pushed by a promising market for the delivery of small-sats. There are currently more than 100 micro launchers projects operated by new entrants and supported by local agencies.

The fierce competition has led to new innovations in terms of fuel. Liquid oxygen and methane as propellants will be translated to significant gains like simpler and lighter launch designs and reusable-friendly engines.

The next application that does impact the space sector is satellite internet with the use of satellite constellations. Those companies are focusing on improved connectivity through low earth orbit (LEO) satellites, wireless broadband, optical communication and other technologies.<sup>11</sup>

A constant and flawless internet connection is a must for modern companies and inhabitants, where the connectivity reflects the sociability.

Earth observation is a long-established domain and it is now experiencing growth and an interest boost as well as key disruptions. The end users and applications are multiple, from public entities to industries and from weather forecast and GPS technology to the management of energy resources and military and defense.

With a vertical integration, data providers are becoming analytics providers. The access to computing power and storage capacities are becoming cheaper thanks to cloud technologies. And what is more, satellite data providers are switching to a subscription-based business model.<sup>12</sup>

Deep space exploration and the will of some people to colonize other planets has led companies to develop high level missions to transport human and cargo beyond earth's atmosphere.

Space manufacturing will be a large segment of the space economy.<sup>13</sup>

Having the ability to perform in-space manufacturing (ISM) enables a solution for on-demand fabrication, maintenance and repairs. It also enables the possibility of flexible missions like the recycling capabilities for critical systems or habitats.

Another application is space tourism.<sup>14</sup>

A few companies are developing access to space for private citizens, space explorers and space programs. Unthinkable a few years ago, space hotels will exist at the end of the decade. Even now the prices are exorbitant, a space ticket could see its price tag drop by a lot.

A last application, but for now, a little far-fetched, is asteroid mining and space mining in general.

Disruptive companies are developing technologies to extract water, rare minerals and metals from near earth asteroids.

As humans continue their inexorable upward climb, our natural resources continue to decrease. The extraction of valuable minerals and resources leads to issues including environmental damage and human exploitation. Mining asteroids instead of earth would mean an unlimited supply of raw materials.

Those are all possibilities for future application in space and it gives a little glance at how space economy could be designed like. Still, most inventions were not invented on purpose and were the side product of something else, so there are surely many more applications to come. GAFAM is using or is trying to make use of most of those applications.

Let's dive now into GAFAM and learn the insights of the companies

## **2. An overview of the entities**

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### **2.1 Numbers and facts**

For millennia, governments ruled the world. Today, political leaders are still considered by most as the highest sphere of power.

Yet, in reality, the tech giants are constantly gaining in influence and might.

Also referred as the “Big Five”, their tool for dominating the world is Big Data and thanks to it, GAFAM have become more powerful than governments.

Sitting on their mountain of data, the GAFAM are building a global empire which covers the whole planet and reaching even the most remote regions. They fascinate, amaze, worry and shake the greatest world leaders thanks to Big Data and Artificial Intelligence (AI) and here is why:<sup>15</sup>

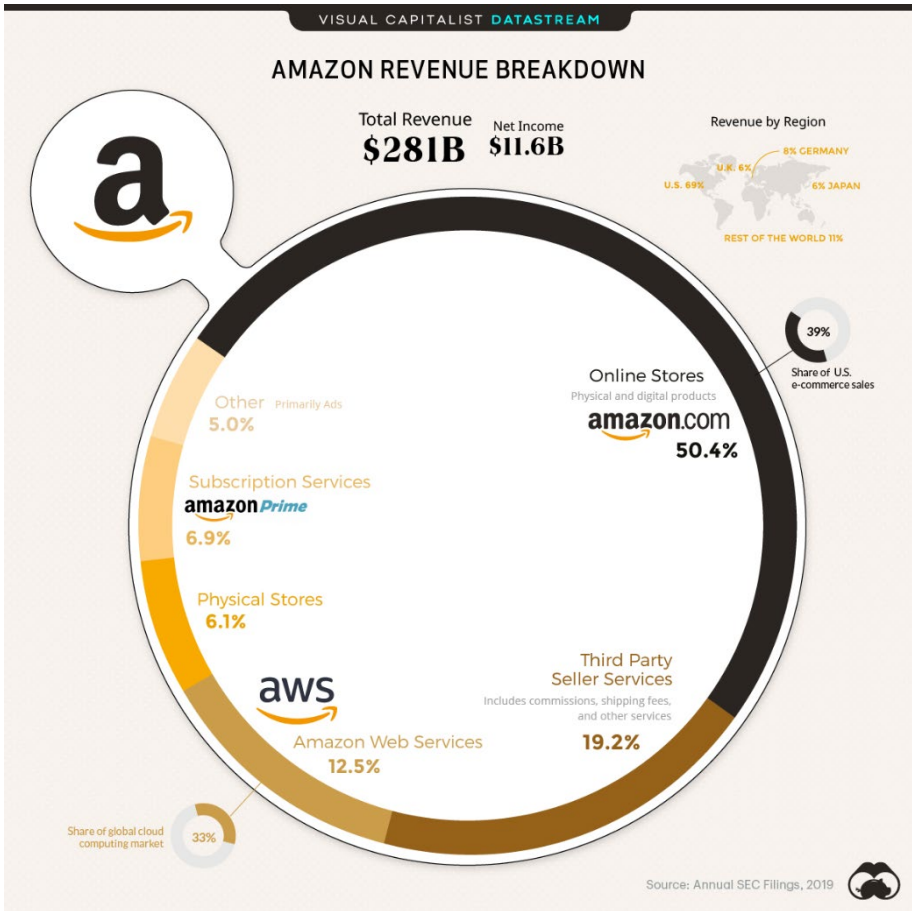
The “Big Five” reach a market capitalization of 8 trillion USD, they are all listed on NASDAQ and they are all among the top 10 most highly rated American companies. Their market capitalization has doubled from January 2019 to July 2020.<sup>16</sup>

That sum is higher than the combined GDP of Australia, Canada, England and France together, which are four of the world’s wealthiest countries. That market capitalization is also 2 times the GDP of the whole African continent.

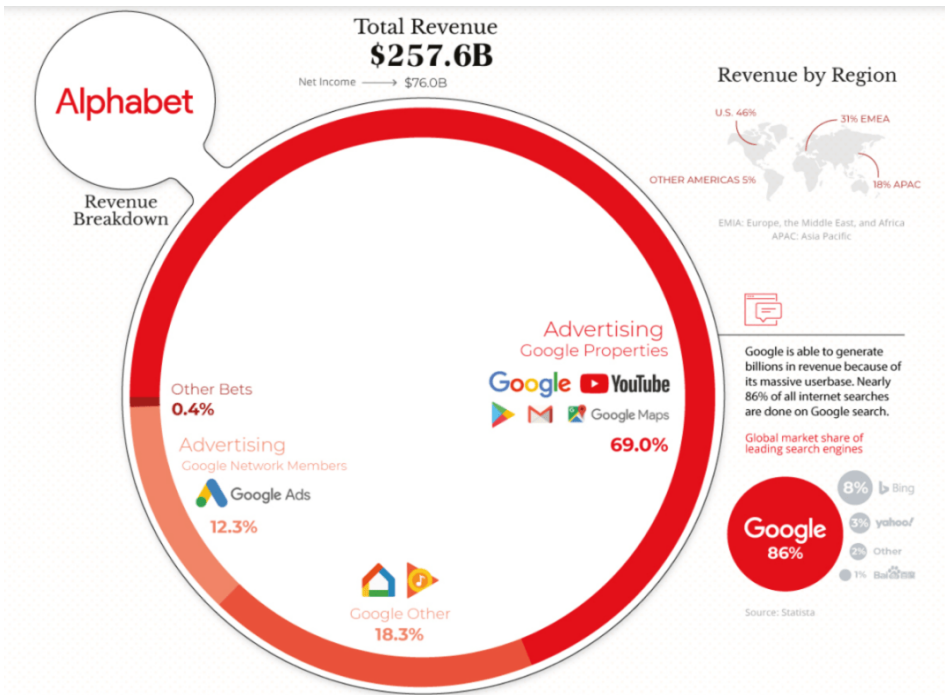
GAFAM generated in 2021 1,4 trillion USD in revenue. That’s more than the GDP of Brazil and its 220 million inhabitants.

Amazon, Apple and Google are on the top 10 most profitable companies in the world.

Let me show you a revenue breakdown of those 3 companies. To keep the comparison even, I took the data of 2020 because 2021 was still not available for all of them.<sup>17</sup>

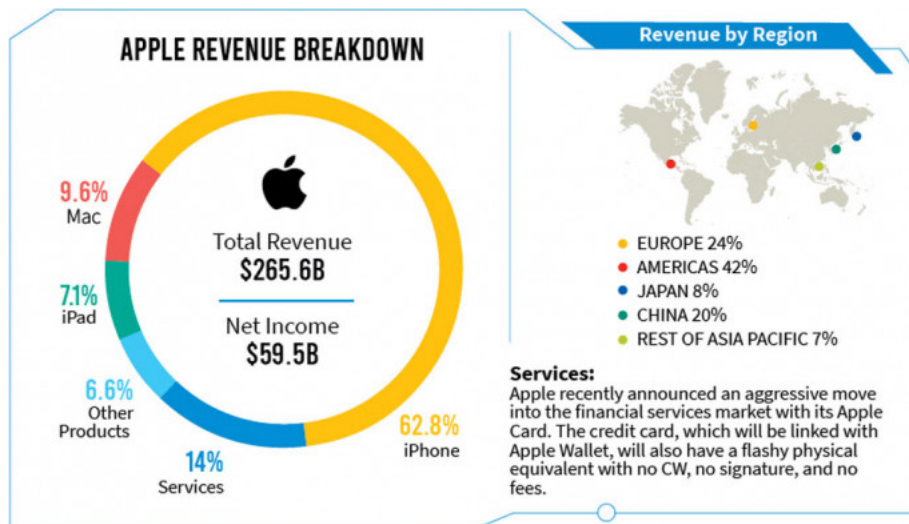


X.1 Amazon revenue Breakdown



X.2 Google Revenue Breakdown





### X.3 Apple Revenue Breakdown

With Covid-19 and the explosion of e-commerce and the consumption of multimedia content, the “Big Five” have seen their market capitalization and revenues jump even more:

Amazon’ total revenue in 2021 is 469 billion USD and a net income of 33,4 billion USD

Apple’ total revenue in 2021 is 365 billion USD and a net income of 94,5 billion USD

Google’ total revenue in 2021 is 260 billion USD and a net income of 76 billion USD

Microsoft’ total revenue in 2021 is 170 billion USD and a net income of 61,3 billion USD

Facebook’ total revenue in 2021 is 117 billion USD and a net income of 39,4 billion USD

The acronym “Big Five” was coined by Goldman Sachs due to the fact that those 5 companies make up as 25% of the value of the whole S&P 500 by market capitalization.

The oldest company of the “Big Five” is Microsoft, which was created in 1975. Apple is the second company and was created in 1980. Amazon in 1997, Google as forth in 2004 and at last Facebook, which came out in 2012.

What is more, due to the immense influence on their sector of activity, many investors see their actions as an index.

The GAFAM compete in several types of markets, including mobile and PC operating systems, computer hardware, software products and entertainment. GAFAM are also competing in futuristic fields such as AI, cloud and quantum computing.

Let's now have a look on how the "Big Five" have managed in the past, and in the future, to build an empire and stay on top of the food chain with acquisitions and different types of business models.

## **2.2 Business Models and Acquisitions**

The GAFAM have built their empire through hundreds of acquisitions of start-ups and companies. Those 5 giants all used the same pattern to dominate their environment. All started in a single sector of activity like web search for Google or e-commerce for Amazon. To establish themselves as world leading companies, the GAFAM extended to other domains and activities through merges and acquisitions.

Over the past decade, GAFAM consolidated an Internet oligopoly by merging or acquiring over 400 companies, from start-ups to potential rivals. Between 2014 and 2017, the "Big Five" integrated 250 companies from various sectors like the communications and digital hardware, same as the hardware and service sector. And from 2015 to 2017, GAFAM brought 175 companies into their holdings.<sup>18,19,20</sup>

Amazon is the largest e-commerce platform in the world. This was only possible with acquisitions of dozens of companies in this sector. In 2012, Amazon bought most of the cloud

computing start-ups and Amazon Web Services (AWS) in now a world leader in cloud industry. Now the company is aiming for the robotics, healthcare and autonomous vehicle sectors.

Apple acquired a lot of firms from domains like virtual assistant, software automation and health sensors. Originally developed by the Department of defense, Apple purchased Siri in 2010.

Since 2013, Apple established itself by acquiring 14 artificial intelligence, facial recognition and machine learning companies and managed to boost its income from services.

Apple also entered the music streaming sector in 2014 with the acquisition of Beats and the creation of Apple Music, just to compete and get market shares from Spotify.

In the first 6 months of 2019, Apple acquired 25 companies.

Google has also seen its benefit an income rising from acquisitions. From Android in the mobile operating systems to Google earth or Youtube, all those entities are acquisitions made by Google.

Since 2007, Google did the acquisition of around 30 artificial intelligence firms.

80% of the digital mapping business is owned by Google and it acquired its main competitor in 2013, Waze.

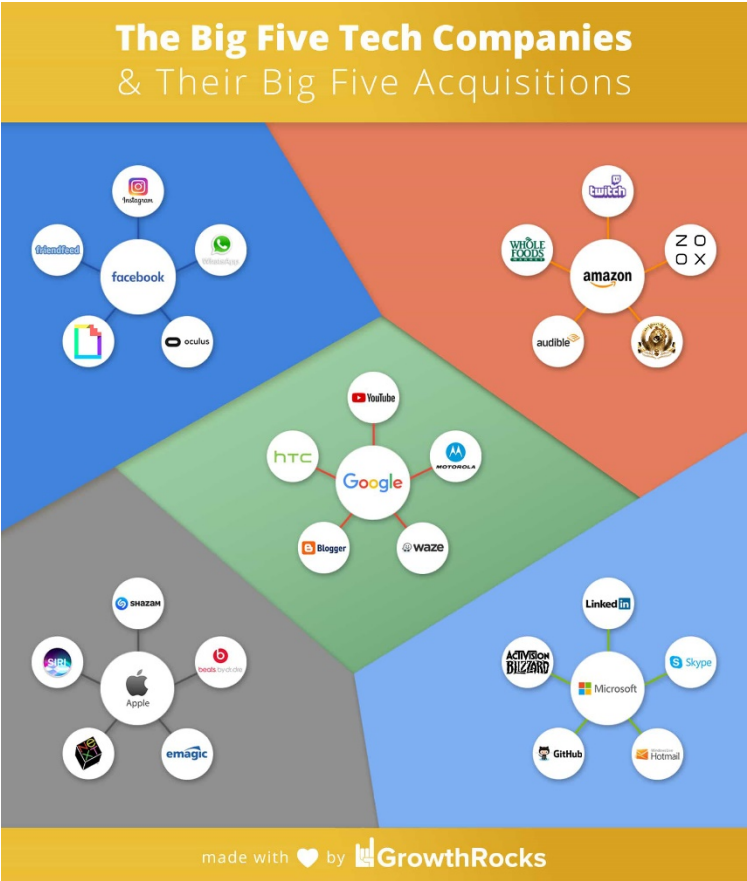
Despite investigations by regulators from around the world, Google continuous to grow by absorbing companies. To compete with Microsoft and Amazon, Google is also active in the cloud sector.

Microsoft is the oldest company of the GAFAM and purchased in average 6 companies per year since its creation in 1975.

In 2016, Microsoft acquired LinkedIn to have an access on massive databases and being able to compete with Facebook and Google in the data game.

In 2022, Microsoft acquired Activision Blizzard for 68,7 billion USD, which is one of the biggest acquisitions ever. Microsoft is famous for its operating systems and has also a long history in gaming, both as developer and publisher.

Facebook did establish itself in the social media sector as leader with the acquisition of WhatsApp and Instagram and the company has the same aggressive level of acquisitions as before and managed to acquire 70 companies since its creation but in 2022, no firm has been acquired yet. Facebook has changed its name to meta to reflect its focus on the upcoming metaverse.



X.4 GAFAM acquisition map

GAFAM are not only leaders in terms of acquisitions, but to keep a dominant place on the market, the GAFAM are making sure to have the highest visibility as possible by spending huge amounts in digital advertising.

Amazon, Google and Facebook take over half of the global market share of digital advertising spendings.

Google was in 2019 the largest ad seller and accumulated 104 billion USD in net ad revenues. Facebook came second with 68 billion and Amazon fourth.

Two out of three dollars spend for digital advertising in America went to those 3 entities.

Intellectual property (IP) and patents are methods used by GAFAM to fortify their dominance on the market. <sup>21</sup>

In 2019, GAFAM were some of the largest patent holders with Microsoft coming at top 5 with 29 800 patents, Google 14<sup>th</sup> with 21 000 patents and Apple 27<sup>th</sup> with 14 900 patents.

2020 has seen a record number of new patents coming from GAFAM.

A last method I found that GAFAM uses to do business and impose dominance and power is donations to political parties and scientific groups.

Google NetPAC and Microsoft Political Action Committee are supporting major think tanks, political candidates from both conservative and liberal parties with donations. This helps to implement GAFAM's public policy ideas.

From 2015 to 2018, over half a billion USD has been spent by GAFAM to flatter and persuade people working in the Congress to ensure that the governmental framework for digital age synced with their own.

Now that we know the immense force of GAFAM, their capabilities and willpower, it is inevitable that the "Big Five" are showing interest in the New Space. And the time has come. We are focusing now on how the GAFAM are entering the New Space.

### **3. GAFAM in the New Space**

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Each single entity in GAFAM have all different visions and approaches to space. Each firm has a distinctive satellite strategy that is influenced by a given corporate style, pre-existing relationships with other companies and differences in the strategic vision.

We will divide those strategies in 2 main objectives that those companies follow:

- Commercial satellite constellations that generates and provides lots of data, that need to be stored, processed, analyzed and commercialized.
- The expansion of computing power for direct connections between data centers and satellite broadband ground stations to increase the application speed and reduce latency.

Let's dive in those strategies and see the different approaches GAFAM are using to enter New Space.

#### **3.1 Google** <sup>22,23,24,25</sup>

Google doesn't have a huge space portfolio compared to Amazon or Microsoft but its strategy and relationship with space actors comes from a long-lasting investment in the sector, rather than a large business strategy.

Google invested for many years in specific domains of the space sector to level up its relationship with the companies already implemented.

From high resolution imaging satellites to artificial intelligence and computing power for the Cloud, Google is implementing itself slowly in the sector.

*"We work with some of our largest and most transformative customers to do something epic,"*

- Scott Penberthy, director of applied AI at Google Cloud.

Projects with NASA's Frontier Development Lab and Google Cloud aimed to take low-resolution photographs and when combined with AI, it created a high-resolution image. Same goes with the acquisition of Sky Box (later Terra Bella), which offers high resolution services.

CNES and Google had a partnership to launch stratospheric balloons which was called "Loon Project" to enable the access to internet to the most remote locations on earth. Sadly, this project did not lead to any success and was terminated.

Google invested just under 1 billion in Space X in 2015 to push the company forward. This is a segment of their long-lasting investment in the new space and it seems like Space X is the main partner of Google for the new space adventure. Google also gained a Space X board seat that it still holds.

Last year, Space X announced that its Starlink satellite broadband network would be connected to Google Cloud by putting ground stations at Google Cloud data centers.

Computing platforms and customers will reach Google Cloud in a single click from Starlink network which will reduce latency and improve the performance and security. Companies with a large geographic footprint like public sector agencies or the U.S. military will have access to low-latency high-speed broadband that connects them directly to Google Cloud resources.

Google Cloud and Starlink are selling the combination of their services to customers, more details are coming out this year.

This event might upset Microsoft because Microsoft announced in 2021 a partnership with Starlink to connect their satellites with the Azure Module Data Centers. More info in the section 3.5 of this thesis.

In 2012, so quiet some time ago now, Google invested in Planetary Resources, a company that develops technologies for asteroid mining. This doesn't mean that Google will go in the space mining business but with Google's moonshot philosophy, it is dream big or go home. The power of a vision did bring Google to invest 1 billion in a company that officially aims to colonize Mars.

## 3.2 Amazon <sup>26,27,28,29,30,31</sup>

Ever heard of “amazonification of space” ? This expression will slide in our daily life, the same as when you google something on the internet. Big tech players like Amazon have means and are resolved to spend as much as what is needed to impose themselves as leader and impenetrable market power. Their overwhelming presence could also distort the perspectives for start-ups who will be inclined to seek an acquisition as tempting exit.

Amazon has not been shy about its ambition and vision to be THE cloud provider for satellite companies. Among its aerospace customers, Amazon can count on Maxar, which owns a fleet of high-resolution satellites which are linked to Amazon Cloud. Another company is Spire which is a plane/ship tracking and weather data company and Capella Space which is a radar imaging satellite company.

Amazon Web Services (AWS) and its AWS ground stations is bringing satellite customers together. The AWS ground stations are enabling operators to send commands to their own satellites, to proceed data and to scale the next operations. The factor that grants Amazon such a massive success is that it lets the operators the control about the satellite without them having to worry about building or managing their own ground station infrastructure and the data can be downloaded anywhere. In terms of cost, it is an 80% cost saving for managing ground stations by paying only for the actual antenna time used.

Pre-processing data in orbit for earth observation(EO) missions facilitates downloading to ground stations and by doing so, AWS takes away some of the pain in receiving and processing data on ground and is therefore a valuable lever that businesses can rely on.

Another huge step that Amazon is making to enter the New Space is the Kuiper Project.

Unveiled in 2019, Project Kuiper is taking on Starlink and aims to launch an internet broadband satellite constellation of 3 200 small-sats. With investments of more than 10 billion USD coming from Amazon, the first satellites are planned to being launched later this year and the first service availability is planned for 2024. Starlink and Amazon are trying to get the most



market shares in India right now due to its huge market potential and an internet penetration of only 43% in 2020.

In April 2022, Amazon announced a partnership with Blue Origin, Arianespace and United Launch Alliance (ULA).

Blue Origin is another company founded by Jeff Bezos in 2000 and its aim is to reduce the cost to access space through reusable rockets. A moon lander “Blue Moon” is also expected to be ready in 2024.

On July 2021, Blue Origin sent its first crewed mission into space via its New Shepard rockets and spaceflight systems.

The next mission is planned for the 31th august but it won't be a crewed mission and its payload are 36 small-sats.

### **3.3 Facebook** <sup>32,33</sup>

Facebook announced a name change to “Meta” while elaborating on a new vision, the metaverse. A tree-dimensional space representation based on virtual and augmented reality.

A new artificial name that arouses interest, a modern and innovation-signaling logo and its CEO announcing that the company will radically change, such events can only be translated by something big that is incoming, something that will change the whole business, but...

I honestly don't know if its due Facebook algorithm in Google search engine or a company will, but I am completely unable to find anything about Facebook and its motivation to go to space. All my results in the search engine will redirect me straight to the Facebook webpage and, as we all know, there is nothing interesting to find. I don't know if Facebook is hiding its space intentions.

In the same time, this is weird hence the will of Facebook to create a metaverse that is only based on the instantly transfer of huge amount of data. Those data will be redirected to satellites and ground stations, so it seems difficult for me to understand why I can't find anything worth writing.

From previous thesis I could find that Facebook was working on a project called Athena, which an internet satellite that is supposed to provide internet to remote locations. The most recent information I found about it was in June 2018 and I didn't find any recent post about it, so it might still be in development phase, although it was supposed to be launched in 2019...

A last insight I found is that Facebook might support and develop a same program, that is from Airbus and it is a solar powered pseudo satellite called Airbus-Zephyr. I don't have much information about it also and I would take this information only by the tip of the fingers.

### **3.4 Apple** <sup>34,35,36,37,38</sup>

Same as Facebook, Apple does not publish a lot about its space pretentions.

But still, 2022 has been a fruitful year to get some insight about Apple's vision in space.

None of the information I found is official.

Apple did tease a few aspects during presentations of their new products. The information also comes from leaks from people working within Apple and from an interpretation of Apple moves and interest and the follow up is just a logical deduction of what could be coming.

The first rumor, but honestly I think it will be made official soon by Apple, comes from Globalstar.

An American satellite operator, that announced that they have been working with Apple since 2020 and that Apple already paid 300 million USD to buy 17 satellites.

Apple is considering to add satellite communication to its mobile phones and has already invested 430 million USD to assess the potential service Globalstar could provide.

But why Globalstar and not another company that is bigger or that has better infrastructures to accommodate all the technical requirements needed for such a plan?

Globalstar worked in the past with Nokia and Qualcomm, so they know how to work with big companies but in the last decade, Globalstar lost more than 1,5 billion USD and its stocks are currently trading at 1USD per share.

The reason why Apple chose Globalstar as partner is that their business provides low-bandwidth telecom services and they are licensed to operate on a valuable large spectrum. Those low-bandwidth are allowing the communication like text messages from Internet of Things (IoT) devices with satellites.

Globalstar also promises that they have the ability to seamlessly link affordable mobile phones to cell towers and satellites. This could be useful in areas with no or unreliable cellphone coverage and therefore satellite connectivity is useful in rural areas or while travelling for emergency message or location tracking. It might be also a thing for the future, when the number of space tourist will rise, Apple could be the only smartphone producer that provides connectivity on earth and in space.

But based on Globalstar current satellite network, it is highly improbable that they can offer the bandwidth for phone calls immediately.

Another leak, but I would only take it with the fingertips hence I don't know from whom this is coming and when it was published. The information comes from New Space Index, which is a website that lists most of the satellites constellations that are being build, are in development and those that could be build but nothing is decided yet. New Space Index also does market analysis of companies in the space sector. My point is that Apple is listed on this website and it has apparently the will to launch a satellite constellation for a space based cellular broadband.

This could be in fact the partnership of Apple with Globalstar and their ability to connect a cellphone immediately to a satellite.

On the 7<sup>th</sup> September 2022, the new Iphone series will come out (Iphone 14). This event organized by Apple has the “Far Out” slogan and Apple posted for the last 2 years an augmented reality “Easter Egg” on their website, where it was possible to visualize space via your Iphone or Ipad.

This could be a hint that Apple will bring out new technology that is directly linked with the ideas mentioned above or at least have a relationship with space.

And lastly, Apple co-founder Steve Wozniak has created a start-up called Privateer Space and it will be responsible for the clean up of space debris, tracking objects like space trash and active satellites to help avoid collisions.

### **3.5 Microsoft** <sup>39,40,41,42,43,44</sup>

Microsoft has also big intentions and pretentions about new space. Satellite broadband is now a key component to meet the needs of large and lucrative customers.

Microsoft Azure Orbital is taking on Amazon Web Services (AWS) ground stations by offering the same functionalities, enabling satellite operators to control their own satellite and download data without the need of having to build their own ground station facilities.

Unlike Amazon and Google, Microsoft is teaming up with several aerospace partners like KSAT, ViaSat, Kratos, SES, Airbus and Space X. The cooperation will profit Microsoft with a wider network of worldwide ground stations and to provide satellite broadband connectivity to the edge for company-class resources such as Microsoft Azure Modular Data Center. Microsoft and SES are also sharing ground stations to support the expansion of SES’s O3b mPOWER medium earth orbit (MEO) broadband network.

Microsoft is also working closely with the Department of Defense to collect data from an infrared imaging satellite to his Azure Cloud and proceeded to deliver the data to multiple endpoints using a ball-developed event driven software.

Another project is Microsoft Azure orbital Emulator, which enables simulations of satellite constellations using software and hardware. It will be used by developers who need to train and evaluate artificial intelligence algorithms involving satellite networking before launching those satellites. It is useful to accelerate the launch of satellites and it is already being used by many customers.

Microsoft is teaming up with Airbus to use SpaceEye, which can see through clouds and therefore enhance images taken from space. With the use of synthetic aperture radar, the radar data is unaffected by cloud cover and by combining it with historical images, an image prediction is generated by AI.

Thales Alenia Space is also a business partner for Microsoft because both are developing on-orbit computing technologies and this onboard the International Space Station (ISS) in 2023.

By deploying on-orbit computers, on-orbit application frameworks and high performance EO sensors to enable new on-orbit climate data processing applications. Both companies will work together on remote sensing, computer vision and climate science to develop the next generation of EO computing capacities and gathering faster and better data.

Both companies are also working closely together on AI and the project is called “DeeperVision” and which will be used for a quickly and systematically mass processing earth observation (EO) imagery. DeeperVision will also be running on the ISS using space edge computing capacities.

Microsoft is also working with NASA using AI to guarantee the astronauts more safety by automatically detecting damage in an astronaut’s equipment. An example is glove monitoring because gloves are often at risk of getting cut by micrometeorite shards.

Boeing is also involved with Microsoft to help to update the latter company’s infrastructure but I don’t know much more about it.

## **4. Discussions**

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As an aerospace student and being personally fascinated by space, I did not have much knowledge about GAFAM nor their will to enter New Space.

This thesis completely changed my vision of how I am apprehending those companies now with a skeptical eye.

Thinking of great cooperation and sharing of ideas, I went more and more in a “do it yourself perspective” and “sharing is losing market share” perspective of the companies.

The more information, testimonials of other aerospace and research papers I found, the more cynical I got about the idea of GAFAM entering New Space.

In my opinion, in not even a lifetime, space went from the unreachable but still inevitable to a consumer-centric Disneyland that is at the verge of implosion.

The too aggressive mercantile approach of space is devastating, even more when the only players are pushing the limits to the absolute end and their overwhelming power is annihilating any other player around.

My survey and long talks with many aerospace and colleagues working in Centre Nationale d'études spatiales (CNES), European Space Agency (ESA) and Luxemburg Space Agency (LSA) were the prelude of what drastic measures we will have to take to get at least something under control. Their fear and concerns will be analyzed in 4.1 Result Analysis and we will understand why I could not include that much of the survey in this thesis as I thought I could and why it is very important in 4.2 Managerial Recommendations to keep track of the activity of GAFAM, limit their influence and building our own GAFAM because cooperation and sharing are not on the menu of priorities of GAFAM.

## 4.1 Result Analysis

To begin with, I asked every interviewee if they knew about GAFAM and their future plans. Well, it was pretty obvious that they knew what GAFAM stands for because all interviewee is working in innovation, development or industrial policies in space and because I made sure, beforehand, to make an interview with people working on that field.

About the question, their future plans, all of the interviewee knew that GAFAM had a strong desire to enter new space, that many of those companies were collaborating with space actors and creating new business models to have access to space and open up new markets.

The methods used by GAFAM or their different approaches was not well known, some had more or less insights, past experiences and ideas of how GAFAM is trying to enter new space. Many of those insights were very interesting because for example I got aware that Google tried to work with CNES on stratospheric balloons to give internet access to remote locations. This might be now the business model of half of GAFAM, but this was a few years ago and no satellite was needed. I found it interesting and found not too much about it on the internet. Sadly, the idea got abandoned.

For the first question of the interview, are you excited about the entry of GAFAM in the new space, all respondent gave the same answer and it was easily seen on their faces, not at all!

This marked the tone and the direction of all interview, none of the interviewee had a good feeling about it, they were preoccupied and worried.

Worried about how GAFAM would threat its new environment, how GAFAM would cope with points like anonymity, privacy and sovereignty of information. How GAFAM, with their opportunist vision would handle things and a few interviewees did not wish to have GAFAM in space and said they did not belong in space because space belongs to the public interest and GAFAM is looking at their own interests.

The question, or the problem is not GAFAM entering new space, it is private companies, neglecting regulations and rules, with their own interests and preoccupations that is entering a public domain that should remain the interest of the public.

The next few questions were for me interesting because I got many insights about the previous cooperations of GAFAM and European space agencies and a history recap of the space sector. With their knowledge of space, it was my starting point for more accurate and detailed researches and it gave me even more motivation and enthusiasm to dig in. Space means a lot to the interviewees and this could be seen by the way they spoke about it, the way it has to be protected and how precious it is. GAFAM only sees precious gold coins in space that have to be collected.

Even if private, capitalistic and profit-oriented companies did help to open space to a broader palette of customers and users and they made space interesting again, it still does not change the fact that space is of public interest and should be shared unanimously. As long as the public does not control and regulates the space actors, it is not in the European interest to support GAFAM entering new space.

Question 5 talks about the Digital Service Act (DSA) and the Digital Markets Act (DMA). Knowing that GAFAM's business model relies on information and big data, it is a necessity that Europe takes measures and regulates the information and personal details that are circulating on the world wide web. The European commission introduced those regulations and many other data protection policies and the interviewee were all clear on that point, we need those general data protection regulations (GDPR). Some were worried that we are limited by the time because if we grant even more access to GAFAM to our data and let them thrive, there will be a point of no return, where we do not have the power anymore to contest and rival the GAFAM.

The next few questions about cooperation of private and public company did divide slightly the opinions but still the main ideas were completely the same, we need European based companies in space that are under the control of public will and opinion.

There were a few collaborations with private companies due to the close proximity of the activities but they remained marginal and were limited to the strict minimum. The European aim is a sustainable development with less impact and a knowledge-based economy where information is respected.



The opinions did diverge when asked about satellite constellations and if they were needed. A satellite constellation does bring many advantages but if every company is building constellations for the same purpose as other companies and knowing that Starlink for example wants to launch 40 000 satellites to space... This will undeniably make us face new challenges, and one of those is space debris. As interesting as this subject is, I won't go into detail because it merits a master thesis for its own, but space debris will be some nasty issues we will have to face.

About the opportunities GAFAM could bring, the mood was not to its peak, at all, and the view of the interviewee was that there won't be any opportunity, for us at least, by working with GAFAM. Again, we need European based companies under European regulations because new space itself is a heaven for opportunities and all company entering now will benefit from the early access in the given activity.

About the threats, we listed privacy issues, the respect of data and a waste of resources for multiple satellite constellations and poor debris mitigation. Again, more than interesting subject that needs further research on it. See more in 4.2 managerial recommendations.

The last two questions of my interview were about the future and how it could/should look like.

Opinions go in the same direction, Europe will act as a whole in a coordinated and supportive manner, push European companies into space even more, with European values brought forward.

Some views were a bit more skeptical and some think there will be conflicts about data protection and privacy, same as data sovereignty. I think we already have those issues but we need to be aware of it.

And at last, the hopes for the future are a more circular economy and a sustainable value chain in space.

## 4.2 Managerial recommendations

After reading, informing myself and speaking with many aerospaceers, it seemed clear to me that we know what GAFAM stands for, we know approximatively what they want to do with space and how they want to enter new space, but what we don't really know is the importance of data and data protection. Well, we know it is important, but I think, we are not giving data protection and data sovereignty its rightful value.

What I would recommend:

First, we need more thesis, master dissertations and researches about the way GAFAM is entering new space because it is a very fast evolving environment with new business models created on a daily basis. The info I got till 2022 is not as useful as a thesis written in 2024 with 2024 information because the human capacity to adapt is astonishing and the technological progress we are making in space right now goes up exponentially.

Second, cooperation in Europe is key. If human interaction and dialogues between cultures is complicated, then I don't know what is supposed to be easy. We need European GAFAM, we need a European alignment of ideas, budget and political will. I might be naïve but it is surely not complicated to pick up the phone and tell our cherished neighbors what we want, how we want it and when we want it. We have to be transparent on some points to give a flow to that tranquility lake we are right now that is dragging us backwards. It is a shame that the Artemis rocket could not launch yesterday due to a fuel leak but it still gives me hope and a smile for the future.

And thirdly, and this is by far the most important point, we have to watch out and put a big effort on how we deal with data, the use of data and to whom we are trusting them. GAFAM rely on big data and with some more protectionism and awareness of the importance of privacy, we would secure ourself and have some dignity left.

I don't know how the new generation of youth will handle data privacy but at the moment, only from what I am seeing... oh boy... If now, already at a young age we do not care about what we are doing with our personal data, how will it look like in the future.

GAFAM only relies on data, and if we are the owners of our data, then we can decide what we want to do, but at the moment, the data belongs to GAFAM and it is getting worse every minute.

So, to fix that and give our European companies the needs to fight back, we need more research about the importance of data, data protection and data usage.

Of course, this thesis is already a good starting ground but we need to build even higher, because as we know, the sky is not the limit.

## **5. Conclusion**

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I will keep it brief here because I think I already told all the important points that have to be remembered and I also exceeded by a bit the 30 page limit, but it is worth it.

To conclude, GAFAM are entering New Space. With a mercantile approach and a good management of data utilization, GAFAM will have an impact on our daily life, even without us noticing it. The power relations between previous public space actors and the GAFAM is completely disproportionate.

We need to be aware, skeptical and proactive when we are dealing with GAFAM because those companies are profit driven and could not care less about our privacy. Jeff Bezos is making 2 500 USD per second and apparently it is still not enough, so we have to place our priorities straight.

The whole European market will get overwhelmed by the GAFAM' might if we do not act now and fast but it seems like we are already taking good turns with the creation of European based space companies.

We have still many barriers ahead but we are humans, we are fighters and we will never step back before the unknown.

## 5.1 Limitations

I was not really bothered by a lack of information or the unwillingness to share a company's vision because it was always possible to find even small clues about a company's inspirations, business models, tactics and vision.

It is still a tricky subject and it seems understandable not wanting to share such critical information that could be used in a harmful way by the competition.

I was bother by Facebook because I did not manage to find much about them and how the are going to enter new space. Knowing that their whole business model is based on only private data of customers and that they obviously will need access to space to expand their influence, it did bother me quite a lot honestly because they profit from us, they want even more but as return, we get shown to the exit. This is inadmissible.

Maybe my research attitude was not good enough or I did not enter the right key words to find the info but still, I doubt it and well... it is GAFAM, so who would have wondered ?

The limitation I also found is the limitation we are imposing ourself on how we are accepting the dominance of GAFAM and how we still allow it. GAFAM makes money because we allow it and we are playing their games without any major setback for them. Well, I am not completely right on this one because GAFAM are paying billions in fines each year (trust issues, data privacy breach, monopolistic situations,...) but I think it is not enough, moneywise, and also the public should stand against this criminality that GAFAM is practicing every day.

## **5.1 Potential future applications**

This could also be a master thesis on its own and honestly, I don't know the future applications that can result when GAFAM will be completely implemented in the new space because all great invention started from another idea and it was by luck or mistake that we have made many discoveries. We are dreamers so I won't impose any limits in our drive for more and our passion for exploration. I will leave it like this because out of blank pages comes the most exciting and mind-blowing adventures.

Thank you for your time dear aerospaceers and friends, I truly hope this master dissertation could englobe the importance of an event like GAFAM entering new space, that it did give a brief but accurate vision of the situation and environment and finally I hope that it did bring you and us a step further to the stars and the beautifulness of space.

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2. PWC : Main trends and challenges in the space sector(2019)  
<https://www.pwc.fr/fr/assets/files/pdf/2019/06/fr-pwc-main-trends-and-challenges-in-the-space-sector.pdf>
3. NASA: Emerging space,The evolving landscape of 21<sup>st</sup> century American spaceflight  
[https://www.nasa.gov/sites/default/files/files/Emerging\\_Space\\_Report.pdf](https://www.nasa.gov/sites/default/files/files/Emerging_Space_Report.pdf)

## 7. Annexe

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The survey I did with ESA and CNES:

### The entry of GAFAM Survey ESA

Survey done by Kirsch Maxence, aerospace student at Toulouse Business School

This survey represents the opinions of each interviewee and it does not represent the general statement of the company

#### **Interviewee introduction:**

Job: Industrial policy Officer

#### **Questions:**

**1) Are you excited about the idea of GAFAM entering the new space? Why?**

No, not at all. And why should we? The GAFAM have an opportunist vision and by doing so, they are trying to squeeze money everywhere that is possible. It is not a reproach because that's also how business works but in my opinion, it is not their business. I don't see why I should be excited about GAFAM because they don't belong here in space.

**2) How was it before when only state-owned companies were active in space?**

The idea of space entrepreneur is not new, it has just seen now a rise in success.

In the 1990's there were already many companies trying to establish themselves in the aerospace sector. Kistler Aerospace and Space Island Group were one of those companies that tried to create

business in space. But at that time, the space industry was not ready as there were no legal or governmental processes / frameworks in place to support space entrepreneurship.

In the 2000's, Elon Musk made millions by selling his share of PayPal and this gave him the opportunity to invest in new sectors. Space X with its ingenious rocket launchers was a good system but help came at the right moment. After a few failed rockets launches, Space X was at the verge of bankruptcy and NASA save them by opening new contacts for Space X.

The good lobbying methods and tactics of Space X did save them and Space X did even push and forced NASA to implement new procurement processes and competitions which supported space entrepreneurship in way which had not been done before. This allowed Space X to enter the sector and rival decades old incumbents such as ULA and Arianespace in only a few short years.

In the 2010's, the influx of money from the Silicon Valley was astonishing and it marked a new shift in the mentalities. Companies are learning quickly how to shift their approach from one of caution and step by step certification to that of rapid prototyping and "failing fast".

And finally in the 2020's, those mentalities and technological advancements have seen a normalization. What seems to be impossible 30 years ago, is now doable at a fraction of the original price. NASA has created a business push by being a start-up and business friendly organization. With new business incubators centres and loosening up regulations and requirements that were too much time consuming, NASA made the whole environment way more favourable for innovation and gave a huge momentum to the New Space.

Last but not least, ESA and the people working in ESA are civil servant. They have technical and authoritative responsibilities as regards space technologies, regulations, safety standards etc and cannot change regulations or restrictions too much. ESA does not compete commercially; it can survive as it does.

### **3) Why do you think GAFAM wants to enter the new space now?**

The principle is always the same. Market shares and maximisation of the profit.

Amazon with Amazon Web Services (AWS) are experiencing an explosion in earth observation and are making it even more and easier. Pre-processing data in orbit for EO missions facilitates downloading to Earth stations (less data to transfer), however is not always easy to do for any number of reasons. AWS takes away some of the pain in receiving and processing data on ground and is therefore a valuable lever that business can rely on.

Facebook wants to reach new customers and enter the era of metaverse.

Apple and Microsoft are also pushing their range influence and are working closely with aerospace companies like Space X.

### **4) Are there different barriers to enter new space than before?**

There is a barrier shift from 1990 to 2010.

1990 was facing challenges that seemed to be herculean tasks so no company was challenging those barriers.

2010 made it easier to have access to investments and capital so the companies were much more inclined to jump on the boat.

The ecosystem was open now for advancements in innovation. Many companies are now in the launcher rocket business or the earth observation activities.

Now the companies need to focus on a new technology, quantum computers.

There are 2 types of businesses:

- The business as usual (normal companies, making normal things and those are established by now)
- Crazy companies (off the wall companies that are not on point yet like debris mitigation or databases on the moon)

The barriers are not complicated and tall for the established companies in established sectors.

For those people in those crazy companies, the barriers to enter are huge and seem to be unbreakable.

It depends on the financial support and the risk those companies are taking.

The market creates a need or it is the government that is pushing a new need. In the case of Ariane 6 for example, ESA has agreed to be an anchor customer and purchase a minimum number of launches every year.

To conclude, the market is the barrier. And how insurmountable this barrier is, is determined by how big and mature the market is. The bigger and mature the market is, the easier it is for companies to ignore those barriers to enter new space.

#### **5) What do you think of the Digital Service Act (DSA) and the Digital Markets Act (DMA) proposed by the European Commission?**

We need this protection. We are running out of time; it can be too late soon. GAFAM are worldwide, their influence is not matched and very few have the power to stop them.

General Data protection Regulations (GDPR) is very important to ESA because consent is needed for everything. Efforts are being made everywhere to keep the sovereignty of information and data to those whom it belongs to.

#### **6) Has your company considered working with GAFAM companies?**

Not that I know of. Well at least I have not heard anything about it.

The purpose of the Industrial Policy section at ESA is to support a fair return on investment for ESA Member States and to evaluate the overall bidding performance of industry, in order to improve it.

**7) If yes, since when?**

...

**8) Is there another company that you consider more important when talking about entering new space?**

On the digital side, all those companies are opportunists. Follow the flow.

Space X forced a change.

But there are so many companies now that they are all important in their own domain of expertise.

Exotrail with its electric propulsion might not be industry defining but they are still interesting.

Same goes to SpinLaunch with their innovative idea to transport materials to the outer space.

**9) Which opportunities do you think the cooperation between your company and GAFAM companies will lead to?**

We would consider a cooperation if there could be an opportunity for research but I doubt that this is ever going to happen.

For data management like Amazon is doing it in space with its satellite constellations.

**10) Could there be any threats or inconveniences?**

Privacy.

The respect of data.

Waste of rare resources for satellite constellation and poor debris mitigation.

Just think about Google books a few years ago. Those companies don't even realise that they are stealing private information and it is a wonder they are losing the case in front of the court. Maybe it won't be long anymore before they are above the right.

**11) Do you know how other state-owned companies have reacted to the announcement of GAFAM entering the new space?**

I really don't know.

**12) What do you think will result from it?**

Conflicts about data protection and privacy, data sovereignty

**13) Something you wish happened differently in the new space sector?**

No constellation. But I think we will have to go down through that phase to realise our mistakes.



# The entry of GAFAM Survey CNES

Survey done by Kirsch Maxence, aerospace student at Toulouse Business School

This survey represents the opinions of each interviewee and it does not represent the general statement of the company

## Interviewee introduction:

Job: Innovation, Operations and System engineer in space domain

## Questions:

### 1) Are you excited about the idea of GAFAM entering the new space? Why?

Pas du tout, je suis inquiet.

Ceci représente un enjeu pour l'économie de la connaissance avec un intérêt public. Les GAFAM n'ont pas ce même intérêt et manipulent la connaissance pour leur propre intérêt privé.

Il faut distinguer entre la CNES qui est une entreprise publique et les GAFAM qui sont des entreprises privées.

CNES rêve d'une collaboration avec des entreprises qui ont un intérêt public, où la propriété intellectuelle est respectée avec un partage de l'information ainsi qu'une transparence.

### 2) How was it before when only state-owned companies were active in space?

Pas vraiment excitant.

L'espace était dominé par un héritage du combat. L'espace était réservé aux militaires et scientifiques, ce qui laissait peu de place à l'innovation.

De long délais étaient à prévoir pour innover de nouveaux lanceurs ou satellites.

Avec l'arrivée des entreprises privées, le secteur a subi un changement qui a accéléré l'efficacité en sortant de sa niche, voire son cloisonnement.

### **3) Why do you think GAFAM wants to enter the new space now?**

C'est une question stratégique. Les intentions se portent sur la chaîne de valeur où les GAFAM peuvent permettre de s'élargir horizontalement ainsi que verticalement.

En contrôlant toute la ligne de production, une efficacité accrue en est le résultat et ainsi la productivité augmente.

Le pari est la production en série, ce qui peut être aperçue avec OneWeb, Iridium et Starlink.

Le prix du satellite a été divisé par dix et cela leur donne une position de monopole sur le marché.

### **4) Are there different barriers to enter new space than before?**

Ce qui a permis l'essor du secteur spatial privé est le modèle de l'économie américaine qui se base sur un système libéral avec des financements publics importants.

Ceci a été un levier pour l'activité privée qui en a largement profité.

En 2000, NASA propose aux entreprises privées américaines une collaboration pour développer de nouveaux lanceurs. Space X et Sierra Nevada s'y sont lancés.

Avec le support de la population américaine et des entreprises américaines, l'investissement venant du public est pharaonique.

L'idée est de baisser les barrières à l'entrée. Les qualifications ont aussi été revu à la baisse pour permettre un accès encore plus simple. Ceci a donné lieu à des certificats beaucoup trop simple à recevoir.

La culture européenne est opposée à la culture colonisatrice des Etats-Unis qui se traduit par une politique libérale et une prise de risque considérable.

### **5) What do you think of the Digital Service Act (DSA) and the Digital Markets Act (DMA) proposed by the European Commission?**

Ceci est essentiel pour garantir une propriété intellectuelle, une science participative et un crowdfunding.

L'intelligence collective est primordiale, il faut l'encadrer et la respecter.

### **6) Has your company considered working with GAFAM companies?**

Pas avec des GAFAM américaines. On est à la recherche de partenaires européens.

Mais on a des échanges bien sûre.

En 2014, nous avons travaillé étroitement avec Google pour la création du projet loom. Celui-ci consistait à déployer des ballons stratosphériques pour avoir une couverture internet jusqu'aux coins les plus reculés.

Ces ballons sont bien moins chers que des satellites, mais peuvent remplir des tâches de télécommunication et d'observation.

Personnellement je n'ai pas suivi l'évolution du contrat et je ne sais pas comment le projet s'est finalisé, mais ce projet a été abandonnée il y a 5 ans.

#### **7) If yes, since when?**

Il faut avancer avec précaution. Du au fait de la proximité de notre activité, il est probable que des échanges se font, mais ils restent marginaux et ce limitent au strict minimum.

Nous avons besoin de GAFAM européennes.

Récemment, les entreprises européennes développent des constellations de satellites. Le but est un développement durable avec un impact moindre et une économie de la connaissance où l'information est respectée.

#### **8) Is there another company that you consider more important when talking about entering new space?**

Je pense à Monsanto. Ils veulent déployer une constellation de satellites pour surveiller les récoltes.

On a aussi Porsche qui cherche des solutions pour la connectivité de ces voitures pour un avenir avec des voitures autonomes. Cette culture du divertissement a pour but d'élargir l'emprise et l'influence de la marque.

Il y a tellement d'entreprises intéressantes comme Descartes Underwriting, qui est une assurance mais qui pourrait se servir du new space pour l'observation.

#### **9) Which opportunities do you think the cooperation between your company and GAFAM companies will lead to?**

Peu de coopération avec les GAFAM. Seules les entreprises européennes du new space peuvent avoir un enjeu majeur avec des opportunités importantes.

Le new space est un marché énorme avec pleins de nouveaux services et il est d'une importance stratégique d'être le premier.

On doit ouvrir l'Europe à des marchés où on a été à l'écart.

Les entreprises européennes du new space s'intéressent entre autres à la santé, les assurances et le divertissement automobile.

**10) Could there be any threats or inconveniences?**

Déjà abordé. Les données privées sont d'une importance capitale et entre de mauvaises mains peuvent causer beaucoup de dégâts. Prenons l'exemple du secret politique et médicale.

**11) Do you know how other state-owned companies have reacted to the announcement of GAFAM entering the new space?**

Non je n'ai pas vu d'annonces officielles.

Mon impression est que certaines agences étatiques européennes se méfient moins vis-à-vis des GAFAM et qui valorisent les entreprises des deux cotées de l'atlantique.

**12) What do you think will result out of it?**

L'Europe va réagir de la même manière qu'elle a réagi face à la Russie, de manière coordonnée et solidaire où les valeurs européennes sont mises en avant.

L'Europe a besoin d'un GAFAM européens.

Notre façon de répondre aux crises récentes est un espoir pour l'Europe.

**13) Something you wish happened differently in the new space sector?**

Ce que je souhaite:

- Le secteur spatial doit arrêter d'être une économie linéaire, car ceci représente une gêne considérable et en ce moment il n'y a pas assez de volonté pour changer cet aspect.
- Le recyclage des débris spatiaux en évitant le greenwashing.

Ce qui doit augmenter :

- Mettre les choses sur la table
- Créer de nouveaux acteurs
- Plus d'intérêts pour créer une économie circulaire.

