The Evolution of Space Strategy: France, Germany, and the Rise of New Space

1. Introduction

Over the past fifty years, the European space sector has achieved impressive results, growing from users of USA technology & components into a self-sustained space ecosystem. To this end, France, under the leadership of its space agency, the Centre National d'Études Spatiales (CNES), has taken a preeminent role in this transition, and solidified its hegemonic position with large scale orbital endeavors like the Ariane Rocket Series, the Galileo navigation system, and military satellite programs. On the other end, Germany represents a completely different case by using the DLR (Deutsches Zentrum für Luft- und Raumfahrt) to mainly promote scientific research and advanced technology. These two countries demonstrate radically different approaches to the space domain – a difference that embodies national priorities in policy, industrial integration, and development.

Outside of the Traditional Space evolution, the industry is undergoing a paradigm shift with New Space. Traditional mission-critical systems rely on high reliability (HiRel) and components that have been proved in invoice performance and rigorously tested before launch, whereas New Space advocates a completely different philosophy, focused on cost-cutting, shorter time to market and acceptable levels of risk. They are changing the industry with their use of Commercial Off-The-Shelf (COTS) components to reduce waste, lowering the cost of satellite production (e.g., SpaceX, Rocket Lab, and OneWeb). Estimated now in the trillions of dollars, the New Space market is fueled by commercialization of Low Earth Orbit (LEO) satellites and a new set of small satellite technologies namely CubeSats and SmallSats (McKinsey & Co., 2022).

This transformation of New Space leads us to an important question: Can France and Germany adapt to this drastic change? As the strategic gap between traditional suppliers and COTS components narrows, CNES, purveyor of launch expertise and satellite integration, will have to balance the two worlds. On the other hand, DLR might use its research capabilities to help grow new German space industries like Isar Aerospace.

In this paper, we will articulate the difference between French and German space strategies, analyze how CNES cemented its leadership role in Europe and examine how New Space is challenging the traditional space supply chain. These transformations will have an effect beyond space, opening potential synergies between the space sector and other domains, including automotive technology and artificial intelligence.

2. The French Space Strategy: Historical and Current Components

Not all nations have seen an even development of European space industry. France and Germany, Europe's two largest economies, have taken different paths in the space sector. CNES (Centre National d'Études Spatiales) in France, for example, has emphasized launch technology, commercialization, and close ties with the defense industry, while DLR (Deutsches

Zentrum für Luft- und Raumfahrt) in Germany has instead focused on scientific research and technology development but has been quick to delegate responsibility for a European presence in space to ESA (European Space Agency). The agency's long-term paths were shaped by historical, political, and industrial factors, which manifested in these strategic differences.

2.1. CNES: France's Space Strategy

CNES was founded in 1961 under President Charles de Gaulle with a clear national goal: building an independent space industry and cutting reliance on the United States. While Germany held more of a posture towards research, France showed a considerably more commercial aim, especially in closer alignment with defense militaries on their new space program.

Among the main goals of CNES's strategy are: the development of the Ariane Rocket Series, those being Ariane 1 (1979), Ariane 5 (1996–present), Ariane 6 (in development); the development of satellite navigation and telecommunications systems such as the Galileo Navigation System (European counterpart to U.S. GPS and Russia's GLONASS), giving the European Union autonomy in satellite navigation, and deep space missions together with ESA, scaling up France's technological footprint; and the integration of the Defense and Military – CNES has been the driving force behind many military satellite programs, such as Syracuse, a satellite communications system for the French Armed Forces.

France controls more than 50% of Europe's space technology market, after decades of government subsidies and strategic investments, CNES (2023). It has also advanced out of greater dependence on U.S. space components, bringing American imports below 50%, thus fortifying its technological sovereignty.

2.2. DLR Germany's Space Strategy

Unlike France, Germany has had a rather scientific and research-driven view of space. Founded in 1969, DLR has become a preeminent aerospace research institution, collaborating extensively with ESA and other global partners. DLR, on the other hand, isn't trying to compete with commercial spaceflight and defense like CNES and is instead focused on scientific exploration, environmental monitoring, and AI for space technologies.

Germany's space strategy includes a focus on scientific studies and next generation technologies. DLR has been a leading force for AI applications in satellite navigation and advanced space materials. Major contributions to Earth observation programs for environmental monitoring.

Germany, unlike France which has independent launch capabilities, relies on ESA to launch major satellites. Training in computer engineering up to project completion in October 2023, specializing in climate research and planetary exploration, with machine learning integrated into spacecraft architecture.

The closer Ariane gets to a conformal service, the more opportunity Germany has to compete with the rest of the world in a globalized space launch environment in which an independent German commercial launch program does not exist. In contrast to France, Germany has lacking links between its space sector and its defense industry, and as such, it has not had as strong government backing for military space applications.

Germany continues to be a major player in space research, especially in the field of artificial intelligence-based satellite systems, environmental science, and space robotics (DLR, 2024). However, it is less competitive than France in some sectors of the industry due to the absence of commercial spaceflight capabilities, and limited defense use.

2.3. Comparison: CNES vs. DLR

While both CNES and DLR are key players in ESA, their attitudes towards space development are poles apart.

Criteria	CNES (France)	DLR (Germany)
Initial Objective	Reduce reliance on the U.S., build an independent space industry	Focus on space research and technology development
Strategic Approach	Commercialization, defense integration, independent launch capability	Scientific research, collaboration with ESA
Launch System	Ariane Rocket Series (Ariane 5, Ariane 6)	No independent launch capability, relies on ESA
Major Achievements	Galileo Navigation, Ariane Rockets, Syracuse military satellites	AI in space navigation, advanced materials, environmental research
Target Market	Defense, commercial spaceflight, telecommunications	Scientific research, international collaboration
Industrial Integration	Strong links with Airbus, Thales, and the French defense sector	Weaker connections to the German automotive and defense industries

In broad strokes, this comparison illustrates how France's commitment to independent launch capabilities and integration with sovereign defense sectors has left it with a monopoly over the European space domain, while German investment in an approach focused on research and scientific exploration has largely crippled its ability to compete commercially.

3. Dominance: How France (CNES) Made It Happen

France, the leading space power in Europe Germany, and other European countries have put a priority on scientific research in an ESA framework, but CNES has used its strong government backing, strategic partnerships, access to cutting-edge launch vehicle technologies, and integration of their defense sector to establish its own standing. In this section we discuss some of the elements that have led to CNES being unrivalled in the European space industry.

3.1. Government Support and Long-Term Investment Policies

The strong government support from France, in terms of funding as well as advisory capacity, is one of the major reasons for CNES's superiority. As of October 2023, CNES has been funded by billions in state subsidies since the agency's inception in 1961 in order to develop and augment France's autonomous space capabilities, particularly in launch vehicle technology and commercial spaceflight.

- 1973: The Ariane program, in partnership with ESA, was launched in France, granting Europe the ability to create its own independent launch system.
- 1990s – 2000s: Acts of government investment in Ariane 5 by the French government helped make it one of the most prolific commercial satellite launch vehicles in the world.
- Present day: France is still backing Ariane 6 development, which aims to rival SpaceX's Falcon 9 by lowering the cost of launches.

Long-term institutional investment policies of CNES (2023) have maintained the French space industry within tomorrow's frontier, despite increasing competition from New Space companies, including SpaceX and Rocket Lab. The influx of funds has allowed CNES to take more risks and to experiment more aggressively than much of Europe – especially Germany, which has no robust government-backed commercial space program.

3.2. Quarterly Report on selected European Standards and Outcomes

CNES may operate as an independent space agency, but it has always worked closely with ESA, and has been able to take the lead in the construction of European space policy. France is ESA's largest financial contributor, providing over 25% of the agency's budget (CNES, 2023).

Collaboration with ESA has been a key focus of CNES, leading to the establishment of standardized protocols and frameworks, including the European Cooperation for Space Standardization (ECSS) that ensures compliance with uniform engineering, safety, and quality practices across European space missions. Such influence allows CNES to dominate ESA decisions as ESA depends on Arianespace's Ariane rockets for its main space missions.

With its financial and technological supremacy, CNES has made France the de facto leader in ESA programs and a dominate voice in the direction Europe's space ambitions will take.

3.3. The Triumph of the Ariane Rocket Family – France's Ace in the Hole

The Ariane rocket program has been CNES's strongest competitive strategy that cemented French superiority in Europe's space industry. While France is not the only country in Europe currently unable to independently launch on its own (Germany being the other country presently) France has steadfastly improved and extended the Ariane family of launch vehicles, earning itself the most reliable and commercially attractive rocket system in the world.

- Ariane 1 (1979): One of Europe's independent forays into space, it ushered in an era of rocket launches.
- Ariane 5 (1996 - present): 95% success rate, which is better than most U.S. launch systems. It was turned into ESA's main launch vehicle for satellite launch and deep space missions. At the zenith of this effort, it accounted for over 50% of the world commercial satellite launch market (CNES, 2023).

- Ariane 6 (under development): Also intends to lower launch prices by 40% versus Ariane 5. It is a direct competitor of SpaceX's Falcon 9, but incorporates partial reusability to keep costs down.

The position of CNES has a noticeable bold side to it that, unlike Germany, does not rely solely on ESA for space launch services, but rather since the Ariane series, CNES has been predominant in the European launch market giving CNES and France the dubious title of leading spacefaring nation in Europe.

3.4. Integration in the Defense Sector and Cutback of American Dependence

A key reason for CNES's dominance is its deep ties to the French defense industrial complex. Whereas Germany has a more limited focus on the civil space research domain, France has made extensive investments in military applications of space, thereby enhancing its geopolitical muscle and independent access to space. One notable example of this is the development of the Syracuse satellite system, a series of military communication satellites designed to enhance the operational capabilities of the French Armed Forces.

Additionally, France has worked to reduce its dependency on U.S. space components. At one point, 80% of European space components were imported from the United States. However, through strategic investment and government subsidy programs, France has drastically lowered this reliance, with American imports now accounting for less than half of what they once did (CNES, 2023).

In establishing a close partnership between space and defense, CNES has helped make sure that the French space industry is politically funded and strategically essential. In contrast, Germany's absence of military space efforts and a dependence on civilian funding for its technicians has left it unable to catch up to France's commercial model.

3.5. Comparative Analysis: CNES vs. Other Space Agencies

To understand CNES's dominance, it is useful to compare it to other major space agencies in terms of capabilities, strategic goals, and financial backing.

Factor	CNES (France)	DLR (Germany)	ESA	NASA (U.S.)
Launch Capabilities	Ariane Rocket Series	No independent launch system	Depends on Ariane	Falcon 9, SLS
Core Strategic Focus	Commercialization & Defense Integration	Scientific Research & Technology Development	Pan-European Cooperation	Deep Space Exploration
Primary Funding	French Government & ESA	German Government & ESA	EU Member Contributions	U.S. Federal Budget
Major Projects	Ariane, Galileo, Syracuse Satellites	AI in Space, Materials Science	Collaborative Missions	Artemis, ISS, Mars Missions

CNES cannot compete on NASA's scale, but they have overtaken other European agencies by strapping in government investment, independent launches, and military applications to make it Europe's strongest space agency.

4. How New Space is Easing into the Role of the Traditional Space Industry

New Space represents a fundamental shift of the space industry. In contrast to Traditional Space, based on maximum reliability via extensive Ground Testing, allowing a long development cycle, New Space is based on cost reduction, shorter production timelines and an acceptable amount of risk.

The rise of New Space competition embodied by SpaceX, Rocket Lab, OneWeb, and others is challenging CNES and ESA's traditional model of development. Whereas CNES and ESA have more cautious practices with the Adrienne rocket and long-term missions, new space disrupts the entire the supply chain, operational concepts, and investment strategies of the space industry.

4.1. Transformational Paradigm: Traditional Space vs New Space

Traditional space is expensive with long timelines and highest levels of reliability. It was primarily led by government agencies like NASA, ESA and Roscosmos, concentrating on:

- Maximum reliability. Before use, components needed years of tests for resistance to radiation, conditions of extreme temperature, and long operational lifetimes.
- High cost. Hundreds of millions of dollars are needed to develop a single large satellite.
- Long development cycles. One space mission from scratch could consume 10-15 years of planning before tool time.

On the other hand, New Space is faster, cheaper, and with acceptable risk. Yet, what drives New Space is the involvement of private corporations seeking to monetize outer space, especially with regard to telecoms, satellite internet, and Earth observation. New Space embraces some core qualities, such as Commercial Off-The-Shelf (COTS) components usage and the "launch fast, fail fast, learn fast" mentality.

For traditional hardware models, HiRel certification is not required, resulting in 1/1000 reduction in satellite production costs (McKinsey & Co., 2022). Particularly, SpaceX has opted for commercial processors instead of radiation-hardened space-grade chips, allowing for substantial cost savings. Additionally, rather than meticulously test every piece, companies accept some degree of failure and make up for it with redundancy. Reusable assets provide cost optimization: Developed by SpaceX, Falcon 9 reusability has lowered the cost from $62 million to approximately $20 million per launch (SpaceX, 2023).

4.2. Implications for CNES and the European space strategy

CNES has developed France's space industry based on Traditional Space, operating major systems including the Ariane Rocket Series, Galileo satellites, and the Syracuse military programs. It now faces severe pressure from New Space.

Firstly, Ariane launches are still too expensive. The average launch cost of Ariane 5 is $150 million per mission, almost 10 times expensive than Falcon 9. The Ariane 6, though designed to be cheaper, simply cannot compete directly with SpaceX.

Furthermore, the development cycles are longer than New Space. While Ariane 6 has been delayed multiple times, Falcon 9 has been on more than 300 missions over a decade. The traditional process of satellite development takes years, whereas New Space companies manage to build the next gen of satellites in a 6–12-month window.

Lastly, use of COTS components is heavily encouraged. In this context, ESA introduced the ECSS-Q-ST-60-13C standard to enable the usage of COTS components in space applications. This has led CNES to think about embracing commercial technology to lower costs and remain competitive.

But CNES and ESA still adheres to the Traditional Space model but is also now possibly learning from New Space and working with private companies. Examples include: Starlink competitors, which include cost-effective commercial satellites made by Thales Alenia Space and Airbus; and the partnership with German startup Isar Aerospace for small launch vehicles for LEO satellites.

4.3. Risk of long-term space debris accumulation

The Kessler Effect is a serious risk to the space industry with the rapid increase in LEO (Low Earth Orbit) satellites. This phenomenon is known as Kessler syndrome, and it describes a situation in which collisions between space debris cause a chain reaction that leads to a dangerous level of orbital debris density, making spaceflight more hazardous.

When adding satellites already planned for launch in the next decade, there are currently over 6,000 active satellites in usable Earth orbit (ESA, 2023). Debris from failed satellites, or accidental collisions, could jeopardize critical global communications infrastructure.

To combat this problem, both space agencies and private companies are working on debris mitigation solutions such as: self-cleaning satellites, where satellites are fitted with drag sails to take themselves out of orbit when they are done collecting data; technology for active debris removal, for example ESA and the startup Astroscale are developing robotic collectors for space debris; and reusable components standards like the reusable rockets and satellites to reduce waste encouraged by SpaceX and Blue Origin.

5. Traditional HiRel Supply Chain vs. New Space Supply Chain

These developments transform the execution of space missions and redefine the supply chain of components from Traditional Space to New Space. The New Space supply chain is characterized by short timelines, low costs, and minimum risk at the expense of absolute quality and maximum reliability as the High-Reliability (HiRel) model works.

Due to these differences, manufacturers, distributors, and space agencies are forced to consider a new approach, particularly surrounding procurement, component validation, and logistics.

5.1. The Traditional HiRel Supply Chain Characteristics

The traditional space supply chain, used by agencies like CNES, ESA, and NASA, follows a highly regulated and methodical process to ensure component reliability in the harsh environment of space. This approach is characterized by strict procurement and component qualification procedures, where space hardware – classified as HiRel (High Reliability) – undergoes rigorous testing. Components must pass exhaustive temperature, radiation, and environmental assessments, often taking years to qualify. For instance, burn-in tests lasting 1,000 hours evaluate long-term stability, while radiation hardening protects microchips from cosmic radiation, and thermal cycling simulates extreme temperature fluctuations in space.

These stringent requirements also lead to extended manufacturing and testing timelines. A single satellite chip may take 5–10 years to fully qualify before deployment, while components for deep-space missions and geostationary satellites (GEO) must demonstrate a minimum operational lifetime of 15 years. Additionally, the high reliability standards drive up costs, with HiRel components being 100 to 1,000 times more expensive than commercial counterparts. Due to the still-developing market for space hardware, production runs remain short, further increasing costs.

Strict tracking and certification add another layer of complexity, as each part is assigned a unique serial number with a complete documented testing history. This level of traceability is mandatory for organizations like ESA and NASA to prevent the use of counterfeit parts.

Although this model guarantees near-absolute reliability, it does so at the expense of cost efficiency and innovation speed, making it difficult to keep pace with the rapid development cycles of the New Space industry.

5.2. Features of New Space Supply Chain

The use of Commercial Off-The-Shelf (COTS) parts has become a defining characteristic of the New Space industry, with companies sourcing components from sectors like automotive, consumer electronics, and medical technology. For example, SpaceX opts for commercial processors instead of expensive radiation-hardened space-grade chips to reduce Starlink production costs.

This shift has dramatically accelerated production cycles and lowered costs. Unlike traditional models that take years to build satellites, New Space companies can manufacture and deploy them in just 6 to 12 months. Small satellites now range in cost from $100,000 to $500,000, whereas traditional satellites often require hundreds of millions in investment.

Rather than striving for 100% reliability in each component, New Space companies prioritize risk acceptance and redundancy optimization. By designing networks that function despite some failures, they ensure operational success without the need for extreme durability. SpaceX, for instance, launches thousands of Starlink satellites, knowing that not all need to function perfectly for the network to remain effective.

Additionally, bulk ordering and mass manufacturing have replaced the small, custom-built approach of traditional space systems. Inspired by the automotive industry, companies like

SpaceX and Tesla have introduced large-scale production techniques to streamline efficiency and drive down costs.

While this approach accelerates innovation, it also presents challenges, particularly in ensuring component reliability and addressing space debris concerns, as the shorter lifespan of satellites increases the risk of orbital congestion.

5.3 Comparison: HiRel vs. New Space Supply Chain

Criteria	Traditional HiRel Supply Chain	New Space Supply Chain
Component Type	Fully space-qualified HiRel components	COTS (Commercial Off-The-Shelf) components
Cost	Extremely high, up to millions per component	100-1000 times cheaper than HiRel
Production Timeline	5-10 years for qualification	6-12 months, accepts higher risk
Innovation Speed	Slow, long development cycles	Rapid iteration and continuous updates
Operational Strategy	99.999% reliability, cannot afford failure	Accepts some failures, mitigates with redundancy
Primary Applications	Deep-space missions, military satellites	Internet constellations, Earth observation, commercial

5.4. How Do Space Agencies and Manufacturers Adapt?

New Space's emergence prompted manufacturers, distributors and space agencies to adapt. ESA released the ECSS-Q-ST-60-13C standard to enable the use of COTS components in controlled space environments. Manufacturers such as Infineon are designing "Radiation-Tolerant COTS", which becomes a middle-path product between HiRel and commercial grade parts. Additionally, Chris Elhanan, vice president of telecom systems at Thales Alenia Space, said a collaboration between CNES, Airbus, and Thales Alenia Space enables them to move from custom satellite assembly to mass production. NASA and ESA are test-driving hybrid models, keeping HiRel standards for critical missions while COTS is used for commercial and Earth observation satellites.

6. Future of the Space Industry

The old is giving way to the new – Traditional Space (HiRel) is being dethroned by New Space. This transition poses important questions for the future of space exploration, satellite technology and supply chains: Should New Space replace Traditional Space entirely? How will government space agencies like CNES, ESA, NASA adapt? How can we bridge the gap between space and automotive industries? Between space and AI?

Potential answers include: Space and automotive industries might collaborate, New Space could collapse, or we could see a hybrid model (somewhere between Traditional Space and New Space) emerge.

6.1. Scenario 1: Closer Collaboration for the Space and Automotive Industries

In fact, one of the biggest trends behind this is the crossover between the space and automotive industries is due to Commercial Off-The-Shelf (COTS) Shared Use of Components. Our sector designs electronic components that demonstrate high reliability and low price adopted standards such as AEC-Q100 (Automotive Electronics Council), automotive industry. Israeli space startups have typically relied on imported processors; however, Infineon, Texas Instruments, and STMicroelectronics are now rolling out radiation-tolerant automotive-grade chips designed for Low Earth Orbit (LEO) satellites.

Moreover, by taking mass production and supply chain automation to the next level when it comes to electric cars, Tesla changed the automotive landscape. SpaceX is using parallel principles, where it lights up thousands of Starlink satellites a year instead of building each and every one with a one-off design. Airbus and Thales Alenia Space are also switching over to high volume satellite manufacturing, with costs experiencing declines from several hundred million down to just $10-20 million per satellite.

Lastly, the introduction of the Auto Industry Battery and Amp Electric Motor Tech. This technology leap in lithium-ion batteries has been made possible with EVs, and now it's translating into space power systems to make satellites lighter and more energy-efficient. Recent developments like those being explored by Tesla and Bosch for electric propulsion systems for satellite thrusters and orbital adjustments.

As the lines continue to blur between space and automotive sectors, there may be a potential market for "space-rated" commercial components that will service the new emerging market to benefit both industries.

6.2. Scenario 2: Halting a New Space Bubble Burst and Space Debris Crisis

New Space is blossoming quickly, but there are big risks that could be its undoing.

Firstly, the operations are costly and there is massive reliance on venture capital. The new Space companies rely heavily on private investment, and if the profits do not come, these companies could clawing up the financial ladder. In 2020, OneWeb went bankrupt amid funding shortfalls. Blue Origin and Rocket Lab are challenged to be profitable as commercial launch services are expensive to operate.

Furthermore, SpaceX plans to launch 42,000 Starlink satellites; Amazon and OneWeb have similar ambitions. This could lead to a flood of LEO satellites saturating the market, thus making profits untenable, and stifling any future business growth.

Lastly, ESA and NASA caution that the rapid increase in low Earth orbit (LEO) satellites may cause the Kessler Effect, wherein collisions with space debris create a cascading chain reaction of fragmentation. Poor space debris management may result in regulators enforcing strict launch restrictions on access to space, impacting the viability of New Space.

If New Space can't figure these financial and environmental challenges out, governments will intervene to shut it all down, which would lead to a return to existing environmentally friendly and regulated and granulated operation in space.

6.3. Scenario 3: Leverage Some of Both Old and New Space

Instead of Trad Space being fully replaced or New Space collapsing, a hybrid model could develop under which Traditional Space continues to be important for deep-space exploration and military applications when the highest possible reliability is necessary, and New Space leads the commercial market from satellite internet to telecommunications and Earth observation. As a result, ESA has expanded its ECSS-Q-ST-60-13C standard, which permits – under controlled coverage – the application of COTS components in an increased number of space applications.

Government space agencies now partner with private companies, using commercial innovation while keeping long-term sustainability in mind.

6.4. Key Factors That Will Shape the Future of Space

As the industry progresses, there will be a few variables that will prove out whether Traditional Space, New Space or a mixed model will win:

Factor	Impact on Traditional Space	Impact on New Space
ESA & NASA Regulations	If HiRel standards remain dominant, Traditional Space retains control over critical missions.	If COTS components become widely accepted, New Space will continue growing.
Collaboration with Automotive Industry	Could lower costs for HiRel components.	Helps scale satellite production and improve logistics.
Space Debris & Kessler Effect	If not addressed, stricter regulations could force New Space to adopt safer practices.	If uncontrolled, governments may limit satellite launches, slowing growth.
Financial Sustainability	Government funding remains stable.	If investment slows down, New Space companies may struggle to survive.

7. Conclusion

International space industry is in the midst of a radical transition from HiRel to New Space, and with it comes opportunities and challenges. Throughout this piece, we discussed the divergence between the two countries (CNES, France-DLR, Germany) space strategy, how CNES cemented its supremacy, analyzed the growth of New Space and how it would affect the traditional supply chain, and strategized the upcoming states of the industry.

With strong government backing, long-term investment in the Ariane Rocket Series, strategic partnerships with ESA, and little integration with the defense sector, France (CNES) secured its position as Europe's top space power. On the other hand, the German counterpart (DLR), focusing more on science and technology than commercial launch systems, cannot compete in the burgeoning field of space commercialization with CNES.

Commercial Off-The-Shelf (COTS) components, cost-cutting strategies, declining prices of access to space, and much shorter iterations on acquisition processes are just the start of how New Space is changing the industry led by companies such as SpaceX and Rocket Lab. This puts CNES and ESA under pressure, as the Traditional Space (HiRel) model is getting too slow and expensive in relation.

The space supply chain is maturing from the stringent HiRel specification means of testing to rapid, less expensive commercial production. This evolution is also reflected in ESA's ECSS-Q-ST-60-13C standard that has paved the way towards the wider adoption of COTS components in space.

The future of space may take many paths. Greater collaboration between the space and automotive industries, as both industries work toward strengthening mass production and using commercial-grade parts. A possible unraveling of New Space, if companies' efforts to achieve profitability and address concerns about space debris come to naught. Rise of a hybrid approach – government agencies concentrate on critical missions, and commercial space companies dominate satellite constellations and telecommunications

Generally speaking, CNES has made a comprehensive plan on how to keep being competitive in a new era of commercial space flight which leads us to make a number of changes. Traditional Space will still have a future in deep-space missions and military applications, however, so-called New Space is proving that affordability and rapid iteration matter more than absolute reliability.

In the end, the space game is changing — a mix of technological progress, commercial production methods, and changing policies will define who will lead the next tier of space exploration in the 21st century.

8. References

CNES Dominance (Ariane 5): https://en.wikipedia.org/wiki/Ariane_5

Current Trends and Characteristics of the New Space Market and Component Supply Chain: https://en.wikipedia.org/wiki/Private_spaceflight

France's Space Strategy (CNES) and Government Support for Defense & Aerospace: Overview of CNES's history, missions, and strategic goals: https://en.wikipedia.org/wiki/CNES

French Government and Defense Integration (ESA's overview of European space agencies): https://en.wikipedia.org/wiki/European_Space_Agency

High-reliability Electronics: https://en.wikipedia.org/wiki/Reliability_engineering

Lecture 8 - Blockchain in Space (2024) *Space Industry Market Trends and the Impact of New Space on Traditional Aerospace Strategies.*

"Space Economy of the Future" by McKinsey & Company: https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/space-the-1-point-8-trillion-dollar-opportunity-for-global-economic-growth

SpaceX and the categorical imperative to achieve low launch cost: https://spacenews.com/spacex-and-the-categorical-imperative-to-achieve-low-launch-cost/