

Article

Experimental Aircraft: Comparative Analysis of Governance, Funding, and Business Models

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Abstract

Decarbonizing aviation, particularly for long-range operations, is critical for meeting international climate targets, yet it remains technically and operationally challenging. Experimental aircraft (EA) serve to enable flying research infrastructures that provide realistic flight environments for validating emerging technologies and bridging the gap between research and future operational aircraft. While motivated by long-range aviation decarbonization, the study analyses experimental aircraft across multiple scales and missions, focusing on governance structures, funding mechanisms, and business models rather than technical performance metrics. Beyond their technical role, the success and sustainability of EA programs depend strongly on how they are governed, financed, and operated—dimensions that remain comparatively underexplored in the literature, which has primarily emphasized technical performance and flight-test results. To address this gap, this study adopts a structured, multi-method qualitative research approach combining desk-based investigation, a systematic literature review, and comparative case study analysis. The paper reviews and classifies 74 experimental aircraft programs worldwide, with a primary analytical focus on Europe and the United States, examining governance models, funding structures, and business models alongside contextual factors such as platform scale, sectoral orientation, and stakeholder involvement. The results show that most experimental aircraft function as technology demonstration and strategic innovation platforms, supported predominantly by public and public-private funding due to the high-risk and long-term nature of flight research infrastructures. Governance arrangements vary with mission and scale, balancing public oversight, industrial leadership, and academic participation. These findings support the EXAELIA project and provide a reference framework for future experimental aircraft programs.



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1. Introduction

The aviation industry faces mounting pressure to achieve decarbonization by 2050, in line with international climate targets and the European Union's Green Deal objectives [1]. Long-range aircraft, responsible for nearly half of all aviation-related CO₂ emissions in 2019, represent one of the most difficult segments to decarbonize [2]. Achieving this

transition requires not only radical advances in aerodynamics, propulsion, structures and alternative fuels, but also new infrastructures that accelerate the safe and efficient validation of disruptive technologies before they reach commercial application.

Experimental aircraft (EA) have emerged as essential instruments for this transformation. By enabling in-flight evaluation of advanced technologies, ranging from blended-wing-body (BWB) architectures and hydrogen propulsion to digital flight-control systems, EA bridge the gap between laboratory-scale research and market-ready solutions [3]. Compared to simulation and ground testing, they offer unmatched realism, reducing risks associated with certification and deployment while promoting cross-sectoral collaboration among academia, industry, and regulators [4]. As such, EA not only support technological validation but also serve as catalysts for broader innovation ecosystems.

Globally, several initiatives have leveraged EA to accelerate aerospace innovation. In the United States, NASA and Boeing's experimental demonstrators have long pioneered the flight validation of novel propulsion and structural concepts [5], while in Europe, Airbus has advanced comparable efforts through its dedicated test platforms [6]. The European landscape, however, remains fragmented, reflecting the distribution of experimental aircraft activities across different countries. While multiple research infrastructures exist at national or project-specific levels, e.g., [7,8], Europe lacks a unified, modular, and large-scale flying testbed dedicated to supporting next-generation aviation technologies on a continental basis. This gap raises concerns over Europe's ability to compete globally in aerospace innovation, particularly in the transition to climate-neutral aviation.

Beyond technical development, the long-term success of EA depends critically on their governance, funding, and business models. Governance defines how stakeholders, including regulators, research institutions, manufacturers, and operators, coordinate decision-making, ensure accountability, and manage risks. Funding models vary from state-driven and grant-based mechanisms to public-private partnerships (PPPs) and industry-led consortia, each with distinct trade-offs in terms of sustainability and scalability. Meanwhile, business models determine how EA create, deliver, and capture value, whether as shared research infrastructures, commercial services, or hybrid arrangements. Despite their importance, these organizational and economic dimensions remain underexplored, with most studies focusing narrowly on technical achievements. The studies identified in this work provide valuable insights into specific platforms or technologies, but almost none systematically examine broader governance, funding, or business model aspects, limiting their applicability for informing programmatic or policy decisions.

This paper addresses these gaps by providing a comprehensive overview of existing EA worldwide, focusing on governance structures, funding approaches, and business models, as well as the interconnections between them. The review is based on an extensive analysis of the literature, resulting in a comprehensive dataset. The analysis also considers complementary factors that influence these models. Furthermore, the paper provides a comparison between the USA and Europe with reference to governance structures, funding approaches, and business models, and highlights lessons learned from EA. The insights gained are directly linked to the ongoing development of a modular European experimental aircraft program under the EU-funded EXAELIA project [9], which aims to provide flexible, scalable infrastructures for future long-range aircraft featuring radical changes in aircraft and propulsion technologies enabling and supporting the adoption of innovative aircraft configurations (e.g., blended wing body, truss-braced high aspect ratio wing, etc.). The dataset and analysis will support the formulation of exploitation strategies and roadmaps within the project.

Although experimental aircraft differ significantly in scale, mission, and technical configuration, they share a common role as flying research infrastructures. This study adopts the umbrella term ‘experimental aircraft (EA)’ to enable cross-cutting analysis of governance, funding, and business models—dimensions that transcend technical heterogeneity and remain largely underexplored.

Figure 1 illustrates representative examples of experimental aircraft, including NASA X-57 Maxwell [6], NASA X-48 BWB [10], e-Genius [11], and Airbus Flightlab [12], highlighting the wide diversity of platform types and models arrangements within the EA landscape. Additional characteristic examples arise from research initiatives, such as the Novel Aircraft and Scaled Flight Test Demonstrator (SFD) [13] and the Inverted Joined Wing Scaled Demonstrator Programme (MOSUPS) [14], further underscoring the heterogeneity of experimental aircraft in terms of scale, mission, and organizational structure.



Nasa X-57 Maxwell



Nasa X-48 BWB



e-Genius



Airbus Flightlab

Figure 1. Representative examples of experimental aircraft [6,10–12] * (* Images are derived from Openverse (using Creative Commons license) and free public domain images from NASA Image and Video Library).

2. Methodology

2.1. Analytical Framework

This study adopts an exploratory and classificatory research design to systematically analyse governance structures, funding mechanisms, and business models associated with experimental aircraft programs. Given the heterogeneity of experimental aircraft platforms, the diversity of institutional arrangements, and the limited availability of standardized quantitative data, the research is not hypothesis-driven. Instead, it is guided by the following research questions:

1. What governance, funding, and business models are employed in existing experimental aircraft programs worldwide?
2. How do these models relate to platform scale, sectoral orientation (civil, defence, or dual-use), and strategic objectives?
3. What lessons can be derived from existing experimental aircraft programs to inform the development of a future European experimental aircraft?

To address these questions a qualitative, multi-method approach was used, combining desk-based investigation, a systematic literature review, structured case study analysis, and expert input, as detailed in the following paragraphs.

Although various subtypes of experimental aircraft exist in the literature, such as prototype aircraft, research aircraft, flying demonstrators, and flying testbeds, this work adopts the more general term ‘experimental aircraft (EA)’ to encompass all of these categories.

The present study adopts a structured, multi-method research approach, as summarized in Table 1, to identify and analyse existing governance structures, funding mechanisms, and business models associated with EA. The methodology is designed to provide both breadth and depth, combining empirical evidence with expert insights to develop a comprehensive understanding of global EA practices.

Table 1. Summary of the methodological approach.

Research Methods	- Desk Research - Literature Review - Case Study Analysis - Internal Partners Insights
Data Sources (>390)	- Scientific Literature - Public Reports - Websites - Internal Project Partners’ Input - Case Study and Project-Specific Documentation
Analytical Framework	- Categorization based on governance, funding, and business models - Also considered contextual factors (e.g., Ownership, Sectoral Domain, Involved Actors, Lessons Learned, etc.) that may influence these dimensions
Geographic Scope	Europe (mainly) and Worldwide (international)
Temporal Scope	Past and Existing EA
Platform Types	Crewed and Uncrewed Vehicles
Application Scope	Civil and Defence Sectors
Number of EA identified	74

The research process integrates three primary methods: desk-based investigation, literature review, and case study analysis. Desk research was conducted to collect publicly available information from institutional reports, governmental documents, industry publications, project-level outputs and internal partners insights. Internal partners insights refer to knowledge contributed by project EXAELIA partners concerning specific initiatives and experimental platforms within their experience, which helped direct the data collection and identification of relevant testbeds. In addition, a systematic literature review was undertaken, encompassing academic articles, technical reports, policy documents, and grey literature relevant to aviation research infrastructures and testbeds.

A comprehensive analytical framework guided the classification of EA. The analysis focuses on the organizational and economic dimensions of experimental aircraft programs, including governance structures, funding mechanisms, and business models. Technical performance characteristics—such as range, payload, propulsion type, and aerodynamic capabilities—are intentionally excluded from the detailed analysis, as the study does not aim to compare aircraft capabilities. These characteristics are included in the comprehensive table solely for reference, providing complementary information.

To account for variation across cases, several contextual factors were also considered, such as ownership structures, sectoral orientation in civil and defence domains, the types of stakeholders involved, geographical location, and key lessons learned from implementation and operation. Distinctions between sub-scale/full-scale and academic/industrial platforms are also preserved.

In addition, the scope of this study covers both crewed and uncrewed flying testbeds, across civil and defence applications. While selected experimental aircraft from regions outside Europe and the USA are included for context, the analysis is most robust for Europe and the USA, where data availability, transparency, and traceability are highest. Experimental aircraft in other regions, including Russia and China, are likely underrepresented due to limited access to verifiable sources. In addition, the temporal scope includes both past and currently operational testbeds. In total, 74 EA were identified and examined using the defined framework.

2.2. Data Structure and Compilation of EA Data

To systematically capture and analyse information on the 74 identified experimental aircraft (EA), a standardized Excel data table structure was developed. Each entry in the dataset corresponds to one EA and is described using a consistent set of fields. These fields ensure comprehensive coverage of governance, operational, funding, technological, and contextual aspects, while also supporting cross-case comparison and traceability. The data on EA were compiled into a structured table containing information on governance, funding, business models, complementary data, and over 420 literature sources.

Given the nature of the research questions, grey literature (including institutional reports, project documentation, and official program descriptions) constitutes a primary empirical data source. Peer-reviewed literature is used to frame the analytical approach, while grey literature provides factual input required to classify governance structures, funding arrangements, and operational models. Analytical rigor is maintained through systematic classification and cross-case synthesis.

The table below (Table 2) summarizes the main attributes and their respective descriptions applied in the categorization of EA.

Table 2. Data structure overview.

Key Attributes	Description	Key Attributes	Description
Testbed Name	Official name of the EA	Launch Year	Year operations started
ID No	Internal unique identifier for easy referencing	End of Operations Year	Year ended (if applicable)
Indicative Figure	A representative image or illustration of the EA	Main Organizations Involved	Partners or stakeholders
Country of Origin	Country where the testbed is based or coordinated	Crewed/Uncrewed	Type of aircraft or platform used
Governance Model/Leader Entity	Type of governance and lead organization	Civil/Defence–Military/Dual Use	Intended application or domain
Funding Structure/Main Funding	Source(s) of funding	Scale	Physical scale of the EA
Business Model	Operating approach	References	Source of the information (link, doc, partner input)
Key Testbed Technologies	Technologies tested		

3. Results and Analysis

The EA were primarily categorized according to three key dimensions: governance models, which define organizational structures, stakeholder roles, and decision-making mechanisms; funding and financing strategies, which distinguish between public, private, and hybrid approaches; and business models, which consider how value is created, delivered, and sustained over time. These core dimensions were complemented by additional contextual factors, including ownership structures, civil or defence orientation, the nature of participating stakeholders, geographical setting, and lessons learned from implementation and operation. The classification of governance, funding, and business models presented herein is based on the analysis of the identified experimental aircraft and is specific to this study; it should not be interpreted as a standardized or universally adopted classification.

Table 3 presents an excerpt of the collected data for indicative EA. The complete table presenting all identified experimental aircraft along with the relevant supporting data (as outlined in Table 2) is included in Appendix A.

Table 3. Excerpt of collected data and structure for indicative testbeds.

EA Name	Country of Origin	Governance Model	Funding Structure	Business Model	Launch Year
Clean Sky 2—SFD	Netherlands	Public Governance	Public Funding	Technology Demonstration and Strategic Innovation Business Model	2017
Airbus Flightlab-BLADE EA demonstrator	France	Public–Private partnership	Public–Private Funding	Technology Demonstration and Strategic Innovation Business Model	2010
General Electric Boeing 747-400 jumbo jet	USA	Corporate Governance	Private Funding	Technology Demonstration and Strategic Innovation Business Model	2010
Ilyushin Il-76	Russia	Public Governance	Public Funding	Commercialization-focused	1971
e-Genius-Mod	Germany	Academic Governance	Public Funding	Technology Demonstration and Strategic Innovation Business Model	2022
GA-USTAR aircraft	USA	Academic Governance	Public Funding	Academic Research and Education	2015

3.1. Governance Models

EA operate under a range of governance structures that reflect their strategic goals, funding sources, stakeholder composition, and sectoral focus. Understanding the governance model of an EA is essential to assessing how decisions are made, how resources are managed, and how stakeholders interact. The following five governance models have been identified, along with representative EA (Table 4).

Analysis of governance models reveals a diverse distribution (Figure 2), reflecting the multifaceted nature of experimental aircraft and their varied objectives. Public–private partnerships and fully public governance collectively account for 41% of the identified EA, underscoring the central role of state involvement in managing large-scale or strategically significant flying infrastructures. These arrangements frequently involve government agencies collaborating with private aerospace firms and academic institutions, enabling shared investment, risk mitigation, and access to specialized technical and operational expertise. They also facilitate alignment with national or regional strategic priorities, such as aerospace innovation, defence capabilities, and sustainable aviation development.

Table 4. Governance model types, descriptions, and representative EA testbeds.

Governance Model Type	Description	Representative EA Examples
Corporate Governance	This model is characterized by private ownership and control. A corporation or commercial entity is the primary decision-maker, overseeing the EA project in alignment with its business strategy, profitability goals, and shareholder interests. Governance is typically structured through formal corporate hierarchies, with executive leadership, boards of directors, and internal R&D units managing the initiative. This model is common in proprietary platforms developed for commercial product testing or technology demonstration.	Boeing ecoDemonstrator [15] Airbus UPNEXT [16] JetZero [17]
Public Governance	Public governance refers to EA that are wholly controlled and operated by governmental bodies or publicly funded research organizations. These testbeds are designed to serve national priorities, such as public safety, strategic capability development, or scientific advancement. Operations are fully funded through public budgets, with policy-driven decision-making, and often focus on civil aviation regulation, defence testing, or space research.	NASA X-57 Maxwell [18] NLR Research Aircraft Cessna Citation II [19] SWiFT (Stealth Wing Flying Testbed) [20]
Public–Private Partnership (PPP)	Under a PPP governance model, public sector entities (e.g., government agencies, national labs) and private companies collaborate to develop and operate the EA. Responsibilities, risks, and investments are shared, leveraging public oversight and objectives with private-sector innovation and efficiency. Decision-making structures are negotiated through formal agreements, often under joint steering committees or boards. PPPs are frequently used in dual-use or strategically significant testbeds.	Boeing X-48 [21] Rolls-Royce “Spirit of Innovation” [22] Kawasaki XC-2 [23]
Collaborative Consortium Governance	This model involves a network of multiple partners, often including universities, research institutions, private companies, and public agencies, working together through structured consortia. Decision-making is typically collective, based on consensus or shared governance bodies. This inclusive model supports joint innovation, open research, and distributed ownership, often aligned with EU-funded or multi-partner initiatives.	E-FAN X [24] H2FLY HY4 [25] ECLIPSE [25]

Table 4. Cont.

Governance Model Type	Description	Representative EA Examples
Academic Governance	In this structure, universities or academic institutions lead and operate the EA. The primary objectives centre around research, experimentation, education, and publication. Governance decisions are guided by academic leadership and faculty, often with funding from research grants and national or international research programs. These EA typically serve as open platforms for advancing early-stage or exploratory technologies.	UIUC Subscale Sukhoi [26] e-Genius-Mod [27] MOSUPS [14]

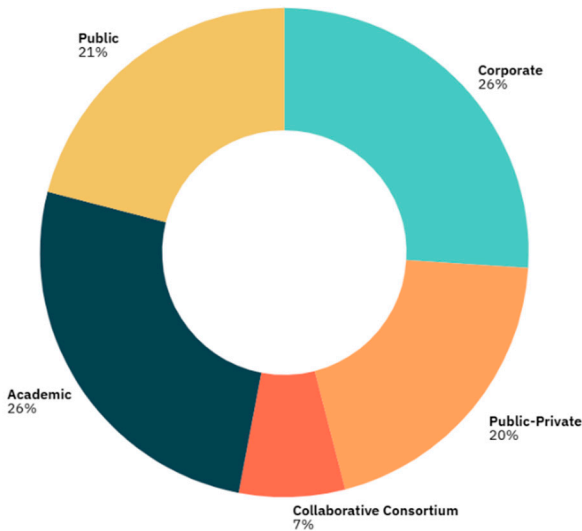


Figure 2. Governance models of EA including corporate, public, public–private partnership, collaborative consortium governance and academic governance.

Corporate governance and academic governance models are each represented in approximately 26% of EA. Corporate governance typically encompasses industry-led initiatives—such as Boeing’s ecoDemonstrator and Airbus UPNEXT—focused on commercialization, technology demonstration, operational readiness, and the maturation of market-relevant technologies. These platforms often operate under private or hybrid funding arrangements and prioritize efficiency, scalability, and regulatory compliance. In contrast, academic governance, exemplified by e-Genius-Mod and UIUC Subscale Sukhoi, emphasizes research, experimentation, and education, offering flexible environments for validating emerging technologies, testing novel concepts, and training the next generation of aerospace engineers.

The governance models shown in Figure 2 categorize experimental aircraft according to the primary entity responsible for strategic decision-making and operational oversight. Corporate governance refers to industry-led initiatives under private organizational control, typically aligned with commercial or strategic industrial objectives. Public governance encompasses platforms led by governmental bodies or publicly funded research organizations, often serving purely national or public-interest goals. Public–private partnership governance involves shared responsibility between public authorities and private industry, combining public oversight with industrial capability and risk-sharing. Collaborative consortium governance describes multi-actor arrangements in which universities, research

institutes, public agencies, and private companies jointly manage and operate the platform through structured consortia. Finally, academic governance refers to experimental aircraft led and operated primarily by universities or academic institutions, with decision-making guided mainly by research and educational objectives.

3.2. Funding Models

The financial structure underpinning EA plays a critical role in their development, sustainability, and operational flexibility. Different funding models reflect the varying objectives, risk appetites, and stakeholder involvement across EA initiatives. The following three main funding models have been identified, along with representative experimental aircraft (Table 5).

Table 5. Funding model types, descriptions, and representative EA testbeds.

Funding Model Type	Description	Representative EA Examples
Private Funding	In this model, the EA is financed exclusively by private investors, including corporations, venture capitalists, or industry consortia. This model is driven primarily by commercial objectives, focusing on rapid innovation cycles, market-driven technology development, and potential financial returns. Private funding may offer greater operational agility but typically requires clear business models and demonstrable value propositions.	Alice Aircraft by Eviation [28] Vertical Aerospace [29] Diamond DA 62 [30]
Public Funding	In this model, financial support for the EA is provided entirely by government budgets or public grant programs. Funding is directed towards projects that serve broader societal or strategic goals such as advancing scientific knowledge, enhancing national security, or developing critical infrastructure. Public funding often ensures stable and long-term support but may be subject to political and budgetary constraints.	S3CM [31] GA-USTAR aircraft [32] Puffin demonstrator [33]
Public–Private Funding	This mixed funding structure combines resources from government entities and private sector participants. By sharing the financial burden, risks, and potential benefits, public–private funding models aim to leverage the strengths of both sectors: the public sector’s mandate for public interest and strategic investment, and the private sector’s drive for innovation and commercial viability. These partnerships often underpin testbeds with dual-use applications or significant technological challenges.	ZeroAvia Hydrogen Aircraft [34] MAGMA [35] Boeing ecoDemonstrator [15]

The funding landscape for EA is largely dominated by public financing, which supports over half (54%) of the identified platforms (Figure 3). This predominance reflects the strategic importance and inherently high-risk nature of these experimental infrastructures, where government backing is critical for research and development, infrastructure investment, regulatory compliance, and long-term operational sustainability. Publicly funded platforms often focus on foundational research, technology demonstration, or strategic national priorities, with examples including NASA’s X-57 Maxwell and the Clean Sky 2—Scale Flight Demonstrator.

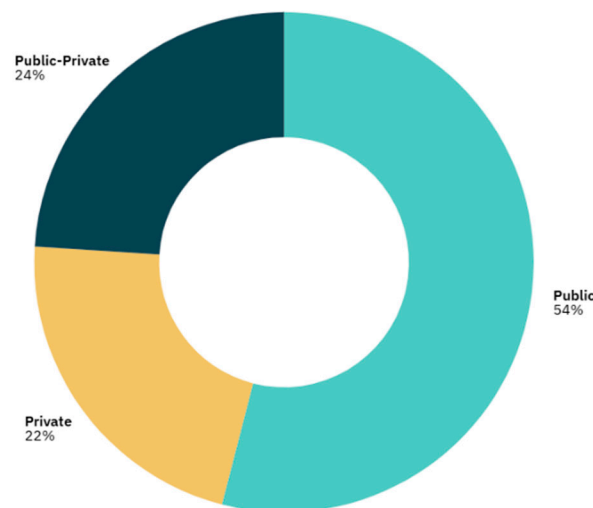


Figure 3. Funding models of EA including public, private, and mixed (private–public) funding sources.

Private funding accounts for 22% of EA, highlighting a substantial but comparatively smaller role for market-driven and commercial investments. These platforms are typically industry-led initiatives with clear commercialization pathways, rapid innovation cycles, and higher operational agility, such as Joby Aviation’s eVTOL demonstrators or Boeing’s ecoDemonstrator program.

Meanwhile, 24% of EA operate under mixed public–private funding models, reflecting a growing trend toward collaborative financial arrangements that balance risk, capability, and strategic goals. These hybrid models leverage the innovation and efficiency of private investors alongside the stability, long-term vision, and regulatory support provided by public stakeholders. Platforms such as the E-FAN X or Rolls-Royce “Spirit of Innovation” exemplify this approach, where public entities provide oversight and strategic alignment while industry partners contribute expertise, technology, and additional capital. Collectively, this funding distribution illustrates how different financing structures are tailored to platform objectives, risk profiles, and stakeholder involvement, enabling a diverse ecosystem of experimental aircraft capable of advancing both technological innovation and strategic aerospace priorities.

The funding models shown in Figure 3 classify experimental aircraft according to their primary sources of financial support. Private funding refers to platforms financed predominantly by corporate investment, venture capital, or other private-sector resources, typically associated with market-driven or commercialization-oriented initiatives. Public funding encompasses experimental aircraft supported mainly through governmental budgets, national research programs, or publicly funded institutions, often addressing strategic, scientific, or policy-driven objectives. Public–private funding combines financial contributions from public authorities and private-sector partners, enabling risk sharing and long-term investment in high-cost or high-risk experimental aircraft programs.

3.3. Business Models

The business model adopted by an EA shapes its operational priorities, stakeholder engagement, and long-term sustainability. Different business models reflect the varied purposes EA serve, from academic research to commercial exploitation. The following three main business models have been identified, along with representative experimental aircraft (Table 6).

Table 6. Business model types, descriptions, and representative EA testbeds.

Business Model Type	Description	Representative EA Examples
Commercialization Focused	This model emphasizes transforming flying testbeds into revenue-generating products or services. The primary aim is to develop market-ready solutions that can be sold, licensed, or integrated through partnerships. Business success is measured by profitability, scalability, and market impact. Funding often involves private investment, and operations prioritize efficiency, customer needs, and commercial competitiveness.	Joby Aviation [36] Alice Aircraft by Eviation [28] Vertical Aerospace [29]
Technology Demonstration and Strategic Innovation	EA adopting this model are used to develop, validate, and showcase new aerospace technologies. Their purpose is to reduce technical and operational risks, provide proof of concept, and attract further investment or policy support. These testbeds often serve as platforms for early-stage innovation, enabling stakeholders to demonstrate capabilities that can lead to commercialization or regulatory adoption.	Airbus A350 XWB Testbed [37] Lockheed Martin CATBird [38] Boeing Phantom Ray [39]
Academic Research and Education	This business model centres on supporting scientific research and training the next generation of aerospace professionals. EA operating under this model primarily facilitate knowledge creation, curriculum development, and academic publication. Funding typically comes from research grants, public institutions, and educational programs. The focus is on exploration, experimentation, and contributing to the broader scientific community.	Cirrus SR22T [40] UIUC Aero Testbed [41] Hyperion 1.0–2.1 [42]

The business models adopted by experimental aircraft organizations (Figure 4) indicate that these platforms predominantly function as innovation enablers rather than direct commercial enterprises. The majority of EA (65%) operate under the technology demonstration and strategic innovation model, reflecting their primary role in advancing aerospace capabilities, validating emerging technologies, and reducing technical and operational risks. These platforms often support long-term industrial or defence strategies, providing a controlled environment for testing propulsion systems, autonomous flight controls, and novel airframe designs. Representative examples include Airbus's A350 XWB Testbed,

Boeing's Phantom Ray, and Lockheed Martin's CATBird, which facilitate multi-stakeholder collaboration while de-risking new technologies before potential commercialization.

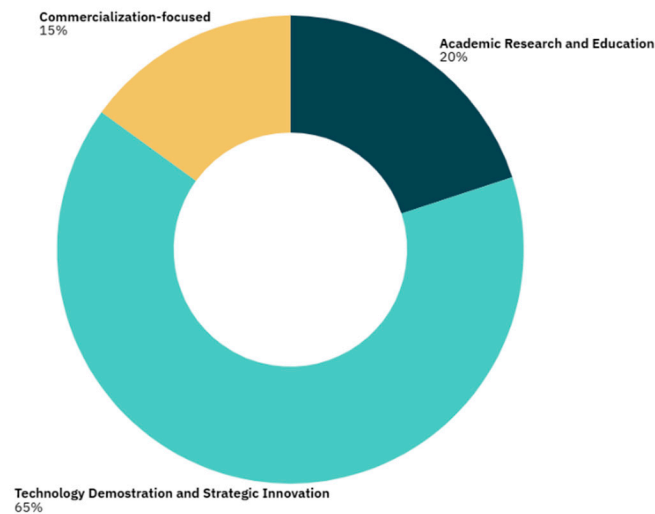


Figure 4. Business models of EA including commercialization-focused, academic research and education, and technology demonstration and strategic innovation.

Only a minority of EA (15%) follow a commercialization-focused business model, actively pursuing revenue generation through market-ready products or services. These platforms, exemplified by Joby Aviation, Alice Aircraft by Eviation, and Vertical Aerospace, operate with private funding or hybrid financing and emphasize rapid innovation, market entry, and scaling, often in emerging sectors such as electric vertical take-off and landing (eVTOL) aircraft.

Meanwhile, 20% of the flying platforms are oriented toward academic research and education, serving as platforms for fundamental research, curriculum development, and knowledge dissemination. Universities and research institutions, such as UIUC Aero Testbed, Hyperion 1.0–2.1, and e-Genius-Mod, use these EA to train the next generation of aerospace engineers and to explore early-stage or high-risk technologies that may later feed into industrial or commercial programs.

The business models shown in Figure 4 categorize experimental aircraft according to their primary purpose and value-creation logic. Commercialization-focused models emphasize the development of market-ready products or services, with activities oriented toward revenue generation, scalability, and industrial deployment. Academic research and education models prioritize scientific research, experimentation, and training, serving as platforms for knowledge creation and workforce development within universities and research institutions. Technology demonstration and strategic innovation models focus on validating, de-risking, and showcasing emerging aerospace technologies, supporting long-term industrial strategies and public-interest objectives rather than immediate commercial returns.

3.4. Interconnections Between Funding, Business, and Governance Models

3.4.1. Interplay Between Funding and Business Models of EA

The relationship between funding structures and business models for EA programs reveals clear and consistent patterns aligned with the goals and stakeholders involved:

Public and Public–Private Funding

Public and public-private funding models predominantly support technology demonstration and strategic innovation business models. These initiatives frequently involve

multi-sector partnerships among government agencies such as NASA, the European Union, and defence departments, research institutions, and leading aerospace industry players including Airbus, Boeing, and Rolls Royce.

The primary objective of these projects is to develop new technologies, validate their feasibility, and drive innovation forward without immediate commercial pressure. This approach allows for higher risk tolerance and long-term strategic investment. Notable examples include the E-FAN X [24], Boeing X48 [11], and Zero-e testbeds [43].

Private Funding

Conversely, private funding, sourced from corporations or venture capital, is mainly associated with commercialization-focused business models. Companies such as Joby Aviation, Lilium, and Vertical Aerospace rely heavily on private investment to accelerate product development, enter the market, generate revenue, and scale operations rapidly. This trend is especially prominent in emerging sectors like electric vertical take-off and landing (eVTOL) aircraft and urban air mobility (UAM). Examples include Vertical Aerospace [29], DA 62 Diamond Aircraft [30], and Scout B1-100 [44].

Academic and Government Grants

Academic and government grants are typically directed toward supporting academic research and education or innovation business models. These projects emphasize fundamental research, educational programs, and the nurturing of innovation ecosystems, often hosted by universities and academic institutions. Representative examples include the Raven [45], Hyperion [42], and X-HALE [46] flying testbeds.

3.4.2. Interplay Between Governance Structures and Funding Models

An examination of governance structures in relation to funding sources reveals distinct alignments that reflect the core mission and operational focus of EA:

Government-Led or Public Institution Governance

EA governed by government agencies or public research institutions—such as NASA, European Union agencies, or defence ministries—typically rely on public or public-private funding. These entities prioritize the public good, strategic innovation, and technology advancement, often supporting high-risk, long-term projects that may not have immediate commercial returns.

Representative examples include the NASA Gulfstream III [47], NASA Langley AIRSTAR [48], and Super Guppy Foamie [49], which operate under governance models emphasizing national or regional aerospace capabilities and strategic research.

Corporate Governance

When governance is led by corporations, funding generally consists of a blend of private investment complemented by government grants or partnerships. Corporations steer the strategic direction towards market-driven goals as commercial viability becomes attainable. This governance-funding combination balances innovation with business imperatives, facilitating technology maturation and product commercialization.

Notable examples of corporately governed testbeds include JetZero [17], and Boeing ecoDemonstrator [15] programs.

University Governance

EA under university or academic institution governance predominantly receive public grants and academic funding. These testbeds focus on education, fundamental research,

and fostering innovation ecosystems. Governance is typically exercised by academic leadership or research consortia, ensuring alignment with scientific and educational objectives.

Examples include the e-Genius-Mod [27], and VELA 2 [50] flying testbeds, which exemplify the academic governance model emphasizing research and training.

3.5. Contextual Aspects of EA

3.5.1. Scale and Type of EA

The analysis of EA reveals a fairly balanced distribution between sub-scale and full-scale platforms, with a slight majority of 53% classified as sub-scale. This balance reflects the diverse needs for both cost-effective, smaller-scale experimentation and full-scale operational testing.

Similarly, the split between crewed and uncrewed EA is nearly even, with uncrewed platforms representing a slight majority at 53%. This highlights the growing importance and adoption of uncrewed aerial systems in flight testing, alongside traditional crewed aircraft.

Crewed platforms dominate the full-scale, civil aviation, and defence–military sectors, serving traditional piloted aircraft testing and commercial aviation development.

Uncrewed platforms are more common among sub-scale programs and play a growing role in defence and dual-use applications. This trend corresponds with increased focus on emerging technologies such as autonomous systems, surveillance drones, and next generation defence platforms.

Scale in Relation to Funding and Governance Models

The scale of EA exhibits clear correlations with their funding sources and governance structures.

Full-Scale Experimental Aircraft

Full-scale testbeds are predominantly supported by major industry players such as Airbus, Boeing, Rolls-Royce, and Lockheed Martin. These projects frequently involve collaboration with government or defence agencies, including the FAA, U.S. Air Force, and various European defence agencies. The governance model for full-scale testbeds typically emphasizes industry–government partnerships, combining commercial expertise with public strategic oversight. This structure facilitates the large investments and coordination necessary for full-scale, operationally representative platforms.

Sub-Scale Experimental Aircraft

Sub-scale experimental aircraft are more commonly found within academic and research institutions, smaller specialized companies, or government research laboratories such as NASA and various universities. These platforms often serve experimental, educational, or early-stage innovation purposes (i.e., demonstrators). Governance for sub-scale experimental aircraft is frequently led by academic bodies, with funding primarily sourced from government grants and research funds, enabling a focus on scientific discovery and technology development.

3.5.2. Regional Aspects

Geographic Distribution of EA

The geographic distribution of EA (Figure 5) highlights distinct regional dynamics in aerospace innovation and investment. The United States emerges as the global leader, hosting nearly half (43%) of all identified experimental flying platforms. This dominant position reflects the country's substantial and sustained commitment to advancing both civil and defence aerospace technologies through extensive funding, infrastructure, and industry capabilities. In Europe, EA activities are notable but more fragmented across

different countries. The United Kingdom, France, and Germany stand out as the primary contributors, with 8, 7, and 7 programs respectively, each demonstrating significant testbed development and operational capacity. However, the dispersed nature of these efforts suggests opportunities for enhanced coordination and integration at the regional level, potentially leading to more efficient resource use and greater collective impact.

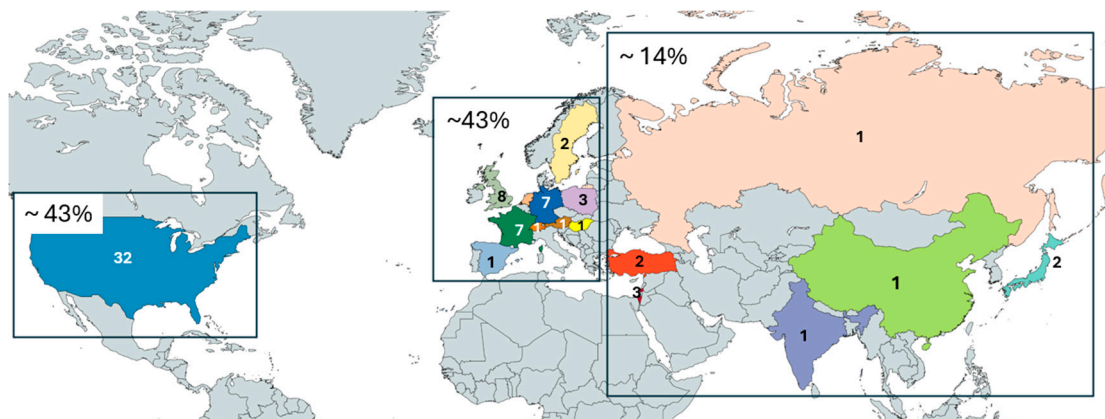


Figure 5. Geographic distribution of documented experimental aircraft based on accessible and verifiable sources (does not represent the total number of experimental aircraft developed per country).

Across regions, the governance and funding models of flying experimental aircraft display distinctive characteristics:

- Europe and the USA frequently utilize public–private partnerships backed by strong institutional support from, for example, the EU Horizon programs, NASA, and the U.S. Department of Defense (DoD).
- Japan and India predominantly rely on government and defence ministry funding, with projects often fully publicly funded and oriented towards technology demonstration.
- Emerging markets like Turkey and Israel exhibit mixed funding models, combining private investment with indirect public support for strategically important projects.

A comparison of EA programs in the United States and Europe (Table 7) reveals distinct governance, funding, and strategic approaches shaped by regional priorities and institutional frameworks.

Table 7. Regional differences in EA programs: U.S. vs. Europe.

Aspects	USA	Europe
Dominant Governance	Public Governance (NASA, DoD)	Corporate (e.g., Airbus)
	Corporate (Boeing, Lockheed, etc.)	Public–Private Partnerships (EU Frameworks)
Funding	Public (NASA, DoD)	Public–Private (EU, Horizon 2020, national programs)
	Public–Private (e.g., NASA-industry)	Corporate Investment
Business Focus	Mixed: Aerospace/Defence (NASA, Lockheed) + Commercial eVTOL	Predominantly innovation-focused within Airbus and Rolls Royce
Academic Involvement	Strong (UIUC, MIT, etc.), many purely academic projects	Strong but more connected to EU consortia or applied research

3.5.3. Civil, Defence, and Dual-Use Applications

Civil-use testbeds primarily involve crewed, full-scale aircraft focused on commercial aviation and urban air mobility (UAM). Examples include projects led by Boeing, Airbus, and Joby Aviation. Defence–military EA feature a mix of crewed and uncrewed platforms, with a recent shift favouring uncrewed systems like UAVs and drones. Dual-use EA often represent full-scale platforms co-funded by government and industry, bridging commercial and defence objectives with robust funding and strategic collaboration.

3.5.4. Launch and Operational Period Trends

Experimental aircraft have evolved significantly over time, reflecting shifts in technology focus and sector priorities:

- Early testbeds and demonstrators (1980s to 2000s) primarily concentrated on crewed, full-scale aircraft, with substantial government defence involvement. These platforms were designed for traditional aerospace applications, emphasizing established propulsion and avionics technologies.
- More recent projects (2010s onward) show a marked shift toward electric and hydrogen propulsion, urban air mobility (UAM), and uncrewed aerial vehicles (UAVs). This transition mirrors broader trends toward sustainability, autonomy, and innovative air transport concepts.
- There is an emerging trend of commercialization of full-scale EA, signalling a movement away from purely research.

3.5.5. Organizational Involvement Patterns

The types of organizations involved in EA development vary according to scale, technology, and sector:

- Large aerospace corporations such as Airbus, Boeing, and Rolls-Royce dominate full-scale projects, frequently collaborating with government aviation and defence agencies to leverage resources and strategic capabilities.
- Universities and research centres—including institutions like NLR, TU Delft, NASA research centres, and various international universities—primarily lead or contribute to sub-scale and uncrewed platforms, focusing on innovation, fundamental research, and technology validation.
- Complex full-scale projects often involve multi-organization consortia that span national boundaries and sectoral domains, combining expertise from industry, academia, and government to address the multifaceted challenges of modern aerospace development.

4. Discussion—Lessons Learned from EA

The analysis highlights fragmentation in the European experimental aircraft landscape and the predominance of project-specific platforms. While this study does not provide prescriptive design guidelines, it establishes boundary conditions and design principles that can inform European-level initiatives such as EXAELIA.

4.1. Key Lessons on Flight Testing, Collaboration, and Technology Challenges

Early and iterative flight testing is critical for advancing technology readiness. Real-world flight tests reveal practical challenges and performance insights that simulations cannot, helping de-risk innovations and attract additional funding and partnerships. Integration and collaboration across disciplines and sectors—often through public–private partnerships—enable multi-stakeholder investment, modular technology development, and faster innovation cycles. High-risk technologies, such as hydrogen propulsion, require

adaptive funding, phased development, and government support to overcome technical and financial barriers.

4.2. Collaborative Governance Is Key to Flying Research Platforms Success

Governance is most effective when it balances industry, academia, and public institutions. Industry provides commercialization expertise, academia contributes research capabilities, and public bodies supply strategic oversight and funding. Public–private partnerships and collaborative consortia align diverse interests and help manage risks across long development cycles.

4.3. Funding Patterns Reflect the Strategic Nature of Experimental Aircraft

Public funding dominates, supporting over half of identified platforms, particularly those focused on innovation and technology demonstration. Public–private funding models are increasingly common, sharing costs and risks while leveraging industry efficiency and government strategic priorities. Purely private funding is more prevalent in commercialization-focused projects, especially in emerging sectors like urban air mobility.

4.4. Scale and Sectoral Leadership Vary with Governance and Funding

Full-scale flying platforms are typically led by large aerospace corporations in partnership with government agencies, supporting defence and commercial aviation. Sub-scale platforms are often academic-led, focusing on early-stage research, technology validation, and education.

4.5. Public–Private Partnerships Enable Risk Sharing and Innovation

High-cost, high-risk EA benefit from public–private collaboration, pooling resources, expertise, and capabilities. Such partnerships improve the likelihood of successful technology maturation, facilitate regulatory navigation, and harmonize standards across sectors and geographies.

4.6. Geographic and Regional Nuances Shape Flying Research Platforms Ecosystems

The US leads in EA activity, combining public governance with corporate investment and venture capital, accelerating commercialization. Europe features a fragmented but diverse ecosystem, with public–private partnerships and consortia dominating. Emerging markets (Turkey, Israel, Japan, India) employ varied funding mixes reflecting national priorities and industrial policies.

4.7. Experimental Aircraft Are Primarily Strategic Innovation Platforms

Over 65% of flying testbeds focus on technology demonstration and strategic innovation. Only a small proportion target direct commercialization, while academic research and education remain key components. EA serve as enablers of aerospace progress and ecosystem growth rather than short-term profit centres.

4.8. Flight Testing and Certification Require Early and Sustained Investment

Early, iterative flight testing is essential for validating designs and accelerating technology readiness. Sustained funding and government oversight ensure safety, regulatory compliance, and operational readiness. Early engagement with certification bodies (FAA, EASA) supports sustainable business cases.

4.9. Modularity and Flexibility Enhance Testbed Value and Longevity

Modular, flexible designs enable diverse missions, extended operational lifespans, and innovative business models. Careful governance and compliance strategies are needed to navigate regulatory and export-control requirements.

4.10. Technology-Specific Funding and Governance Adaptations Are Necessary

Emerging and high-risk technologies, including hydrogen propulsion and autonomous systems, require adaptive funding and governance models. Government grants and subsidies help overcome early-stage barriers, while phased development approaches mitigate risk.

4.11. Cross-Disciplinary Collaboration and Multi-Stakeholder Networks Are Essential

Due to high complexity and costs, multi-organization consortia and collaborative networks are standard practice. They pool resources, enable knowledge sharing, coordinate innovation across sectors and borders, and harmonize standards, facilitating smoother project delivery and broader technology adoption.

5. Conclusions

This study provides a global overview of experimental aircraft (EA) programs, highlighting their pivotal role in advancing aerospace innovation and supporting the transition to climate-neutral aviation, with a particular focus on governance structures, funding mechanisms, and business models.

The analysis of 74 EA worldwide shows that these platforms primarily serve as technology demonstration and strategic innovation tools rather than commercial enterprises. Over 65% of EA focus on validating emerging aerospace technologies, reducing technical and operational risks, and supporting long-term industrial or defence strategies. Academic and education-oriented platforms remain important for fostering innovation, training engineers, and enabling early-stage research.

Governance strongly shapes EA objectives and outcomes. Public and public-private partnerships dominate large-scale, high-risk platforms, providing shared investment, risk mitigation, and alignment with strategic priorities. Corporate governance supports commercialization-focused initiatives, while academic governance emphasizes research and education.

Funding patterns reflect strategic and technological goals. Public funding underpins innovation-focused EA, while public-private partnerships combine oversight with private-sector agility. Purely private funding is mainly linked to commercialization-oriented platforms. These structures ensure that high-risk, long-term projects remain viable and resources are aligned with platform objectives.

Scale and design affect operational roles. Full-scale platforms, often led by aerospace corporations with government collaboration, support defence and commercial aviation, whereas sub-scale platforms—typically academic—enable early-stage experimentation. Modular, flexible designs extend operational life, support multiple missions, and allow adaptive business models.

Regional differences are notable. The U.S. leads in integrated public-corporate efforts, Europe relies on consortia and partnerships, and emerging markets employ mixed funding reflecting national priorities. Multi-stakeholder collaboration, both nationally and internationally, remains crucial for standardization, knowledge sharing, and accelerated innovation.

Key lessons from EA emphasize the value of early and iterative flight testing, cross-disciplinary collaboration, and adaptive governance and funding approaches. High-risk

technologies, including hydrogen propulsion and autonomous systems, benefit from phased development, sustained funding, and active regulatory engagement.

Finally, while this study provides insights into EA governance, funding, and operations, limitations include a focus on past and existing projects, regional data biases, and restricted access to proprietary information. Future work should incorporate emerging testbeds and non-English sources to provide a more globally representative understanding of evolving trends in experimental aviation.

The insights from this analysis will directly support the EXAELIA project by informing the development of roadmaps and exploitation strategies for European experimental aircraft under the initiative. A structured evaluation of EA program effectiveness, including development of metrics and models for different experimental aircraft categories, constitutes an important direction for future research. Beyond this, the findings provide a reference framework for future EA endeavours worldwide, particularly in the underexplored areas of governance, funding, and business models. By highlighting best practices, lessons learned, and organizational approaches, this study can guide the design, management, and sustainable operation of next-generation experimental aircraft programs, ensuring that both technological innovation and strategic value creation are effectively aligned [6].

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Appendix A. Complete Excel Table, Including Dataset and Literature Sources

Testbed Name	ID No	Country	Governance Model	Business Model	Key Technologies	Scale	Launch Year	End of Operations	Crewed/Uncrewed	Civil/Defence–Military/Dual	Source
Boeing ecoDemonstrator	EA_0001	USA	C.G	T&I	SAFs, Flight Controls, Operational and Load Optimization, Environmental Impact	full	2012	ongoing	Crewed	Civil	[15,51–58]
Airbus Flightlab—BLADE EA demonstrator	EA_0002	France	P.P.	T&I	Aerodynamic Design, Emissions, Data Connectivity	full	2010	ongoing	Crewed	Civil	[6,59–66]
Airbus UPNEXT	EA_0003	France	C.G	T&I	Aerodynamic Design, New Fuels	full	2020	ongoing	Crewed	Civil	[16,67–74]
Airbus A310 MRTT	EA_0004	Spain	C.G	T&I	Air Refueling, Systems Integration and Testing	full	2006	2023	Crewed	Civil	[75–82]
Airbus A350 XWB Testbed	EA_0005	France	C.G	T&I	Aerodynamical and Structural Design, Engine Testing	full	2012–2013	ongoing	Crewed	Civil	[37,83–89]
Rolls-Royce’s “Spirit of Innovation”	EA_0006	UK	P.P	T&I	Energy Systems, Structural Design and Thermal Testing	full	2019	2022	Crewed	Civil	[22,90–100]
NASA X-57 Maxwell	EA_0007	USA	P.G.	T&I	Flight Systems, Avionics	full	2016	2023	Crewed		[10,18,101–110]
ZeroAvia’s Hydrogen-Powered Aircraft	EA_0008	UK	P.P.	T&I	Hydrogen Fuel Cells, Power Electronics	sub	2019–2020	ongoing	Crewed		[34,111–123]
Joby Aviation Joby	EA_0009	USA	C.G. (before 2021) P.P. (after 2021)	C.F	eVTOL, Electric Propulsion, Noise Reduction	full	2015	ongoing (planned to be commercialized)	Crewed		[36,124–134]

Testbed Name	ID No	Country	Governance Model	Business Model	Key Technologies	Scale	Launch Year	End of Operations	Crewed/Uncrewed	Civil/Defence–Military/Dual	Source
Lilium Jet	EA_0010	Germany	C.G.	C.F	Electric Ducted Fans, Li-ion Batteries, Fly-by-Wire	full	2017	2024	Crewed		[135–146]
Alice Aircraft by Eviation Aircraft	EA_0011	Israel	C.G	C.F	Electric Propulsion, Battery System, Composite Airframe	full	2019	2025 (paused)	Crewed		[28,147–155]
Urban Aeronautics' CityHawk	EA_0012	Israel	C.G	C.F	Ducted-Fan VTOL, Hydrogen Fuel Cells	full	2017	ongoing (to be commercialized)	Crewed		
Vertical Aerospace (eVTOL Aircraft)	EA_0013	UK	C.G	C.F	DEP, Lightweight Composites, Low-Noise Design	full	2018 (first flight)	ongoing (to be commercialized)	Crewed		[156–163]
General Electric Boeing 747-400 jumbo jet	EA_0014	USA	C.G	T&I	Turbofan Engines, FADEC, Aero Testing	full	2010	2018	Crewed		[164–167]
Rolls Royce Boeing 747-200B	EA_0015	UK	C.G	T&I	Engine Integration, Instrumentation	full	early 1980s	late 2000s	Crewed		[167–169]
Airbus EcoPulse (TBM-900)	EA_0016	France	C.G	T&I	HMI, AI-Assisted Operations	full	2022	ongoing	Crewed		[170–179]
NLR Research Aircraft Cessna Citation II	EA_0017	Netherlands	P.G.	T&I	Sensor Integration, Instrumentation	full	1993	ongoing	Crewed		[19,180–182]
NLR SFD	EA_0018	Netherlands	P.G.	T&I	DEP, Hybrid Propulsion, Advanced Controls	sub	2017	ongoing	Uncrewed		[13,183–189]
NASA Gulfstream III Aerodynamics Research	EA_0019	USA	P.G.	T&I	Morphing Wings, Aeroelastic Actuation	full	2012 (first flight)	2015	Crewed		[47,190–196]
NASA Langley 's AIRSTAR	EA_0020	USA	P.G.	T&I	Subscale Testing, Adaptive Control, Telemetry	sub	early 2000s	ongoing (probably)	Uncrewed		[48,197–203]

Testbed Name	ID No	Country	Governance Model	Business Model	Key Technologies	Scale	Launch Year	End of Operations	Crewed/Uncrewed	Civil/Defence–Military/Dual	Source
NASA F-15B TN 836 Aeronautics Research	EA_0021	USA	P.G.	T&I	High-AOA Aerodynamics, Fly-by-Wire	full	late 1980s	late 2010s	Crewed	Defence–Military	[191,204–207]
E-FAN	EA_0022	France	C.G	T&I	Electric Propulsion, Lightweight Composites	full	2011	2017	Crewed	Civil	[208–212]
E-FAN X	EA_0023	UK	Collaborative Consortium Governance	T&I	Hybrid-Electric, High-Voltage Systems	full	2017	2020	Crewed	Civil	[24,213–216]
Boeing X-48 (2 models: X-48B and X-48C)	EA_0024	USA	P.P.	T&I	BWB Aerodynamics	sub	2005	2012–2013	Uncrewed	Defence–Military	[21,217–220]
JetZero’s project	EA_0025	USA	C.G	C.F	Aero Efficiency, Alternative Propulsion	sub	2021	ongoing	Uncrewed	Dual Use	[17,221–224]
Ilyushin Il-76 (many variants were developed)	EA_0026	Russia	C.G P.G.	C.F	Heavy Transport, Turbofans, Rugged Airframe	full	1971	ongoing	Crewed	Defence–Military	[225–230]
Lockheed Martin CATBird (Cooperative Avionics Test Bed)	EA_0027	USA	P.P.	T&I	Avionics, Autonomous Systems	full	2007	2014	Crewed	Defence–Military	[38,231–235]
MIT Lincoln Laboratory’s Airborne Sensor Test Bed	EA_0028	USA	P.G.	T&I	EO/IR Sensors, Communications	full	1990s	Ongoing	Crewed	Defence–Military	[236–239]
Lockheed Martin X-56	EA_0029	USA	P.P.	T&I	Uncrewed Systems, Advanced Controls	sub	2013 (first flight)	2017	Uncrewed	Defence–Military	[240–248]
Boeing Phantom Ray	EA_0030	USA	C.G	T&I	Stealth UAV, Autonomous Missions	full	2010	2013	Uncrewed	Defence–Military	[39,249–255]

Testbed Name	ID No	Country	Governance Model	Business Model	Key Technologies	Scale	Launch Year	End of Operations	Crewed/Uncrewed	Civil/Defence–Military/Dual	Source
Scaled Composites Proteus	EA_0031	USA	C.G	C.F	High-Altitude Aerodynamics, Lightweight Composites	full	1998	ongoing	Crewed	Dual Use	[256–260]
Honeywell 757 Flying Testbed	EA_0032	USA	C.G	T&I	Propulsion Testing, Avionics Systems	full	2005	ongoing	Crewed	Dual Use	[261–267]
Kawasaki XC-2	EA_0033	Japan	P.P	T&I	Composites, Turbofans, Fly-by-Wire	full	2010	ongoing	Crewed	Defence–Military	[23,268–270]
SWiFT (Stealth Wing Flying Testbed)	EA_0034	India	P.G.	T&I	Stealth Wing, Autonomous Control	sub	2022	ongoing	Uncrewed	Defence–Military	[20,271–275]
Turkish Aerospace Industries (TAI) Anka UAV (1–3 variants)	EA_0035	Turkey	C.G	T&I	UAV Autonomy, Stealth Design	full	2022	ongoing	Uncrewed	Defence–Military	[276–279]
Israel Aerospace Industries (IAI) Heron UAV	EA_0036	Israel	P.P	C.F	EO/IR Sensors, SATCOM, Autonomous Ops	full	1994 (first flight)	ongoing	Uncrewed	Defence–Military	[280–287]
DA 62—Diamond Aircraft	EA_0037	Austria	C.G	C.F	Efficient Engines, Composite Airframe	full	2012	ongoing	Crewed	Civil use (private, training, utility aviation)	[30,288–294]
Zero-e	EA_0038	France	P.P.	T&I	Hydrogen Combustion, LH ₂ Storage, Fuel Cells	full	2020	ongoing	Crewed	Civil Use	[43,295–299]
H2FLY HY4	EA_0039	Germany	C.C.	T&I	DEP, Aeroelastic Structures, Digital Twin	sub (1:5–1:3 scale of a regional airliner)	2018	2023	Uncrewed	Civil Use	[25,300–308]
Numerical Design Results Demonstrator (NORD)	EA_0040	Poland	A.G.	T&I	Dynamic Stability, Flight Data Analysis	subd	early 2020s	possibly ongoing	Uncrewed	Civil	[309,310]

Testbed Name	ID No	Country	Governance Model	Business Model	Key Technologies	Scale	Launch Year	End of Operations	Crewed/Uncrewed	Civil/Defence–Military/Dual	Source
AlbatrossONE	EA_0041	UK	C.G.	T&I	Hinged Wing-Tips, Gust Alleviation	subd	2019	ongoing	Uncrewed	Civil use	[311,312]
FLEXOP demonstrator	EA_0042	Hungary	C.C.	T&I	Aeroelastic Tailoring, Flutter Control	full	2015	2020	Uncrewed	Civil use (potentially dual use)	[313–316]
e-Genius-Mod	EA_0043	Germany	A.G.	T&I	Electric Motor, Battery System	full	2022	ongoing	Crewed	Civil Use	[27,317]
Scout B1-100	EA_0044	Switzerland	C.G	C.F	Autonomous Control, Robust Airframe	sub	mid-to-late 2010s or early 2020s	ongoing	Uncrewed	Civil	[44,318,319]
Cirrus SR22T	EA_0045	USA	A.G.	R&E	DEP Propulsion	sub	2017	ongoing	Uncrewed	Civil	[40,320]
MAGMA	EA_0046	UK	P.P.	T&I	Fluidic Controls, Circulation Control	sub	2017	early 2020s	Uncrewed	Civil	[35,321–323]
Super Guppy Foamie	EA_0047	USA	P.G.	T&I	Scaled Model, Balloon Launch	sub	around 2012	ongoing	Crewed	Civil	[49,324,325]
GA-USTAR aircraft	EA_0048	USA	A.G.	R&E	Dynamic Scaling, Flight Data Systems	sub	2017	ongoing	Uncrewed	Civil	[32,326,327]
UIUC Subscale Sukhoi	EA_0049	USA	A.G.	R&E	Scaled Aerodynamics, High-Precision Telemetry	sub	2015	ongoing	Uncrewed	Civil	[26,328–333]
SAGITTA demonstrator	EA_0050	Germany	P.P.	T&I	Flying Wing, Autonomous Jet	sub	2014–2015	2020–2021	Uncrewed	Civil	[26,328–333]
Flying V	EA_0051	Germany	P.P.	T&I	Integrated BWB Airframe, Lightweight Composites	sub	2014 2020 (first flight)	ongoing	Uncrewed	Civil	[334–339]
MOSUPS	EA_0052	Poland	A.G.	T&I	Box-Wing Design, Ducted Fan Propulsion	sub	2014 (first flight)	early 2020s (probably)	Uncrewed	Civil	[14,340–344]

Testbed Name	ID No	Country	Governance Model	Business Model	Key Technologies	Scale	Launch Year	End of Operations	Crewed/Uncrewed	Civil/Defence–Military/Dual	Source
TURAC	EA_0053	Turkey	A.G.	T&I	Hybrid VTOL, Advanced Flight Control	sub	2014	ongoing	Uncrewed	Dual Use	[345–347]
Great Planes Avistar Elite	EA_0054	USA	A.G.	R&E	Aerodynamic Simulation, Sensor Integration	sub	2014	ongoing	Uncrewed	Civil	
GL-10 Greased Lightning Prototype	EA_0055	USA	P.G.	T&I	DEP, Tilt-Wing VTOL	sub	2013	2017	Crewed	Military	[348–353]
Technology-Evaluation Research Aircraft (PTERA)	EA_0056	USA	P.P.	T&I	DEP, Autonomous Systems	sub	2013	ongoing	Uncrewed	Civil	[190,354,355]
UIUC Aero Testbed	EA_0057	USA	A.G.	R&I	Electric Propulsion, Autonomous Control	sub	2013	possibly ongoing	Uncrewed	Civil	[41,356]
Sig Rascal 110	EA_0058	USA	A.G.	R&E	Large Airframe, Sensor Integration	sub	2006	possibly concluded	Uncrewed	Civil	[357–359]
Phastball	EA_0059	USA	A.G.	R&E	EDF Propulsion, Autonomous Avionics	sub	around 2013	possibly ongoing	Uncrewed	Civil	[360–363]
S3CM	EA_0060	Japan	Public Governance	T&I	Low-Sonic-Boom Aero, Supersonic Control	sub	2015 (first launch)	concluded-single use	Uncrewed	Civil	[31,364,365]
Yak-54 UAV	EA_0061	USA	A.G.	R&I	Flight Control, Radar Sensors	sub	2012	possibly ongoing	Crewed	Civil	[366,367]
X-HALE	EA_0062	USA	A.G.	R&E	Flexible Wings, Aeroelastic Modeling	sub	2010	possibly ongoing	Uncrewed	Civil	[46,368–370]
Puffin demonstrator	EA_0063	USA	P.G.	R&E	Tail-Sitter VTOL, Electric Propulsion	sub	2008	2011	Crewed	Civil	[33,371]
Hyperion 1.0, 2.0, 2.1	EA_0064	USA	A.G.	R&E	Hybrid Propulsion, BWB Design	sub	2008	2011	Uncrewed	Civil	[42,372,373]

Testbed Name	ID No	Country	Governance Model	Business Model	Key Technologies	Scale	Launch Year	End of Operations	Crewed/Uncrewed	Civil/Defence–Military/Dual	Source
Generic Future Fighter (GFF) demonstrator	EA_0065	Sweden	A.G.	R&E	Stealth, AI Autonomy, Advanced EW	full	2009	ongoing	Both crewed and uncrewed	Military	[374–378]
BB-1, BB-2, BB-3, BB-4	EA_0066	China	A.G.	T&I	BWB Aerodynamics, Low-Speed Dynamics	sub	2008	2012	Uncrewed	Civil	[3,379]
Raven	EA_0067	Sweden	A.G.	R&E	Scaled Aircraft, Micro Turbines, Control Systems	sub	2007	possibly ongoing	Uncrewed	Civil	[3,45,380,381]
SensorCraft RPV	EA_0068	USA	P.G.	T&I	SAR/EO Sensors, Stealth, Autonomous Flight	full	early 2000s	-	Uncrewed	Military	[382]
ECLIPSE	EA_0069	UK	C.C.	T&I	Flapless (Fluidic) Control, Turbojet Propulsion	sub	2009 2010 (first flight)	2010	Uncrewed	Defence–Military	[383–387]
VELA 2	EA_0070	Germany	A.G.	R&E	DEP, BWB Airframe	sub	2007	possibly concluded	Uncrewed	Civil	[50,388]
FASER (Ultrastick 120)	EA_0071	USA	P.G.	T&I	Scaled Turbine Mode, Adaptive Control	sub	2006	ongoing	Uncrewed	Civil	[389,390]
GTM-T2	EA_0072	USA	P.G.	T&I	Flight Dynamics, System ID	sub	2005	finalized in 2010s	Uncrewed	Civil	[203,391–393]
Innovative Evaluation Platform (IEP)	EA_0073	France	C.C.	T&I	Modular Testbed, Nonlinear Control	sub	2005	2010 (NACRE project ending)	Uncrewed	Civil	[394–397]
AC20.30	EA_0074	Germany	A.G.	R&E	BWB, Scaled Electric Testbed	sub	early 2000s	possibly concluded	Uncrewed	Civil	[398]

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