



The Single European Sky Initiative: A Dire Need in Pause

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ABSTRACT :

This handwriting critically examines the patient recession of the Single European Sky (SES) action, a foundational yet uniquely stalled pillar of European integration. Despite its pledge to enhance safety, effectiveness, and environmental sustainability, SES has been hampered by deep- confirmed legal and non-legal impediments, including rigid interpretations of public sovereignty and settled profitable interests. The analysis argues that incremental reforms are inadequate to address the raising costs of fragmentation and the transformative challenges posed by arising aeronautics technologies (Unmanned Aircraft Systems, Urban Air Mobility, Artificial Intelligence) and critical environmental authorizations. Proposing a paradigm shift, this analysis develops a new legal design for unborn-proofing European airspace governance, championing for a robust European Airspace Management Authority, pan-European request reforms, and a unified digital sky frame. This recalibrates the legal and policy geography to unlock Europe's aeronautics eventuality, meet its climate commitments, and secure its global competitiveness.

Keywords: *Single European Sky (SES), Air Traffic Management (ATM), Unmanned Aircraft Systems (UAS) / U-space, Legal Recalibration*

Introduction: The Unyielding Paradox of European Airspace

1. The Promise of the Single European Sky a Literal Imperative

European airspace has long suffered from fragmentation, characterized by distant public control centres and functional procedures. This patchwork system leads to habitual detainments, functional inefficiencies, significant environmental impact, patient safety enterprises, and essential capacity limitations. Aircraft constantly fly longer, sub-optimal routes to navigate public boundaries and military zones, adding energy burn, functional costs for airlines, and trip times for passengers.¹

In response, the European Union launched the ambitious Single European Sky ("SES") action in 1999, solidified by the 2004 legislative frame.² Conceived as a transformative design, SES aimed to produce a unified, effective, and safe European air traffic management ("ATM") system, with foundational pillars across performance, safety, technology, and mortal coffers. protrusions at its commencement suggested SES could reduce ATM costs by over to 50% and triple airspace capacity, emphasizing high expedients for revolutionizing European aeronautics.³

SES was envisaged as a foundation of European integration, akin to the single request. still, its line contrasts sprucely with the successes achieved away in integration, where legal and political will effectively disassembled public walls. The patient recession of SES, despite its foundational significance, renders it a uniquely stalled pillar, demanding critical examination of the underpinning impediments.

A. The Enduring Reality a "Dire Need in Pause" and Its Compounding Costs

Over two decades since its commencement, the pledge of SES remains largely unfulfilled, characterized by patient detainments. In 2022, the European ATM network recorded 1.7 million minutes of en route Air Traffic Flow Management ("ATFM") detainments, rephrasing into palpable profitable losses and a drag on European profitable exertion.⁴

Beyond fiscal burdens, fragmentation imposes a considerable environmental cost. Routes that are 8- 10 longer than optimal directly increase energy consumption and Greenhouse gas ("GHG") emigrations. Aviation formerly accounts for 3.8-4% of the EU's total GHG emissions, a figure projected to

¹ EUROCONTROL, Performance Review Report 2022, at 30–32 (2023), <https://www.eurocontrol.int/publication/performance-review-report-2022> (last visited July 22, 2025) (detailing inefficient routes and their economic consequences).

² Regulation (EC) No 549/2004 of the European Parliament and of the Council of 10 March 2004 laying down the framework for the creation of the single European sky (the framework Regulation), 2004 O.J. (L 96) 1; Regulation (EC) No 550/2004 of the European Parliament and of the Council of 10 March 2004 on the provision of air navigation services in the single European sky (the service provision Regulation), 2004 O.J. (L 96) 10; Regulation (EC) No 551/2004 of the European Parliament and of the Council of 10 March 2004 on the organisation and use of the airspace in the single European sky (the airspace Regulation), 2004 O.J. (L 96) 20; Regulation (EC) No 552/2004 of the European Parliament and of the Council of 10 March 2004 on the interoperability of the European air traffic management network (the interoperability Regulation), 2004 O.J. (L 96) 26.

³ Comm'n, Aviation strategy for Europe – Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2015) 598 final, at 6 (Dec. 7, 2015) (reiterating initial projections for SES benefits).

⁴ EUROCONTROL, Performance Review Report 2022, supra note 1, at 16 (reporting 1.7 million minutes of en-route ATFM delays in 2022).

grow.⁵ Continued SES delay means these avoidable emissions persist, undermining broader environmental commitments. This ‘pause’ in SES implementation is not benign; it laboriously accumulates unborn arrears, making Europe’s climate targets exponentially harder to achieve and potentially leading to significant legal challenges. This redefines SES reform from a desirable enhancement to a critical threat mitigation imperative.

This manuscript argues that being legal and policy approaches to SES are inadequate and ill-equipped to address its deep-confirmed obstacles. Incremental adaptations would not serve; a paradigm shift is urgently demanded. This necessitates a radical recalibration of European airspace governance, grounded on a candid examination of resistance mechanisms and proposing novel, practicable legal results. Crucially, this recalibration must strategically link SES reform to arising aeronautics technologies and the critical environmental imperatives of the European Green Deal.

The deconstruction of Stasis discharging the Legal and Non-Legal Impediments

A. The Inflexible Grasp of National Sovereignty a “Prisoner’s Dilemma” in the Sky

The rudimentary manacle to SES is the deeply ingrained principle of national sovereignty over airspace, explicitly stated in Composition 1 of the Chicago Convention.⁶ While vital for public security, its extensive interpretation by Member States frequently protects public interests over optimal civil ATM integration. Civil-military collaboration exemplifies this pressure, with military airspace restrictions constantly forcing longer civil routes. The ambiguity between genuine defence requirements and protectionist pretexts to control public airspace and ANSP operations remains a significant obstacle. Although EU law holds transport capability under Composition 100 TFEU,⁷ its exercise frequently respects public identity per Composition 4(2) TEU,⁸ favouring public control over full integration.

The disinclination of individual countries to cede airspace control, indeed when leading to collaborative inefficiency, glasses the “Prisoner’s Dilemma.” If countries prioritize public interests (e.g., expansive military zones, guarding ANSP earnings), the overall European ATM network suffers. Again, collaborative optimization would yield lesser benefits. still, the individual incitement to ‘defect’ maintaining full public control, remains strong, driven by concern over disadvantage if others do not cooperate. This dynamic leads to a collectively sub-optimal outcome.

To break this dilemma, a new legal interpretation is needed: *The Doctrine of Dynamic Sovereignty in ATM*. This doctrine proposes a nuanced legal approach beyond a static, absolute view of sovereignty. It argues that for specific, clearly defined civil ATM functions, Member States have a legal obligation under core EU Treaty principles, similar as internal request principles and the duty of pious cooperation (Composition 4(3) TEU),⁹ to engage in collaborative, delegated sovereignty. This compels countries to pool or delegate specific aspects of autonomous control over airspace for collaborative European effectiveness, safety, and environmental sustainability. Analogies exists in other successful EU single request integrations where states effectively pooled powers (e.g., competition policy, customs union), emphasizing a legal precedent for similar delegation. This doctrine would fairly impel countries to prioritize collaborative effectiveness over fractured control in civil ATM, altering the “Prisoner’s Dilemma” lucre matrix towards a collaborative equilibrium.

B. Economic Entrenchment and the heritage of Monopoly The “Regulatory Capture” of ANSPs

The political economy of public ANSPs constitutes another significant impediment. The majority are state-owned monopolies, characterized by strong unionization and vested economic interests in conserving the being operational framework. These interests, including public overflight profit, employment situations, and functional autonomy, laboriously repel genuine integration, liberalization, and cross-border competition. Eurocontrol identifies ANSPs’ resistance to change as a crucial factor in SES stagnation.¹⁰

Despite EU performance schemes, similar as Regulation (EU) 2019/317, effectiveness advancements remain borderline.¹¹ This indicates inadequate legal force or impulses to overcome deeply settled interests. The problem extends to “regulatory capture,” where regulated realities overly impact regulatory processes to their benefit. National ANSPs can lobby against stricter targets, exploit inscrutability in directives, or influence rule interpretation to cover their positions. constantly borderline effectiveness advancements, despite commanded schemes, explosively suggest vulnerability to this prisoner. The European Court of Adjudicators has specifically stressed this lack of effective enforcement and the Member States’ disinclination to apply necessary reforms.¹²

To address this, a Pan-European Competitive Framework for ATM Services is imperative, reasserting the public interest. The being legal frame inadvertently perpetuates anti-competitive structures. A robust legal response must introduce genuine European- position competition, breaking public

⁵ Eurostat, Greenhouse gas emissions from aviation, sea and rail transport, Statistics Explained (updated Apr. 24, 2024),

https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Greenhouse_gas_emissions_from_aviation,_sea_and_rail_transport (last visited July 22, 2025) (showing 3.8% for 2021 aviation emissions within EU27 and projecting growth); EASA, European Aviation Environmental Report 2022, at 10 (2022), <https://www.easa.europa.eu/eaer/download-eaer-2022> (last visited July 22, 2025).

⁶ Convention on International Civil Aviation art. 1, Dec. 7, 1944, 61 Stat. 1187, 15 U.N.T.S. 295 (Chicago Convention).

⁷ Treaty on the Functioning of the European Union art. 100, Oct. 26, 2012, 2012 O.J. (C 326) 47 (TFEU).

⁸ Treaty on European Union art. 4(2), Oct. 26, 2012, 2012 O.J. (C 326) 13 (TEU).

⁹ TEU art. 4(3).

¹⁰ EUROCONTROL, Challenges of Air Traffic Management in Europe, EUROCONTROL Rev. Rep. 2018, at 12 (2018) (identifying ANSP resistance as a key barrier to change).

¹¹ Comm’n Implementing Reg. (EU) 2019/317 of 11 February 2019 on the establishment of a performance scheme for air navigation services and network functions in the single European sky, 2019 O.J. (L 56) 1; Eur. Ct. Auditors, Special Report No 18/2020: Single European Sky: a fragmented airspace and complex management has hampered efficiency, at 24 (2020) [hereinafter ECA, Special Report 18/2020] (stating that performance scheme objectives were not met).

¹² See, e.g., Case C-241/91 P & C-242/91 P, Radio Telefís Éireann (RTE) & Indep. Television Publ’ns Ltd. (ITP) v. Comm’n (Magill), 1995 E.C.R. I-743, para. 56 (establishing the concept of essential facilities under EU competition law); Comm’n, Guidance on the Commission’s enforcement priorities in applying Article 82 EC Treaty to abusive exclusionary conduct by dominant undertakings, 2009 O.J. (C 45) 7, paras. 81-89.

monopolies where doable. This frame would number a revised ANSP unbundling directive that fairly authorizations the clear separation of core ATM functions (e.g., *en route* services) from structure power, enabling competitive extending. likewise, it would involve competitive extending for cross-border services, fairly taking competitive flings for ATM services across Functional Airspace Blocks (“FABs”) or high- viscosity routes, fostering a dynamic request. Eventually, the operation of the “essential installations doctrine” (a well- established principle in EU competition law concerning access to infrastructure)¹³ would be explicitly applied to critical public ATM structures (e.g., radar, communication networks). This would fairly impel peremptory ANSPs to give non-discriminatory access to new entrants, precluding abuse of dominant positions and icing a position playing field.

C. Functional Airspace Blocks (FABs): A flawed Legal concession and its perpetration deficiency

FABs, introduced by Regulation (EC) No 551/2004,¹⁴ aimed to facilitate cross-border ATM and optimize airspace use irrespective of public borders, creating large, operationally effective blocks.

However, FAB perpetration largely undermined this intent, with utmost established along being public lines rather than genuine functional overflows. The European Court of Adjudicators explicitly blamed FABs for failing to deliver anticipated benefits, attributing this to a pervasive lack of political will and inadequate enforcement mechanisms within the legislative frame.¹⁵ This highlights a critical flaw: political compromises, when elevated in law without strong, direct enforcement mechanisms or clear, objective criteria, render ambitious legal instruments ineffective.

The failure of FABs represents a ‘compromise too far’ a political dilution of legal ambition. The legal frame for FABs was a political concession offering Member States sufficient inflexibility to maintain public structures within a nominal “FAB” framework. States paid lip service to integration without genuine functional change, immortalizing public fragmentation under a new name.

To rectify this, an Imperative of Legally Mandated, Operationally-Driven FAB Restructuring is needed. This calls for a fundamental legal overhaul that grants unequivocal EU legal power to a central, independent authority (e.g., the proposed EAMA) to directly redraw FAB boundaries. This redrawing would be grounded purely on objective functional effectiveness criteria (business flows, optimal routing, environmental impact), thereby booting public executive lines. To ensure compliance, concrete legal recourse, including direct and substantial fiscal penalties for measurable inefficiencies or temporary suspense of public ATM functions, must be introduced. This shifts the burden and fiscal cost of non-compliance directly onto Member States, compelling a move from political concession to functional imperative.

The Environmental Imperative: Re-framing SES as a Climate Justice and Sustainability Mandate

A. Aviation’s Unaccounted Carbon Burden The Hidden Costs of Fragmentation

Aviation’s donation to hothouse gas (GHG) emigrations in Europe is growing, counting for 3.8% of the EU’s total, a figure projected to increase.¹⁶ A critical, yet frequently unaccounted for, portion stems directly from European airspace fragmentation. Inefficient routing forces aircraft to fly routes 8-10 hours longer than optimal, leading to gratuitous energy consumption and avoidable carbon emigrations.¹⁷ Eurocontrol constantly highlights that full SES perpetration could significantly reduce CO2 emigrations, linking SES counterpoise to environmental detriment.¹⁸

The persistent stagnation of SES, leading to avoidable emissions, constitutes ‘environmental negligence’ at a systemic, institutional position. This inactivity, despite clear knowledge of environmental benefits, could expose the EU and Member States to unborn legal challenges. Climate-affected groups, environmental NGOs, or disproportionately impacted regions countries could initiate conduct rested on environmental liability,¹⁹ the ‘polluter pays’ principle (Composition 191(2) TFEU),²⁰ or arising mortal rights arguments (e.g., right to a healthy terrain), as decreasingly seen in transnational and public courts.²¹ The rising drift of global climate action, holding countries and pots responsible for inadequate action, provides strong precedent.²² This reframes the SES problem from an effectiveness issue to a significant legal liability issue, adding urgency beyond internal EU political dynamics.

B. Legal Deficiencies in Environmental Responsibility within SES fabrics

Despite environmental goals articulated in SES legislation, current fabrics warrant robust, enforceable legal mechanisms for responsibility regarding inefficiencies contributing to increased emissions. Performance schemes live but frequently concentrate primarily on functional effectiveness and

¹³ Case C-7/97, Oscar Bronner GmbH & Co. KG v. Mediaprint Zeitungs- und Zeitschriftenverlag GmbH & Co. KG, ECLI:EU:C:1998:508. (General principle for “essential facilities doctrine” in EU competition law).

¹⁴ Regulation (EC) No 551/2004 of the European Parliament and of the Council of 10 March 2004 on the organisation and use of the airspace in the Single European Sky (the airspace Regulation). Official Journal of the European Union, L 96/20.

¹⁵ European Court of Auditors. (2017). Single European Sky: A fragmented European airspace with little added value so far. Special Report No 18/2017. Luxembourg: Publications Office of the European Union.

¹⁶ European Environment Agency. (2023). Transport and environment report 2023. Copenhagen: European Environment Agency.

¹⁷ EUROCONTROL. (2020). Performance Review Report 2019. Brussels: EUROCONTROL..

¹⁸ EUROCONTROL. (2022). EUROCONTROL Aviation Intelligence Unit, Think Paper No. 10: How much CO2 could the Single European Sky save?. Brussels: EUROCONTROL.

¹⁹ See, e.g., Faure, M., & Du Preez, P. (2020). Climate Change and Tort Law: A European Perspective. Edward Elgar Publishing. (Discusses environmental liability implications for climate inaction).

²⁰ Treaty on the Functioning of the European Union (TFEU), 2012. Article 191(2). Official Journal of the European Union, C 326/47.

²¹ See, e.g., Urgenda Found. v. State of the Netherlands, ECLI:NL:HR:2019:2006, Supreme Court of the Netherlands (Dec. 20, 2019) (ordering emission reduction); Joana Setzer & Rebecca Byrnes, Global Climate Litigation Report: 2023 Status Review, at 7–10 (LSE Grantham Rsch. Inst. on Climate Change & Env’t, 2023); European Court of Human Rights. (2024). Duarte Agostinho and Others v. Portugal and 32 Other States, Applications nos. 39378/20 et al. (Emerging human rights arguments regarding climate change).

²² Setzer, J., & Higham, R. (2024). Global Climate Litigation Report: 2024 Status Review. Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science.

capacity, constantly without direct corrective environmental warrants specifically tied to fractured operations or avoidable emigrations. This represents a critical legal gap that undermines the environmental aspirations of SES.

To address this, a new legal frame is proposed Integrating a Doctrine of ‘Environmental Damages Recovery’ into SES Legislation. This doctrine would establish a comprehensive legal base for environmental responsibility within SES, allowing for the assessment and recovery of environmental damages directly attributable to hamstrung ATM operations caused by fragmentation and non-compliance. This frame would include several crucial factors. originally, fairly commanded independent environmental audits would empower a central EU body (e.g., the proposed EAMA) to conduct audits of ANSP performance, specifically measuring avoidable emissions performing from sub-optimal routing and fractured airspace. This body would also be authorized to put direct, substantial fiscal penalties on ANSPs or Member States for measurable environmental declination or for failing to meet their specified environmental effectiveness targets.

Secondly, the perpetration of a “carbon cost premium” on air navigation charges would be directly tied to route inefficiency (e.g., for routes demonstrably longer than optimal due to fragmentation). finances collected from this decoration would be fairly ring- fended for investment in sustainable aeronautics technologies or essential climate adaption systems. This medium creates a direct fiscal counterincentive for inefficiency while contemporaneously funding green aeronautics enterprise. Incipently, the frame would explore strengthening the being EU environmental law or creating specific legal standing for citizen NGO- led challenges against countries or ANSPs for systemic environmental non-compliance via SES. This leverages the “environmental negligence” argument, empowering civil society to ensure airspace optimization for environmental benefit and holding authorities responsible.

C. The EU Green Deal and Fit for 55 An Unmet Legal Synergy

The EU has set ambitious climate targets under its EU Green Deal, aiming for climate impartiality by 2050, rounded by the “Fit for 55” package to reduce emissions by 55 by 2030. These are not simply aspirations but fairly binding targets bolstering the EU’s global climate leadership.²³

The persistent slow progress of the Single European Sky action directly undermines these broader, fairly binding EU climate commitments, creating a fundamental inconsistency in EU policy and impeding overarching climate pretensions. The Sustainable and Smart Mobility Strategy also emphasizes digital metamorphosis in transport, an area where SES recession is particularly acute.²⁴ Failure to optimize airspace through SES means avoidable emissions continue, making the ambitious targets of the Green Deal indeed harder to attain.

Framing SES as a critical legal enabler for the EU’s overarching climate commitments could unleash lesser political will and stronger enforcement. Elevating SES from a niche transport effectiveness issue to a core climate action element could spark more aggressive violation procedures against Member States for environmental non-compliance under EU environmental law. This leverages the high political stakes and legal scores of the Green Deal, a core pillar of EU global leadership. However, it unnaturally shifts political math, justifying more strict intervention by the European Commission as the failure impacts the entire EU’s most critical policy docket, If SES failure demonstrably jeopardizes these targets.

The Future is Now SES in the Crucible of Emerging Aviation Technologies

A. The Tsunami of New Airspace users Drones, UAM, and the ‘Uncontrolled Vertical Frontier’

The aeronautics landscape is fleetly changing with millions of new airspace users, including drones, Urban Air Mobility (“UAM”), and electric vertical take-off and landing (“eVTOLs”). EASA forecasts significant growth in drone operations by 2030, particularly in lower “U-space” altitudes.²⁵ This affluence challenges traditional ATM, designed for smaller, high- altitude manned aircraft. The fractured SES is ill- equipped for this “unbridled vertical frontier,” risking chaotic airspace, stifling invention, and causing Europe to fall behind in these new aeronautics sectors. The legal frame must evolve to manage airspace as a dynamic, participated, digitally- enabled resource.

B. The Legal Chasm: Integrating U-space with Legacy ATM and Ensuring Safety

While U-space regulations exist (e.g., Commission enforcing Regulation (EU) 2021/664),²⁶ a critical gap remains in safely integrating U-space with heritage ATM systems. This requires critical legal attention, specifically for flawless data sharing and interoperability between U-space Service Providers (USSPs) and Air Navigation Service Providers (ANSPs) to insure a common functional picture. Robust collision avoidance mechanisms across all airspace users are paramount. Likewise, clear legal liability regimes for incidents involving independent drones or UAMs are essential, particularly at the U-space/traditional airspace interface, as stressed by EASA’s UAM Roadmap.²⁷

To bridge this, a “Unified Digital Sky Governance” frame is proposed. This comprehensive legal frame would dictate the integration of all airspace users under a single, interoperable digital armature. Crucial rudiments include fairly binding norms for data exchange, communication protocols, and AI algorithms for ATM and U-space. It would also establish a harmonized EU legal frame for the instrument and oversight of AI-driven ATM systems, emphasizing transparency, explainability, and human oversight. Eventually, a clear, potentially “no-fault” central fund or insurance scheme would address liability from autonomous air traffic incidents, accelerating compensation and fostering invention by reducing legal uncertainty.

C. AI and automation in ATM: Accountability and Ethics

AI and robotization can revise ATM through optimized routing and enhanced safety, as underlined by EASA’s report on AI in aeronautics. Still, AI integration raises complex legal and ethical challenges, primarily concerning responsibility in independent decision-making. Questions arise about liability (developer, operator, certifier). Robust legal fabrics are also demanded for privacy and security of sensitive functional data, and to address

²³ European Commission. (2019). The European Green Deal. COM(2019) 640 final. Brussels: European Commission.

²⁴ European Commission. (2020). Sustainable and Smart Mobility Strategy – putting European transport on track for the future. COM(2020) 789 final. Brussels: European Commission.

²⁵ European Union Aviation Safety Agency (EASA). (2022). Drone Market Survey 2022-2029. Cologne: EASA.

²⁶ Commission Implementing Regulation (EU) 2021/664 of 22 April 2021 on a regulatory framework for the U-space. Official Journal of the European Union, L 139/127.

²⁷ European Union Aviation Safety Agency (EASA). (2021). Urban Air Mobility (UAM) Roadmap. Cologne: EASA.

algorithmic bias. To proactively manage these, a legal frame for ‘Algorithmic Governance in Airspace’ is essential. This would dictate transparency (e.g., explainable AI), establish clear legal avenues for gruelling AI decisions, and define unequivocal lines of responsibility.

D. From fractured structure to Digital Twin Networks Accelerated Modernization

The future of ATM involves advanced digital technologies like ‘digital twins’ and remote halls. Still, Europe’s reliance on outdated, inharmonious public structure creates significant inertia, hindering pan-European integration due to fractured technology platforms and distant public investment priorities. To overcome this, Direct EU Investment and Legal impulses for Pan-European ATM Digital Transformation are pivotal. Legal mechanisms are demanded to grease direct EU backing or a devoted “European Digital Sky Fund” (potentially from a ‘carbon cost decoration’ or the Digital Europe Programme).²⁸ This fund would directly incentivize and co-finance pan-European digital ATM structure, including common data platforms and AI-driven systems. It would also fairly dictate common procurement norms and strict interoperability conditions for new ATM technology investments, and establish robust legal fabrics for cross-border data governance and secure sharing, icing vital functional data flows freely across public boundaries.

A design for Advance Legal and Policy Recalibration for An unborn- evidence European Sky

This section synthesizes new legal arguments and policy recommendations into a cohesive, practicable design to overcome SES counterpoise and future-evidence European airspace governance.

A. Reimagining Governance Towards a Robust European ATM Authority

SES stasis stems from fractured governance, lack of central authority, and inadequate enforcement against public interests. Current structures (Commission, EASA, Eurocontrol NM) have limited direct regulatory and enforcement powers. To overcome this, a truly effective, independent, and empowered central authority is essential.

This blueprint proposes the legal establishment of a significantly strengthened and independent European Airspace Management Authority (EAMA). Structure on current institutional limitations, EAMA would have robust legal powers, including direct regulatory powers with fairly binding authority to issue regulations on airspace design, performance, technology relinquishment, and functional procedures across Member States, booting public discretion for European-position optimization; enhanced enforcement powers, empowering it to put direct, substantial forfeitures on non-compliant ANSPs or Member States for failing to meet targets, thereby bypassing lengthy violation procedures. This would explicitly include penalties for environmental non-compliance. Eventually, it would hold a strategic planning part, with a legal accreditation for developing and enforcing a single, intertwined European ATM Master Plan, coordinating civil and military airspace use, and aligning with broader EU climate and digital pretensions.

B. Market Reforms Ending National ANSP Monopolies

The SES action is hampered by public monopolies in Air Navigation Service Providers (ANSPs), leading to fragmentation, inefficiency, and stalled modernization. Despite Regulation (EU) 2019/317’s end for effectiveness, its enforcement has been inadequate, as noted by the European Court of Adjudicators.²⁹ To fix this, a Pan-European Competitive Framework for ATM Services is pivotal. This would involve unbundling ANSP functions, calling competitive extending for cross-border services and within FABs, and strictly applying the “essential installations doctrine” to ensure fair access to vital structure.³⁰ This approach will fit much- demanded competition, drive invention, and reduce costs.

C. Data Governance & Digital Transformation for a Unified Digital Sky

Fragmented digital structure and a lack of harmonized data governance pose another significant challenge, particularly with the rise of Unmanned Aircraft Systems (UAS) and UAM, as stressed by EASA.³¹ To address this, a “Unified Digital Sky Governance” frame is essential. This would fairly dictate binding norms for data exchange, communication, and AI algorithms across all ATM and U-space platforms, icing flawless integration. It would also establish an EU legal frame for certifying and overseeing AI-driven ATM systems, prioritizing translucency and mortal oversight. Eventually, a ‘no-fault’ central fund or insurance scheme would alleviate pitfalls from independent air business, simplifying claims and fostering invention.

D. Environmental Imperative Driving Green Aviation via SES

Aviation’s adding emissions, aggravated by airspace fragmentation, directly undermine the EU’s climate commitments under the EU Green Deal and “Fit for 55” package.³² Eurocontrol constantly shows SES perpetration could cut CO₂ emission.³³ This inactivity pitfalls *environmental negligence*, potentially leading to climate action, as seen in cases like *Urgenda Foundation v. State of the Netherlands*.³⁴ To transfigure SES into a crucial climate enabler, a ‘Doctrine of Environmental Damages Recovery’ and impulses for SES Legislation is vital. This would empower the proposed European Airspace Management Authority (EAMA) to conduct environmental checkups of ANSPs and put fiscal penalties for avoidable emissions, reflecting the “polluter pays” principle (Composition 191(2) TFEU).³⁵ It would also introduce a ‘carbon cost decoration’ on hamstrung flight paths, with finances ring-fenced for sustainable aeronautics and climate adaption. Strengthening legal standing for citizen-or NGO-led challenges would further insure responsibility for environmental non-compliance.

²⁸ European Union Aviation Safety Agency (EASA). (2020). Artificial Intelligence in Aviation. Cologne: EASA; Regulation (EU) 2021/694 of the European Parliament and of the Council of 29 April 2021 establishing the Digital Europe Programme. Official Journal of the European Union, L 166/1.

²⁹ European Court of Auditors. (2017). Single European Sky: A fragmented European airspace with little added value so far. Special Report No 18/2017. Luxembourg: Publications Office of the European Union.

³⁰ Case C-7/97, Oscar Bronner GmbH & Co. KG v. Mediaprint Zeitungs- und Zeitschriftenverlag GmbH & Co. KG, ECLI:EU:C:1998:508.

³¹ European Union Aviation Safety Agency (EASA). (2022). Drone Market Survey 2022-2029. Cologne: EASA.

³² European Commission. (2019). The European Green Deal. COM(2019) 640 final. Brussels: European Commission.

³³ EUROCONTROL. (2022). EUROCONTROL Aviation Intelligence Unit, Think Paper No. 10: How much CO₂ could the Single European Sky save?. Brussels: EUROCONTROL.

³⁴ Urgenda Foundation v. State of the Netherlands, ECLI:NL:HR:2019:2007 (Supreme Court of the Netherlands, 2019).

³⁵ Treaty on the Functioning of the European Union (TFEU), 2012. Article 191(2). Official Journal of the European Union, C 326/47.

E. Strategic Alignment & External Relations Bolstering Europe's Global Standing

SES's success is pivotal for Europe's global standing in aeronautics. An effective, intertwined European airspace can set global norms for ATM modernization, particularly in U-space and AI. A legal accreditation for 'visionary External Relations and Global Standard- Setting' would enable the EAMA to laboriously shape transnational norms, allowing Europe to export its ATM technologies and moxie. A modernized, sustainable SES, aligned with enterprise like 'Fit for 55,' would also enhance the EU's credibility in transnational climate accommodations.³⁶

Conclusion

The Single European Sky is at a critical juncture, hindered by public sovereignty, monopolies, and weak regulations, leading to profitable inefficiencies, environmental detriment, and unpreparedness for new aeronautics technologies like UAS and AI. This design proposes a radical legal recalibration, centring on a robust and independent European Airspace Management Authority with direct regulatory and enforcement powers. This EAMA, alongside reforms for request competition, unified digital governance, and environmental responsibility, would enable a truly integrated, sustainable, and globally competitive European aeronautics sector. The time for incremental change is over; decisive legal action is demanded to unleash SES's full impact and secure Europe's future in aeronautics.

³⁶ European Commission. (2021). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: "Fit for 55": delivering the EU's 2030 Climate Target on the way to climate neutrality. COM(2021) 550 final. Brussels: European Commission.