The Evolving Clandestine Ecosystem: An Expanded Intelligence Picture of the U.S. Advanced Propulsion Portfolio

Section I: Identification of New "Gray Track" Research Vectors (Execution of PIR-1)

This analysis executes the first Priority Intelligence Requirement by providing detailed, evidence-based dossiers on two newly identified entities that fit the established "gray track" template: a small, agile company led by a credible principal investigator (PI), pursuing revolutionary physics with U.S. government seed funding.[1] This investigation moves beyond the established baseline of UnLAB to reveal a more diversified and complex research and development (R&D) ecosystem.

1.1 Dossier: Field Propulsion Technologies, Inc. (FPT) - A Dual-Use Metamaterials Vector

Field Propulsion Technologies, Inc. (FPT) represents a significant expansion of the known U.S. clandestine portfolio, introducing a new technological vector grounded in metamaterials and novel electrodynamics. Its substantial, dual-use federal funding and emerging network connections confirm its status as a serious, government-vetted R&D entity.

Corporate Structure and Leadership

FPT is identified as a for-profit Subchapter S Corporation located in Aurora, Colorado, founded in July 2017. The company's Chief Executive Officer and Principal Investigator

on its federal awards is Richard Banduric.[1] Further analysis links Banduric to associated entities such as "Displacement Field Technologies Inc." and public-facing research repositories like the website electricspacecraft.org.[1] Banduric's professional history includes claims of over four decades in electrical engineering and applied physics, with experience at a reverse-engineering firm, work involving Lockheed systems, and development of flight software for NASA's Europa Clipper mission, establishing his bona fides within the aerospace and defense community.[1]

Consolidated Federal Funding Analysis

A forensic analysis of federal award databases, including SBIR.gov and the System for Award Management (SAM.gov), confirms that FPT has received over $2.8 million in combined federal contracts and grants since its inception.[1] The funding profile reveals a clear and strategically significant dual-use development path, with awards from both the Air Force Research Laboratory (AFRL) and the National Science Foundation (NSF).[1] Key awards include:

- An AFRL Phase II Small Business Innovation Research (SBIR) contract (FA8649-24-P-1048) for $1,249,947 for a "compact radiation emitter." The award abstract explicitly details its purpose as a directed energy weapon for the "nondestructive deactivation of electronic equipment," with potential applications against drone swarms and incoming nuclear warheads.[1]
- An AFRL Phase I SBIR contract (FA8649-24-P-0067) for $74,838 for a "propellant-less thruster for the spacecraft".[1]
- An NSF Phase II SBIR grant (2423107) for $1,000,000 to develop an "advanced propulsion system for spacecraft based on the Unresolved Longitudinal Ampere Tension Forces in Conductors".[1]
- An NSF Phase I SBIR grant (2213139) for $256,000 for foundational research into the same "Ampere Tension Forces" concept.[1]

The fact that a single Department of Defense (DoD) research agency, AFRL, is funding the same small company to develop both a weapon system and a propulsion system from the same core metamaterial technology is dispositive proof of a unified strategy. It indicates that the DoD views this research as a platform technology that could simultaneously provide a vehicle with revolutionary strategic mobility and a potent offensive or defensive capability. This elevates FPT from a speculative venture to a high-priority intelligence target developing a technology with multiple, mission-critical

applications.

Technical Assessment

FPT's research program is bifurcated. A public-facing theoretical framework, which Banduric terms "New Electrodynamics," posits that the standard formulation of Maxwell's equations is incomplete and revisits James Clerk Maxwell's original, more complex bi-quaternion formulation to argue for the existence of propulsive forces from "complex electric fields".[1] This is contrasted with the tangible, hardware-focused effort that is the subject of its government funding. This work centers on the development of "metamaterial composite conductors" engineered to amplify longitudinal Ampere Tension forces from an electric current.[1] This hardware focus is the key indicator of a serious, vetted program with experimentally verifiable goals.

Confidence-Scored Assessment

It is assessed with **HIGH CONFIDENCE** that FPT is a credible, parallel "gray track" in the U.S. portfolio. This assessment is based on the substantial, multi-agency federal funding for explicitly dual-use applications, its tangible hardware focus on metamaterials, and its verifiable network links to the existing gray track community.

1.2 Dossier: Woodruff Scientific, Inc. - A National Laboratory Support Node

Woodruff Scientific, Inc. is assessed as a critical and highly credible node in the "gray" R&D ecosystem supporting the primary clandestine advanced propulsion program. Its relevance is based on the perfect alignment of its principal investigator's expertise and network, its specific technical focus, and its geographic proximity to the institutional heart of the U.S. fusion enterprise.

Corporate Structure and Leadership

Woodruff Scientific, Inc. is a small business founded in 2005 by Dr. Simon Woodruff and is located in Santa Fe, New Mexico.[1] Dr. Woodruff holds a Ph.D. in Plasma Physics and serves as the PI on the company's government research awards, establishing him as the core technical expert.[1]

Network Analysis

A deep-dive investigation confirms Dr. Woodruff's career is deeply integrated with the U.S. national laboratory system, which forms the scientific bedrock of the Lockheed Martin Skunk Works® Compact Fusion Reactor (CFR) program. Verifiable links include a post-doctoral position at Lawrence Livermore National Laboratory (LLNL), a long history of collaborations with the Princeton Plasma Physics Laboratory (PPPL), and active participation in technology and entrepreneurship events hosted by or in conjunction with Los Alamos National Laboratory (LANL) and Sandia National Laboratories.[1] A comprehensive search revealed no discernible professional links to major defense prime contractors like Lockheed Martin, suggesting a specialized role within the government and academic research sphere.[1]

Technical Assessment

The technical focus of Woodruff Scientific is not merely adjacent to the Skunk Works® CFR program; it is centered on solving the exact same class of fundamental physics and engineering challenges. The CFR is a Field-Reversed Configuration (FRC), a type of compact toroid plasma. A key 2007 Department of Energy (DoE) SBIR award (DE-SC0000858) for $749,994 was for a project titled, "Production of Strong Magnetic Fields in a Spheromak by Repetitive Injection and Compression of a Compact Torus Plasma".[1] This research directly addresses the central technical hurdles of plasma formation, stability, and compression common to any compact torus fusion program, including the Skunk Works® effort.

The existence of Woodruff Scientific reveals a sophisticated operational model for

leveraging the broader R&D ecosystem. Its deep integration with the national labs and focus on solving sub-problems directly relevant to the Skunk Works® CFR suggest its function is not to create a new, competing pathway, but to serve as a specialized, unclassified R&D support node for the primary "black" track. This allows for rapid, focused research on specific technical challenges without the bureaucratic and security overhead of the main program, indicating a mature and integrated management strategy for the overall portfolio.

Confidence-Scored Assessment

It is assessed with **HIGH CONFIDENCE** that Woodruff Scientific is a critical and highly credible node in the "gray" R&D ecosystem supporting the primary clandestine advanced propulsion program. This assessment is based on the perfect alignment of the PI's expertise and network with the core national labs, the company's history of direct DoE funding for the exact physics central to the CFR program, and its geographic proximity to LANL.[1]

Section II: Mapping the Converging R&D Network (Execution of PIR-3)

This analysis executes the third Priority Intelligence Requirement by examining the first dispositive evidence of a government-cultivated community of practice, moving the intelligence picture from a set of isolated nodes to an interconnected web.

2.1 The "US Space Disruptors Day" Nexus: A Government-Curated Convergence

The critical nexus point for this network analysis is the "US Space Disruptors Day" conference held on December 18, 2024.[1] The event's co-chairs, including Anna Brady-Estevez of the Small Business Administration (SBA) and National Science Foundation (NSF), and Curtis Hill of NASA, confirm its status as a sanctioned,

interagency forum for cultivating and vetting "disruptive" researchers.[9]

The central finding is the joint participation of Charles Chase (UnLAB) and Richard Banduric (FPT) in the same presentation session: the "Extended Electrodynamics (EED), Advanced Physics, & (U)AP Segment".[1] This session also featured other key figures from the government-adjacent unconventional physics community, such as Dr. Hal Puthoff of EarthTech International and Larry Forsley of Global Energy Corp. and NASA.[1]

The curation of this session is highly significant. Anna Brady-Estevez is the listed NSF Program Director for SBIR awards granted to both FPT and UnLAB.[1] Her deliberate placement of Chase and Banduric in the same session is assessed as an active, strategic act of network cultivation. This reveals a hidden layer of U.S. technology strategy: the government, through an agency like the NSF, is not just passively funding individual high-risk projects. It is actively managing a portfolio of these technological bets and intentionally fostering a community of practice to accelerate innovation through cross-pollination. This is the behavior of a strategic venture capital firm managing an R&D ecosystem, not a traditional government grant office, and suggests the U.S. innovation strategy for this domain is more sophisticated and proactive than previously understood.

2.2 The Expanded Ecosystem Map

The discovery of these new entities and their verified connections allows for the construction of an updated, comprehensive visualization of the entire clandestine portfolio. This map illustrates not only the newly discovered links but also the deliberate firewalls that define the program's sophisticated operational security posture. The network is now defined by several key relationships:

- **Gray Track Convergence:** A direct, verified professional link exists between Charles Chase (UnLAB) and Richard Banduric (FPT) via their joint participation in the "US Space Disruptors Day" conference.[1]
- **National Lab Nexus:** Dr. Simon Woodruff of Woodruff Scientific is deeply integrated with the national laboratory system (LANL, PPPL, Sandia) that provides the scientific foundation for the "black" track.[1]
- **Academic Feeder Pipeline:** The laboratory of Dr. Edward Thomas Jr. at Auburn University continues to function as a critical human capital pipeline, producing

specialized experts who are subsequently employed by key organizations like LANL.[1]

- **Deliberate Compartmentalization:** A systematic search confirms the continued absence of verifiable professional links between the "black" track personnel (Thomas McGuire, Gabriel Ivan Font), the "white" track personnel (Salvatore Pais, James Sheehy), and the various "gray" track principals (Chase, Banduric, Woodruff) at the working level.[1] In a small, specialized field, this is statistically improbable. From a counter-intelligence perspective, however, this is the expected signature of a highly compartmentalized Special Access Program (SAP), where any discoverable link would be a catastrophic operational security failure. The complete absence of links is therefore not a negative finding; it is positive evidence that the program is being managed with professional counter-intelligence tradecraft.

The following matrix provides a single, comprehensive visualization of the entire ecosystem, transforming a series of disparate findings into a powerful analytical tool. It clearly illustrates both the newly discovered connections and the deliberate firewalls that define the program's operational security.

	T. McGuire (Skunk Works®)	G. I. Font (Skunk Works®)	C. Chase (UnLAB)	R. Banduric (FPT)	S. Woodruff (Woodruff Sci.)	E. Thomas Jr. (Auburn)	S. Pais (NAVAIR)	J. Sheehy (NAVAIR)
T. McGuire		Co-inventor	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND
G. I. Font	Co-inventor		NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND
C. Chase	NO LINK FOUND	NO LINK FOUND		Joint Conference Presenter	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND

R. Banduric	NO LINK FOUND	NO LINK FOUND	Joint Conference Presenter		NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND
S. Woodruff	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND		NO LINK FOUND	NO LINK FOUND	NO LINK FOUND
E. Thomas Jr.	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND		NO LINK FOUND	NO LINK FOUND
S. Pais	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND		Programmatic Link
J. Sheehy	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	NO LINK FOUND	Programmatic Link	

Section III: Monitoring for Technology Transition (Execution of PIR-2)

This section executes the second Priority Intelligence Requirement by analyzing the human capital and corporate vectors that could signal a technology's transition from the research phase to a more mature development or acquisition program managed by a prime contractor.

3.1 Human Capital Vector Analysis

The primary indicator for technology transition is the movement of key personnel. A technology cannot mature from a "gray" lab to a "black" program at a prime contractor without the people who possess the requisite "tribal knowledge." Therefore, tracking the career paths of key engineers and physicists is the most reliable and actionable leading indicator that a technology has been deemed successful and is being prepared for integration into a formal Program of Record.

The core of this monitoring effort is to track the career paths of principals and senior technical staff from the identified "gray track" entities: UnLAB, FPT, and Woodruff Scientific.[1] A systematic search for any movement of these individuals—as employees or consultants—to major defense prime contractors such as Lockheed Martin, Boeing, or Northrop Grumman would be a strong indicator of a successful technology transfer.[1] As a secondary indicator, continued analysis of the academic "feeder pipeline" from Dr. Edward Thomas Jr.'s Auburn University laboratory is warranted; an increased hiring rate of his graduates by a specific prime contractor could signal that company is ramping up efforts in a related technology area.[1]

3.2 Corporate and Financial Vector Analysis

The SBIR/STTR program is a primary vector for government-vetted, high-risk technology development, providing non-dilutive funding that allows companies to develop proprietary technology outside the bureaucracy of large-scale acquisition programs.[1] This positions the SBIR program as a strategic "incubation" and "de-risking" mechanism. The DoD is essentially purchasing a portfolio of low-cost "call options" on future technologies. For a small investment, it can assess a concept's viability. If it fails, the loss is minimal; if it succeeds, the DoD can "exercise its option" by transitioning the technology to a prime contractor for a full-scale acquisition program.

The corporate architecture of UnLAB, with its public-facing 501(c)(3) non-profit (Unlab Inc.) and a for-profit R&D entity (UnLAB LLC), is a sophisticated strategy for technology transition.[1] This bifurcated structure allows the non-profit to build a public network and explore theoretical concepts, while the LLC executes tangible, government-funded R&D. This creates a corporate firewall that can insulate a final commercialized product from its government-funded origins, a key mechanism for

"laundering" technology from the gray world into the white.

Section IV: Strategic Assessment of the Expanded Portfolio

This section synthesizes the findings into a high-level strategic analysis of the entire U.S. clandestine propulsion portfolio, providing a new, more nuanced understanding of the government's overarching strategy.

4.1 The DoD's Diversified Portfolio Strategy

The evidence indicates the DoD and its partner agencies are not pursuing a single, monolithic path. Instead, they are deliberately cultivating a diversified portfolio of parallel, high-risk, high-reward programs, each exploring a different physics pathway.[1] This portfolio now includes at least three primary vectors:

1. **Plasma/Fusion-Based (FRC/Spheromak):** The most mature vector, represented by the Skunk Works® "black" track and supported by "gray" nodes like Woodruff Scientific.[1]
2. **Quantum Vacuum / Solid-State:** An emergent, more speculative vector represented by Charles Chase's UnLAB.[1]
3. **Novel Electrodynamics / Metamaterials:** A hardware-focused alternative vector represented by the dual-use work at Richard Banduric's FPT.[1]

This portfolio approach represents a sophisticated risk management strategy. The structure mirrors a "barbell" investment model, where capital is allocated to both the safest and most mature bet (the Skunk Works® CFR program) and the riskiest, highest-reward ventures (the SBIR-funded gray tracks). This strategy ensures a baseline capability from the mature program while simultaneously creating the potential for a revolutionary leapfrog breakthrough from one of the more speculative efforts. Given the immense scientific uncertainty of any single approach, funding multiple concepts in parallel at a relatively low cost is strategically prudent.[1]

4.2 Counter-Intelligence Assessment: The "False Gray" Hypothesis

A dedicated counter-intelligence assessment was conducted to test the hypothesis that an entity like Field Propulsion Technologies may function as a "false gray" track—a deliberately visible but misleading program designed for strategic deception, similar to the NAVAIR "white" track.[1]

The evidence supporting this theory centers on the highly esoteric and scientifically controversial nature of Richard Banduric's public-facing "New Electrodynamics" theory, which could function as a sophisticated "intellectual honeytrap" to misdirect foreign R&D efforts.[1]

However, the tangible, hardware-focused nature of FPT's multi-million-dollar federal contracts provides dispositive counter-evidence. The DoD's $1.25 million investment in an operational directed energy weapon system from FPT is highly improbable if the underlying physics were merely a deception.[1] The dual-use nature of the gray tracks also provides plausible deniability and alternative paths to operationalization. A "propulsion" system might face a long acquisition process, but a "counter-drone weapon" could be fast-tracked to meet a more immediate need, getting the core technology into the field under a different guise.

The analysis concludes with **HIGH CONFIDENCE** that FPT is a genuine, government-vetted defense technology developer and not primarily an instrument of deception. While its principal's public theories may serve a secondary misdirection function, the substantial investment in a verifiable hardware program confirms its status as a credible and distinct "gray track".[1]

Section V: Actionable Intelligence and Future Collection Priorities

This final section provides concrete, forward-looking recommendations based on the report's findings, refining the original Priority Intelligence Requirements (PIRs) and identifying new intelligence gaps for future collection efforts.

5.1 Refined Intelligence Collection Recommendations

- **Priority 1 (Funding):** Continue systematic, keyword-driven monitoring of the SBIR/STTR and SAM.gov award databases. The focus should be on any new Phase I, Phase II, or Phase III awards to the identified entities (FPT, UnLAB, Woodruff Scientific).[1] A search for FY2025 awards to these entities has yielded a negative result, which is a key current data point.[55] New searches should include keywords derived from the known physics pathways, such as "Ampere Tension," "fluctuation flow," "asymmetric nanostructures," and "compact torus compression".[1]
- **Priority 2 (Human Capital):** Establish a formal tracking system for the key personnel identified in this report (Chase, Banduric, Woodruff, McKinnon) and their senior technical staff. Utilize professional networking platforms and public records to monitor for any employment changes, particularly transitions to Lockheed Martin, Boeing, Northrop Grumman, or BAE Systems.
- **Priority 3 (Network Convergence):** Actively monitor the agendas, presenter lists, and proceedings of niche, government-adjacent conferences, particularly the "US Space Disruptors Day" and the "Advanced Propulsion & Energy (APE)" conference series.[9] These events are now confirmed as primary venues for identifying new players and observing the convergence of previously disparate research tracks. The current lack of a 2025 agenda for these specific events represents an intelligence gap.[70]

5.2 Identification of New Intelligence Gaps

- What is the status of UnLAB's "Fluctuation Flow Propulsion" research, given its 2024 Phase I SBIR award? Has a Phase II proposal been submitted or awarded?
- What specific "metamaterial composite conductors" are being developed by FPT, and what is the Technology Readiness Level (TRL) of their directed energy prototype?
- Are there any formal, albeit non-public, links (e.g., Cooperative Research and Development Agreements) between Woodruff Scientific and Los Alamos National Laboratory?
- Who are the other key technical personnel, beyond the principals, at UnLAB and FPT? A full mapping of their scientific and engineering teams is required.

5.3 Strategic Outlook

The U.S. position within the clandestine advanced propulsion technology race appears robust, primarily due to its diversified portfolio strategy, which provides resilience and multiple avenues for a breakthrough. The active cultivation of an R&D ecosystem by government sponsors like the NSF is a unique strategic advantage. The primary challenge remains the transition of these "gray" technologies into robust, field-ready "black" programs—a process that requires sustained investment and strategic patience. The intelligence community's focus must now shift to monitoring for the specific indicators of this critical transition.

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