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IN-SPACE MANUFACTURING

Transforming Manufacturing Beyond Earth

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Executive Summary

Global ISM: Technical Validation Ahead of Commercial Scale

The global in-space manufacturing (ISM) ecosystem is advancing from scientific feasibility toward selective commercial validation, but remains structurally pre-scale. Microgravity enabled production has demonstrated early promise across pharmaceuticals, advanced materials, and additive manufacturing.

15+
Active Startups Globally

22
Funding rounds all-time

> **Key Signal**
> The United States anchors global activity, supported by deep capital markets, government alignment, and technological leadership. The United Kingdom has emerged as a credible secondary hub, while participation from other markets remains nascent.

Exit Activity: Minimal, but directionally meaningful

Exit activity remains limited to a single transaction, the 2020 acquisition of Made In Space by Redwire Space, representing capability-driven consolidation rather than a demand-validated commercial exit.

No IPOs have been recorded. Strategic acquisitions are likely to remain the dominant liquidity pathway in the near term, concentrated among platform consolidators seeking to integrate manufacturing and infrastructure capabilities.

Capital: Episodic & Concentrated

$397M
All-time equity funding

Funding peaked at $227M in 2025, driven by Varda Space Industries' $187M Series C - a single round representing 82% of that year's total. Capital is consolidating behind the few startups demonstrating credible progress.

The Defining Variable

Technological feasibility in ISM is established. The sector's critical open question is whether microgravity enabled products can achieve defensible performance advantages over improving terrestrial alternatives at a cost structure that supports recurring commercial demand.

> **Bottom Line**
> Until orbital production cycles become routine and post-ISS infrastructure is secured, ISM is likely to remain a high-conviction, premium-vertical opportunity rather than a broad industrial market.

Snapshot

$227M
Peak Annual Funding (2025)

82%
Of 2025 funding from a single round

95%
Of all time ISM funding from US & UK

1. Introduction

In-space manufacturing (ISM) refers to the production, assembly, or processing of materials in microgravity or orbital environments to achieve material characteristics that are expensive or difficult to replicate under terrestrial gravity constraints. On Earth, gravity induces convection, sedimentation, and buoyancy effects that can introduce defects during crystal growth and materials processing. In microgravity, these forces are reduced, enabling more uniform fluid dynamics and, in specific process regimes, material formation outcomes that are difficult or impossible to replicate under terrestrial gravity, including larger or more structurally uniform crystals in certain pharmaceutical and semiconductor applications.

Since 2000, when sustained ISS research operations commenced, more than 3k scientific investigations from over 108 countries have been conducted aboard the International Space Station (ISS), establishing a sustained research base in microgravity materials science and biotechnology[1]. Commercial interest in ISM has intensified over the past decade due to structural shifts in space access economics and orbital infrastructure development. Launch costs to Low Earth Orbit (LEO), which historically exceeded $20,000 per kilogram and in some programs surpassed $50,000 per kilogram, have declined by an order of magnitude with the introduction of partially reusable launch systems. This reduction has expanded commercial access to orbit, though it remains economically viable primarily for high-value, low-mass applications[2].

The broader space economy reached approximately $570 billion in 2023, according to the Space Foundation, encompassing satellite services, ground infrastructure, launch, and government space expenditure[3]. Estimates vary across sources depending on definitional scope. While satellite communications and navigation dominate current revenue pools, ISM represents a capital-intensive, emerging segment focused on applications where microgravity confers measurable performance or yield advantages. Despite improving technical feasibility, ISM remains throughput-constrained and logistically complex. Its near-term trajectory depends on demonstrating repeatable commercial demand rather than achieving terrestrial-scale production volumes.

2. Industry Overview: Structural Enablers of ISM

The emergence of in-space manufacturing reflects the convergence of three structural enablers: improved economic access to Low Earth Orbit (LEO), the transition from government-dominated to commercially oriented orbital infrastructure, and incremental regulatory clarification supporting private-sector participation. Together, these factors have meaningfully expanded the feasibility frontier for ISM, though structural dependencies and cost constraints remain active considerations for the sector's near-term trajectory.

2.1 Launch Economics Have Improved, But Value Density Remains the Commercial Gating Factor

Access to LEO has become materially more affordable over the past decade. SpaceX currently lists its Falcon 9 at approximately $67 million per launch. In its expendable configuration, the vehicle can deliver up to 22,800 kg to LEO, implying a per-kilogram cost of roughly $2,900 under maximum payload utilization[4]. While these economics do not enable mass industrial production in space, they selectively support high-value, low-volume applications. ISM's commercial viability is therefore driven by value density, the economic return per kilogram launched, rather than production scale. Despite this improvement, launch economics remain prohibitive for bulk industrial production. Applications must justify launch costs through performance premiums or yield improvements that materially exceed terrestrial alternatives. However, access remains concentrated among a limited number of launch providers, introducing cadence and pricing dependency risk in the near term.

2.2 The Post-ISS Infrastructure Transition Opens New Platforms, But Continuity Risk Remains

The ISS launched its first module in 1998[5], was first crewed in November 2000[6], and commenced sustained research operations in early 2001[7]. NASA's Commercial LEO Destinations (CLD) program is intended to facilitate privately operated space stations in the post-ISS era. Contracts have been awarded to Axiom Space and Blue Origin–led consortiums. Diversification of orbital infrastructure reduces single-platform dependency and establishes a foundation for sustained industrial presence in orbit beyond government missions. These initiatives aim to establish commercially operated platforms capable of supporting research, manufacturing, and tourism. While diversification of orbital platforms is structurally significant, no fully commercial station is yet operational. The transition from ISS to private infrastructure represents both an opportunity and a near-term continuity risk for ISM startups.

2.3 Regulatory Foundations Are Forming, With the US Leading and Global Frameworks Emerging

The U.S. Commercial Space Launch Competitiveness Act (2015) grants U.S. entities legal rights over resources extracted from celestial bodies, reducing ambiguity surrounding commercial space resource utilization[8].The Act clarified private ownership rights over space-derived resources such as asteroid materials, signalling broader U.S. policy support for commercial space activity, although its direct applicability to orbital manufacturing remains limited. Complementing this, NASA's In-Space Production Applications (InSPA) program supports maturation of commercially relevant microgravity production technologies through targeted funding. Globally, other jurisdictions, including the European Space Agency (ESA) and emerging space agencies in Asia are also developing commercialization frameworks, underscoring the increasingly international character of orbital industrial activity.

3. Startup Landscape, Positioning & Commercial Maturity

3.1 Slow by Design: ISM's Founder Entry Curve Reflects Infrastructure-Linked Ecosystem Maturation

Year-wise company formation trends in In-Space Manufacturing (ISM) highlight a structurally deliberate build-out, shaped less by venture-driven scaling dynamics and more by the availability of enabling infrastructure, launch access, orbital platforms, and demonstrated use case viability.

Early activity predates the recent commercial space momentum, with isolated company formations recorded in 2010 (one company) and 2014 (two companies), largely technology-driven pioneers exploring microgravity manufacturing feasibility rather than operating within a defined commercial market. Between 2016 and 2021, startup formation remained limited to one company per year, reflecting a prolonged capability-validation phase where constrained launch access, high infrastructure dependency, and uncertain commercial demand limited broader founder participation. Ecosystem expansion during this period was shaped by deep-tech conviction and institutional partnerships rather than market-pull dynamics.

A gradual shift emerged from 2022 onward. The ecosystem recorded two new companies in 2022, followed by three companies each in 2023 and 2024, the highest annual formation levels to date. While absolute numbers remain small, this clustering of new entrants signals improving founder confidence, driven by expanding private launch cadence, growing visibility around commercial space station roadmaps, and increasing validation of in-orbit production use cases.

Unlike software-led ecosystems where company creation can scale rapidly with market demand signals, ISM's growth remains tightly coupled with external infrastructure milestones, resulting in slower but more capability-intensive founder entry, with startups positioning early across materials science, orbital manufacturing platforms, and in-space logistics layers.

Takeaway: ISM's formation curve is slow by design, not by lack of ambition. The modest but accelerating entry rate since 2022 is a meaningful signal, reflecting genuine improvements in launch economics and commercial orbital infrastructure rather than speculative founder activity. Future acceleration in startup creation is likely contingent on sustained reductions in launch costs, operationalization of commercial orbital platforms, and clearer pathways to recurring revenue from space-manufactured products.

3.2 Strategic Positioning of Startups

The ISM startup ecosystem clusters around three strategic archetypes, each reflecting a distinct commercialization logic, capital requirement, and time horizon.

1. High-Value Microgravity Manufacturing represents the nearest-term commercial opportunity, centered on producing materials or biological products that benefit from reduced convection and sedimentation in microgravity. The economic thesis is value density, products must command margins sufficient to offset launch and return costs. Varda Space Industries' W-1 mission, launched in 2023 and successfully returned in February 2024, demonstrated end-to-end orbital manufacturing and re-entry capability at pilot scale, representing one of the first commercially operated orbital manufacturing return missions demonstrating controlled re-entry capability[9]. Commercial maturity in this segment depends on repeatable mission cadence, regulatory approval in end markets, and demonstrable performance advantages over terrestrial alternatives.

2. In-Orbit Assembly & Structural Fabrication addresses the longer-horizon opportunity of manufacturing or assembling structures directly in space, reducing dependence on launch fairing constraints and enabling architectures that exceed conventional payload limits. Made In Space (acquired by Redwire) pioneered on-orbit additive manufacturing, while Orbital Composites is developing robotic composite manufacturing systems for orbital applications[10]. Most initiatives remain in early developmental stages, this archetype represents an infrastructure-driven investment thesis rather than a near-term monetization play.

3. Enabling Platforms & Orbital Infrastructure encompasses companies developing the foundational capacity for orbital

production, including commercial station modules, autonomous robotics, and reusable return vehicles. Axiom Space is developing commercial station modules to support industrial LEO activity, while Space Forge is building reusable return vehicles optimized for microgravity manufacturing payloads. These firms monetize access and infrastructure capacity rather than end-products, typically carrying higher upfront capital intensity and longer gestation periods as a result.

ISM's startup landscape reflects a divergence between product-driven models targeting near-term high-margin outputs and infrastructure-driven models positioned for long-term orbital industrialization. Near-term validation potential is most visible in high-value, low-volume manufacturing, while in-orbit assembly and platform-scale plays represent longer-duration bets contingent on the broader space economy's expansion.

3.3 Commercial Readiness

The ISM ecosystem remains commercially early-stage, with companies distributed across three maturity tiers, pre-revenue R&D, demonstration-stage validation, and limited early commercial deployment, and the landscape heavily weighted toward technology validation rather than sustained revenue generation.

At the pre-revenue stage, most ISM startups are supported by government grants, public-private partnerships, and research contracts. NASA's InSPA program continues to fund microgravity production research, underscoring that many use cases remain in feasibility validation phases where technical progress has not yet translated into demand validation or economic repeatability.

At the demonstration stage, a second cohort has achieved end-to-end orbital manufacturing and controlled re-entry but has yet to establish repeatable commercial cadence. Varda Space Industries' successful capsule return mission in 2024 is technically significant, but the primary commercial inflection point for this segment remains the transition from proof-of-concept to multi-mission deployment with recurring customers, with regulatory processes in pharmaceuticals and advanced materials serving as an additional gating factor.

A smaller subset has entered early commercial operations, typically integrated with existing orbital infrastructure.

Redwire has conducted additive manufacturing and bioprinting research aboard the ISS under government and institutional contracts, though revenues remain episodic and contract-based rather than demand-scaled.

3.3.1 Early Target Industries

Initial commercialization efforts are concentrated in sectors characterized by high value density, performance sensitivity, and the capacity to absorb validation costs.

Pharmaceuticals represent the highest near-term potential (subject to regulatory approval and demonstrable clinical advantage), with microgravity conditions studied for enabling more uniform protein crystal growth[11]. Varda Space Industries is actively exploring pharmaceutical production models incorporating orbital manufacturing and Earth return capability. Regulatory timelines, including FDA requirements, remain the primary gating factor between technical validation and commercial adoption, though the pricing power of specialty therapeutics may offset orbital manufacturing costs if microgravity delivers demonstrable drug quality improvements.

Advanced Materials, including specialty fibers such as ZBLAN optical fiber, have been manufactured aboard the ISS with demonstrated performance differentiation. However, ongoing terrestrial manufacturing improvements continue to narrow the comparative advantage, making cost-performance validation a continued priority.

Defense applications focus on dual-use infrastructure, in-orbit servicing, and resilient space architectures, with recent U.S. space policy frameworks emphasizing increased commercial integration, potentially creating future demand pathways for ISM capabilities.

Semiconductors remain largely exploratory, with the theoretical benefit centered on reduced convection-related defects during crystal growth. Commercial viability will depend on demonstrable material improvements at scale relative to advancing terrestrial fabrication techniques.

Early target industries share three structural characteristics, high gross margins, tolerance for low production volumes, and capacity to absorb validation and regulatory costs. ISM commercialization is not constrained by technological curiosity but by economics, repeatability, and cadence reliability. Until orbital production cycles become routine, commercial traction is likely to remain concentrated in premium, performance-driven verticals rather than mass industrial markets.

4. Funding Landscape, Capital Concentration & Market Signals

4.1 From $270K to $227M: ISM Funding Driven by Episodic Spikes, Not Sustained Growth

The global In-Space Manufacturing (ISM) ecosystem comprises 15+ active startups, of which 10+ have secured external funding, reflecting early but selective investor participation. Cumulatively, the sector has attracted approximately $397M in all-time equity funding across 22 rounds, a figure that signals genuine but still concentrated market conviction rather than broad-based capital deployment.

$397M

All-time **equity funding** across **22** rounds

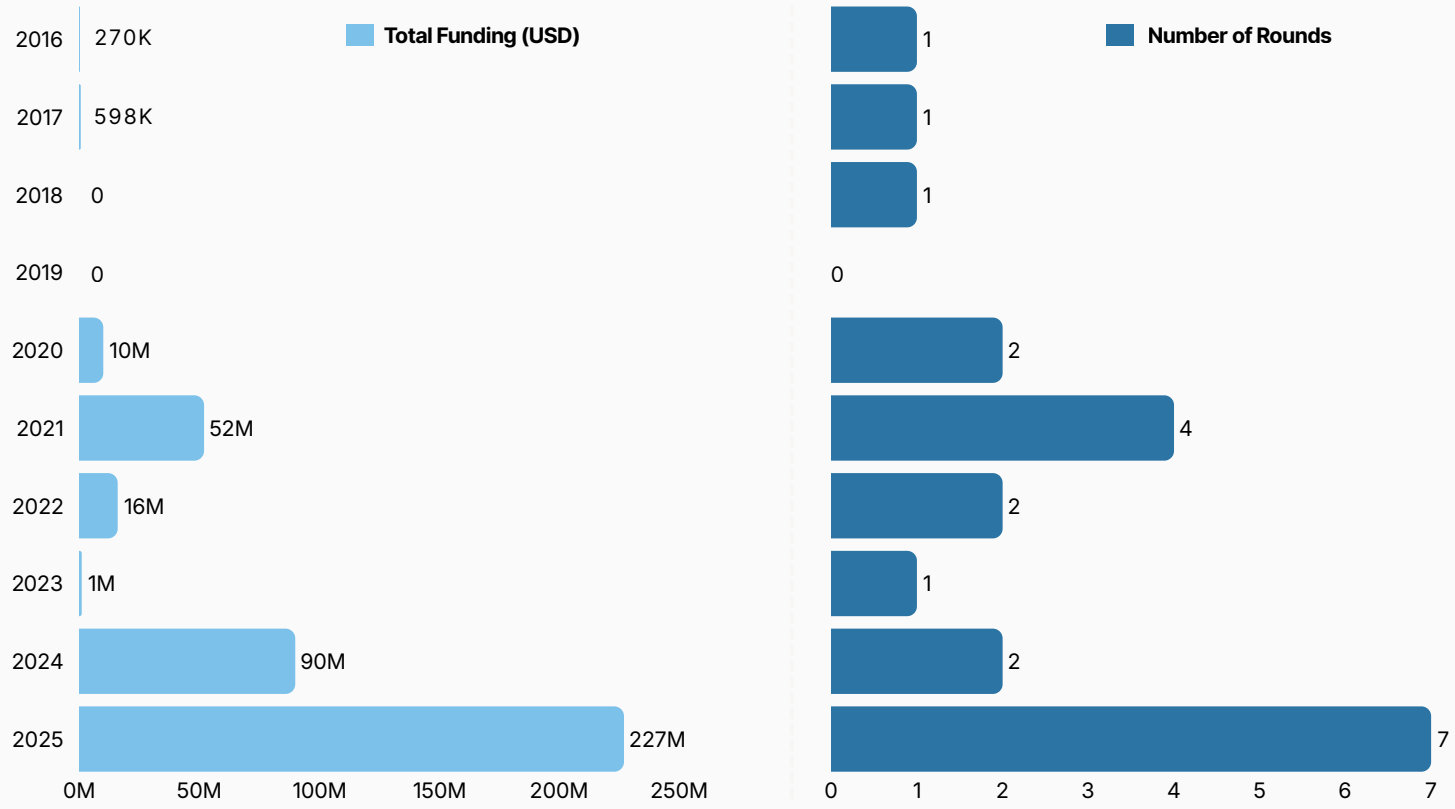
Between 2015 and 2017, funding remained sub-$1M with single rounds annually, capital at this stage was a technical feasibility bet, not a commercial one. The first meaningful signal of investor confidence emerged in 2021, when funding jumped to $52M across four rounds, marking ISM's transition from fringe research interest to a fundable deep-tech category.

That momentum moderated in the subsequent period. Funding declined to $16M in 2022 and further to $1M in 2023, alongside reduced deal activity, reflecting a period of investor recalibration as the sector awaited clearer evidence of operational and commercial viability. The pullback suggests that capital deployment in ISM remains sensitive to the availability of tangible proof points rather than being driven by sustained sectoral conviction.

The market responded with a decisive reallocation. Funding surged to $90M in 2024 and hit an all-time high of $227M across seven rounds in 2025, driven predominantly by

Exhibit 1

YoY Funding & Number of Rounds in ISM



-YTD figures are considered up to Mar 10, 2026. (Source: Tracxn)
-2024 Round Count- One of the two funding rounds recorded in 2024 was undisclosed at the time of publication. Analysis reflects only the confirmed transaction: Varda Space Industries' $90M Series B (April 2024). The undisclosed round is excluded from stage-wise and company-level breakdowns but is captured in the annual funding total.
-Total funding rounds are 22 (all-time). The exhibit reflects 2016–2025 activity only, with 1 rounds occurring prior to 2016, hence the charted total appears lower.

Varda Space Industries' $187M Series C, a single transaction representing ~82% of the year's total. This concentration is not incidental; it reflects a structural shift where capital is consolidating behind the few startups demonstrating credible progress toward scaled in-orbit manufacturing, while the broader ecosystem remains undercapitalized.

ISM's funding trajectory is one of episodic, milestone-driven spikes rather than linear expansion, with the $1M-to-$227M arc over a decade pointing to a bifurcating market where outsized capital is increasingly chasing proven startups, even as early-stage players compete for a comparatively thin deal pool.

4.2 Volatile Medians, Outlier-Driven Averages: ISM Round Sizes Reflect a Deal-Driven Market

Median round size trends in the In-Space Manufacturing (ISM) ecosystem reveal the depth and volatility of capital deployment in a low-volume, deep-tech funding environment, where a single large transaction can meaningfully shift annual averages.

Between 2015 and 2017, median round sizes remained below $600K, fluctuating from $500K in 2015 to $598K in 2017 (~20% increase), reflecting small exploratory investments aligned with early-stage technology validation.

Funded activity was limited in 2018–2019, with median values remaining negligible during this phase.

A meaningful step-up in funding depth emerged from 2020 onward. Median round size rose sharply to $5M in 2020, an approximately 8.3x increase over 2017 ($598K) levels signaling growing investor willingness to deploy more substantive capital as the sector's technical foundations strengthened. This momentum carried into 2021, when the median doubled to $10M (~100% YoY growth), the highest typical cheque size observed in the ecosystem to date. Median values moderated to $8M in 2022 and further to $1M in 2023, reflecting a period of investor recalibration consistent with broader funding trends across the ecosystem during this phase.

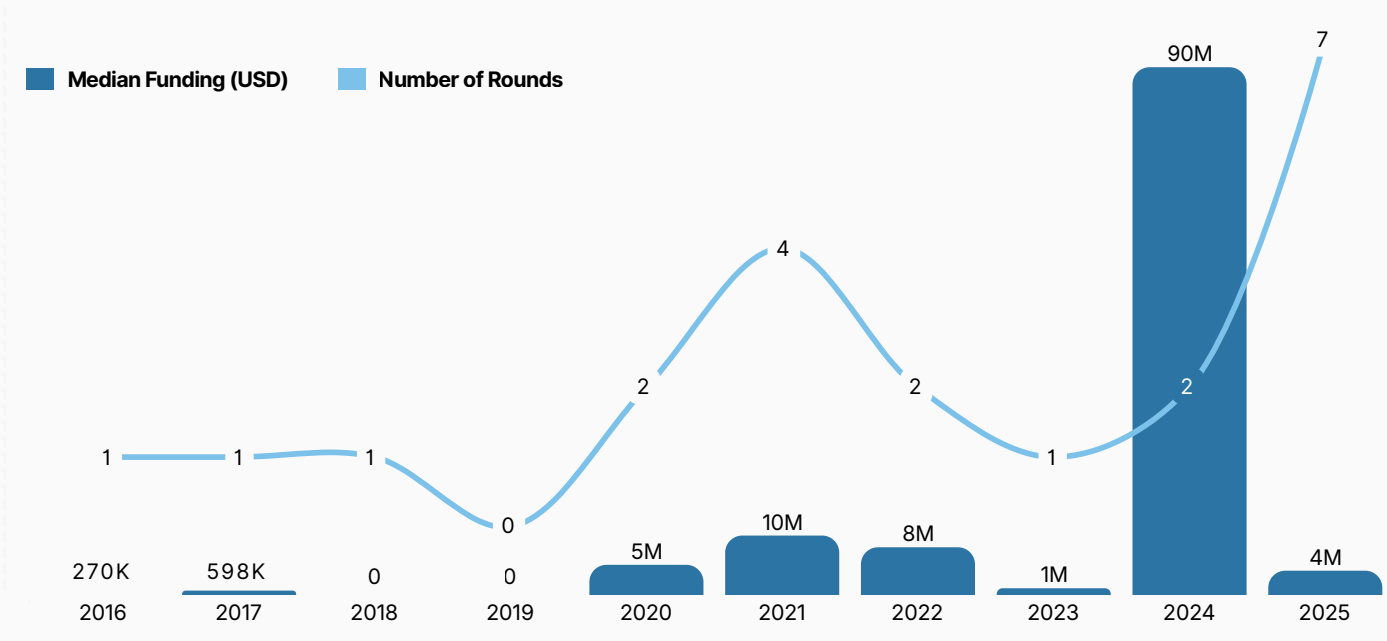
82%

of **2025 funding** from a **single round**

The subsequent rebound brought a pronounced shift. Median round size rose to $90M in 2024, though this figure should be interpreted with caution, with only two rounds recorded that year, the median was heavily influenced by

Exhibit 2

Median and Average Rounds size in ISM



YTD figures are considered up to Mar 10, 2026. (Source: Tracxn)

large individual transactions rather than reflecting a broad shift in typical cheque sizes. In 2025, despite ISM recording its highest-ever annual funding, the median round size moderated to $4M (~96% decline from 2024). This apparent divergence is explained by deal composition: a single outlier transaction, Varda's $187M Series C, accounted for the bulk of annual capital, while the remaining six rounds were substantially smaller, pulling the median down and suggesting a wider distribution of deal sizes than the headline funding figure implies.

Sharp swings in ISM's median round size are less a reflection of shifting investor sentiment and more a structural artifact of a low-volume market where outlier transactions disproportionately shape annual trends. The more durable signal is the directional step-up in typical cheque sizes since 2020, pointing to gradually deepening capital commitment even as deal-level volatility persists.

4.3 From Seed Bets to Scale Capital: ISM's Stage Mix Signals Early but Selective Maturation

Stage-wise funding trends in the In-Space Manufacturing (ISM) ecosystem point to a sector gradually progressing from seed-dominated exploration toward selective scale financing with late-stage capital making its first meaningful appearance only in 2025. As of Mar 10, 2026 YTD, the ecosystem has recorded 16 seed-stage rounds, 5 early-stage rounds, and only 1 late-stage round, indicating that most startups remain in early validation or initial scaling phases.

All recorded investments between 2015 and 2017 were entirely concentrated at the seed stage, with funding remaining below $600K annually, reflecting exploratory capital aligned with initial technology validation. Funded

Table 1

Top Funding Rounds by Stage in ISM

SL No.	Startup	Round Date	Round Name	Round Amount (USD)
1	Space Forge	Dec 21, 2021	Seed	10M
2	Varda Space Industries	Dec 08, 2020	Seed	9M
3	Reditus Space	Dec 01, 2025	Seed	7M
4	Varda Space Industries	Apr 05, 2024	Series B	90M
5	Varda Space Industries	Jul 30, 2021	Series A	42M
6	Space Forge	May14, 2025	Series A	30M
7	Varda Space Industries	Jul 10, 2025	Series C	187M

YTD figures are considered up to Mar 10, 2026. (Source: Tracxn)

activity remained limited through 2018–2019, with no recorded stage-wise deployment.

Meaningful expansion emerged from 2020, when seed-stage investment rose sharply to $10M, anchored by Varda Space Industries' $9M Seed round (Dec 2020), the largest single seed transaction in the dataset and an early signal of concentrated investor conviction in platform-level in-orbit manufacturing. Stage diversification began in 2021, with total early-stage funding reaching $42M, driven primarily by Varda Space Industries' $42M Series A round. In parallel, seed-stage activity accounted for $10M in total funding, led by Space Forge's $10M Seed round, indicating that a small cohort of startups was beginning to progress beyond proof-of-concept. Funding moderated in 2022, with early-stage capital declining to $16M (~62% YoY) and seed tapering to $173K (~98% YoY), reflecting a period of investor recalibration across the ecosystem.

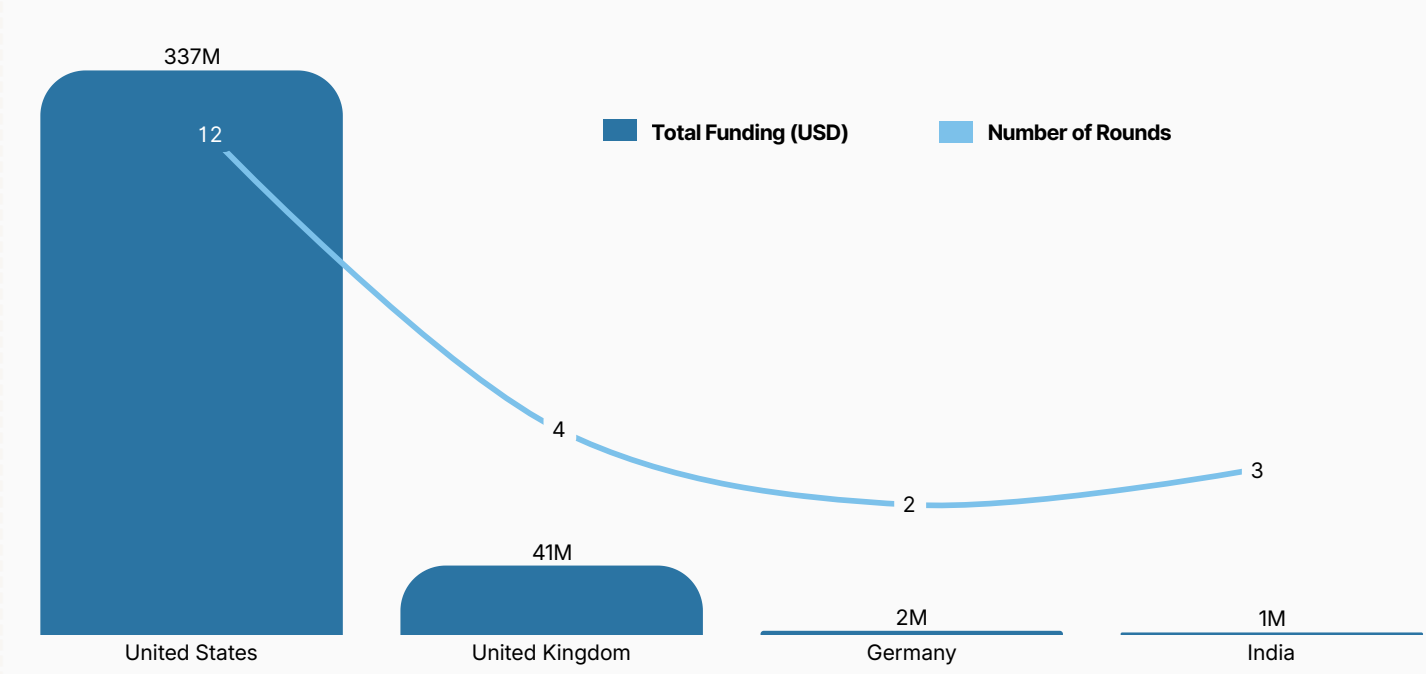
$187M

Varda Series C, 2025
Largest ISM round on record

Activity in 2023 returned primarily to seed-stage deployment ($1M), while 2024 saw concentrated early-

Exhibit 3

Top all time funded geographies



YTD figures are considered up to Mar 10, 2026. (Source: Tracxn)

stage investment of $90M, driven entirely by Varda Space Industries' $90M Series B, signaling renewed and deepening conviction in startups demonstrating credible progress toward commercial readiness. The most significant structural development came in 2025, when ISM recorded its first meaningful late-stage funding, with Varda Space Industries closing a landmark $187M Series C, alongside Space Forge's $30M Series A at the early stage and Reditus Space's $7M Seed round, the first year in which all three stages recorded simultaneous activity. Late-stage capital accounted for ~82% of total 2025 funding, marking the ecosystem's first credible transition toward scaled commercial ambition.

ISM's stage-wise progression signals selective but directionally meaningful maturation, wide early participation narrowing sharply as capital requirements scale. Varda Space Industries' progression from a $9M Seed in 2020 to a $187M Series C in 2025 is the clearest illustration of this

Table 2

List of Acquisition in ISM

Company Name	State- City	Acquired By	Acquisition Date	Acquisition Price
Made in Space	California-Mountain View	Redwire Space (Redwire Corporation)	Jun 23, 2020	Undisclosed

YTD figures are considered up to Mar 10, 2026. (Source: Tracxn)

95%

of all-time ISM funding from **US and UK combined**

concentration reflects both the depth of the US venture ecosystem and the first-mover advantage of US-based startups in demonstrating commercial in-orbit manufacturing viability.

The United Kingdom represents the second-largest funding destination, accounting for approximately $41M across 4 rounds (~10% share), supported primarily by Space Forge, whose Seed and Series A rounds signal growing investor confidence in UK-based orbital manufacturing capabilities. While materially smaller than the US in absolute terms, the UK's funding trajectory points to an emerging cluster with credible technical foundations.

Funding activity beyond these two markets remains at an early stage. Germany has attracted approximately $2M across 2 rounds (~0.5% share), with participation from startups such as Orbital Matter, while India has recorded approximately $1M across 3 rounds (~0.3% share), led by companies such as Inbound Aerospace, reflecting nascent but broadening geographic participation in the ISM ecosystem.

trajectory, and currently the only complete funding arc in the ecosystem, underscoring that broad-based scaling remains a forward opportunity rather than a present reality.

4.4 US and UK Lead, But ISM's Geographic Funding Footprint Remains Narrow

Investment in the In-Space Manufacturing (ISM) ecosystem is strongly concentrated across a small number of established space innovation clusters, with the United States and United Kingdom collectively accounting for approximately 95% of all-time equity funding indicative of early-stage geographic concentration rather than structural dominance, reflecting the early-stage nature of the sector and its dependence on mature deep-tech venture ecosystems.

The United States dominates capital deployment, attracting approximately $337M across 12 rounds (~85% of all-time funding), driven largely by Varda Space Industries' multi-stage funding progression from Seed through Series C. This

ISM's geographic funding footprint is currently narrow, with capital formation concentrated in ecosystems that combine deep-tech venture maturity with established space infrastructure. The early participation from Germany and India, while limited in scale, suggests that the sector's investor base has potential to broaden as domestic space programs mature and proof points from US and UK startups reduce perceived technical risk globally.

4.5 One Exit in Six Years: ISM's Liquidity Pathway Remains Early but Directionally Meaningful

Exit activity in the In-Space Manufacturing (ISM) ecosystem remains limited, consistent with the sector's early commercial maturity and long development timelines. As of Mar 2026 YTD, the ecosystem has recorded one acquisition and no IPOs, reflecting that liquidity pathways are still in their formative stage, a pattern typical of deep-tech sectors at a comparable stage of development.

The only recorded exit occurred in June 2020, when Made In Space was acquired by Redwire Space (Redwire Corporation), a capability-driven consolidation move that enabled the integration of in-space manufacturing technologies into a broader space infrastructure platform. While acquisition price was undisclosed, the transaction is notable as the first signal of strategic interest from larger space infrastructure players in ISM capabilities.

The absence of IPO activity and limited acquisition frequency is less a structural weakness than a reflection of where most ISM startups currently sit in their development arc, still progressing through technology validation and early scaling phases. As startups like Varda Space Industries advance toward commercial operations, the conditions for a more active exit environment are gradually forming, with strategic acquisitions the more probable near-term liquidity pathway ahead of public market listings.

5. Investor Trends

5.1 High-Conviction Backers Driving ISM's Venture Landscape

Investor participation in the In-Space Manufacturing (ISM) ecosystem is concentrated among a small group of deep-tech and frontier technology venture capital firms, with the most active investors characterized by repeated backing of the same startups rather than broad portfolio diversification, a pattern reflective of the sector's capital intensity and long development timelines.

Table 3

List of Most Active VCs by Number of Rounds (Non-Exhaustive List)

Most Active VCs	No. of Rounds	No. of Portfolio Companies	Recent Investment as Investor (Non-Exhaustive List) (USD)
Founders Fund	4	1	Varda Space Industries (Jul 10, 2025- Series C,187M)
Lux Capital	4	1	Varda Space Industries (Jul 10, 2025- Series C,187M)
Space VC	3	1	Space Forge (May 14, 2025- Series A,30M)
Khosla Ventures	3	1	Varda Space Industries (Jul 10, 2025 - Series C,187M)
Starbridge Venture Capital	2	2	Space Forge (Dec 21, 2021-Seed,10.2M)

YTD figures are considered up to Mar 10, 2026. (Source: Tracxn)

Founders Fund and Lux Capital lead with four rounds each, driven by their sustained backing of Varda Space Industries across multiple stages, from early validation through to its landmark $187M Series C in July 2025. Khosla Ventures mirrors this conviction with three rounds in Varda, while Space VC has maintained consistent support for Space Forge across three rounds, reflecting confidence in reusable manufacturing satellite technology. Starbridge Venture Capital stands out as the only investor in this cohort with two portfolio companies, having backed both Space Forge and an additional ISM entrant at the seed stage.

The concentration of rounds within single portfolio companies is a defining feature of ISM's investor landscape. Rather than deploying capital across a broad set of early-stage bets, leading investors have chosen to double down on technically credible startups, a strategy that reflects the high barriers to proof-of-concept in orbital manufacturing and the premium placed on demonstrated infrastructure readiness over early-stage optionality.

Takeaway: ISM's venture landscape is currently shaped by a small cohort of high-conviction, frontier-technology investors with the appetite and expertise to support capital-intensive, long-horizon deep-tech ventures. As launch costs continue to decline and commercial orbital platforms mature, the conditions for broader institutional and strategic investor participation are gradually forming, pointing to a potential expansion of the capital base supporting the ecosystem in the years ahead.

6. Challenges & Risk Factors

Despite improving structural enablers, ISM remains exposed to a set of systemic constraints that are shaping commercialization timelines and capital deployment patterns. These are not barriers unique to ISM, they are characteristic of any deep-tech sector at a comparable stage of infrastructure and market maturity.

Capital Intensity Limits Viable Unit Economics to High-Margin Applications

Orbital manufacturing requires spacecraft development, payload integration, launch procurement, and in certain models controlled re-entry systems. SpaceX's Falcon 9 is listed at approximately $67M per launch (~$2,900/kg to LEO under full utilization)[12], and dedicated missions with proprietary return vehicles materially increase capital requirements beyond rideshare alternatives. Insurance, mission assurance, FAA licensing for re-entry, and compliance costs add further financial burden[13]. As a result, viable unit economics are currently limited to high-margin products or firms supported by long-term government or strategic contracts, reinforcing the value density thesis that governs ISM's near-term commercial logic.

Capital intensity is a structural feature of orbital manufacturing rather than a transitional constraint. Near-term commercial viability will remain concentrated in applications where performance premiums and margin structures can absorb the full cost of mission development and regulatory compliance.

Regulatory Sequencing Adds Timeline Risk, Particularly in Pharmaceuticals

Regulatory exposure is most acute in pharmaceutical and dual-use applications. Space-manufactured drugs must meet terrestrial FDA Good Manufacturing Practice (GMP) requirements regardless of production environment, introducing extended timelines between technical validation and commercial adoption. Under Article VI of the Outer Space Treaty, states bear international responsibility for national space activities conducted by non-governmental entities, while legal jurisdiction is established, operational standards specific to in-orbit manufacturing processes remain underdeveloped[14].

Regulatory sequencing is an independent gating factor from technical readiness, companies can achieve mission success and still face multi-year pathways to commercial deployment. Early engagement with regulatory frameworks, particularly FDA approval pathways, is increasingly a competitive differentiator for ISM startups targeting pharmaceutical applications.

Launch and Infrastructure Dependency Introduces Operational Concentration Risk

ISM missions rely on a limited number of launch providers and a single operational orbital platform, the ISS, currently planned through 2030, after which a NASA-contracted SpaceX deorbit vehicle will manage controlled re-entry. NASA's Commercial LEO Destinations (CLD) program is intended to bridge the post-ISS transition, but no fully private station is yet operational. The gap between ISS retirement and commercial platform readiness represents a near-term continuity consideration for startups currently reliant on ISS access. Launch cadence disruptions, whether technical, geopolitical, or scheduling-related can directly delay production cycles, as manufacturing throughput is tied to mission frequency rather than factory capacity alone.

Infrastructure and launch concentration are the most operationally immediate risk factors for ISM. Diversification of both launch providers and orbital platforms is a prerequisite for the sector transitioning from episodic mission cadence to industrialized production cycles.

Orbital Debris and Re-Entry Complexity Add Operational and Financial Uncertainty

NASA currently tracks >27,000 pieces of orbital debris larger than 10 cm, with additional smaller fragments posing collision hazards for manufacturing platforms and return vehicles[15]. Controlled re-entry operations require FAA regulatory clearance and precision execution, and licensing delays have previously impacted commercial mission timelines[16]. Insurance and liability exposure for on-orbit incidents or failed re-entry events introduce additional financial uncertainty that is difficult to model at early commercial scales.

Debris proliferation and re-entry complexity are growing operational considerations as orbital activity increases. While not unique to ISM, they add cost and timeline uncertainty that startups must factor into mission economics, particularly for reusable return vehicle models.

Demand Validation Remains the Sector's Most Fundamental Commercial Uncertainty

Most ISM revenue to date remains contract-based and government-supported rather than driven by sustained commercial product demand. While microgravity advantages have been demonstrated experimentally, notably in protein crystallization and specialty fiber production, widespread commercial adoption depends on measurable and defensible performance improvements relative to terrestrial alternatives[17]. Continued advances in Earth-based manufacturing, particularly in advanced materials and semiconductor fabrication, could narrow the performance premium that justifies orbital production costs.

Compounding this, ISM faces a structural coordination challenge: infrastructure readiness, launch cadence, regulatory clarity, capital availability, and end-market demand must mature in parallel. Delays in any single layer can cascade across the value chain, extending time-to-revenue and increasing capital requirements for early-stage operats.

Demand validation is ISM's most fundamental and least resolved commercial uncertainty. The sector's long-term viability depends not on continued feasibility demonstration but on establishing that microgravity-enabled products deliver durable, scalable economic advantages over improving terrestrial alternatives, a threshold that remains to be crossed at commercial scale.

7. Future Outlook

ISM's trajectory over the next decade will be determined less by technological feasibility and more by infrastructure continuity, launch cadence, capital discipline, and sustained demand validation. Recent demonstrations have meaningfully reduced feasibility risk, the defining question now is whether the sector can transition from validated pilots to repeatable, economically viable operations.

Post-ISS Transition: Platform Continuity as a Structural Enabler

NASA plans to operate the ISS through 2030, with controlled deorbit scheduled thereafter. In June 2024, NASA awarded the U.S. Deorbit Vehicle contract to SpaceX, marking the first confirmed step toward managed ISS retirement and underscoring the agency's continued reliance on commercial launch infrastructure for end-of-life orbital operations[18]. To facilitate continuity, NASA has awarded Commercial LEO Destinations (CLD) agreements to Axiom Space and a Blue Origin-led consortium to develop privately operated successor platforms. If successfully deployed, these stations could transition ISM from government-hosted research access to commercially priced orbital infrastructure, a meaningful structural shift for the sector's long-term operating environment.

No fully commercial station is yet operational, and the gap between ISS retirement and private platform readiness represents a near-term continuity consideration. Sustained industrial activity in orbit will require predictable platform access beyond public research allocations.

Commercial station development is the single most consequential infrastructure variable for ISM's post-2030 outlook. Successful deployment of Axiom and Blue Origin-led platforms would remove the sector's most significant structural dependency, transitioning ISM from a government-access model to a commercially scalable one.

Launch Economics: Improving Trajectory, But Cadence Remains the Gating Variable

Launch economics have improved materially, with SpaceX's Falcon 9 listed at approximately $67M per launch (~$2,900/kg under full utilization) and commercial launch cadence reaching record levels in recent years according to the U.S. Federal Aviation Administration (FAA). These improvements have expanded ISM's feasibility window for high-value, low-volume applications[19].

However, routine manufacturing throughput requires not only continued cost reductions but also predictable, high-frequency launch scheduling. Without increased cadence and diversified launch supply, ISM production cycles will remain episodic rather than industrialized, limiting the sector's ability to serve customers requiring reliable delivery timelines.

Launch cost reduction is a necessary but insufficient condition for ISM scalability. Cadence reliability and launch provider diversification are the more critical near-term variables, determining whether ISM can transition from mission-by-mission pilots to recurring production cycles.

Market Positioning Within the Broader Space Economy

The global space economy reached approximately $570B in 2023 and could exceed $1 trillion by 2040 under baseline projections referenced by the World Economic Forum, with satellite communications, navigation, and Earth observation currently accounting for the majority of sector value. ISM represents a comparatively small but strategically positioned emerging subsegment.

For ISM to capture meaningful share within this expanding economy, microgravity-enabled products must demonstrate measurable, defensible performance advantages over terrestrial alternatives. Defense procurement frameworks increasingly emphasizing commercial partnership models represent a near-term demand pathway, while pharmaceuticals and advanced materials offer longer-horizon opportunities contingent on regulatory integration and cost-performance validation.

ISM's addressable market is real but currently narrow. Capturing meaningful share of the broader space economy will require the sector to move beyond premium niche positioning, a transition that depends on cadence reliability, regulatory integration, and sustained customer pull rather than continued feasibility demonstration.

Horizon View: Near-Term Milestones and Long-Term Conditions

Over the next three to five years, sector progress will likely be measured by repeated multi-flight production cycles, transition from grant-supported pilots to commercial contracts, development of reusable return vehicles, and demonstration of end-market regulatory compliance, particularly FDA pathways for pharmaceutical applications. Commercial viability in this window will hinge on cadence reliability rather than single-mission technical success.

Beyond 2030, the outlook depends on successful deployment of commercial LEO stations, institutionalized procurement pipelines in defense and pharmaceuticals, diversification of launch providers, and regulatory harmonization across jurisdictions. If defense and pharmaceutical procurement frameworks incorporate orbital manufacturing as a strategic capability rather than an experimental niche, ISM adoption could accelerate meaningfully.

ISM's near-term priority is operational repeatability; its long-term opportunity is ecosystem integration. The sector's upside is structurally linked to the expansion of the orbital economy, but realizing that upside will require capital efficiency, infrastructure continuity, and sustained customer pull working in concert rather than in isolation.

8. Appendix

Appendix A: Research Methodology

A.1 Research Scope & Data Cut-Off

This report examines the global in-space manufacturing (ISM) startup ecosystem, focusing on company formation trends, strategic positioning, commercial maturity, funding patterns, investor participation, geographic capital concentration, and exit outcomes. The analysis aims to assess the evolution of ISM as an emerging industrial segment within the broader space economy.

The scope includes startups engaged in microgravity-enabled product manufacturing, in-orbit assembly and structural fabrication, and enabling orbital infrastructure development. Funding and investment analysis incorporates all-time activity, with year-to-date (YTD) figures considered up to March 10, 2026.

A.2 Data Sources

This report synthesizes insights from a market intelligence database, institutional publications, and secondary research sources, including:

Market intelligence databases:
Tracxn (startup identification, funding rounds, investor participation, geographic classification, and exit tracking)

Secondary sources:

- Company disclosures, mission announcements, and investor press releases
- Public policy documents and institutional publications from space agencies and regulatory bodies
- Media reports and sector-focused research publications covering space industry developments

A.3 Ecosystem Segmentation Framework

For analytical consistency, ISM startups are categorized based on their primary strategic positioning within the orbital manufacturing value chain:

- High-value microgravity manufacturing: Startups focused on producing premium materials, biological products, or specialty components benefiting from microgravity conditions
- In-orbit assembly & structural fabrication: Companies developing capabilities to manufacture or assemble large-scale structures directly in space
- Enabling platforms & orbital infrastructure: Firms building commercial space station modules, reusable return vehicles, autonomous robotics, or related enabling systems

Segmentation is based on primary commercialization logic rather than technological overlap, acknowledging that some startups operate across multiple layers.

A.4 Funding, Investor & Exit Analysis

Funding analysis includes:

- Equity funding rounds such as angel, venture capital, strategic investments, and private equity
- Publicly disclosed transactions only
- Stage-wise classification across Seed, Early (Series A/B), and Late (Series C and beyond)
- 2024 Round Count- One of the two funding rounds recorded in 2024 was undisclosed at the time of publication. Analysis reflects only the confirmed transaction: Varda Space Industries' $90M Series B (April 2024). The undisclosed round is excluded from stage-wise and company-level breakdowns but is captured in the annual funding total.

Total funding reflects disclosed venture equity rounds tracked via Tracxn for identified ISM-focused startups and excludes grants, debt instruments, government contracts, and undisclosed financing.

Investor analysis focuses on:

- Most active venture capital firms by number of rounds
- Portfolio concentration patterns and repeat investor participation
- Identification of mega rounds and late-stage outlier transactions influencing annual funding trends

Exit analysis includes:

- Acquisitions and IPOs involving ISM startups
- Publicly disclosed exit transactions only

Exit trends are interpreted as indicators of ecosystem maturity and liquidity pathway development rather than comprehensive measures of investor returns.

A.5 Limitations & Interpretation Notes

The report focuses on startup-led commercial activity and does not benchmark government-led research programs or traditional aerospace contractors unless directly relevant to startup ecosystem development.

Funding data reflects publicly announced transactions and may underrepresent undisclosed investments, grant-based funding, or strategic program support.

Given the small number of startups and funding rounds, annual trends may be significantly influenced by individual large transactions, limiting direct comparability across years.

Sector positioning, geographic funding distribution, and commercialization signals should be interpreted as directional indicators of ecosystem evolution rather than definitive measures of industrial scale or market maturity.

Appendix B: Acronyms & Abbreviations

Acronym	Full Form
ISM	In-Space Manufacturing
LEO	Low Earth Orbit
ISS	International Space Station
VC	Venture Capital
PE	Private Equity

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