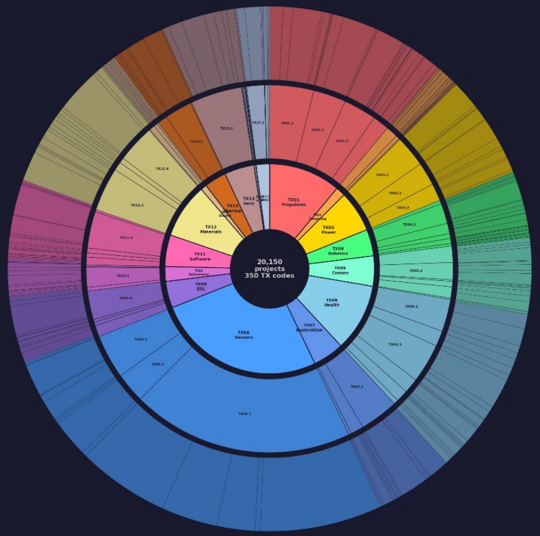
NASA TechPort TX Classification Analysis



Human-Assigned vs. ML-Predicted Technology Taxonomy

20,150 projects | public techport.nasa.gov API | 100% portfolio coverage | TREX ML classifier

March 2026

This analysis was generated using Claude (Anthropic) with live access to NASA's public TechPort database via an MCP server. All data comes from the public TechPort REST API (techport.nasa.gov) and public web sources — no internal or restricted NASA data was used.

The TechPort MCP server is open-source and accessible at:
nasatechport.alexandervandijk.com/mcp
github.com/tobedetermined/techport-mcp

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Context & Objective

The Question

NASA's Technology Taxonomy (TX) is one of the key ways to slice the ~20,000-project TechPort portfolio by technology area. But TX assignment is a judgment call — set by the submitting NASA technologist. The depth and consistency of TX submissions varies across programs, from no TX at all to full 3-level codes. Before using it for portfolio analysis, we need to know: is this field consistent, trustworthy, and useful?

What We Found in the API

TechPort provides a human-assigned TX code for each project — the standard classification used in portfolio reviews and gap analyses.

While exploring the API, we discovered TechPort also exposes TREX — NASA's own ML taxonomy classifier. TREX reads a project's title and description and predicts the most appropriate TX code based purely on technology content, with no knowledge of program context.

Its existence means every project has a potential second opinion on its TX classification — one generated by an ML model rather than human judgment.

What We Did

Ran all 20,150 TechPort projects through TREX to generate a complete set of ML-predicted TX codes — enabling a portfolio-wide comparison of human vs. ML classification.

Compared agreement rates at the top-level TX area (e.g., TX08 vs TX09).

Analyzed patterns by technology area and by program to understand where TX is reliable and where it breaks down.

Performed a focused analysis on the Flight Opportunities (FO) program to examine human vs. ML classification for projects our team knows firsthand.

The NASA Technology Taxonomy (TX)

NASA's Space Technology taxonomy organizes all technology development into 17 top-level areas. Revised in 2024, the TX taxonomy replaced the earlier TA (Technology Area) system. TX codes are the standard classification used in TechPort for portfolio tracking, gap analysis, and investment planning.

Code	Technology Area		Code	Technology Area
TX01	Propulsion Systems		TX10	Autonomous Systems
TX02	Flight Computing & Avionics		TX11	Software & Computing
TX03	Power & Energy Storage		TX12	Materials & Structures
TX04	Robotics & Autonomous Systems		TX13	Ground & Launch Systems
TX05	Communications & Navigation		TX14	Thermal Management
TX06	Human Health & Life Support		TX15	Aeronautics
TX07	Exploration & In-Situ Resource Utilization		TX16	Air Traffic Management
TX08	Sensors & Instruments		TX17	Guidance, Navigation & Control
TX09	Entry, Descent & Landing			

Note: The prior "TA" (Technology Area) numbering is no longer used. TX was adopted in 2024 with restructured areas and updated sub-classifications.
Reference: https://www.nasa.gov/otps/2024-nasa-technology-taxonomy/

Classification: Two Valid Lenses

Human Classification

Assigned by NASA technologists and/or PI

Best judgment by the person close to the work

Varies in depth: some use TX12, others TX12.4.1

816 projects (4.0%) left unclassified entirely

ML Classification (TREX)

Analyzes project title + description text

Classifies based on ML trained model

Always returns 3-level depth (e.g., TX08.1.5)

Deterministic: same input = same output

100% coverage — classifies every project

🚀 **Both attempt to classify the same thing — the project's technology. The difference is method: human judgment vs. ML model. Where they disagree, the project potentially sits at a taxonomy boundary.**

The Core Finding

76.3%
Top-level area agreement (human TX vs ML TX)

23.7%
Top-level area mismatch

816
No human TX at all (4.0%)

Of 19,334 projects with a human-assigned TX (20,150 − 816), the ML agrees on the top-level technology area (e.g., both say TX08) for 76.3%. For 23.7%, the ML sees a different area entirely.

What "mismatch" means in practice: a project classified under one technology area by the human may not show up in portfolio reviews for the area the ML thinks it belongs to. For example, a LiDAR sensor project filed under TX04 (Robotics) won't appear in a TX08 (Sensors) portfolio review — even though the core technology is a sensor.

The disagreements are not random — they follow consistent patterns by technology area and by program, which makes them analyzable.

🚀 **76% agreement means TX carries real signal. The 24% mismatch is systematic, not random — which makes it interpretable and correctable.**

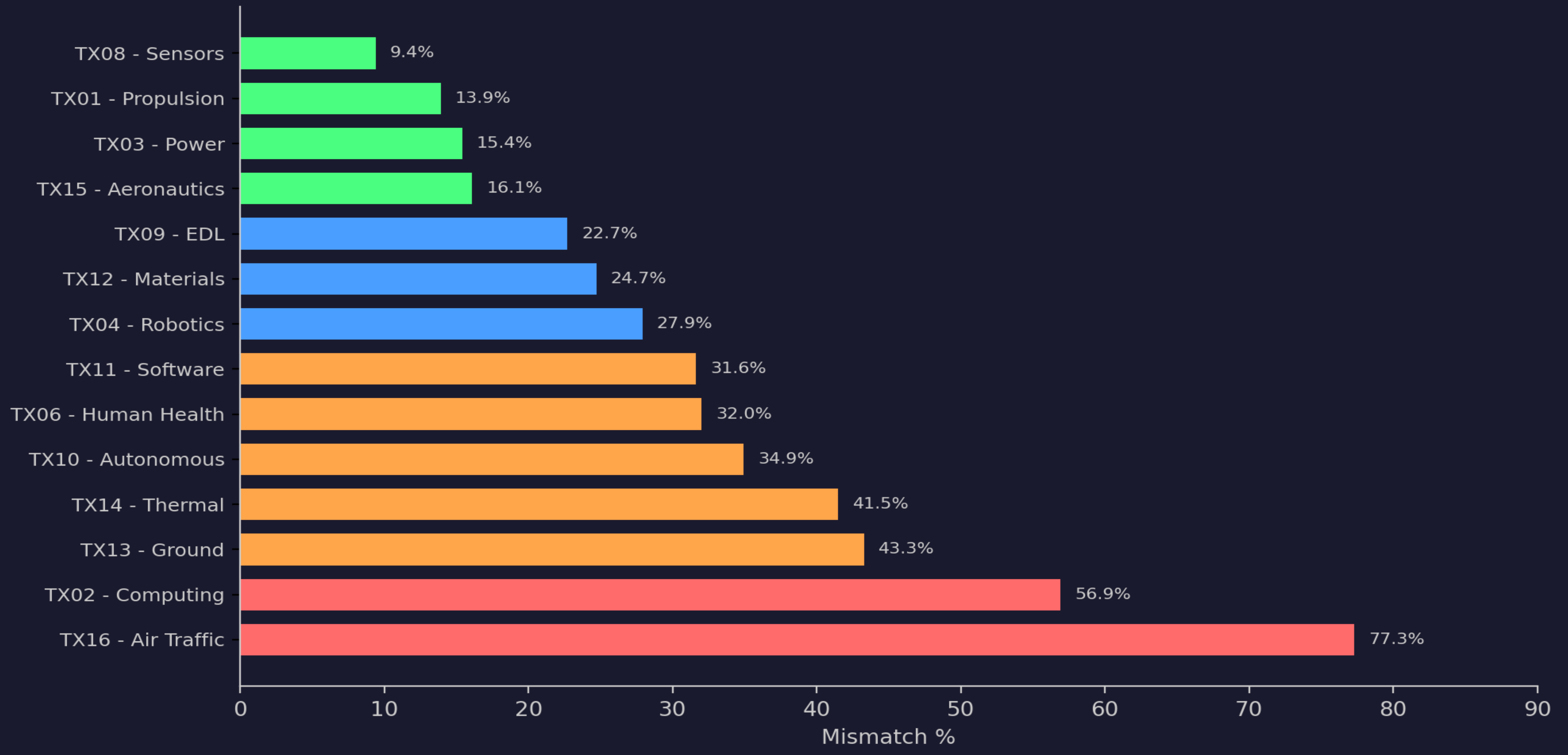
TX08 (Sensors) Is the Taxonomy's Gravity Well

Under ML classification, TX08 gains 987 net projects — more than any other area. The ML sees sensor technology embedded in health monitors, robotic perception, comms hardware, and thermal sensors.

From	To TX08	Count	What's happening
TX06 (Health)	TX08	301	Biomedical sensors classified by tech identity
TX12 (Materials)	TX08	136	Materials characterization = sensor work
TX05 (Comms)	TX08	116	Comm receivers are sensor technology
TX11 (Software)	TX08	113	Sensor data processing systems
TX14 (Thermal)	TX08	99	Thermal sensors reclassified
TX02 (Computing)	TX08	93	Sensor signal processing
TX04 (Robotics)	TX08	69	Perception sensors for robots
TX09 (EDL)	TX08	56	Navigation/landing sensors
TX07 (Exploration)	TX08	54	In-situ measurement instruments

🚀 **A TX08 portfolio review based on human assignments misses ~1,000 relevant projects.**

Mismatch Rate by Technology Area



Classification Quality by Program

🚀 Science programs classify best. Center innovation funds classify worst.

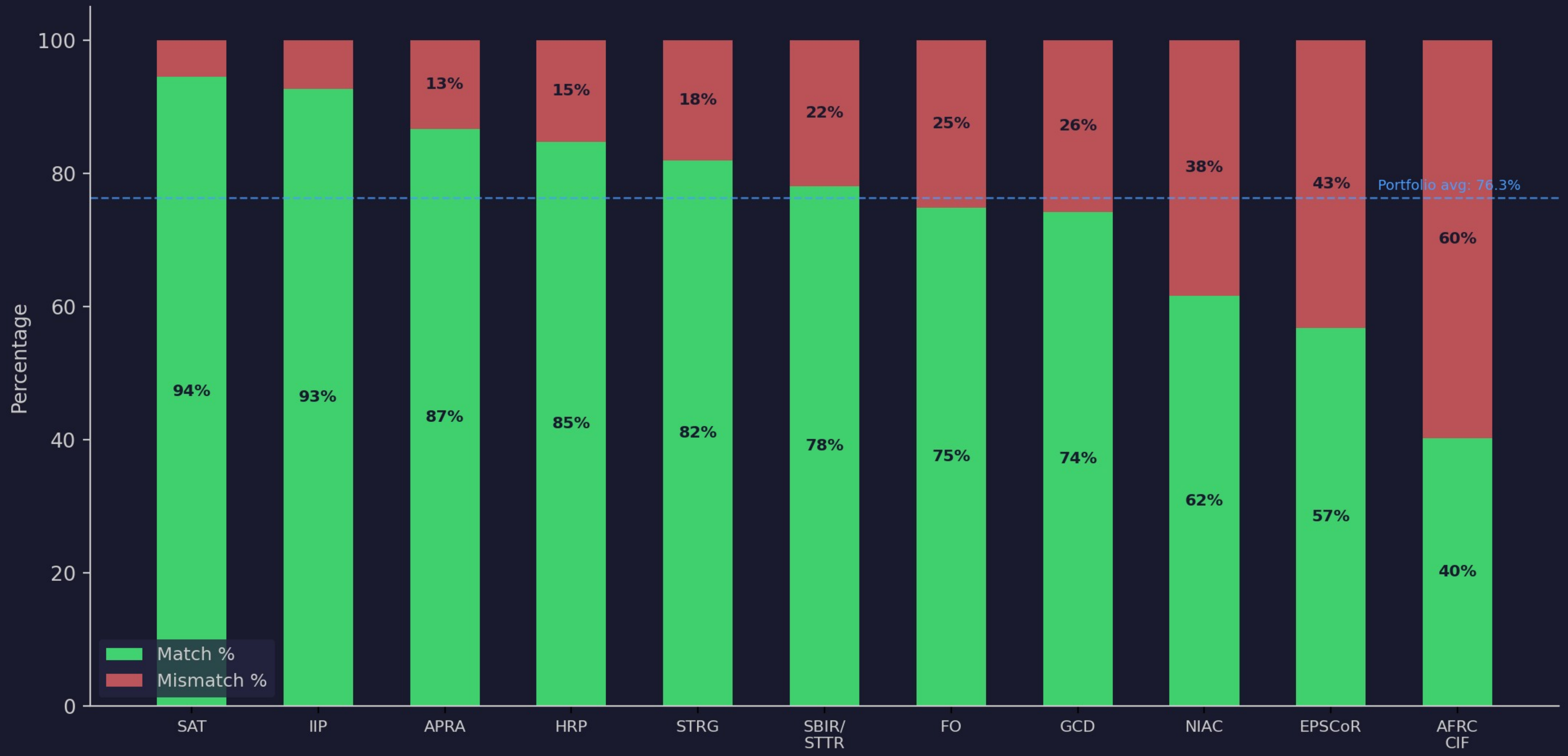
Program	Projects	Match %	Mismatch %	Gran. Gap %	Null TX
SAT	91	94.5%	5.5%	0.0%	0
IIP	94	92.6%	7.4%	1.1%	0
APRA	246	86.6%	13.4%	0.0%	0
HRP	184	84.7%	15.3%	0.0%	8
STRG	1,102	81.9%	18.1%	0.0%	0
SBIR/STTR	12,272	78.0%	22.0%	1.5%	154
FO	430	74.8%	25.2%	0.0%	10
GCD	468	74.2%	25.8%	2.5%	104
NIAC	327	61.6%	38.4%	5.4%	12
EPSCoR	346	56.8%	43.2%	0.0%	1
AFRC CIF	139	40.2%	59.8%	40.2%	37

Science programs (SAT, IIP, APRA): well-defined tech scopes → clean classifications

FO at 74.8% match — mid-range, consistent with its broad technology scope

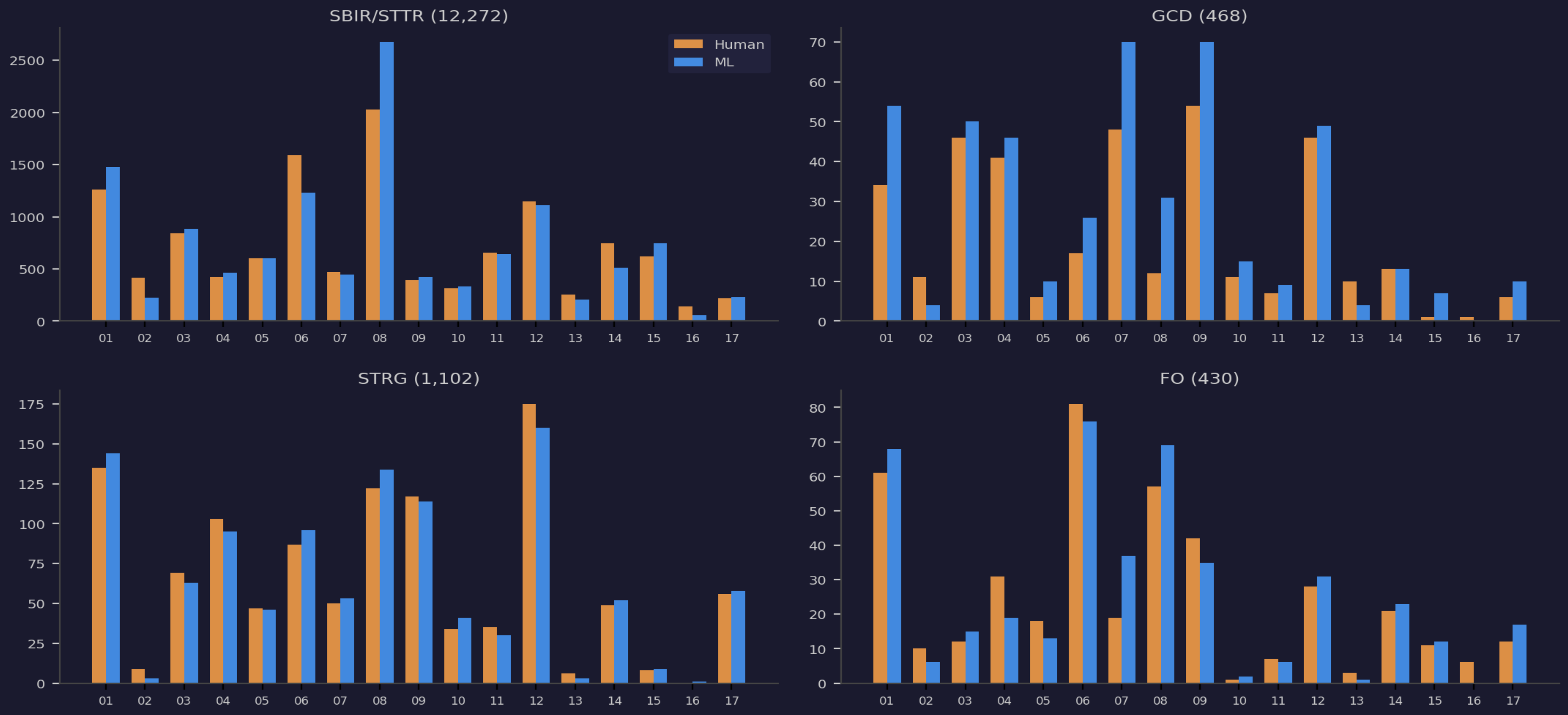
AFRC CIF: 59.8% mismatch + 40.2% granularity gap — most projects mis- or under-classified

Classification Quality by Program



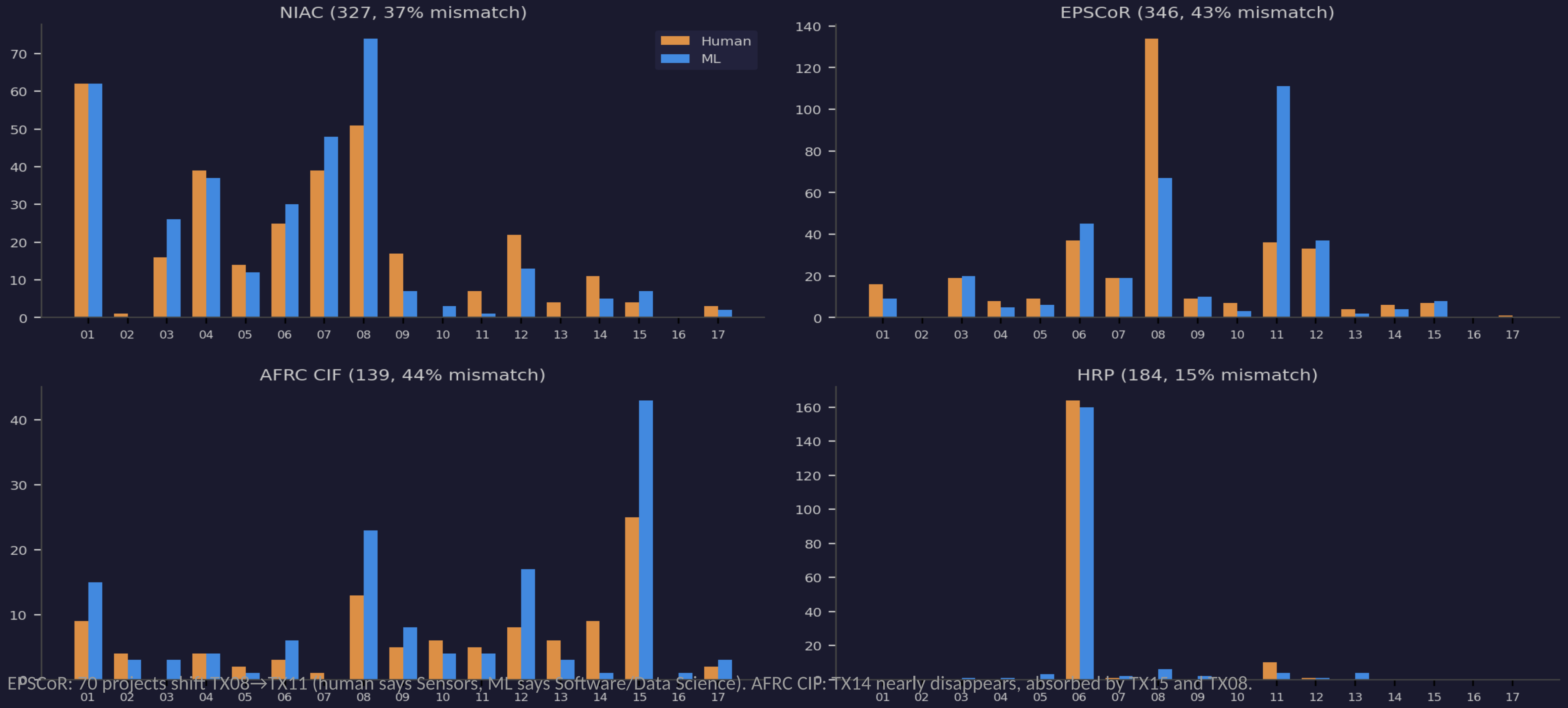
TX Distribution: Major STMD Programs (Human vs. ML)

How each program's technology profile shifts under ML classification. X-axis: TX01–TX17.



TX Distribution: High-Mismatch Programs

Programs with the highest mismatch rates show the most dramatic shifts. X-axis: TX01–TX17.



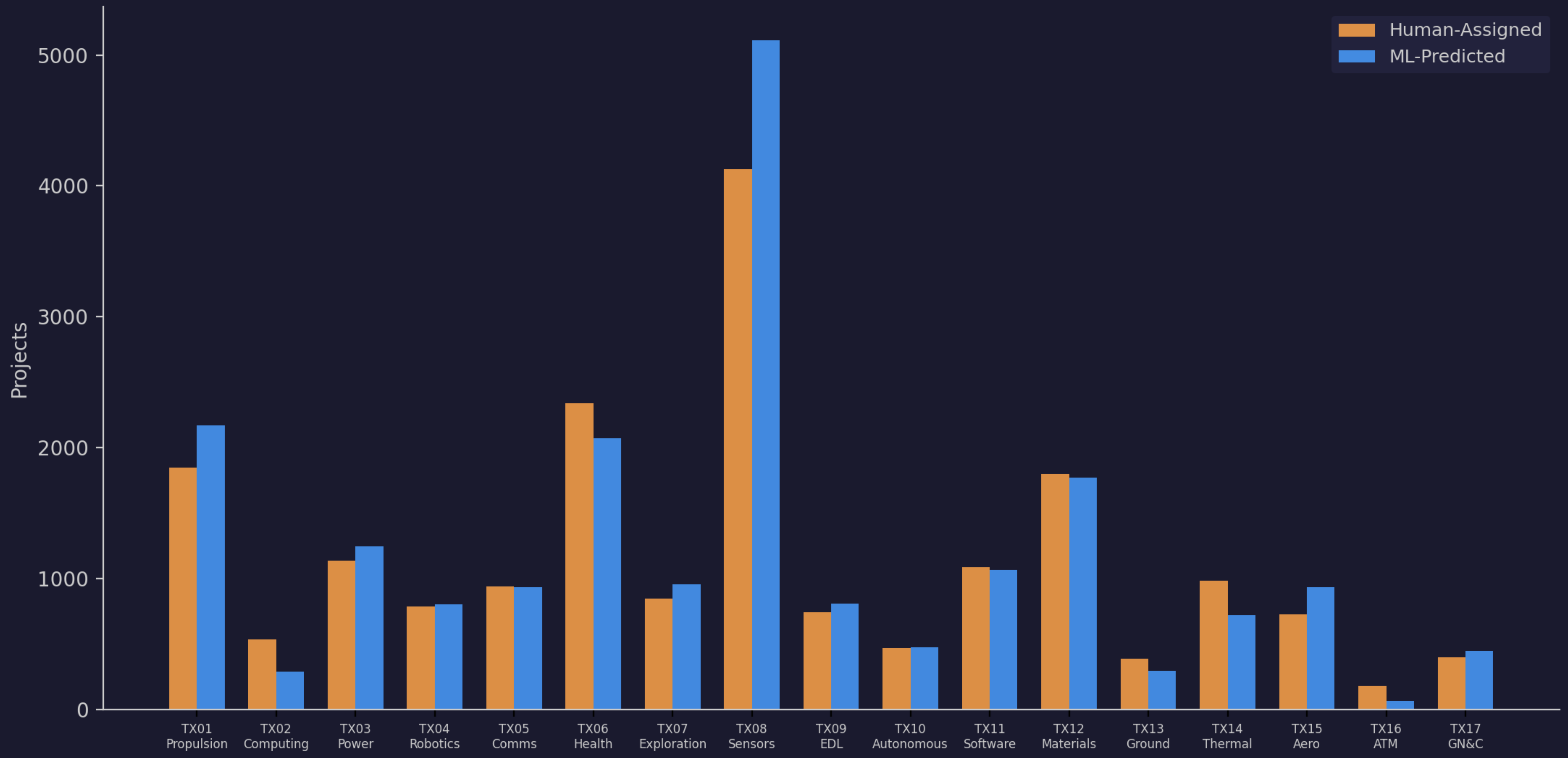
EPSCoR: 70 projects shift TX08→TX11 (human says Sensors, ML says Software/Data Science). AFRC CIP: TX14 nearly disappears, absorbed by TX15 and TX08.

Dual View: How the Portfolio Shifts Under ML Classification

Some areas grow significantly, others shrink — revealing where technology is hidden.

Area	Human-Assigned	ML-Predicted	Delta	Shift
TX08 - Sensors	4,127	5,114	+987	Absorbs from all areas
TX01 - Propulsion	1,849	2,170	+321	Thermal + ATM projects
TX15 - Aeronautics	728	932	+204	ATM & flight systems
TX03 - Power	1,135	1,248	+113	Fuel cells from other areas
TX07 - Exploration	849	954	+105	ISRU & surface ops
TX06 - Health	2,338	2,072	-266	Sensors & materials out
TX14 - Thermal	981	718	-263	To propulsion & sensors
TX02 - Computing	534	286	-248	To sensors & software
TX16 - Air Traffic	181	66	-115	To propulsion & aero
TX13 - Ground/Launch	386	292	-94	To materials & propulsion

Dual View: Human vs. ML Portfolio Distribution



The Granularity Gap: 613 Under-Specified Projects

3.2% of projects are assigned a top-level TX code only (e.g., 'TX12') with no sub-area. The ML provides the missing sub-classification for every one.

What the ML fills in:

Human: TX12 (Materials)
ML: TX12.4.1 (Manufacturing Processes)

Human: TX08 (Sensors)
ML: TX08.1.5 (Lasers)

Human: TX06 (Human Health)
ML: TX06.3.1 (Medical Diagnosis)

Worst granularity gap programs:

Program	Count	Gap Rate
MEP	17	58.6%
AOSP	6	54.5%
AFRC CIF	41	40.2%
SCaN	11	35.5%
MSFC CIF	49	30.1%
MSFC IRAD	44	29.3%
MCO	31	25.4%

Flight Opportunities
TX Deep Dive

Flight Opportunities: TX Deep Dive

FO's 24.7% mismatch rate matches the portfolio average — but the patterns are FO-specific.

430
FO projects

24.7%
Top-level mismatch (human vs ML TX)

75.3%
Top-level agreement

10
No human TX provided

Top Reclassification Flows in FO

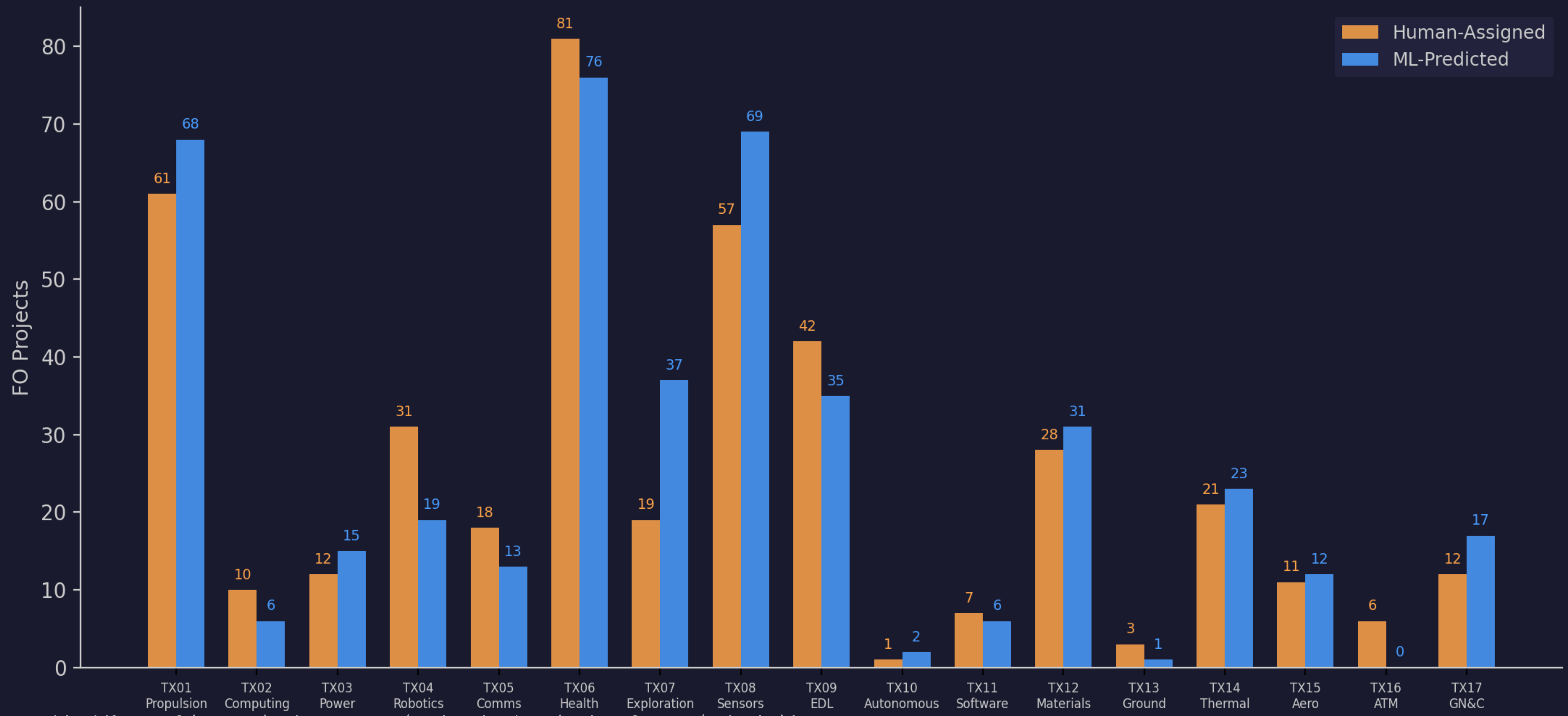
Human TX	ML TX	Count	Pattern
TX04 (Robotics)	TX07 (Exploration)	9	Lunar tools filed under manipulation → ISRU
TX06 (Health)	TX08 (Sensors)	5	Biomedical instruments → sensor tech
TX09 (EDL)	TX08 (Sensors)	5	Landing sensors → sensor/laser tech
TX05 (Comms)	TX08 (Sensors)	5	Receivers and optical systems → sensors
TX04 (Robotics)	TX08 (Sensors)	4	Perception hardware → sensor tech
TX14 (Thermal)	TX01 (Propulsion)	3	Cryo thermal mgmt → propulsion systems

🚀 **Dominant FO pattern: lunar surface tools filed under Robotics (TX04) are reclassified to ISRU (TX07). And sensor technology is undercounted, just like portfolio-wide.**

Top FO areas (human): TX06 (81), TX01 (61), TX08 (57), TX09 (42)

Top FO areas (ML): TX06 (76), TX08 (69), TX01 (68), TX07 (37)

FO: Human vs. ML Technology Area Distribution



Notable shifts: TX08 (Sensors) gains 12, TX07 (Exploration/ISRU) gains 18, TX04 (Robotics) loses 12

FO Examples: Where Human and ML Disagree

Specific FO projects where the classification lens matters:

Project	Human TX	ML TX	What's happening
LiDAR Hazard Detection (Astrobotic)	TX09.4 Vehicle Systems	TX08.1.5 Lasers	Filed under EDL — but the tech is a laser sensor
Psionic Nav Doppler LiDAR	TX09.5 Flight Mech & GN&C	TX08.1.5 Lasers	Same pattern — precision nav LiDAR = sensor tech
ISRU Pilot Excavator Bucket Drum (UCF)	TX04.3.4 Sample Handling	TX07.1.1 Resource Exploration	Robotic manipulation tool, but the purpose is resource extraction
Dust In-situ Manipulation DIMS (UCF)	TX06.1.1 Atmosphere Revit.	TX07.2.5 Dust Mitigation	Life support classification, but it's lunar dust management
Atmospheric Obs on Commercial RLVs (APL)	TX05.2.3 Atmospheric Char.	TX08.3.4 Environment Sensors	Filed under Comms — ML sees the sensors, not the platform
Two-Phase Pumped Loop (Creare)	TX14.2.2 Heat Transport	TX01.1.1 Propulsion Sys.	Thermal management tech, ML recognizes propulsion application

In each case, both are defensible — but the mismatch means one community misses the project.

What This Means for FO Portfolio Reviews

Hidden FO Connections

~106 FO projects (25%) are classified differently by the ML — these sit at taxonomy boundaries

FO's LiDAR and navigation sensor work is filed under EDL (TX09) but is relevant to the Sensors (TX08) community

Lunar surface tool projects are filed under Robotics (TX04) but are doing ISRU (TX07) work

FO biomedical projects are filed under Health (TX06) but involve sensor hardware (TX08)

Practical Implications

When reviewing FO's technology portfolio, pull projects by both human TX and ML TX to get the full picture

FO projects may be relevant to technology communities beyond the primary TX — especially Sensors (TX08) and ISRU (TX07)

FO's 74.8% match rate is solid for a program with broad technology scope — better than NIAC (62%), EPSCoR (57%), and all CIFs

10 FO Projects With No Human TX (ML-predicted TX shown):

ID	Title	ML TX
12204	Physics of Regolith Impacts in Microgravity Experiment	TX07.2.5
94200	Additively Manufactured Ceramic Rocket Engine Components	TX12.4.1
94199	Carbon Nanotube Infused Launch Vehicle Structures	TX12.1.1
94194	Enhancement of Nanosat Launch Vehicle Booster Main Engine	TX01.1.3
94192	LauncherOne Collaborative Opportunity	TX14.1.2
94204	LauncherOne Small Launch Vehicle Propulsion Advancement	TX01.1.3
94203	Propulsion System and Second Stage Structural Loads	TX01.1.3
94193	Spyder: A Dedicated CubeSat Launcher	TX01.1.5
94196	Spyder: Critical Technology Demonstration Tests	TX17.5.1
94191	Technology Maturation for Air Launched Liquid Rocket	TX15.1.3

Which TX Should You Trust?

The 76% agreement means most of the portfolio is unambiguous. The question is what to do about the 24% where they disagree.

Use ML TX for...

"What technology does NASA have in area X?"

Portfolio completeness — 100% coverage, full 3-level depth, no gaps

Cross-cutting technology discovery — finds hidden sensor projects, ISRU work, etc.

Capability gap mapping — matches technology identity to shortfalls

Use Human TX for...

"Which program funded this and why?"

Organizational accountability — who claimed the work

Solicitation tracing — maps back to SBIR subtopics, BAAs

Program-level portfolio reviews within a known scope

Use Both for...

Finding hidden connections — the 4,587 mismatches are taxonomy boundary projects

Investment analysis — where program intent diverges from technology reality

Dual-tagging as standard practice for future submissions

The Bottom Line

For technology portfolio analysis — gap mapping, capability assessments, investment prioritization — the ML classification is the more reliable primary lens. It has no coverage gaps, no granularity gaps, and classifies by what the technology IS rather than who funded it. The human TX remains essential context for understanding organizational intent and funding flows.

🚀 **Yes, TX is useful for portfolio analysis — especially with dual classification.**

Recommendations

For Portfolio Managers

Use dual-TX views for portfolio reviews

Pull projects where mlPredictedTx matches your area, not just human-assigned TX

The 4,587 mismatched projects are hidden connections across the portfolio

For Taxonomy Governance

Backfill 613 granularity gaps with ML sub-areas

Classify 816 null-TX projects

Consider dual-tagging as standard practice

For Program Managers

Programs with >30% mismatch: review TX assignments

CIF programs: address granularity gaps and null TX projects

Consider whether TX reflects the tech or the program

For NASA-Wide Visibility

TX08 is systematically undercounted by ~1,000 projects

Cross-cutting technologies (sensors, power, materials) need multi-area visibility

ML classification can serve as automatic secondary tagging

Future Work

Destination Field Quality

TechPort's destination field (Earth, Moon, Mars, etc.) shows similar quality issues to TX — inconsistent tagging, projects tagged with multiple destinations, empty values.

The TechPort API lists a DREX endpoint (/drex/predict) that appears to be an ML classifier for destinations, analogous to TREX for TX codes. However, this endpoint is not publicly accessible — it returns no data regardless of authentication method.

If DREX becomes available, running the same human-vs-ML comparison on destinations could significantly improve the usability of destination data for portfolio analysis.

Methodology & References

Methodology

Data: TechPort allData cache (20,150 projects, March 24, 2026)

ML model: NASA TREX (POST /trex/predict)

Input: project title + description text

Output: single best-matching TX at 3-level depth (deterministic)

Coverage: 100% of portfolio (20,150/20,150)

Comparison: top-level area match + exact 3-level code match

Granularity gap: human top-level only, ML provides sub-area

Queryable via MCP

techport_find_projects fields=["mlPredictedTx", "txMismatch"]

techport_portfolio_summary (Taxonomy Drift section)

techport_classify_technology (live single-project prediction)

Data Sources

NASA TechPort — techport.nasa.gov

TechPort allData API (weekly snapshot, 108 MB)

NASA TREX ML Classifier (POST /trex/predict)

NASA Technology Taxonomy (TX01–TX17, 495 nodes)

Tools

TechPort MCP Server — LLM-native access to TechPort

Claude (Anthropic) — analysis and deck generation

python-pptx — programmatic slide generation

Reproducibility

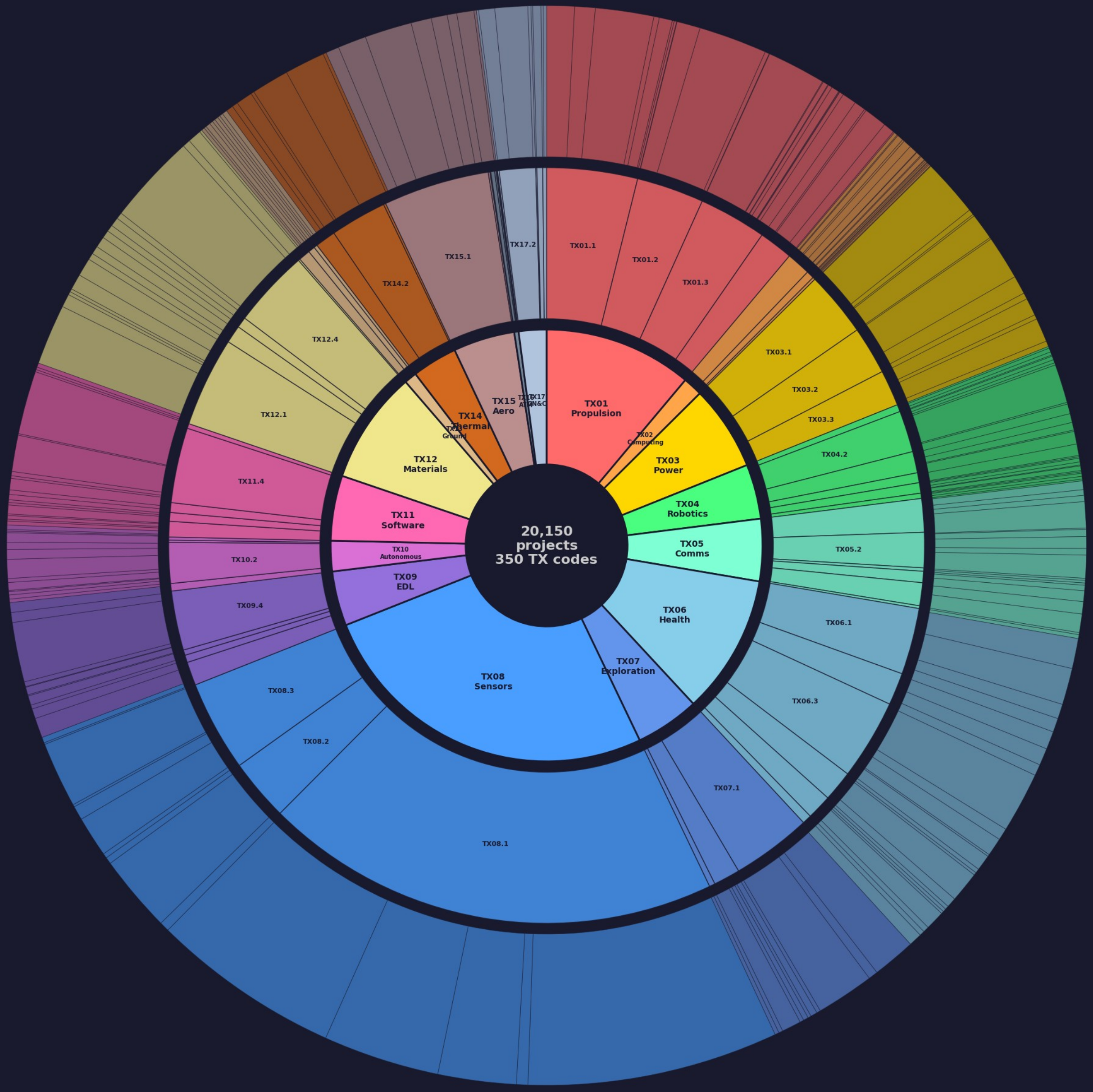
20,150 TREX classifications ran March 24–25, 2026 (~5.5 hrs)

Deterministic: same title + description = same TX prediction

Full log: classify_all.log (20,150 API calls)

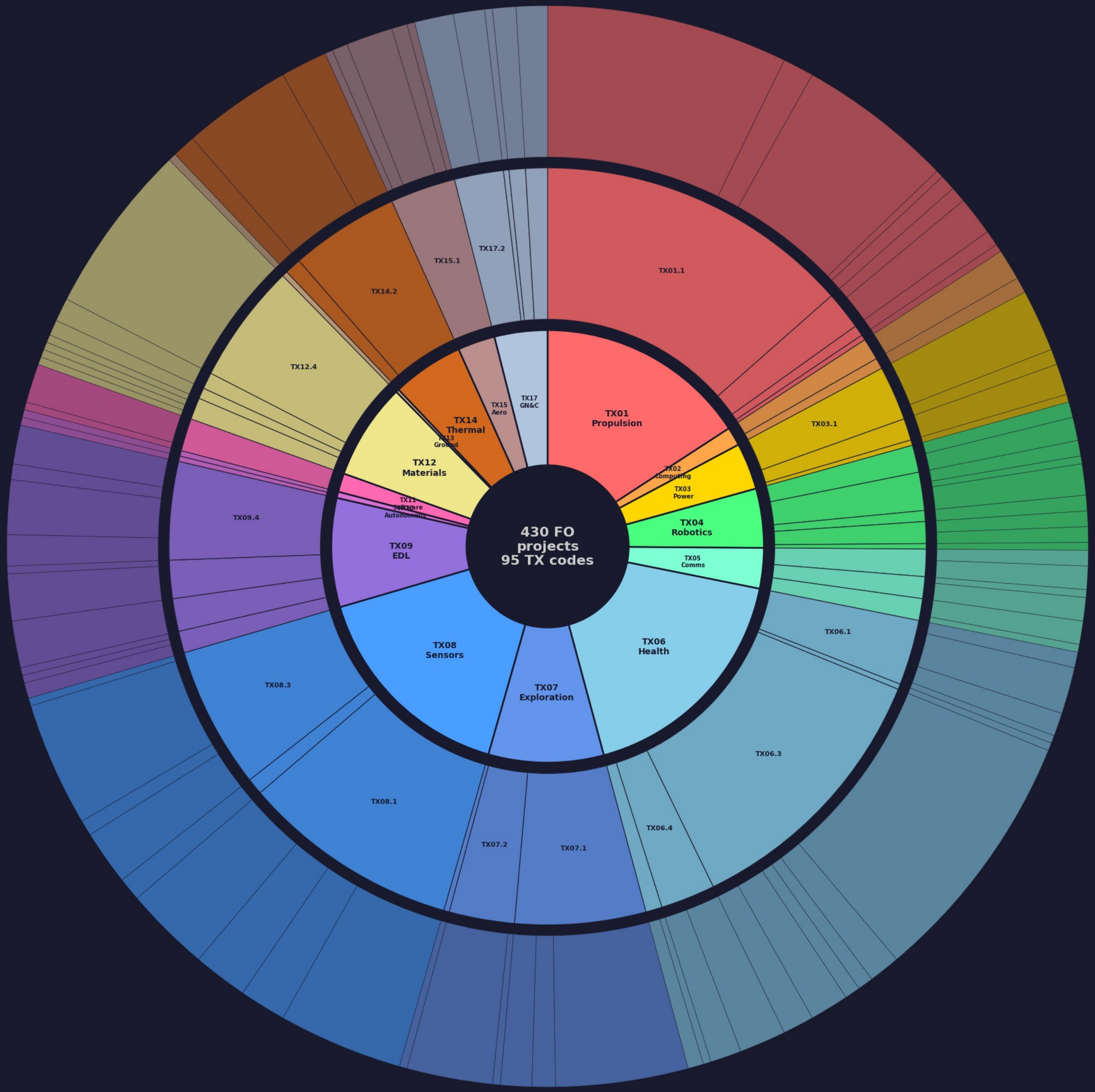
TechPort Portfolio (20,150 projects)

- TX01 Propulsion
- TX02 Computing & Avionics
- TX03 Power & Energy
- TX04 Robotic Systems
- TX05 Comms & Navigation
- TX06 Human Health
- TX07 Exploration & ISRU
- TX08 Sensors & Instruments
- TX09 Entry, Descent & Landing
- TX10 Autonomous Systems
- TX11 Software & Computing
- TX12 Materials & Structures
- TX13 Ground & Launch
- TX14 Thermal Management
- TX15 Aeronautics
- TX16 Air Traffic Mgmt
- TX17 GN&C



Flight Opportunities (430 projects)

- TX01 Propulsion
- TX02 Computing & Avionics
- TX03 Power & Energy
- TX04 Robotic Systems
- TX05 Comms & Navigation
- TX06 Human Health
- TX07 Exploration & ISRU
- TX08 Sensors & Instruments
- TX09 Entry, Descent & Landing
- TX10 Autonomous Systems
- TX11 Software & Computing
- TX12 Materials & Structures
- TX13 Ground & Launch
- TX14 Thermal Management
- TX15 Aeronautics
- TX17 GN&C



Backup: TX Taxonomy Level 2 (TX01–TX09)

TX01: Propulsion Systems
TX01.1: Chemical Space Propulsion
TX01.2: Electric Space Propulsion
TX01.3: Aero Propulsion
TX01.4: Advanced Propulsion
TX01.X: Other Propulsion Systems
TX02: Flight Computing and Avionics
TX02.1: Avionics Component Technologies
TX02.2: Avionics Systems and Subsystems
TX02.3: Avionics Tools, Models, and Analyses
TX02.X: Other Flight Computing and Avionics
TX03: Aerospace Power and Energy Storage
TX03.1: Power Generation and Energy Conversion
TX03.2: Energy Storage
TX03.3: Power Management and Distribution
TX03.X: Other Power and Energy Storage
TX04: Robotic Systems
TX04.1: Sensing and Perception
TX04.2: Mobility
TX04.3: Manipulation
TX04.4: Human and Robot Interaction
TX04.5: Autonomous Rendezvous and Docking
TX04.6: Robotics Integration
TX04.X: Other Robotic Systems
TX05: Comms, Nav, and Orbital Debris
TX05.1: Optical Communications
TX05.2: Radio Frequency
TX05.3: Internetworking
TX05.4: Network-Provided PNT
TX05.5: Revolutionary Comms Technologies
TX05.6: Networking and Ground-Based OD Tracking
TX05.7: Acoustic Communication
TX05.X: Other Comms and Nav Systems

TX06: Human Health, Life Support, and Habitation
TX06.1: ECLSS and Habitation Systems
TX06.2: Extravehicular Activity Systems
TX06.3: Human Health and Performance
TX06.4: Environmental Monitoring and Safety
TX06.5: Radiation
TX06.6: Human Systems Integration
TX06.X: Other Human Health and Life Support
TX07: Exploration Destination Systems
TX07.1: In Situ Resource Use
TX07.2: Mission Infrastructure and Sustainability
TX07.3: Mission Operations and Safety
TX07.X: Other Exploration Destination Systems
TX08: Sensors and Instruments
TX08.1: Remote Sensing Instruments and Sensors
TX08.2: Observatories
TX08.3: In Situ Instruments and Sensors
TX08.X: Other Sensors and Instruments
TX09: Entry, Descent, and Landing
TX09.1: Aeroassist and Atmospheric Entry
TX09.2: Descent
TX09.3: Landing
TX09.4: Vehicle Systems
TX09.5: Flight Mechanics and GN&C for EDL
TX09.X: Other Entry, Descent, and Landing

Backup: TX Taxonomy Level 2 (TX10–TX17)

TX10: Autonomous Systems
TX10.1: Situational and Self-Awareness
TX10.2: Reasoning and Acting
TX10.3: Collaboration and Interaction
TX10.4: Engineering and Integrity
TX10.X: Other Autonomous Systems
TX11: Software, Modeling, Simulation, and Info Processing
TX11.1: Software Development and Engineering
TX11.2: Modeling
TX11.3: Simulation
TX11.4: Information Processing and AI
TX11.5: Mission Architecture and Systems Analysis
TX11.6: Ground Computing
TX11.X: Other Software and Info Processing
TX12: Materials, Structures, Mech Systems, and Mfg
TX12.1: Materials
TX12.2: Structures
TX12.3: Mechanical Systems
TX12.4: Manufacturing
TX12.5: Structural Dynamics
TX12.X: Other Materials and Structures
TX13: Ground, Test, and Surface Systems
TX13.1: Infrastructure Optimization
TX13.2: Test and Qualification Environments
TX13.3: Assembly, Integration, and Launch
TX13.4: Mission Success Technologies
TX13.5: Surface Systems Technologies
TX13.X: Other Ground and Surface Systems

TX14: Thermal Management Systems
TX14.1: Cryogenic Systems
TX14.2: Thermal Control Components and Systems
TX14.3: Thermal Protection Components and Systems
TX14.X: Other Thermal Management Systems
TX15: Flight Vehicle Systems
TX15.1: Aeroscience
TX15.2: Flight Mechanics
TX15.X: Other Flight Vehicle Systems
TX16: Air Traffic Management and Range Tracking
TX16.1: Safe All-Vehicle Access
TX16.2: Weather and Environment
TX16.3: Traffic Management Concepts
TX16.4: Architectures and Infrastructure
TX16.5: Range Tracking and Flight Safety
TX16.6: Integrated Modeling, Simulation, and Testing
TX16.X: Other Air Traffic Management
TX17: Guidance, Navigation & Control
TX17.1: Guidance and Targeting Algorithms
TX17.2: Navigation Technologies
TX17.3: Control Technologies
TX17.4: Attitude Estimation Technologies
TX17.5: GN&C Systems Engineering
TX17.6: Aircraft Trajectory Generation and Management
TX17.X: Other GN&C Technologies

Source: NASA TechPort API /api/taxonomies/nodes (495 total nodes: 17 level-1, 94 level-2, 384 level-3). TX taxonomy revised 2024, replacing the prior TA (Technology Area) system.