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Distributed Timing & Coherence Infrastructure for Autonomous Fleets

Building the constraint layer that keeps autonomous vehicles in sync with each other and the world.

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Drifting out of sync isn't a software bug. It's physics.

Every autonomous vehicle accumulates timing and positioning errors — it's unavoidable physics, not design limitations. For today's small fleets using GPS on short missions, sensors and AI mask drift well enough. But as fleets scale, missions extend, and environments get more complex, each vehicle loses track of the others — and nothing in today's autonomy stacks corrects it.

AIR
Degraded UAS Coordination

A multi-UAS formation shares sensor data to build a common operating picture. As onboard clocks diverge, timestamps on target tracks stop correlating across platforms. The same target appears as two. Operators lose confidence in the fused picture and revert to manual coordination — negating the entire point of autonomous teaming.

GROUND
Autonomous Tactical Convoy

Mixed unmanned ground vehicles and crewed platforms maneuver through a GPS-denied corridor. Over the course of the operation, accumulated drift shifts each platform's estimate of the others' locations. The operator's common picture fragments before anyone realizes it. They drift and don't know it.

MARITIME
Coordinated USV Search

An autonomous surface fleet executing a search pattern relies on shared timing to divide coverage zones. As clocks drift, gaps and overlaps emerge silently. The fleet completes the mission believing it covered the full area. It didn't.

The same physics constrain every fleet that scales: military swarms, mining convoys, driverless cars.
Drift happens. We stop it. Autonomous fleets stay coordinated.

WHY NOW

Three conditions have converged to fix drift. The window won't stay open.

GPS Vulnerability Is Real

GPS jamming and spoofing are documented failure modes in active theaters — Ukraine, the Middle East. The Pentagon has responded with resilient PNT requirements and active evaluation programs. The budget lines exist. This is the procurement window.

Autonomous Scale Is Hitting a Physics Wall

After a decade, Waymo operates in 5 cities. The constraint isn't sensor quality — it's the cost of city-by-city mapping and terrain modeling. The market is stalled not on perception, but on reference infrastructure that doesn't exist yet.
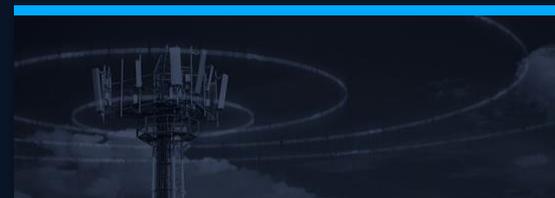
The Signal Environment Just Arrived

The depth and breadth of RF telecommunications signals from space, terrestrial, and military networks has dramatically increased in the past two years. However, no one has built the infrastructure to exploit it.

Why the window closes: The first company to demonstrate field performance and lock in OEM design-in relationships owns the layer. Timing infrastructure is deeply embedded and extremely costly to replace once validated.

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Introducing the Time-Range Coherence Processor (TRCP).

An embedded Multi-Processor System on a Chip (MPSoC) that integrates hardware timestamping, disciplined oscillators, and RF signal processing to maintain nanosecond-level clock alignment and centimeter-class positioning across heterogeneous fleets — without persistent GPS. **Drift Happens. We stop it. Autonomous fleets stay coordinated.**

Beneath the Stack

Sits below AI, sensors, and autonomy software. Doesn't compete. Rather, it constrains their drift.

Hardware-Layer Precision

Physical timestamping delivers deterministic, modelable timing that software cannot replicate.

Network-Agnostic

Operates across cellular, military mesh, and space. All the vehicles share and coordinate their information. No new radios required.

Scales With the Fleet

As node count grows, the distributed constraint architecture gets stronger, not weaker.

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TECHNOLOGY ARCHITECTURE

Navigation becomes a network effect.

NAVIGTR IP
What the TRCP does at each node

Hardware Timestamping
Deterministic measurement at the physical layer. Enables modelable, repeatable timing that cannot be accomplished in software.

Two-Way Time Transfer (TWTT) + Ranging
Nodes exchange timing and range observables over any available link. Constrains clock offset and inter-platform distance simultaneously.

Pseudo-Doppler from Signals of Opportunity
Extracts additional range data from ambient L- and S-band signals. No dedicated ranging hardware required.

12-State Kalman Solver
All three mechanisms fused jointly — oscillator-aware, adaptive covariance.

These mechanisms produce three measurable outputs — validated on the next slide.

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Every node added to the network makes every other node more precise.

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What we measure. How we prove it.

CLOCK ALIGNMENT

Nanosecond-level

How precisely two nodes agree on time. The foundational state variable beneath all spatial coordination.

Two-Way Time Transfer (TWTT) with hardware timestamping and oscillator-aware Kalman estimation.

HOLDOVER DURATION

Time-to-threshold

How long fleet alignment stays within mission-useful bounds after the external reference degrades or is denied.

Measured as divergence rate vs. free-running baseline. The gap between those curves is what we sell.

RELATIVE RANGE

Centimeter-class

How precisely two nodes know their distance from each other. Turns timing into spatial coordination.

Pseudo-Doppler ranging from Signals of Opportunity (SoOP) in L- and S-bands.

HOW WE VALIDATE

5-node testbed using real hardware timing references, hardware timestamping, and controlled degradation scenarios validates clock alignment and holdover duration. Relative range accuracy validated through RF signal processing with known-position ground truth.

WHAT WE MEASURE AGAINST

After 30 minutes of GNSS denial, independent oscillators accumulate microseconds of relative clock error — enough to break coordinated timing, positioning, and formation control. Each platform's drift is invisible to the others. The fleet doesn't know it's decoherent.

COMPETITIVE LANDSCAPE

Every stack above us needs what we provide. None of them build it.

AUTONOMY PLATFORMS & OEMs

Defense

Industrial

| Anduril | Shield AI | Skydio | Lockheed Martin / Defense Primes | Caterpillar | Komatsu |

Automotive

| Waymo | Applied Intuition | Aurora |

Every company depends on timing coherence at scale. None of them build it.

NAVIGATION & SENSORS

| GPS / GNSS | IMU / INS | UWB | RTK / SwiftNav | Xona Space | Locata |

Sensor drift is local. Reference drift is systemic. Every platform above solves the first. None solve the second.

TIMING & COHERENCE INFRASTRUCTURE

Navigtr TRCP   *No one has built this layer.*

TRCP is complementary to every company on this slide. Each one is a potential customer.

Building this layer requires a multi-year investment in oscillator physics, RF engineering, and estimation theory that falls outside of these companies' core mission — and any that tried would lock it into their own stack. Navigtr builds it for all.

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BUSINESS MODEL + GO-TO-MARKET

ARM Holdings — not NVIDIA. Prove it at DoD. Scale it everywhere else.

PHASE 1 · Pre-Seed → Now

Defense (*Beachhead*)

Why

Hardest timing conditions — GPS denied, RF contested.

What we sell

Programmable hardware-based dev boards and embedded MPSoC's into defense OEM stacks.

How we get there

Quiet: technically validating first wins at SDA and service research labs. Collecting before/after drift measurements.

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Revenue: **Module sales + O&M fees**

PHASE 2 · Seed → 2027–2028

Industrial (*Bridge*)

Why

Commercial revenue + production discipline but less regulatory friction than automotive.

What we sell

Hardened embedded MPSoC modules at production grade.

How we get there

Design-in relationships with mining and port automation, and warehouse robotics OEMs. Cost curve and technical architecture refinement.

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Revenue: **Module sales + O&M fees**

PHASE 3 · Series A → 2028+

Automotive (*Endgame*)

Why

Approx 15.6M new car sales in 2028*. 5-10% with ADAS+ features that benefit from TRCP.**

What we sell

License IP to Tier 1 automotive suppliers. Custom production as makes sense.

How we get there

Defense credibility + industrial production record opens Tier 1 conversations.

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Revenue: **IP licensing**

Not SaaS. Not a platform. Neutral infrastructure — like silicon timing companies SiTime and Microchip.

A staged path to a $3B+ infrastructure market.

DEFENSE · Beachhead

ACTIVE PIPELINE

2026 — **Space Development Agency (SDA) R&D**
$720K

2026 — **Army Research Lab**
$500K

2027 — **SDA Tranche 4**
~500 space vehicles

2027 — **Army Integrated Tactical Network**
~1,000 initial tranche

We don't size defense as a TAM. We track funded programs with timing infrastructure gaps.

INDUSTRIAL · Bridge · 2027-2028

Scaling past the point where GPS and fixed beacons hold fleets together.

WHERE FLEET COHERENCE BREAKS

Mining: Caterpillar is scaling from 690 to 2,000+ autonomous trucks by 2030 — increasingly mixed-vendor sites with no common temporal reference. GPS occlusion in pit walls already causes stoppages.

Ports: 75+ automated terminals coordinate robotic vehicles via installed beacons, magnetic wires, and transponders — costly to maintain and brittle at where timing misalignment degrades throughput.

Logistics: As autonomous material handling pushes beyond warehouse walls into staging yards and cross-dock facilities, positioning breaks down.

Production revenue, integration data, and cost curve validation before automotive.

AUTOMOTIVE · Endgame · 2028+

TAM
$3.12B
15.6M new U.S. vehicles x $200 TRCP avg. selling price.

SAM
$156M – $312M
5–10% L3+ Advanced Driver Assist Systems x $200.

SOM
1 OEM design-in
~48K vehicles x $200 = ~$9.6M in first year. Prove unit economics in one model line and unlock Tier 1 pipeline.

TRCP at ~$200: ~4% of single vehicle autonomy budget. Comparable to V2X module pricing.

TRACTION & VALIDATION

Senior review and dialog with the Pentagon. Zero VC capital yet. Every dollar invested is founder capital.

★ **SDA Technical Dialog**

Iterative and continuing technical input and guidance from Space Development Agency. Most eager and active customer.

★ **Air Force Research Laboratory**

Active and iterative program office engagement ongoing.

★ **Army Program Manager PNT**

Scheduled technical discussion. PM PNT operates the validation testbed environment directly aligned with TRCP demonstration requirements.

📄 **Patent Pending**

IP filed and pending. Technology architecture is novel — a unified constraint solver.

💰 **Self-Funded to Date**

Zero VC dilution to date. Pre-seed round is the first external capital — full upside available to investors.

🔬 **Foundational Modeling is Complete**

Algorithm development ahead of hardware. Clock model complete. Ranging algorithms near complete. RF models in progress (2–3 months to completion).

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From validated model to deployable system in 14 months.

Models Finalized	Bench Prototype Running	Defense Demo with Data	Deployable System + Field Evaluation	Industrial Market + Seed Raise
M1 · Month 2	**M2–M3 · Months 5–6**	**M4–M5 · Months 8–9**	**M6–M7 · Months 12–14**	**Months 14–18**
• Ranging algorithms complete	• 5-node testbed running clock discipline and ranging	• Drift suppression data under representative conditions	• Python to C on target MPSoC	• Industrial OEM outreach begins
• Unified simulation with documented performance claims	• Model-vs-hardware correlation documented	• SoOP pseudo-Doppler integrated into unified estimator	• Defense-evaluable form factor	• Seed raise using defense field data
• SoOP architecture defined	• Kalman filter optimality confirmed via innovation whiteness testing	• SDA technical dialogue active	• Field evaluation with defense evaluator present	• Production architecture scoping for production-grade oscillators
• 3ns timing accuracy target defended		• SDA R&D proposal response submitted or in preparation	• Series A data package assembled	
TRL 3 · Finalizing	*TRL 4*	*TRL 5*	*Series A Ready*	*Commercial Bridge*

$2.5M Pre-Seed — This funding

Pre-seed capital funds the full arc. Funding half doesn't get half the result — it gets a bench prototype with no field data and no deployable form factor. That's a weak re-raise position.

TRL = Technology Readiness Level
M = Milestone

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Built to solve this problem

John Liebetreu, PhD
CTO / Co-Founder

PhD, Comms Systems & Signal Processing

Engineering Fellow, GDMS (22 yrs)

Chief System Engineer, GPS-III

Chief Technologist, Intel — Broadband Wireless

14 patents · 30+ publications · IEEE

Collin Lee
CEO / Co-Founder

MBA, Johns Hopkins

White House, National Security Council, Director

House Appropriations Defense — $35B portfolio

VP, Intelligence Systems — GDMS

Created 80-person space tech incubator

Tim Meehan
Physics & Software Lead

MS, Engineering Physics — Stanford

BS Physics — USNA (4.0, Trident Scholar)

20+ yrs simulation for science & defense

15 yrs DOE: plasma physics, MHD modeling
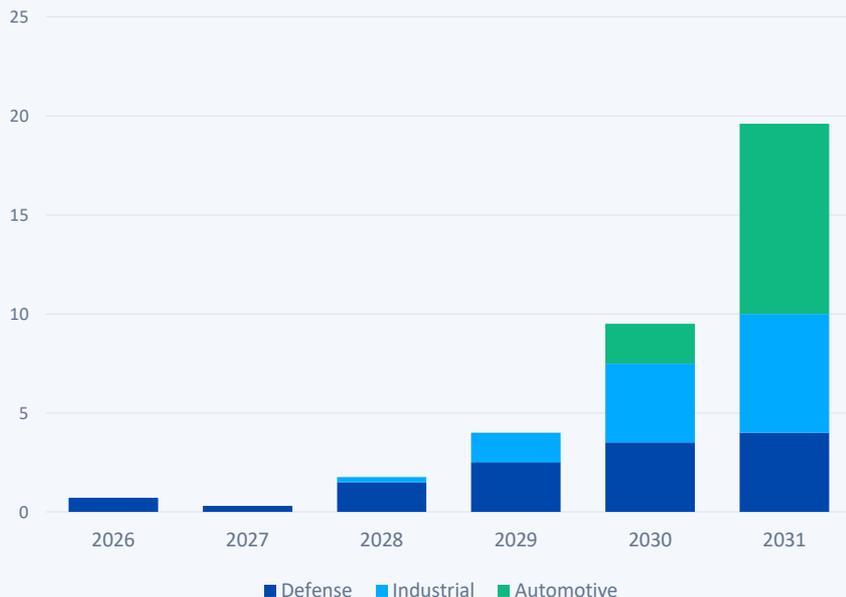
Defense software (EOS Defense, Gray Analytics)

Luke Hollmann, PhD
Signal Processing Lead

PhD, Electrical Engineering — Notre Dame

RF & Digital Signal Processing (DSP)

15+ yrs: sonar, RF, tracking & estimation

Principal investigator, $8M+ R&D programs

Kalman filtering, beamforming, detection

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Capital ladder tied to each market phase

Pre-Seed · Now **$2.5M**

Unlocks Defense

MVP prototype (time transfer + ranging + SoOP), 18-month runway to first defense deployment.

Seed · 2027–2028 **$5M**

Bridges Defense → Industrial

Execute first defense contracts, hardened FPGA production modules, 2–3 hires, initial industrial OEM outreach and design-in relationships.

Series A · 2028+ **$15M**

Unlocks Phase 3: Automotive

Production-grade MPSoC, manufacturing partner, industrial fleet deployments, Tier 1 automotive OEM engagement and IP licensing.

Total to automotive scale: ~$22.5M

2026: defense reflects one-time SDA prototype development contract. 2027: recurring module revenue begins.
2030: Automotive reflects initial IP licensing. 2031 assumes 48K vehicles × $200 ASP (1 OEM design-in). Revenue in $M.

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$2.5M Pre-Seed

18-month runway through MVP and seed preparation.

USE OF FUNDS

Engineering Team	74%	**$1,850K**
4 founders full-time + 2 specialized hires (embedded systems, RF validation)		
Hardware & Test Equipment	9%	**$225K**
Operations & G&A	5%	**$125K**
Seed Preparation & Market Development	12%	**$300K**
Total		**$2,500K**

WHAT THIS INVESTMENT DE-RISKS

✓ **Execution pace risk eliminated**

Full-time dedicated engineering team. Development pace accelerates to match the 14-month milestone arc.

✓ **Hardware validates the models**

5-node testbed proves the physics work outside simulation. Model-to-hardware correlation documented.

✓ **Defense evaluator engagement**

SDA technical dialogue active. Field evaluation with defense evaluator present. First external validation.

✓ **Series A data package created**

Drift suppression data under representative conditions. The asset that raises the seed round.

✓ **Raise from strength, not from empty**

4 months of funded runway post-MVP. Seed preparation and industrial OEM engagement.

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Autonomy scales when time coherence scales.

Drift Happens. We stop it. Autonomous fleets stay coordinated.

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