



TECHNICAL BRIEF

ANS COMPOSITE

Technology maturity & path to commercialization — companion to the ANS Capability Statement
Rachael V. Hager dba ANS Composite · Franklin County, Virginia · Licensed, never manufactured

NON-TRADITIONAL DEFENSE CONTRACTOR

SBA-CERTIFIED WOSB

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EXECUTIVE SUMMARY

ANS Composite licenses a **four-filing, patent-pending portfolio** of adaptive electromagnetic and radiation-survivability materials. We are not claiming new physics: the individual component dynamics are established, mature art at [TRL 4–6](#). What is novel — and what is patent-pending — is **the architecture that integrates those proven dynamics into one adaptive, self-healing, load-bearing system**. Because that integrated architecture has not yet been tested end-to-end, the comprehensive TRL is [2–3](#). That number reflects integration maturity, not the physics. ANS offers immediate collaboration to close the gap — as a partner that lowers a program's cost and risk rather than adding to it.

THE FOUR FILINGS — ONE ARCHITECTURE

FILING 1 · #64/020,126

Adaptive Self-Healing Shield

The base layer: frequency-adaptive broadband shielding that self-heals battle damage in the field — no depot return.

FILING 2 · #64/081,373

Multi-Domain EM Defense

EMP, high-power-microwave and directed-energy hardening, HEMP-configurable (MIL-STD-188-125) — keeps kill-web nodes alive under attack.

FILING 3 · #64/086,584

HETD Structural Skin

Shielding built into the load-bearing structure — blast, impact and EM pulses in one member; the platform's own skin becomes the shield.

FILING 4 · #64/087,652

ARI Printable Ink

The whole defense as a single-pass printable ink — printed to shape at unmanned-mass scale; hardens AI and edge-compute enclosures.

HOW TO READ THE NUMBERS IN THIS BRIEF

Every performance figure in this document is an engineered design target, not a measured result. No independent third-party validation has been performed yet — closing that gap is precisely what this brief proposes. Where a figure comes from the established literature on a component dynamic, it is described as such. Where it is ANS's target for the integrated architecture, it is stated as a target. [First planned verification: ASTM D4935-18 planar shielding-effectiveness coupons \(30 MHz–1.5 GHz\) at an independent accredited laboratory](#), with higher-band methods priced as separate additions.

APPLICATIONS & SCREENING PRIORITIES

MISSILES, GROUND & TACTICAL

Missiles and precision munitions · command-and-control ground stations · enclosed compartments and engine bays · battle-damage survivability patches.

SPACE, AIR & AUTONOMY

Satellite and space-vehicle survivability · unmanned and attritable platforms · aircrew and remote-operator enclosures · AI and edge-compute hardening.

INFRASTRUCTURE & COMMERCIAL

Grid, data-centre and C4ISR shelter hardening (MIL-STD-188-125 / IEC) · quantum-sensor and precision-instrument enclosures · commercial EMI compliance.

THE PORTFOLIO — WHAT EACH FILING DEFENDS AGAINST

FILING 1 · ADAPTIVE SELF-HEALING SHIELD · #64/020,126

Defends against — broadband EMI, directed energy and EMP, and dense RF environments (5G/6G, radar, satellite downlink).

FILING 2 · MULTI-DOMAIN EM DEFENSE · #64/081,373

Defends against — EMP across the triple-phase E1/E2/E3 profile, high-power microwave, and directed-energy weapons. **Nuclear:** configurable for HEMP hardening via stabilising additives and tuned sub-layers (MIL-STD-188-125).

FILING 3 · HETD STRUCTURAL SKIN · #64/086,584

Defends against — co-incident blast, ballistic and hypervelocity impact, and EM pulses, in one load-bearing member. **Nuclear:** adds radiation-hardened structure — total-ionising-dose and single-event-effect survivability (design targets).

FILING 4 · ARI PRINTABLE INK · #64/087,652

Adds — shielding plus structural reinforcement in a single print pass, with no post-fabrication coating step.

- ★ Together, Filings 2 and 3 address nuclear-event survivability — Filing 2 blocks the electromagnetic pulse, Filing 3 hardens the structure against the radiation.
- ★ Operator-protection layer — designed to remain transparent to the operator’s own body-area network (IEEE 802.15.6) while attenuating external electromagnetic interference, to support interface safety and reduced operator fatigue.

MULTI-MECHANISM ARCHITECTURE — THE INVENTIVE STEP

HOW IT INTEGRATES

Conventional practice stacks separate parts — a structural layer, a shielding gasket or coating, a hardening treatment — each addressing one domain and each adding parasitic mass. ANS’s patent-pending architecture co-designs the domains into **one graded, load-bearing member**, so a single structure carries load, dissipates co-incident mechanical and electromagnetic transients, and maintains shielding continuity across seams and apertures.

Low-risk ingredients, high-value recipe. The constituent dynamics — conductive composites, frequency-selective surfaces, self-healing chemistries — are independently demonstrated, established art, and every technical claim is traceable to a published, verifiable source. ANS is the first to combine them into one adaptive architecture.

DESIGN TARGETS — TO BE VERIFIED BY INDEPENDENT TEST

Frequency-adaptive — real-time impedance auto-matching intended to self-tune to the incoming threat on a millisecond scale.

Self-healing — incoming energy is converted to heat; mild thermal treatment ($\leq 80\text{ }^{\circ}\text{C}$) is targeted to restore conductivity after damage. **Recovery will be reported as directly measured conductivity, not inferred from shielding recovery.**

Mass — $\approx 1.2\text{--}1.3\text{ g/cm}^3$ for the waterborne-polyurethane build, against copper at 8.9 g/cm^3 — under half the mass of the formed metal enclosure structure it is intended to replace.

First-article coupons — **0.5–1.0 mm nominal thickness**, single lot, in ASTM D4935-18 matched reference/load geometry.

Shielding effectiveness — broadband attenuation across the filed range is the design objective; the verified figure will be whatever the independent laboratory measures, plotted against the measurement system noise floor. **ASTM D4935 is honest to approximately 1.5 GHz; X-band and above require separate methods and are quoted separately.**

Durability — retained shielding after repeated flexure is a design target supporting conformal and field-repairable use.

Structural — built into the load path, self-supporting, with seam and aperture continuity co-cured in.

Manufacturability — printable by direct-ink-write and fused-deposition routes; absorption-dominant, low-reflection embodiments; conforms to complex geometry.

TECHNOLOGY READINESS — TWO HONEST NUMBERS

COMPONENT DYNAMICS — THE PHYSICS, PROVEN

TRL 4–6

Conductive composites, frequency-selective surfaces and self-healing chemistries are each independently demonstrated in the published literature.

The distance between those two numbers is the opportunity. Thresholds to advance: (1) independent third-party coupon validation of the combined shield → TRL 4; (2) subsystem demonstration on a representative structure in a relevant environment → TRL 5–6; (3) platform-integrated qualification → TRL 7+. Each threshold is a defined, fundable milestone.

INTEGRATED ARCHITECTURE — THE COMBINATION, EARLY

TRL 2–3

The co-designed architecture has not yet been integration-tested end-to-end. That is the entire gap — and it is a test gap, not a physics gap.

STATE OF THE ART — ANS VS. CONVENTIONAL PRACTICE

CAPABILITY	CONVENTIONAL — COATINGS, GASKETS, LAMINATES	ANS ARCHITECTURE
Multi-domain (EMI, EMP/HPM, kinetic) in one part	No — separate parts per domain	Yes — co-designed single member
Self-healing after damage	No	Yes — thermally triggered recovery
Load-bearing (structural)	Add-on mass, non-structural	Yes — carries primary or secondary load
Nuclear-EMP (HEMP) configurable	Specialised, separate hardening	Yes — to MIL-STD-188-125
Additive / field-repairable	Limited	Yes — printable single-pass ink

TECHNICAL APPROACH — ILLUSTRATIVE 18-MONTH ARC

MONTHS 0–2

Evaluation-option agreement and mutual NDA; joint requirements definition and an agreed written test plan.

MONTHS 2–6

Coupon fabrication under toll processing; independent accredited-laboratory validation — shielding effectiveness first, then recovery after damage.

MONTHS 6–12

Subsystem build on a representative structure; extended-band characterisation priced as separate additions.

MONTHS 12–18

Relevant-environment demonstration; platform-integration plan and the field-of-use licence decision.

An option phase is embedded so evaluation bridges into development without a funding gap. Component-dynamics demonstrations can be furnished as short video links where page limits apply.

VERIFICATION PLAN — WHAT EACH TEST ACTUALLY PROVES

METHOD	BAND / CONDITION	WHAT A PASS ESTABLISHES — AND WHAT IT DOES NOT
ASTM D4935-18 planar coupon	30 MHz – 1.5 GHz	Material-level shielding effectiveness on matched reference/load pairs, plotted against the system noise floor. Says nothing about seams, apertures, enclosures, or any frequency above the fixture ceiling.
Free-space or waveguide transmission	X-band, 8.2 – 12.4 GHz	Extends the measured record above the D4935 ceiling — a separate priced method, an addition to the baseline rather than a replacement for it.
Direct conductivity, before and after damage	Thermal recovery cycle	The honest measure of self-healing. Recovery inferred from shielding alone overstates it; conductivity is measured directly for this reason.
IEEE Std 299 / 299.1 enclosure	Demonstration article	Seam and aperture continuity at the box level. Sequenced after material data exists, never instead of it.
MIL-STD-188-125 / MIL-STD-810H	HEMP; environmental	Threat-representative and environmental screening at the subsystem gate — the TRL 5–6 threshold.

ONE DOOR, THEN TWO LANES

Every engagement starts the same way — **a mutual NDA and a paid, time-boxed, non-exclusive evaluation-option agreement**, scoped to one narrowly written field of use. Weeks, not months. What follows depends only on who the counterparty is. **ANS licenses and advises; ANS does not manufacture**, and no prime intermediary is required.

LANE 1 · GOVERNMENT-DIRECT — THE PRIORITY Prototype Other Transaction. A direct evaluation licence scoped to your program's field of use, plus priced technical support. As a **non-traditional defense contractor participating to a significant extent**, ANS's involvement removes the one-third cost-share trigger on a prototype OT. Production follow-on runs under **10 U.S.C. § 4022(f)**. Validation is funded inside the agreement — the OT budget pays an independent accredited laboratory directly, with the test plan and data rights settled up front.

LANE 2 · INDUSTRY, FFRDC OR INTEGRATOR — PARALLEL Evaluation option, then a field-of-use licence. The partner evaluates at its own cost and risk in its own facility; the resulting data returns to ANS. Federally funded research and development centres are the natural first stop — they take in technology at evaluation maturity routinely, and their people are U.S.-persons throughout. A commercial licence, if any, is a separate and later decision.

THE PATH — FOUR GATES

1 · EVALUATION & OPTION
Mutual NDA, then a paid non-exclusive option, narrowly scoped. Low-overhead start. ANS retains 100% ownership of all four filings.

2 · FUNDED DEVELOPMENT
Government: prototype OT, fully government-funded, plus priced technical support. Industry: partner-funded evaluation under the option.

3 · INDEPENDENT VALIDATION
Accredited-laboratory coupon testing, then subsystem, then relevant environment. Funded within the agreement; test-data rights settled before work begins.

4 · PRODUCTION & FIELDING
Government: production follow-on under § 4022(f). Industry: field-of-use commercialisation licence. Utility conversion in 2027; platform insertion thereafter.

WHY A SPONSOR OR PARTNER WINS

LOW-OVERHEAD ENTRY
A signed evaluation option starts the work in weeks, not months, and commits no one to a production decision.

ZERO COST-SHARE
A non-traditional participating to a significant extent removes the one-third cost-share trigger on a prototype OT.

BUILT FOR THE THREAT
A survivability architecture designed for contested electromagnetic environments — at low cost to start, with no host-platform redesign.

What ANS does not do. No blanket exclusive licence — every licence is written to a field of use. No lump-sum sale of the portfolio. No cooperative research agreement and no joint intellectual property — engagements are fee-for-service or licence-based, and title never transfers. ANS does not offer Government Purpose Rights, and nothing in an ANS agreement broadens or converts on the passage of time.

RISK MAP & ENGINEERED FALLBACKS

WHERE THE RISK ACTUALLY SITS

Validation — no independent third-party coupon data yet. This is the TRL 2–3 gate and the honest headline risk.

Integration — co-designed domains must not degrade one another across the graded stack.

Manufacturing — scale-up and print repeatability of the additive ink.

Intellectual property — the provisional-to-utility conversion window closes in 2027.

WHAT REDUCES IT

Two independent validation lanes — OT-funded independent-laboratory testing on the government side, partner-funded testing under an evaluation option on the industry side. A configurable architecture plus hands-on inventor advisory de-risks per-platform fit.

The additive process ships with in-situ defect detection as a qualification aid.

Every claim is traceable to a published source; conversion is on track inside the window.

DEMAND — DEFENSE AND DUAL-USE

DEFENSE INTEGRATION

Homeland missile-defense build-out and space-based interceptor survivability · missile and hypersonic platform hardening in contested electromagnetic environments · aircrew and remote-operator protection · the special-operations edge — man-portable communications, position and timing, and small unmanned systems that must survive with no depot behind them.

PRIVATE-SECTOR SCALABILITY

Critical-infrastructure hardening — grid, data centres, C4ISR shelters (MIL-STD-188-125 / IEC) · quantum-sensor and precision-instrument enclosures · biomedical passive shielding · commercial electronics EMI compliance and additive parts with shielding printed in. A licensing-first model scales without ANS building a factory.

DATA RIGHTS & INTELLECTUAL PROPERTY POSITION

TECHNICAL DATA	BASIS	POSITION	ASSERTED BY
The architecture and the four U.S. provisional filings (#64/020,126; #64/081,373; #64/086,584; #64/087,652), including design, formulation and layup data	Developed exclusively at private expense	ANS-owned. Licensed by field of use. Not delivered.	Rachael V. Hager dba ANS Composite
Test, coupon and validation data generated under agreement- or licensee-funded testing	To be developed under a negotiated agreement or evaluation option	ANS property on creation; use rights negotiated per agreement	Rachael V. Hager dba ANS Composite
ANS licenses directly to the Government by field of use rather than delivering technical data packages — the mechanism contemplated by 10 U.S.C. § 3793 and DFARS 252.227-7012. ANS does not offer Government Purpose Rights, and no right under an ANS agreement broadens or converts on a timer. The formulation is never delivered; a performance specification and qualification data are. ANS retains ownership of all four filings, and full technical detail is available only under executed mutual NDA.			

BOTTOM LINE

Proven component dynamics, a patent-pending integration architecture, and a non-traditional posture that zeroes a program's cost-share — with two funded validation lanes available to close the TRL 2–3 gap. **Low cost to start, real strategic advantage — an asset, not a supplicant.**