Request for Adjustments to Enhanced SBIR benchmarks

Issues with the Proposed Phase 1 to 2 Transition Benchmark:

- Standards and penalties are retrospective, not prospective: Because the proposed new standards and penalties are retroactive, they would punish firms despite past compliance without giving an opportunity to change future behavior. Retroactive penalties would also be more likely to have unintended consequences e.g. negative impact on agency mission, national security. DOD has also expressed its concern with retroactive application.

- A company's Phase 1 transition rate varies little with its number of Phase 1 wins, and has very little to do with commercialization success.

- Agencies, not companies, control overall conversion: how many Phase 1s and 2s to award, in what ratio, and how risky to set the topic. Agency priorities or funding changes also strongly affect conversion ratio (e.g. AFWERX)

- New modeling and data demonstrates that because penalty calculations are retroactive, once a company is suspended, even if it begins meeting the standard it will be unable to come into compliance in <4 yrs because their prior performance (when they were in compliance) keeps their average below the new enhanced benchmarks.

Requested Adjustments

- Implement a 4 year probation period before suspension
  - Provides firms time to track and meet the enhanced benchmark; See Cases
  - If the goal is to influence future behavior rather than punish past behavior, this probationary period is not just helpful, but necessary

- Allow companies to meet Ph1 transition OR Commercialization benchmark
  - Allows firms that missed the retroactive Phase 1 transition benchmark to continue based on enhanced commercialization success, including spin-offs and sales
  - Allows firms that serve core agency R&D needs to continue even if commercialization is limited, e.g. for agency-specific topics or national security (especially as patents are removed, which helped cover this case).
  - Allows agencies like DoD and DoE to continue benefitting from customers for their unique national security missions

- Regardless of other changes, for firms excluded for a year, benchmark only the years after re-entry
  - Makes exclusion only 1 year so long as company thereafter meets benchmark

Phase 1 transition rate by number of Phase 1 wins

	SBIR firms with Phase 1 wins 2016-2020				
By number of SBIR wins	20 or less	21-39	40-49	50-99	100+
Average Phase 1 conversion (estimated by 2017-2021 Ph2s)	52%	58%	61%	54%	63%
Percentage of firms with <50% Phase 1 Conversions		33%	45%	36%	30%

- Phase 1 transition % varies little with number of Phase 1 wins/yr
- **Over 30% of firms with >20 Phase 1s/yr would not meet the 50% benchmark**
- Agencies control the overall transition rate, not under company control
- Retroactive application means there is nothing the companies can do

Under retroactive enhanced Ph 1 benchmark, a one year suspension is likely to last 4-5 years

- **Current benchmarks:** This is a rolling window that looks at the ratio of Phase 1 to Phase 2 awards over the past five years, minus the most recent year. Firms that do not meet the current 25% standards are excluded for a year from applying for Phase 1 and Direct to Phase 2, but they are then re-tested on the benchmark (with 5 years history) before they can return.
- **Enhanced benchmarks @ 50%**: If the enhanced Phase 1 transition benchmark test is enacted retroactively over a rolling 5-year period, any removal of a firm for "one year" would effectively remove it for multiple years, not just one.
- **Case Examples**: All assume 20 Phase 1/year and a starting 40% conversion rate, steady each year, back to 2017, and that Phase 2s are won in the subsequent year to the Phase 1. By end of 2022, the firms would have five years of Phase 1s from 2017-2021 (100) and 40 Phase 2s (2018-2022), for a 40% conversion.
- Such a firm's performance would well exceed the current benchmark of 25%, by 60%.
- But with a 50% retroactive benchmark, the firm would immediately (FY22) miss the benchmark, be notified 4/1/23 and removed on 6/1/23. No time to react.
- Currently after the 1 year suspension, the firm would get tested again before it can re-enter.
- Because it wouldn't have time to fix the problem (i.e. it was blocked from new Phase 1s 6/1/23), it would be blocked again by the "rollover" nature of the test, that keeps bringing in the past results and extends the suspension to multiple years. This applies across multiple cases.

Specific Case Studies relative to retroactive benchmarks

Assumptions for Case Studies:

- Assume 20 Phase 1/year, starting 40% conversion rate, steady each year
- Phase IIs are won in the subsequent year to the Phase 1
- By end of 2022, the firms would have five years of Phase 1 from 2017-2021 (100) and 40 Phase 2s (2018-2022), for a 40% conversion
- The 40% is acceptable historically as the benchmark is now 25%, and the firm exceeds this by 60%

Conclusion from the cases:

- The result appears to be punitive rather than inducing change in behavior: a firm with previously-compliant performance would be barred from program participation for more than the stated one year, but instead effectively 4-5 years
- This would likely have a severe impact on the firm, its employees and its community
- This would remove access to the firm's technology for multiple years
- This could have unintended consequences for agency mission, national security, etc.

Case 1: Boost to compliance: Barred for 5 years

Company wins 100 Ph 1s over 5 years with 40% conversion rate. Increases Phase 1 conversion to 50% starting in 2023, but is suspended 6/1/2023.

FY	Ph1	Ph2	5yr Ph1/Ph2 Average	Notes
2017	20	---		
2018	20	8		
2019	20	8		
2020	20	8		
2021	20	8		
2022	20	8	40%	Miss benchmark
2023	14	8	40%	4/1/23 notified. Suspended at 6/1/23
2024	0	7	41.5%	Calc: Ph1s '19-'23/Ph2s '20-'24
2025	0	0	41.9%	
2026	0	0	42.6%	
2027	0	0	44.1%	
2028	---	0	50%	Eligible after 5 years.

Five year removal: The firm is blocked from proposing starting 6/1/2023, and despite being compliant for 2023 @ 50%, the earlier years' drag down the cumulative conversion until all 40% years age out of the calculation.

Case 2: Boost to 70%; Barred for 4 years

Company wins 100 Ph 1s over 5 years with 40% conversion rate. Increases transition rate to 70% immediately.

FY	Ph1	Ph2	5yr Ph1/Ph2 Average	Notes
2017	20	---		
2018	20	8		
2019	20	8		
2020	20	8		
2021	20	8		
2022	20	8	40%	Miss benchmark
2023	15	8	40%	4/1/23 notice. 6/1/23 suspension
2024	0	10.5	44.7%	Calc: Ph1s '19-'23/Ph2s '20-'24
2025	0	0	46.0%	
2026	0	0	48.2%	
2027	0	0	52.9%	Eligible 6/27: 4 years
2028	---	0	70.0%	

Immediately boosting conversion to 70% would only cut the suspension to 4 years. Even converting 100% - a nearly impossible rate for such a competitive program - would still lead to the company being barred for two years.

Case 3: 1 yr warning+boost to 60%: Barred for 4 years

1 year Warning period. Company wins 100 Ph 1s over 5 years with 40% conversion rate. Begins to improve transition rate starting 2023 (to 50%, then 60% in 2024). Banned 6/2/2024.

FY	Ph1	Ph2	5yr Ph1/Ph2 Average	Notes
2017	20	---		
2018	20	8		
2019	20	8		
2020	20	8		
2021	20	8		
2022	20	8	40%	Miss benchmark
2023	20	8	40%	4/1/23 notice.
2024	15	10	42%	Suspended 6/1/24
2025	0	9	45%	Ph1s '20-'24/Ph2s '21-'25
2026	0	0	47%	
2027	0	0	49%	
2028	---	0	54%	Eligible 6/28: four years

An extra year warning period helps a little, but not enough to shorten the penalty period less than 4 years, even if a firm ends up with a 50% conversion rate in the year of suspension and a 60% conversion the year after.

Case 4: 4 yr probation, boost to 60%
Stays in by meeting benchmarks

4 Year Probation Period. Company wins 100 Ph 1s over 5 years with 40% conversion rate. Improves transition rate to 50% in 2023. Cut back Phase 1 wins to 15 (fewer risky proposals), boosts conversion to 55% in 2024, 60% 2025 and later, Off probation in four years.

FY	Ph1	Ph2	5yr Ph1/Ph2 Benchmark	Notes
2017	20	---		
2018	20	8		
2019	20	8		
2020	20	8		
2021	20	8		
2022	20	8	40%	Miss benchmark
2023	20	8	40%	4/1/23 notice
2024	15	10	42%	
2025	15	8.25	44%	
2026	15	9	48%	
2027	15	9	52%	Off probation
2028	---	9	57%	

A 4-year probation period allows a firm a time window to boost performance, reaching short term compliance and based on that coming to full compliance without being shut out. Probation could require meeting the target % for the years after the year of notice.

Companies that appear to not meet 50% proposed enhanced Phase 1 benchmark, using 2016-2020 base

Company	Ph1 2016-2020	Ph2 2017-2021	Ph1 conversion	% in excess of original benchmark	Jobs
Intellisense	91	40	43.9%	75%	160
Lynntech	130	54	41.5%	66%	105
Nanohmics	68	23	33.8%	35%	45
Stottler Henke	50	20	40.0%	60%	60
Toyon	86	41	47.6%	90%	195
Triton	159	72	45.3%	81%	130

While these 6 companies are the only ones affected now, a company's Phase 1 conversion rates are not static, and other companies like these could be excluded for 4-5 years in the future if adjustments are not made.

Some of the SBIR-derived technologies from firms with <50% Phase I transition

Intellisense

- IoT AWARE Flood Sensor replacing legacy flood monitoring at 1/10th the cost. 700 units already deployed
- Micro Weather Station platform for in-situ weather reporting anywhere in the world is already deployed in over 60 countries across all continents. It is the military's top choice for weather monitoring, with more than $65 mm in savings for the Air Force alone over 10 years.

Triton Systems

- Materials solution anticipated to save over $550 mm on the F-35 Joint Strike Fighter and over $200 mm for the F-22 aircraft in lifecycle costs. Publicized by the Air Force as an SBIR success story.
- SBIR-derived solutions led to spin offs that enabled the world's smallest heart pump (acquired by Abiomed), cancer therapy (IPOed as Aduro/Chinook Therapeutics), and world leading cleantech (FRX) and water (Fluence) companies.

Lynntech

- Flight Breathing Hypoxia Trainer currently commissioned at seven Navy Aviation Survival Training Centers and a power management system being installed in the MK 18 Underwater Unmanned Vehicle.

Toyon

- The VideoPlus system is used at US and allied borders for Border Patrol monitoring, a maritime infrared camera is in use for off-shore oil and gas operations, and Track-to-Track fusion software is being used by Navy for surveillance

Stottler Henke

- Command and Control System being deployed by the US Space Force's Satellite Control Network under $25 M contract. Government previously invested >$750 mm in mostly large companies for similar development.
- Helicopter crew training system is being used by all US Navy training squadrons. SBIR-derived scheduling systems being used by NASA, Boeing, General Dynamics and Mass General Hospital.

Nanohmics

- Real-time image correction system being used by Raytheon for improved MQ-9 reaper drone effectiveness

Why should the enhanced benchmark be meeting either Phase I transition or Commercialization benchmark?

- Some companies do high risk work that produce commercialization results meeting the enhanced commercialization benchmark, but do not meet the 50% Phase I transition benchmark.
- Some other companies focus on unique agency needs which may not have as much commercialization potential, e.g. R&D meeting specific agency objectives including classified and national security related programs.

One Example:

- Toyon: Does not meet 50% Phase I transition: 47.6% Phase I transition.

But exceeds the commercialization benchmark (e.g. Total commercialization $5.25 for every SBIR$, including $2.26 in non-SBIR Federal sales/SBIR$, and has SBIR revenue <20% of its revenue). Heavy classified/national security work. 195 employees.

Results of inserting the “or”:

- Without the “or”:
  - Lose businesses that are successfully commercializing but don’t meet the enhanced Phase 1 conversion benchmark
  - Lose businesses that focus on the SBIR goal to meet Federal R&D needs for which there is little commercial marketplace (including programs that are classified or addressing national security)
  - Penalizes firms for past actions that exceeded compliance at the time
- With the “or”:
  - Likely keep the companies that have been successful in commercialization
  - Plus keep the businesses that have been successful in Federal R&D for which there is little commercial marketplace

A waiver likely won't help

- The waiver as currently drafted is directed to allow the agencies to allow excluded companies to propose into a select set of topics for which the agencies have asked for such broadened proposal access
- There are likely to be very few of these if any per company
- The result is that the company would still be primarily excluded from the SBIR program, with perhaps a few exceptions
- Hence, many of the agencies would be deprived of the best ideas and solutions in many cases due to the exclusion

Appendix

Our SBIR-derived products support our warfighters and protect our citizens

Intellisense Systems, Inc. is a leading provider of advanced sensing and display solutions supporting a data continuum from acquisition to visualization. We are a technology innovator and advanced systems integrator that solves some of our customers' toughest challenges by designing, developing, and manufacturing solutions that sense, transmit, process, and display mission-critical information in the most austere environments on earth. Our innovative technologies include integrated sensor systems, wearable technologies, avionics and display systems, and artificial intelligence software solutions. *All our technologies have their roots in SBIR.* Intellisense generated over $42M in revenue in 2021, employs over 160 employees, and is organically growing at +25% YoY rate. The average salary per employee is $130,359/yr and an additional 14 positions will be filled by the end of 2022.

DHS
IoT AWARE Flood Sensor

The AWARE Flood Sensor was developed through SBIR Phases I-III as part of the DHS' Smart Cities Initiative. AWARE Flood replaces legacy flood monitoring systems at 1/10 the cost, providing significant cost savings and increased public safety awareness for state, city, and county flood /emergency management organizations. Over 700 units have been deployed by counties and municipalities as well as the Army Corps of Engineers across the U.S.

USSOCOM/USAF
Micro Weather Station-Military (MWS-M)

An SBIR success story, the MWS-M is a first-of-its-kind solution to meet the mission-critical needs of USSOCOM for providing in-situ weather reporting anywhere in the world. Used in over 60 countries and on all 7 continents. Intellisense Systems offers a variety of true all-in-one weather stations. We've integrated the data storage, wireless communications, batteries, and solar collectors all into one unit—dramatically reducing the size, weight, and cost by 10x compared to competing technologies.

MWS Commercialization
Micro Weather Station-Commercial (MWS-C)

The MWS Commercial variant was a direct derivative of the military MWS and funded internally by Intellisense to adapt to the commercial market primarily using cellular networks to transmit the environmental data. The MWS-C was introduced in 2020 and has been adopted by drone delivery services, energy markets, resource protection, distribution warehouses, railroads, medivac helicopters, and general aviation operations. The MWS-C represents the success of leveraging SBIR to develop dual-use technologies that address both military and commercial markets.

Air Force
IWOS

The Integrated Weather Observation System (IWOS®) from Intellisense Systems is the compact, wireless, rugged weather station. This system can replace legacy automated weather stations or be set up for remote or temporary airfield operations. It monitors over a dozen environmental parameters with built-in data processing and satellite or cellular communications in a package that fits into a single case and weighs less than 25 lb. With its accuracy, portability, modularity, and professional-grade construction, the IWOS delivers greater availability and a lower lifecycle cost compared to other weather stations.

Army
Ballistic Meteorological Sensor (BMS)

The Ballistic Meteorological Sensor (BMS) was derived from the Micro Weather Station SBIR to provide rugged, compact, power-efficient meteorological sensing capabilities for military ground vehicles and is featured as one of the latest sensor modernization initiatives of the M1A2 Abrams tank. It is the ideal meteorological sensor for improving ballistic accuracy, monitoring hyperlocal weather conditions to improve lethality. The system also serves to provide situational awareness for emergency response vehicles across the U.S.

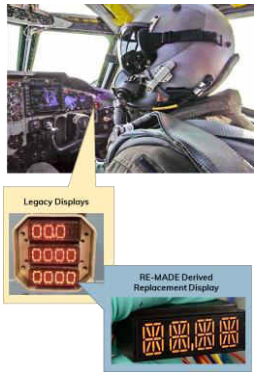
Air Force
Software Solutions – Quantimet®

Quantimet is the cloud-based software solution from Intellisense that enables users to view, analyze, and export data from their environmental sensors with any internet-connected device. Users can receive status updates, send remote commands, and plot trends from all Internet of Things (IoT)-connected devices located around the world. This service stores your data using a cloud-based data logger so it is always available, helping prevent lengthy trips into the field. It provides an enabling capability

Air Force
MC-130J Video Display Terminal (VDT)

Intellisense leveraged SBIR funding to develop the VDT to replace a legacy display that faced Diminishing Manufacturing Source and Material Shortage (DMSMS) issues. The Intellisense VDT enabled MC-130J Talon III aircraft installations to proceed as planned beginning in FY2019Q4, overcoming the DMSMS issue and ensuring aircraft were available for AFSOC missions in support of USSOCOM. Intellisense has delivered over 100 units to date. USAF acquisition savings for the new VDT compared to the legacy unit are estimated at $11M.

DLA
RE-MADE B-52 Display Replacement



Intellisense worked closely with the Defense Logistics Agency to successfully reverse engineered an existing Critical/Weapon System Application Item (CAI) for the B-52 to overcome an extremely diminished manufacturing supply issue. The outcome after SBIR Phase II is a new part that leverages modern manufacturing capabilities and increases performance and reliability while reducing unit price. Intellisense is now a DLA Approved Source and is delivering production units to the DLA.

Air Force
Large Area Display (LAD)

The Intellisense Large Area Display is the successor to the SBIR-funded High Resolution Video Terminal Display (HVDT) originally designed for the B-52. The advanced LAD features multiple innovations including touchscreen, built-in video processing, and high-speed fiber optic video interface. The LAD builds on the know-how gained from VDT/HVDT and completely re-architects the product to address commercial markets and achieve safety certification.

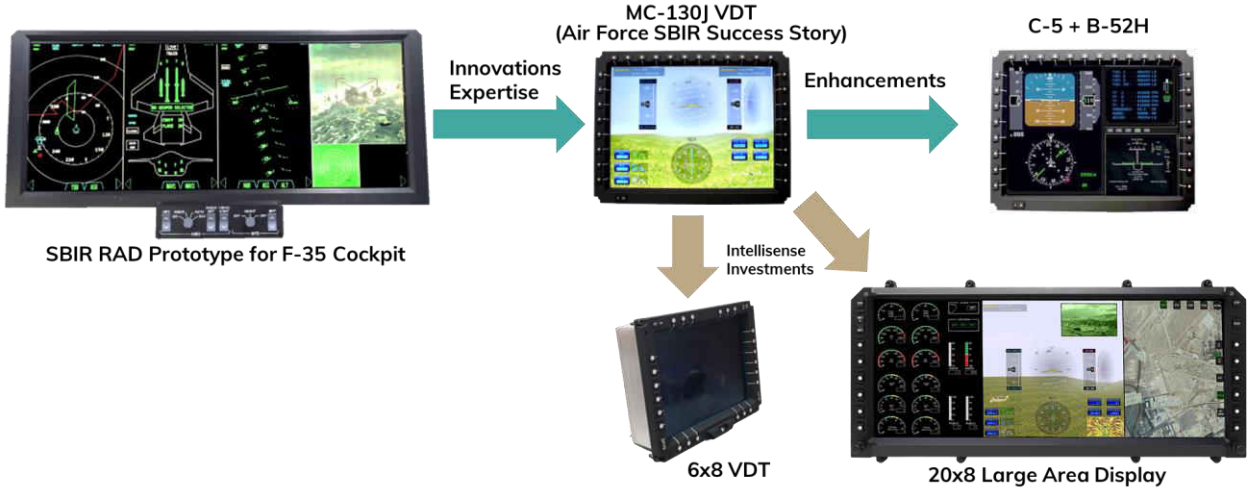
Air Force
Advanced Targeting Pod (ATP) Display

Intellisense is developing the ATP display to replace both the legacy Multi-Function Color Display (MFCD) and graphics processor on the B-52H. Derived from the SBIR funded VDT and HVDT, the technology transitioned to OTA funding. It provides enhanced, high-resolution video feeds for precision targeting capability and supports future growth capabilities. It is under development through early 2023 with follow-on production scheduled for early 2024.

Avionics Displays and Processing Solutions

Launchpad for Intellisense Display and Avionics Products

- **The launch of our display product line through initial USAF SBIR investments has led to other military contract totals of $12M with a future production outlook of over $130M: $40M for 20x8 Large Area Displays (LAD), $65M for 12x9 Video Display Terminal (VDT) displays, and $30M for 6x8 inch displays.**
- Intellisense originally developed the Revolutionary Avionics Display (RAD) is based on SBIR funding as a future upgrade for the F-35 cockpit display.
- The technical know-how, innovations, and ingenuity generated during RAD have been applied to create the modern and advanced products meeting DoD needs for agile modernization at low cost.



SBIR investment served as the launchpad for the Intellisense Avionics Display product line.

LAD-2008	VDT-0608	SVDT-0608	VDT-1209	3ATI SED
				
Ruggedized to MIL-STD and DO-160 ☑	Ruggedized to MIL-STD and DO-160 ☑	Ruggedized to MIL-STD and DO-160 ☑	Ruggedized to MIL-STD and DO-160 ☑	Ruggedized to MIL-STD and DO-160 ☑
Industry Standard Interfaces ☑	Industry Standard Interfaces ☑	Industry Standard Interfaces ☑	Industry Standard Interfaces ☑	Industry Standard Interfaces ☑
Customizable Bezel ☑	Customizable Bezel ☑	Customizable Bezel ☑	Customizable Bezel ☑	Customizable Bezel ☑
Safety Certified up to DAL A ☑	Safety Certified up to DAL A ☐	Safety Certified up to DAL A ☐	Safety Certified up to DAL A ☑	Safety Certified up to DAL A ☐
Sunlight Readable ☑	Sunlight Readable ☑	Sunlight Readable ☑	Sunlight Readable ☑	Sunlight Readable ☑
NVIS-Compatible ☑	NVIS-Compatible ☑	NVIS-Compatible ☑	NVIS-Compatible ☑	NVIS-Compatible ☑
Multitouch Screen Technology ☑	Multitouch Screen Technology ☐	Multitouch Screen Technology ☐	Multitouch Screen Technology ☑	Multitouch Screen Technology ☐
vFusion ☑	vFusion ☐	vFusion ☐	vFusion ☑	vFusion ☐
Graphics Processing ☐	Graphics Processing ☐	Graphics Processing ☑	Graphics Processing ☐	Graphics Processing ☑
LAD-2008 Details	VDT-0608 Details	SVDT-0608 Details	VDT-1209 Details	3ATI SED Details

Micro Weather Station (MWS®)

The U.S. Military's Top Choice for a Rugged Portable Weather Station

USSOCOM, US Air Force, US Navy, US Marine Corps and US Army

The MWS was conceived under a Phase 1 SOCOM SBIR in 2010 to address the need for local weather data in remote environments, prompted by the crash of a CH-47 Chinook and loss of life due to lack of accurate mission weather data. This compact weather station with integrated communications and power is now in use by all U.S. Armed Services and is the cornerstone of DoD tactical weather programs as well as for foreign militaries such as the Australian Army and Canadian DND. Over 1,100 units have been manufactured and shipped to the DOD alone by Intellisense in California and are in use operationally in over 60 countries and all 7 continents. This SBIR technology has generated over $35M in small business revenue and has led to an entire family of tactical weather sensor products for ships, tanks, commercial applications, and software as a service.

As a result of the MWS SBIR success, both the U.S. Air Force and Navy have funded Intellisense through SBIR to develop the Integrated Weather Observation System (IWOS®) to provide more accurate and persistent weather data in remote, tactical environments in support of fixed wing aviation operations and to replace the U.S. military's aging, foreign-made TMQ-53 tactical weather system, which costs the Air Force $50M in sustainment funding every 5 years. Both Intellisense's IWOS and MWS will be procured and sustained under a sole-source Phase 3 Air Force program of record, with the IWOS set to replace the entire TMQ-53 inventory at a fraction of its sustainment costs, saving the Air Force >$65M over the next 10 years.

MWS-C400	MWS-C500	MWS-C600	MWS-M525	MWS-M625
				
Fully Integrated ☑	Fully Integrated ☑	Fully Integrated ☑	Fully Integrated ☑	Fully Integrated ☑
Cloud Based Data Logging ☑	Cloud Based Data Logging ☑	Cloud Based Data Logging ☑	Cloud Based Data Logging ☑	Cloud Based Data Logging ☑
Orientation Parameters ☑	Orientation Parameters ☑	Orientation Parameters ☑	Orientation Parameters ☑	Orientation Parameters ☑
Easy to Use ☑	Easy to Use ☑	Easy to Use ☑	Easy to Use ☑	Easy to Use ☑
Standard Weather Sensors ☑	Standard Weather Sensors ☑	Standard Weather Sensors ☑	Standard Weather Sensors ☑	Standard Weather Sensors ☑
Additional Sensors and 360° Camera ☒	Additional Sensors and 360° Camera ☑	Additional Sensors and 360° Camera ☑	Additional Sensors and 360° Camera ☑	Additional Sensors and 360° Camera ☑
Lidar Ceilometer ☒	Lidar Ceilometer ☒	Lidar Ceilometer ☑	Lidar Ceilometer ☒	Lidar Ceilometer ☑
Military Grade ☒	Military Grade ☒	Military Grade ☒	Military Grade ☑	Military Grade ☑
MWS-C400 Details	MWS-C500 Details	MWS-C600 Details	MWS-M525 Details	MWS-M625 Details

Intellisense's family of environmental sensors and software service were all born from the MWS SBIR.

All our innovative products were developed with seed funding from the SBIR program, and the business generated by the sales of these products employs over 160 highly trained staff.

Triton Systems

Triton Systems
Driven to Innovate

Triton Systems (Triton) has been spinning off companies and products as part of its business model for over twenty years. We've been able to make that happen in part by leveraging Small Business Innovation Research (SBIR) programs to move early-stage ideas from lab-based prototypes to mature, manufactured products. That's how we've helped create more than $2 billion in shareholder value over the past fifteen years, enabling employment opportunities and the creation of over 100 patents – all while supporting DoD with its defense and security goals. Below showcases some of those companies and products.

Nickel Free Conductive Filler

Triton's nickel-free conductive filler has transitioned to the F-35 Joint Strike Fighter and is used to provide mission-critical functionality. It replaces more expensive and environmentally hazardous material, and will save the DoD over $550 million across the aircraft's lifecycle and is positioned to be applied to other military aircraft platforms. *"Implementation of Triton's non-nickel-based material system will significantly reduce sustainment costs and eliminate the risk of exposure for factory workers, military maintainers and depot workers."* – Maj. George Woodworth, an Air Force Research Laboratory researcher.

Pressure Sensitive Adhesives

Developed under SBIR funding, Triton Systems' Pressure Sensitive Adhesives (PSA) have been implemented on the Air Force's F-22 aircraft platform. They are used to attach materials/functionalities that are critical for aircraft performance and survivability. They dramatically simplify and accelerate the related sustainment processes, including repair, and will: (i) save $200M in life-cycle costs for F-22, and (ii) enable enhanced aircraft availability – a critically important metric of aircraft fleet readiness for the DoD. These products are also well positioned for transition to additional military aircraft platforms.

Chinook Therapeutics (NASDAQ:KDNY)

Aduro Biotech, founded by Triton to explore cancer therapies, was acquired by Chinook. Chinook created new company (Sairopa) to pursue monoclonal antibodies generated through Aduro Biotech's B-Select platform.
https://www.chinooktx.com/

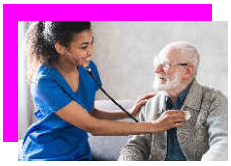
FRX Innovations

Leading U.S. cleantech company manufactures halogen-free, flame-retardant plastics. Received greentech awards for its product Nofia, a flame-retardant additive for fibers, textiles, electronics and electrical components, wires, cables, foams, films, sheets, and moldings.
https://www.frx-innovations.com/

Fluence Limited

World's leading decentralized water and wastewater treatment company. Its innovative, sustainable technologies create high-quality, cost-effective water and wastewater treatment solutions. Installed at hundreds of plants to meet municipal, commercial, and industrial needs.
https://www.fluencecorp.com/

Sensera Limited (acquired by Abiomed – NASDAQ:ABMD)



Designs and manufactures specialized high-performance sensors and modules, like microelectromechanical systems (MEMS). Acquired by Abiomed, and enabled Abiomed to produce the world's smallest heart pump, the Impella®, which has helped countless patients recover from major heart surgery.
https://www.abiomed.com/

Nanotron (acquired by Inpi
NASDAQ: INPX)

Ultrawideband (UWB), short-range RF technology detects the location of people, devices, and assets with superior precision.
https://www.inpixon.com/

Si2 Technologies Inc. (Privately Held)

Designer and manufacturer of flexible, high-precision antennas, arrays, and signal-management products for military air, land, sea, and space applications that face space, weight, power, and signature restrictions.
https://www.si2technologies.com/

CHINOOK THERAPEUTICS
FRX INNOVATIONS
Si2
Sensera®
inpixon Indoor Intelligence
fluence

Triton Systems, Inc.
330 Billerica Road, Suite 200, Chelmsford, MA 01824
Tel: 978-250-4200 Web: www.tritonsystems.com
Email: info@tritonsystems.com

U.S. AIR FORCE

SUCCESS STORIES

Air Force SBIR/STTR

Triton Systems
Chelmsford, Massachusetts

MATERIALS TECHNOLOGY SET TO LOWER COSTS, REDUCE ENVIRONMENTAL HAZARDS IN F-35 AND OTHER AIRCRAFT

The Air Force is poised to reduce hazardous materials in aircraft, and save big dollars over the long haul, through a small business partnership.

With the backing of a SBIR contract, Massachusetts based **Triton Systems** successfully developed a technology to produce nickel-free material systems. In addition to eliminating nickel and associated environmental hazards, Triton's technology provides compelling cost savings for F-35 and other aircraft platforms. On the U.S. F-35 fleet alone, this could lead to an estimated $550 million savings across the life cycle of the program.

The technology has been developed and demonstrated in close collaboration with F-35 manufacturers, Northrop Grumman and Lockheed Martin.

Triton used the manufacturing process and pilot manufacturing scale equipment to demonstrate several relevant product forms. Triton also has demonstrated fully-formulated resin systems meeting specific technical requirements for the F-35.

Current fighter aircraft incorporate nickel-based materials to meet various system requirements, which creates several problems. In addition to high costs, nickel is a hazardous material that has been identified for removal to the widest extent possible because of its environmental, health and safety concerns. Nickel based materials require additional handling procedures during many steps in the installation process and their regulatory impacts include limitations on application equipment and controls as well as allowable worker exposure.

On the U.S. F-35 fleet alone, this could lead to an estimated $550 million savings across the life cycle of the program.

The newer Triton technology provides a path to eliminate nickel from a number of mission-critical material systems used on aircraft platforms. For the F-35 Joint Strike Fighter program, replacing nickel-based material systems with lower-cost, non-nickel based material systems is a high priority. The idea is to reduce hazards and address high operational and sustainment costs.

Courtesy U.S. Air Force

The technology is now positioned for transition to several applications on the F-35 program.

Triton's initial success under the SBIR program led to additional funding through the Rapid Innovation Fund (RIF) program. The RIF award allowed Triton to bring the technology and product to a maturity level ready for qualification and transition.

The company has a solid track record of driving early-stage technologies from the laboratory to the marketplace. Triton has spun-off a number of successful companies, attracting more than $200 million in external venture financing.

We solve complex problems that others won't

Flight Breathing Awareness Trainer (FBAT) – Portable Electrochemical Oxygen Separation Device for Physiological Awareness Training: High altitude flight presents many risks to pilots including hypoxia, hyperventilation, and other physiological episodes (PE), which severely affect a pilot's cognitive function and extensive training is critical to ensure early recognition of physiological symptoms during flight. To address this need, Lynntech developed the On-Demand Hypoxia Trainer (ODHT) with funding from the SBIR program. The ODHT was successfully transitioned from the SBIR program with $8M post SBIR dollars. Units have been manufactured and commissioned at seven different Navy ASTCs in the US. Currently, the new and expanded version, Flight Breathing Awareness Trainer (FBAT) is under development which adds capability beyond hypoxia training to simulate malfunctions for the F-35, F-15, F-18 and T-6 platforms.

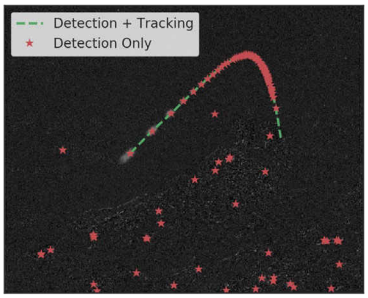


Electrochemical Drug Infusion Pump (TRIAD-MP): Lynntech has developed a multi-channel infusion pump for expeditionary medical support after the Alaris III was discontinued by Beckton Dickinson. Since 2018, Lynntech has secured ~$5.5M of post-SBIR funding (with support from Air Combat Command, as well as the AFRL's 711th Human Performance Wing) and is focused on advancing the design through a pre-production prototype stage, slated to be completed in Q4 2022 with emphasis on reaching TRL 6 by the end of contract activity. Currently, AFRL is evaluating five gamma prototypes delivered by Lynntech and providing feedback to support the next stages of development. Regulatory approval planning is also on-going with design history file (DHF) development now underway, to support the 510(k) regulatory pathway.

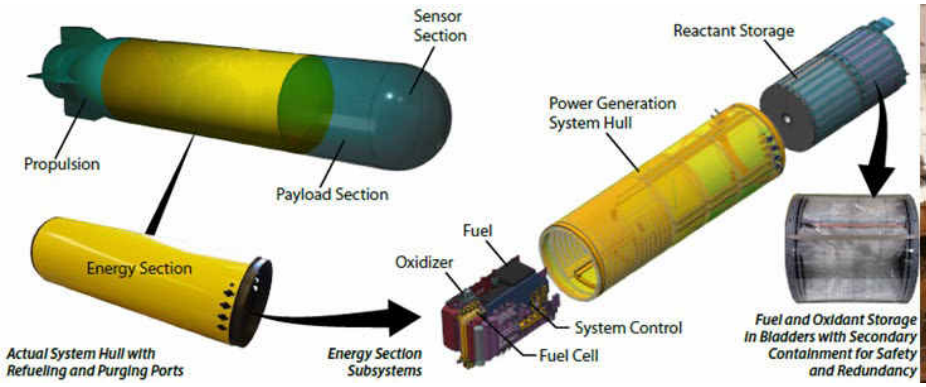


The TRIAD-MP™ pre-production prototype shown during evaluation at AFRL*

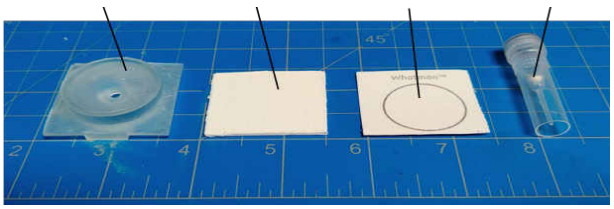
Multi-Spectral Solution to Sniper Missed-Distance Corrective Offset: Lynntech has developed an aiding technology that tracks a sniper's projectile as it travels downrange and determines the corrective offset needed (if any) to re-engage the target rapidly and successfully. The core technology innovation is the fusion of shot detection, the computed ballistic solution, and machine vision methods to determine an appropriate corrective offset. This project has since received ~$500K in post-Phase II funding in 2021 to develop advanced prototypes for end-user engagement testing and validation. Future development efforts proposed to the Army have focused on adapting the SNIPRES technology for use by the next generation machine gun team with support from PEO Soldier.

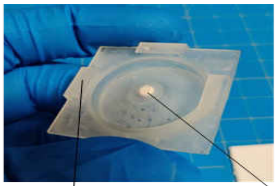


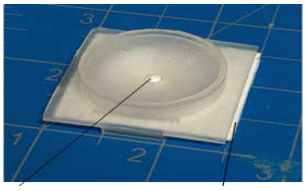
A Flexible Power Management System Architecture for Unmanned Underwater Vehicles: Lynntech developed a fuel cell hybrid power management system to interface with the SSAM-III sensor for the Mk 18 Mod 2 UUV. This power system was designed to be a replacement for traditional Li-Ion batteries and provide significantly improved endurance over batteries (21 hrs vs. 12 hrs). Lynntech designed, built, and integrated a fully packaged and autonomous fuel cell power system into a custom UUV energy section hull. This prototype used a high energy density chemical-hydride as the fuel to increase mission duration. This project received ~$3.4M of post-SBIR funding to package the various sub-systems of the hybrid fuel cell power system in a form factor to fit within the MK 18 MOD 2 UUV, provide sufficient useable peak power to support the advance sensor packages, and provide sufficient energy to sustain at least a single mission.



Simplified Miniature Blood Sampler and Preserver for Toxicant Exposure Monitoring: Lynntech developed a device to collect and transport blood specimen spots from point of collection to a laboratory. Our envisioned product improves the fieldability of dried blood spot (DBS) technology in minimally resourced environments through accessories/design improvements that reduce the risk of cross contamination, improve analyte stability at extreme environmental conditions (heat and humidity), and improve desiccation of the collected sample. This project received ~$1.5M of post-SBIR funding in 2021 to focus on design for manufacturing and scale-up, conduct performance validation for stability and end-use applicability in a relevant environment and develop the DBS device to the point of FDA submission. Future iterations will be focused on integrating customer feedback into the product to improve and/or expand capabilities (e.g., include additional analytes, implement compatibility with additional downstream clinical assay workflows etc.).







Successful Case Studies in Small Business Innovation Research

Toyon Research Corporation is a nationally recognized small business providing innovative technical solutions and defense systems analysis since 1980. Toyon performs advanced technical research and development to support customer needs, including a history of successful small business innovation research (SBIR) projects. We leverage SBIR programs to move early-stage, cutting edge technologies into fully fledged products with successful commercial applicability.

Toyon supports multiple commercial and government clients with solutions for their most challenging problems. These are some of our recent case studies.

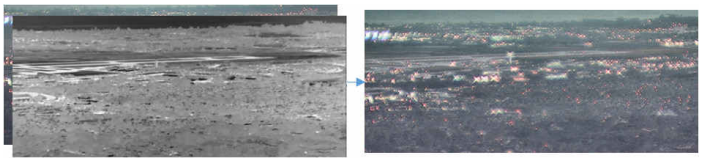
VideoPlus

Originally developed with SBIR funding, the VideoPlus product line has been deployed at the US Southern and Northern borders and at allied nation borders (counter-ISIS operations). VideoPlus enhances very-long-range infrared and visible surveillance video to detect and track suspicious human movements and cue responses from border patrol personnel. **Toyon has commercialized VideoPlus with > $10M in license sales and follow-on software integration contracts.** VideoPlus has also been deployed for varied applications including commercial nuclear site security and has been adapted for drone video processing and autonomy support.

VideoPlus®

Video Processing Sub-System (VPSS)

Applying techniques developed under SBIR efforts, Toyon developed the VPSS processing suite to support surveillance variants of a next generation light-armoured vehicle (LAV). **The Toyon VPSS is deployed via LAV for operational use by multiple US-allied nations.** The VPSS is an innovative software package that includes real-time, low-latency functionality: real-time imagery stabilization, automated moving target detection, real-time tracking, and other video enhancement algorithms, including multi-sensor fusion, image blending, and video transcoding. Toyon's algorithms execute on military hardened computer hardware (using CPUs and GPUs) and interface with state-of-the-art, high definition imagers.

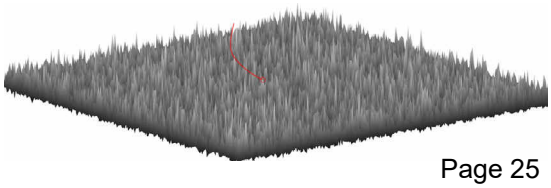


SBIR SUCCESS POINTS

- For every dollar invested in Toyon by the SBIR program, we have received an additional $2.26 in commercialization funds from other sources
- Participated in the SBIR program since 1986
- From 30 employees to 250 and growing!
- SBIR funding accounts for less than 17% of annual revenues
- Phase III SBIR projects (not funded by the SBIR program) account for greater than 47% of annual revenues
- Transitioned multiple SBIR projects from an initial concept (TRL1-2) to operational technology (TRL 7+)

Overhead Persistent Infrared

(OPIR) algorithms, initially funded via the DOD SBIR program, have been demonstrated with the Space Based Infrared System, a missile warning system. Toyon's algorithms process data to solve critical challenges for emerging threats including dim and highly maneuverable targets. **Toyon's OPIR algorithms are currently being transitioned to onboard space-based solutions for future proliferated satellite ISR platforms.**



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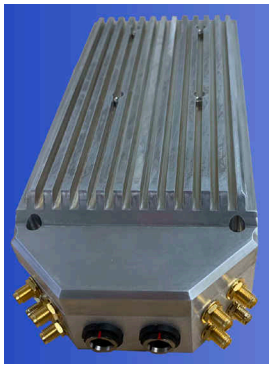
Maritime Infrared Camera

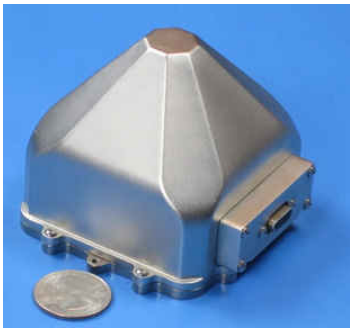
Toyon developed a system for semi-automatically detecting whales on a NOAA SBIR program. **The technology developed on this SBIR was used to estimate the abundance of gray whales migrating along the California coast, but deployment of the system led to other applications including supporting oil and gas exploration, military systems with active sonar, and the shipping industry.** Oil and gas operations were supported in Canada, Asia, and most recently offshore in the Atlantic Ocean. To support these operations, we deployed a new ship-based infrared system that was developed using internal Toyon investment along with oil and gas industry funding. Total revenue from deployment of the system has **exceeded $1.3M** and is expected to grow in the coming years.

GPS-Denied Global Navigation System

Under a SOCOM Phase I, and a Navy Phase II SBIR program, as well as an internal research and development effort funded entirely with company funds, Toyon demonstrated the feasibility of a global navigation system (GNS) that does not rely on GPS, but provides GPS-like performance anywhere on the globe, and even in some locations where GPS cannot normally operate. **This technology is now being miniaturized for dismounted applications under a SOCOM Phase III SBIR contract, and for airborne applications under another Phase III SBIR effort with a major supplier of unmanned aerial systems** (with a market value of over $2B on the NASDAQ). **Phase III contracts obtained to date are worth over $4M.**



Inertial Navigation System



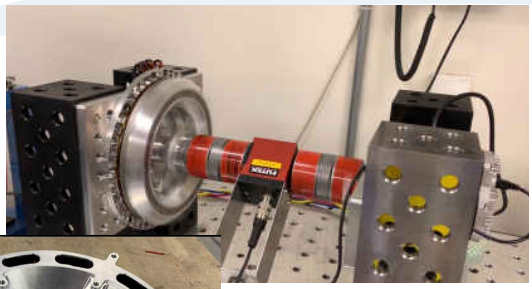
Under an Army SBIR Phase I, II, and III program, Toyon developed and produced the world's first navigation-grade inertial measurement unit based on micro-electro-mechanical systems technology. Toyon designed and developed the electronics and software and invented advanced calibration and systems identification algorithms that allow the inertial sensor to self-calibrate in the field. **Toyon is currently in the process of negotiating the licensing of the electronics, software, and algorithms for this technology with a major U.S. company** (over $7B in annual revenues and a market value of over $92B on the NASDAQ). The very small size of the system, along with navigation-grade performance, makes it very attractive for virtually any platform and mission that requires an inertial sensor for navigation. **Phase III funding received so far is in excess of $8M.**

MAUI (Modular Autonomy Incubator)

Toyon's MAUI– a scalable reinforcement learning framework that supports AI training within high-fidelity battlespace simulator, is the product of a recently completed Phase II SBIR program out of the Naval Air Warfare Center Aircraft Division. Moving into a **$1 M Phase III**, Toyon will be delivering a modeling and simulation environment and analysis toolbox to support testing and evaluation of the F/A-18 operational flight program by PMA-265, Boeing St Louis (F/A-18 Prime Contractor), and the Advanced Weapons Lab China Lake.

Torque-Dense Electric Motor

Under an Army SBIR program, Toyon developed a revolutionary electric motor design that provides twice the torque density per pound than the state-of-the-art in current electric motor technology. This motor design will enable lighter-weight systems with more available power. This technology is directly relevant to electric cars and manned and unmanned airborne platforms. **Toyon is seeking venture capital for this patent-pending technology that will be the basis of Toyon's next spinoff in the near future.**



Track-to-Track Fusion

Developed under a NAVIR SBIR program Toyon has developed algorithms and software for automating the process of fusing and analyzing data from surveillance and tracking systems. The algorithms, software, and analysis tools enhanced on the SBIR effort are currently being used by the Navy to support large surveillance and tracking programs. **Phase III contracts derived from this topic are worth over $20M in revenue.**

ONGOING INNOVATION

Thanks to the availability of SBIR programs, Toyon has created a track record of success in demonstrating innovation, generating ongoing employment opportunities, and supporting the government in defense systems.

To learn more about the work we do, please visit TOYON.COM.

Stottler Henke

Smarter Software Solutions

Through the SBIR program Stottler Henke has

- Developed Unique Capabilities for solving the most difficult problems
- Greatly aided the Capabilities and Efficiencies of the US Government and Commercial Industry

Satellite Control Network Command and Control

The Air Force had a serious problem. The archaic command and control (C2) system for the Satellite Control Network (used to maintain the health of many billions of dollars of in-space satellites) was failing. They had already wasted $750M in 9 previous failed attempts to replace it. Only Stottler Henke was able to develop the required globally-distributed, real-time, tactical, C2 system required, at a cost of less than $25M using technology funded by the SBIR program.

Boeing 787 Dreamliner Assembly and other Operations

Boeing uses Stottler Henke technology developed under the SBIR program to most efficiently schedule the assembly of the 787 Dreamliner production lines (a $20B annual operation) and 60 other operations areas. After a worldwide search and evaluation, Boeing determined that Stottler Henke's technology was uniquely qualified and simply the best. This technology improves Boeing's efficiency and improves its competitiveness against its foreign competitors.

Massachusetts General Hospital

Massachusetts General Hospital uses Stottler Henke SBIR-funded technology to schedule clinical rotations, on-call shifts, and clinic hours for its medical residency program. The software solution has reduced the time and effort needed to generate efficient schedules that support the hospital's complex staffing needs and comply with complex and changing rules and constraints, improving the efficiency of health care and training.

Helicopter Cockpit Operations Training

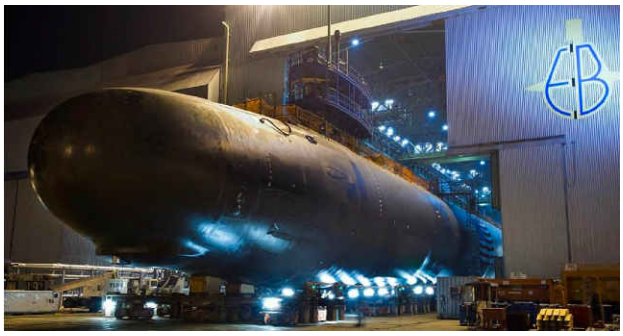
Stottler Henke's SBIR funded technology provides desktop anywhere / anytime MH-60S & MH-60R helicopter crew training to the US Navy. "The trainer has already saved the government millions of dollars…," said Navy LCDR Sal Rafanello, Training Systems Integrated Product Team leader for the MH-60. The trainer is used by all US Navy helicopter training squadrons, used by many fleet squadrons both on land and at sea, thus improving defense readiness. The trainer has received over $15 million in non-SBIR follow-on funding.

Space Shuttle Scheduling

With our first Phase II SBIR we completely developed and fielded a system to automatically schedule Space Shuttle Processing and launch preparations, and automatically set Shuttle launch dates. The system was used by NASA for 18 years, only being retired when the entire Shuttle Fleet was, in 2011. The $375K Phase II SBIR has saved NASA 1000s of an hours and many millions of dollars and provided a capability that they did not have before, since the automatic capability had a much quicker turnaround time than the human expert schedulers. NASA also benefited by more efficient launch operations.

Submarine Acoustic Analysis Trainer

One of the US Navy's most important tasks is keeping track of our adversaries' submarines. Human expert acoustic signal analysts monitor acoustic data to detect and classify underwater sources. Stottler Henke developed with SBIR funds for the U. S. Navy an Acoustic Analysis Intelligent Tutoring System (AAITS) which enables students to practice the detection and classification of sources of underwater acoustic signals and receive automatic feedback. It is fielded at a dozen locations. This improved training leads to improved performance of this task vital to national security.



Submarine Construction Scheduling

Stottler Henke's SBIR-funded technology is being leveraged and enhanced by General Dynamics Electric Boat (GDEB) for the scheduling of submarine construction. The AI-based system streamline's GDEB's large-scale production scheduling, saving both project management labor and construction labor. The result is a dynamic schedule that adapts to real-time production variability, as well as the injection of unexpected new work. This allows GDEB to maximize production speed while minimizing cost, providing important capabilities to this nation's defense as efficiently as possible.

Tactical Mission Planning

Stottler Henke developed the Visualization Planning Execution and Review (ViPER) system for carrier air wings (ViPER-CVW), initially under an SBIR. Now ViPER-CVW has been incorporated into the Joint Mission Planning System (JMPS) program of record and is used operationally to more efficiently generate improved Navy air mission plans. A version was also created and fielded on board all US submarines to improve their mission planning process. Both versions improve national defense readiness.

Advanced Intelligent Scheduling

Aurora is the most advanced Intelligent Planning and Scheduling Solution available on the market today. It utilizes advanced artificial intelligence to tackle scheduling problems with complex constraints by incorporating the judgment and experience of expert human schedulers. Originally developed for NASA, Aurora is particularly effective when applied to large projects with complex constraints and resource requirements, often being the only solution applicable. In fact, in dozens of independent evaluations, Aurora has outperformed every competitor every time. Aurora is literally undefeated. Total follow-on sales of Aurora are over $40M.

Delivering Scientific Research that Advances our National Interest

Example Outcomes of SBIR/STTR Funding

Nanohmics uses applied science with innovative engineering to deliver smarter system solutions

Significantly Improved identification of our nation's highest-value targets Our real-time image correction solution is integrated into Raytheon's Multi-Functional Targeting system (MTS). It increased targeting accuracy and stand-off range, which has significantly improved the overall platform mission effectiveness and established Nanohmics as a high-value transition partner. Nanohmics has delivered 44 units with active orders pending. The MTS is a multi-million-dollar imaging system with 4,000+ units in operation on 20+ platforms. $2.5 million non-SBIR follow-on funding to date.

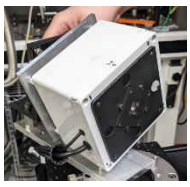
Protecting deployed warfighters against drinking water contamination Production delivery and fielding of our water toxicity instruments to the US Army. Nanohmics has passed delivered over 100 production units which are fielded worldwide and supplied units with over 10,000 consumable test chips. Useful for industrial wastewater effluent testing market, which currently relies on in-lab observation of whole organisms.

Growing the economy with venture-funded spinouts Faradox Energy Storage Devices raised $1.2M in venture funding that multiplies the government investment to improve the efficient use of energy.

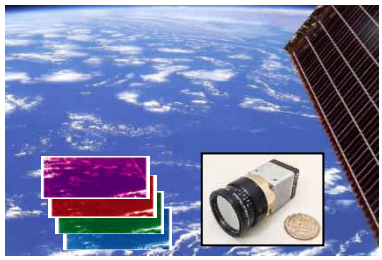
Improving navigation for high-altitude parachute jumpers Nanohmics has Fielded the GlideLine™ Systems with thousands of military users and was recently sold to Complete Parachute Solutions (CPS).

Protecting ground vehicles from guided missiles We have delivered live fire and field tested our Fast Repeater Halo laser threat sensor system for BAE System's RAVEN Active Protection System (APS) we anticipate $1.5M follow-on funding for the laser sensing and incoming missile sensor system. BAE has further interest in collaboration on several other defense-related technologies.

Countering High Energy Laser (HEL) Weapons The Argus™ counter-directed energy weapon (C-DEW) system geolocates laser threats for attack and counterfire. Working with Danbury Mission Technology: (Formerly Goodrich-Collins Aerospace), we have completed field testing and anticipate the incorporation of the technology by the US Army C5ISR command on air-launched effects (ALE) and small drones.

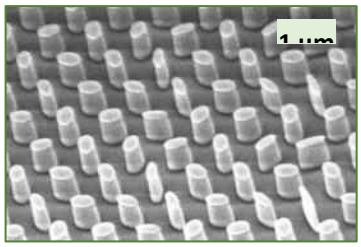


Conducting spectral Imaging experiments from Space With NASA, our revolutionary spectral sensor has been launched to the International Space Station for earth observation experiments and is poised to improve navigation performance and safety of autonomous vehicles.



Laser eye protection for Navy Pilots in the Pacific Working with Raytheon Missiles and Defense, Nanohmics anticipates a potential $3M OSD-funded collaboration to provide a laser warning system to pacific command pilots for eye safety.

Development of transformational next-gen meta-optics Nanohmics has collaborated with both DARPA and NASA to advance the science and application of a new generation of lightweight nano-scale optics that focus light and enable very low size, weight, and Power (SWaP) spectral dispersion for hyperspectral sensing, optical communications, and many other future applications that maintain or countries leadership in both commercial and defense-related optics.



Enabling over-the-horizon comms and navigation in GPS Denied Environments Nanohmics has developed very compact long wavelength antennas which are of interest to L3 Harris and Lockheed Martin (LM). We are currently collaborating with LM-Missiles and Fire Control to transition our gun launchable accelerometer/IMU.

SBIR/STTR research has generated patents in 15 technology areas with patents pending in 18 other areas.

NANOHMICS INC.
6201 E. Oltorf St.
Austin, TX 78741
www.nanohmics.com
T 512-389-9990
F 512-389-9850
info@nanohmics.com