

Mission Systems Sector Division Reference Guide

Northrop Grumman Today

Leading global security company

\$33.8 billion sales in 2019

– 85% U.S. / 15% International

\$64.8 billion total backlog

(as of December 31, 2019)

~90,000 employees

Leading capabilities in:

- Autonomous Systems
- Cyber
- C4ISR
- Space
- Strike
- Logistics and Modernization

Focus on Growth and Performance



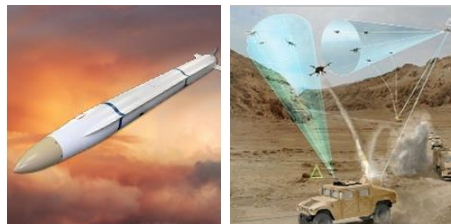
Four Operating Sectors at a Glance

Aeronautics Systems



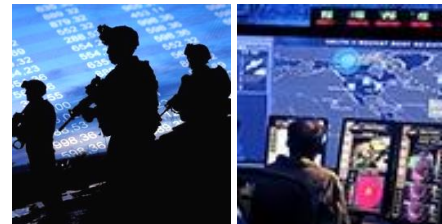
- Autonomous Systems
- Aerospace Structures
- Advanced Technologies and Concepts
- Aircraft Design, Integration and Manufacturing
- Long-range Strike
- Multi-Domain Integration and Operations
- Intelligence, Surveillance and Reconnaissance
- Battle Management

Defense Systems



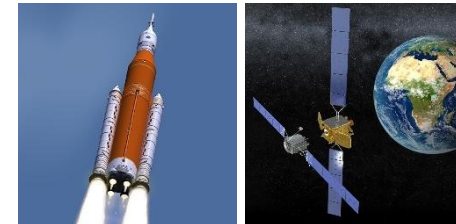
- Integrated Air & Missile Defense
- Defensive Cyber and Information Operations
- Platform Modernization and Fleet Operations Support
- Advanced Weapons
- Precision Munitions
- Software Systems Modernization and Sustainment
- All-domain C4I
- Propulsion Systems

Mission Systems



- Airborne Sensors and Networks
- Artificial Intelligence/Machine Learning
- Cyber and Intelligence Mission Solutions
- Navigation, Targeting and Survivability
- Maritime/Land Systems and Sensors
- Engineering & Sciences
- Emerging Concepts Development
- Multi-domain C2
- Agile/DevSecOps Systems

Space Systems









- Launch Vehicles
- Propulsion Systems
- Commercial Satellites
- Military and Civil Space Systems
- Science and National Security Satellites
- Human Space and Advanced Systems
- Space Components
- Missile Defense
- Space Exploration
- Space ISR Systems

Mission Systems Sector Locations



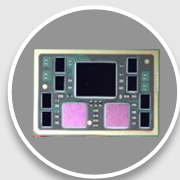
Mapped out are the locations of major Mission Systems campuses and facilities, as well as the sector's international subsidiaries.

Northrop Grumman Mission Systems

AIRBORNE SENSORS & NETWORKS	CYBER & INTELLIGENCE MISSION SOLUTIONS	MARITIME/LAND SYSTEMS & SENSORS	NAVIGATION, TARGETING & SURVIVABILITY	EMERGING CAPABILITIES DEVELOPMENT	MISSION SYSTEMS EUROPE
					
SUMMARY					
Airborne C4ISR&T capabilities with a focus on networked multi-function sensors and integrated mission systems.	End-to-end hardware, software and cyber solutions supporting critical intelligence and defense missions for our nation and allies.	Advanced multi-mission capabilities for surface ships, submarines, unmanned maritime platforms, and ground-based radar systems.	Trusted provider of critical capabilities for assured operations, precision engagement, and aircraft survivability.	Development, maturation and deployment of key technology capabilities and mission concepts to drive winning mission and business solutions.	Capabilities across defense, national security and commercial markets. Focused in cyber and intelligence, C2, naval systems, avionics, navigation and positioning and postal sorting equipment.
KEY PROGRAMS					
<ul style="list-style-type: none"> • Next Gen Jammer-Low Band • E-18G Growler Block II • F-22 & F-35 • APG-83 SABR • LONGBOW Apache • Freedom Radio Product Line • JCREW • BACN 	<ul style="list-style-type: none"> • Unified Platform • TUSCAN programs • Triton Ground Systems • Systems Secure Processor • MAVEN 	<ul style="list-style-type: none"> • Virginia Class • Columbia Class • SEWIP B3 • AN/TPS-80 G/ATOR • AQS-24B/C • IBNS • LCS DEPS • Restricted Programs 	<ul style="list-style-type: none"> • LAIRCM • APR-39 D(V)2 • Cockpit Upgrades • LITENING • INS / IMU 	<ul style="list-style-type: none"> • Digital RF • Digital EOIR • Edge Processing • Advanced PNT • AI/ML • Multi-domain Solutions 	
KEY CUSTOMERS					
US Navy, US Air Force, US Army, US Marine Corps, US National Guard, International, Classified	DoD, US Air Force, US Army, US Navy, USDI, USCYBERCOM, Intelligence Community, Classified	US Navy, US Coast Guard, US Marine Corps, US Army, Classified, International	US Air Force, US Coast Guard, US Marine Corps, Classified, International	DARPA, US Air Force, US Navy, US Army, MDA, Intelligence Community, Classified	UK Government, Airbus, Leonardo, BAE Systems, International

Emerging Capabilities Development

MULTIFUNCTION SYSTEMS



CORE CAPABILITIES

- Digital RF
- Digital EOIR
- Advanced Electronics
- Comms & Networking
- Multifunction Systems

KEY PROGRAMS

- ACT (IV-V)
- MIDAS
- Small Wonder
- Pebble Beach (Transition)
- Bears (Transition)
- Vigilant Chase

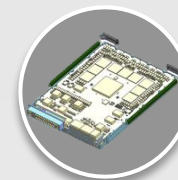
INTELLIGENT MISSION CAPABILITIES & FOUNDRY



- AI/ML
- Next-Gen Modes
- Advanced PNT
- Resilient C3
- Multidomain Solutions
- Foundry

- Offset
- Alpha Bravo
- Thunderhawk
- Sargent
- Hunter (Transition)
- ATL/Foundry

CAPABILITY MATURATION & DEPLOYMENT



- Digital RF
- Digital EOIR
- Edge Processing
- Tech Asset Store

- Nighthawk
- DATE
- DECA
- EMW Suite
- IR Camera Core

Northrop Grumman Mission Systems Technology Focus Areas

ADVANCED MANUFACTURING



DIGITAL THREAD & ADVANCED OPERATIONS



EO/IR & OPTICS



RADAR, SIGNAL PROCESSING, AND PNT



MARITIME APPLICATIONS



EMERGING CAPABILITIES



SUMMARY

Explore advanced circuit designs, novel semi conductors and devices, new approaches for surface treatments and improved interfaces.

Provide agile manufacturing capabilities through developing novel materials, processing parameters, specs, and design guides to leverage additive manufacturing on structures, electronics, ground systems, and manufacturing tools/aids.

Northrop Grumman is evolving its digital culture to harness integrated digital technologies to deliver solutions with the speed, agility, and affordability that our customer's require.

Provide a structured process for integrating and linking requirements, schedule, decision milestones, and verification enabling the product team to work as a single integrated team.

From surface to space, Northrop Grumman's electro-optical/infrared (EO/IR) sensors harness the power of light to give warfighters a 24/7 view of the battlespace and the ability to deliver effects with unprecedented precision.

Air EO/IR: passive image sensors use visible and infrared spectral bands to provide spherical situational awareness, long-range precision targeting and protection from infrared guided missiles

Capabilities with a focus on networked multi-function sensors and integrated mission systems. C4ISR&T, advanced multi-mission capabilities, submarines, unmanned platforms, and ground-based radar systems.

Trusted provider of critical capabilities for assured operations, precision engagement, and aircraft survivability.

We are a world leader in the design, development and production of naval systems. From sonar that can map the deepest depths of the ocean to anti-submarine systems and advanced electronic warfare, we're constantly evolving to counter increasingly sophisticated threats at sea.

Advanced multi-mission capabilities for surface ships, submarines, unmanned maritime platforms, and ground-based radar systems.

Aims to drive growth through maturation and development of forward-leaning solutions and products, transition of advanced capabilities, and acceleration of technological business relationships.

Technologies that enable significant reductions in the prime power required for a given level of computing that also fit within the same or smaller volume

Broad based interest of free space quantum sensing, quantum information process algorithms, and quantum simulation

Northrop Grumman Mission Systems Collaboration Opportunities



	Technology Areas
Digital Transformation	AR/VR for manufacturing and supply chain, state of the art training for factory, operational efficiency tools
Advanced Manufacturing	Industry 4.0: Advanced vision automated inspection, flexible robotics, AI/ML in manufacturing, modelling and simulation for manufacturing Electronics: Advanced semiconductor packaging, RF filters Additive Manufacturing: 3D printed electronics, high speed precision measurement, ceramics, high strength aluminum
Materials Development	General: Environmental coatings, underfill for high reliability electronics, microwave magnetic materials, electronic cleaning chemicals, thermal management materials Hypersonics: High temperature composites, thermal barrier coatings, thermal management materials (endothermic cooling)
Photonics	Fiber optic transceivers, photonic integrated circuits, LiDAR, avalanche photo detectors (APDs), Geiger mode APDs
EO/IR	Focal plane arrays, infrared detectors, DROICs, mercury cadmium telluride (MCT) fabrication, type II strained-layer superlattice (T2SLS)



SBIR: A method for starting your collaboration

Small Business Innovation Research (SBIR) Strategy

Bottom Line Up Front



SBIR

Federal agencies with extramural R&D budgets exceeding \$100 million are required to obligate a minimum of 3.2% of their extramural R&D budgets for SBIR awards each year.



NCTA

Non-Contract Technical Authority.
Internally funded activities for technology development to support Northrop Grumman's Roadmaps & Pursuits.



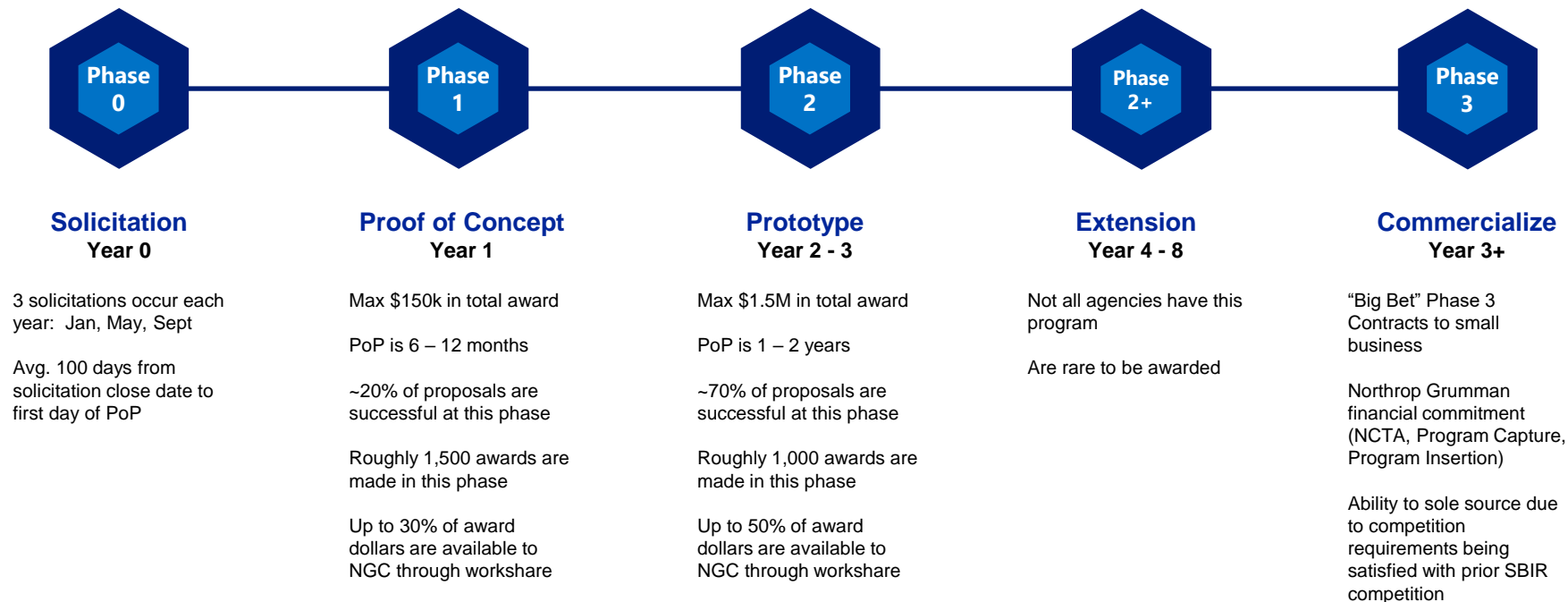
CRAD

Customer Research and Development.
Funded Activities through program of record contracts to develop technologies for capability & capacity.

Bottom Line Up Front

Small Business Innovative Research (SBIR) contracts represent a major investment in future technologies by our largest customers. Funding is obtainable through our small business & startup community to support Northrop Grumman's technology integration strategy for the technologies of the future. When our customer performs an investment Northrop Grumman wants to continue to grow the investment.

SBIR Fast Facts



Value Proposition

Four Key Values

R&D Funding

Investment in technologies important to Northrop Grumman



Customer Insight

Rapid alignment of supplier to Northrop Grumman teams to support needs of the Warfighter.

Technology Scouting

SBIR topics represent a leading indicator of the technologies of the future



Supplier Intimacy

Enables us to perform risk assessment of small businesses before they are a supplier

Value Proposition

SBIR is an alternate funding stream for R&D that does not impact NCTA or CRAD and SBIR promises to bring Northrop Grumman incredible value along several dimensions ranging from customer relations and business development to engineering and operations. Our customers are telling us what technologies they want, the suppliers they value, and providing the funding to pursue them.

Internal Alignment Opportunities

Achieving the Values

R&D Funding



NCTA Planning

- Use strategically to extend Northrop Grumman's NCTA funds on technology needs to support the Warfighter.
- Engage greater technical community to better shape future R&D Focus Areas

Customer Insight



Business Development

- Each division to engage directly with customer
- Early knowledge of customer needs and wants

Technology Scouting



Technology Campaigns

- Align technology gaps to support campaign roadmaps with funding to Campaign SMEs
- Identification of technology trends being funded
- Early engagement to startup community
- NG Pitch Events

Supplier Intimacy



Global Supply Chain

- Identify non-traditional defense contractors for OTAs
- Risk reduction for small business suppliers
- Creating Database for quick access for proposals

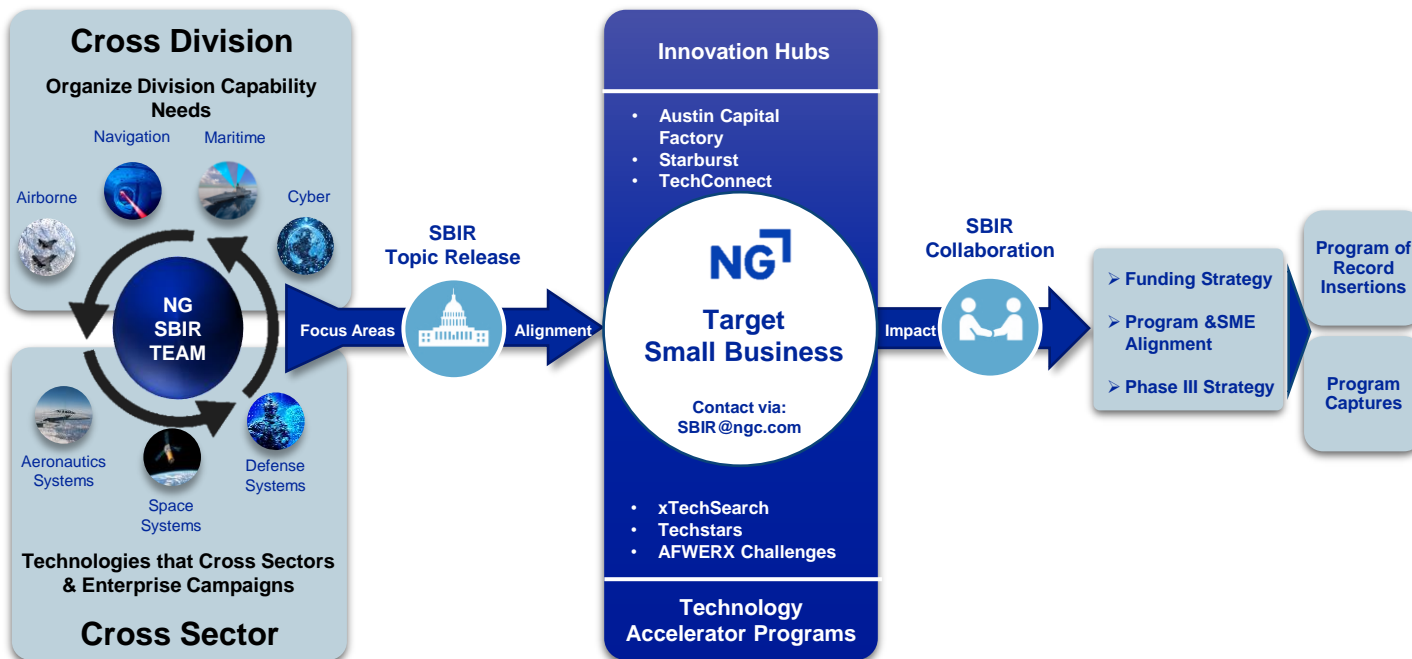
Alignment Opportunities

Achieving the full value of SBIR requires action across the entire Northrop Grumman Enterprise including program offices, engineering, manufacturing and supply chain organizations. Northrop Grumman offers a variety of different paths for collaboration due to the diversity of technical and operational capabilities across the company.



Engagement Strategy

NGMS SBIR OV-1 Process



Innovation Hubs & Accelerator Programs

- Continue our customers investments
- Alignment to Portfolio Companies Northrop Grumman collaborates with and offers mentorship services
- Early collaboration is critical

Enabling vs Discriminating Technology Values

- Technology aligns to our current and future program needs versus 5+ year roadmap
- Support our capture teams both technically and business needs (non-traditional, socioeconomic)

External Process to Engage Northrop Grumman

How to Begin Your Technology Insertion

Northrop Grumman establishing process for SBIR company engagement and increased enterprise awareness for small business technology integration.



Technology Alignment

Contact us via SBIR@ngc.com to schedule a meeting.

Learn more about our process by visiting us at:
http://www2.northropgrumman.com/suppliers/Pages/SBIR_STTR.aspx



Collaboration Strategy

Understand what Sector & Division would value your technology prior to engagement.

Know the level of collaboration requesting from Northrop Grumman for a rapid technology insertion (Phase III).



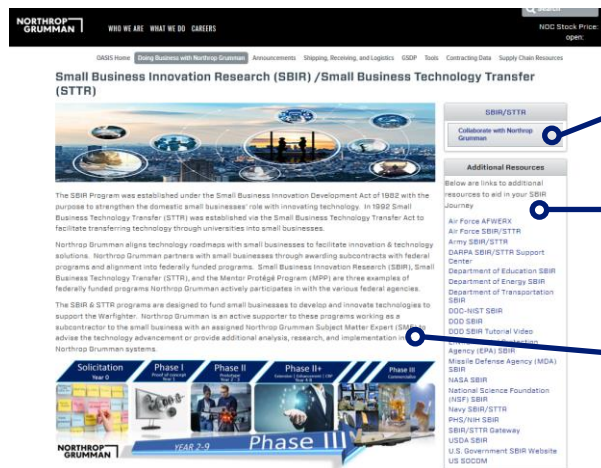
The Outcome

A joint strategy of how your business and Northrop Grumman will be able to work together towards a Phase III strategy.

Requirements for Effective Collaboration Discussion

1. Northrop Grumman Sector & Division Alignment
2. Any Prior NG Points of Contact
3. Current TRL / MRL
4. Vision for Collaboration
5. Are you a Non-Traditional
6. Do you retain any Socio-Economic Status
7. Any prior SBIR or DoD experience examples
8. Early Engagement after SBIR award

Northrop Grumman Web Presence



Option for small businesses to connect directly with the Northrop Grumman. Sector shared email: SBIR@NGC.com



Quick hyperlinks to key SBIR stakeholders



Background information available to public on how to engage with Northrop Grumman and important information on SBIR

Future Updates

- Quarterly emails with SBIR topics of interest
- Post SBIR topics of interest to NG
- Post SBIR technologies of interest to NG

NORTHROP
GRUMMAN

The logo graphic consists of a thick horizontal line extending from the end of the word "NORTHROP" to the right, and a thick vertical line extending downwards from the end of the word "GRUMMAN" to the right, forming an L-shape.