NORTHROP GRUMMAN

DEFINING THE FUTURE

Navigation Systems Division

Overview

Navigation Systems Division (NSD) provides situational awareness electronic systems and products for defense, civil, and commercial markets.

NSD offers inertial navigation systems, with and without embedded GPS, Identification Friend or Foe (IFF) systems, Fiber Optic Acoustic Systems (FOAS), integrated avionics and vetronics systems, and logistic support products and services.

NSD is part of the Electronic Systems sector of Northrop Grumman Corporation. Its headquarters is located in Woodland Hills, California with domestic operations in Salt Lake City, Utah and Canton, Massachusetts. NSD global subsidiaries include: LITEF in Freiburg, Germany and LITAL in Pomezia, Italy.

NSD's primary customers include the military services of the Department of Defense, U.S. government defense related agencies, selected foreign governments, and U.S. and international aerospace and defense companies. NSD products and subsystems are deployed worldwide in a range of applications for space, air, land, sea and undersea.

Selected platforms NSD supports include: EADS Eurofighter, Tornado fighter, E-3 AWACS surveillance, command and control aircraft, P-3C Orion surveillance aircraft, F-15, F-16 and F/A-18 tactical aircraft, C-17 and C-130 cargo aircraft, NH90, MH-60, AH-64D Longbow Apache, AH-1Z SuperCobra, UH-1Y Huey and Tiger helicopters, and a world wide variety of unmanned vehicles, missiles, and torpedos.

Listed below are other platforms in production or development on which NSD products and subsystems are installed or are targeted to be installed:

ON LAND - Future Combat Systems, Stryker armored vehicles, Light Armored Vehicles, M-1 Abrams Main Battle Tank, Bradley Fighting Vehicles, light assault vehicles, HMMWV, and a range of international land platforms.

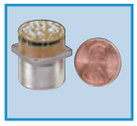
AT SEA - The Virginia and Seawolf class attack submarines, Expeditionary Fighting Vehicle, DDG-51 Arleigh Burke class destroyer, Advance Seal Delivery System, torpedoes, and mine hunting vessels.

IN THE AIR - Many U.S. Air Force/ U.S. Navy aircraft platforms including the A-10, B-1B, B-2, B-52, C-130, E-3, F-111G, F117A, F-15, F-16, KC-10A, KC-135, OA-10A, E-2, C-17, Global Hawk, Predator, FA-18, MH-60, AH-1Z, UH-1Y, and Cruise Missile. Our products are also on the Korea Aerospace Industries T-50 and A-50.

IN SPACE - The U.S. Air Force Titan II Missile, U.S. Navy Trident missile, Cassini, Deep Impact and Messenger spacecraft, Mars Rover, Payload Launch Vehicle rocket, Atlas V, and Space Based Infrared System, as well as, the National Missile Defense and Terminal High Altitude Area Defense programs.

Many of the products that we provide to the military also have civil and commercial applications. They include Airbus A310/A319/A320/A321/A330/ A340/A380, Iluyshin 96M, TU 204 and Saab 2000 aircraft.

Navigation and Positioning Systems


NSD's navigation and positioning systems provide location and direction information of satellites, fixed-and rotary-winged aircraft, missiles, ships, land vehicles and underwater vehicles.

NSD offers the broadest portfolio of inertial sensor technologies, and is a world leader in fiber optic gyroscope technology. Some applications of NSD inertial technology include:

- Standard Carrier Aircraft Inertial Navigation Systems (CAINS) for U.S. Navy F/A-18, AV-8B, S-3B, F-14 and E-2C
- Scalable Space Inertial Reference Units (SSIRU) in Aura satellite, Messenger spacecraft, ESA Herschel Space Observatory
- G-2000 gyros for the MAGU North Finding System
- LN-200S that helped land and direct the Mars Exploratory Rovers
- LN-100/LN-100G in service for the U.S. Air Force, U.S. Navy, U.S. Army, U.S. Marine Corps, and U.S. Coast Guard, and more than 70 international and domestic customers
- LISA-200 for UH-60 helicopter
- LTN-101E fiber optic gyro inertial unit selected for A380 and other Airbus aircraft
- LN-120G used in the RC-135
- LN-200 for high performance pointing in service on various domestic and international programs
- LN-270 used on all classes of ground-based military vehicles



Integrated Avionics and Vetronics Systems


Integrated avionics system programs include the development of a variety of helicopter and fixed-wing applications. These systems integrate communications, navigation, sensors, digital maps and mission planning capabilities. NSD's integrated avionics systems include:

- C-17 avionics
- Tactical cockpit for the E-2C
- Eurofighter and Tornado
- AH-IZ/UH-IY
- SH-60 Seahawk platforms

Integrated vetronics systems that NSD is capable of integrating into combat and tactical wheeled vehicles include mission computers, navigation, day / night vision, multi-function displays, targeting, defensive aids, communication and vehicle health monitoring.

Identification Friend or Foe (IFF)


NSD's IFF systems provide for situational awareness and threat identification. Applications include:

- The AN/APX-121(V) Mode S/ Mode 5 transponder that meets the latest military and civil mandates
- AN/UPX-39 supports the U.S. Air Force Atmospheric Early Warning System
- AN/UPX-24 shipboard IFF interrogator application identifies aircraft for naval shipboard use
- The AN/APX-101 IFF transponder is installed on more than 12,000 aircraft and ships
- The AN/PPX-3B IFF interrogator set has been proven with Stinger, Avenger, SA-7, RBS-70, Chaparral and Redeye missiles

Fiber Optic Sensors and Fiber Optic Acoustic System (FOAS)

NSD applies its Fiber Optic Acoustic System (FOAS) technology to the Light Weight Wide Aperture Array (LWWAA) sonar system currently being installed on Virginia class submarines.

FOAS technology is also being developed for towed arrays for Los Angeles and Virginia class fast attack submarines.

In addition, NSD'S advanced development programs address the shallow and deep-water undersea surveillance requirements and the U.S. Navy's Integrated Undersea Surveillance System requirements as well as systems for unmanned underwater vehicles and unmanned surface vehicles.

FOAS technology is central to NSD's ongoing effort to address the homeland security of U.S. Maritime ports.

Logistic Support Products and Services

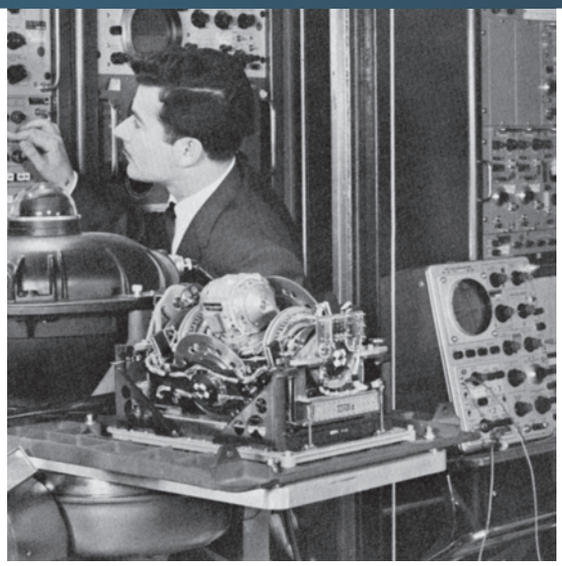
NSD products are supported by Northrop Grumman Corporation's worldwide service network. Our service technicians have an average of 17 years of experience repairing advanced and high technology electronic equipment. Northrop Grumman's field engineering team is ready to provide on-site assistance.

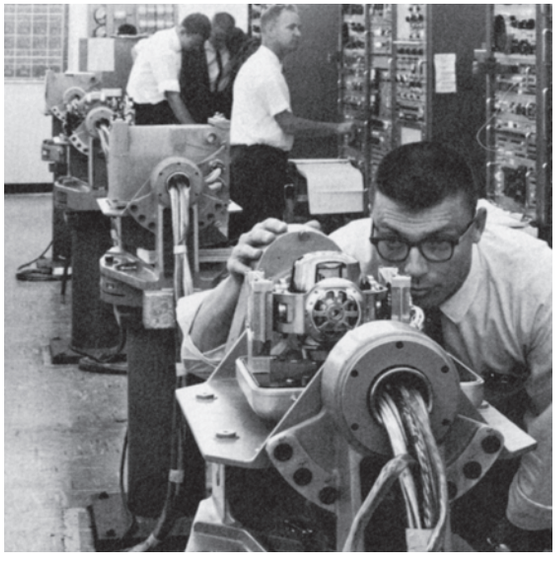
NSD has worldwide support and service centers that combine high quality repairs with rapid turnaround times.

Inertial Systems History

NSD inertial system development dates back to 1954 when Litton Industries committed substantial funds and scientific and engineering talent to internal independent research and development programs involving digital and inertial research investigations. Successes resulting from this research include:

- The first Inertial Navigation System (INS) to be delivered for an operational aircraft (P-3 Orion)
- The first INS to be adapted for an international application (F-104 Starfighter for NATO)
- A C-135 (equivalent to the civilian B-707) flew over the North Pole, demonstrating navigation in a region known to defy conventional navigation methods. The navigation system blended celestial, inertial and Doppler radar technologies
- The world's first production contract for a tactical aircraft production INS, with more than 4,500 systems produced for the U.S. Air Force F-4 Phantom
- The first practical application of INS technology for land navigation and surveying with the Position and Azimuth Determining System
- The first INS selected by the U.S. Army (OV-1D Mohawk)
- The first standardized multi-aircraft INS developed for the U.S. Navy
- The first non-gimbaled (strapdown) attitude and heading reference system adopted for an operational aircraft (AH-64 Apache)
- A second North Pole flight, this time with an inertial system using a ring laser gyro, not mechanical gimbals or a rotating gyro
- The first standardized INS for a U.S. Air Force aircraft
- The first production embedded GPS/INS production system
- The first tactical grade fiber optic gyroscope inertial measurement unit
- The first navigation grade fiber optic inertial navigation system





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