

Technology Transfer
Naval Air Warfare Center
Aircraft Division

Patent Portfolio



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NAVAIR'S ROLE IN NAVAL AVIATION IS . . .

- . . . To develop, acquire, and support aircraft and related systems which can be operated and sustained at sea
- . . . To work with industry on behalf of the United States Navy to deliver products and services to the sailor and marine



Comparative Scaling

USS George Washington (CVN-73)
overlaid on typical airfield runway
(12,000 ft x 150 ft)

Our Capabilities Support the Unique Mission of Naval Aviation

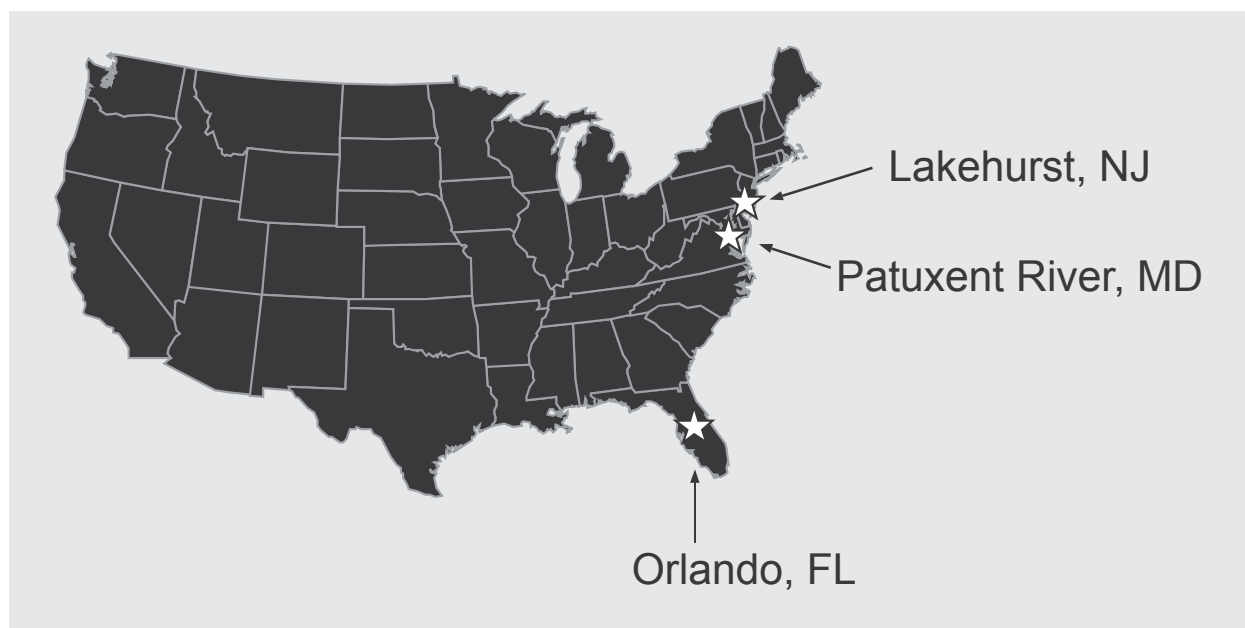


MISSION AND LOCATIONS

Mission

“To be the Navy’s principal research, development/test, evaluation, engineering, and fleet support activity for Naval aircraft, engines, avionics, aircraft support systems and ship/shore/air operations. This mission includes: research and development of manned and unmanned air vehicles, air vehicle propulsion systems, including air Anti Submarine Warfare (ASW) systems, core and mission-unique avionics airborne surveillance systems, aircraft launch and recovery systems, aviation support equipment, and related functions such as aircraft modeling and analysis and aircraft active and passive signatures; systems integration of all air platform subsystems; conduct of test and evaluation for these same aircraft, propulsion, avionics, and support systems, as well as aircraft electronics warfare throughout the spectrum of the life cycle to ensure successful operational performance; maintain aircraft test and evaluation ranges; assure an effective transition to production, including manufacturing production support and pilot/emergency production, to maintain a response industrial base; and perform in-service engineering of aircraft, avionics, and launch/recovery systems; direct the operations of the Naval Air Warfare Center Aircraft Division (NAWCAD) and its subordinate activities.”

NAWC Locations



CURRENT RESEARCH INTERESTS

The Naval Air Warfare Center, Aircraft Division is the full spectrum research, development, test and evaluation (RDT&E), engineering, and fleet support center for air platforms. The product test areas include aircraft systems (manned and unmanned), airborne technology, propulsion, flight test and engineering, avionics design and production, human systems and aircraft-platform interface.

The most important assets are the more than 10,000 scientists and engineers (S&E's) and technicians and 15,000 acres and 7,400 square miles of test ranges supporting the RDT&E facilities. Our unique capabilities and state-of-the-art facilities are unmatched in the world. NAWCAD is located at Patuxent River, Maryland (65 miles south, southeast of Washington, DC).

Expert technical cooperation is needed in various technical areas such as Physics, Chemistry, Mathematics, Electronics, Aerodynamics, Material Science & Engineering (software, hardware, processing, etc.).

Various state-of-the-art technologies of the NAWCAD are as follows:

Acoustic Science and Technology:

Ocean acoustics, physical oceanography, active and passive sonar technology, sonar processing technology, acoustic and non-acoustic sensors, microwave radar, bluegreen laser radar, and transduction material technology.

Advanced Aircraft Materials:

Materials science & engineering, hybrid materials, light weight high strength alloys, processing science, fatigue and fracture, structure design optimization, polymer, metal and ceramic matrix-composites, intermetallics, refractory metal alloys and coatings, corrosion inhibitors, environmental/surface interactions in adhesives, sealants, elastomers, electronic materials, lubricants, non-destructive testing (for structural integrity and stealthiness), polymer chemistry, composite repair technologies, and development of smart skins and smart structures.

Advanced Processors/Computer Systems Technology:

RISC and parallel computer architecture, data fusion, information storage (optical disks, semiconductor and ferroelectric memories, magnetic media, advanced recorders) Artificial Intelligence, Neural Network Systems, real-time telemetry processing, symbolic computer algebra/mathematics, tools for logistic planning, flight operations aircraft servicing and reporting systems, and object oriented systems.

Aircraft Controls and Displays:

Helmet mounted displays, flat panel displays, including LED, LCD, electroluminescent, plasma, field emission, and vacuum fluorescent, projection displays, etc.

Aircraft Design and Performance:

Design, development and evaluation, V/STOL, RPV's, computational fluid dynamics, flight vehicle systems, digital fly-by-wire, flying qualities criteria, etc.

Avionic Systems:

Systems engineering, technology management and application in avionics, advanced concepts for avionics (developing requirements, conducting analyses), define and evaluate avionics architecture for new and upgraded aircraft (simulation and hot bench capabilities), etc.

Environmental Sensing:

Development and/or application of environmental sensors (wind velocity and direction) in support of aircraft operations.

IR detection and imaging system:

IR detection and imaging systems, signal and image processing, automatic target recognition, reconnaissance sensors, LIDAR systems, hydrographic and atmospheric measurements, lasers and countermeasure systems.

Flight Control Design and Aerospace Test and Evaluation Engineering:

Fluidic flight control, air frame dynamics and simulation, flight control system design and instrumentation, flying qualities analysis and simulation, fluidic control system design and test, conceptual design and evaluation of V/STOL, UAV, hypersonic, and tiltrotor, flight vehicle systems, flight testing techniques (instrumentation, simulation and support), aerodynamic and structural analysis, etc.

Fiber Optics communication and network technology:

High speed fiber optic components and networks, high speed links, optical switching and modulation techniques, and nonlinear optical materials and devices.

High Strength Cables and Harnesses:

Design and manufacture of cables and harnesses for aircraft flight operations and emergency landing operations at sea.

Life Support and Human Factors:

In-flight crash protection and escape systems, oxygen systems, survival and rescue equipment, emergency locator/beacon voice radios, advanced helmet mounted displays, man-machine interface in flight environment, acceleration/basic stress physiology, biochemistry in stress, and G protection techniques and devices, dynamic flight simulation, air crew visual performance, and human factor engineering.

Design for Maintainer:

Human systems integration (HSI) related limitations and constraints which challenge maintainers or impact their performance while executing maintenance tasks on naval aircraft. This includes the mitigation of in-service human performance degraders as well as addressing the design of systems early in the acquisition process. Technical solutions include new maintenance processes, training solutions, state of the art tools, work aids and protective clothing.

CURRENT RESEARCH INTERESTS CONTINUED

Manufacturing Technology:

Leading edge in product design, manufacture, quality assurance through combined computer aided design (CAD), computer aided manufacturing (CAM), computer integrated manufacturing (CIM) functions, reverse engineering, electronics assembly, cable and harness fabrication, printed circuit board fabrication, hybrid microelectronics, and stereolithography; and computer aided acquisition and logistics support.

Microwave Technology:

Solid state conformal radar, sea clutter, non-cooperative target recognition, MMIC, CAD/CIM/CAM and adaptive antennas and processing.

Systems, Software, and Computer Technologies:

Neural networks, fuzzy logic, case based reasoning, genetic algorithms, visual reality, robotics, design error systems, intelligent control, parallel processing, software technologies for signal processing, operating system software for real-time Mission Critical Computer Resources (MCCR), AI and expert systems, high-level specification languages for automatic code generation, software engineering environments, interface standards and software frameworks for integrating Computer-Assisted Software Engineering (CASE) tools, avionics architecture design and analysis, fault tolerant avionics design, etc.

Weapons System Analysis, Design, Integration:

Operations analysis as applied to weapon system modeling, effectiveness and survivability, system design, optimization, filtering, design studies to meet reliability and maintainability and cost targets.

Propulsion and Power Engineering:

Full life cycle systems engineering and integration of all elements of air-breathing aircraft propulsion and power systems, including turbo-fan, turbo-jet, turbo-prop, and turbo shaft engines; reciprocating engines; propellers, secondary power and mechanical systems; helicopter drive system; fuel and fuel systems, lubricants, and chemical analysis; electrical power, wiring, EMI, and battery systems; controls, control system integration, prognostics and diagnostics; life management, reliability, and structural integrity; engine component design, analysis, and test; blade and vane repair and analysis; fleet health metrics; altitude test; engine accessory test; noise and environmental test; rotor spin test; electrical, fuels, battery, and dynamics laboratories; requirements definition, performance monitoring, and in-service engineering.

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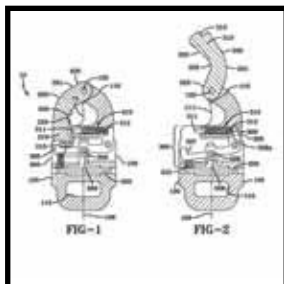
NAWCAD PATENT ABSTRACTS

Patent Number: 8,056,196

Issue Date: 15-Nov-2011

Title: Quick release fitting

Abstract: A quick release fitting including a housing assembly having a main portion and a housing arm extending from the main portion, a locking arm and a locking mechanism. The locking arm has a first locking arm end and a second locking arm end, the first locking arm is rotatably attached to the housing arm. The locking mechanism is disposed within the housing assembly, and communicates with second locking arm end such the locking arm can be locked or unlocked to the housing assembly. When locked the locking arm is secured to the housing assembly and the housing arm, the locking arm and the housing assembly form a slot, when unlocked the locking arm is not secured to the housing assembly.

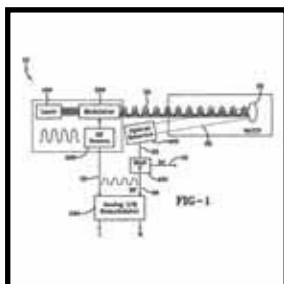


Patent Number: 8,044,999

Issue Date: 25-Oct-2011

Title: Image enhancer for detecting and identifying objects in turbid media

Abstract: An image enhancer that includes a laser for emitting an optical signal toward an object in a turbid medium, a modulator for modulating laser intensity of the optical signal, an RF source for driving the modulator and for providing a reference signal, an optical detector for detecting the modulated optical signal that is reflected from the object, the optical detector converting the reflected optical signal into an electrical signal, the electrical signal having RF and DC components, an I/Q demodulator for mixing the RF component of the electrical signal with the reference signal and producing in-phase and quadrature phase signal components that can be digitized and processed such that both contrast and range images of the object are produced.

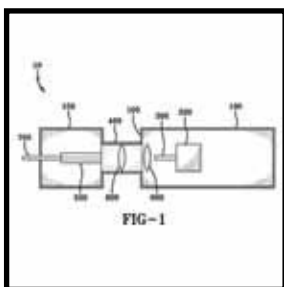


Patent Number: 8,023,784

Issue Date: 20-Sep-2011

Title: Optical subassembly package configuration

Abstract: An optical subassembly package configuration for monitoring a fiber, the configuration includes a container, an optical subassembly, an optical fiber, and a ferrule. The container has a face, and the optical subassembly is disposed within the container. The optical fiber communicates with the subassembly. The ferrule is attached to the face of the container, the fiber being monitored terminates inside the ferrule.

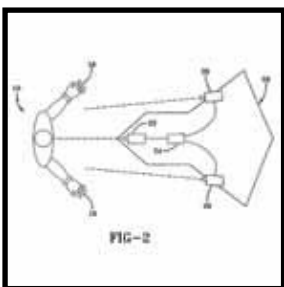


Patent Number: 8,005,257

Issue Date: 23-Aug-2011

Title: Gesture recognition apparatus and method

Abstract: A method of identifying a human gesture using a machine includes providing a time sequence of data related to the human gesture; transforming the time sequence of data into waveforms; extracting features from the waveforms; and identifying the human gesture based on the extracted features.

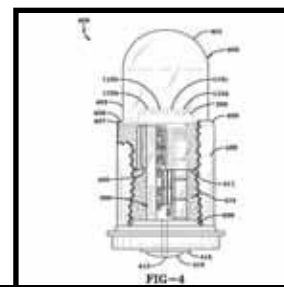


Patent Number: 8,004,216

Issue Date: 23-Aug-2011

Title: Variable intensity LED illumination system

Abstract: A variable intensity LED illumination system is configured to provide a change in luminance versus input voltage that corresponds to a desired transfer function, such as the dimming characteristics of an incandescent lamp, which more closely resembles the response of the human eye. The system also advantageously provides overvoltage protection, increased brightness, energy efficiency, and significantly better longevity and ruggedness, compared to incandescent lamps.

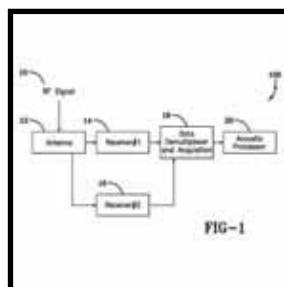


Patent Number: 7,986,585

Issue Date: 26-Jun-2011

Title: Reception of uplink data from sonobuoys

Abstract: A method for improving the bit error rate in digital transmissions of sonobuoy sensor data from a sonobuoy to a receiver platform includes computing a send checksum on a frame of sonobuoy sensor data, copying the frame of data and checksum into a plurality of subframes, delaying one of the plurality of subframes for a predetermined period, multiplexing the delayed subframe with the plurality of subframes into a transmit frame; and transmitting the transmit frame. The invention is particularly suited to improving the reception of legacy sonobuoy receivers in littoral waters where radio frequency interference and signal propagation is a severe problem.

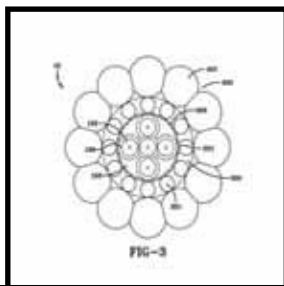


Patent Number: 7,954,410

Issue Date: 7-Jun-2011

Title: Fast rope

Abstract: A fast rope, which includes a weighted core, a first braid surrounding the core, a second braid surrounding the first braid, and a third braid surrounding the second braid. The core is constructed from lead wires extruded over a polyester yarn, the first braid is strands of polypropylene, the second braid is strands of composite press material, and the third braid is strands of spun polyester.

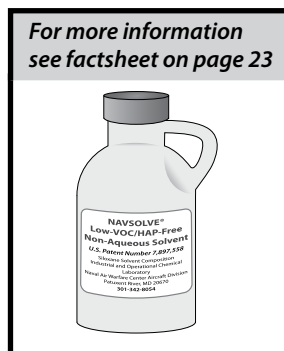


Patent Number: 7,897,558

Issue Date: 1-Mar-2011

Title: Siloxane solvent compositions (NAVSOLVE®)

Abstract: The present invention relates to non-volatile organic compositions having a VOC of about zero, a flash point above 140° F., and a vapor pressure of less than seven millimeters of mercury (7mm Hg). The non-volatile organic compositions comprise an alkylated cyclicsiloxane having 5 to 8 repeating siloxane units, an alkylated cyclicsiloxane having 3 or 4 repeating siloxane units, and at least one glycol alkyl ether.



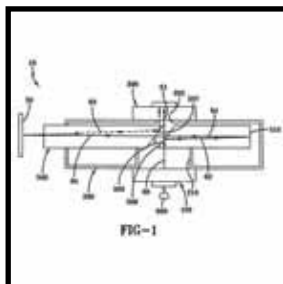
NAWCAD PATENT ABSTRACTS

Patent Number: 7,785,144

Issue Date: 14-Dec-2010

Title: Optical bench fiber optic transmitter

Abstract: The subassembly includes a laser for omitting signals towards fibers to be monitored, a passive alignment carrier, a photodetector for monitoring reflected laser signals from the fibers and for monitoring laser output power, and an optical fiber. The laser is disposed within the passive alignment carrier. The optical fiber is embedded in the passive alignment carrier, and has an angled fiber facet. The laser emits signals toward and through the angled fiber facet, whereby a portion of the laser signal illuminates the photodetector, and another portion illuminates the fibers that are being monitored and reflects back to the photodetector such that faults on the fibers can be detected.

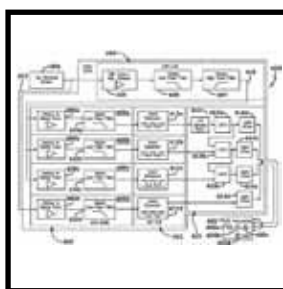


Patent Number: 7,839,304

Issue Date: 23-Nov-2010

Title: Method and system for alerting aircrew to unsafe vibration levels

Abstract: An onboard system for a rotary wing aircraft detects a limit cycle oscillation in the tail mast and provides a timely indication of the limit cycle oscillation to an aircrew before serious damage to the airframe is likely to occur.

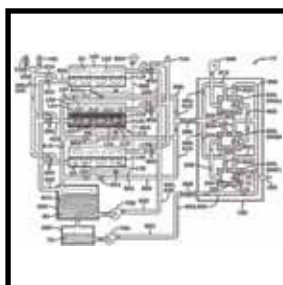


Patent Number: 7,836,723

Issue Date: 23-Nov-2010

Title: Air conditioning system

Abstract: An air conditioning system that includes desiccant compartments for holding a desiccant; a heat exchanger, a blower and a vessel. The heat exchanger can be filled with a heat transfer medium, while the blower blows ambient air by the heat exchanger such that the blown air is cooled and the heat exchanger is warmed such that thermal energy increases and is transferred from the air to the heat transfer medium causing the heat transfer medium to turn into vapor. The vapor is then diffused to one of the desiccant compartments such that the vapor is adsorbed onto the desiccant creating a mixture. Then an energy source is applied to the mixture such that the vapor and desiccant are separated. The separated vapor is transported to the vessel where it is condensed and then sent back to the heat exchanger, such that the system is able to be continuously operating.



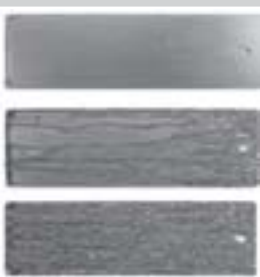
Patent Number: 7,820,076

Issue Date: 26-Oct-2010

Title: Oleaginous corrosion and mildew-inhibiting composition (NAVGUARD™)

Abstract: The invention relates to an oleaginous mildew and corrosion-inhibiting composition, and the use of said composition to protect metal from corrosion and mildew. The composition comprises, in parts by weight, from about 20 to 60 parts of an oleaginous material such as a lubricating oil, 10 to 40 parts of organic solvent, 20 to 60 parts of corrosion-inhibitor consisting of a sulfonic acid-carboxylic acid metal complex or a mixture of said metal complex with a small but effective amount of an oil soluble alkyl phosphate, for 0.1 to 2.0 parts of an oil soluble antioxidant, from 0.0 to 5.0 parts of a water-displacing compound, an effective amount of a mildew-inhibiting compound, and from 0.0 to 1.0 part of heterocyclic metal deactivator.

For more information
see factsheet on page 26

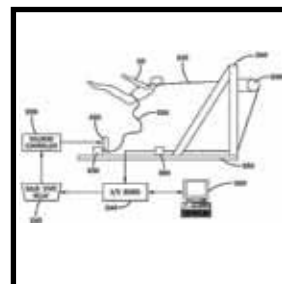


Patent Number: 7,819,031

Issue Date: 26-Oct-2010

Title: Parachute opening and shock emulator

Abstract: A parachute opening shock emulator including a seat structure and a catching mechanism. The seat structure includes a seat for holding a manikin, the seat is movable such that the manikin can be pulled from the seat simulating the parachute opening shock phase of an ejection. The catching mechanism is for catching the manikin after it is pulled from the seat.



Patent Number: 7,811,391

Issue Date: 12-Oct-2010

Title: Composition and process for preparing protective coatings on metal substrates

Abstract: This invention comprises an acidic aqueous solution for treating metal substrates to improve the adhesion bonding and corrosion protection of the metal surface which comprises effective amounts of water soluble trivalent chromium compounds, fluorozirconates, effective amounts of at least one corrosion inhibitors such as benzotriazole, fluorometallic compounds, zinc compounds, thickeners, surfactants, and at least about 0.001 mole per liter of the acidic solution of a polyhydroxy and/or carboxylic compound as a stabilizing agent for the aqueous solution.



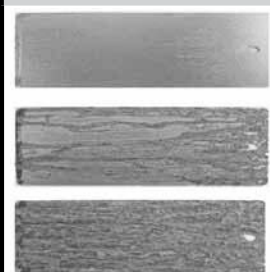
Patent Number: 7,776,233

Issue Date: 17-Aug-2010

Title: Oleaginous corrosion resistant composition (NAVGUARD™)

Abstract: The invention relates to an oleaginous corrosion-inhibiting composition, and the use of said composition to protect metal from corrosion. The composition comprises, in parts by weight, from about 20 to 60 parts of lubricating oil, 10 to 40 parts of organic solvent, 20 to 60 parts of corrosion-inhibitor consisting of a sulfonic acid-carboxylic acid metal complex or a mixture of said metal complex with a small but effective amount of an oil soluble alkyl phosphate, from 0.1 to 2.0 parts of an oil soluble antioxidant, from 0.1 to 5.0 parts of a water-displacing compound and from 0.0 to 1.0 part of a metal deactivator.

*For more information
see factsheet on page 26*

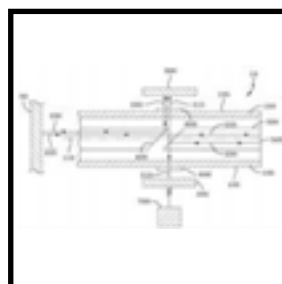


Patent Number: 7,714,991

Issue Date: 11-May-2010

Title: Fiber optic optical subassembly configuration

Abstract: A fiber optic optical subassembly configuration for monitoring fibers. The configuration includes a hollow container, a laser for emitting laser signals towards the fibers being monitored, a photodetector for monitoring reflected laser signals from the fibers being monitored and for monitoring laser output power, a beam splitter and an optical fiber. The optical fiber, disposed within the hollow container, has a coated end face surface, the laser emits signals toward and through the beam splitter, whereby a portion of the laser signal illuminates the photodetector, and another portion traverses down the optical fiber toward the coated end face surface and reflects off the coated end face surface toward the fibers that are being monitored, and reflects back from the fibers being monitored to the photodetector such that faults on the fibers can be detected.

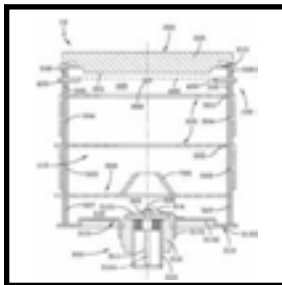


NAWCAD PATENT ABSTRACTS

Patent Number: 7,687,992

Issue Date: 30-Mar-2010

Title: Gating large area hybrid photomultiplier tube

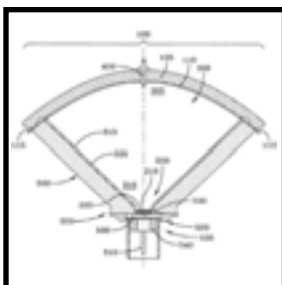


Abstract: A gating large area hybrid photomultiplier tube that includes an envelope, a photocathode for emitting electrons in correspondence with incident light entering the envelope, a collecting anode having a semiconductor device which has an electron incident surface for receiving photoelectrons emitted from the photocathode, a gating grid for gating the photoelectrons emitted from the photocathode, an electron incident surface, and an ion target for collecting positive ions from the photoelectrons. The envelope has a first opening and a second opening; the photocathode is disposed at the first opening, while the collecting anode is disposed at the second opening of the envelope.

Patent Number: 7,667,399

Issue Date: 23-Feb-2010

Title: Large area hybrid photomultiplier tube



Abstract: A large area hybrid photomultiplier tube that includes a photocathode for emitting photoelectrons in correspondence with incident light, a semiconductor device having an electron incident surface for receiving photoelectrons from the photocathode, and a cone shaped container. The container has a first opening and a second opening. The photocathode is disposed at the first opening, and the semiconductor device is disposed at the second opening.

For more information
see factsheet on page 33



Patent Number: 7,629,004

Issue Date: 08-Dec-2009

Title: Composition and process for removing and preventing mildew and fungal growth (NAVCLEAN®)

Abstract: This invention comprises a composition and the process of using the composition for removing and preventing mild, mildew, and fungal growth. The composition comprises at least one alkali metal perborate, at least one inhibiting compound selected from the group consisting of alkali metal silicates, triazoles and mixtures thereof in any ratio, at least one corrosion inhibitor, and effective amounts of surfactant.

Patent Number: 7,626,398

Issue Date: 01-Dec-2009

Title: System for isolating faults between electrical equipment

For more information
see factsheet on page 28



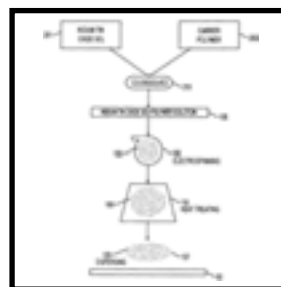
Abstract: A system is disclosed that can be inserted between cable runs of electrical equipment so as to provide access to signal/data lines associated with the electrical equipment. The system includes a microprocessor and a matrix switch and preferably display equipment and measurement instrumentation. The microprocessor controls the matrix switch so as to route signals to a high impedance probe array that then feeds data to measurement instrumentation. The system provides pattern analyzers, which are resident in the microprocessor routine software. The measurement instrument provides measurement quantities, timing, and patterns that may be compared to known good data to ascertain the state of the health of the electrical equipment. The system is also capable of blocking signal paths and providing known good signals to the associated electrical equipment. Test data is stored in memory for later retrieval and the display equipment provides a pass, fail or intermittent indication.

Patent Number: 7,618,580

Issue Date: 17-Nov-2009

Title: Method for fabrication of a polymeric, conductive optical transparency

Abstract: A method for fabrication of an optical transparency, that includes electrospinning of an Indium Tin Oxide sol polymer solution such that nanofibers are formed, heat treating the electrospun nanofibers such that the Indium Tin Oxide is in a conductive form, and dispersing the heat treated nanofibers into a substantially optically clear polymer.



Patent Number: 7,606,642

Issue Date: 20-Oct-2009

Title: Just in time wiring information system

Abstract: A just in time wiring information system, which includes an aircraft wiring information system module, a technical reference module, an interactive computer aided cable repair system module, and an e-suite. The e-suite communicates with the aircraft wiring information system module, the technical reference module, and the interactive computer aided cable repair system module such that via the e-suite a user may obtain information from each of the modules.



Patent Number: 7,606,411

Issue Date: 20-Oct-2009

Title: Robotic gesture recognition system

Abstract: A gesture recognition system enabling control of a robotic device through gesture command by a user is provided, comprising a robotic unit, a video or infrared camera affixed to the robotic unit, computing means, and high and low level of control gesture recognition application code capable of enabling the system to locate points of left hand, right hand, upper torso and lower torso of the user in the video imagery and convert it to a waveform data, correlate the waveform data to user command data, and form corresponding control voltage command(s) for production of electric current voltage(s) to drive one or more of the electric motors or actuators of the robotic device to thereby control same. In addition, a computer software program is provided for use in the gesture recognition system described above.

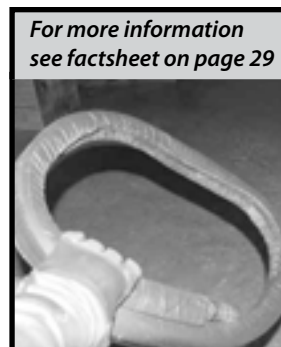


Patent Number: 7,568,418

Issue Date: 04-Aug-2009

Title: Radially compressive rope assembly

Abstract: A radially compressive rope assembly is provided for enabling controlled descent from altitude. The radially compressive rope assembly is comprised of a load-bearing rope core surrounded by a flexible, compressible mantle, capable of recovery after deformation thereof. The flexible, compressible mantle is covered by a flexible sheath, disposed adjacent the outer perimeter of the mantle, which allows a user to slide easily against the sheath down the radially compressive rope assembly while compressing the mantle material through the sheath during descent, resulting in increasing or decreasing the speed of descent.



NAWCAD PATENT ABSTRACTS

Patent Number: 7,564,455

Issue Date: 21-Jul-2009

Title: Global Visualization Process for personal computer platforms (GVP+)

Abstract: A system and process that incorporates hardware and software as elements to be combined with procedures and processes to obtain, format, store, combine, control, display, record, and visualize dynamic scenarios by interacting with accurate, realistic models and actual events within, on, and above a three-dimensional surface to be observed or modeled. The present invention software and process is capable of displaying extremely high resolution terrain models and imagery in real time over the entire surface of the planet, as well as a large number of moving entities and their associated graphical models. These features, combined with a network application programming interface (API), make the present invention suitable for flight simulation out-the-window displays, command and control scenarios, and mission review or rehearsal.



*For more information
see factsheet on page 31*

Patent Number: 7,548,801

Issue Date: 16-Jun-2009

Title: Just in time wiring information system

Abstract: A just in time wiring information system, which includes an aircraft wiring information system module, a technical reference module, and interactive computer aided cable repair system module, and an e-suite communicates with the aircraft wiring information system module, the technical reference module, and the interactive computer aided cable repair system module such that via the e-suite a user may obtain information from each of the modules.



*For more information
see factsheet on page 33*

Patent Number: 7,524,516

Issue Date: 28-Apr-2009

Title: Corrosion inhibiting mildew remover kit (NAVCLEAN®)

Abstract: The corrosion inhibiting mildew remover kit includes a premeasured amount of sodium perborate, a premeasured amount of a liquid inhibitor and a premeasured amount of a liquid blend. The premeasured amount of sodium perborate, the premeasured amount of liquid inhibitor, the premeasured amount of liquid blend and water combine to form an aqueous solution that can be applied to a mildew infected area. The aqueous solution removes mildew from a mildew infected area and does not cause corrosion.



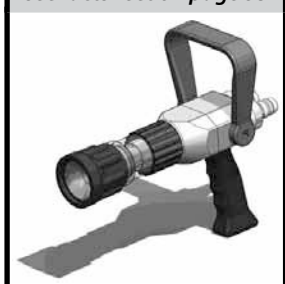
Patent Number: 7,523,876

Issue Date: 28-Apr-2009

Title: Adjustable liquid atomization nozzle

Abstract: An apparatus for mixing two or more fluids, gases or other substances and conveying said fluids, gases or other substances through a convergent-divergent (C-D) nozzle to produce a highly atomized output flow that is adjustable from no atomization to full atomization, said preferred embodiment of said apparatus having a housing and a nose portion and a gripping portion, the housing including an outer conduit and an inner conduit, the outer and inner conduits positioned and arranged to convey fluids, gases and other substances from an entry point to an exit point and into the entry end of a C-D nozzle and through said C-D nozzle to produce an output flow. The location of the outer conduit, inner conduit and C-D nozzle may be adjusted to vary the output flow from no atomization to full atomization. The pressure and flow rate in each conduit may also be separately adjusted to obtain the desired output flow.

*For more information
see factsheet on page 35*



Patent Number: 7,494,670

Issue Date: 24-Feb-2009

Title: Composition and process for removing and preventing mildew and fungal growth (NAVCLEAN®)

Abstract: This invention comprises a composition and process of using the composition for removing and preventing mold, mildew, and fungal growth. The composition comprises at least one alkali metal perborate, at least one inhibiting compound selected from the group consisting of alkali metal silicates, triazoles, and mixtures thereof in any ratio, at least one corrosion inhibitor, and effective amounts of surfactant.

For more information
see factsheet on page 33

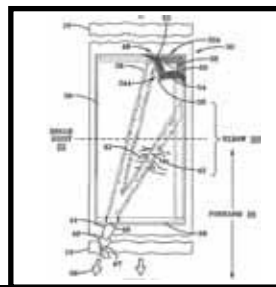


Patent Number: 7,464,413

Issue Date: 16-Dec-2008

Title: Rapid release mechanism for textile apparel pockets (receptacles) and packs (stowage receptacles)

Abstract: A mechanism that enables rapid release and access to contents stored at inconveniently located garment or storage receptacles is disclosed. The mechanism allows two sides of a receptacle storing contents to be opened simultaneously and rapidly with a one-handed operation, thus revealing the receptacle's interior, and releasing the contents thereof for immediate access to user.

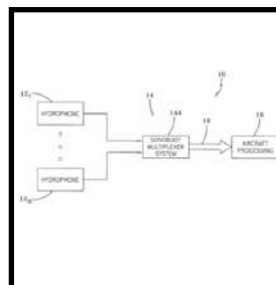


Patent Number: 7,430,152

Issue Date: 30-Sep-2008

Title: System and method of operation thereof for increasing acoustic bandwidth of transmitting devices

Abstract: Disclosed is a system, and a method of operation thereof, which improves the RF link employed between a transmitting sonobuoy and an associated receiving aircraft. The sonobuoy receives acoustic information from hydrophones and transmits this information to the aircraft, via beams having a predetermined frequency spectrum. The system breaks the total frequency spectrum of the beams into sub-bands. The sub-bands are multiplexed on the RF link interconnecting the sonobuoy to the aircraft. More particularly, the frequency spectrum defining an acoustic bandwidth of about 750 Hz is broken into a selected number (e.g., 6 or 4) of sub-bands and multiplexed onto and forming the RF link.

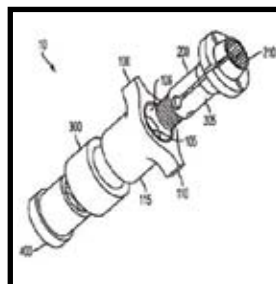


Patent Number: 7,380,467

Issue Date: 03-Jun-2008

Title: Bond integrity tool

Abstract: The present invention is directed to a bond integrity tool, which includes a shoulder housing, a collar shaft, and an end cap. The collar shaft has a neck portion and a mouth portion. The neck portion is disposed within the shoulder housing, and the mouth portion is able to grip a test piece. The end cap communicates with the neck portion, such that when the end cap is initiated the end cap applies force on the shoulder housing, which in turn applies force on the collar shaft, which grips the test piece such that the bond integrity between the test piece and surface may be tested.



NAWCAD PATENT ABSTRACTS

For more information
see factsheet on page 37



Patent Number: 7,331,183

Issue Date: 19-Feb-2008

Title: Personal portable environmental control system

Abstract: A personal portable environmental control system, which includes a thermoelectric device, two heat sinks, an exhaust fan for blowing ambient air across one heat sink and a blower for blowing ambient air across the other heat sink such that the blown air is conditioned (either heated or cooled). The thermoelectric device is disposed between the two heat sinks.

Patent Number: 7,239,311

Issue Date: 03-Jul-2007

Title: Global Visualization Process (GVP) and system for implementing a GVP

Abstract: A system and process that incorporates hardware and software as elements to be combined with procedures and processes to obtain, format, store, combine, control, display, record, and visualize dynamic scenarios by interacting with accurate, realistic models and actual events within, on, and above a three-dimensional surface to be observed or modeled. One application provides a user-manipulation large-scale dynamic display of systems testing in a real world environment for real time visualization by test personnel. The Global Visualization Process (GVP) system is an integrated software solution for high-performance visualization. GVP software and process is capable of displaying extremely high resolution terrain models and imagery in real time over the entire surface of the planet, as well as a large number of moving entities and their associated graphical models. The system can display imagery a 2 cm/pixel, and infinitely detailed terrain in real time over the whole surface of a planet. All displayed data is referenced to the World Geodetic System 1984 (WGS-84) ellipsoid for true round-earth effects, and can be rendered in correct asymmetric stereo. These features, combined with a network application programming interface (API), make GVP suitable for flight simulation out-the-window displays, command and control scenarios, and mission review or rehearsal.

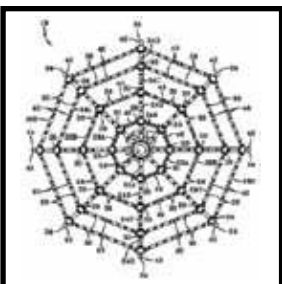


Patent Number: 7,225,999

Issue Date: 05-Jun-2007

Title: Spray array apparatus

Abstract: Spray array apparatus which includes a plurality of water and air carrying spoke members extending radially from a central fluid distribution assembly. The spoke members are connected to a plurality of water and air carrying strut members. The spoke members are divided into segments and the segments and strut members are detachably joined together by means of manifold joints which have water and air passageways allowing fluid communication between spoke segments and strut members. The apparatus is towed at the end of a boom of a tanker aircraft and is connected to the boom by means of a gimbal allowing two degrees of freedom to reduce bending moments and connection stresses. Selected fluid parameters are transmitted to the tanker aircraft to adjust fluid flow, if necessary.

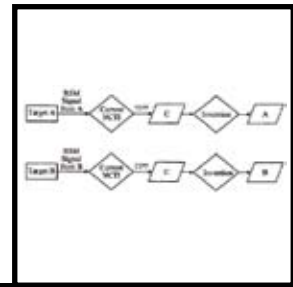


Patent Number: 7,180,442

Issue Date: 20-Feb-2007

Title: Target identification method using cepstral coefficients

Abstract: A method of identifying an unknown target comprising creating a density function of cepstral coefficients for a known target; receiving a signal from the unknown target; transforming the signal from a time spectrum to a frequency spectrum using a Fourier transform; transforming the frequency spectrum to a cepstrum; creating a density function of cepstral coefficients for the unknown target; and comparing the density function of the unknown target with the density function of the known target.

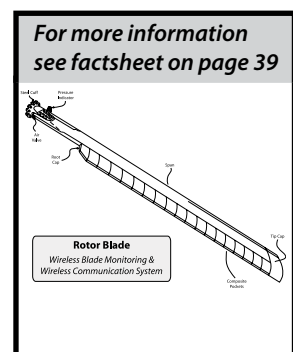


Patent Number: 7,176,812

Issue Date: 13-Feb-2007

Title: Wireless blade monitoring system and process

Abstract: The present invention can be generally described as a blade monitoring and wireless communications system. This monitoring and communications system is formed by the integration of commonly available or easily developed hardware and/or software components, which may be controlled by non-proprietary, open architecture software. This allows the present invention to easily incorporate a variety of sensors and/or detectors; thereby, providing the user with the first blade monitoring system capable of providing an improved blade monitoring capability.

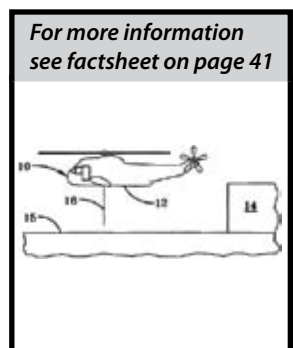


Patent Number: 7,025,304

Issue Date: 11-Apr-2006

Title: Helicopter messenger cable illumination

Abstract: An apparatus for illuminating the messenger cable of a helicopter includes a helicopter having a floor and including a RAST system; the RAST system comprising a messenger cable with a connector attached to one end for lowering to a landing deck of a ship, the RAST system further comprising a winch for raising and lowering the messenger cable, a housing attached to the floor of the helicopter through which the messenger cable is raised and lowered, a top of the housing including an opening through which the messenger cable passes, a sheave attached to the top of the housing and over which the messenger cable passes and a pulley attached to the housing and over which the messenger cable passes; a luminescent cover attached to a portion of the messenger cable adjacent the connector; a light mounted on the top of the housing for charging the luminescent cover; and a limit switch mounted on top of the housing for stopping upward motion of the messenger cable.



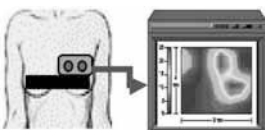
NAWCAD PATENT ABSTRACTS

Patent Number: 7,010,339

Issue Date: 07-Mar-2006

Title: Hybrid lidar-radar for medical diagnostics

For more information
see factsheet on page 42

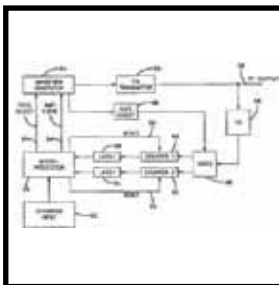


Abstract: A hybrid lidar-radar system for detecting the presence of objects, such as cancerous tumors, within tissues by detecting reflected signals from the tissue and discriminating the information related to the cancerous tumor from the undesirable backscattering of light created by the tissue itself. The hybrid lidar-radar system utilizes continuous wave light that is preferably modulated at frequencies up to 60 GHz. The present invention filters the return signals from the tissue at a subcarrier modulation frequency so as to reject erroneous information contained in scattered lights, while at the same time retaining the coherent, unscattered and modulated light information so as to provide for an accuracy detection of tumors within tissues.

Patent Number: 6,760,571

Issue Date: 06-Jul-2004

Title: Automatic frequency deviation detection and correction apparatus



Abstract: An RF carrier signal is frequency modulated by a modulating signal, as a function of the amplitude of the modulating signal. The number of cycles in the frequency modulated carrier is counted in a first counter during the positive half cycle of the modulating signal and in a second counter during the negative half cycle of the modulating signal. A microprocessor obtains the difference of the counts in the counters, and from the difference computes the deviation of the modulated carrier from the center frequency of the carrier. This is compared with a desired deviation and the microprocessor calculates and generates a correction signal to vary the amplitude of the modulating signal when the difference between the computed and desired deviation exceeds a predetermined value. An arrangement is also provided whereby, after a calibration procedure, an external source may provide the modulation signal.

For more information
see factsheet on page 43



Patent Number: 6,669,764

Issue Date: 30-Dec-2003

Title: Pretreatment for aluminum and aluminum alloys

Abstract: Pretreatment aluminum and aluminum alloys and the process and composition for pretreating said aluminum and its alloys to provide a coating with color recognition for identification purposes and to improved the corrosion-resistance, electrical conductivity, and adhesion properties which comprises pretreating said aluminum and its alloys with an effective amount of an acidic aqueous solution having a pH ranging from about 2.5 to 5.5 comprising water soluble trivalent chromium compounds, alkali metal hexafluorozirconates, divalent zinc compounds, alkali metal fluoro-compounds, and effective

For more information
see factsheet on page 43



Patent Number: 6,663,700

Issue Date: 16-Dec-2003

Title: Post-treatment for metal coated substrates

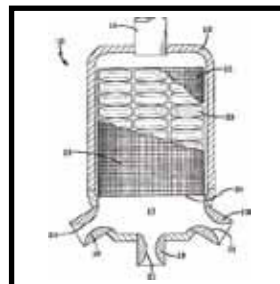
Abstract: Aqueous compositions for post-treating metal coated substrates such as cadmium-plated steel, and zinc-nickel coated substrates and the process for using said compositions to provide a color recognizable coating and to improve the corrosion-resistance, abrasion, electrical, and adhesion properties of the coating. The post-treatment composition comprises an acidic aqueous solution having a pH ranging from about 2.5 to 5.5 and contains effective amounts of trivalent chromium compounds, alkali metal hexafluorozirconates, at least one divalent zinc compound, alkali metal fluoro-compounds, and effective amounts of water soluble thickeners, wetting agents or surfactants.

Patent Number: 6,598,802

Issue Date: 29-Jul-2003

Title: Effervescent liquid fine mist apparatus and method

Abstract: An apparatus for creating a fine liquid mist includes a container capable of holding fluid; one of a perforated basket and a porous bag disposed in the container; a liquid supply connector connected to the container; a mixing chamber connected to the container; and at least one convergent/divergent nozzle connected to the mixing chamber. A method of forming an effervescent fine liquid mist includes mixing liquid and chemical reactant to form non-toxic, noncombustible gas bubbles; mixing the liquid and the gas bubbles to form a two-phase fluid flow; and directing the two-phase fluid flow through at least one convergent/divergent nozzle.



Patent Number: 6,527,841

Issue Date: 04-Mar-2003

Title: Post-treatment for metal coated substrates

Abstract: An aqueous composition for post-treating metal coated substrates such as cadmium-plated steel or zinc-nickel coated substrates and the process for using said composition to improve the corrosion-resistance, abrasion, and adhesion bonding properties of the metal coatings. The composition comprising an acidic aqueous solution having a pH ranging from about 2.5 to 4.5 containing effective amounts of trivalent chromium salts, an alkali metal hexafluorozirconate, at least one alkali metal fluoro-compound, and effective amounts of water soluble thickeners and/or surfactants.

*For more information
see factsheet on page 43*



Patent Number: 6,521,029

Issue Date: 18-Feb-2003

Title: Pretreatment for aluminum and aluminum alloys

Abstract: Pretreated aluminum and aluminum alloys and the process for pretreating said aluminum substrates to improve its corrosion-resistance, and adhesion properties which comprises pretreating said aluminums with an effective amount of an acidic aqueous solution having a pH ranging from about 2.5 to 4.5 and comprises effective amounts of a trivalent chromium compound, alkali metal hexafluorozirconates, at least one alkali metal fluoro-compound, and small but effective amounts of water soluble thickeners and/or surfactants.

*For more information
see factsheet on page 43*



Patent Number: 6,511,532

Issue Date: 28-Jan-2003

Title: Post-treatment for anodized aluminum

Abstract: Composition for post-treating anodized aluminum and aluminum alloys and the process for using said composition to improve the corrosion-resistance, abrasion, and adhesion bonding properties of the anodized aluminum and its alloys. The composition comprises an acidic aqueous solution having a pH ranging from about 2.5 to 4.5 containing effective amounts of trivalent chromium salts, alkali metal hexafluorozirconates, an alkali metal fluoro-compound e.g. fluoroborates and/or fluorosilicates, and effective amounts of water soluble thickeners and surfactants.

*For more information
see factsheet on page 43*



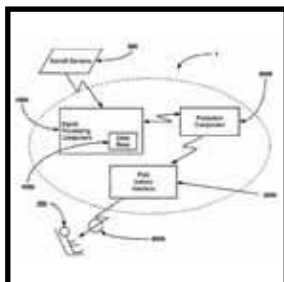
NAWCAD PATENT ABSTRACTS

Patent Number: 6,484,072

Issue Date: 19-Nov-2002

Title: Embedded terrain awareness warning system for aircraft

Abstract: An embedded terrain awareness warning system for aircraft being flown by a pilot includes a signal processing component, a protection component and a pilot vehicle interface. A method for providing an embedded terrain awareness warning system for aircraft being flown by a pilot includes providing a signal processing component, a protection component and a pilot vehicle interface. The signal processing component communicates with three-dimensional digital terrain elevation data and is able to take input data from aircraft sensors, aircraft computers or navigation systems and determine aircraft position and velocity. The protection component is in communication with the signal processing unit such that the protection component is able to determine if a potential controlled flight into terrain exists and is able to predict a recovery flight path to avoid terrain. The pilot vehicle interface communicates with the protection component such that the pilot vehicle interface can issue a warning to the pilot of the aircraft of impending flight into terrain, and issue a directive solution to prevent the impending flight into terrain.



Patent Number: 6,375,726

Issue Date: 23-Apr-2002

Title: Corrosion resistant coatings for aluminum and aluminum alloys

Abstract: This invention is for the protection and surface treatment of aluminum, aluminum alloys and coated aluminum substrates against corrosion. The aluminum substrates are treated with an acidic aqueous solution containing small but effective amounts of at least one trivalent chromium salt such as a trivalent chromium sulfate, at least one alkali metal hexafluorozirconate such as potassium hexafluorozirconate in combination with small but effective amounts of at least one water soluble or dispersible thickening agent such as a cellulose compound and at least one water soluble surfactant. The corrosion resistant aluminum substrates of this invention have improved adhesion for overlaying coatings e.g. paints and a lower electrical resistance contact.

*For more information
see factsheet on page 43*

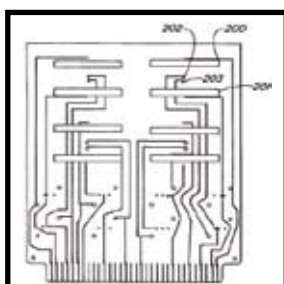


Patent Number: 6,300,778

Issue Date: 09-Oct-2001

Title: Solder paste and residue

Abstract: This invention relates to an on-line statistical process control device for solder paste and residues. The invention consists of electronics hardware, software, and probing systems. The electrical hardware of the invention provides voltage and current measurements of solder paste materials, the software of the invention controls the hardware, provides real-time complex, non-linear least squares curve fitting for equivalent circuit analysis, data storage and retrieval of circuit parameters and behavior, and statistical process control tracking and charting. The probing systems of the invention allows for 2, 3, and 4 probe surface and bulk measurements of the solder paste and residues.



Patent Number: 6,249,241

Issue Date: 19-Jun-2001

Title: Marine vessel traffic system (SureTrak)

Abstract: The marine Vessel Traffic System (VTS) is an improved radar harbor surveillance sensor, computer and display system that monitors marine harbor traffic, provides advisories to vessels in areas selected by the system operators, and provide the operators of the system with an early warning of unacceptable traffic conflicts in the confined waterways of the harbor. The VTS collects harbor traffic information from multiple remote sensor collection sites around the harbor and integrates, records, merges and presents the remote site data onto a single operator display, selected from a plurality of operator displays. VTS provides quick accurate computer generated graphic display of the harbor traffic, possible surface and subsurface conflicts, and key vessel identification information and the VTS documents incidents and traffic conditions for the Coast Guard or other waterway authorities.

*For more information
see factsheet on page 44*



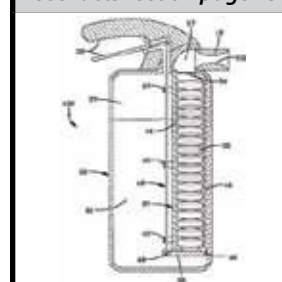
Patent Number: 6,241,164

Issue Date: 05-Jun-2001

Title: Effervescent liquid fine mist apparatus and method

Abstract: An apparatus for creating a fine liquid mist includes a container capable of holding fluid; one of a perforated basket and a porous bag disposed in the container; a liquid supply connector connected to the container; a mixing chamber connected to the container; and at least one convergent/divergent nozzle connected to the mixing chamber. A method of forming an effervescent fine liquid mist includes mixing liquid and chemical reactant to form non-toxic, noncombustible gas bubbles; mixing the liquid and the gas bubbles to form a two-phase fluid flow; and directing the two-phase fluid flow through at least one convergent/divergent nozzle.

*For more information
see factsheet on page 45*



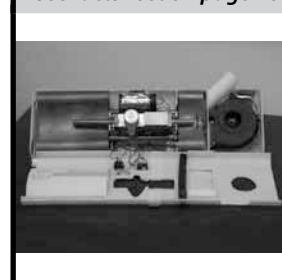
Patent Number: 6,240,742

Issue Date: 05-Jun-2001

Title: Modular portable air-conditioning system

Abstract: A modular air-conditioning system is disclosed and consists of a power supply module, blower module(s), air-conditioning module(s), and an air-distribution module. The power module may be comprised of batteries, whereas the blower module provides ventilation through the air-conditioning system that extracts heat from the flow of fluid and directs the extracted heat to a heat exchanger. The heat exchanger is a closed-low pressure system consisting of a liquid filled with a water adsorbing material. The heat is extracted from boiling liquid in a lower chamber of the heat exchanger and transferred to an upper chamber of the heat exchanger by way of heat and mass transfer.

*For more information
see factsheet on page 46*



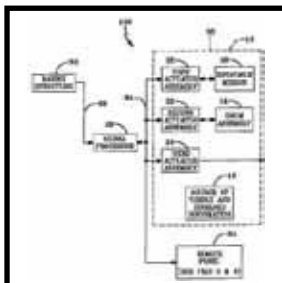
NAWCAD PATENT ABSTRACTS

Patent Number: 6,239,725

Issue Date: 29-May-2001

Title: Passive visual system and method of use thereof for aircraft guidance

Abstract: A landing guidance system is disclosed for use with helicopters or other aircraft during the terminal phase of approach to a marine structure, such as a moving ship at sea. Signals from shipboard pitch and roll position sensors are routed to a signal processor that computes stabilization corrections which, in turn, are applied to a multi-axis electromechanical system that moves internal elements of an optical system to compensate for motion of a shipboard platform resulting in a stabilized optical presentation in inertial space to the pilot of an approaching aircraft. A dual display is provided through the use of a spectral beam splitter that allows both an infrared and visible display to be presented to an approaching pilot. This allows the pilot to use the display with and without night vision devices. The visible energy display to the pilot is color-coded with three distinct colors.

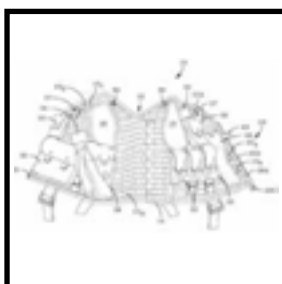


Patent Number: 6,233,740

Issue Date: 22-May-2001

Title: Aircrew integrated recovery survival vest

Abstract: A vest particularly suited for survival purposes is disclosed. The vest has removably attachable pockets as well as a removably attachable hoisting harness so as to facilitate the needs for survival and, in addition, has provisions for easily adjusting the size thereof.

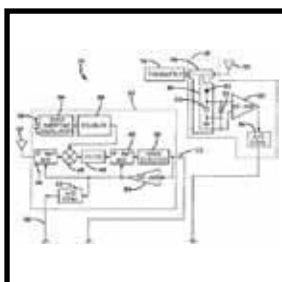


Patent Number: 6,125,270

Issue Date: 26-Sep-2000

Title: Verification system for transmitters and command tone generators

Abstract: A system for verifying the operational performance of command tone generators, transmitters, and antennas including its signal quality and strength as well as its reflected power is disclosed. The system includes a receiver that receives a RF signal and develops an output AM demodulated signal having a d.c. component that is proportional to the amplitude of the received RF signal. The d.c. component serves as an AGC input for the receiver so as to hold the AM demodulated signal constant within a specified range for the input RF signal. The AGC value is digitized to form tuned RF power in sync with the address detection with a microprocessor correcting for AGC nonlinearities.



*For more information
see factsheet on page 47*



Patent Number: 6,105,382

Issue Date: 22-Aug-2000

Title: Chest mounted armored microclimate conditioned air device

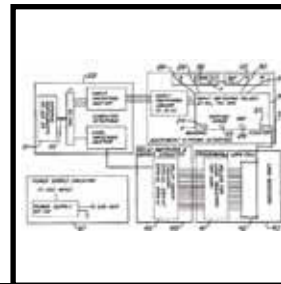
Abstract: A cooling and heating device that may be used in conjunction with a personal air conditioned apparatus is disclosed. The cooling and heating device not only cools the user of the personal conditioned air apparatus, but provides for heating a user by harnessing the by-product of the cooling process, as well as provides ballistic protection for the person using the personal conditioned air apparatus.

Patent Number: 6,005,399

Issue Date: 21-Dec-1999

Title: Solder paste and residue measurement system

Abstract: This invention relates to an on-line statistical process control device for solder paste and residues. This invention consists of electronics hardware, software, and probing systems. The electrical hardware of the invention provides voltage and current measurements of solder paste materials, the software of the invention controls the hardware, provides real-time complex, non-linear least squares curve fitting for equivalent circuit analysis, data storage and retrieval of circuit parameters and behavior, and to statistical process control tracking and charting. The probing systems of the invention allows for 2, 3, and 4 probe surface and bulk measurements of the solder paste and residues.

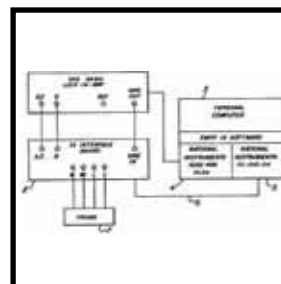


Patent Number: 5,656,933

Issue Date: 12-Aug-1997

Title: Solder paste and residue measurement system

Abstract: The invention relates to an on-line statistical process control device for solder paste and residues. The invention consists of electronics hardware, software, and probing systems. The electrical hardware of the invention provides voltage and current measurements of solder paste materials, the software of the invention controls the hardware, provides real-time complex, nonlinear least squares curve fitting for equivalent circuit analysis, data storage and retrieval of circuit parameters and behavior, and statistical process control tracking and charting. The probing systems of the invention allows for 2,3, and 4 probe surface and bulk measurements of the solder paste and residues.



Patent Number: 5,520,331

Issue Date: 28-May-1996

Title: Liquid atomizing nozzle

Abstract: A convergent/divergent gas nozzle atomizes a liquid provided through a lid delivery tube having an aperture which is centered within a central gas conduit of an upstream mixing block connected to the nozzle. The aperture of the liquid delivery tube is located just upstream of a narrowed throat of the nozzle. The throat of the nozzle is dimensioned such that its inside diameter is equal to the outside diameter of the liquid injector tube. A spout is located at the discharge end of the nozzle which has an inside diameter equal to two times the inside diameter of the throat. This nozzle displays superior performance, providing an extremely fine mist having high momentum. This nozzle is particularly well-suited to fire extinguishment.

For more information
see factsheet on page 48



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NAWCAD PATENT FACTSHEETS

NAVSOLVE®

U.S. Patent Number 7,897,558

Technology and Background:

The Navy uses petroleum-based solvents to clean aerospace platforms and other related equipment. The problem is that these products, such as P-D-680 and MIL-PRF-680, contain hazardous air pollutants (HAPs) and volatile organic compounds (VOCs), which cause health and environmental problems. Specifically, the VOCs released during the cleaning process contribute to the formation of ground-level ozone or "Photochemical smog," which can damage lung tissue, cause respiratory illness and damage vegetation. Moreover, new stricter environmental regulations are starting to take effect that will mandate the use of Low-VOC, HAP-free solvents. The new specification requires that a solvent must be free of HAPs, must contain no more than 25 grams per liter of VOCs, must be effective on grease and oil, must not contain ozone-depleting substances (non-ODS), must be non-toxic, must be compatible with metals and non-metals, and must be safe to use.

Technology Solution:

NAWCAD has invented "NAVSOLVE®", an effective environmentally friendly cleaning solvent that meets and exceeds the new Low-VOC, HAP-Free specifications.

In order to identify a solvent that meets the new regulations, NAWCAD's Materials Engineering Division at Patuxent River, MD, recently tested several candidate commercial products. While the product testing was ongoing, a new specification MIL-PRF-32295 entitled "Cleaner, Non-Aqueous, Low-VOC, HAP-Free," was developed to classify environmentally friendly cleaners for DoD use. Since the Aerospace National Emission Standards for Hazardous Air Pollutants (NESHAP) states that immersion cleaning solvents must have vapor pressures less than 7 mm Hg, and wipe cleaning solvents must have vapor pressures less than 45 mm Hg, these limits soils such as oils and hydraulic fluids and Type II products as suitable for cleaning heavy soils such as greases and carbon residues. While a few of the tested products met the Type I requirements, NAVSOLVE® is the only product that has been shown to be suitable as a type II product.



NAWCAD PATENT FACTSHEETS

NAVSOLVE® *continued*

Summary of Benefits:

- Low-VOC = 16 g/l
- HAP = Free
- Effective (Cleaning Efficiency Equivalent to MIL-PRF-680 Cleaner)
- Non-ODS
- High Flash Point > 142 °F
- Non-Corrosive
- Compatible with Metals and Non-metals
- Non-Toxic
- Non-Offensive Odor
- Cost Effective
- Recyclable
- Fast Drying
- Cleaning - Grease and Oils

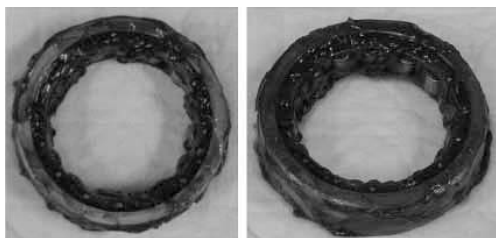
Market Opportunities:

Solvent Degreasing/Cleaning:

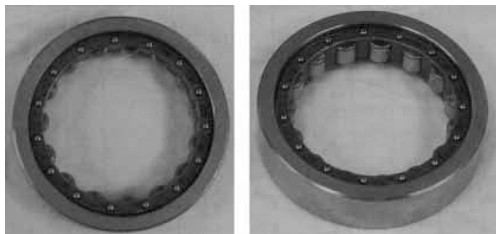
- Parts Washing (Parts Washer/Immersion Tank)
- Automotive Degreasing/Cleaning
- Weapons Cleaning
- Aircraft Engines and Parts/Components Cleaning
- Shipboard Bearing Cleaning
- Corrosion Inhibition
- Dewatering/Water Displacement

Soils Removed:

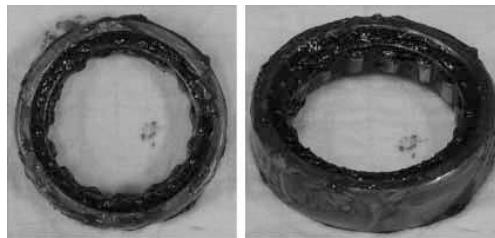
- Carbon Deposits
- Grease (MIL-PRF-10924)
- Particulate Matter
- Mineral Oils
- Water-Soluble Oils
- Synthetic Oils
- Rust Inhibitors
- Wet Paint



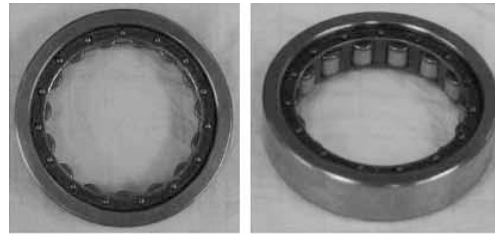
Bearing - Before MIL-PRF-680 Cleaning



Bearing - After MIL-PRF-680 Cleaning
Pictures Taken/Bearings Cleaned October 14, 2009



Bearing - Before NAVSOLVE® Cleaning



Bearing - After NAVSOLVE® Cleaning
Pictures Taken/Bearings Cleaned October 14, 2009

Integrated Net-Centric Diagnostics Dataflow for Avionics Systems

U.S. Patent Application Number 12/554,147

Technology and Background:

Imagine you're at your general doctor, complaining of dull intermittent pain along your left arm. After running a series of tests, your doctor determines you need a specialist. The specialist, with limited information, runs another series of tests. A diagnosis is made, a remedy provided, and you resume normal activity. Could the specialists have optimized your health, at a lower costs, if vital information was exchanged? Conversely, with future visits to the general doctor, could they benefit from the specialist's information?

Transfer this scenario to the repair of complex avionics systems used in Naval Aviation. Often, the front-line maintainer (general doctor) does not communicate vital information to the back-line maintainer (specialist), thus increasing repair time with unnecessary diagnostic procedures. Similarly, when the back-line maintainer diagnoses and provides a repair solution, this information is frequently not communicated to the front-line maintainer, thereby reducing future diagnostic and repair effectiveness and efficiency.

Enter the Net-Centric Diagnostic Framework (NCDF) - a technology enabling the sharing of diagnostic and maintenance information between the repair activities of Naval Aviation. This technology optimizes resource management and provides superior information on events and conditions, needed to empower the maintainer.

Technology Solution:

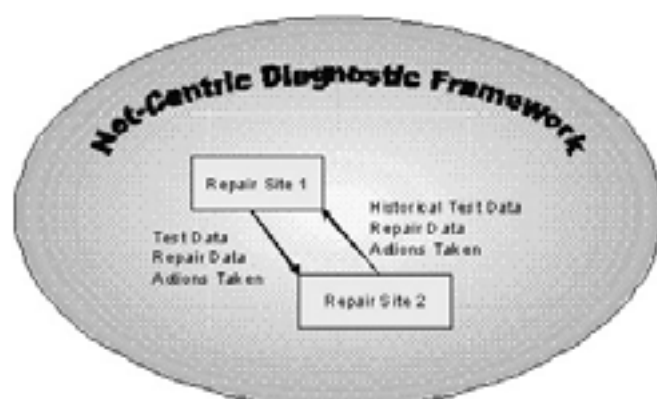
The NCDR is a suite of software, run on several different computers at different levels of maintenance to allow the flow of information between maintenance levels in a standard message format (TCP/IP) and a standard data format (Automatic Test Markup Language, or ATML.)

Summary of Benefits:

- Greater system availability
- Decreased maintenance times at all levels of maintenance
- Decrease logistics costs
- Continuously updated historical data on which to make maintenance decisions
- Increased maintainer awareness of system repair status and history

Market Opportunities:

- Commercial aviation maintenance
- Automotive maintenance
- Any system which needs to exchange information between a tester and a larger systems or maintenance levels



NAWCAD PATENT FACTSHEETS

NAVGUARD™

U.S. Patent Number 7,776,233; 7,820,076

Technology and Background:

Preventing corrosion of metals in aircraft, vehicles and structures is a critical priority for the military, especially in harsh environments where humidity, salt, and heat can reduce metal parts to piles of rust. Corrosion is difficult to detect and correct, and therefore prevention is usually the most cost-effective treatment. Applying corrosion preventive compounds (CPCs) into the internal spaces of airframes is effective in combating metal degradation. However, due to limited performance, traditional CPCs require repeated applications during regular maintenance intervals. The present invention, NAVGUARD™, provides high-performance, long-lasting, corrosion protection, without requiring repeated applications. This technology is also available with a mildew inhibitor additive.

Technology Solution:

NAVGUARD™ was developed to fulfill the need of the Navy for a longer lasting corrosion prevention film on Navy aircraft metal surfaces, while at the same time inhibiting the growth of mildew on the CPC film. The compounds used for this CPC mildew inhibiting formulation are readily available, environmentally benign and are cost effective. Standard industrial techniques and chemical processing methods can be utilized in fabricating and packaging this CPC product in large quantities. The effectiveness of the mildew inhibitor additives into NAVGUARD™ and selected products from MIL-C-81309 and MIL-C-85054 specifications was performed at the Naval Research Laboratory at Stennis Space Center and showed good results on all tested products. In addition to preventing mold growth, the CPC film was found to last longer than currently used CPC systems, which would translate to fewer CPC treatments on aircraft, reducing down time and maintenance costs and extending the life cycle of aircraft.

NAVGUARD™ was developed in accordance with MIL-PRF-81309 (Corrosion Preventive Compounds, Water Displacing, Ultra-Thin Film) and exceeds those specification requirements. For example, NAVGUARD™ lasted three times longer than the 14-day neutral salt fog (ASTM B 117) requirements for aluminum panels. In side-by-side tests with other CPC products, NAVGUARD™ products out performed commercially available competitors by a factor of three on aluminum and steel. This formulation is expected to perform equally well on other corrosion-sensitive surfaces. It has been tested successfully on aluminum, magnesium, and ferrous alloy surfaces.

CPC Product on Steel Panels Following Seven Days at ASTM B 117 Salt Spray Test



NAVGUARD™



(MIL-C-81309) Corrosion Preventive Compounds, Ultra Thin Film



(MIL-PRF-32033) Lubricating Oil, General Purpose Preservative

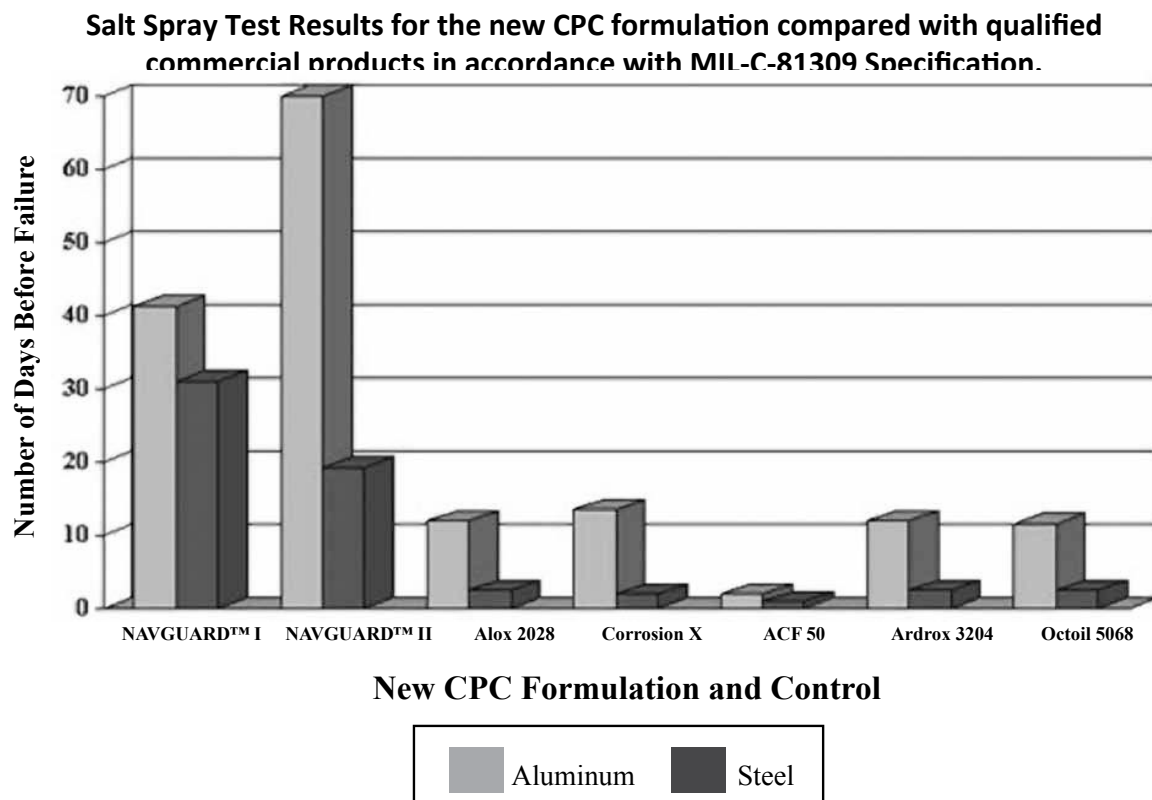
NAVGUARD™ *continued*

Summary of Benefits:

- Cost effective formulation from commercially available chemicals
- Foggable by using aerosolizing nozzle
- Low-VOC content and environmentally friendly composition
- Compatible with metal and non-metal components
- A water displacing agent
- Extremely effective corrosion inhibitor for aluminum, magnesium and steel alloy surfaces
- Previously treated surfaces require no removal process
- Durable coating that provides long-term protection on multiple metal surfaces

Market Opportunities:

- Commercial and private marine and aircraft market
- Manufacturers of products with metallic based materials
- Automotive parts
- Machining and metal cutting business that could coat machined product to protect it while transport to customer
- Used to maintain and protect industrial machinery such as lathes, mill machines, CNC equipment, etc.
- Military aircraft
- Naval ships



System for Isolating Faults Between Electrical Equipment (*Smart Connector*)

U.S. Patent Number 7,626,398

Technology and Background:

Avionics failures are a fact of life in modern aviation. For the Navy, 50 or more electronic Avionics Boxes are installed on any given aircraft. With a Naval inventory of over 3,400 aircraft, that's a lot of boxes. Suppose the cockpit "**Check Avionics**" indicator lights up, signaling one of these boxes has failed. What if the built-in diagnostics of your aircraft always results in ambiguity, and the maintenance crew is forced to remove several of these boxes, when only one really needs to be fixed? For the Navy and Marine Corps, **approximately 72% of the total aircraft maintenance is driven by avionics-related deficiencies**. This translates into aircraft that are "not ready to fly". Enter the **Smart Connector** for Electronics Fault Isolation.

Technology Solution:

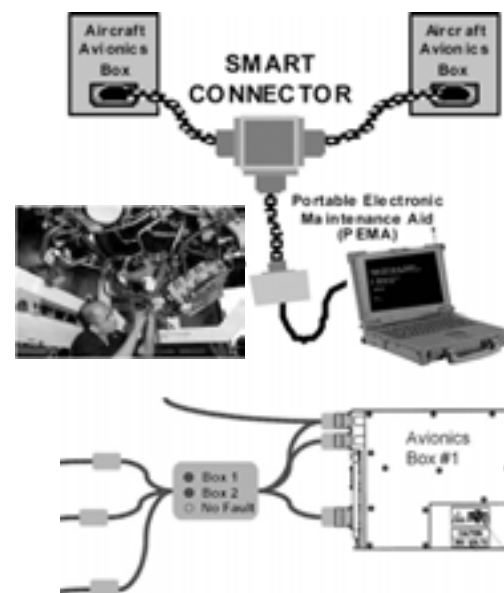
The Smart Connector enables the maintainer to break diagnostic ambiguities at the aircraft by inserting test access points between avionics boxes. The prototype includes a customized cylindrical Military Specification (MIL-SPEC) connector, which routes signals of interest to a handheld tester. The handheld tester analyzes data bus traffic, power signals and other signals of interest between two functioning avionics boxes and provides a maintainer as easily-understood indication of the health of the connected boxes. The device can be programmed to detect a wide range of fault indicators as they are discovered through the analysis of fielded avionics systems and wiring. The device is small enough to be integrated into aircraft wiring bundles or to function as stand-alone support equipment.

Summary of Benefits:

This technology can accelerate on-aircraft testing, therefore realizing reductions in false alarms and associated aircraft downtime, logistics costs and costs associated with testing the "good" assets at another maintenance level or location.

Market Opportunities:

- Commercial Aviation
- Automotive Repair or other ground vehicles
- Complex computer systems
- Any electronics



Radially Compressive Rope Assembly

U.S. Patent Number 7,568,418

Technology and Background:

Special forces routinely use standard type ropes or “fast ropes” for climbing and/or descending to or from helicopters, buildings, cliffs, etc. The high levels of friction that can be used generated between the hands, arms, upper body, thighs and legs and the rope in controlling the rate of descent is an unavoidable hazard for this type of rope system. In addition, there are problems in descending in conditions of rain, snow and wind creating uncertainties in the rate of descent due to a slippery, swinging rope. Any grease or oil present on the rope, hands or body also complicate the effective use of these ropes. These problems can result in injuries such as rope burns, fractured bones, twisted ankles, and internal injuries.

Technology Solution:

To address the need for a better fast rope, the Naval Air Warfare Center Aircraft Division at Patuxent River, Maryland developed the Radially Compressive Rope Assembly, which has the potential of revolutionizing rope technology that is used for the descent of personnel from helicopters and other vehicles or structures. For convention ropes, the level of friction generated between a person and the rope is the basis for controlling rate of descent or providing the ability to climb the rope. For the Radially Compressible Rope Assembly, a tighter grip does not translate into the creation of larger amounts of friction, but rather a greater indent in the rope, providing a greater hand holding block.

Prototype compressive ropes have been constructed and tested at the Naval Air Warfare Center Aircraft Division, Patuxent River, Maryland. Modifications and improvements to this original design are currently in process. Though the compressive rope assembly is moderately more expensive than existing fast ropes, the greatly increased amount of control and safer operation, will justify its higher cost. The development of various types of rope attachments, fasteners and accessories that take advantage of the compressibility feature, could expand market use into the rope market areas such as tow ropes, safety harnesses and other types of lowering systems.



Squeezing by hand compresses rope minimizing need of friction.

Radially Compressive Rope Assembly *continued*

Summary of Benefits:

Instead of varying the grip to modulate the amount of friction for controlling descent rate of a person, varying grip modulates the amount of compression or indent of the rope. This translates into:

- Lower injury rates from friction burns
- Better control of the speed of descent by a person
- Provide a rope system that permits extremely rapid engagement, descent, and disengagement of the user, allowing multiple users to descend in a relatively short period of time
- Provide a more sure grip even in wet, snow, sea, oily or other adverse conditions
- Provide a method to modify the rope assembly's weight to accommodate the various wind conditions at rope deployment locations - thereby enabling the rope to hang vertically without motion - thus providing additional safety to roping operations

Market Opportunities:

Potential market areas would include:

- Fire escape
- Homeland Security applications
- Law enforcement related personnel such as SWAT teams, FBI, etc.
- Fire Fighters and First Responders
- Recreational climbing enthusiasts
- School gyms, gymnastic applications
- Obstacle and rope courses
- Playgrounds
- Other rope containing products that may benefit from the compressibility feature such as rope ladders, lowering ropes, repelling ropes, etc. *Carabiners or other rope fasteners could be modified to take advantage of the compressibility feature*
- Tow ropes, securing ropes that may benefit by using specially designed fasteners, hooks, etc. that can easily be adjusted to desired positions on the rope
- Military - Special forces and Coast Guard rescuers for descending from helicopters and other structures



Radially compressive rope hanging next to a standard climbing rope.



Radially Compressive Rope

Just In Time Wiring Information System

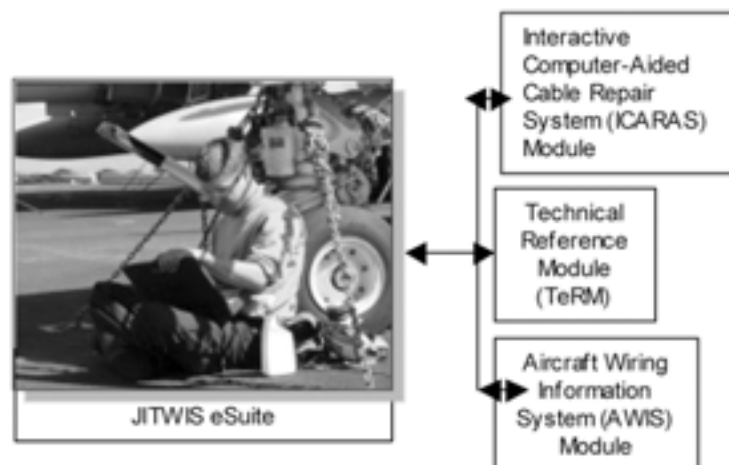
U.S. Patent Number 7,548,801

Technology and Background:

A study conducted by Government Accounting Office in 1998 identified wiring maintenance actions as a leading cause of unscheduled maintenance man hours. Further evaluation of these maintenance actions have proven that unscheduled wiring system maintenance actions, on aircraft wiring systems, account for almost 1.5 million maintenance man hours annually within Naval Aviation alone. Much of the maintenance time is spent researching required technical information relevant to the components and tooling required to maintain the wiring system. The technical information relative to the wiring system components currently resides in system or aircraft technical manuals, military and commercial specifications as well as wiring component vendor catalogs. These manual and/or catalogs are generally provided in paper format. Several problems of these resources include: the requirement of several hundred manuals to describe the operation, maintenance and repair processes; required information for the specific maintenance action is dispersed among multiple manuals; discontinuity of information; pages of paper technical manuals can be damaged and unreadable when used in inclement environments. These problems increase the impact on over all maintenance man hours and costs. As a result of working with each of these manuals, the concept of developing an “umbrella” program was envisioned that could provide multiple resources in a central location. Upon further evaluation, the idea for creating a system where any number of software systems could function both independently, as well as with integrated capabilities was the foundation for the Just In Time Wiring Information System (JITWIS) eSuite.

Technology Solution:

The JITWIS eSuite is a computerized suite of integrated software systems, designed and built to standardize the input, retrieval, update of wiring system component, tooling, and repair information by the development of intelligent integrated functionalities resulting in a single resource for wiring system maintenance, engineering and logistical applications. The JITWIS eSuite provides immediate access to technical data needed for troubleshooting, repair and maintenance of wiring systems across multiple applications. The JITWIS eSuite was developed by NAWCAD in support of aircraft wiring systems and is a single Point-of-Access to three unique maintenance logistics and engineering resources (Aircraft Wiring Information System (AWIS), Intelligent Computer Aided Cable Repair System (ICACRS), and Technical Reference Module (TeRM)). The flexibility and unique nature of the JITWIS eSuite allows the system to contain wiring system data that is applicable to wide range of applications such as aircraft, automobiles, ground weapons system (e.g., tanks, and armored personnel carriers), spacecraft and support equipment.



NAWCAD PATENT FACTSHEETS

Just In Time Wiring Information System *continued*

Summary of Benefits:

- Comprehensive wiring system configuration management philosophy
- Reduction of maintenance cycle times
- Reduction of Technical Manual development and update costs
- Reduces training costs resulting from deploy-ability of common computer based training capabilities

Market Opportunities:

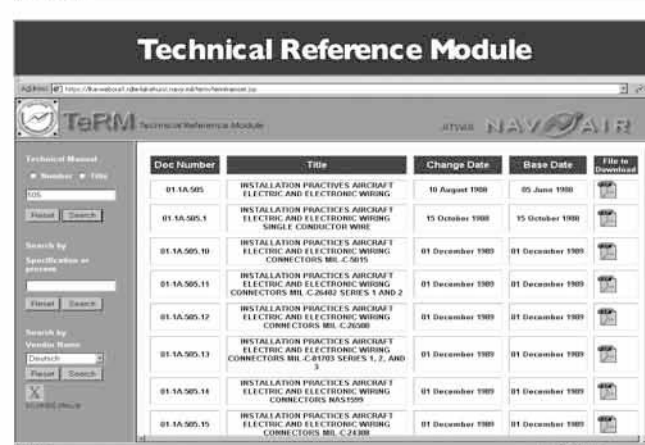
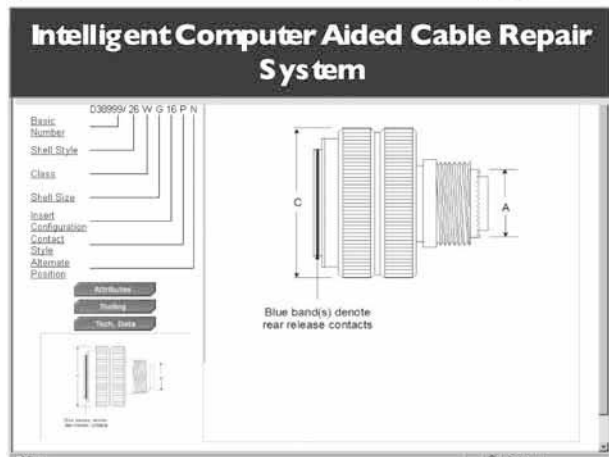
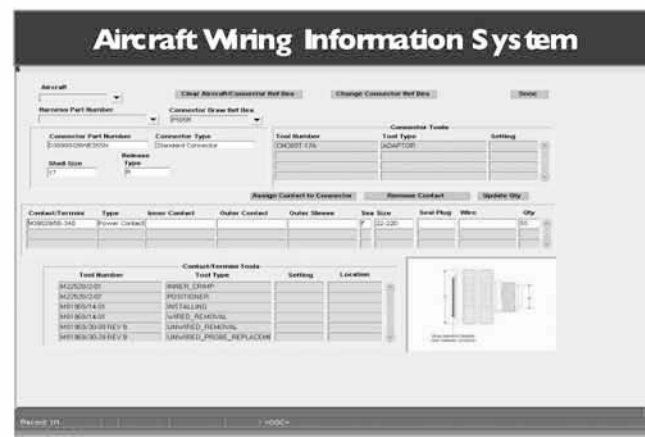
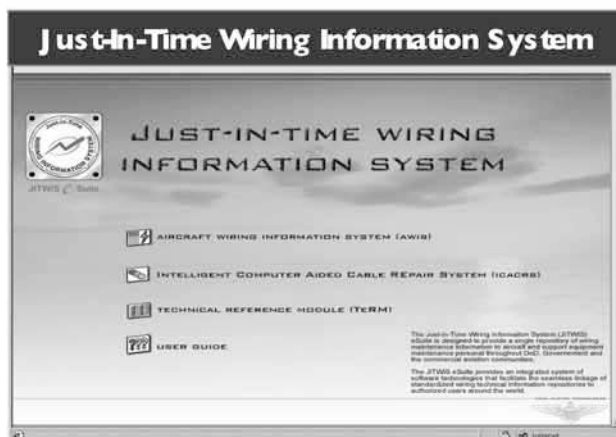
Applications such as aircraft, automobiles, ground weapons system (e.g., tanks and armored personnel carriers), spacecraft and support equipment.

Status:

The JITWIS eSuite is presently in use at Navy and Marine Corps, Aircraft Intermediate Maintenance Department, Module Repair Work Centers at Norfolk, VA; MALS Cherry Point, New River, NC; MCAS Miramar, CA and aboard the USS Eisenhower.

Presently NAWCAD is actively seeking commercial partners:

- To License this technology to make, use and sell for both military and commercial markets
- To perform cooperative research and development of this technology



NAVCLEAN®

U.S. Patent Number 7,494,670; 7,524,516; 7,629,004

Technology and Background:

NAVCLEAN® relates to a corrosion inhibiting mildew remover kit. More specifically NAVCLEAN® relates to a composition process and kit for removing mildew, mold, and fungal growth on various surfaces. Mildew growth on aircraft surfaces, particularly aircraft operated in humid climates is a serious problem. The build-up of mildew causes corrosion and operational damage to the aircraft along with creating potential health hazards to flight crew and maintenance personnel. Traditional products and methods for removing mold and mildew are time consuming, labor intensive, environmentally hazardous and often inadequate. Other solutions that adequately removed mildew in the past, such as household chlorine bleach, have caused accelerated corrosion to aircraft surfaces.

Technology Solution:

NAWCAD has developed and successfully tested NAVCLEAN® for use in removing and inhibiting mold, mildew and other growth on various surfaces to include military aircraft structures. This patented multi-pack kit and formulation (shown in Figure 1) has passed evaluation requirements on selected tests in regards to MIL-PRF-85570D and ADS-61A-PRF-2002 specifications. The multi-pack is completely self-contained; everything needed to mix the mildew remover is contained, within the six-gallon bucket, which also serves as a shipping container. Upon application, the aqueous solution effectively cleans and removes mildew from an infected area within 5 to 15 minutes, inhibits future growth, and helps prevent corrosion. The individual components and the final mixture are environmentally friendly, non-toxic with no strong unpleasant odor. NAVCLEAN® is an advancement over current mildew remover kits in that it is pre-measured, pre-packaged, and can be stored (unmixed) for several months prior to use. NAVCLEAN® can be used up to 24 hours from when the solution was made. The mildew kit also reduces the time required to clean an aircraft, saving considerable labor costs. The mildew remover multi-pack kit has been shipped to several U.S. Army bases for use on helicopters returning from Iraq and Afghanistan and has received positive feedback.



Figure 1 - Corrosion Inhibiting Mildew Remover Kit.

NAWCAD PATENT FACTSHEETS

NAVCLEAN® *continued*

Summary of Benefits:

- Extremely effective in removal and prevention of mold and mildew
- Non-corrosive to cleaning surfaces, particularly metals
- Cost effective formulation from commercially available chemicals
- Environmentally friendly
- Unlike bleach, the most commonly used mold cleaner; NAVCLEAN® is not caustic and has no odor

Market Opportunities:

- Residential cleaning, home products for cleaning bathrooms, hot tubs, etc.
- Cleaning industry for homes, commercial businesses, public facilities, etc.
- Marine market - cleaning of pleasure craft, houseboat, yachts, cruise line ships, etc.
- Swimming pools, spas, hot tubs, gyms, locker rooms/showers, etc.
- Industrial processing facilities such as pulp and paper mills, food processing, etc.
- Agricultural - mill and dairy industry
- Cars, trucks, trains, ships, buildings and/or any other object that needs removal of mildew
- Military aircraft
- Naval ships



Mildew Growth Before and After Cleaning with Mildew Remover Inside T-39 Aircraft.

Adjustable Liquid Atomization Nozzle (ALAN)

U.S. Patent Number 7,523,876

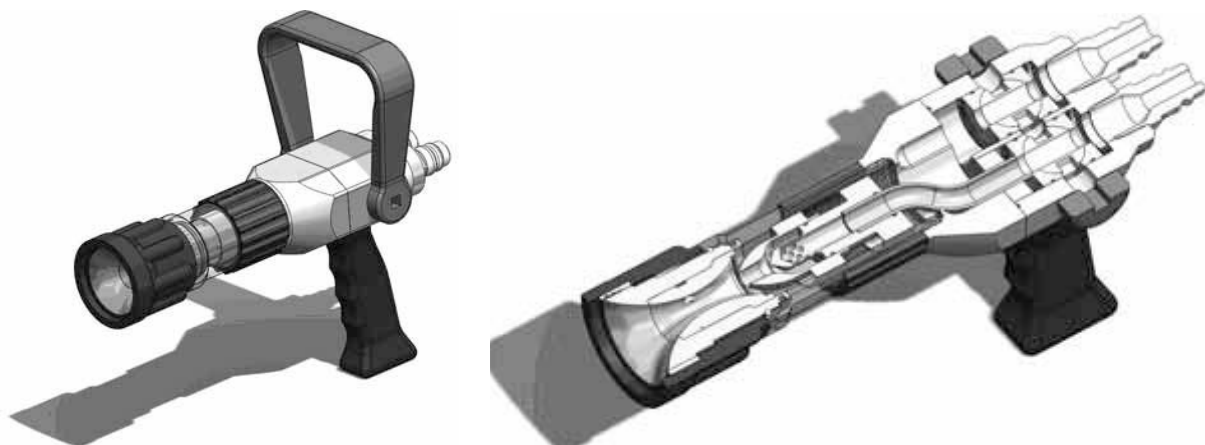
Technology and Background:

The Adjustable Liquid Atomizing Nozzle (ALAN) is an adjustable, portable, hand held device that is especially useful to mix and atomize two or more fluids. Fluorocarbon based fire extinguishing agents are environmentally harmful since they cause depletion of the Earth's ozone layer. Present U.S. law and treaty agreements require the replacement and phasing out of such materials, which classified halon as a class I Ozone Depleting Substance. Therefore, a need exists for replacing halon systems by improving existing water sprinkler based systems for more effective fire extinguishment use. The ALAN can provide the first responder, commercial, military and civilian community with a more efficient and effective tool to fight fires.

Fine Water Mist (FWM) type systems have very favorable characteristics as replacements for halon systems and are continuing to be studied by Navy scientists and engineers. Typically, such systems include nozzles for creating misting fluids using a pressurized gas and such types of systems are well-known. A disadvantage to current FWM systems is they require high pressure spray of the liquid and the gas. Another disadvantage is the need for fine holes which are easily clogged and worn causing the mixture to exit the nozzle at a reduced level of efficiency and effectiveness.

Technology Solution:

The ALAN is a convergent/divergent (C-D) nozzle structure that produces an extremely fine atomization using low pressurization of liquid and gas being delivered to the nozzle. This ALAN provides an improvement over other currently available nozzle systems by providing controllability, adjustability, ease of use, and portability. The fluids and gases are delivered through relatively large holes providing minimal wear and clogging of those holes by debris. The ALAN can flow one or two fluids depending on desired applications. Effective atomization depends upon the viscosity of the materials to be mixed and the ratio of the gas to liquid. This ratio can be varied or adjusted by the operator to accommodate the desired result to intended application. Additionally, the atomization can be varied and adjusted to meet the handing needs during the process or application. Everything from highly efficient atomization, droplet sizes under 100 microns, to purely laminar flow of one fluid is possible through the improved ALAN hand held unit.



Prototype of Adjustable Liquid Atomization Nozzle

Adjustable Liquid Atomization Nozzle (ALAN) *continued*

Summary of Benefits:

- Nozzle can be fabricated using standard machining methods, using a variety of metals, composite, and/or plastic materials
- Relatively large nozzle orifice does not clog or become obstructed from dirt or debris in the water
- The ALAN may be clamped, pressed, screwed or otherwise fastened into housings, chambers, tanks, hoses and the like, of substances, liquids or gases supply methodologies to achieve the resultant mixture
- Provides a method for the operator to vary or adjust the output atomization range from fully optimized to fully laminar flow
- Provides a hand held adjustable liquid or gas atomization nozzle for changing requirements
- Provides a method to control the output of atomization and fluid flow on a hand held unit
- Provides a means to mix fluids (gases or liquids) at one source and disperse the resultant mixture through an adjustable converging-diverging non-clogging nozzle
- Uses a minimal amount of water, resulting in less water damage to the house or structure
- Use nozzle for fire extinguishing foam systems where it would have the potential of consuming lesser quantities of foaming agents, thus reducing fire fighting costs and minimizing site clean up and contamination

Market Opportunities:

- Utilize in place of, and in addition to, the standard large water capacity fire hose nozzles
- Replace building fire sprinkler systems for public buildings, offices, hospitals, schools, factories, restaurants, etc.
- A portable self pressurizing unit for use in buildings, commercial trucks, various marine craft and larger ocean vessels, aircraft, and emergency vehicles
 - *Using the nozzle maximizes the effectiveness of the water that is carried in the portable units*
- ALAN can be utilized for fire protection, medical, agricultural, painting, food, snow making and any other industry that requires the mixing of two or more substances, liquids or gases
- The nozzle's ability to atomize droplets in micrometer sizes makes it attractive for use in other applications:
 - Evaporative cooling mist
 - Ice particle production
 - Drying/freeze drying
 - Mixing of material
 - Combustion of liquids or slurries
 - Fuel injection nozzles
 - Smoke stack scrubbers
 - Humidification
 - Dust Suppression
 - Aeration
 - Deodorizers
 - Deposition and application of coatings

Personal Portable Environmental Control System (PPECS)

U.S. Patent Number 7,331,183

Technology and Background:

A Personal Portable Environmental Control System (PPECS) has been developed and patented by NAWCAD. The PPECS relates to a personal portable environmental control system. More specifically, but without limitation, the PPECS relates to a wearable air cooling and heating system.

Military operations, as well as other similar operations, often require being in extreme environments that can be very cold and very hot. Personal environmental control systems may be very helpful to users in that they increase comfort to the user as well as allow greater concentration on the mission. In extreme cold, added clothing may be too bulky or not adequate. In extreme heat there are few if any alternatives. Therefore, a need exists to provide heating and cooling to personnel involved in varying temperature environments to improve overall performance while completing assigned tasks.

Thus, there is a need to provide a portable environmental system without the limitations inherent in present methods.

Technology Solution:

The PPECS is a personal portable environmental control system, which includes a thermoelectric device, two heat sinks, an exhaust fan for blowing ambient air across one of the heat sinks, and a blower for ambient air across the other heat sink which generates either heated or cooled air. The PPECS provides conditioned air (cooled or heated) to personnel involved in varying temperature environments without restricting the movement of the user.



Personal Portable Environmental Control System (PPECS)

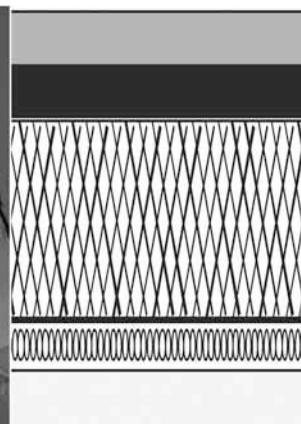
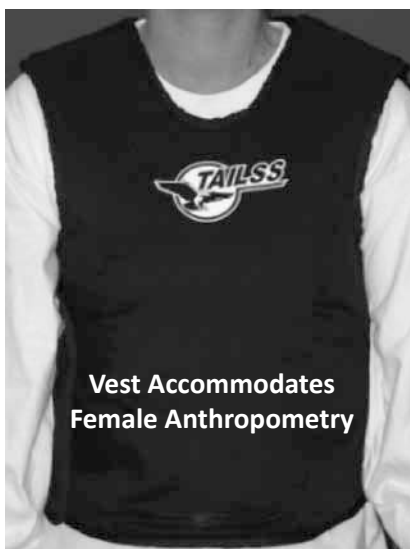
continued

Summary of Benefits:

- Portable, light weight, self contained systems
- Can be configured to meet specific mission requirements
- Can be integrated with new or existing forced ventilated clothing systems
- Device can be configured to run from batteries, vehicle power or AC power that's been converted to DC power
- Can provide cooling/heating as long as a power source is available
- PPECS is easy to maintain
- Vest accommodates female anthropometry
- Interceptor Armor
- Portable: 57 W dry / 300W with sweating; 3.5lb; 3hr duration w/ 3lb battery (Model UBI-2590); $\Delta T = 18^{\circ}\text{F}$ (10°C) cooling from ambient; $\Delta T = 45^{\circ}\text{F}$ (25°C) heating from ambient
- Vehicle system: $\Delta T = 36^{\circ}\text{F}$ (20°C) cooling from ambient; $\Delta T = 72^{\circ}\text{F}$ (40°C) heating from ambient; unlimited duration

Market Opportunities:

- Exercise, recreational, or motor sports
- Fire Fighters and First Responders for rescue missions
- Hazmat teams or specialist engaged in hazardous waste handling and clean-up
- Foundries, power plants, mining, and mill workers
- Military applications in extreme temperature environments
- Mascot and character costumes
- Any need which requires cooling and/or heating



Flame protection (optional Nomex outer layer)

Air Distribution Bladder

Spacer for ventilation and heat & vapor removal

Wicking liner (or Tee shirt)

Skin

Wireless Blade Monitoring System and Process

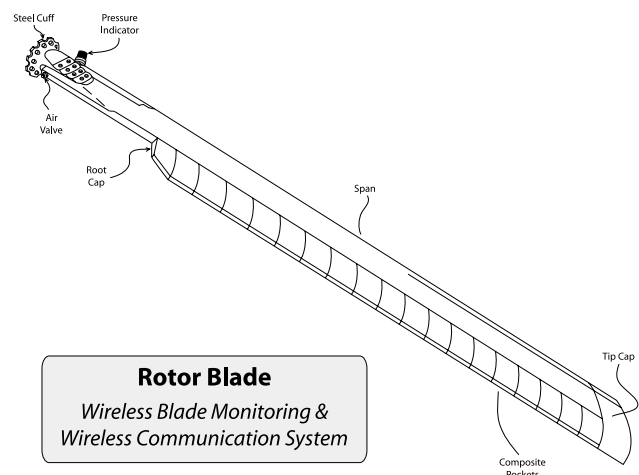
U.S. Patent Number 7,176,812

Technology and Background:

The Wireless Blade Monitoring System is formed by the integration of commonly available or easily developed hardware and/or software components. These components are controlled by non-proprietary, open architecture software. This allows the system to easily incorporate a variety of sensors and/or detectors providing an improved blade monitoring capability. Both civilian and military pressurized helicopter blades have a finite operating life, and can be rendered unserviceable due to damage and fatigue wear. Loss of pressurization, and damage detection and/or blade condition information may provide the capability to avoid blade associated flight hazards. The system currently in use by the U.S. Navy and Marine Corps, called In-flight Blade Inspection System (IBIS), utilizes a radioactive isotope, strontium 90, as a means of transmitting the below ideal pressure threshold condition to a sensor in the aircraft. The present system consists of one indicator per blade, and one detector per aircraft that must be handled as a radioactive component. This fact drives up the logistic support, disposal, repair, replacement, and environmental costs. A need for a low-cost rotor blade pressure and condition monitoring system which can provide early in-flight indication of potential rotor blade faults, without the use of radioactive isotopes is required for fleet safety. Additional system requirements are form, fit and function replacement that is easy-to-use, relatively simple to manufacture, and economical to install on both military and commercial helicopters.

Technology Solution:

NAWCAD has developed and successfully tested, in a lab environment, a form, fit and functional replacement blade monitoring system. This new system and process is capable of providing real time, in-flight advisory of the blade pressurization and structural condition of a helicopters rotor blade(s) which does not use any hazardous material. The Wireless Blade Monitoring System uses inexpensive digital sensors, modern battery and wireless communication technologies in a unique manner in order to produce a highly reliable advisory information system capable of enhancing flight safety, while reducing operating costs. The early indication of loss or blade pressure and damage or fatigue cracking is a safety advisory to the flight crew. This early advisory has the potential to then save the flight crew and helicopter. In addition to indicating blade health on a cockpit display, the wireless device can communicate with a laptop or handheld PC for ground safety checks. Environmentally friendly, it does not require the use of radioactive sources, which provides the advantages of eliminating procurement of radioactive sources; the handling and disposal costs associated with such sources; and the exposure of personnel and the environment to radiation in the event of a flight or ground mishap. Additional advantages include highly durable, reliable, functionally and operationally simple to use, and easy to install.



Wireless Blade Monitoring System and Process *continued*

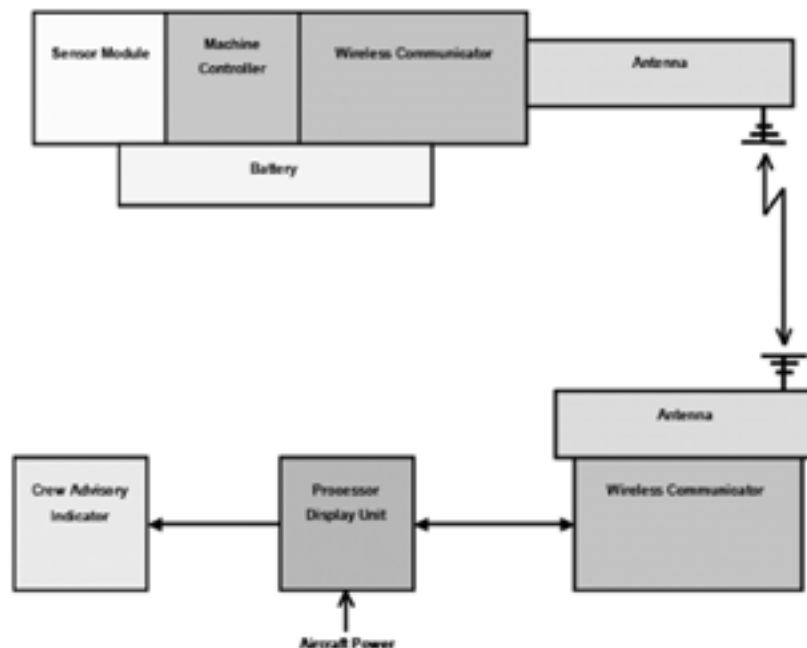
Summary of Benefits:

- Environmentally friendly
- Easily manufactured from low-cost, readily available and/or configurable devices
- An order of magnitude life cycle cost savings over existing technology
- Continuous monitoring of actual pressures and temperatures offering in-flight prognostic blade health monitoring capability
- Eliminates procurement, handling, personnel exposure and disposal of radioactive materials/components presently used today
- Ground crews can remotely monitor blade health with handheld devices
- System plugs directly into existing hardware and electronics of many aircraft
- Has been successfully laboratory tested against high G force environments experienced on helicopter rotor blades and the high electromagnetic environment on aircraft carrier flight decks

Market Opportunities:

Over 500 U.S. Department of Defense helicopters could use this system as a direct replacement. Labor and skill required to install the wireless monitoring system in place of currently used system is minimal since it is designed to plug directly into existing sockets and sensor holders. The utilization of this system on helicopters used by Government agencies, foreign militaries, and commercial entities should naturally follow. The total potential helicopter market is several thousands.

Since the system is easy to modify with software and other components this technology would have a use in various applications where gas pressure and temperature need to be monitored such as chemical plants, nuclear power plants, refineries, and other remote monitoring of sensors, particularly in dynamic/rotating systems where wired systems are inappropriate.



Helicopter Messenger Cable Illumination

U.S. Patent Number 7,025,304

Technology and Background:

The Helicopter Messenger Cable illumination relates to a Recovery Assist, Secure and Traverse (RAST) system used in helicopters for increasing the visibility of the messenger cable that is lowered from the helicopter. The RAST system is a landing assist and secure system. It provides the means to assist landing and securing an airborne helicopter to the flight deck of a seagoing ship. The RAST system has components on both the ship and the helicopter.

During night landings when the ship's deck is marginally lit, the deck crew may not be able to see the messenger cable to capture it for hookup actions. Dangerous situations may occur when the cable becomes snarled with the ship's hardware or entangled with a crewman. Delay to recovery of the helicopter resulting from possible hookup difficulties, especially under worst case or emergency conditions, also represents an adverse safety element.

Various shipboard lights, cable paints, and other reflective devices had been implemented in an effort to improve visibility of the messenger cable with limited success. Modification of the aperture on the existing RAST illumination light lower protective cover to provide increased illumination of the messenger cable was successful when the messenger cable was close to the helicopter, but failed to provide deck personnel with adequate visibility as the cable reached the flight deck.

Technology Solution:

NAWCAD has developed an improved visibility to the messenger cable and connector to facilitate helicopter landing operations during times of low visibility.

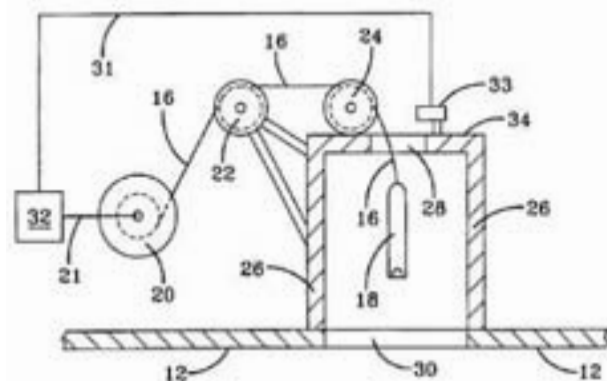
The simple solution was to affix a short piece of luminescent "glow" cover to the messenger cable spanning the distance from the top of the messenger probe to the pulley. A bracket with a halogen or UV charging light will be added near the cable adjacent to the cable sheave. This light will charge the luminescent material so that it retains a visual glow for at least 10 minutes and will be visible to ship's crew when lowered during the helicopter recovery evolution. The Helicopter Messenger Cable Illumination allows flight deck crew to maintain eye contact with the messenger cable to the ship's flight deck, resulting in increased shipboard safety.

Summary of Benefits:

- System cost would be low
- Installation of the system is easily achieved
- Improved visibility of the messenger cable for flight deck crew members

Market Opportunities:

- United States Department of Defense helicopters;
- Rock climbing enthusiasts
- First Responders, Fire Fighters, Forest and Rescue Services.



Hybrid Lidar-Radar for Medical Diagnostics

U.S. Patent Number 7,010,339

Technology and Background:

The noninvasive and early detection of biological tissue abnormalities with submillimeter dimensions, such as cancerous tumors, is an important challenge and constant improvements are being sought. The well-established X-ray and ultrasound techniques lack the resolution to detect such small objects some of which may be cancerous tumors. In addition, the risk of tissue ionization that may damage healthy tissues prevents the use of X-ray for routine examination. Magnetic resonance imaging (MRI) has submillimeter resolution, but the cost of this technique is still high for general use.

The need of a safe, inexpensive and efficient method for the early detection of tissue imperfections, such as cancerous tumors, has led to the investigation of optical imaging techniques.

After several years of research and development at NAWCAD, a new hybrid lidar-radar system was developed and patented.

Technology Solution:

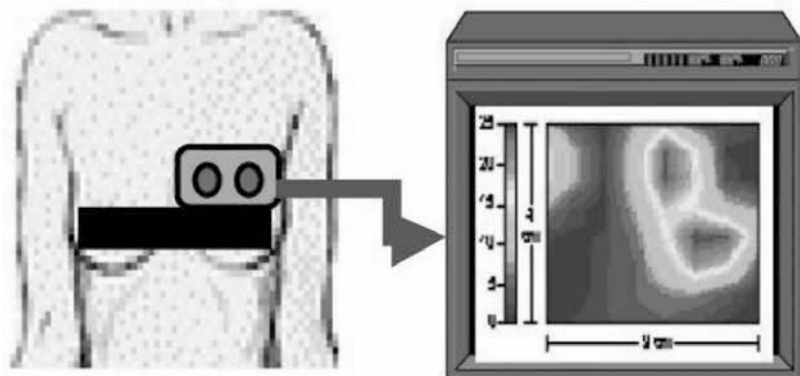
A hybrid lidar-radar system for detecting the presence of objects, such as cancerous tumors, within tissues by detecting reflected signals from the tissue and discriminating the information related to the cancerous tumor from the undesirable back scattering of light created by the tissue itself. The hybrid lidar-radar system utilizes continuous wave light that is preferably modulated at frequencies up to 60 GHz. The present invention filters the return signals from the tissue at a subcarrier modulation frequency so as to reject erroneous information contained in scattered lights, while at the same time retaining the coherent, unscattered and modulated light information so as to provide for an accuracy detection of tumors within tissues.

Summary of Benefits:

- Safe
- Noninvasive
- Allows for early detection of biological tissue abnormalities
- Higher resolution
- Detects smaller objects
- Prevents damage to healthy tissues
- Inexpensive

Market Opportunities:

- Medical field
- Mobile Medical facilities



Medical Diagnostics

Trivalent Chromium Pre/Post Treatment Corrosion-Resistant Coatings (TCP)

U.S. Patent Numbers 6,375,726; 6,511,532; 6,521,029; 6,527,841; 6,663,700; 6,669,764

Technology & Background:

In order to improve the corrosion resistance and bonding of paints to aluminum alloys, anodized aluminum and sacrificial coatings, a surface treatment is required. A class of chemicals called conversion coatings is used for this purpose. For more than 50 years, the standard corrosion resistance surface coatings for aluminum or zinc-coated alloys in both military and industrial applications has been hexavalent chromium, which is a highly toxic carcinogen. After several years of research and development at the Naval Air Warfare Center Aircraft Division, Patuxent River, MD a new line of environmentally benign and highly effective coatings for application on aluminum and zinc-coated alloys was developed named Trivalent Chromium Pre/Post Treatment Corrosion-Resistant Coatings (TCP).

Technology Solution:

TCP was invented as a more environmental benign coating than hexavalent chromium without sacrificing corrosion resistance or other performance characteristics. A family of four United States Patents for these corrosion resistance coatings were issued and are now available for licensing.

Summary of Benefits:

There are many benefits to TCP. They are the only non-hexavalent chromium conversion coatings that will fully meet all military specifications for pre/post treatment of aluminum. Numerous inside and outside laboratory and field test show that TCP is the best all-around alternative to chromate coatings available at this time. Additionally, its improved electrical conductivity makes it ideal for applications in the electronics and telecommunications industries. A few of the benefits include:

- Can be applied at room temperature by immersion, spray or wipe
- Contact / dwell time two (2) - ten (10) minutes
- No post treatment / cures required
- Easy to mix and handle
- Provides good surface adhesion
- Meets EPA and OSH Requirements
- Cheaper to make than chromate conversion coatings

Market Opportunities:

The four TCP patents are environmentally benign and highly effective corrosion resistant coatings recently developed by the U.S. Navy are available for licensing and can be utilized in the following areas:

- Boats
- Swimming Pools
- Window Frames
- Wheels
- Automobiles
- Aircraft
- Bicycles
- Fasteners
- Military Vehicles



NAWCAD PATENT FACTSHEETS

Marine Vessel Traffic System (SureTrak)

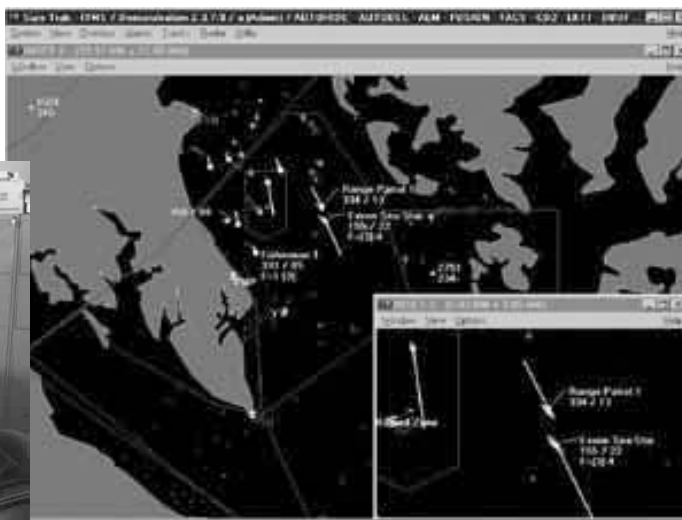
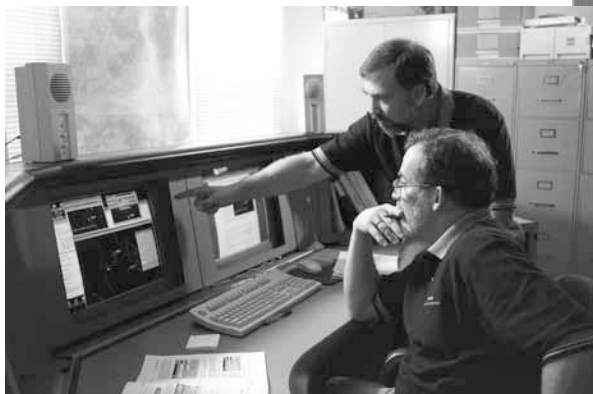
U.S. Patent Number 6,249,241

This invention is an improved radar harbor surveillance sensors, computer display system to monitor marine harbor traffic, provide advisories to vessels in areas elected by the system operators, and provide the operators of the system with an early warning of unacceptable traffic conflicts in the confined waterways of the harbor. Each system consists of a number of remote sites providing radar, camera, video, and audio communicated to a central Vessel Traffic Center (VTC). VTC data integration and display provides the ability to identify, monitor, and advice of potentially dangerous vessel traffic conditions and fuse multi-radars on a single display. Although the primary purpose of SureTrak is to insure safe passage of vessels throughout waterways, the system also provides the ability to document traffic conditions and incidents.

The object of this invention is to monitor vessel traffic and provide advisories to vessels in transit or anchorage in key waterways. To accomplish this task, the SureTrak system is capable of acquiring data from one in the initial fielded system to 18 remote sites in the form of radar track data, digitized radar image data, camera video, and audio. Data is processed and displayed in a form that provides for early recognition of potentially dangerous situations and communication of the impending condition of vessels of concern. This feature is intended to provide the capability to allow advised vessels to implement corrective actions in a timely manner. Each system functions 24 hours a day, seven days a week with a system availability of 99.9%.

It is a further objective of this invention to provide and aid waterway authorities in the conduct of other mission roles including search and rescue, law enforcement, pollution control, and marine safety. Through data collection, the SureTrak system facilitates waterway authorities command and control capabilities to detect events and coordinated responses.

Department of Defense, Homeland Security, United States Coast Guard, Port Authorities, Customs, Airports, State and Local Government, and many other could benefit from this technology.



Effervescent Fine Water Mist System

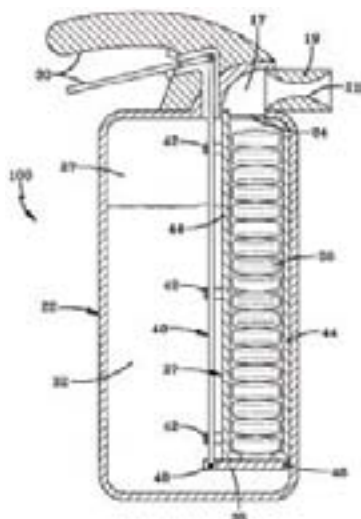
U.S. Patent Number 6,241,164

U.S. Navy scientists established and patented a design for an Effervescent Fine Mist System (EFWMS) for fire suppression and successfully fabricated and demonstrated elementary prototypes. This fine water mist system would serve as a dual-use substitute for halon (an ozone depleting chemical) and CO₂ (a global warming agent) fire suppression systems in aircraft, vehicles and ships as well as in homes and offices.

EFWMS involves the use of a chemical reaction (water with a chemical reactant) to produce a bubbly two-phase (effervescent) flow through a converging-diverging nozzle. The “effervescent flow” contains non-toxic gas bubbles produced by the chemical reaction, which is required as the energy to atomized the water in the nozzle. The rapid expansion of the gas bubbles in the nozzle produces sufficient energy to shear the water causing the water to explode into small droplets. The EFWMS is a self-contained system using pressure the energy to both shear the water into a fine mist and propel the mist a great distance to penetrate flames and fire. It has the added benefit of using a non-toxic and inert gaseous agent to aid in oxygen depletion around the fire and enhance extinguishment.

The EFWMS would fulfill a need that exists for an ‘environmentally safe’ replacement for fire extinguishers which currently use Halon 1301, 1211 or CO₂. Although the military may continue to use halon via waivers on existing platforms only, all new military and civilian uses have been banned. Therefore, new solution to fire suppression are required and encouraged. Also, significant cost reductions would also be realized by eliminating the use of Halon.

This dual-use technology would find both military and civil applications for fire suppression in aircraft cabins and storage bays, vehicles and in military and civilian fire suppression applications in remote sites. The technology could also be used in sprinkler head replacements (to reduce water consumption and cost), hand held portable fire extinguishers, cable plenums, flammable container closets and anywhere where limited space, weight and cost are significant factors in providing fire control/suppression such as in planes and ships.



Portable, Modular Air-Conditioning System

U.S. Patent Number 6,240,742

Severe heat stress in humans adversely affects mental and physical performance. Individuals who wear protective encapsulating garments are routinely exposed to high temperature and humidity environments. External thermal generating sources, such as motors, instrumentation, and/or solar radiation, can exacerbate heat stress. Current personal cooling systems are inadequate.

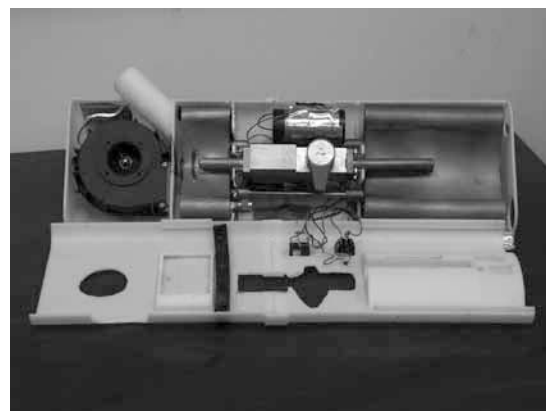
NAWCAD has done extensive research in the field of personal air-conditioning systems. This has resulted in the development of various cooling devices that can be worn by an aviator or integrated with a chemical-biological suit for use in desert warfighting scenarios. These devices can have applications outside of the Naval aviation environment, as well.

The NAWCAD technology features an air-conditioning system of modular construction. Each module can be configured, changed or added on thus giving flexibility for satisfying the various in-the-field thermal, filtration, and power requirements. The system is portable, man-mounted and field serviceable allowing it to be easily operated and worn without encumbering the user. Add-on capabilities for increasing cooling power and capacity, for air filtration for chemical-biological threat environments, and for enabling the connection to electric power and/or air flow sources are some of the options of this modular system. The system is comprised of a power supply, blower, air-conditioning, air distribution, and air filtration modules. The power module which may consist of batteries; powers the blower module that moves air through the air-conditioning module and encapsulated garment. Thus, effectively extracting heat from the body and preventing overheating of the individual

Some advantages of the Navy's personal air-conditioning system technology include the following:

- Man-mounted
- Field Serviceable
- Batter-powered
- Lightweight
- Easy to maintain
- Field configurable to meet specific mission requirements
- Can be integrated with new or existing forced ventilated clothing systems
- Can input or extract sufficient heat to minimize heat related performance
- Degradation

Some examples of invention usage would be as an addition to gear worn by fire-fighters, first responders, mascot and character costumes, race car drivers, sports enthusiasts, specialists engaged in hazardous waste handling and clean-up, foundry, power plant, mining, and mill workers, to name a few.



Chest Mounted Armored Microclimate Conditioned Air Device

U.S. Patent Number 6,105,382

Personal heating and cooling apparatus technology has many applications, including but not limited to uses in aviation, sports clothing manufacturing, hazardous waste handling and clean-up, fire fighting units, power plants, mining, foundries, and mills.

NAWCAD holds a patent for a chest mounted armored microclimate conditioned air device, which also provides ballistic protection for the users.

This device is fully portable, dual-cycle microclimate cooling device encased in a thin chest-mounted ballistic protective enclosure. Worn over the chest and suspended by straps over the shoulder, it provides conditioned air to reduce heat stress and exhaustion. Ideally, it should be worn under an equipment survival vest, but it can be rapidly separated from the wearer's ensemble by a quick-release mechanism attached to the front of the device. The overall dimensions are very similar to those of the ballistic protective shield currently used by Navy and Marine Corps aviators.

The device works by drawing ambient air through a filtrated blower assembly and then pushing that air into the device at its inlet point. The filtered air is then conditioned as it passes through the device and exists the opposite side into a routing hose. This conditioned air is pumped to the garment through a suite inter-connect.

Some examples of invention usage would be as an addition to gear worn by astronauts, fire fighters, special weapons and tactics (SWAT) teams, police officers, sports enthusiasts, specialists engaged in hazardous waste handling and clean-up, foundry, power plant, mining, and mill workers, to name just a few.

To obtain a commercial license for, or more information about this technology, contact the Office of Research and Technology Applications. The technology is described in U.S. Patent Number 6,105,382 entitled "Chest Mounted Armored Microclimate Conditioned Air Device."



Liquid Atomizing Nozzle Technology

U.S. Patent Number 5,520,331

The U.S. Navy designed, developed and patented a new and unique fine mist nozzle technology. Patent Number 5,520,331 covers a convergent/divergent nozzle which atomizes a liquid provided through a delivery tube along with a gas, resulting in an extremely fine mist having a high momentum. This is a low-pressure system using a combined stream of air and liquid. Low pressure compressed air is employed which expands beyond the throat of the nozzle, shearing the low pressure liquid into small droplets and hurling them out of the nozzle as a high momentum mist. The technology has been successfully prototype, demonstrated and fully optimized.

Other existing mist nozzles (i.e., water) create droplets that are relatively large in size and a fine mist cannot be achieved. The subject system is capable of providing an extremely fine liquid atomization using a combination of liquid and gas delivered to the nozzle at low pressure. High pressurized systems (greater than 500 psi) tend to easily clog because they require small apertures to produce small droplets, while the low pressure system (less than 25 psi) proves to be extremely reliable and maintenance free. The use of this nozzle system eliminates the need for high-pressure fittings, pumps and steel piping to achieve the atomizing, and also minimizes the amount of liquid required to operate the system. Thus, a savings of space, weight and cost would be significant through the use of this new highly efficient technology. The process is unique in its application and constitutes an improvement of the quality, reliability, control and effectiveness of misting systems.

This atomizing nozzle design has been successfully demonstrated and licensed for fire suppression applications (i.e., aerospace, rail, marine and offshore oil industries, building, and other fixed structures). Additional potential commercial applications/field of use for this nozzle technology may be found in the areas of snow making equipment, oral drug administration, paint and adhesive sprayers, spray dryers, lubricating applications, etc., where a highly efficient low pressure, non-clogging, reliable and effective high momentum misting system is required.

To obtain a commercial license for, or more information about this technology, contact the Office of Research and Technology Applications. The technology is described in U.S. Patent Number 5,520,331 entitled "Liquid Atomizing Nozzle."





How To Do Business With Us

Doing Business With Us

The U.S. Navy has statutory authority to use its facilities to perform specific types of work for private parties. These business arrangements benefit both the Navy and industry by increasing the utilization of Navy facilities, providing unique facilities for use by private parties, and fostering healthy relationships between the Navy and industry.

Technology transfer adds a valuable dimension to government-sponsored research and development. It provides the tools for American industries to leverage the technologies developed at Federal laboratories and bring new products to market. Both the Federal Government and industry benefit from this process.



Technology Transfer

Patent License Agreement (PLA)

A PLA is a contract between the Federal Government and a non-Federal party, which ensures that the Federal Government agrees not to sue the non-Federal party for infringing on the Federal Government's patent.

It is the Federal Government's technology transfer policy to promote the utilization and commercialization of inventions that arise from agency-supported research and development through a PLA.

In granting a PLA to make, use or sell the invention the non-Federal party must satisfy a number of conditions. They include a satisfactory development or marketing plan, as well as information about its ability to implement the plan. The non-Federal party must commercialize the invention within a specified period of time and must continue to make the benefits of the invention reasonably accessible to the public. The company must report its utilization of the patent periodically to the Federal agency holding the patent. The Federal Government always retains an irrevocable royalty-free right to practice the invention.

Normally, a PLA will be granted to companies agreeing to manufacture the product(s) substantially in the U.S.A. A PLA can be exclusive, partially exclusive, or non-exclusive.

Selling Products & Services

Small Business Innovation Research (SBIR)

SBIR is a highly competitive, three-phase award program, which provides small businesses with opportunities to propose high-quality innovative solutions that meet the specific R&D needs of Naval Aviation.

- Fosters R&D project insertion into Naval Aviation systems
- Stimulates technological innovation
- Uses small businesses to meet Federal R&D needs
- Encourages minority and disadvantaged business participation
- Increases private sector commercialization derived from DoD R&D, specifically Naval Aviation suppliers

NAVAIR Office of Small Business Programs (OSBP)

The NAVAIR Office of Small Business Programs provides training, guidance, and innovative strategies, ensuring quality solutions for NAVY and Marine Corps acquisition teams.

OSBP maximizes opportunities for small business to include:

- Veteran Owned Small Businesses
- Service Disabled Veteran Owned Small Businesses
- Historically Underutilized Business Zone Programs (HUBZone) Small Businesses
- Small Disadvantaged Businesses
- Women-Owned Small Businesses
- Historically Black Colleges & Universities/ Minority Institutions

Business Opportunities

FBO.gov is the single government point-of-entry for Federal Government procurement opportunities over \$25,000. Government buyers are able to publicize their business opportunities by posting information directly to FedBizOpps via the Internet.

DoD has mandated that every contractor in order to receive a contract must be registered in Central Contractor Registration (CCR), which is also necessary for payment purposes. It supports the goal of a paperless acquisition process. You can register on-line at no charge.

Buying Products & Services

Cooperative Research and Development Agreement (CRADA)

CRADAs were established and authorized under the Federal Technology Transfer Act of 1986, as a vehicle to improve the transfer of Federal Government owned and commercially useful technologies from Federal Laboratories to the private sector.

The primary purpose of the CRADA is to allow Government-Owned, Government Operated (GOGO) and Government-Owned and Contractor-Operated (GOCO) to enter into cooperative agreements for technology transfer with all types of organizations. This includes other federal agencies; units of state or local government; industrial organizations; public and private foundations; non-profit organizations, including universities; and individuals who are licensees of Federally-owned inventions.

CRADAs support the broader purpose of providing the means for a laboratory to leverage its research and development efforts, consistent with the laboratories mission. Through a CRADA, for example, a laboratory may gain access to outside expertise and facilities, and in some cases, funds that can be used to further the mission goals of the laboratory. In addition, the commercialization efforts of a non-Federal party may result in royalty payments to the laboratory as well as relevant laboratory personnel.

The broader purpose of CRADAs is that they encourage the creation of teams to solve technological and industrial problems for the greater benefit of the country. These teams may be partnerships between Federal laboratories and commercial organizations, or between Federal laboratories and universities, or just about any combination of Federal and non-Federal organizations.

Commercial Service Agreement (CSA)

A CSA is a legal agreement between the Department of Defense (DoD) and a non-Federal party, whereby non-Federal parties pay for the use of DoD research and development laboratories. CSAs are not subject to procurement regulations, but they cannot compete with the private sector. All work conducted under a CSA remains proprietary information of the non-Federal party.

APPLICATION FOR LICENSE TO PRACTICE INVENTION

APPLICATION FOR LICENSE TO PRACTICE INVENTION		Return completed application to: NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION ATTN: ORTA REP 22473 MILLSTONE ROAD BLDG 505 PATUXENT RIVER, MD 20670
PART I IDENTIFICATION OF INVENTION		
1. Navy Case No.:	2. Title Of Invention:	3. Name of Inventor(s):
4. Patent Data: a. U. S. PATENT APPLICATION SERIAL NO.: _____ FILING DATE: _____ b. U. S. PATENT NO.: _____ ISSUE DATE: _____		
5. Source of information concerning the availability of a license on this invention:		
PART II IDENTIFICATION DESCRIBING APPLICANT		
6. Name and address of the Person, Company, Partnership, Corporation or Organization applying for license:		7. Name, address and telephone number of representative of Applicant to whom correspondence should be sent:
8. Applicant's citizenship or place of incorporation:		9. Is applicant a Small Business Firm as defined at Section 2 of Public Law 85-536 (15 USC 632) and implementing regulations of the Administrator of the Small Business Administration? ☐ YES ☐ NO
10. Is applicant directly or indirectly controlled by a foreign company or government?		☐ YES ☐ NO
(If yes, please identify company and/or government: _____)		
11. Nature and type of Applicant's business identifying products or services which the Applicant successfully commercialized:		
12. Approximate number of Applicant's employees:		
13. State Applicant's best knowledge of the extent to which the invention is being practiced by private industry of the Government, or both, or is otherwise available commercially:		

APPLICATION FOR LICENSE TO PRACTICE INVENTION

PART III PLAN FOR DEVELOPMENT AND /OR MARKETING OF THE INVENTION

14. Describe in detail applicant's plan for development and/or marketing of the invention:

- a. State the time which applicant believes will be required to bring the invention to practical application. Include milestones and a target time by which applicant will have a commercial product available to the public.
- b. State the nature and amount of anticipated investment of capital and other resources which applicant believes will be required to make the invention available to the public.
- c. State the Applicant's capability and intention to fulfill the plan, including information regarding manufacturing **(specify every country where products embodying the invention or produced through the use of the invention will be manufactured)**, marketing, financial and technical resources.
- d. State the fields of use for which Applicant intends to practice the invention:
- e. State the geographic areas in which the Applicant intends to manufacture any products embodying the invention and the geographic areas where Applicant intends to use and/or sell the invention.

PART IV OTHER

15. State minimum number of years for which Applicant seeks a license:

16. Identify licenses previously granted to Applicant under Federally-Owned inventions:

17. State any other information which the Applicant believes will support a determination to grant the license to Applicant:

18. Type of license requested:

NONEXCLUSIVE

☐

EXCLUSIVE

☐

PARTIALLY EXCLUSIVE (identify limitations)

☐

19. Signature of Applicant or Representative of Applicant

Date:

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<http://nawctsd.navair.navy.mil>

Naval Air Systems Command
Office of Small Business Programs (OSBP)

22473 Millstone Road
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Patuxent River, MD 20670
Phone: 301-757-9000
Fax: 301-757-9093
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Naval Air Warfare Center
Aircraft Division, Lakehurst
Business and Partnership Office

Building 150/3 Highway 547
Lakehurst, NJ 08733
Phone: 732-323-2899
<http://www.navair.navy.mil/nawcad>

Naval Air Warfare Center
Weapons Division

Code 4L4000D
1900 N. Knox Rd, Stop 6312
Bldg 00005, Room 1507
China Lake, CA 93555
Phone: 760-939-1074
Fax: 760-939-0708
<http://www.navair.navy.mil/nawc wd>

Naval Air Warfare Center
Aircraft Division
Small Business Innovation Research (SBIR)

Building 209 Room 141
48150 Shaw Road
Patuxent River, MD 20670
Phone: 301-342-0219
Fax: 301-995-3656
email: SBIR.NAVAIR@navy.mil
<http://www.navair.navy.mil/SBIR>

A person wearing a yellow hazmat suit and a helmet is crouched on the deck of a ship at night. They are reaching out towards a large, dark, rectangular object, possibly a piece of equipment or a container. The background shows the ship's structure and a dark sky with some light reflecting off the water or the ship's surface.

**NAWC Aircraft Division
Business & Partnership Office**

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<http://www.navair.navy.mil/nawcad>