NAVAL BIODYNAMICS LABORATORY

1991 AND 1992
COMMAND HISTORY

August 1993

NAVAL BIODYNAMICS LABORATORY
P.O. Box 29407
NEW ORLEANS, LA 70189-0407

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Prepared for

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COMMANDING OFFICER'S STATEMENT

The years 1991 and 1992 were productive, challenging, and dynamic for the Laboratory in a changing and uncertain world. Facing the realities of decreased resources, we made significant progress in creating a lean and efficient organization. I'm impressed by how our professional, technical, and administrative staff have met this challenge and continue to meet mission requirements.

We completed a series of tests in the vertical accelerator investigating the effects of added head mass on head and neck accelerative response. We also began a second series investigating the effects of a night vision goggle equipped aviator's helmet on head and neck response to acceleration forces. These high priority tests will serve as important predictors of neck injury risk in aircrewmen ejecting from aircraft while wearing helmet-mounted devices.

Our Human Factors assessment of the U. S. Coast Guard's prototype 47-ft motor lifeboat demonstrated our ability to provide rapid response to customer needs and resulted in significant changes to this vessel. We also completed an internationally sponsored study of the effects of ship motion on crew physical performance. The second phase of this combined Canadian, United Kingdom, Netherlands, and United States ship motion project is underway at NBDL studying crew cognitive performance.

In addition to accomplishing our mission, we continue to demonstrate a commitment to being active in the surrounding civilian community. Through our highly successful Partnership in Education Program with a local elementary school, numerous fund raisers, volunteer efforts, and frequent tours of the Laboratory, we became true partners with our New Orleans neighbors.

We look forward to the challenge of the future, confident about our ability to contribute to the safety and enhanced performance of Sailors and Marines.

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INTRODUCTION

HISTORY

The Naval Biodynamics Laboratory (NBDL) was established as the Naval Aerospace Medical Research Laboratory Detachment (NAMRLD) in April 1971 by the Bureau of Medicine and Surgery. NAMRLD was a detachment of the Naval Aerospace Medical Research Laboratory which is located at the Naval Air Station, Pensacola, Florida. The initial purpose of the Detachment was to study human response to impact acceleration. In 1975, the mission was expanded to include human response to vibration, ship motion, and human performance. NBDL was designated a separate command by the Secretary of the Navy in February, 1980, and officially established by OPNAV NOTICE 5450 on 28 February 1980.

Captain Channing L. Ewing, MC, USN was the first Officer in Charge of the Laboratory. Commander Robert S. Kennedy, MSC, USN became the Officer in Charge in December of 1976, and was relieved by Captain James E. Wenger, MC, USN in August 1979. Captain Wenger became the first Commanding Officer when the Laboratory was designated a command in August 1980. Captain Loys E. Williams, MC, USN assumed command in 1982 and was relieved by Captain Robert J. Biersner, MSC, USN in August of 1984. Captain Biersner served until April 1987 and was succeeded by Commander Don M. Herron, MSC, USN. Captain Douglas W. Call, MSC, USN became Commanding Officer in May 1987 and was relieved by Commander Robert W. Rendin, MSC, USN, in May 1992.

COMMAND RELATIONSHIPS

NBDL is under the command of Naval Medical Research and Development Command (NMRDC) and receives primary support from the Chief, Bureau of Medicine and Surgery, Washington, DC.

NASA Michoud Assembly Facility

NBDL leases its facilities from the National Aeronautics and Space Administration (NASA) Michoud Assembly Facility. The NASA Michoud Assembly Facility in eastern New Orleans boasts a long and colorful history. The King of France deeded the original 35,000 acre site to Antoine Michoud, a Louisiana soldier and statesman, in 1763. The land, located some 15 miles northeast of central New Orleans served as a source of timber for building and repairing ships, and as a rich hunting ground for trappers and fur traders. In later years, the fertile, low-lying fields were used to grow sugar cane, and for almost 100 years the sprawling plantation was owned and operated by the Michoud family.

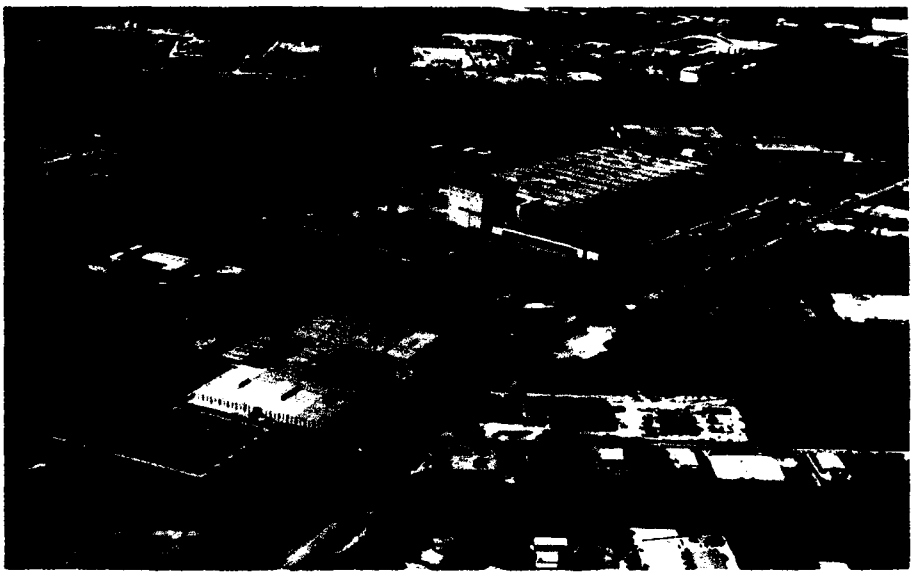
NAVAL BIODYNAMICS LABORATORY

With the outbreak of World War II, large tracts of land with deep-water access were needed for defense related construction. The U. S. Maritime Commission acquired one thousand acres of the former Michoud Plantation for building Liberty Ships. In 1942, plans for the tract were changed and a contract was issued for constructing 1200 plywood cargo airplanes at the new Michoud facility. By October 1943, the main production facility, encompassing 43 acres under one roof, was completed and aircraft construction began. Two years later, with the war drawing to an end, Michoud was closed after completing two airplanes, and was placed in the inventory of the War Assets Administration. Later, the New Orleans Dock Board acquired the tract from the federal government through a lease/purchase agreement to serve as an industrial development complex. With the outbreak of fighting in Korea, the Michoud site was reclaimed by the federal government and in late 1951 was reopened under direction of the U.S. Army Ordnance Department to build 12-cylinder air-cooled engines for Sherman and Patton tanks. As the Korean conflict diminished, engine production was reduced and the Michoud facility closed again in July 1953.

In 1961, NASA acquired the Michoud facility from the Department of Defense to serve as a final assembly point for the manufacture of large space launch vehicles which could be transported by barge to the launch site at Cape Canaveral, FL. The first Apollo mission to the moon in July 1969 was powered by a Michoud built Saturn 1C booster.

In 1973, Martin Marietta Aerospace was awarded a contract to design, develop, and manufacture nine external propellant tanks for the Space Shuttle. The external tank, which provides some 1.6 million pounds of propellant for the Shuttle's three main engines, is the only Space Shuttle component that is not recovered for reuse. Recently, Martin Marietta was awarded contracts to produce fifty-nine of the 154 foot long, 28-foot diameter tanks, and thus continues to support the Space Shuttle project.

Today, the 883-acre Michoud facility contains one of the largest production buildings in the nation, a vertical assembly building for stacking external tank components, as well as pneumostatic and systems test buildings and administrative offices. Some 2,610 Martin Marietta employees work at the Michoud Assembly Facility. Employment by other federal agencies at Michoud increases total employment at the facility to nearly 4,320 people.



NBDL MISSION

OUR MISSION is to enhance the performance of and prevent injury to the men and women of the United States Navy and Marine Corps.

WE WILL ACCOMPLISH this by conducting biomedical research on the effects of mechanical forces encountered by crew members in Navy/Marine Corps aircraft and ships, establishing human tolerance limits to these forces, and developing approaches to minimize their adverse effects.

WE WILL STRIVE CONTINUALLY to conduct the highest quality research to improve the safe and effective performance of Sailors and Marines.

NBDL VISION

WE ARE COMMITTED to providing a research facility dedicated to excellence in which:

THE NAVY AND MARINE CORPS consider NBDL the first source of scientific information relating to impact acceleration and the effects of ship motion on human performance.

BIOMEDICAL RESEARCH ORGANIZATIONS respect the Naval Biodynamics Laboratory as a world leader in conducting biodynamics research.

OUR LABORATORY PROFESSIONALS view the Naval Biodynamics Laboratory as a superior environment for realizing their professional growth and satisfaction.

OUR HIGHER ECHELON COMMAND regards the Naval Biodynamics Laboratory as the model command supporting the Navy Medical Department's strategic goals and objectives.

OUR PEOPLE view themselves as empowered members of one of the world's finest biodynamics research teams.

NBDL GUIDING PRINCIPLES

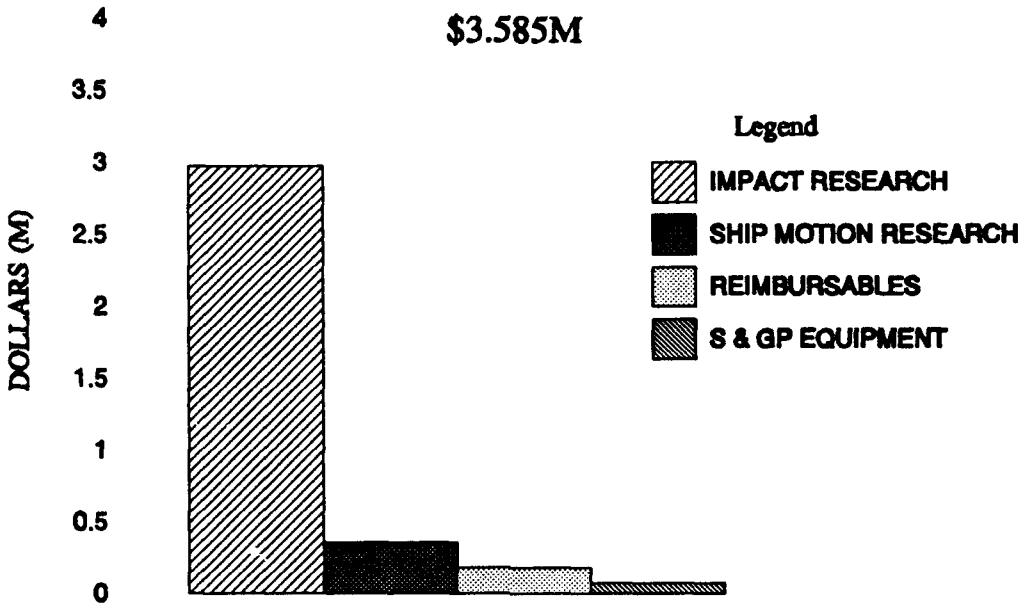
WE EXIST to ensure the best performance from and prevent injury to our Sailors and Marines.

WE WILL support the combat readiness of the Navy and Marine Corps. Maintain pride and quality in all our work. Earn the trust and confidence of our customers by enthusiastically providing prompt responses to their operational research requirements. Share the results of our research with the international scientific community. Be responsible members of our civilian community by providing civic support whenever possible.

WE CARE about each other just as we care about our work. This is the basis of the mutual trust and respect that must exist for us to succeed.

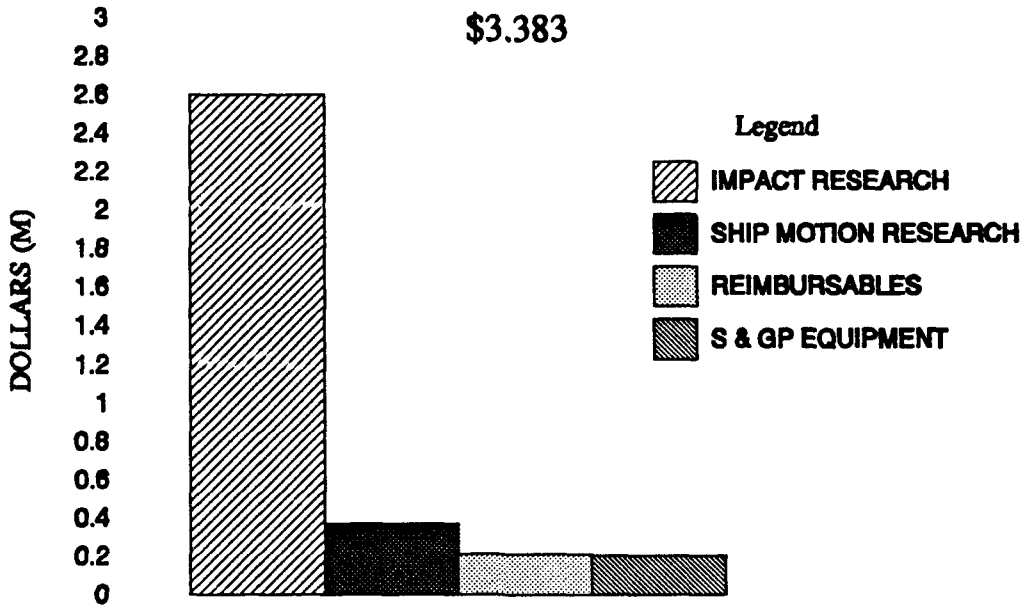
1991 TOTAL FUNDING

$3.585M

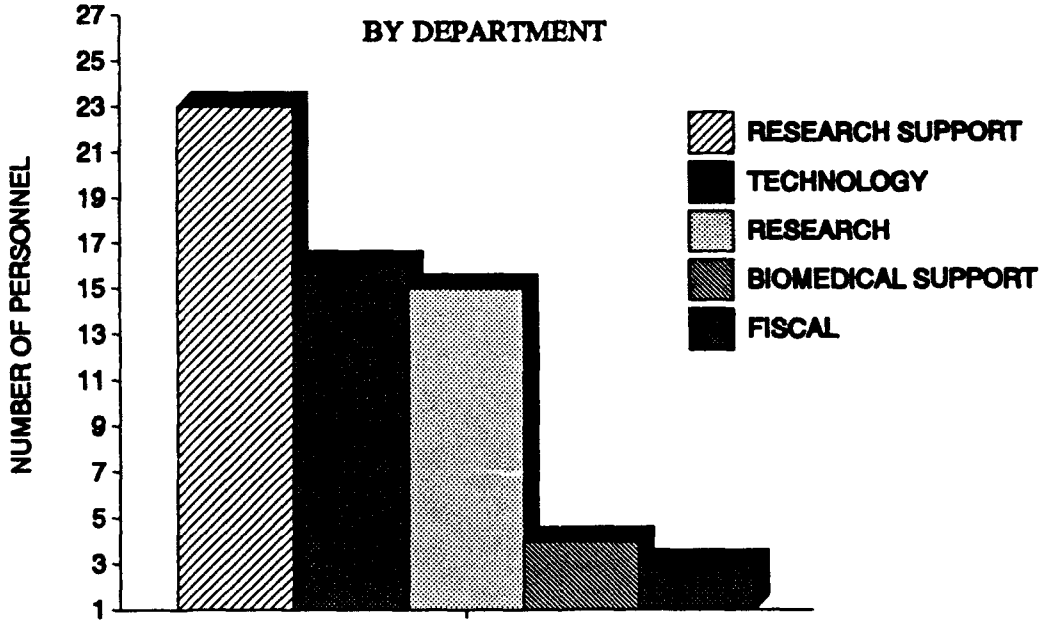


1992 TOTAL FUNDING

$3.383

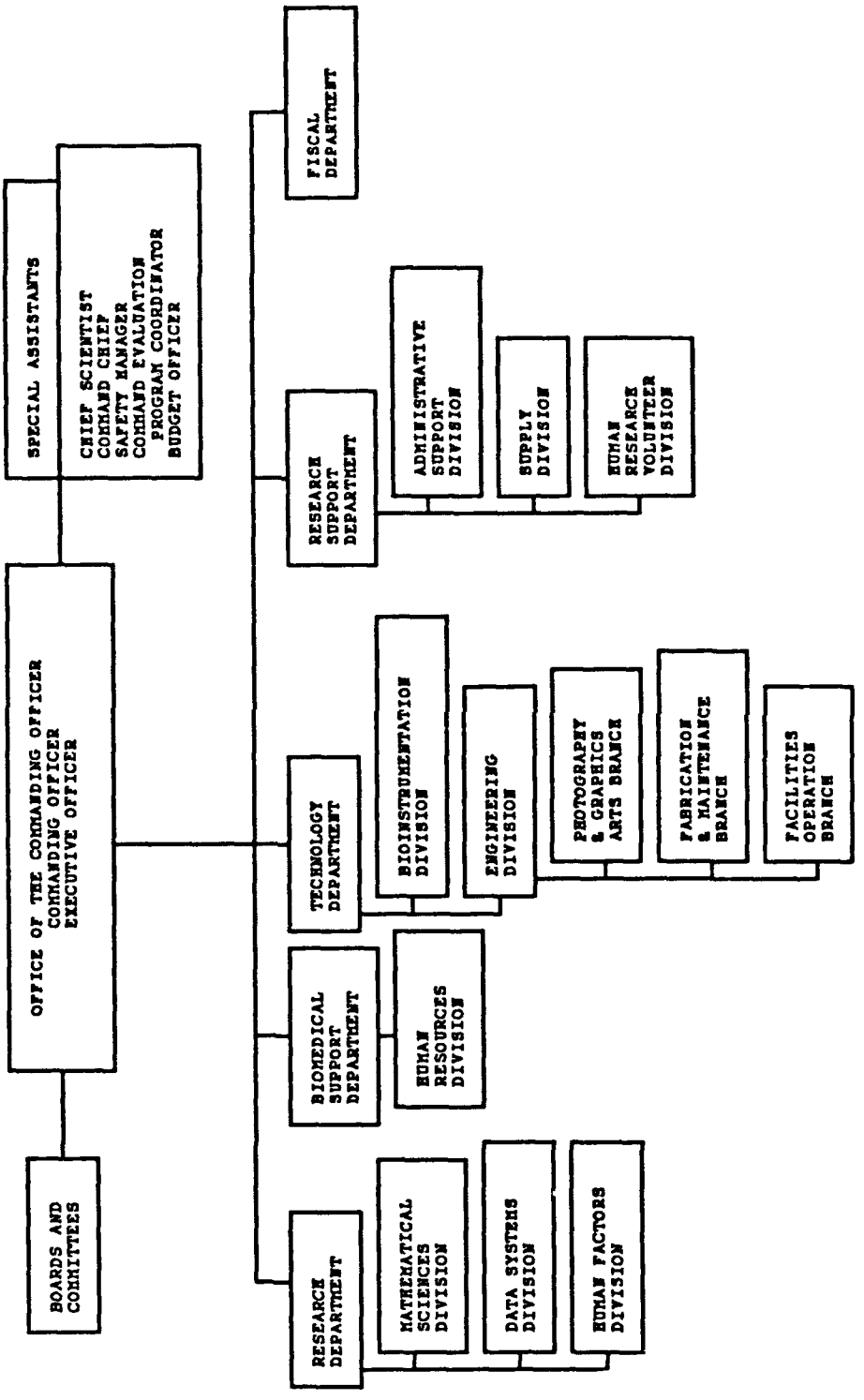


AVERAGE PERSONNEL STRENGTH (1991-1992)



ORGANIZATION CHART

NAVAL BIODYNAMICS LABORATORY



COMMANDING OFFICER

CDR Robert W. Rendin, MSC, USN

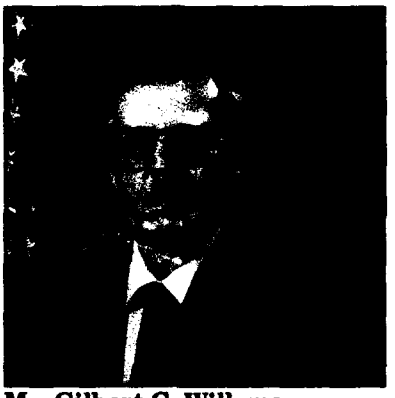
Commander Robert W. Rendin, Medical Service Corps, United States Navy, was born on 21 October 1949, in Jamaica, NY. He received a bachelor of science degree from Rutgers University, New Brunswick, NJ in 1971. Following employment as a community health officer in New Jersey, he received a master of science degree in environmental health from East Tennessee State University, Johnson City, TN in 1974. He entered the Navy in September 1974 and completed officer indoctrination training at the Naval School of Health Care Administration, Bethesda, MD. He then received environmental health officer training at the Navy Environmental Health and Preventive Medicine Unit #5 in San Diego, CA. He was assigned as Environmental Health Officer at the Naval Regional Medical Center, San Diego, CA; then as Chief, Preventive Medicine Service at the U.S. Naval Hospital Taipei, Taiwan; Chief, Occupational and Preventive Medicine Service at the Naval Regional Medical Center, Great Lakes, IL; Environmental Health Officer on the staff of Commander, Naval Air Force Atlantic Fleet; and as Head, Environmental Health Service at the Navy Environmental and Preventive Medicine Unit #2 in Norfolk, VA. Commander Rendin graduated from the U.S. Marine Corps Command and Staff College, Quantico, VA, 1986, and completed Field Medical Service School at Camp Pendleton, CA. He had following tours as Health Service Support Officer for the First Force Service Support Group, Fleet Marine Force, Pacific; and Medical Administrative Officer at the Headquarters, Fourth Marine Division, New Orleans, LA. In September of 1990, he reported to the Naval Biodynamics Laboratory, New Orleans, LA as Executive Officer. Commander Rendin's military awards include the Meritorious Service Medal, the Navy Commendation Medal (two awards), the Navy Achievement Medal, Meritorious Unit Commendation, National Defense Medal, Navy and Marine Corps Overseas Service Ribbon, and the Combined Service Forces Honorary Insignia (Republic of China). Commander Rendin assumed command of NBDL in May 1992.

OFFICE OF THE COMMANDING OFFICER

The Laboratory is directed by the Office of the Commanding Officer. The office is composed of the Commanding Officer, Executive Officer, Chief Scientist, Command Chief Petty Officer, Safety Manager, Command Evaluation Program Coordinator and support personnel. The Commanding Officer is under the military control of the Commanding Officer, Naval Medical Research and Development Command, and is responsible for the command organization, and management of the Laboratory to conduct its mission in the most effective and economical manner possible. The Commanding Officer is a member of the Navy Medical Department.

CDR L. W. Schoenberg, MSC, USN, Executive Officer

Dr. Marc S. Weiss, Chief Scientist and Head, Research Department



Mr. Gilbert C. Willems, Head, Technology Department

CDR T. G. Anderson, MC, USN, Head, Biomedical Support Department

LT K. E. Rice, MSC, USNR, Administrative Officer and Head, Research Support Department

Ms. Severina Garcia, Head, Fiscal Department

YNCS S. M. Rogan, USN, Command Senior Chief

EXECUTIVE OFFICER

The Executive Officer is responsible to the Commanding Officer for the routine management of the command. All orders originating from the Executive Officer are considered as coming from the Commanding Officer. The Executive Officer serves as the direct line supervisor for the departments, manages and facilitates the editorial review of reports and speeches, and exercises fiscal authority as granted by the Commanding Officer. He assumes overall responsibility for command civilian personnel matters and coordinates the submission of the Command History. The Executive Officer is a member of the Navy Medical Department. He chairs numerous Laboratory boards and committees: Protection of Human Subjects, Credentials Review, Safety, Position Management, Sailor of the Quarter/Year, Civilian of the Quarter, and Information Systems.

CHIEF SCIENTIST

The Chief Scientist (CS) serves as principal advisor to the Commanding Officer on the status, plans, and direction of the command's scientific programs. The CS organizes and maintains program documentation which provides maximum information to the Commanding Officer to assist him in managing long range programs and assure the flexibility to initiate prompt research and development efforts in response to line identified fleet problems. The CS maintains liaison and coordination with the Director of Research and Development at the Naval Medical Research and Development Command. The CS is responsible for internal review and management of all research work unit proposals.

COMMAND CHIEF PETTY OFFICER

The Command Chief Petty Officer assists the Commanding Officer and the Executive Officer in matters pertinent to the morale and welfare of enlisted personnel and their dependents. He performs duties as directed to ensure that policies and programs pertaining to enlisted personnel are disseminated, and maintains open lines of communication between the command and members of the enlisted community.

Human Research Volunteers

NBDL has twenty-one billets for Human Research Volunteers (HRVs). HRVs for the Laboratory are recruited from the Recruit Training Command in Orlando, Florida. All HRVs are junior enlisted personnel who have completed Apprenticeship Training. The normal tour length as an HRV is eighteen months. HRVs must meet rigorous mental and physical standards. NBDL Instruction 3900.1E establishes the safety standards that research projects must meet to utilize HRVs. Every project involving HRVs must be reviewed by the NBDL Committee for the Protection of Human Subjects. The committee reviews experimental protocols and recommends approval, modification or disapproval of the project to the Commanding Officer. Final approval authority is vested in the Surgeon General, Bureau of Medicine and Surgery via the Commanding Officer of NMRDC. The HRVs are followed on a long term basis to determine if there are any lasting performance, physiological or medical effects due to impact acceleration exposure. When not involved as subjects in experiments, the HRVs work in all command departments thus greatly enhancing the efficiency of the Laboratory.

Human Research Volunteers

Facilities

The Naval Biodynamics Laboratory houses several unique motion devices. Among these are the horizontal accelerator, vertical accelerator, ship motion simulator, and motion desensitization chair and visual drum.

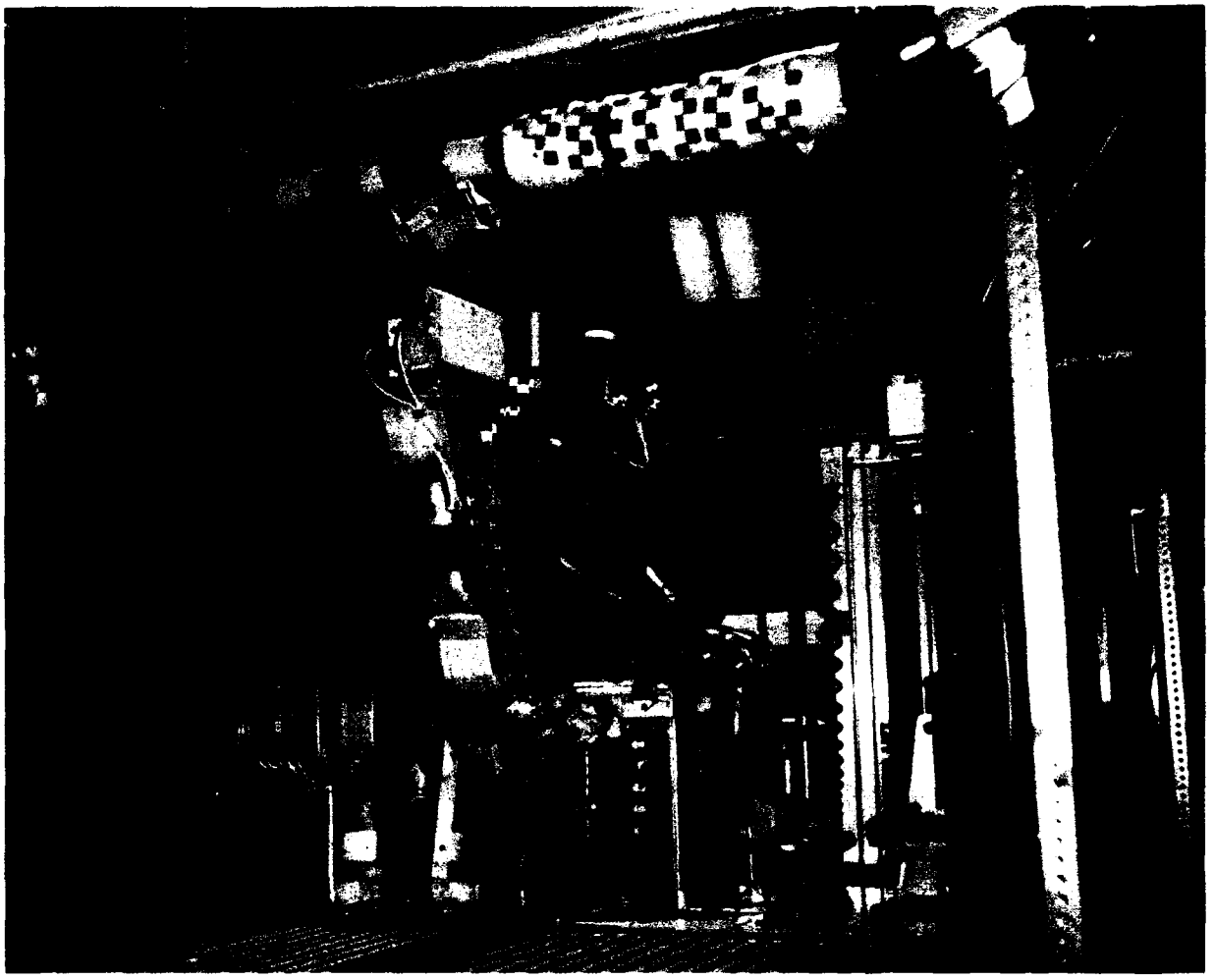
Horizontal Accelerator. The command's Impact Research Program is designed to investigate the effects of indirect impact forces on the head and neck, and their potential for producing injury. To achieve this, a 700 foot, enclosed, environmentally controlled horizontal acceleration test track has been in operation at NBDL since 1972. The track incorporates a thrust accelerator with a control console and several sleds. On the horizontal accelerator, the sled is accelerated along the track with a Bendix, 12 inch Hyge system capable of generating 225,000 lbs of thrust. Dry nitrogen, provided by NASA, delivers the needed pressure to trigger the sled. The sled is decelerated by friction forces ranging from 2 to 4 meters per second squared. Two sleds are currently in use, a Z-axis sled and an omni-directional sled capable of rotating 360 degrees. Several important safety systems are in place to protect HRVs, technicians, and equipment. All the safety systems work independently and triggering any one will automatically shut down the system.

HRVs are given non-injurious impact accelerations. During these tests, angular and linear displacements, velocities, and accelerations of selected body segments are measured in three dimensions by man-mounted transducers. Physiological data including somatosensory evoked potentials, electroencephalogram (brain waves), electrocardiogram (muscle recordings) and respiratory patterns are recorded and analyzed. Mechanisms of central nervous system injury have been derived from similarly instrumented primates.

Currently, acceleration data are collected by a Hewlett-Packard 9000/220 computer and analyzed by a Hewlett Packard 9000/835 computer. High speed instrumentation cameras record the motions of HRVs. A computer based photodigitizing system scans the film with automatic pattern recognition algorithms, determines the changing X and Y position of photo targets mounted on the HRV during the acceleration, and writes the results to a magnetic tape. The analysis combines the measured photographic and inertial data with sensor position and alignment, sensor calibration, camera position and alignment, camera optical calibration, photo target position, and standard anatomical coordinate systems based upon X-rays of each HRV. Motion of the HRV is determined independently from photographic and inertial data, and the results are compared for agreement as a final check of data integrity.

Horizontal Accelerator

Vertical Accelerator. The Laboratory studies human response to impact by also using a nitrogen powered vertical accelerator which propels a restrained HRV or manikin on an instrumented carriage along a 42-ft vertical track. The HRVs are initially exposed to low levels of acceleration which are increased in increments of a single "G" within a well established safety range. Before, during, and after each sled run, a physiological data acquisition system is used to collect and analyze physiological measurements and to medically monitor and provide information concerning human response to impact. Although numerous $+G_x$ (or axial impact) experiments have been conducted on supine HRVs using the horizontal accelerator, the vertical accelerator allows a more realistic investigation of the biomechanical effects of forces similar to those produced by an aircraft ejection seat. Similar to the horizontal accelerator, the vertical accelerator force can be regulated to produce different onset thrusts. The vertical accelerator has also been used to simulate forces encountered aboard Navy ships during underwater explosions.



Vertical Accelerator

Ship Motion Simulator. A unique device at NBDL is the ship motion simulator (SMS). The SMS is capable of simulating ship motions in weather conditions of up to Sea State 5 with three degrees of freedom - heave, pitch and roll. The SMS is driven by a hydraulically powered piston, the motion of which is controlled by modulating the hydraulic flow via a servovalve-controlled actuator.

The moving system, consisting of the cab and the carriage, is guided along rails attached to a support tower. It carries a double yoke and trunnion system, operated under similar but independent control, that permits roll and pitch motions to be superimposed, singly or in combination, upon the vertical translational (heave) oscillation. The hydraulic power is delivered by a combination of up to four drive pumps located in a separate building.

A 900 gallon-per-minute hydraulic pump provides a heave acceleration of +2.0 g(z) to -0.92 g(z), a velocity of plus or minus 17 feet per second and a displacement of plus or minus 11 feet. A second high pressure, low volume hydraulic pump powers pitch and roll actuators that permit accelerations of plus or minus 150 degrees per second squared with a rate of plus or minus 25 degrees per second and a displacement of plus or minus 15 degrees. The descent of the carriage during the heave downstroke is gravitational and limited by friction to approximately 0.9 g. Numerous fail-safe features are in place to prevent the cab and support from falling or crashing including feedback transducers that transmit position information to the control system. Should any of these numerous safety interlocks be triggered, the system automatically shuts down.

Emergency shutdowns can be automatically or manually executed if pumps become overheated, valves become stuck, or system monitors fail. HRVs and researchers also have the capability to shutdown the system by pressing emergency stop buttons located in the motion cab and at the control console.

The SMS is supported by a Zenith/386 microcomputer and a Hewlett-Packard 6942A Microprogrammer. Selected motion data are loaded via the microcomputer into the 6942A format required to drive the SMS. The microcomputer is also used for digitization, storage, and subsequent analysis of motion or other data from the SMS.

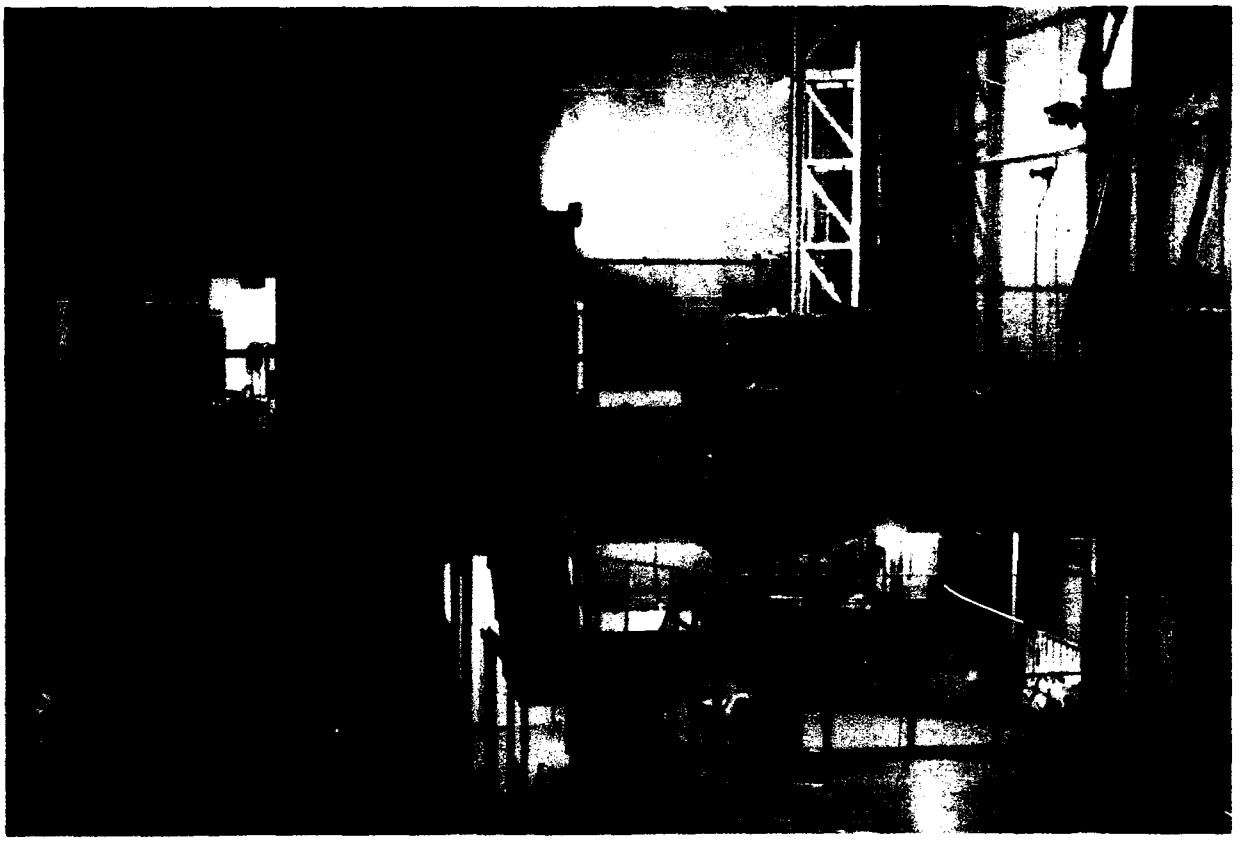
A dedicated 14-channel, FM analog tape recorder is available for data collection and/or playback into the SMS. Data are collected via accelerometers and rate sensors which are placed at various points in a ship's hull. The direction of placement determines the type of motion recorded, i.e., heave, pitch or roll. Mathematical formulas can be used to calculate motion effects at any point in the ship. Usually only a portion of the recorded motion is used and it is repeated continuously to create a smooth motion profile. Sinusoidal or simulated at-sea motion synthetic drive signals can also be generated via three dedicated Hewlett-Packard 3314 Arbitrary Function Generators.

The SMS can accommodate a total payload of 5000 pounds, including the moving cab and up to three HRVs. The SMS cab is an 8-ft cube with the forward top edge truncated to accommodate forward pitch motion adjacent to the tower. In its standard configuration, the air-conditioned cab is windowless; however, view ports can be installed if necessary.

HRVs are continuously observed at the control station by means of closed-circuit TV; two-way communication is conducted via an audio system. The cab can be fitted with up to three forward-facing seats with safety harnesses and with parallel, facing bench type workstations equipped with video display terminals and other performance test apparatus. HRVs can stop a testing session at any point by activating a safety switch on their console.

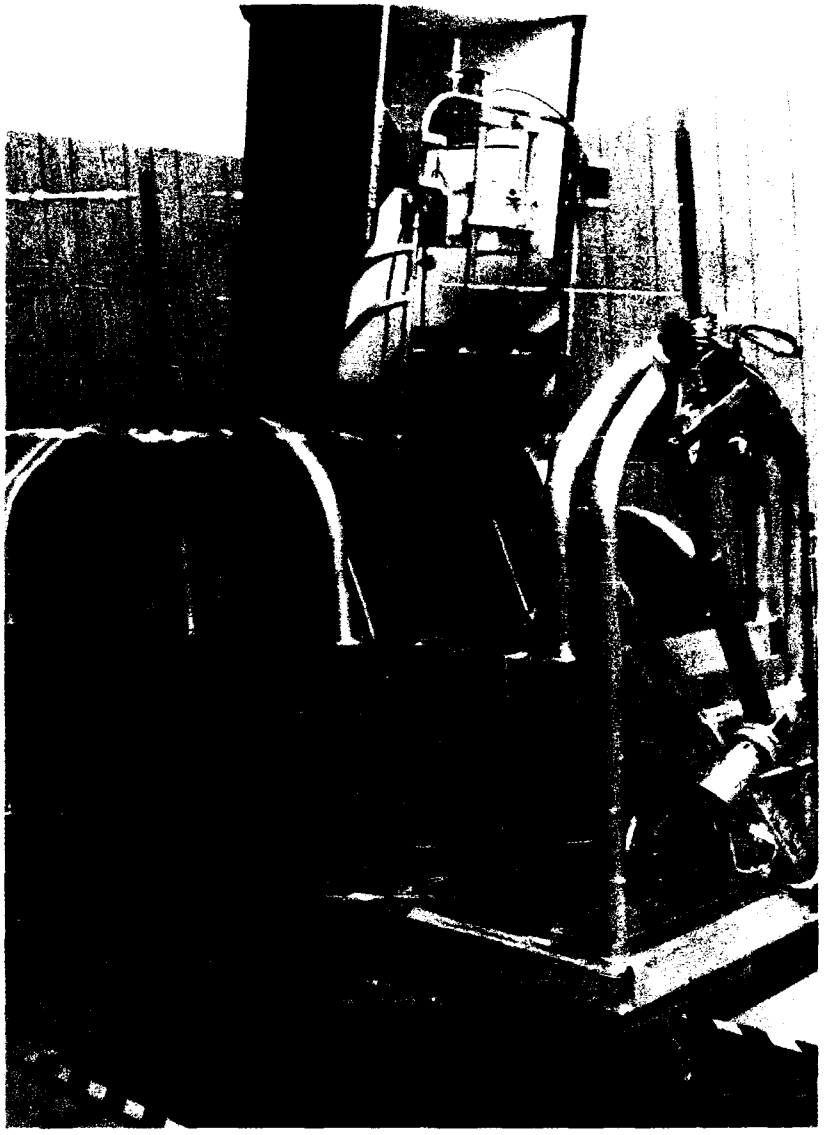
The cab is also equipped with biomedical instrumentation to monitor: ECG, EEG, respiration, pallor, and other physiological measurements.

In conjunction with the moving cab, a fixed, dimensional replica of the motion cab is available. The static cab's test station is identical in equipment and configuration. The interiors of both have been carefully matched in terms of painting, lighting, air-conditioning, experimental equipment, and other relevant variables. The static cab is frequently used for baseline training and testing prior to testing in the motion cab.



Ship Motion Simulator

Motion Desensitization Chair. A three-axis/tilt/rotation chair capable of producing a myriad of motions is used to desensitize subjects to motion environments. This device combined with a cognitive/behavioral training program has been used to successfully treat subjects suffering from intractable motion sickness. In addition to the motion desensitization chair, a visual rotation drum designed to create coriolis stimulation is housed at the University of New Orleans. This device is used in conjunction with the aforementioned cognitive/behavioral training program to alleviate the effects of motion sickness.



Motion Desensitization Chair

RESEARCH DEPARTMENT

Department Mission and Functions

The Research Department designs, plans, conducts, and analyzes all experiments involving impact acceleration and platform motion required to meet program goals and Navy needs and requirements. The Department is responsible for: specifying requirements for biomedical instrumentation and biomedical data; assisting other Departments in evaluating and interpreting analytical, numerical, and statistical data; evaluating physiological and pathological injury models; and critically evaluating protective standards derived from the impact and motion database. The Department has three divisions--Human Factors, Mathematical Sciences, and Data Systems.

MATHEMATICAL SCIENCES DIVISION

Division Mission and Functions

The Mathematical Sciences Division conducts original scientific work in the area of biodynamics and mathematical sciences, and supports other departments in the development and use of all analytical, numerical and statistical procedures to analyze research data.

Work Unit. 63216N M0097.001. **"Determination of Human Dynamic, Injury, and Performance Response to Impact Acceleration and Development of Validated Manikin Components."**

Principal Investigator: Salvadore J. Guccione, Jr., Ph.D.

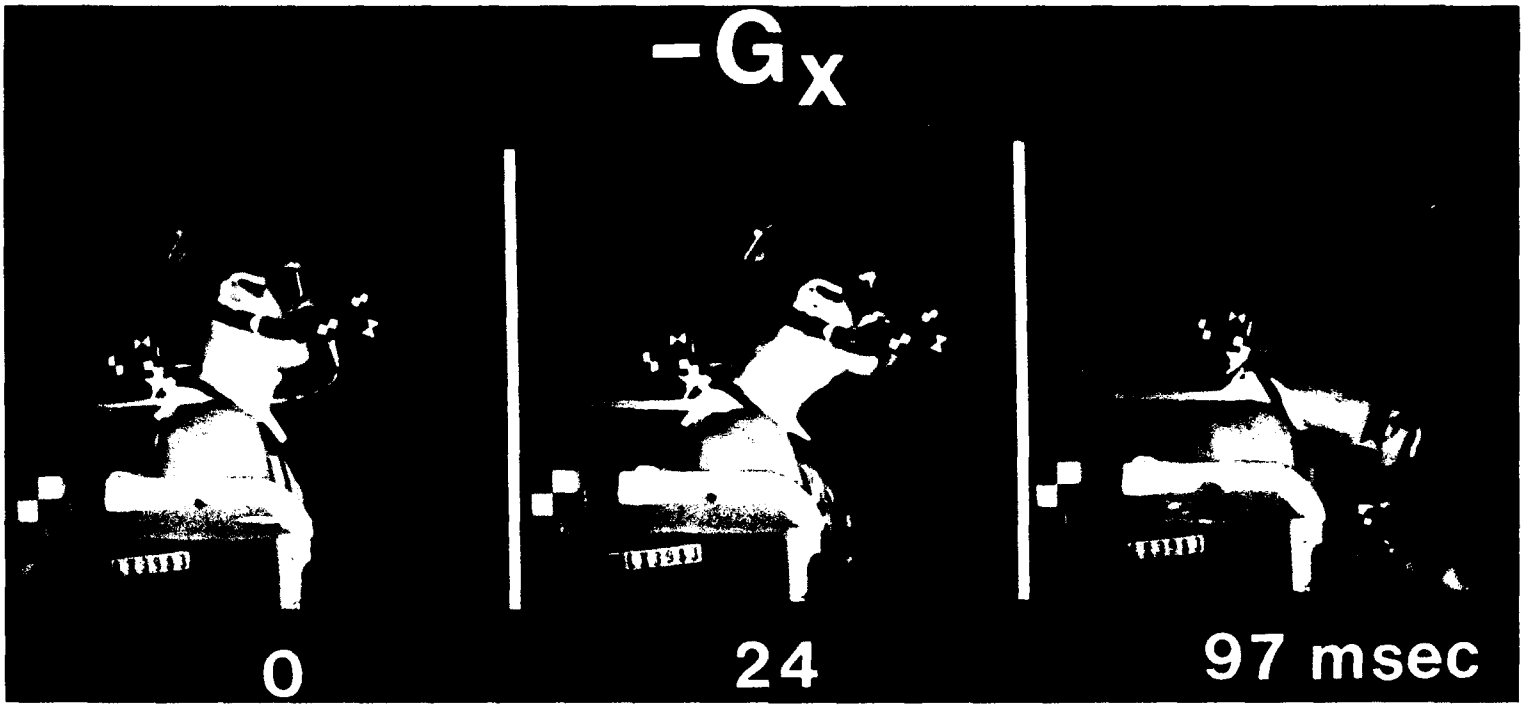
Associate Investigators: Marc S. Weiss, Ph.D. and Mr. Gilbert C. Willems

The Naval Biodynamics Laboratory is investigating human head and neck response to whole body linear accelerations to further define the dynamic responses of these anatomical segments to impact forces; determine the relationship between the dynamic and physiological responses and injury potential; and to develop validated computer models of human head and neck biodynamic and physiological responses to impact.

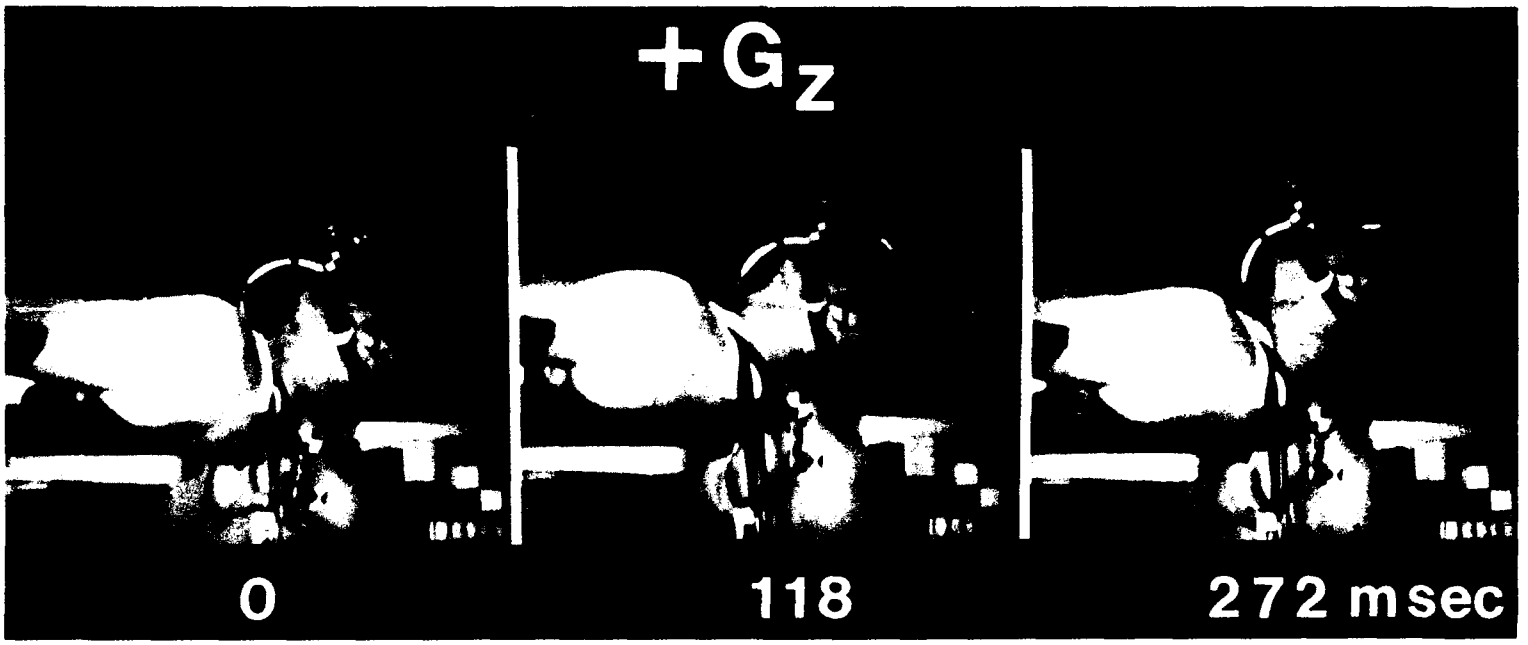
Significant Accomplishments and Research Findings: A side-by-side evaluation of arrays of a new type of angular rate sensor and conventional linear accelerometers was performed using NBDL's horizontal accelerator. Sixty-five experiments were conducted in a variety of configurations. Tests completed in mid-November 1990 were analyzed and confirmed that these new sensors will form the basis of a new, portable data acquisition system which will be usable at other facilities. These results were presented at the 35th STAPP Car Crash Conference, 18-20 November 1991, in San Diego, CA.

Engineers from the Naval Air Development Center, Warminster, PA visited NBDL to discuss Navy aircrew head-mounted systems and possible areas of research collaboration. This meeting preceded completion of a series of 129 helmeted human volunteer tests. These tests, up to 10g, were performed on the vertical accelerator and measured the effects of added head mass and shifts in head center of gravity produced by helmet-mounted systems. These tests included an electromyographic measure of neck muscle responses to impact acceleration.

Analysis of these tests will provide information regarding the potential for injury from wearing night-vision goggles or other operational or planned helmet-mounted devices.



Time Series Showing Response of an Unrestrained Head and Neck during a -G_x Acceleration



Time Series Showing Response of an Unrestrained Head and Neck During a Horizontal +G_z Acceleration

Experimental Setup for the Helmet and Added Head Mass Test Series for Impact Acceleration in $+G_z$

NBDL, in cooperation with local universities, has made significant progress on a finite element model of the human head and neck during impact acceleration. As part of continuing contract support, Ronald C. Anderson, Ph.D., and Richard T. Hart, Ph.D., both of the Biomedical Engineering Department at Tulane University, New Orleans, LA are developing this model for use in neck injury assessment. GPA Associates of New Orleans, LA has successfully developed new X-ray digitization, stereo X-ray, and 3-D reconstruction algorithms to provide a more precise location of crucial head/neck anatomical landmarks. They have also completed calibration of a new 35mm still camera photogrammetric system for use with the accelerometer/angular rate sensor package.

Based on encouraging results from validation runs for the new photogrammetry and inertial measurement systems on the vertical accelerator, a photogrammetry facility was installed on the horizontal accelerator. An instrumented manikin experimental series was conducted to validate the inertial motion instrument package and the new photogrammetric camera system.

In an attempt to successfully clean extremely deteriorated tape and recover important archival neurophysiological data, a state-of-the-art cleaner for analog instrumentation tape has been procured, installed, and tested. Parallel efforts to digitize and analyze neurophysiological data are continuing.

Contributing to research accomplishments and findings were a number of contracted efforts. These are as follows:

"A Statistical Method for Estimating Time Delays in Signals using Spatial Amplitude Mapping." Three analysis techniques were developed for the time-shift analysis of non-stationary signals such as the somatosensory evoked potentials recorded during NBDL impact acceleration tests. These techniques used a previously developed discrete method known as spatial amplitude mapping to generate two-dimensional distributions of time-delay information. All three techniques improved detection of somatosensory evoked potentials in the presence of EEG noise. The development of an optimized procedure will be required for the practical application of this approach.

"Evaluation of Software Packages for Constructing Linkage Models of the Cervical Spine." Numerous commercially available software packages were reviewed to determine if they could be used by NBDL. The object of the review was to find programs which could be utilized to develop simple computer models of the cervical spine. Considerations of cost, user friendliness, documentation, training, etc., were used in the review. Final recommendations included several packages which were suited to different aspects of model development.

"Finite Element Modeling of Cervical Spine." A three-dimensional finite-element model of the cervical spine, which was previously developed, was significantly improved. Techniques were developed for automatically generating finite element models of the cervical spine using a few points on each vertebral body. Viscoelastic material properties were investigated for refining the discrete model to include the addition of components to represent the muscles and ligaments.

"Development of Multidimensional Statistical Models for Predicting and Scaling Human and Human Surrogate Head-Neck Kinematic and Dynamic Response to Impact Acceleration." The major objectives of this three year contract are the development of techniques for predicting human head-neck motion in impact acceleration environments from the head-neck morphology of the subject, the nature of the acceleration pulse, the initial orientation of the subject's head and neck and biofidelic manikin response under the same and more severe conditions. During 1991, modeling techniques were applied to three specific impact acceleration situations; (1) side impact (+Y), (2) frontal impact (-X), and (3) added head mass (i.e., simulated helmets and helmet-mounted devices) for the -X direction. The results demonstrate an analytical approach for extrapolating human head/neck kinematics to levels and types of exposure where injury would be expected. Future applications of this modeling technique include analysis of the effects of mass distribution parameters on head/neck dynamic response to +Z vertical impact acceleration.

"Analytical Plumb Line Calibration of 35mm Photodata Acquisition System." Determined the precise calibration of a 35mm camera system for acquiring both head anthropometry and impact acceleration test initial condition data. The 35mm system was shown to be quite accurate. The calibration data were processed through the new photogrammetric package developed in 1990 after being digitized on a Mann photocomparator. Although the digitizing was done off-base, NBDL is in the process of obtaining a photocomparator from the Defense Mapping Agency. With this acquisition, the calibration process will become a totally in-house procedure.

"Camera Network Design for Research Anthropometry and Condition Determination." The initial conditions and head anthropometry from a 35mm camera system as opposed to the old X-ray and high speed camera systems used previously were determined. This new system reduces the X-ray exposure to HRVs in obtaining the necessary head/neck anthropometry data. It also eliminates the need for costly frame-by-frame digitization of high-speed camera film used in impact acceleration photodata acquisition. This new system also provides site survey data for the experimental sled or carriage setup, eliminating the need for standard theodolite techniques used previously. All these various data are processed through the new photogrammetric package (PC-GIANT) developed in 1990.

"Photogrammetric Tables for T-2 Vertical Added Head Mass Experiments." Determined the position of cervical anatomical landmarks in the head and neck for the subjects who participated in this experimental series using the new X-ray photogrammetry system developed in 1990. This new system, a PC-version of a standard photogrammetric package GIANT, was employed to provide accurate head-neck geometry via approved stereo X-rays of the neck and six simultaneous 35mm photos of the head. This new system provides a more accurate and more portable means of obtaining the required data.

"Computational Modeling of the Cervical Spine and Head." The primary objective of this contract was the continued development of a kinematic, discrete finite element model of the human head and neck subjected to indirect impact accelerations. A simple two motion segment model was developed to evaluate the effects of modeling assumptions for the material properties of the disk. Investigation of modeling strategies to represent the interaction of the facet joints demonstrated the limitations of the software for large deformation analysis. Finally, the effects of the addition of damping to a previously developed model eliminated previous numerical instabilities.

"Modeling the Effects of Added Helmet Mass During Impact Acceleration." The primary objective of this investigation was to develop the existing model of the human head and neck to a point where the effects of adding various mass and inertial properties representing a given helmet design could be assessed. The final product included an anatomically and biomechanically correct Occ-C1-C2 complex, inclusion of muscle models capable of wrapping around hard tissue structures, and the automation of model construction. The automated procedure permits models specific to any HRV to be easily made based on anatomic landmarks.

HUMAN FACTORS DIVISION

Division Mission and Functions

The Human Factors Division designs, conducts, and analyzes experiments on the interactions of human operators and military operational environments, and uses the data generated from these experiments to develop human factors engineering standards and specifications for military systems. The Division also conducts in-house and field projects on motion and its effects on performance, and develops and validates techniques to reduce the adverse effects of motion on humans in the military environment.

The Division is responsible for determining the effects of the inertial environment on the operability of military weapons platforms. It assumes overall responsibility for the operation of the ship motion simulator (SMS) and formulates plans for use of this device. The coordination of air and sea field projects falls under the authority of the Division. The Human Factors Division also performs research in conjunction with other governmental and non-governmental organizations. The Division focuses on identifying the effects of low frequency oscillatory motion on human operator performance in combat systems operations. Areas of special interest are cognitive and psychomotor performance during adverse conditions and biodynamic stress encountered on naval vessels.

Work Unit. 63706N M0096.002. **"Protection of Naval Personnel from Motion Sickness and Other Adverse Motion Effects."**

Principal Investigator: F. Douglas Holcombe, LCDR, MSC, USN

Associate Investigators: Thomas G. Dobie, M.D. and Sharon L. Conwell, LT, MSC, USNR

Significant Accomplishments and Research Findings: The objectives of this work unit are to investigate, develop and validate new techniques to strengthen crew performance in operational environments. The goal is to reinforce operational capability by diminishing the adverse effects of ship motion, which include biomechanical interference to physical and cognitive task performances and deleterious effects of motion sickness. The overall effect of these factors is degraded combat capability. The requirements for this work are provided in Tentative Medical Requirements No. 10 (Ship Motion) and No. 20 (Sustained Operations Studies).

U.S. Navy ship crews are subjected to continuous whole-body motions of varying magnitudes which degrade crew performance. These oscillatory motions are induced by wave and hull interactions in heavy seas. Thus, two different concerns are apparent: the ability to estimate the degree of performance degradation in a particular circumstance, and the evaluation of the cost-benefit function used to select hull designs for new ships. Assessment of on-scene readiness is of the highest importance in military operations. This research directly addresses this problem by establishing baseline effects of motion on specific physical and cognitive human abilities which are known elements of actual shipboard tasks. The same information, with data covering a range of abilities and shipboard tasks, will significantly increase the utility of the hull design cost-benefit function. International concern over this problem has resulted in a collaborative effort between the U.S. Navy, the

Defence Research Establishment Atlantic of Canada, and the Admiralty Research Establishment of the United Kingdom.

During the feasibility study conducted in October 1991, HRVs experienced typical ship motions on board the SMS. Experimental protocols were used in which the important physical parameters of continuous and transient oscillatory motion exposure (i.e., frequency, acceleration, complexity, and time-course) and other important variables associated with naval environments were systematically altered. Special attention was given to frequencies known to be associated with adverse biomedical effects during sea operations. The motion profiles to be used were established in consultation with the David Taylor Research Center and the Naval Sea Systems Command.

Subjects were fitted with formfitting cotton/lycra body suits. The suits were required in order to affix suitable photo-targets and to make accurate measurements of body movements. For the feasibility study, subjects had adhesive electrodes attached to various portions of their bodies to measure physiological variables. Subjects were then fitted with a tri-axial accelerometer pack to transmit acceleration signals.

The SMS cab was modified to permit the subject to safely stand and walk about in the cab. The cab contained three forceplates positioned flush with the deck. The forceplates detected changes due to subject movement. The subject was required to perform a standing, walking, and weight positioning routine on or near these forceplates while the SMS was in operation. A weight positioning device designed to permit the weight to slide down a track was mounted on the bow wall at a height of 5 feet.

The feasibility study to investigate the effects of motion-induced interruptions on performance was successfully completed. Four subjects performed a one-hour, standing/walking/weight positioning routine for each of two motion conditions in the SMS. A total of 8 experimental runs were completed. Forceplate, subject-mounted accelerometer, energy expenditure, and performance data were collected on these runs.

LCDR Holcombe, Head, Human Factors Division, and Dr. Dobie, Visiting British Scientist, attended the NATO International Exchange Group (IEG)/6 SG/5 on Seakeeping and its constituent American British Canadian Dutch (ABCD) Working Group on Human Performance at Sea, held on 14-18 October 1991 at The Netherlands Organization (TNO) Institute for Perception, Soesterberg, the Netherlands. Representatives from the United States, the United Kingdom, the Netherlands, and Canada met to discuss and evaluate progress in the study on motion-induced interruptions (MII) to performance. Discussions of the feasibility study results lead to several recommendations for modification of the main study protocol. ABCD Working Group recommendations were completed to more effectively standardize the experimental protocol.

The investigation to determine the amount of physical energy needed by subjects to maintain stability while performing simple tasks in a motion environment was completed. Oxygen consumption measuring equipment (OXYLOG) was obtained, tested, and calibrated for use in the SMS. This equipment was modified for acquiring data from ambulatory subjects. The face mask equipped with OXYLOG was not used due to ineffective sealing around the subject's face. An alternate mask was selected which provided better sealing and subject comfort. Light-weight tubing was used to connect the face mask to the OXYLOG. Tubing adapters were modified or fabricated in-house at NBDL.

LCDR Holcombe attended meetings of the Canada, United Kingdom, and the United States (CANUKUS) steering committee in Halifax, Nova Scotia, 7-8 January 1992 to discuss the progress of the investigation. From these meetings it was determined that new motion time history command signals were needed to drive the SMS. These new signals were needed to reduce the incidence of motion sickness and permit more MII events to be recorded. Plans for correction were immediately formulated.

LCDR Holcombe attended the meeting of NATO Information Exchange Group Six (IEG/6), Subgroup Five (SG/5) on Seakeeping and its constituent ABCD Working Group on Human Performance at Sea, held 2 - 10 April at the Institute of Naval Medicine in the United Kingdom and INSEAN -- Italian Ship Model Basin -- in Rome, Italy. At the ABCD Working Group meeting, representatives from the United States, the United Kingdom, the Netherlands, and Canada met to discuss and evaluate progress in the study on motion-induced interruptions to physical performance. Discussions of the energy expenditure study results led to several recommendations for modifying the main study protocol. LCDR Holcombe also reported the results of the energy expenditure study at the NATO IEG/6, SG/5 Seakeeping Meeting.

DATA SYSTEMS DIVISION

Division Mission and Functions

The Data Systems Division specifies, acquires, develops, maintains, and operates systems and procedures used for collecting, reducing, and analyzing data related to the impact and motion research programs.

Significant Accomplishments and Research Findings: Data Systems personnel redesigned the EZFLOW computer software to process 500 frames of photo data. In the past only 250 frames of data could be processed for each experimental run. This modification and change to sensor software allowed more experimental data points to be analyzed. In addition, new software was designed to process new angular sensors. The Data Systems Division also processed over 361 vertical helmeted and over 52 horizontal experimental runs using manikins.

The Division was also instrumental in effecting command-wide improvements in ADP resources and management. Among these are the following: (1) conducted a laboratory-wide review and inventory of ADP hardware and software followed by coordinated and integrated upgrade of command ADP equipment, (2) developed and implemented database software for the tracking and storing of command publication and bibliographical data, and (3) developed software to support the Fiscal Department's requirements for maintenance of budgetary data.

BIOMEDICAL SUPPORT DEPARTMENT

Department Mission and Functions

The Biomedical Support Department provides professional and technical support for all biodynamic experiments using HRVs. It provides professional advice and control in experiments using HRVs and in the selection for experimental purposes. The Department selects and schedules the use of HRVs in all experiments as required by the principal investigators. The Department also provides medical support for all HRVs used within the Laboratory's scientific programs. The Department provides hematology, pathology, and X-ray services for all HRVs used in scientific experimentation and is also responsible for the long-term follow-up for all HRVs.

Significant Accomplishments and Research Findings: LCDR Stephen V. Mawn, MC, USN, et al., wrote an article published in the January 1992 edition of *Aviation, Space, and Environmental Medicine* entitled, "The Relationship Between Head and Neck Anthropometry and Kinematic Response During Impact Acceleration." A strong relation was found between head and neck anthropometry and linear acceleration of the head along the Z-axis. These findings are potentially applicable to areas such as aircrew selection, physical training, and protective equipment development.

TECHNOLOGY DEPARTMENT

Department Mission and Functions

The Technology Department oversees the activities of its two component divisions, Bioinstrumentation and Engineering. The Department provides electrical and mechanical engineering support for experimental requirements as specified by other departments, researchers, and the Chief Scientist. This support consists of mechanical design and fabrication of experimental devices, design and construction of electrical/electronic systems for device motion control, photographic systems, and acquisition of inertial and physiological data. The Department also installs and maintains the Laboratory's personal computer systems and supervises new facility construction and repair or renovation of existing facilities.

Significant Accomplishments: A mock-up of both the open and closed bridges of the Coast Guard's 47-ft motor lifeboat was completed. This mock-up was a key element in the successful completion of the work unit "Human Factors Assessment of the Coast Guard's 47-ft Motor Lifeboat."

Extensive modifications were made and instrumentation enhancements were implemented in the SMS in support of the motion induced interruptions experiments. Because the subjects are ambulatory in these tests, many safety enhancements were required. Also because of the large number of data channels required, a major upgrade in data acquisition capability was implemented by installing a new Hewlett-Packard Apollo/400 engineering workstation. This included the networking of several PC's within Technology, greatly enhancing data acquisition and analysis capabilities. A network linked to Data Systems HP 9000/835 system has also been installed, providing for direct transfer of impact data to this analysis system. A new facility for calibrating 35mm cameras was built. Calibration devices were also fabricated to support the new still photogrammetry system used for determination of the initial position and orientation of anatomical segments during impact experiments. Modifications to both the vertical and horizontal accelerators were implemented to accommodate this new technique. In addition, the Technology Department's divisions jointly provided fabrication, operational, maintenance, instrumentation, data acquisition and data analysis support for vertical and horizontal accelerator, ship motion simulator, and motion desensitization chair experiments.

ENGINEERING DIVISION

Division Mission and Functions

Provides design, operation, and maintenance support for the mechanical facilities and equipment of the Laboratory; operates and maintains linear acceleration systems including initial configuration and construction of sleds, seats, restraint systems, camera mounts, etc.; operates and maintains platform motion facilities; and configures the ship motion simulator and the vibration devices for specific experiments. Develops, adapts, and modifies specialized cameras (such as high speed photometric movie cameras) to specific experimental situations involving high acceleration and oscillatory motion; operates and maintains all high speed and special cameras, documentary cameras, and audiovisual equipment in the Laboratory. Supports Laboratory projects through the operation of well-equipped machine and

woodworking shops. Constructs or supervises the construction of new facilities required for the conduct of research. Coordinates engineering functions with the other departments through the Head, Technology Department.

Significant Accomplishments: A reimbursable project for the Naval Aerospace Medical Research Laboratory (NAMRL) to fabricate two lightproof capsules began and substantial progress was made in 1992. The project consists of the construction of two man-rated capsules each to be mounted at opposite ends of the linear track structure of NAMRL's coriolis acceleration platform (CAP). The basic function of each device will be to rotate a human subject, seated in the lightproof enclosure, about the subjects local roll axis, while the CAP is rotating in either a clockwise or counterclockwise direction. Although the original design was developed by an outside architectural and engineering firm, substantial in-house design efforts were required to correct deficiencies and add enhancements requested by the customer. Additionally, all shop drawings were generated in-house. The main efforts consisted of fabricating the support structure, procurement and installation of the drive train, and the fabrication of a lightweight fiberglass enclosure to provide the required lightproof environment. Fabrication of the enclosures required importing and learning technologies utilized in the boat-building industry which were previously unavailable in-house. Modifications to the motion cab of the SMS were completed, to support the motion-induced interruptions (MII) portion of the CANUKUS experimental design. Upon completion of this phase of the experiments, work began to reconfigure the cab into the configuration required for the next phase of this program.

A camera and light support structure was designed, fabricated, and installed at the horizontal accelerator site. This facility was required in order to provide the capability to obtain initial condition information and head anthropometry data via still photogrammetry.

A permanent facility for calibrating 35mm cameras was established. Calibration "spiders" (special-purpose photogrammetry targets) were fabricated.

In anticipation of the arrival of female HRVs, redesign of restraint systems for the two accelerators into a "unisex" configuration was completed. Substantial fabrication effort was expended during the year.

BIOINSTRUMENTATION DIVISION

Division Mission and Functions

Provides instrumentation designs for human and human surrogate impact acceleration and platform motion experiments. The Division is responsible for installing, operating, and maintaining complete data acquisition (analog and digital) systems employed in the experiments conducted by the Department, and provides electronic/electrical operation and maintenance support for the Laboratory's experimental devices. It is also responsible for the configuring of field data measuring and acquisition systems for use aboard ships or at other field locations.

Significant Accomplishments: New physiology amplifiers were designed, built, and installed on the vertical accelerator to monitor the subject's neck muscle activity during the +Z helmeted mass-distribution experimental series.

The physiological data acquisition system on the existing motion desensitization chair was upgraded. Data acquisition was originally limited by available slip rings to three channels. Addition of the multiplexed data telemetry system increased the number of available physiology data channels to 16.

Procured, accepted delivery, and completed installation of a seven track instrumentation tape recorder. This equipment enhances our physiology data acquisition system reliability. The new recorder replaced an existing recorder that was no longer supported by its manufacturer.

The ship motion simulator was rewired to accommodate the data acquisition requirements of the CANUKUS program. Additional cabling was installed to accommodate subject data from force platforms, EMG amplifiers, motion sensors, and oxygen consumption measuring equipment. Three PC-based data acquisition systems were added to the system. Chart recorders were installed to provide real time hard copies of signal data. Video monitoring and recording equipment was installed to track subject movements.

The procurement of a spectrum analyzer, used for maintaining the physiology data telemetry system, was completed. A magnetic tape cleaner/conditioner was procured. This equipment is being used to clean archived magnetic tape so that physiological data may be recovered. New lighting and camera systems were installed on horizontal and vertical accelerators to support the new photogrammetry system.

Experiments were conduted that verified operation of new angular velocity sensors. The operational check-out of a portable neurophysiological data acquisition system was completed. This system is being used to digitize archived evoked response data.

An Optotrak infrared three dimensional measurement system was procured to support the SMS and impact experiments. A Telefactor portable physiology data acquisition system was added to support the SMS and impact research programs.

RESEARCH SUPPORT DEPARTMENT

Department Mission and Functions

The Research Support Department provides administrative services and support to all departments of the command, coordinates administrative and clerical support services, provides coordination with other departments concerning administrative and financial matters, maintains and reviews all support agreements and memoranda of understanding, and is responsible for the efficient operation of its divisions.

SUPPLY DIVISION

Division Mission and Functions

Uses appropriate sources for the procurement of authorized materials and services; performs materials handling and distribution; conducts stock/inventory control and shipping/receiving functions; maintains command plant property/equipment records, manages the in-house plant property and equipment program ensuring that inventory controls are executed.

Significant Accomplishments: Until October 1991, the Supply Division used metal bar-codes for use with the bar-coding inventorying system. These metal tags were often difficult for the optical scanner to read, causing supply personnel to spend unnecessary amounts of time conducting the inventory process. Accuracy was also a concern. To correct these problems, the existing metal tags were replaced with paper bar-code tags using the same inventory numbers as found in the Navy Telecommunication System's Plant and Minor Property System. The results were: 1) the ability to quickly inventory plant and minor property throughout the command and 2) the ability to accomplish the inventory more accurately.

FISCAL DEPARTMENT

Department Mission and Functions

Directs formulation, justification, and administration of command fiscal and budgetary management policies, plans and procedures; establishes and enforces "in-house" budget, fiscal, and accounting control policies; coordinates allocation of both direct and reimbursable funds with program managers; Commanding Officer's advisor for payroll management, prepares the budget for submission to higher authority. Monitors financial operations and reports to the Commanding Officer on a continuing basis regarding the financial status of the command. Responsible for: utilizing appropriate guidelines established by Federal Acquisitions Regulations for the procurement of authorized materials and services; provides administrative, technical, and management authorities with factual data which meet NBDL reporting requirements.

Significant Accomplishments: The Fiscal Department implemented a new payroll certification process for the civilian workforce. This new system allows direct access to the Navy Supply Center Regional Financial Service Department in Charleston, SC. At the end of each pay period, civilian time cards are processed through the computer system before they are mailed to the financial center. This automated process eliminates the need to mail the time cards overnight and prevents the problem of losing time cards through the mail.

NAVAL BIODYNAMICS LABORATORY

PROFESSIONAL MEETINGS ATTENDED IN 1991

Anderson, T. G., attended the AGARD 71st Aerospace Medical Panel Meeting, Naval Air Station, Pensacola, FL, 2 May 1991.

Anderson, T. G., attended the Aerospace Medical Association Annual Scientific Meeting, Cincinnati, OH, 5-9 May 1991.

Anderson, T. G., attended the Family Practice Residency Program Directors Meeting, Pensacola, FL, 16 May 1991.

Anderson, T. G., attended the Aerospace Medical Problems Course, Pensacola, FL, 22 October 1991.

Call, D. W., attended the Naval Aerospace Physiology FAILSAFE Working Meeting, Pensacola, FL, 28-30 January 1991.

Call, D. W., attended the Naval Aviation Training Safety Advisory Group Meeting, Naval Air Station, New Orleans, LA, 19-21 March 1991.

Call, D. W., attended meetings at the School of Allied Health/Department of Orthopaedics, University of Louisville School of Medicine, Louisville, KY, 2-4 April 1991.

Call, D. W., attended Naval Medical Research and Development Command Strategic Planning Meeting, Baltimore, MD, 14-19 April 1991.

Call, D. W., attended meetings at Naval Medical Research and Development Command and Naval Air Systems Command, Washington, DC, 5-7 June 1991.

Call, D. W., attended the Planning Meeting of the Co-Location of the NBDL, Dayton, OH, 10-11 June 1991.

Call, D. W., attended the Navy Surgeon General's Conference, Washington, DC, 19-26 October 1991.

Call, D. W., attended the NASA Occupational Health Program 1991 Annual Meeting, New Orleans, LA, 5 December 1991.

Conwell, S. C., attended the Human Factors Engineering Short Course, University of Michigan, Detroit, MI, 28 July - 10 August 1991.

Dobie, T. G., attended the Aerospace Medical Association Scientific Meeting, Cincinnati, OH, May 1991.

Dobie, T. G., attended the SPAWAR Research and Development Information Exchange Conference, Naval Weapons Center, China Lake, CA, 4 May 1991.

Dobie, T. G., attended the Motion Sickness Research Meeting, Naval Aerospace Medical Research Laboratory, Pensacola, FL, 25-26 July 1991.

Dobie, T. G., attended meetings with the CANUKUS Steering Committee and OMPAT Technical Advisory Group, Washington, DC, 4-8 August 1991.

Dobie, T. G., attended the UK Medical Research Council, the Psychological Subcommittee Meeting, University Psychological Department, and the NATO IEG/6 S615 and ABCD (sponsor) meetings, London, England; Soesterburg, The Netherlands; 9 October - 3 November 1991.

Dobie, T. G., attended meeting on Joint NBDL/UK/Canadian Ship Motion Research Projects, IEG/8 S615 Subgroup Seakeeping, London, England, 22 October - 2 November 1991.

Endler, J. L., attended Cognitive Performance Assessment Software Briefing, Pensacola, FL, 16 September 1991.

Garcia, S. S., attended the Naval Medical Research and Development Command Finance Conference, Charleston, SC, 23-28 June 1991.

Guccione, S. J., Jr., attended the Technical Working Group Meeting, U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL, 11-13 March, 1991.

Guccione, S. J., Jr., attended the AGARD 71st Aerospace Medical Panel Meeting, Pensacola, FL, 1-3 May 1991.

Guccione, S. J., Jr., attended the Tri-service Working Group Meeting on Biodynamics, Bethesda, MD, 15-17 October 1991.

Holcombe, F. D., attended meetings at U.S. Coast Guard Headquarters and Naval Sea Systems Command, Washington, DC, 21-23 February 1991.

Holcombe, F. D., attended the Research and Development Information Exchange Conference, China Lake, CA, 2-4 April 1991.

Holcombe, F. D., attended the SPAWAR Research and Development Information Exchange Conference, Naval Weapons Center, China Lake, CA, 4 May 1991.

Holcombe, F. D., attended meetings at Aerospace Medical Association, Cincinnati and Battelle Memorial Institute, Columbus, OH, 5-9 May 1991.

Holcombe, F. D., attended the LCAC Fleet Support Conference, Camp Pendleton, CA, 13-17 May 1991.

Holcombe, F. D., attended the Motion Sickness Research Meeting, Naval Aerospace Medical Research Laboratory, Pensacola, FL, 25-26 July 1991.

Holcombe, F. D., attended the CANUKUS Steering Committee Meeting and the DMPA Technical Advisory Group Meeting, W shington, DC, 4-8 August 1991.

Holcombe, F. D., attended the UK Medical Research Council, London, England/the Subcommittee, University Department/NATO IEG/6 S615, 11 October 1991.

Holcombe, F. D., attended the ABCD Working Group on Human Performance, Soesterberg, The Netherlands, 14-15 October 1991, and CANUKUS meetings, London, England; Soesterberg, The Netherlands, 11-30 October 1991.

Holcombe, F. D., attended the Naval Surface Warfare Research and Development Conference, Panama City, FL, 4-8 November 1991.

Holcombe, F. D., attended meetings at Naval Sea Systems Command, Washington, DC, 16-20 November 1991.

Kaufman, B., attended the Biomedical Engineering Society Annual Meeting, Charlottesville, VA, 11-14 October 1991.

Kaufman, B., attended the 13th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Orlando, FL, 31 October - 3 November 1991.

Kaufman, B., attended the 21st Annual Meeting of the Society for Neuroscience, New Orleans, LA, 12-15 November 1991.

Matson, D. L., attended the Biopsychometric Assessment Group Meeting, San Diego, CA, 2-3 May 1991.

Matson, D. L., attended the SPR Annual Meeting and Symposium on Experimental Psychophysiological Approaches, Chicago, IL, 8-13 October 1991.

Matson, D. L., attended the 21st Annual Meeting of the Society for NeuroScience, New Orleans, LA, 12-15 November 1991.

Reed, A., attended the Motion Sickness Program Meeting, Naval Aerospace Medical Research Laboratory, Pensacola, FL, 25-26 July 1991.

Rendin, R. W., attended the Tri-service Aeromedical Research Panel (TARP) Meeting, Pensacola, FL, 13-16 January 1991.

Rendin, R. W., attended the Senior Officer Course in Military Justice, Camp Lejeune, NC, 26-31 January 1991.

Rendin, R. W., attended the SAFE Symposium, Las Vegas, Nevada, and the TARP Meeting, Oklahoma City, OK, 10-15 November 1991.

Rice, K. E., participated in the Scientist at Sea Program, Norfolk, VA, 4-9 December 1991.

Vitellaro, A., attended Naval Medical Research and Development Command Finance Conference, Charleston, SC, 23-28 June 1991.

Webb, S. C., attended the SPAWAR Research and Development Information Exchange Conference, Naval Weapons Center, China Lake, CA, 4 May 1991.

Webb, S. C., attended the Aerospace Medical Association 1991 Annual Scientific Meeting, Cincinnati, OH, 5-9 May 1991.

Weiss, M. S., attended the Technical Working Group Meeting, Fort Rucker, AL, 11-13 March, 1991.

Weiss, M. S., attended the Naval Medical Research and Development Command Strategic Planning Meeting, Baltimore, MD; Pentagon, Washington, DC; and Bioengineering Meeting, University of Philadelphia, Philadelphia, PA, 14-19 April 1991.

Weiss, M. S., attended the 121st Meeting of the Acoustical Society of America, Baltimore, MD, 29 April - 1 May 1991.

Weiss, M. S., attended the AGARD AMP Meeting, Pensacola, FL, 1-3 May 1991.

Weiss, M. S., attended meetings at Aerospace Medical Association 1991 Annual Scientific Meeting, and TARP, Cincinnati, OH, 6-10 May 1991.

Weiss, M. S., attended meetings at Naval Medical Research and Development Command and Naval Air Systems Command, Washington, DC, 5-7 June 1991.

Weiss, M. S., attended the Strategic Planning Advisory Group Meeting, Bethesda, MD, 16-20 September 1991.

Weiss, M. S., attended the ISO/TC 108/SC-8 Meeting, Berlin, Germany, 1-4 October 1991.

Weiss, M. S., attended the IEEE 13th Annual International Conference, Orlando, FL, 31 October - 2 November 1991.

Weiss, M. S., attended the Experimental Safety Vehicles (ESV) Conference, Paris, France, 3-7 November 1991.

Weiss, M. S., attended meetings at SEXTANT Avionigue, Bordeaux, France, 8-9 November 1991.

Weiss, M. S., attended the 21st Annual Meeting of the Society for Neuroscience, New Orleans, LA, 12-15 November 1991.

Weiss, M. S., attended the Naval Medical Research and Development Command's Commanding Officers' Meeting/Coast Guard Research and Development Meeting, Groton, CT, 7-13 December 1991.

Wildzunas, R. M., attended the Aerospace Medical Association 1991 Annual Scientific Meeting, Cincinnati, OH, 6 May 1991.

Willems, G. C., attended the AGARD/AMP Symposium, Pensacola, FL, 2 May 1991.

Willems, G. C., attended Modifications to Coriolis Accelerator Platforms Meeting, Pensacola, FL, 29 May 1991.

Willems, G. C., attended the 18th Annual Workshop on Human Subjects for Biomechanics Research/25th STAPP Car Crash Conference, San Diego, CA, 16-21 November 1991.

PROFESSIONAL MEETINGS ATTENDED IN 1992

Anderson, T. G., attended the Aerospace Medical Association Scientific Meeting Miami, FL, 10-15 May 92.

Anderson, T. G., attended the Aerospace Medical Problems Training Course Pensacola, FL, 22-25 Oct 92.

Bishop, B., participated in the Strategy Working Group of the NMRDC Strategic Planning Meeting, in Bethesda, MD, 26-30 May 92.

Call, D. W., attended the Navy Escape System Development Planning Conference II, Patuxent, MD, 31 Apr-2 May 92.

Conwell, S. L., attended Contract Meeting with Battelle Institute, Columbus, OH, 13-15 Sep 92.

Conwell, S. L., attended American Psychological Association Convention Meeting in Washington, DC, 13-19 Aug 92.

Dobie, T. G., attended the Annual Scientific Meeting, Aerospace Medical Association, Miami Beach, FL, 10-15 May 92.

Guccione, S. J., attended the Annual Scientific Meeting, Aerospace Medical Association, Miami Beach, FL, 11-13 May 92.

Guccione, S. J., attended the Tri-Service Working Group Planning Meeting at Wright Patterson AFB, OH, 21-22 Apr 92.

Holcombe, F. D., attended the Contract Review Meeting for the NBDL ship motion simulator experiments, Halifax, CAN, 6-10 Jan 92.

Holcombe, F. D., attended CANUKUS Steering Committee Meeting; NAVSEA Funding Meeting; Cognitive Performance Symposium, Washington, D.C., 12-18 Aug 92.

Holcombe, F. D., attended the Contract Review Meeting at Battelle, Columbus, OH, 14 Sep 92.

Holcombe, F. D., attended the U.K. Medical Research Council and the Psychological Subcommittee, University Psychological Department and NATO IEG and ABC's meetings in London, England, 11-22 Oct 92.

Holcombe, F. D., attended meeting with personnel at NAVSEA and personnel at DTRC regarding ship motion projects at Washington, D.C., 15-20 Nov 92.

Holcombe, F. D., attended the IEG/6 SG/ and ABCD meetings to review Canadian, United Kingdom and United States sponsored ship motion research in 30 Mar-9 Apr 92 London, England.

Holcombe, F. D., attended the NSW Research and Development Conference, Panama City, FL, 4-8 Nov 92.

Kaufman, B., attended Quality Strategic Working Group of the NMRDC Strategic Planning Meeting, Bethesda, MD, 29 Apr-1 May 92.

Matson, D. attended the 21st Annual Meeting of the Society for Neuroscience, New Orleans, LA, 12-15 Nov 92.

Matson, D., attended the SPR Annual Meeting and Symposium on Experimental Psychophysiological Approaches, Chicago, IL, 8-13 Oct 92.

Rendin, R. W., attended the Aviation Medicine Research Initiatives, BUMED, Washington, DC, 18-20 Feb 92.

Rendin, R. W., attended the 33rd Navy Occupational Health and Preventive Medicine Workshop, Virginia Beach, VA, 15-20 Mar 92.

Rendin, R. W., attended the USN/USMC Aviation R&D Working Group, Washington, DC, 6-9 Apr 92.

Rendin, R. W., attended the meeting on Crew Escape Systems, Warminster, PA, 15-17 Jun 92.

Rendin, R. W., attended the Surgeon General's Conference and MSC Leaders Conference, Herndon, VA, 7-10 Oct 1992.

Rendin, R. W., attended the NMRDC Commanding Officer's Conference, Bethesda, MD, 19-23 Oct 1992.

Rendin, R. W., attended the Armed Services Biomedical Research Evaluation Committee Meeting, Wright Patterson AFB, Dayton, OH, 5-6 Nov 1992.

Rendin, R. W., attended the Tri-Services Aeromedical Research Panel meeting, Ft. Rucker, AL, 1-2 Dec 1992.

Schoenberg, L. W., attended the Navy Crew System Management Meeting, Indian Head, MD, 1-4 Sep 92.

Seaman, G. M., attended the Emergency Medical Service Conference, Atlanta, GA, 6-10 May 92.

Weiss, M. S., attended IEEE Committee Meetings, Washington, DC, 16 & 17 Mar 92.

Weiss, M. S., attended the USN/USAF Joint Escape Planning Meeting, Wright Patterson AFB, OH, 21 & 22 Apr 92.

Weiss, M. S., attended the Navy Escape System Development Planning Conference II, Baltimore, MD, 1-2 Apr 92.

Weiss, M. S., attended the Federal Laboratory Consortium "Technology Transfer in the Fast Lane" Meeting, Indianapolis, IN, 4-7 May 92.

Weiss, M. S., attended the Annual Scientific Meeting, Aerospace Medical Association, Miami, FL, 11-15 May 92.

Weiss, M. S., attended the Meeting of the Escape System QFD Team at NAWC, Warminster, PA, 27-28 May 92.

Weiss, M. S., attended the IEEE Committee Meeting, Washington, DC, 15 June 92, and the Inter-laboratory Review Meeting, NADC, Warminster, PA, 16 Jun 92.

Willems, G. C., attended the Tri-Service Crew Casualty Working Group Meeting, Brooks AFB, San Antonio TX, 15-17 Dec 92.

NAVAL BIODYNAMICS LABORATORY

PRESENTATIONS FOR 1991

Anderson, T. G., "Visual Representation of Quantitative Data: Orthodox Views and Novel Approaches." Presented at the Naval Biodynamics Laboratory Science Seminar, New Orleans, LA, 19 July 1991.

Anderson, T. G., "Imponderables: Answers to the Most Commonly Asked Scientific Questions of Our Time." Presented at the Naval Biodynamics Laboratory Science Seminar, New Orleans, LA, 30 August 1991.

Call, D. W., "Physiological Stresses in Naval Aviation Operations: Career Opportunities in the Naval Medical Service Corps." Presented at the School of Allied Health, University of Louisville, Louisville, KY, 2 April 1991.

Call, D. W., "Biodynamic Research to Reduce Neck Injuries in Naval Aircrew." Presented at the Department of Orthopaedics, University of Louisville, Louisville, KY, 4 April 1991.

Call, D. W., "Physiological Stresses in Naval Aviation Operations." Presented at the Naval Biodynamics Laboratory Science Seminar, New Orleans, LA, 12 April 1991.

Call, D. W., "Human Factors in Vehicle Design." Presented at the Psychology Department, University of New Orleans, New Orleans, LA, 24 April 1991.

Call, D. W., "Naval Biodynamics Laboratory." Presented at the NASA Occupational Health Program 1991 Annual Meeting. New Orleans, LA, 5 December 1991.

Dobie, T. G., May, J. G., Scott, S. M., and Gutierrez, C. A., "Motion Sickness Counseling: The Optimal Number of Sessions." Presented at the Aerospace Medical Association Scientific Meeting, Cincinnati, OH, May 1991.

Dobie, T. G., "Current Status of the Preparation for the CANUKUS Studies at NBDL." Presented at the Ship-Motion Sub-Committee of the RNPRC, UK Medical Research Committee, London, England, September 1991.

Dobie, T. G., "Progress on CANUKUS Study." Presented at the UK Medical Research Council Meeting, London, England, 11 October 1991.

Dobie, T. G., "Symptomatology Checklists in Relation to Global Magnitude Estimates." Presented at the ABCD Working Group on Human Performance, Soesterberg, The Netherlands, 14-15 October 1991.

Gilbert, N. S., "Screening Techniques and Physical Limitation for Exposure to Hazardous Occupations." Presented at the Naval Biodynamics Laboratory Science Seminar, New Orleans, LA, 26 July 1991.

Guccione, S. J., Jr., "+Z Mass Addition Experiments on the Vertical Accelerator: March - July 1991." Presented at the Technical Working Group Meeting, U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL, 12 March 1991.

Guccione, S. J., Jr., Watkins, T. A., Weiss, M. S., and Call, D. W., "A Kinematic Model for Predicting the Effects of Helmet-Mounted Systems." Presented at the Aerospace Medical Association Scientific Meeting, Cincinnati, OH, May 1991.

Holcombe, F. D., Dobie, T. G., and Webb, S. C., "The NBDL Ship Motion Simulator." Presented at the SPAWAR Research and Development Information Exchange Conference, Naval Weapons Center, China Lake, CA, 4 May 1991.

Holcombe, F. D., "Reflections on Human Factors and Marketing." Presented at the Naval Biodynamics Laboratory Science Seminar, New Orleans, LA, 29 August 1991.

Holcombe, F. D., "Effects of Ship Motion on Human Performance at Sea: Interim Report No. 1." Presented at the ABCD Working Group on Human Performance, Soesterberg, The Netherlands, 14-15 October 1991.

Losh, M., "High Performance Continuous and Simultaneous Acquisition and Disk Storage of Event Related Data." Presented at the 13th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Orlando, FL, 2 November 1991.

Matson, D. L., "Face Formation Systems." Presented at the Naval Biodynamics Laboratory Science Seminar, New Orleans, LA, May 1991.

Matson, D. L., "Virtual Reality." Presented at the Naval Biodynamics Laboratory Science Seminar, New Orleans, LA, November 1991.

Mawn, S. V., "Cervical Spine Anatomy and Injury." Presented at the Naval Biodynamics Laboratory Science Seminar, New Orleans, LA, 25 January 1991.

Morrison, T. R., Webb, S. C., and Wildzunas, R. M., "Investigation of Fatigue Effects on Performance of U.S. Coast Guard Crews." Presented at the Aerospace Medical Association Scientific Meeting, Cincinnati, OH, 6 May 1991.

Pittman, M. E. and Mugnier, C. J., "35mm Still Camera Calibration and Initial Photodata Acquisition." Presented at the NBDL-ASEE Summer Faculty Research Colloquium, New Orleans, LA, June 1991.

Riemer, T. and Losh, M., "Increasing Signal to Noise Ratio for Human SSEPs." Presented at the NBDL-ASEE Summer Faculty Research Colloquium, New Orleans, LA, June 1991.

Riemer, T. and Losh, M., "Increasing Signal to Noise Ratio for Human SSEPs." Presented at the U.S. Navy-ASEE Summer Faculty Research Colloquium, New Orleans, LA, Aug 91.

Russo, E., "Linkage Models of the Cervical Spine." Presented at the NBDL-ASEE Summer Faculty Research Colloquium, New Orleans, LA, June 1991.

Russo, E., "Linkage Models of the Cervical Spine." Presented at the U.S. Navy-ASEE Summer Faculty Research Colloquium, New Orleans, LA, August 1991.

Watkins, T. A., "Statistical Modeling and Scaling of Head/Neck Kinematics." Presented at the NBDL-ASEE Summer Faculty Research Colloquium, New Orleans, LA, June 1991.

Weiss, M. S., "Biodynamic Standards - Attempting an International Consensus." Presented at the Naval Biodynamics Laboratory Science Seminar, New Orleans, LA, May 1991.

Weiss, M. S., Guccione, S. J., Jr., Call, D. W., and Watkins, T. A., "Scaling Hybrid III and Human Head Kinematic Responses to Frontal Impact and Lateral Impact." Presented at the 13th International Technical Conference on Experimental Safety Vehicles, Paris, France, 4-7 November 1991.

Willems, G. C. and Knouse, D. R., "A Detailed Evaluation of the ATA Angular Motion Sensor in Realistic Simulated Crash Environments." Presented at the 35th STAPP Car Crash Conference, San Diego, CA, 18-20 November 1991.

PRESENTATIONS FOR 1992

Anderson, T., "Recent Developments in Aviation Medicine." Presented at the Monthly Meeting of the Association of Naval Aviation, New Orleans, LA, 19 March 1992.

Call, D. W., "PE 603216N Aircrew Systems Technology Project M0097: Aircrew Impact Injury Prevention." Presented at the OP091 Pentagon Briefing, Washington, D.C., 17 January 1992.

Call, D. W., "A Career in Naval Aerospace Physiology Research, Development, Test and Evaluation." Presented at the Annual Naval Aerospace Physiology/Failsafe Conference, Pensacola, FL, 29 January 1992.

Call, D. W., "Career Opportunities in Biomedical and Human Factors Engineering." Presented at the Freshman Engineering Practice Seminar, Tulane University, New Orleans, LA, 18 March 1992.

Call, D. W., and Weiss, M. S., "Applying NBDL Human Head/Neck Response Data in Naval Escape Systems Development." Presented at the Naval Escape System Development Planning Conference II Naval Air Warfare Center, Patuxent River, MD, 1-2 April 1992.

Call, D. W., "Human Factors Research in Operational Environments." Presented at Graduate Seminar, Psychology Department, University of New Orleans, New Orleans, LA., 29 April 1992.

Guccione, S. J., "Summary of +Z Vertical Human Helmet Experiments." Presented to Tri-Service Working Group Meeting, Wright-Patterson AFB, OH, 21 April 1992.

Guccione, S. J., "Report on a New Instrumentation System for Measuring the Dynamic Response of the Human Head/Neck During Impact Acceleration." Presented to the Tri-Service Working Group Meeting, Wright-Patterson AFB, OH, 22 April 1992.

Guccione, S. J., "Scaling Hybrid III and Human Head Kinematic Response to Impact Acceleration." Presented to the 36th Stapp Car Crash Conference, Seattle, WA, 2 November 1992.

Holcombe, F. D., "Human Factors Division Research Programs." Brief to U.S. Navy Surgeon General, New Orleans, LA, 6 October 1992.

Holcombe, F. D., "Effects of Ship Motion on Human Performance at Sea: Interim Report III and Preliminary Results of MII Study." Presented to the ABCD Working Group on Human Performance, Institute of Naval Medicine, Gosport, Hampshire, United Kingdom, 26-27 October 1992.

Holcombe, F. D., "Human Factors Division Research Programs." Brief to Prospective Chief of the Medical Services Corps, New Orleans, LA, 5 November 1992.

Holcombe, F. D., "Naval Biodynamics Laboratory Human Factors Division Research Programs Overview: FY 91-93. "Presented to Aerospace Experimental Psychologists Meeting, Pensacola, FL, 20 November 1992.

Rendin, R. W., "Aircrew Impact Injury Prevention: Naval Biodynamics Laboratory." Brief to Chief of Naval Operations Science and Technology Requirements Committee, Arlington, VA, 1 November 1992.

Rog, A., "Time Delay Estimation of Noisy Signals Using Spatial Amplitude Distribution Analysis." Presented to the 124th Annual Meeting of the Acoustical Society of America, 31 October 1992.

Weiss, M.S., "A New Instrumentation System for Measuring the Dynamic Response of the Human Head/Neck During Impact Acceleration." Presented to the Aerospace Medical Panel of the NATO Advisory Group for Aerospace Research and Development, Cesme, Turkey, 27 April 1992.

Willems, G. C., "Dynamic Measurements - The Old and the New." Presented at the Naval Biodynamics Laboratory Science Seminar, New Orleans, LA, 10 January 1992.

1991 PUBLICATIONS

Dobie, T. G., *"Teaching the Right Stuff-The Heart of the Matter"*. Technical Report No. NBDL-90R017 (NTIS No. AD A232826), Naval Biodynamics Laboratory, New Orleans, LA, January 1991.

Dobie, T. G., May, J. G., Gutierrez, C., and Heller, S. S., *The Transfer of Adaptation Between Actual and Simulated Rotary Stimulation*. Research Report No. NBDL-90R015 (NTIS No. AD A234781), Naval Biodynamics Laboratory, New Orleans, LA, April 1991.

Francis, D., *X-Ray Anthropometry Digitization Program for the Hewlett-Packard 9000/835 Computer*. Technical Report No. NBDL-90R003, Naval Biodynamics Laboratory, New Orleans, LA, May 1991.

Francis, D., *X-Ray Anthropometry Transformation Program for the Hewlett-Packard 9000/835 Computer*. Technical Report No. NBDL-90R002, Naval Biodynamics Laboratory, New Orleans, LA, May 1991.

Guccione, S. J., Jr., Watkins, T. A., Weiss, M. S., and Call, D. W., "A Kinematic Model for Predicting the Effects of Helmet-Mounted Systems." *Aviation, Space, and Environmental Medicine*, Vol. 62, No. 5, p. 477, May 1991. (Abstract)

Holcombe, F. D. and Webb, S. C., *Human Factors Assessment of USCG 47-Ft Motor Lifeboat*. Technical Report No. NBDL-91R003 (NTIS No. AD A245835), Naval Biodynamics Laboratory, New Orleans, LA, October 1991.

Losh, M. W., "High Performance Continuous and Simultaneous Acquisition and Disk Storage of Event Related Data." *Proceedings of the 13th Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, The Institute of Electrical and Electronics Engineering, Inc., New York, NY, Vol. 13, pp. 413-414, 1991.

Matson, D. L., "Naval Biodynamics Laboratory Research in Human Response to Impact Acceleration." *Shock and Vibration Technology Review*, Vol. 1, pp. 3-12, November 1991.

Morrison, T. R., Webb, S. C., and Wildzunas, R. M., *The Effects of Fatigue on 41-Ft. Utility Boat Crew Members*. Research Report No. NBDL-90R012 (NTIS No. AD A238973), Naval Biodynamics Laboratory, New Orleans, LA, May 1991.

Morrison, T. R., Webb, S. C., Swensen, E. E., and Wildzunas, R. M., "Fatigue Effects on Performance of U.S. Coast Guard Boat Crew." *Aviation, Space, and Environmental Medicine*, Vol. 62, p. 451, May 1991.

Morrison, T. R., Dobie, T. G., Willems, G. C., Webb, S. C., and Endler, J. L., *Ship Roll Stabilization and Human Performance*. Research Report No. NBDL-90R007 (NTIS No. AD A232721), Naval Biodynamics Laboratory, New Orleans, LA, January 1991.

Starr, J. B., Webb, S. C., Day, H. R., and Frey, R., "Aptitude Measurement in U.S. Subcultures." *International Journal of Intercultural Relations*, Vol. 15, pp. 149-161, 1991.

Watkins, T. A., Weiss, M. S., Call, D. W., and Guccione, S. J., Jr., "*A Kinematic Model for Predicting the Effects of Helmet-mounted Systems.*" *AGARD Conference Proceedings No. 517*, North Atlantic Treaty Organization Advisory Group for Aerospace Research and Development, Neuilly-sur-Seine, France, pp. 7:1-7, 1991.

Webb, S. C., "*500 Years of Hispanic Heritage 1492-1992: A Cultural Mosaic.*" Defense Equal Opportunity Management Institute, Patrick Air Force Base, FL, pp. 1-18, April 1991.

Willems, G. C. and Knouse, D. R., "*A Detailed Evaluation of the ATA Angular Motion Sensor in Realistic Simulated Crash Environments.*" *Proceedings of the 35th STAPP Car Crash Conference*, Society of Automotive Engineers, San Diego, CA, pp. 303-334, November 1991.

Willems, G. C., Muzzy, W. H., III, Knouse, D. R., and Gilreath, F., *Dynamic Response of the Hybrid III Dummy to $+G_z$ Simulated Ship Shock--Cushioned vs Hard Seats.* Research Report No. NBDL-91R002, Naval Biodynamics Laboratory, New Orleans, LA, November 1991.

1989 and 1990 Command History. (NTIS No. AD A247185), Naval Biodynamics Laboratory, New Orleans, LA, July 1991.

1992 PUBLICATIONS

Alem, N., Shanahan, D., Barson, J., and Muzzy, W., *"The Effectiveness of Airbags in Reducing the Severity of Head Injury from Gunsight Strikes in Attack Helicopters."* NATO-AGARD Conference Proceedings, 532(44):1-9 September, 1992.

Bibliography of Scientific Publications of the Naval Biodynamics Laboratory 1980-1991. Report No. NBDL-92R003, Naval Biodynamics Laboratory, New Orleans, LA, June 1992. (DTIC No. AD A255952)

Bishop, B., Francis, D. A., and Jupiter, G. L., *EZFLOW Data Reduction and Analysis System Operating Procedures for the Hewlett Packard 9000/835 System,* Technical Report No. NBDL-92R002, Naval Biodynamics Laboratory, New Orleans, LA, July 1992.

Gluck, G. S. and Mawn, S. V., "The Klippel-Feil Syndrome: Implications for Naval Service." *Military Medicine*, Vol. 157, pp. 318-322, June 1992.

Holcombe, F. D. "HFE at the Naval Biodynamics Laboratory," *The Aerospace Experimental Psychologist Bulletin*, Vol. 1, No. 2, pp. 4-7, June 92.

Liberati, D., Brandazza, P., Casagrande, L., Cerini, A., and Kaufman, B., *"Detection of Transient Single-Sweep Somatosensory Evoked Potential Changes via Principal Components Analysis of the Autoregressive-with-Exogenous-Input Parameters."* Proceedings of the 14th Annual Conference of the IEEE Engineering in Medicine and Biology Society, pp. 2454-2455, 1992.

Mawn, S. V., Lambert, J. J., and Catyb, J. L. "The Relationship Between Head and Neck Anthropometry and Kinematic Response During Impact Acceleration." *Aviation, Space and Environmental Medicine,* Vol. 63, pp. 32-36, January 1992.

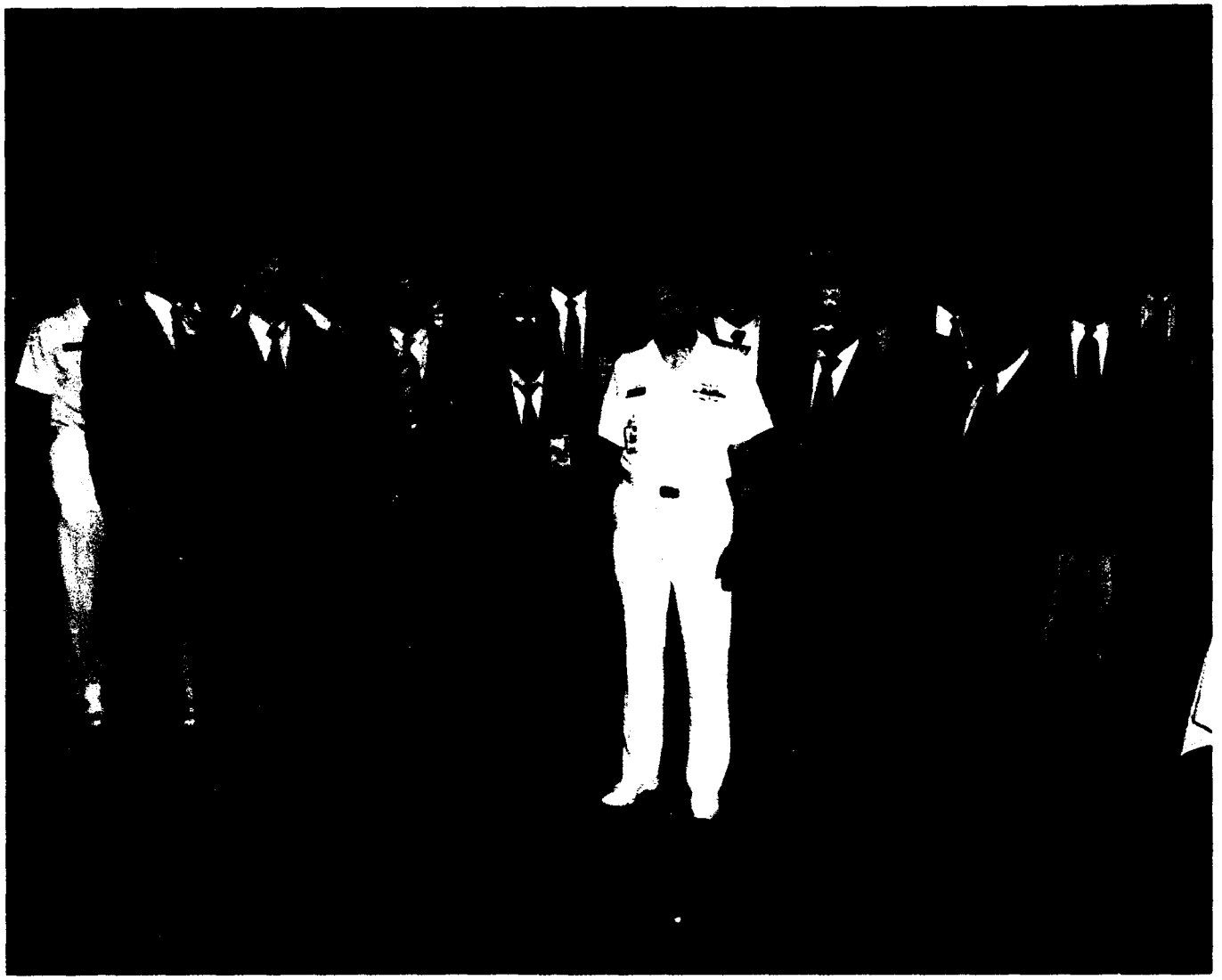
Webb, S. C. "1492-1992 500 Years of Hispanic Heritage," *Mainstream,* Volume III No. 1, pp. 19-23, Spring 1992.

Webb, S. C. "Hispanics in the Military: Stories of Honor" *Defense Equal Opportunity Management Institute Reflections* Winter 91/Spring 92, pp. 8-9, 1992.

Weiss, M., Willems, G. Guccione, S., Mugnier, C., and Pittman, M., *"A New Instrumentation System for Measuring the Dynamic Response of the Human Head/Neck During Impact Acceleration."* NATO-AGARD Conference Proceedings, 532 (21):1-6, September 1992.

CONFERENCE HOSTED

In April 1991, NBDL served as host for the NATO SeaKeeping SubGroup 5 semiannual meeting. Participants from the U.S. (Naval Sea Systems Command, David Taylor Naval Ship Research and Development Center and NBDL), Canada, United Kingdom and the Netherlands met at NBDL to discuss details for the first year program to investigate motion-induced performance interruptions. During the conference, the American, British, Canadian, and Dutch Working Group on human performance at sea was formally established to guide these studies.

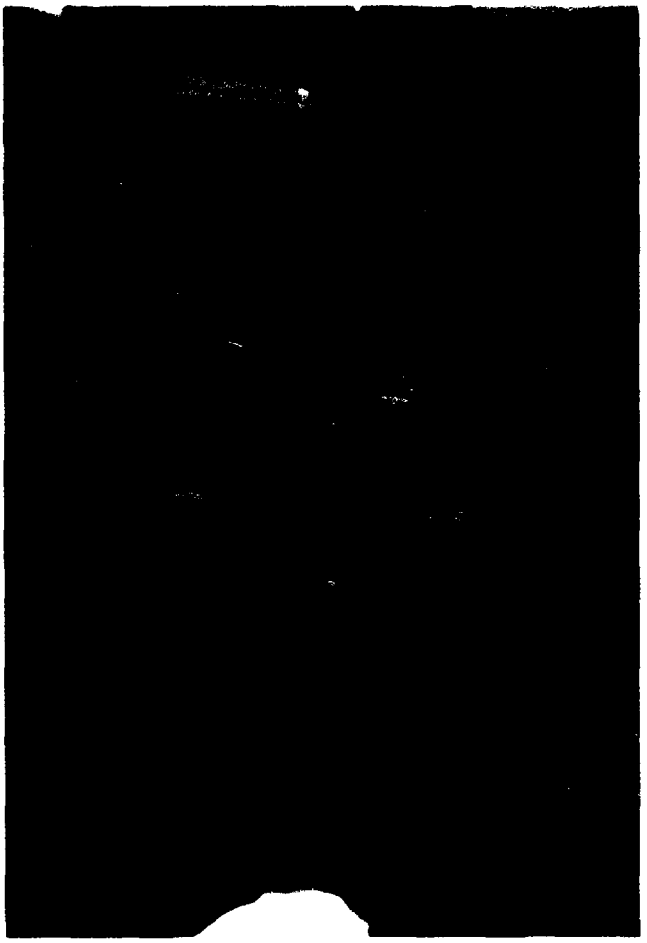


Members of the SG-5 Semiannual Meeting held at NBDL
April 1991

DISTINGUISHED VISITORS IN 1991

MASTER CHIEF PETTY OFFICER OF THE NAVY

In August 1991, The Master Chief Petty Officer of the Navy, AVCM(AW) Duane R. Bushey visited and toured NBDL. During his visit, AVCM(AW) Bushey briefed the enlisted personnel on Navy career issues.



AVCM(AW) Duane R. Bushey

NAVAL BIODYNAMICS LABORATORY

OTHER DISTINGUISHED VISITORS IN 1991

CDR Giuseppe Maria Bailo	Officio Architettura Navale, Italy
Mr. Erich Baitis	David Taylor Research Center, Bethesda, MD
CDR Guy Banta	Naval Health Research Center, San Diego, CA
Mr. Chris Bartholomew	Naval Air Development Center, Warminster, PA
Mr. Willem Bles	TNO Institute for Perception, The Netherlands
Mr. James L. Colwell	Defense Research Establishment Atlantic Darthmouth, N. S., Canada
Mr. Richard DeValcourt	Textron Marine, New Orleans, LA
Mr. Harold Eck	Martin-Marietta Corporation, New Orleans, LA
Dr. Gregory Gaines	Manager, Personnel Security Research Program, Central Intelligence Agency, Washington, DC
Mr. Androas Goertz	Freelance journalist, Germany
Dr. Ross Graham	Defense Research Establishment Atlantic Darthmouth, N. S. Canada
Dr. John Guignard	Guignard Biodynamics, New Orleans, LA
Dr. Paul Harch	New Orleans, LA
Dr. Monty Herron	(Former NBDL CO) Geocenters Inc. Ft. Washington, MD
Mr. Ron Heselgrave	Defense and Civil Institute of Environmental Medicine, Ontario, Canada
Ms. Leslie Hill	WDSU TV-6, New Orleans, LA

LCDR Johannes Istefjord	Royal Norwegian Material Command Norway
Master Sergeant King	U.S. Marine Corps, New Orleans, LA
Mr. Louis Kistney	Police Department, New Orleans, LA
Mr. E. Civ Krikke	Royal Netherlands Navy, The Netherlands
Ms. Stephane Kummer	Direction des Constructions Navales, France
Mr. Thomas Lamb	Textron Marine, New Orleans, LA
LT Daniel Marie Le Coz	Direction des Constructions Navales, France
MCPO Wallace Liggett	Naval Medical Submarine Research Laboratory, Naval Submarine Base, New London, Groton, CT
Dr. Adrian R. J. M. Lloyd	Admiralty Research Establishment, United Kingdom
LTCOL Peter Lurker	Armstrong Medical Laboratory, Wright-Patterson Air Force Base,OH
Dr. James May	University of New Orleans, New Orleans, LA
CDR Nigel Moores	SCNO/CBNS (w), United Kingdom
Dr. Mildred Noto	Principal, Schaumburg Elementary School, New Orleans, LA
Mr. John Pattison	Naval Sea Systems Command, Washington, DC
Mr. Kwok Ping-Kwong	Defense Research Establishment Atlantic, Darthmouth, N. S., Canada
Mr. Juan M. Ponce Gomez	Spanish General Director for Armament and Material Office, Spain

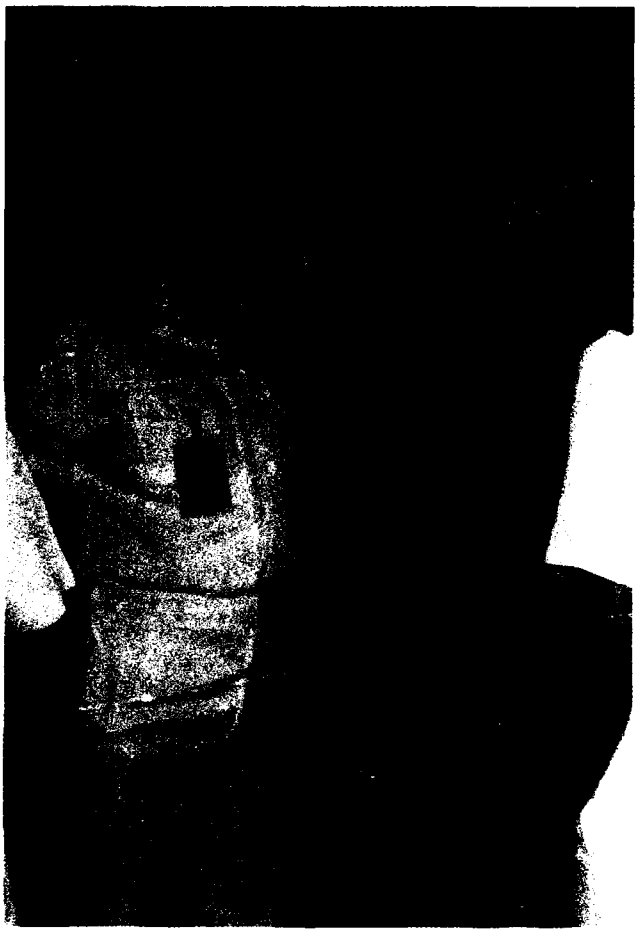
NAVAL BIODYNAMICS LABORATORY

CDR Tim Singer	Research Area Manager Naval Medical Research and Development Command, Bethesda, MD
Mr. Paul F. Smith	Naval Medical Submarine Research Laboratory, Naval Submarine Base Groton, CT
Mr. Richard Strong	Institute of Naval Medicine, United Kingdom
Mr. Eric Swensen	U.S. Coast Guard Research and Development Center, Groton, CT
COL John Tedor	Human Systems Division, U.S. Air Force, Brooks AFB, San Antonio, TX
Dr. Louis Tijerina	Battelle Memorial Institute, 505 King Drive, Columbus, OH
Mr. Joe Valiente	New Orleans Police Department, New Orleans, LA
Mr. Carl Werner	Naval Air Development Center, Warminster, PA
Dr. Kees Wientjes	TNO Institute for Perception, Amsterdam, The Netherlands
CAPT David Yacavone	Naval Safety Center (Code 14), Norfolk, VA

DISTINGUISHED VISITORS IN 1992

NAVY SURGEON GENERAL

On 6 October 1992, NBDL had the distinct pleasure of hosting the Navy Surgeon General, VADM Donald F. Hagen. During his visit, VADM Hagen presented awards, briefed the command, and answered questions concerning the future of health care and medical research and development in the Department of the Navy.



VADM Hagen with Dr. Gilbert and FN Pineda

OTHER DISTINGUISHED VISITORS FOR 1992

Mr. Lee Harris	Department of Health and Human Services, Carville, LA
Mr. Ross Kramer	Homer Industries, New Orleans, LA
Mr. Jack Keller	Homer Industries, New Orleans, LA
Mr. William Keller	Keller Technology, New Orleans, LA
Mr. Erich Baitis	David Taylor Carderock Division, NSWC, Bethesda, MD
Dr. Broadway	Dillard University, New Orleans, LA
Ms. Rhonda Caronne	Humana Hospital, New Orleans, LA
CAPT Rob Carter	NMRDC, Bethesda, MD
CAPT Ray Chaput	NMRDC, Bethesda, MD
Dr. John Crisp	UNO, New Orleans, LA
Mr. Frank Dauvilliers	Peugeot and Renault, Paris, France
Mr. B. Deutsch	Snell Memorial Foundation, New Orleans. LA
LCDR Michael Dobson	NMRDC, Bethesda, MD
Mr. Craig Dye	CSERIAC, Wright Patterson AFB, OH
Dr. Channing Ewing	Snell Memorial Foundation, New Orleans, LA
CAPT Edward Flynn	Commanding Officer, NMRDC, Bethesda, MD
Dr. John Guignard	Guignard Biodynamics, New Orleans, LA
Dr. Marko De Jaeger	NTO Research, The Netherlands

Mr. Joe Johnson	Navy Office of Technology, Bethesda, MD.
Mr. Kip Johnson	NMRDC, Bethesda, MD
Mr. Leon Kehl	Northern Digital Inc., Waterloo, ON
Dr. Ted Knox	Wright Patterson AFB, Dayton, OH
Mr. Todd Kuilan	Northwestern University, Chicago, IL
Dr. Alain Leger	Sextant, Avionique, France
LCDR M. Lucarelli	DCNO Resource, Warfare, Requirements & Assessments, (N88-AIR), Washington, DC
LCDR Kelly McConville	Bureau of Medicine and Surgery, Washington, DC
LCDR James McDonald	Bureau of Medicine and Surgery, Washington, DC
HMCM K. Pedersen	NMRDC, Bethesda, MD
LCDR Puksta	NMRDC, Bethesda, MD
Mr. Richard Roesh	Naval Special Warfare, Panama City, FL
Mr. Loren Kirby, Mr. Verneal Roberts	Tektronix, Irving, TX
RADM Hugh Scott	Assistant Chief, Operational & Fleet Support, Bureau of Medicine and Surgery, Washington, DC
Ms. J. Speake-Ponow	NMRDC, Bethesda, MD
Mr. John Stabb	Battelle Institute, Washington, DC
Ms. D. Stanfield	NRCC, Charleston, SC
Dr. Louis Tijerina	Battelle Memorial Institute, Columbus, OH
Mr. F. "Terry" Thomasson	Naval Air System Command, Washington, DC

Dr. Russ Trahan	UNO, New Orleans, LA
Governor David Treen	(Former Governor of Louisiana) New Orleans, LA
Ms. Linda Warriner Mr. Hervey Warriner Mr. R. Honquest	C.E.I., Chicago, IL
LCDR Stephen Queisser	German Naval Medical Center, Kronshagen, GE

COMMUNITY SERVICE

PARTNERSHIP IN EDUCATION

A key issue concerning many Americans today is the quality of education in the public school systems. For the past four years, NBDL has taken an active role in helping improve the quality of education at a local elementary school. Through the New Orleans Public Schools' Partnership In Education Program, NBDL has adopted the Henry C. Schaumburg Elementary School in East New Orleans.

This partnership has included tutoring students in math and English, performing maintenance projects at the school on weekends and inviting students to the command to learn about careers in science, and the United States Navy.

These volunteer actions have helped improve the academic performance of the students and also greatly increased their individual self-esteem.

Our sailors provide strong role models from varied cultural backgrounds and instill in the students a concern for their school, community, and nation.

SA Jason Taylor, NBDL HRV tutors a student at Schaumburg Elementary School

1991 & 1992 TOYS FOR TOTS CAMPAIGN

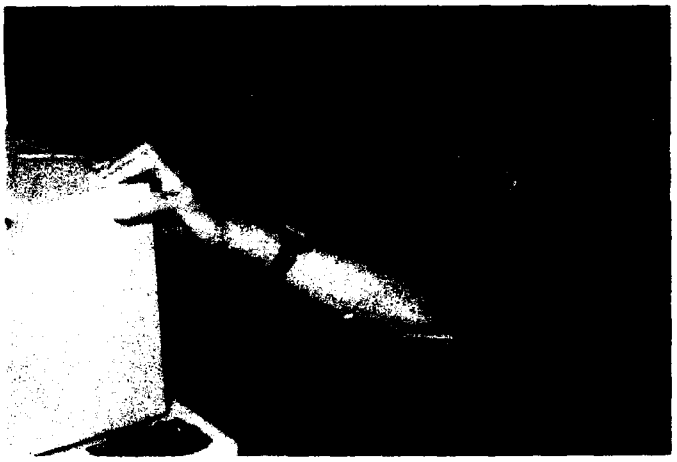
The 1991 and 1992 "Toys for Tots" campaigns were the most successful in the history of NBDL. AN Byron Davis was the coordinator of the 1991 campaign and AN Lopez was the coordinator for the 1992 campaign. NBDL's contributions were presented to the U.S. Marine Corps for distribution to needy children in the New Orleans area.

ENGINEERING AWARENESS DAY, UNIVERSITY OF NEW ORLEANS, COLLEGE OF ENGINEERING

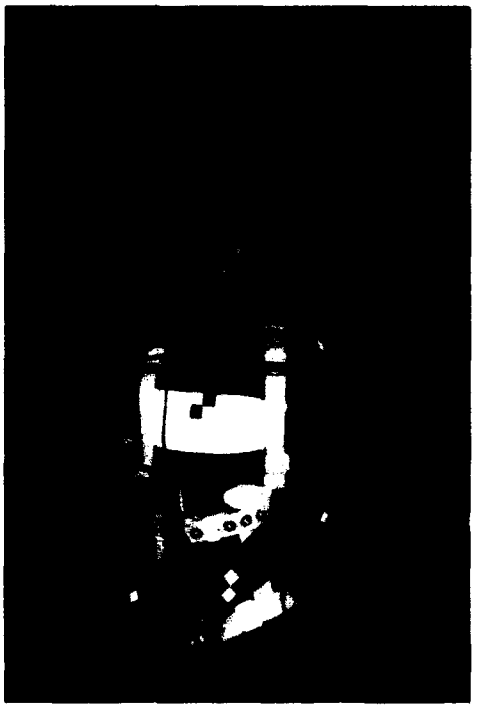
In 1991 and 1992, NBDL participated in the University of New Orleans Annual Engineering Day. Students who attended the one day affair, were seeking jobs in engineering related fields. Engineering students were encouraged to participate in co-operative education programs in order to enhance the possibility of securing a job in engineering related fields. NBDL was one of forty different organizations represented.

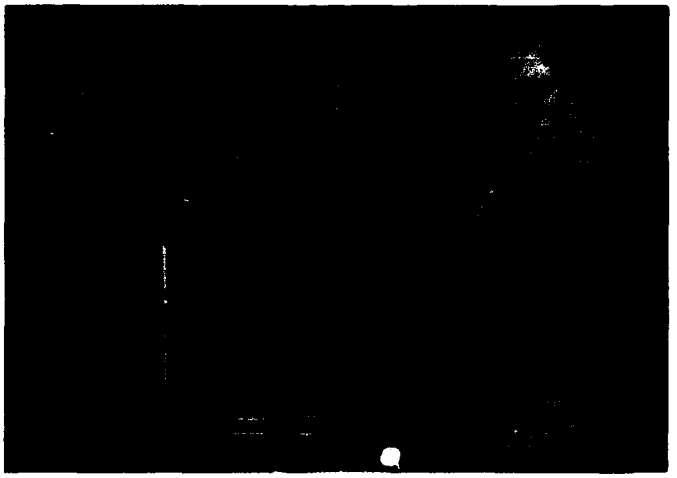
AN Byron Davis, Ms. Bernice Kaufman, and FN Eric Noble participating in the Engineering Awareness Day

NBDL PERSONNEL IN ACTION



NBDL PERSONNEL IN ACTION





NBDL PERSONNEL IN ACTION

MILITARY AWARDS

SAILOR OF THE YEAR 1991

HM1 Harold B. Powe, USN

SAILOR OF THE YEAR 1992

HM2 Gail M. Seaman, USN

SAILORS OF THE QUARTER 1991 & 1992

1991	1992
SA Michael Skaggs	HM2 Gail Seaman
PN3 Russel L. Loeve	PN3 Russel L. Loeve
SN Sergio D. Chinchilla	SK2 Anthony George
HM2 Gail Seaman	SN Alan S. Hovis

OTHER MILITARY AWARDS FOR 1991 AND 1992

Navy Achievement Medal
CPT Shanna L. Nesby, USA
LT Schuyler C. Webb

Navy Commendation Medal
YNC Gary L. Linebrink
LCDR Stephen V. Mawn
YNCS Stephen M. Rogan

Letters of Appreciation

SN Sergio Chinchilla
SN Michael Clapp
SN Harry Ervin
SN George Ferguson
SK2 Anthony George
AN Erik Noble
SN Derrick Taylor
SN Sidney Curry
SN Jason Taylor
HM2 Gail Seaman
SN Scott Garber
PNC Marleene Keffeler
SA Edward Kennedy
SN John Malone
HM1 Harold Powe
SN Michael Skaggs
LT Schuyler Webb

Letters of Commendation

HM2 Joseph Catyb (2)
SN Sergio Chincilla
SN Russel Loeve(2)
BM3 Tony Mack
HM1 Harold Powe
HM3 George Taylor
AZ3 Bradley Boyd
SA Victor Ewing
HM1 Harold Powe
HM2 Gail Seaman
AZ3 Bradley Boyd
FA Michael Skaggs
HM3 George Taylor

NAVAL BIODYNAMICS LABORATORY

Navy Achievement Medal

PN3 Russel L. Loeve

OUTSTANDING PERFORMANCE IN PHYSICAL READINESS PROGRAM

1991

AN Byron Davis
SN George Ferguson
LCDR Stephen Mawn
FN Michael Skaggs
SN Kenneth Tedrick
AN Byron Davis
SN Harry Ervin
SK2 Anthony George
SN Sean McCarthy
SN Darrel Smith
LT Schuyler Webb
SR Richard Ewing
SN Gerald Henderson
CDR Robert Rendin
HM3 George Taylor
HM2 Joseph Catyb

1992

SN Richard Curry
SN Mark Purtell
SN Sean McCarthy
AN Byron Davis
CDR Robert Rendin
SN Jason Taylor
LCDR F. Douglas Holcombe
HM3 George Taylor

CIVILIAN AWARDS IN 1991 AND 1992

DEPARTMENT OF THE NAVY
MERITORIOUS CIVILIAN SERVICE AWARD

In December 1991, Mr. Gilbert Willems, Head of Technology Department at NBDL received the Department of the Navy Meritorious Civilian Service Award for his outstanding achievements. His accomplishments from March 1971 to December 1991, were numerous and were instrumental in the success NBDL had in measuring the physical and biomedical effects of impact acceleration and ship motion. He designed the data acquisition and accelerator calibration systems and set the specifications for control room, cabling trenches and power requirements. Mr. Willems was also the original designer of the accelerometer selection system which allowed the Laboratory to use the minimum number of accelerometers to define three dimensional motion in space for minimum time deviation.

CAPT Call Presenting Mr. Willems with the Department of the Navy Meritorious Civilian Service Award

NAVAL BIODYNAMICS LABORATORY

CIVILIANS OF THE QUARTER 1991 AND 1992

1991

Mrs. Pat McCusker
Mr. Jim Guess
Ms. Severina Garcia
Ms. Bernice Kaufman

1992

Ms. June Gordon
Ms. Severina Garcia
Ms. Connie Dummitt
Mr. Mike Suchanek

CO's Safety Achievement

Mr. Roger Black
Mr. Robin Roth

Letters of Appreciation

Mr. Donald Alt
Ms. Ann Gerads
Ms. Joan Holland (2)
Mr. Bernel Connerly
Ms. Bernice Kaufman
Mr. Mark Lotz
Ms. Pat McCusker (3)
Ms. Carol Pineiro
Mr. William Price
Ms. Angeline Vitellaro

Letters of Commendation

Ms. Severina Garcia
Mr. James Guess
Mr. Mark Lotz
Ms. Pat McCusker (3)
Mr. William Muzzy, III
Ms. June Gordon
Mr. Donald Alt
Dr. Thomas G. Dobie
Ms. Severina S. Garcia
Mr. William F. Price
Mr. Robert Wildzunas (2)
Mr. Bobby Teal (2)

Meritorious Unit Citation Award

Ms. Patsy Carbonette

MILITARY AND CIVILIANS REPORTING/DEPARTING IN 1991

Military Reporting

CDR Thomas Anderson
AA Roderick Belson
LT Sharon Conwell
SN Sidney Curry
SA Mario Hair
AN Trace Harbin
SR Eric Konow
AA Roberto Lopez
SA Sean McCarthy
SA Steven McDaniel
SN William Miller
AR Mike Meyer
SR Richard Ody
SN Mark Purtell
LT Kevin Rice
YNCS Stephen Rogan
HM2 Gail Seaman
SR Darnell Smith
SN Donald Starling

Military Departing

Departing	Reported To
SR Thomas Andree	USS BUTTE
FN Donovan Bourgeau	SPECBOATU 12
SN Sergio Chinchilla	MS "A" School, SSC
HM3 Joseph Catyb	NR NMC New Orleans, LA
SN Harry Ervin	NAVSTA Guantanamo Bay, Cuba
SN Victor Ewing	NSA New Orleans, LA
SA Edward Kennedy	ARDM 1 Oak Ridge, Kings STU
AN Erik Noble	Chanute AFB Sch, NAVSUPPACT
SA Shawn Sauro	NSA New Orleans, LA
SN Kenneth Tedrick	EOD Technician Training
SN Michael Skaggs	Adak AK
SN John Malone	Discharged
CPT S. Nesby, USA	CDC Atlanta, GA

CIVILIANS REPORTING/DEPARTING

Reporting	Departing
Ms. Patsy Carbonette	Ms. Barbara Dejoie
Mr. Andre Rog	Ms. Pat McCusker
	Mr. William H. Muzzy, III
	Mr. Bobby Teal

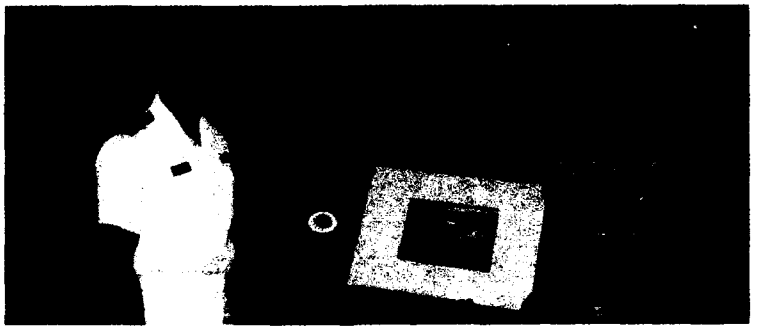
FAREWELL

LCDR Stephen V. Mawn, served as Research Medical Officer and Head, Biomedical Support Department at NBDL during the period 1 August 1986 to 30 August 1991. LCDR Mawn's leadership and dedication to excellence contributed to the success of the command's research efforts and the safety of its personnel. LCDR Mawn authored and co-authored several scientific and technical publications and organized a national conference on spinal injury. He also devoted many hours to coaching command athletic teams, participating in community service events, and increasing command visibility as Public Affairs Officer.

LCDR Stephen V. Mawn Receiving his Farewell from CAPT Call

FAREWELL

LT Schuyler C. Webb, served as a Research Psychologist at NBDL from May 1987 to June 1991. During that time, he was instrumental in revitalizing the Ship Motion Research Program. His human factors studies of U.S. Coast Guard vessels and boat crew performance resulted in highly significant contributions to planning and decision making at the highest levels of command and to NBDL's ability to provide professional research and development services. LT Webb was selected as one of only three Department of Defense representatives to perform an internship at the Defense Equal Opportunity Management Institute, Patrick Air Force Base, FL.



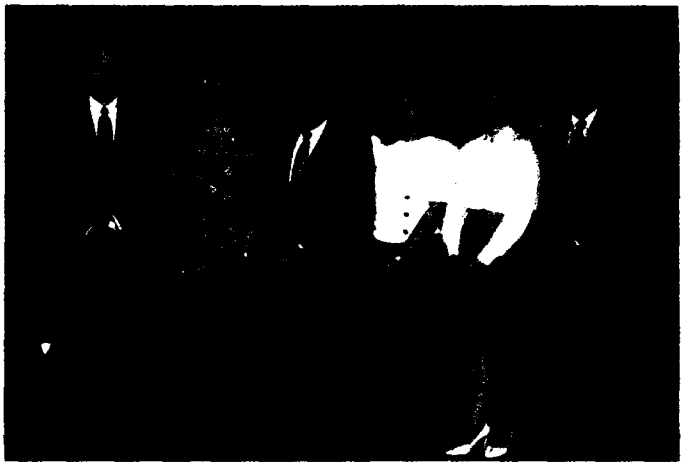
LT Schuyler C. Webb Receiving a Farewell from CDR Rendin

RETIREMENTS FOR 1991

YNC Gary L. Linebrink served as the Command Chief Petty Officer for NBDL from March 1988 to April 1991. During part of this time, he served concurrently as the Administrative Officer, Head, Human Research Volunteer Division, and Head, Research Support Department. He received the Naval Medical Research and Development Command's Senior Enlisted Leadership Award in 1990. His accomplishments were recognized by his receiving the Navy Commendation Medal. Chief Linebrink's retirement ceremony was held at NBDL on 26 April 1991.

YNC Gary L. Linebrink, Command Chief, Naval Biodynamics Laboratory, 19 March 1988-26 April 1991

Mr. Bobby T. Teal retired from NBDL after 35 years in Federal Service. Mr. Teal started out as an Air Force Veterinary Technician at Holloman Air Force Base, NM in 1955. He served as a test subject on numerous acceleration projects and later worked as a Civil Service Technician for the Air Force at Brooks Air Force Base, San Antonio, TX. He transferred to NAMRL in Pensacola, FL and became a "plank" owner when the NAMRL Detachment was established in New Orleans, LA in 1971. His loyal and dedicated service as Head, Animal Care Technician became a strong stabilizing force for this Laboratory.



Mr. Bobby Teal, Pictured Third Person from Left, with Family

NAVAL BIODYNAMICS LABORATORY

MILITARY AND CIVILIANS REPORTING/DEPARTING IN 1992

Military Reporting

CDR Lawrence W. Schoenberg
SA Bruce Davis
AN Grover Hill
FN Tristan Pineda
AA Linton Strawder
SA Vincent Cammayo
SN Enrique Dedios JR.
SN Alan Hovis
SA Richard Ramos

Military Departing

Departing	Reported To
CAPT Douglas W. Call	Retired
SN Sidney R. Curry	USS Yosemite (AD19)
AN Byron O. Davis	Discharged
AN Scott J. Garber	PH "A" School,
AN Trace Harbin	NAS Norfolk, VA
SN Gerald Henderson	NSA New Orleans, LA
AA Erik Konow	NAS Jacksonville, FL
AN Erik G. Noble	AG "A" School, AFB, IL
SN Sean S. McCarthy	RM "A" School San Diego, CA
SA Richard Ody	USS Spruance (DD-963)
SN Daniel Rolewicz	NSA New Orleans, LA
SN Michael Skaggs	NSA Adak, AK
SN Jay S. Smith	HM "A" School, Great Lakes, IL
SA Derrick Taylor	NAS Mayport, FL
SN Jason E. Taylor	IS "A" School, Dam Neck, VA

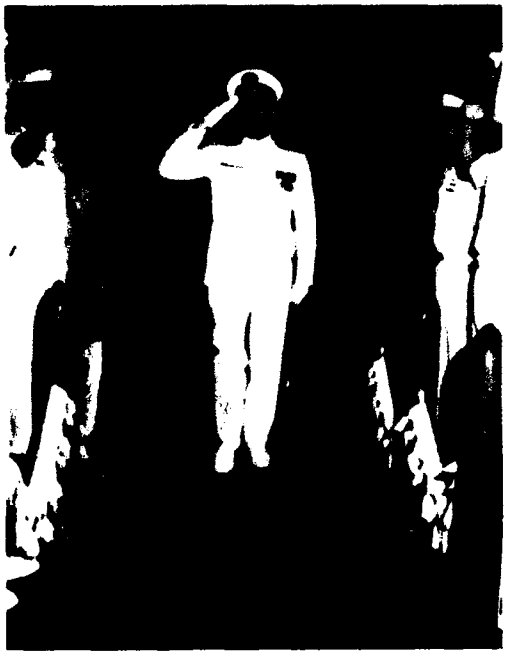
Civilians Reporting/Departing

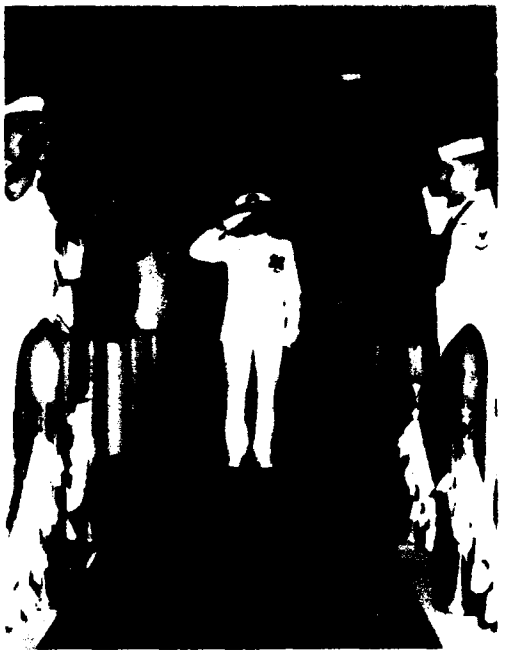
Departing

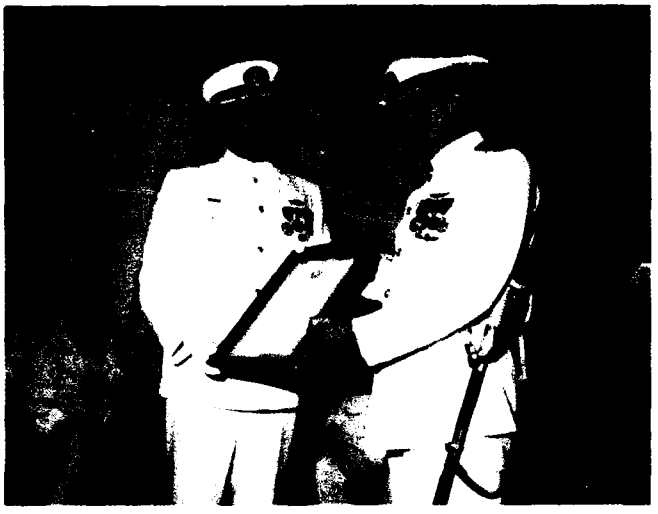
Mr. Donald Alt
Mr. Bernell Connerly
Dr. Thomas G. Dobie
Ms. Angeline M. Vitellaro

CHANGE OF COMMAND/RETIREMENT CEREMONY

On 22 May 1992, the Naval Biodynamics Laboratory's change of command and retirement ceremony took place in the auditorium of Bldg 350 at the NASA Michoud Assembly Facility. CDR Robert W. Rendin, MSC, USN relieved CAPT Douglas W. Call, MSC, USN of his position as Commanding Officer of the Naval Biodynamics Laboratory. CAPT Call also retired after 24 years of service in the U.S. Navy. CAPT Edward T. Flynn, MC, USN, Commanding Officer of the Naval Medical Research and Development Command conducted the ceremony. RADM Hugh Scott, MC, USN, Bureau of Medicine and Surgery, was the guest speaker.







FAREWELL

Dr. Thomas G. Dobie, served as Visiting Scientist to the Naval Biodynamics Laboratory from the University of Leeds, from May 1984 to 30 June 1992. For more than eight years, Dr. Dobie made monumental efforts to reduce performance degradation and human suffering caused by motion sickness. Dr. Dobie produced landmark scholarly articles, many in-house research reports, and numerous briefings and presentations which have all contributed to the very foundation of knowledge in the area of motion sickness.

Dr. Thomas Dobie, was recognized by having the Command Conference Room named in his honor for his initiating the "NBDL Science Seminars"

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TELEPHONE DIRECTORY

OFFICE OF THE COMMANDING OFFICER

CDR R. W. Rendin	Commanding Officer	257-3917
CDR L. W. Schoenberg	Executive Officer	257-3922
YNCS S. M. Rogan	Command Senior Chief	257-3921

RESEARCH DEPARTMENT

Marc Weiss, Ph.D.	Chief Scientist	257-3979
Salvadore Guccione, Ph.D.	Head, Math. Sciences Division	257-3975
LCDR F. D. Holcombe	Head, Human Factors Division	257-3947
Mr. Gary Jupiter	Head, Data Systems Division	257-3938

BIOMEDICAL SUPPORT DEPARTMENT

CDR T. G. Anderson	Department Head	257-3953

TECHNOLOGY DEPARTMENT

Mr. Gilbert Willems	Department Head	257-3892
Mr. Mark Lotz	Head, Bioinstrumentation Division	257-3900

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HM1 H. B. Powe	Head, Admin. Supp. Div.	257-0030
SK2 A. George	Head, Supply Division	257-5478

FISCAL DEPARTMENT

Ms. Severina Garcia	Department Head	257-0030