FERROELECTRICITY NEWSLETTER

Rudolf Panholzer, Professor
Space Systems Academic Group
Sponsor: Office of Naval Research

OBJECTIVE: The objective of this quarterly publication is to provide the ferroelectric research community a means to keep informed about conferences, symposia, workshops and related activities in the field of integrated ferroelectrics. This newsletter offers summaries and titles of recently published and presented papers in addition to individual contributions by engineers and scientists in the field of ferroelectrics.

SUMMARY: A total of four Ferroelectricity Newsletters (FENL) were generated in hard copy format as well as made available on the web: http://www.sp.nps.navy.mil/projects/ferro/ferro.html

Input for the FENL was obtained from various sources, including open literature, proceedings of conferences, symposia, workshops and though individual contacts with scientists. In addition, the PI co-chaired the Thirteenth International Symposium on Integrated Ferroelectrics, a rich source of material for the FENL.

DoD KEY TECHNOLOGY AREAS: Materials, Processes and Structures

KEYWORDS: Integrated Ferroelectrics, Thin Films, Piezoelectric Materials, Pyroelectric Materials, Dielectric Properties, Non-volatile Memories

MAGNETIC TORQUE RODS FOR NAVAL POSTGRADUATE SCHOOL NPSat1

Rudolf Panholzer, Professor
Space Systems Academic Group
Sponsor: National Reconnaissance Office

OBJECTIVE: The objective of this proposal is to fund the acquisition of magnetic torque rods for the attitude control subsystem of the NPSat1 Micro-satellite which is part of the small satellite design program under the NPS Space Systems academic group.

SUMMARY: NPSAT1 will implement a novel, low-cost three-axis attitude control subsystem (ACS) which utilizes only magnetic torque rods for actuators, a three-axis magnetometer as a sensor input, and on-board orbit determination through software algorithms to achieve pointing accuracy less than ±5° in each axis. Funding under this proposal supports the acquisition of the flight magnetic torque rods for NPSat1.

DoD KEY TECHNOLOGY AREAS: Space Vehicles

KEYWORDS: Magnetic Torque Rods

NAVAL POSTGRADUATE SCHOOL SPACECRAFT ARCHITECTURE AND TECHNOLOGY DEMONSTRATION SATELLITE

Rudolf Panholzer, Professor
Space Systems Academic Group
Sponsor: National Reconnaissance Office

OBJECTIVE: The objective of this proposal is to fund the development of the NPSat1 Micro-satellite which is part of the small satellite design program under the NPS Space Systems Academic Group.

SUMMARY: NPSat1 supports the educational efforts in the Space Systems Academic Group while marrying research goals in small satellite technology development. NPSat1 is manifested on the Space Test Program (STP) MLV-05 mission due to launch in January 2006 on a Delta IV. A number of experiments will be flown from the National Reconnaissance Office, Naval Research Laboratory, and from

within the Naval Postgraduate School. Technology demonstration experiments aboard NPSat1 include on-orbit testing of triple-junction solar cells, micro-electromechanical systems (MEMS) rate sensors, lithium-ion and lithium-ion polymer batteries, ferroelectric memory, and a PC-compatible command and data handling architecture. Two science experiments onboard NPSat1 are provided by the Naval Research Laboratory: the coherent electromagnetic radio tomography (CERTO) beacon and a Langmuir probe.

DoD KEY TECHNOLOGY AREAS: Space Vehicles

KEYWORDS: Lithium-Ion Polymer Battery, Space Systems Engineering, Micro-satellite, Command and Data Handling, Ionospheric Tomography, Communications Networking

NAVAL SPACE SYSTEMS ACADEMIC CHAIR
Rudolf Panholzer, Professor
Charles M. Racoosin, Naval Space Systems Academic Chair
Space Systems Academic Group
Sponsor: Naval Space Command

OBJECTIVE: Incumbents of the Naval Space Systems academic chair engage in instruction and research and act as consultants in their area of specialization to students and faculty of the Naval Postgraduate School.

SUMMARY: This proposal funded the Naval Space Systems Academic Chair. The incumbent taught courses in Military Satellite Communications, Space Technology and Applications; Space Mission Analysis and Design; Space Mission Architecting; and Launch Systems selection. He acted as a thesis advisor for the following topics:

1) Using UAVs to supplement satellites for communications and signals intelligence missions,
2) Using UAVs as switching nodes for Battle Group intranets,
3) Joint Space Training,
4) Using Global Broadcast Service to deliver large meteorological products,
5) Using GPS more realistically in campaign-level simulations and wargames,
6) Using a wireless/satellite LAN/WAN in remote combat.

DoD KEY TECHNOLOGY AREAS: Aerospace Propulsion and Power, Air Vehicles, Space Vehicles, Command, Control and Communications, Computing and Software, Manpower, Personnel and Training, Sensors, Modeling and Simulation

KEYWORDS: Aerospace Propulsion, Air Vehicles, Space Vehicles, Communications, Computing, Software, Sensors, Modeling and Simulation

SPACE SYSTEMS OPERATIONS EXPERIENCE TOURS
Rudolf Panholzer, Professor
Space Systems Academic Group
Sponsor: Naval Space Command

OBJECTIVE: The objective of this proposal is to fund Space Systems Academic Group (SSAG) students thesis research projects, directed studies, and space operations experience tours.

SUMMARY: This proposal funded experience tour travel by the Space Systems Operations and Space Systems Engineering students to various government and commercial facilities and organizations. Sites visited this year were: NRO, DARPA, NRL, NRL Blossom Point, ADF Buckley AFB, Lockheed-Martin Littleton, Colorado, U.S. Space Command, Johnson Space Center, Kennedy Space Center, and AFTAC Patrick AFB.

Additionally, this proposal funded thesis specific travel such as: 1) to the ISIOC school in Colorado Springs, 2) a space power conference, 3) a blue force tracking/combat ID conference, 4) various trips to Washington D.C./NASA Dryden to visit thesis sponsors.

DoD KEY TECHNOLOGY AREAS: Aerospace Propulsion and Power, Space Vehicles, Command, Control and Communications, Computing and Software, Electronic Warfare, Manpower, Personnel and Training, Sensors, Manufacturing Science and Technology, Modeling and Simulation

KEYWORDS: Aerospace Propulsion, Air Vehicles, Space Vehicles, Communications, Computing and Software, Sensors, Modeling and Simulation

SPACE SYSTEMS STUDENTS THESIS RESEARCH PROJECTS, DIRECTED STUDIES, AND SPACE ENGINEERING EXPERIENCE TOUR

Rudolf Panholzer, Professor
Space Systems Academic Group
Sponsor: National Reconnaissance Office

OBJECTIVE: The objective of this proposal is to fund Space Systems Academic Group (SSAG) students thesis research projects, directed studies, and space engineering experience tours.

SUMMARY: Funding under this proposal directly supports the Space Systems Engineering curriculum. Specific areas of support include the engineering staff labor and the Space Systems Engineers experience tours. The engineering staff provides continuity and area expertise in the Small Satellite Design Studies Program as well as general thesis research support. The experience tour program includes six weeks of travel of which two weeks is in conjunction with officer students in the Space Systems Operations curriculum on a cadre tour of government, Department of Defense, and industry space facilities. Four weeks of the experience tour are set aside for off-site thesis research at a host facility.

DoD KEY TECHNOLOGY AREAS: Aerospace Propulsion and Power, Space Vehicles, Command, Control and Communications, Computing and Software, Electronic Warfare, Manpower, Personnel and Training, Sensors, Manufacturing Science and Technology, Modeling and Simulation

KEYWORDS: Aerospace Propulsion, Air Vehicles, Space Vehicles, Communications, Computing and Software, Sensors, Modeling and Simulation

FIRST PRINCIPLES PREDICTION OF X-RAY IMPULSE

Donald v. Wadsworth, Senior Lecturer
Space Systems Academic Group
Sponsor: Strategic Systems Programs Office

OBJECTIVE: Develop a first principle technique for predicting the impulse induced on selected surfaces by an X-ray burst in space. Validate the theoretical model by comparing predictions with available underground test data and other experimental data.

SUMMARY: This research project (currently in its second year) supports the Trident Stockpile-to-Target Stewardship program. The multi-year objectives are: (i) collect and archive key data (reports and interviews) relevant to predicting the vulnerability of an RB aeroshell to an x-ray burst in space, (ii) compare the capability of existing physics-based models (finite-element hydro codes and radiation deposition codes) to predict blow-off impulse and damage to various RB composite materials, (iii) modify a selected code to improve fidelity, (iv) validate the modified code against existing test data (UGT and AGT) and, if needed, plan and execute new tests using existing facilities (flash x-ray and surface loading). This is a collaborative effort involving faculty in the NPS Space Systems Academic Group and the departments of Physics, Mechanical Engineering, and Electrical and Computer Engineering. Two Navy

master's degree candidates are performing thesis research in support of this effort. Significant consulting support is being provided by the DoE National Laboratories, as well as Defense Threat Reduction Agency, and DoD contractors.

DoD KEY TECHNOLOGY AREAS: Modeling and Simulation, Directed Energy Weapons

KEYWORDS: X-ray, Weapons Effects, Nuclear Weapon