Scientific and Technical
Information Program

Click the ? icon for help

Transformational Spaceport and Range Technologies: 2000-2004

This custom bibliography from the NASA Scientific and Technical Information Program lists a sampling of records found in the NASA Aeronautics and Space Database. The scope of this topic is divided into two parts and includes technologies for launch site infrastructure and range capabilities for the crew exploration vehicle and advanced heavy lift vehicles. This area of focus is one of the enabling technologies as defined by NASA's *Report of the President's Commission on Implementation of United States Space Exploration Policy*, published in June 2004.

Browse Subject Terms | Browse Corporate Sources

Browse Document Authors | Search for Text

PRINT

Transformational Spaceport and Range Technologies: 2000-2004

A Custom Bibliography From the
NASA Scientific and Technical Information Program

October 2004

Transformational Spaceport and Range Technologies: 2000-2004

This custom bibliography from the NASA Scientific and Technical Information Program lists a sampling of records found in the NASA Aeronautics and Space Database. The scope of this topic is divided into two parts and includes technologies for launch site infrastructure and range capabilities for the crew exploration vehicle and advanced heavy lift vehicles. This area of focus is one of the enabling technologies as defined by NASA's *Report of the President's Commission on Implementation of United States Space Exploration Policy*, published in June 2004.

OCTOBER 2004

Part One: Spaceport Technologies

Part Two

20040121107

Lightning Instrumentation at KSC

Colon, Jose L.; Eng, D.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, C-1 - C-10; In English; No Copyright; Avail: CASI; A02, Hardcopy

This report summarizes lightning phenomena with a brief explanation of lightning generation and lightning activity as related to KSC. An analysis of the instrumentation used at launching Pads 39 A&B for measurements of lightning effects is included with alternatives and recommendations to improve the protection system and upgrade the actual instrumentation system. An architecture for a new data collection system to replace the present one is also included. A novel architecture to obtain lightning current information from several sensors using only one high speed recording channel while monitoring all sensors to replace the actual manual lightning current recorders and a novel device for the protection system are described. Author

Launching Pads; Lightning; Meteorological Instruments

20040121104 West Virginia Inst. of Tech., Montgomery, WV, USA

Corrosion Study Using Electrochemical Impedance Spectroscopy

Farooq, Muhammad Umar; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, G-1 - G-6; In English; No Copyright; Avail: CASI; A02, Hardcopy

Corrosion is a common phenomenon. It is the destructive result of chemical reaction between a metal or metal alloy and its environment. Stainless steel tubing is used at Kennedy Space Center for various supply lines which service the orbiter. The launch pads are also made of stainless steel. The environment at the launch site has very high chloride content due to the proximity to the Atlantic Ocean. Also, during a launch, the exhaust products in the solid rocket boosters include concentrated hydrogen chloride. The purpose of this project was to study various alloys by Electrochemical Impedance Spectroscopy in corrosive environments similar to the launch sites. This report includes data and analysis of the measurements for 304L, 254SMO and AL-6XN in primarily neutral 3.55% NaCl. One set of data for 304L in neutral 3.55%NaCl + 0.1N HCl is also included.

Author

Corrosion Tests; Electrochemical Corrosion; Electrical Impedance; Impedance Measurement; Spectroscopy; Stainless Steels

20040084007 Boeing Co., Vandenberg AFB, CA, USA

Wastewater Recycling at Space Launch Complex 6

Cardinal, Rhonda; 5th Conference on Aerospace Materials, Processes, and Environmental Technology; November 2003; In English; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Wastewater at a launch site is typically generated through four different processes. Acoustic-suppression water has traditionally been used to dampen the effect of launch-induced sound waves on the vehicle and payload. Wash-down water after a launch involving solid rocket motors also is needed to remove corrosive particles from the launch pad and surrounding areas. Fire-suppression water is used to put out fires or cool surrounding areas. Additionally, rainwater accumulates in open containment pits. The Space Shuttle installation at Space Launch Complex 6 (SLC-6) used approximately 400,000 gal of acoustic-suppression water per launch, released in about 30 sec. The installation at Vandenberg Air Force Base, California, included an elevated water storage tank, pumps and piping to carry water from the flame ducts to a wastewater treatment area, and pumps and piping to carry treated water back up a hill to refill the storage tank. As part of the USA Air Force s Pollution

Prevention program, a modular, portable wastewater treatment unit was developed. The unit polishes post-launch wash-down water mixed with acoustic-suppression water from the NASA Delta II launch site and recycles it back to a storage tank. This water is mildly contaminated and is not considered to be hazardous waste; however, it is too contaminated to be released to grade.
Derived from text
Waste Water; Recycling; Hazardous Wastes; Launching Sites

20040055877 Department of the Navy, Washington, DC
Vortex-Assisted Pressure Control at Inlet of Underwater Launch System
Gieseke, Thomas J., Inventor; Apr. 2, 2004; In English
Patent Info.: Filed 29 Oct. 2003; US-Patent-Appl-SN-10695497
Report No.(s): AD-D020132; No Copyright; Avail: Defense Technical Information Center (DTIC)

The present invention relates generally to controlling the flow of a surrounding environmental fluid into an inlet formed in a moving vehicle, and more particularly to a system that uses vortices to control such a flow at the inlet of, for example, an underwater vehicle's underwater launch system. Many underwater launch systems used by underwater vehicles utilize the forward motion of the vehicle and underwater pressure to develop a dynamic pressure head for launch initiation. An inlet formed in the vehicle's hull admits water as the vehicle moves forward. A launch pressurization system coupled to the inlet pressurizes and directs the water flow to a launch tube. The inlet can be open at all times or fitted with a door that is kept closed and flush with the vehicle's hull until a launch is required. A vortex-assisted pressure control system is provided for controlling fluid flow into an inlet formed in a vehicle where such fluid flow into the inlet occurs during vehicle movement. A vortex generator, or generators, is positioned forward of the inlet with respect to the forward movement of the vehicle to generate streamwise vortices in the fluid as the vehicle moves through the fluid. Each vortex generator is controllable so as to adjust the strength of the streamwise vortices and the lateral position of the streamwise vortices relative to the inlet. Sensors are used to detect the lateral position of the streamwise vortices relative to the inlet, and the pressure of the fluid that has entered the inlet. A controller adjusts the vortex generator based on sensor measurements to control the lateral position of the streamwise vortices and the pressure of the fluid entering the vehicle via the inlet. Still another object of the present invention is to provide a vortex generating system for a vehicle that minimizes an acoustic signature associated therewith when the system is not in use.
DTIC
Adaptive Control; Fluid Flow; Launchers; Launching; Patent Applications; Pressure Measurement; Pressure Regulators; Underwater Vehicles; Vortex Generators; Vortices

20040016326 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Proof-of-Concept Application of Impedance-Based Health Monitoring on Space Shuttle Ground Structures
Peairs, Daniel M.; Grisso, Benjamin; Inman, Daniel J.; Page, Kenneth R.; Athman, Robert; Margasahayam, Ravi N.; October 2003; In English; Original contains black and white illustrations
Report No.(s): NASA/TM-2003-211193; No Copyright; Avail: CASI; A03, Hardcopy

Many of the structures responsible for the launch, ground systems and support operations of the space shuttle are still being used well past their nominal expected design life. This has led to an increased interest in monitoring these structures in order to decrease the risk of eventual breakdown or structural failure. One monitoring method, which has shown promising results for such applications, is the impedance-based structural health monitoring technique. This paper presents results from proof-of-concept tests on the launch pad's orbiter access arm bolted connection, solid rocket booster hold down post, mobile launch platform heat shield and crawler transporter bearing. Modification for future tests are suggested.
Author
Space Shuttle Boosters; Systems Health Monitoring; Mechanical Impedance; Ground Support Systems; Mechanical Engineering; Smart Materials

20040003713 NASA Langley Research Center, Hampton, VA, USA
Development of Structural Health Management Technology for Aerospace Vehicles
Prosser, W. H.; [2003]; In English, 1-5 Sep. 2003, Colorado Springs, CO, USA; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

As part of the overall goal of developing Integrated Vehicle Health Management (IVHM) systems for aerospace vehicles, NASA has focused considerable resources on the development of technologies for Structural Health Management (SHM). The

motivations for these efforts are to increase the safety and reliability of aerospace structural systems, while at the same time decreasing operating and maintenance costs. Research and development of SHM technologies has been supported under a variety of programs for both aircraft and spacecraft including the Space Launch Initiative, X-33, Next Generation Launch Technology, and Aviation Safety Program. The major focus of much of the research to date has been on the development and testing of sensor technologies. A wide range of sensor technologies are under consideration including fiber-optic sensors, active and passive acoustic sensors, electromagnetic sensors, wireless sensing systems, MEMS, and nanosensors. Because of their numerous advantages for aerospace applications, most notably being extremely light weight, fiber-optic sensors are one of the leading candidates and have received considerable attention.
Author
Aerospace Vehicles; Systems Health Monitoring; Systems Engineering; Technology Utilization; Remote Sensors

20040000776 ENSCO, Inc., Cocoa Beach, FL, USA
MiniSODAR(TradeMark) Evaluation
Short, David A.; Wheeler, Mark M.; October 2003; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS10-01052
Report No.(s): NASA/CR-2003-211192; Rept-03-003; No Copyright; Avail: CASI; A03, Hardcopy

This report describes results of the AMU's Instrumentation and Measurement task for evaluation of the Doppler miniSODAR(TradeMark) System (DmSS). The DmSS is an acoustic wind profiler providing high resolution data to a height of approx. 410 ft. The Boeing Company installed a DmSS near Space Launch Complex 37 in mid-2002 as a substitute for a tall wind tower and plans to use DmSS data for the analysis and forecasting of winds during ground and launch operations. Peak wind speed data are of particular importance to Launch Weather Officers of the 45th Weather Squadron for evaluating user Launch Commit Criteria. The AMU performed a comparative analysis of wind data between the DmSS and nearby wind towers from August 2002 to July 2003. The DmSS vertical profile of average wind speed showed good agreement with the wind towers. However, the DMSS peak wind speeds were higher, on average, than the wind tower peak wind speeds by about 25%. A statistical model of an idealized Doppler profiler was developed and it predicted that average wind speeds would be well determined but peak wind speeds would be over-estimated due to an under-specification of vertical velocity variations in the atmosphere over the Profiler.
Author
Wind Measurement; Spacecraft Launching; Ground Operational Support System; Wind Velocity

20030112018 Nebraska Univ., Omaha, NE, USA
Proceedings of the NASA Aerospace Technology Symposium 2002
Bowen, Brent D., Editor; Fink, Mary M., Editor; Schaaf, Michaela M., Editor; March 2002; In English; NASA Aerospace Technology Symposium 2002, 3-5 Mar. 2002, Las Cruces, NM, USA; Original contains black and white illustrations
Report No.(s): UNOAI- 02-4; Copyright; Avail: CASI; A07, Hardcopy

Reports are presented from the NASA Aerospace Technology Symposium 2002 on the following: Geo-Referenced Altitude Hold For Latex Ballons; NASA Spaceport Research: Opportunities For space Grant and EPSCoR Involvement; Numerical Simulation Of The Combustion Of Fuel Droplets: Applications, Aircraft/Spacecraft Flight Control, Guidance Navigation; Expertise In System Dynamics and Control, Control Theory and Aerospace Education Ooutreach Opportunities; and Technology For The Improvement Of General Aviation Security: A Needs Assessmemt.
Derived from text
Aerospace Sciences; Spacecraft Control

20030066255 Alaska Univ Anchorage Environmental and Natural Resources Inst, Anchorage, Alaska
Kodiak Launch Complex, Alaska 2002 Environmental Monitoring Studies April QRLV-2 Launch
Cuccarese, Sal V.; Bogan, Daniel L.; Hensel, Richard J.; Kelly, Michael D.; Kennish, John M.; Jul. 2002; In English
Report No.(s): AD-A414159; No Copyright; Avail: CASI; A03, Hardcopy

This document provides the results of environmental monitoring studies done in support of the 24 April 2002 launch of the Quick Reaction Launch Vehicle (QRLV-2) from the Kodiak Launch Complex (KLC), Kodiak Island, Alaska. The University of Alaska Anchorage's Environment and Natural Resources Institute (ENRI) conducted the studies under contract to the Alaska Aerospace Development Corporation (AADC), which is a state-owned entity. An Environmental Monitoring Plan (EMP) was developed by ENRI for five environmental monitoring tasks: Steller sea lion surveys, rocket motor noise measurements, bald eagle nest monitoring, Steller's eider surveys, and environmental quality monitoring. The EMP had a

design life of five launches, with the last occurring in November 2001. AADC subsequently requested that ENRI develop an integrated series of environmental studies for KLC launches in 2002. Four prelaunch and three postlaunch bird surveys were successfully conducted 20-26 April. ENRI conducted point-count surveys at 11 locations and did a complete survey of the lagoon immediately northeast of the launch pad. All birds seen within a 500-meter radius of each point-count station over a 15-minute period were identified to species and tallied. Steller's eiders were only observed in the study area during the first survey, therefore no conclusions regarding the effects of rocket motor noise on this species can be drawn. Pre- and postlaunch harlequin duck numbers were similar, indicating the QRLV-2 launch did not adversely affect the species. The rocket launch also did not produce noticeable effects on the bald eagles that were nesting in the area. This Environmental Assessment also includes the results of surface water chemistry tests to detect any changes in aquatic chemistry, collection of aquatic macroinvertebrates as biological indicators of change, and surveys of epiphytic macrolichens to monitor vegetation. (14 tables, 5 figures, 15 refs.)
DTIC
Water Quality; Invertebrates; Noise Pollution; Rocket Launching; Rocket Exhaust; Lichens; Environmental Monitoring; Environmental Quality

20030065982 NASA Ames Research Center, Moffett Field, CA, USA
Web-based Weather Expert System (WES) for Space Shuttle Launch
Bardina, Jorge E.; Rajkumar, T.; [2003]; In English, 5-8 Oct. 2003, Washington, DC, USA; Copyright; Avail: CASI; A02, Hardcopy

The Web-based Weather Expert System (WES) is a critical module of the Virtual Test Bed development to support 'go/no go' decisions for Space Shuttle operations in the Intelligent Launch and Range Operations program of NASA. The weather rules characterize certain aspects of the environment related to the launching or landing site, the time of the day or night, the pad or runway conditions, the mission durations, the runway equipment and landing type. Expert system rules are derived from weather contingency rules, which were developed over years by NASA. Backward chaining, a goal-directed inference method is adopted, because a particular consequence or goal clause is evaluated first, and then chained backward through the rules. Once a rule is satisfied or true, then that particular rule is fired and the decision is expressed. The expert system is continuously verifying the rules against the past one-hour weather conditions and the decisions are made. The normal procedure of operations requires a formal pre-launch weather briefing held on Launch minus 1 day, which is a specific weather briefing for all areas of Space Shuttle launch operations. In this paper, the Web-based Weather Expert System of the Intelligent Launch and range Operations program is presented.
Author
Internet Resources; Weather Forecasting; Flight Conditions; Spacecraft Launching; Decision Support Systems

20030065679 TRW Space and Electronics Group, Redondo Beach, CA
Biological Effects of Inadvertent Perchlorate Releases During Launch Operations
Hines, Mark E.; von Hippel, Frank; Kennish, John; Sep. 30, 2002; In English; Original contains color illustrations
Contract(s)/Grant(s): F04701-00-D-0203
Report No.(s): AD-A414070; No Copyright; Avail: CASI; A03, Hardcopy

Solid rocket motor fuel contains large quantities of ammonium perchlorate as the primary oxidant and this material has been shown to be toxic to life. In the event of an aborted rocket launch, it is possible that unspent propellant could be deposited near the launch site and coastal marine and terrestrial habitats could be adversely affected. This report presents the results of the following experiments: effects of perchlorate on primary and secondary production in freshwater and marine water samples; decomposition processes in marine and freshwater sediments, freshwater wetland peat, and upland soils; effects of perchlorate on the behavior and growth of the fish species threespine stickleback; and the bioaccumulation of perchlorate by freshwater and marine plankton and in the threespine stickleback fish. Results show that perchlorate will affect photosynthesis in aquatic systems, but this effect appears to occur only when perchlorate levels are extremely high (1000 ppm). Bacterial production also was not adversely affected by the presence of perchlorate except at very high levels in seawater samples. Respiration in marine and freshwater sediments and wetland peat was not adversely affected by perchlorate concentrations as high as 1000 ppm. Soil samples exhibited significant decreases in respiration activity in the presence of 100 and 1000-ppm perchlorate, so it is possible that the deposition of perchlorate to coastal soils following a flight abortion could decrease the rate that material is decomposed in soil, which could adversely affect plant growth. The presence of potassium perchlorate at concentrations up to 10 ppm and perchlorate concentrations nearing 30 ppm in aquaria containing solid propellant had no effect on stickleback mating or the birth and growth of fry. Both the algal/bacterial and fish in aquaria accumulated significant

levels of perchlorate that could be passed on to other tropic levels and later lead to deleterious effects.
DTIC
Biological Effects; Perchlorates; Spacecraft Launching; Remote Sensing; Solid Rocket Propellants

20030065617 Lockheed Martin Corp., Denver, CO, USA
Lockheed Martin Response to the OSP Challenge
Sullivan, Robert T.; Munkres, Randy; Megna, Thomas D.; Beckham, Joanne; June 25, 2003; In English, 14-17 Jul. 2003, Dayton, OH, USA
Contract(s)/Grant(s): NAS8-01098
Report No.(s): AIAA Paper 2003-2708; No Copyright; Avail: CASI; A02, Hardcopy

The Lockheed Martin Orbital Space Plane System provides crew transfer and rescue for the International Space Station more safely and affordably than current human space transportation systems. Through planned upgrades and spiral development, it is also capable of satisfying the Nation's evolving space transportation requirements and enabling the national vision for human space flight. The OSP System, formulated through rigorous requirements definition and decomposition, consists of spacecraft and launch vehicle flight elements, ground processing facilities and existing transportation, launch complex, range, mission control, weather, navigation, communication and tracking infrastructure. The concept of operations, including procurement, mission planning, launch preparation, launch and mission operations and vehicle maintenance, repair and turnaround, is structured to maximize flexibility and mission availability and minimize program life cycle cost. The approach to human rating and crew safety utilizes simplicity, performance margin, redundancy, abort modes and escape modes to mitigate credible hazards that cannot be designed out of the system.
Author
Aerospace Planes; Launch Vehicles; Ground Support Systems; Spacecraft Launching; Navigation; Spacecraft Docking

20030065212 Hubbs-Sea World Research Inst., San Diego, CA
Potential Impact of USAF Atmospheric Interceptor Technology (ait) Launches from the Kodiak Launch Complex, Kodiak Island, Alaska. Monitoring of Noise Levels During the Launch of ait-2
Bowles, Ann E.; Sep. 5, 2000; In English; Original contains color illustrations
Contract(s)/Grant(s): W62N6M-9243-8992
Report No.(s): AD-A413402; No Copyright; Avail: CASI; A03, Hardcopy

The U.S. Air Force (USAF) atmospheric interceptor technology (ait) program must conduct protected species monitoring during periods immediately before and after ait rocket launches from the Kodiak Launch Complex. Monitoring and mitigation efforts for two protected species, the endangered Steller sea lion (Eumetopias jubatus) and the threatened Steller's eider (Polysticta stelleri), are a condition of the FONSI for the program and were conducted by the University of Alaska's Environment and Natural Resources Institute (ENRI) in the days before and after the ait-2 launch. The study reported herein was conducted from 12-15 September, 1999, before, during, and immediately after the ait-2 launch on 15 September. It ran in parallel with the ENRI effort and was designed to provide the USAF with detailed information about the acoustic characteristics of the ait-2 launch, in part for future prediction of animal impacts and in part for comparison with RNOISE model outputs. Opportunistic observations of animal behaviors were obtained during this effort as well. Larson-Davis sound monitors (LD 820, 824) were deployed to collect noise data automatically at four sites within the Safety Exclusion Zone (SEZ) for the launch, including two sites on Narrow Cape, the portion of Kodiak Island extending closest to Ugak Spit. A fifth monitor on Ugak Spit failed. A real-time DAT recording was collected just outside the SEZ, close to the Launch Control Complex (LCC). HSWRI and AFSMC cooperators were able to count and observe the behavior of marine mammals on 9/ 12 from Narrow Cape using a Meade ETX-9OEC Telescope (Lang 2000). They also collected behavioral observations during helicopter approaches and landings on Ugak Island 9/14 (2000-2130 hours) and 9/15 (1330-1350 hours). Sea lions were observed at Ugak Spit after the launch from 1345 to 1500 hours on 9/15 using the Meade telescope. There were no Steller's eiders in the area at the time of the launch. (6 tables, 12 figures, 20 refs.) 7
DTIC
Endangered Species; Acoustic Measurement; Surface to Air Missiles; Noise Pollution; Rocket Engine Noise; Seals (Animals); Stress (Physiology)

20030064977 Federal Aviation Administration, Washington, DC
Reusable Launch Vehicles and Spaceports: Programs and Concepts for 2001
January 2001; In English
Report No.(s): PB2003-105721; No Copyright; Avail: National Technical Information Service (NTIS)

This report provides technical and business information on U.S. commercial and government reusable launch vehicles (RLVs) and spaceports. The report describes operational vehicles and spaceports as well as efforts currently in development or proposal stages. The Federal Aviation Administration (FAA) Associate Administrator for Commercial Space Transportation (AST) first published this report in 1998. Now in its fourth edition, this publication is similar to its predecessors but contains some important additions and changes. Each individual RLV entry has been updated with the most recent publicly available information on the RLV's financial, technical, testing, and manufacturing situation. Each spaceport entry has been updated with respect to financing and infrastructure investment and upgrades. Other significant changes include a more narrow focus on U.S. RLV concepts and programs; except for those competing for the X PRIZE, international RLV concepts under consideration for development are not discussed in this report. Finally, the section on U.S. government RLV programs only focuses on concepts that are intended for space launch opposed to space flight. The resulting report is a comprehensive overview of the RLV industry in the USA.

NTIS

Reusable Launch Vehicles; Launching Bases; Spacecraft Launching; Launching Sites

20030064346 Department of Transportation, Washington, DC, USA

U.S. Commercial Space Transporation Developments and Concepts: Vehicles, Technologies, and Spaceports, 2003

Jan. 2003; In English

Report No.(s): PB2003-105730; No Copyright; Avail: CASI; A04, Hardcopy

This report reviews the major events relating to U.S. commercial space transportation in the past year and showcases current and planned U.S. commercial and commercially-oriented activities. The Federal Aviation Administration Associate Administrator for Commercial Space Transportation (FAA/AST) first published the report in 1998 with an exclusive focus on reusable launch vehicles (RLV). The current edition addresses not only RLVs but also expendable launch vehicles (ELV), propulsion technologies, and launch and reentry sites--commonly referred to as spaceports to provide a complete picture of the U.S. commercial space transportation industry. This report objectively reviews space transportation programs and projects as well as launch and reentry sites that will impact and support the development of commercial space activities and applications. The private sector plays a prominent role in the management, development, and funding of these activities; the federal government and several state governments substantially contribute to or provide leadership for many of the technologies and facilities described herein as well. With the exception of a few X PRIZE vehicle concepts, all activities and developments described in this report are being led by U.S. entities.

NTIS

Space Transportation; Reusable Launch Vehicles; Space Commercialization; Market Research

20030062023 Computer Sciences Corp., Huntsville, AL, USA

Simulation of Wind Profile Perturbations for Launch Vehicle Ascent Flight Systems Design Assessments

Adelfang, S. I.; January 06, 2003; In English, 6-9 Jan. 2003, Reno, NV, USA

Contract(s)/Grant(s): NAS8-60000; No Copyright; Avail: Other Sources; Abstract Only

Ideally, a statistically representative sample of measured high-resolution wind profiles with wavelengths as small as tens of meters is required for assessment of launch vehicle ascent flight systems component capability and vehicle operability for a selected launch site. At most potential launch sites a sample of high-resolution measured wind profiles may not exist. Representative samples of Rawinsonde wind profiles are more likely to be available because of the extensive network of measurement sites established for routine measurements at 12-hr intervals in support of national and international weather observing and forecasting activity. Such a sample, although large enough to statistically represent relatively large wavelength perturbations, would be inadequate for launch system design assessment applications because the Rawinsonde system can accurately measure wind perturbations with wavelengths no smaller than 2000m (1000m altitude increment). Wavelengths less than 2000m in the raw Rawinsonde data, which tend to be dominated by un-damped spurious balloon motion and radar tracking system noise, are filtered within the data processing scheme. The Kennedy Space Center (KSC) Jimsphere wind profiles (150/month and seasonal pairs) are the only adequate high resolution (approximately 150 to 300m effective resolution, but over-sampled at 25m intervals) data that have been used extensively in launch vehicle design, operability assessments and operational protection of vehicle systems for wind perturbation uncertainty. Jimsphere wind profiles have been measured at a few other potential launch sites but the number of profiles is relatively small and the samples are not statistically representative of the site dependent wind profile variability. A simulation process has been developed for enhancement of measured low-resolution Rawinsonde profiles that are more likely to be available in the vicinity of potential launch sites and are a statistically representative sample of wind profile perturbation wavelengths greater than 2000m. The enhancement

produces perturbed wind profiles with wavelengths as small as desired for application in launch vehicle ascent flight simulations and design assessments.
Author
Wind Profiles; Computerized Simulation; Launch Vehicles; Ascent Propulsion Systems; Reliability Analysis; Design Analysis; Spacecraft Components

20030055618 NASA Glenn Research Center, Cleveland, OH, USA
Affordable Flight Demonstration of the GTX Air-Breathing SSTO Vehicle Concept
Krivanek, Thomas M.; Roche, Joseph M.; Riehl, John P.; Kosnareo, Daniel N.; April 2003; In English, 8-12 Apr. 2002, Destin, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 22-708-90-63
Report No.(s): NASA/TM-2003-212315; E-13316; NAS 1.15:212315; APS-III-22; No Copyright; Avail: CASI; A03, Hardcopy

The rocket based combined cycle (RBCC) powered single-stage-to-orbit (SSTO) reusable launch vehicle has the potential to significantly reduce the total cost per pound for orbital payload missions. To validate overall system performance, a flight demonstration must be performed. This paper presents an overview of the first phase of a flight demonstration program for the GTX SSTO vehicle concept. Phase 1 will validate the propulsion performance of the vehicle configuration over the supersonic and hypersonic air- breathing portions of the trajectory. The focus and goal of Phase 1 is to demonstrate the integration and performance of the propulsion system flowpath with the vehicle aerodynamics over the air-breathing trajectory. This demonstrator vehicle will have dual mode ramjetkcramjets, which include the inlet, combustor, and nozzle with geometrically scaled aerodynamic surface outer mold lines (OML) defining the forebody, boundary layer diverter, wings, and tail. The primary objective of this study is to demon- strate propulsion system performance and operability including the ram to scram transition, as well as to validate vehicle aerodynamics and propulsion airframe integration. To minimize overall risk and develop ment cost the effort will incorporate proven materials, use existing turbomachinery in the propellant delivery systems, launch from an existing unmanned remote launch facility, and use basic vehicle recovery techniques to minimize control and landing requirements. A second phase would demonstrate propulsion performance across all critical portions of a space launch trajectory (lift off through transition to all-rocket) integrated with flight-like vehicle systems.
Author
Rocket-Based Combined-Cycle Engines; Single Stage to Orbit Vehicles; Air Breathing Engines; Flight Tests; Reusable Launch Vehicles; Aircraft Design; Hypersonic Aircraft

20030053054 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Scale Model Experiments on Sound Propagation From a Mach 2.5 Cold Nitrogen Jet Flowing Through a Rigid-Walled Duct With a J-Deflector
Kandula, Max; Vu, Bruce; April 2003; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS10-03006
Report No.(s): NASA/TM-2003-211186; NAS 1.15: 211186; No Copyright; Avail: CASI; A04, Hardcopy

The Launch Systems Testbed (LST) represents the evolution of vibroacoustics research and development work performed at NASA John F. Kennedy Space Center (KSC) over the last 15 years. The LST is located at the Launch Equipment Test Facility (LETF) in the KSC industrial complex. The LETF is operated by Sierra Lobo, Inc., as a member of University-Affiliated Technology Development Contract (USTDC) to KSC Spaceport and Engineering and Technology Directorate (YA), with ASRC Aerospace Corporation as a the prime contractor. Trajectory Simulation Mechanism (TSM) is a major component of the LST, developed specifically to simulate nonstationary acoustic loads on launch pad structures, vehicles, and payloads. TSM enhances the capabilities within LST for simulating launch environments of future vehicles. The scaled launch environments will be used to predict the full-scale launch environment via an appropriate scaling procedure. Air Force Research Laboratory (AFRL) has tasked NASA KSC to perform a basic technology test program in support of developing a low-cost clean pad (incorporating passive mitigation techniques) for future launch vehicles. The overall goal of the program is to develop innovative launch exhaust management systems, which effectively reduce launch acoustic environment with innovative duct designs, while eliminating traditional sound suppression water systems. Passive techniques, such as nontraditional duct geometries, resonators, and diffusers, etc., will be investigated. The overall goals are to advance innovative concepts for a clean pad while developing ideas to reduce transmitted sound via investigation and modeling of jet exhaust acoustic and flow field characteristics. The series of tests outlined in this report represent baseline tests and are geared towards defining the acoustic load environment on the TSM pad for open and closed duct configurations. This report summarizes the cold jet acoustic testing for Mach 2.5 supersonic nitrogen jet issuing from a nozzle with 1-inch exit diameter.

Acoustic data, including spectral sound power and Overall Sound Pressure Level (OASPL), are obtained both for a free jet and with the jet flowing through a rigid-walled duct with a J-deflector. The relative performance of closed duct and open duct is evaluated. The results show that the closed duct is superior to the partially open duct, and results in about 3-decibel (dB) noise reduction (near the duct axis) relative to the free jet. The location of the nozzle exit plane (NEP) relative to the duct inlet plane (DIP) has a significant effect on the acoustic field. The results suggest that the location of NEP at 10 inches above the DIP results in reduced acoustic loads relative to 5 inches above the duct inlet and 1 inch into the duct inlet.
Author
Scale Models; Experimentation; Sound Propagation; Nitrogen; Acoustic Properties; Exhaust Systems; Noise Reduction

20030050548

Development of an acoustic actuator for launch vehicle noise reduction

Henderson, Benjamin K.; Lane, Steven A.; Gussy, Joel; Griffin, Steve; Farinholt, Kevin M.; The Journal of the Acoustical Society of America; January 2002; ISSN 0001-4966; Volume 111, Issue no. 1, 174-179; In English; Copyright

In many active noise control applications, it is necessary that acoustic actuators be mounted in small enclosures due to volume constraints and in order to remain unobtrusive. However, the air spring of the enclosure is detrimental to the low-frequency performance of the actuator. For launch vehicle noise control applications, mass and volume constraints are very limiting, but the low-frequency performance of the actuator is critical. This work presents a novel approach that uses a nonlinear buckling suspension system and partial evacuation of the air within the enclosure to yield a compact, sealed acoustic driver that exhibits a very low natural frequency. Linear models of the device are presented and numerical simulations are given to illustrate the advantages of this design concept. An experimental prototype was built and measurements indicate that this design can significantly improve the low-frequency response of compact acoustic actuators. [copyright] 2002 Acoustical Society of America.
Author (AIP)
Active Control; Actuators; Electromechanical Devices; Launch Vehicles; Noise (Sound); Noise Reduction; Spacecraft

20030046942

Simulation technologies for spaceport system design

Brughelli, Kevin M.; AIP Conference Proceedings; January 14, 2002; ISSN 0094-243X; Volume 608, Issue no. 1, 1205-1212; In English; SPACE TECHNOLOGY and APPLICATIONS INTERNATIONAL FORUM- STAIF 2002, 3-6 Feb 2002, Albuquerque, New Mexico, USA; Copyright

The goal of spaceport design is to develop a system capable of launching all missions in a projected capture market on time, at minimum cost, and with maximum safety to ground and flight personnel and hardware. Therefore, the four key performance parameters for a spaceport are launch rate, schedule dependability, cost, and safety. Simulation technologies may be applied to the design process to accurately and cost effectively evaluate these parameters and the factors that affect them. Simulation is vital to spaceport system design and optimization. [copyright] 2002 American Institute of Physics.
Author (AIP)
Aerospace Environments; Cost Effectiveness; Cost Estimates; Launching Bases; Safety; Simulation; Space Transportation; Systems Engineering

20030046940

Reinventing the state spaceport concept

Gormel, Edmond; AIP Conference Proceedings; January 14, 2002; ISSN 0094-243X; Volume 608, Issue no. 1, 1192-1196; In English; SPACE TECHNOLOGY and APPLICATIONS INTERNATIONAL FORUM- STAIF 2002, 3-6 Feb 2002, Albuquerque, New Mexico, USA; Copyright

Spaceport Florida Authority, or 'the Authority,' is meeting the challenge of reinventing the state spaceport concept. The Authority, an economic and academic development agency and a transportation authority that maximizes the strong NASA and military space presence in the state of Florida, serves as a facilitator among industry, education and government sectors that reside on or use Florida's spaceport. This paper discusses the state of Florida's progression in the business of space. From Florida's vision to be a leader in the commercialization of space to it's current role of partnering to grow over six hundred and fifty ($650) million dollars in new space programs. Executive Director Ed Gormel's strategy for reinventing a state spaceport is outlined in the paper. These guidelines, which he believes reflect the needs of the twenty-first century customer,

include customer support, financing, property access and a means to provide dependable infrastructure. [copyright] 2002 American Institute of Physics.
Author (AIP)
Aerospace Industry; Launching Bases; Space Transportation; Spacecraft; Transportation

20030046883
Solid rocket motor fire tests: Phases 1 and 2
Chang, Yale; Hunter, Lawrence W.; Han, David K.; Thomas, Michael E.; Cain, Russell P.; Lennon, Andrew M.; AIP Conference Proceedings; January 14, 2002; ISSN 0094-243X; Volume 608, Issue no. 1, 740-747; In English; SPACE TECHNOLOGY and APPLICATIONS INTERNATIONAL FORUM- STAIF 2002, 3-6 Feb 2002, Albuquerque, New Mexico, USA
Contract(s)/Grant(s): AI01-98NE21866; Copyright

JHU/APL conducted a series of open-air burns of small blocks (3 to 10 kg) of solid rocket motor (SRM) propellant at the Thiokol Elkton MD facility to elucidate the thermal environment under burning propellant. The propellant was TP-H-3340A for the STAR 48 motor, with a weight ratio of 71/18/11 for the ammonium perchlorate, aluminum, and HTPB binder. Combustion inhibitor applied on the blocks allowed burning on the bottom and/or sides only. Burns were conducted on sand and concrete to simulate near-launch pad surfaces, and on graphite to simulate a low-recession surface. Unique test fixturing allowed propellant self-levitation while constraining lateral motion. Optics instrumentation consisted of a longwave infrared imaging pyrometer, a midwave spectroradiometer, and a UV/visible spectroradiometer. In-situ instrumentation consisted of rod calorimeters, Gardon gauges, elevated thermocouples, flush thermocouples, a two-color pyrometer, and Knudsen cells. Witness materials consisted of yttria, ceria, alumina, tungsten, iridium, and platinum/rhodium. Objectives of the tests were to determine propellant burn characteristics such as burn rate and self-levitation, to determine heat fluxes and temperatures, and to carry out materials analyses. A summary of qualitative results: alumina coated almost all surfaces, the concrete spalled, sand moisture content matters, the propellant self-levitated, the test fixtures worked as designed, and bottom-burning propellant does not self-extinguish. A summary of quantitative results: burn rate averaged 1.15 mm/s, thermocouples peaked at 2070 C, pyrometer readings matched MWIR data at about 2400 C, the volume-averaged plume temperatures were 2300-2400 C with peaks of 2400-2600 C, and the heat fluxes peaked at 125 W/cm2. These results are higher than other researchers' measurements of top-burning propellant in chimneys, and will be used, along with Phase 3 test results, to analyze hardware response to these environments, including General Purpose Heat Sources (GPHS) and Radioisotope Heater Units (RHU). Follow-on Phase 3 tests burning propellant blocks up to 90 kg will be briefly described. [copyright] 2002 American Institute of Physics.
Author (AIP)
Burns (Injuries); Combustion; Heat Transfer; Optical Equipment; Pyrometers; Radioactive Isotopes; Rocket Engines; Solid Propellant Rocket Engines; Temperature Measurement; Thermal Environments; Thermocouples

20030032337 NASA Kennedy Space Center, Cocoa Beach, FL, USA
An Overview of Research Activity at the Launch Systems Testbed
Vu, Bruce; Kandula, Max; [2003]; In English, 7-10 Jul. 2003, Stockholm, Sweden; Original contains black and white illustrations
Report No.(s): KSC-2003-045; Copyright; Avail: CASI; A02, Hardcopy

This paper summarizes the acoustic testing and analysis activities at the Launch System Testbed (LST) of Kennedy Space Center (KSC). A major goal is to develop passive methods of mitigation of sound from rocket exhaust jets with ducted systems devoid of traditional water injection. Current testing efforts are concerned with the launch-induced vibroacoustic behavior of scaled exhaust jets. Numerical simulations are also developed to study the sound propagation from supersonic jets in free air and through enclosed ducts. Scaling laws accounting for the effects of important parameters such as jet Mach number, jet velocity, and jet temperature on the far-field noise are investigated in order to deduce full-scale environment from small-scale tests.
Author
Launching; Acoustic Measurement; Signal Analyzers; Rocket Exhaust; Sound Propagation; Test Stands

20030032187 NASA Wallops Flight Center, Wallops Island, VA, USA

An Overview of the NASA Sounding Rocket and Balloon Programs

Eberspeaker, Philip J.; Smith, Ira S.; [2003]; In English, 2-5 Jun. 2003, Switzerland; No Copyright; Avail: Other Sources; Abstract Only

The U.S. National Aeronautics and Space Administration (NASA) Sounding Rockets and Balloon Programs conduct a total of 50 to 60 missions per year in support of the NASA scientific community. These missions support investigations sponsored by NASA's Offices of Space Science, Life and Microgravity Sciences & Applications, and Earth Science. The Goddard Space Flight Center has management and implementation responsibility for these programs. The NASA Sounding Rockets Program provides the science community with payload development support, environmental testing, launch vehicles, and launch operations from fixed and mobile launch ranges. Sounding rockets continue to provide a cost-effective way to make in situ observations from 50 to 1500 km in the near-earth environment and to uniquely cover the altitude regime between 50 km and 130 km above the Earth's surface. New technology efforts include GPS payload event triggering, tailored trajectories, new vehicle configuration development to expand current capabilities, and the feasibility assessment of an ultra high altitude sounding rocket vehicle. The NASA Balloon Program continues to make advancements and developments in its capabilities for support of the scientific ballooning community. The Long Duration Balloon (LDB) is capable of providing flight durations in excess of two weeks and has had many successful flights since its development. The NASA Balloon Program is currently engaged in the development of the Ultra Long Duration Balloon (ULDB), which will be capable of providing flight times up to 100-days. Additional development efforts are focusing on ultra high altitude balloons, station keeping techniques and planetary balloon technologies.

Author

Balloons; NASA Space Programs; Sounding Rockets; General Overviews

20030022661 NASA Glenn Research Center, Cleveland, OH, USA

High Altitude Launch for a Practical SSTO

Landis, Geoffrey A.; Denis, Vincent; Lyons, Valerie, Technical Monitor; February 2002; In English; Conference on Next Generation Space Transportation, Space Technology and Applications Forum, 2-6 Feb. 2002, Albuquerque, NM, USA; Copyright; Avail: CASI; A02, Hardcopy

Existing engineering materials allow the construction of towers to heights of many kilometers. Orbital launch from a high altitude has significant advantages over sea-level launch due to the reduced atmospheric pressure, resulting in lower atmospheric drag on the vehicle and allowing higher rocket engine performance. High-altitude launch sites are particularly advantageous for single-stage to orbit (SSTO) vehicles, where the payload is typically 2% of the initial launch mass. An earlier paper enumerated some of the advantages of high altitude launch of SSTO vehicles. In this paper, we calculate launch trajectories for a candidate SSTO vehicle, and calculate the advantage of launch at launch altitudes 5 to 25 kilometer altitudes above sea level. The performance increase can be directly translated into increased payload capability to orbit, ranging from 5 to 20% increase in the mass to orbit. For a candidate vehicle with an initial payload fraction of 2% of gross lift-off weight, this corresponds to 31% increase in payload (for 5-km launch altitude) to 122% additional payload (for 25-km launch altitude).

Author

High Altitude; Towers; Spacecraft Launching; Materials Selection; Trajectory Analysis; Single Stage to Orbit Vehicles

20030011379 NASA, Washington, DC USA

Mission Profile

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, 17-18; In English; No Copyright; Avail: CASI; A01, Hardcopy

The mission profile of the STS-107 Space Shuttle Mission is presented. A list of the seven crewmembers, the launch site, and abort landing sites for the Space Shuttle Columbia are also given.

CASI

Space Missions; Space Transportation System; Manned Space Flight; Space Shuttles

20030006794

Electrochemical Evaluation of Alloys for Spaceport Design

Calle, Luz Marina; MacDowell, Louis G.; Vinje, Rubiela D.; AIP Conference Proceedings; January 28, 2003; ISSN 0094-243X; Volume 654, Issue no. 1, 296-303; In English; SPACE TECHNOLOGY and APPLICATIONS INT.FORUM-STAIF 2003: Conf.on Thermophysics in Microgravity; Commercial/Civil Next Generation Space Transportation; Human

Space Exploration, 2-5 February 2003, Albuquerque, New Mexico, USA; Copyright

Corrosion studies began at the Kennedy Space Center (KSC) in 1966 during the Gemini/Apollo Programs with the evaluation of long-term protective coatings for the corrosion protection of carbon steel. NASA's KSC Beach Corrosion Test Site, which was established at that time, has been documented by the American Society of Materials (ASM) as one of the most corrosive naturally occurring environments in the world. With the introduction of the Space Shuttle in 1981, the already highly corrosive conditions at the launch pad were rendered even more severe by the acidic exhaust from the solid rocker boosters. In the years that followed, numerous studies have identified materials, coatings, and maintenance procedures for launch hardware and equipment exposed to the highly corrosive environment at the launch pad. The Corrosion Laboratory was established at KSC in 1985 and was outfitted with state-of-the-art electrochemistry equipment to conduct research and materials characterization in many different corrosive environments. This paper will describe the application of electrochemistry in combination with atmospheric exposure to the selection of alloys in a spaceport environment. [copyright] 2003 American Institute of Physics

Author (AIP)

Alloys; Apollo Spacecraft; Carbon Steels; Corrosion; Corrosion Prevention; Corrosion Tests; Electrochemistry; Gemini Spacecraft; Ground Support Systems; Protective Coatings

20030006792

Launch System Testbed: An Innovative Approach for Design and Development of Future Launch Structures

Vu, Bruce T.; Kandula, Max; Margasahayam, Ravi N.; Ford, Danielle M.; AIP Conference Proceedings; January 28, 2003; ISSN 0094-243X; Volume 654, Issue no. 1, 276-289; In English; SPACE TECHNOLOGY and APPLICATIONS INT.FORUM-STAIF 2003: Conf.on Thermophysics in Microgravity; Commercial/Civil Next Generation Space Transportation; Human Space Exploration, 2-5 February 2003, Albuquerque, New Mexico, USA; Copyright

The launch of space vehicles generates extreme conditions, such as vibrations and acoustics that can affect the launch pad, space vehicles, and their payloads. These acoustic loads are the results of intense acoustic environment generated by the interaction of the rocket-engine exhaust stream mixing with the ambient atmosphere. The primary source of structural vibrations and internal loads during launch is due to these acoustic loads. Therefore, being able to manage and suppress these undesirable conditions is critical to proper functioning of vehicle components, payloads, and launch support structures. The goal of the Launch System Testbed at NASA-Kennedy Space Center is to develop new methods to improve the performance of launch systems by reducing noise, vibration, and stress loads generated during launch. [copyright] 2003 American Institute of Physics

Author (AIP)

Cost Estimates; Launch Vehicles; Noise (Sound); Noise Reduction; Personnel; Spacecraft; Test Facilities; Vibration

20020094348 DYNACS Engineering Co., Inc., Cocoa Beach, FL USA, NASA Kennedy Space Center, Cocoa Beach, FL USA

Rocket Noise and Vibration Shuttle/Payload Processing and ISS: Launch Pad Vibroacoustics Research at NASA/KSC

Margasayam, Ravi; Voska, Ned, Technical Monitor; [2002]; In English, 12-16 Dec. 2002, Valdivia, Chile

Contract(s)/Grant(s): NAS10-98001

Report No.(s): KSC-2002-131; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation provides information on the effects of noise of the SSME Space Shuttle Main Engine upon liftoff from Kennedy Space Center. It covers both effects experienced by astronauts within the Shuttles, and effects on the surrounding environment. The presentation then makes recommendations for design methods which take into account vibroacoustics.

Author

Acoustics; Space Shuttle Main Engine; Vibrational Stress; Liftoff (Launching)

20020082307

Communications/Navigation Outage Forecasting System (C/NOFS) statistical energy analysis

Betts, Juan F.; The Journal of the Acoustical Society of America; November 2002; ISSN 0001-4966; Volume 112, Issue no. 5, 2382-2382; In English; Copyright

The objective of this study was the assessment of the dynamics response of the Communications/Navigation Outage Forecasting System (C/NOFS) spacecraft due to incident acoustic environments. C/NOFS is space vehicle (SV) launched using a Pegasus launch vehicle (LV). A statistical energy analysis (SEA) model of the SV was developed from a NASTRAN

finite-element model (FEM). The study compared the dynamic response of the structural subsystems (panels and structural elements) due to incident acoustic Pegasuss protoflight environment [which is 3 dB above maximum expected flight environment (MEFL)] and compared it against the Mil-340 standard workmanship acoustic levels. A concern was raised as to whether the workmanship acoustics, required by Mil-340, imposed on C/NOFS may induce higher vibration responses than what C/NOFS was qualified for, and may result in unnecessary increases in component test levels. The two incident acoustic spectrums were introduced as reverberant loads on the model. The PSD results at the structural panels were compared to random vibration test levels performed on the components for C/NOFS.
Author (AIP)
Dynamic Response; Shells (Structural Forms); Statistical Analysis; Structural Vibration; Systems Analysis

20020080252 ENSCO, Inc., Springfield, VA USA
Safety on Earth From MARSS
Spinoff 2002; 2002, 100-101; In English; Original contains color illustrations; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

ENSCO, Inc., developed the Meteorological and Atmospheric Real-time Safety Support (MARSS) system for real-time assessment of meteorological data displays and toxic material spills. MARSS also provides mock scenarios to guide preparations for emergencies involving meteorological hazards and toxic substances. Developed under a Small Business Innovation Research (SBIR) contract with Kennedy Space Center, MARSS was designed to measure how safe NASA and Air Force range safety personnel are while performing weather sensitive operations around launch pads. The system augments a ground operations safety plan that limits certain work operations to very specific weather conditions. It also provides toxic hazard prediction models to assist safety managers in planning for and reacting to releases of hazardous materials. MARSS can be used in agricultural, industrial, and scientific applications that require weather forecasts and predictions of toxic smoke movement. MARSS is also designed to protect urban areas, seaports, rail facilities, and airports from airborne releases of hazardous chemical substances. The system can integrate with local facility protection units and provide instant threat detection and assessment data that is reportable for local and national distribution.
Author
Chemical Release Modules; Toxic Hazards; Spilling; Weather Forecasting; Hazards; Emergencies; Protection

20020078320 NASA Kennedy Space Center, Cocoa Beach, FL USA
System and Method of Locating Lightning Strikes
Medelius, Pedro J., Inventor; Starr, Stanley O., Inventor; Jul. 16, 2002; In English
Patent Info.: Filed 13 Feb. 2001; US-Patent-6,420,862; US-Patent-Appl-SN-784405; US-Patent-Appl-SN-182404; NASA-Case-KSC-11992-1; No Copyright; Avail: CASI; A02, Hardcopy

A system and method of determining locations of lightning strikes has been described. The system includes multiple receivers located around an area of interest, such as a space center or airport. Each receiver monitors both sound and electric fields. The detection of an electric field pulse and a sound wave are used to calculate an area around each receiver in which the lighting is detected. A processor is coupled to the receivers to accurately determine the location of the lighting strike. The processor can manipulate the receiver data to compensate for environmental variables such as wind, temperature, and humidity. Further, each receiver processor can discriminate between distant and local lightning strikes.
Official Gazette of the U.S. Patent and Trademark Office
Lightning; Position (Location); Receivers; Electric Fields; Sound Fields

20020066446 Aerospace Design and Development, Inc., Niwot, CO USA
Emergency Response Breathing Apparatus
Spinoff 2000; 2000, 44; In English; Original contains color illustrations; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Aerospace Design & Development, Inc.'s (ADD's) SCAMP was developed under an SBIR contract through Kennedy Space Center. SCAMP stands for Supercritical Air Mobility Pack. The technology came from the life support fuel cell support systems used for the Apollo and Space Shuttle programs. It uses supercritical cryogenic air and is able to function in microgravity environments. SCAMP's self-contained breathing apparatus(SCBA) systems are also ground-based and can provide twice as much air than traditional SCBA's due to its high-density capacity. The SCAMP system was designed for use in launch pad emergency rescues. ADD also developed a protective suit for use with SCAMP that is smaller and lighter system than the old ones. ADD's SCAMP allows for body cooling and breathing from the supercritical cryogenic air, requiring no

extra systems. The improvement over the traditional SCBA allows for a reduction of injuries, such as heat stress, and makes it easier for rescuers to save lives.
Author
Breathing Apparatus; Cryogenic Equipment; Portable Life Support Systems; Emergency Life Sustaining Systems; Technology Utilization

20020062189 Global Atmospherics, Inc., Tucson, AZ USA
Lightning Detection in a Flash
Spinoff 2001: Special Millennium Feature; 2001, 69; In English; Original contains color illustrations; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

In a joint project with NASA's Kennedy Space Center, Global Atmospherics, Inc. (GAI), participated in the upgrade and commercialization of the Lightning Detection and Ranging (LDAR) System. Under a Space Act Agreement, GAI and Kennedy agreed to the joint development of a new LDAR system that meets the needs of both NASA and private industry. The resulting development was a volumetric lightning mapping system. NASA operates a three- dimensional LDAR system capable of determining the exact location and altitude of in-cloud and cloud-to-cloud lightning. Under the Space Act Agreement, GAI contributed its wealth of experience and resources to update and improve the current lightning mapping system used by NASA. Previously, commercial systems were only capable of locating cloud-to-ground lightning. The resulting innovations allowed GAI to position the LDAR system for commercial applications. The upgraded product has the ability to measure in-cloud and cloud-to-cloud lightning. Notable improvements have also been made in the system's location accuracy and signal detection. The new product, known as LDAR II, is targeted for use by utility providers, aviation companies, airports, and commercial space vehicle launch facilities. Presently, forecasting services, research facilities, and a utility company are using the system.
Author
Cloud-to-Cloud Discharges; Cloud-to-Ground Discharges; Detection; Forecasting; Lightning; Signal Detection

20020062117 Dow Corning Corp., USA
Elastomers that Endure
Spinoff 2001: Special Millennium Feature; 2001, 106; In English; Original contains color illustrations; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

Through assistance from NASA's Kennedy Space Center, Dow Corning developed a strong, heat-protecting coating with applications in a variety of fields. Previously, NASA used silicate coatings that simply failed to adequately protect, which resulted in the frequent recoating of the damaged areas. The enormous expense of this repeat procedure led Kennedy's Materials Science Laboratory to investigate the possibilities of ablative-type coatings. The investigations resulted in the creation of a silicone ablative material known as the Dow Corning 3-6376 Fast Cure Elastomer. The new product, which does not require a primer coating, is a 100 percent silicone material. It is currently used in the automotive and aerospace industries and serves as an exceptional coating for engine compartment firewalls. Dow Corning's Fast Cure Elastomer has also proved to be an effective sealant. Moreover, it reduces the turnaround time for reuse of the launch structure because of fewer refurbishing operations. This means that NASA is not held up due to repairs when it comes time to launch another Shuttle. To date, the Agency has launched dozens of successful missions without the need for recoating.
Author
Ablative Materials; Elastomers; Glass Fibers; Primers (Coatings); Silicates

20020052379 NASA Kennedy Space Center, Cocoa Beach, FL USA, DYNACS Engineering Co., Inc., Cocoa Beach, FL USA
Rocket Launch Trajectory Simulations Mechanism
Margasahayam, Ravi; Caimi, Raoul E.; Hauss, Sharon; Voska, N., Technical Monitor; [2002]; In English; International Congress on Sound and Vibration, 8-11 Jul. 2002, Orlando, FL, USA
Contract(s)/Grant(s): NAS10-98001
Report No.(s): KSC-2002-062; No Copyright; Avail: CASI; A02, Hardcopy

The design and development of a Trajectory Simulation Mechanism (TSM) for the Launch Systems Testbed (LST) is outlined. In addition to being one-of-a-kind facility in the world, TSM serves as a platform to study the interaction of rocket launch-induced environments and subsequent dynamic effects on the equipment and structures in the close vicinity of the launch pad. For the first time, researchers and academicians alike will be able to perform tests in a laboratory environment

and assess the impact of vibroacoustic behavior of structures in a moving rocket scenario on ground equipment, launch vehicle, and its valuable payload or spacecraft.
Author
Acoustics; Launch Vehicles; Simulation; Trajectories; Vibrational Stress

20020050380 NASA Marshall Space Flight Center, Huntsville, AL USA
Range Safety Systems
Schrock, Kenneth W.; Humphries, Ricky H., Technical Monitor; [2002]; In English; No Copyright; Avail: Other Sources; Abstract Only

The high kinetic and potential energy of a launch vehicle mandates there be a mechanism to minimize possible damage to provide adequate safety for the launch facilities, range, and, most importantly, the general public. The Range Safety System, sometimes called the Flight Termination System or Flight Safety System, provides the required level of safety. The Range Safety System section of the Avionics chapter will attempt to describe how adequate safety is provided, the system's design, operation, and it's interface with the rest of the launch vehicle.
Author
Avionics; Systems Engineering; Range Safety

20020022831 NASA Goddard Space Flight Center, Greenbelt, MD USA
Lessons Learned and Process Improvement for Payload Operations at the Launch Site
Catena, John; Gates, Donald, Jr.; Blaney, Kermit, Sr.; Obenschain, Arthur F., Technical Monitor; [2001]; In English; International Telemetric Conference, 23 Oct. 2001, Las Vegas, NV, USA; Copyright; Avail: Other Sources

For every space mission, there are challenges with the launch site/field operations process that are addressed too late in the development cycle. This potentially causes schedule delays, cost overruns, and adds risk to the mission success. This paper will discuss how a single interface, representing the payload at the launch site in all phases of development, will mitigate risk, and minimize or even alleviate potential problems later on. Experience has shown that a single interface between the project and the launch site allows for issues to be worked in a timely manner and bridges the gap between two diverse cultures.
Author
Launching Sites; Payloads; Loading Operations; Efficiency

20020002753 NASA Kennedy Space Center, Cocoa Beach, FL USA
The Advanced Technology Development Center (ATDC)
Clements, G. R.; Willcoxon, R., Technical Monitor; [2001]; In English; STAIF-2002, 3-7 Feb. 2002, Albuquerque, NM, USA; No Copyright; Avail: CASI; A02, Hardcopy

NASA is building the Advanced Technology Development Center (ATDC) to provide a 'national resource' for the research, development, demonstration, testing, and qualification of Spaceport and Range Technologies. The ATDC will be located at Space Launch Complex 20 (SLC-20) at Cape Canaveral Air Force Station (CCAFS) in Florida. SLC-20 currently provides a processing and launch capability for small-scale rockets; this capability will be augmented with additional ATDC facilities to provide a comprehensive and integrated in situ environment. Examples of Spaceport Technologies that will be supported by ATDC infrastructure include densified cryogenic systems, intelligent automated umbilicals, integrated vehicle health management systems, next-generation safety systems, and advanced range systems. The ATDC can be thought of as a prototype spaceport where industry, government, and academia, in partnership, can work together to improve safety of future space initiatives. The ATDC is being deployed in five separate phases. Major ATDC facilities will include a Liquid Oxygen Area; a Liquid Hydrogen Area, a Liquid Nitrogen Area, and a multipurpose Launch Mount; 'Iron Rocket' Test Demonstrator; a Processing Facility with a Checkout and Control System; and Future Infrastructure Developments. Initial ATDC development will be completed in 2006.
Author
Launching Bases; Management Systems

20020002698 NASA Kennedy Space Center, Cocoa Beach, FL USA
Rocket Launch-Induced Vibration and Ignition Overpressure Response
Caimi, Raoul; Margasahayam, Ravi; Nayfeh, Jamal; Thompson, Karen, Technical Monitor; [2001]; In English; International Congress on Sound and Vibration, 2-6 Jul. 2001, Hong Kong; No Copyright; Avail: CASI; A02, Hardcopy

Rocket-induced vibration and ignition overpressure response environments are predicted in the low-frequency (5 to 200

hertz) range. The predictions are necessary to evaluate their impact on critical components, structures, and facilities in the immediate vicinity of the rocket launch pad.
Author
Rocket Launching; Ignition; Overpressure; Vibration Effects

20010097301 Aerospace Corp., El Segundo, CA USA
Environmental Impact Assessment of US Air Force Launches from Kodiak, Alaska
Lang, V. I.; Huynh, T.; Bowles, A.; Stewart, B.; Plotkin, K.; May 01, 2001; In English; Original contains color plates
Contract(s)/Grant(s): F04701-00-C-0009
Report No.(s): AD-A392213; TR-2001(1306)-2; SMC-TR-01-14; No Copyright; Avail: CASI; A03, Hardcopy

A comparison between noise predictions made with the RNOISE computation model and actual monitoring data, for two USAF atmospheric interceptor technology (ait) Program launches from the Kodiak Launch Complex (KLC), is presented. Maximum A-weighted sound pressure levels (L(sub AMAX)) recorded at locations within 2 km of the launch site ranged from approximately 103 to 105 dB for the two launch vehicles. A-weighted sound exposure levels (ASEL) from the same area ranged from approximately 109 dB to 113 dB. At 5.7 km from the launch site, in the vicinity of a haulout for endangered Steller sea lions, the measured ait-1 L(SUB AMAX) was reduced to approximately 78 dB while the ASEL was approximately 88 dB. The latter values agreed well with A-weighted sound levels predicted using RNOISE for the same location.
DTIC
Environmental Surveys; Launching Bases; Noise Prediction; Damage Assessment; Launching Sites; Launch Vehicles

20010072845 NASA Marshall Space Flight Center, Huntsville, AL USA
So What's an RTG and Are They Safe?
Barret, Chris; Hughes, R. W., Technical Monitor; [2001]; In English; SWE National Conference, 1 Jun. 2001, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

When one considers space missions to the outer edges of our solar system and far beyond, our sun cannot be relied on to produce the required spacecraft (s/c) power. Solar energy diminishes as the square of the distance from the Sun. At Mars it is only 43% of that at earth. At Jupiter, it falls off to only 3.6% of Earth's. By the time we get out to Pluto, solar energy is only .066% what it is on Earth. Beyond the orbit of Mars, it is not practical to depend on solar power for a s/c. However, the farther out we go the more power we need to heat the s/c and to transmit data back to Earth over the long distances. On Earth, knowledge is power. In the outer solar system, power is knowledge. Solar arrays only operate at 19% efficiency, are very vulnerable to damage from radiation and temperature extremes, and cannot be used for even nearby missions that operate in extended darkness, or under the surface of a planet or moon. Twenty-six U.S. space missions, from the Transit to Cassini, have used radioisotope power systems and heater units to take s/c to the far reaches of our solar system and have demonstrated an outstanding record of safety and reliability. Radioisotope thermoelectric generators (RTG's) have proven to be safe, reliable, maintenance-free, and capable of providing both thermal and electrical power for decades under the harsh environments of deep space. RTG's have no problem operating in the high radiation belts of space, the extreme temperatures, or the severe dust storms of Mars, and they have proven to be the most reliable power source ever flown on U.S. s/c. For example, the two Pioneer s/c operated for more than two decades and the Voyager s/c may last for 40 years. RTG's are not nuclear reactors, they serve only as power generators and are not involved in the propulsion of the s/c. They operate on the principle of thermoelectric generation that converts heat directly into electricity, they have no moving parts, are extremely reliable, and have met or exceeded all safety and performance expectations. Federal laws and regulations require analysis and evaluation of the safety risks and any potential environmental impacts. Extensive safety testing of RTG's and RTG components has been performed by the U.S. Department of Energy (DOE) to demonstrate the ability to survive accidents related to Space Shuttle launches and assure that the systems would be safe under all accident conditions, including accidents at or near the launch pad or during orbital reentry. Many design improvements have been made over the four decades that RTG's have been flown on space missions. This paper outlines the operation and safety standards of RTG's and the advanced developments expected to be used on future deep space missions such as the Europa Orbiter, Pluto/Kuiper Express, Solar Probe, Europa Lander, and Titan Explorer missions.
Author
Thermoelectric Generators; Thermoelectricity; Space Missions; Solar System

20010068366 University of South Florida, Tampa, FL USA
Performance Evaluation of the NASA/KSC Transmission System
Christensen, Kenneth J.; 1999 Research Reports: NASA/ASEE Summer Faculty Fellowship Program; November 2000, 53-63; In English; No Copyright; Avail: CASI; A03, Hardcopy

NASA-KSC currently uses three bridged 100-Mbps FDDI segments as its backbone for data traffic. The FDDI Transmission System (FTXS) connects the KSC industrial area, KSC launch complex 39 area, and the Cape Canaveral Air Force Station. The report presents a performance modeling study of the FTXS and the proposed ATM Transmission System (ATXS). The focus of the study is on performance of MPEG video transmission on these networks. Commercial modeling tools - the CACI Predictor and Comnet tools - were used. In addition, custom software tools were developed to characterize conversation pairs in Sniffer trace (capture) files to use as input to these tools. A baseline study of both non-launch and launch day data traffic on the FTXS is presented. MPEG-1 and MPEG-2 video traffic was characterized and the shaping of it evaluated. It is shown that the characteristics of a video stream has a direct effect on its performance in a network. It is also shown that shaping of video streams is necessary to prevent overflow losses and resulting poor video quality. The developed models can be used to predict when the existing FTXS will 'run out of room' and for optimizing the parameters of ATM links used for transmission of MPEG video. Future work with these models can provide useful input and validation to set-top box projects within the Advanced Networks Development group in NASA-KSC Development Engineering.
Author
Performance Prediction; Performance Tests; Transmission Efficiency; Video Communication

20010065867 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Concept Exploration of an Australian Indigenous Space Launch Capability
Rogers, Anthony J.; Mar. 2001; In English
Report No.(s): AD-A390119; AFIT/GSO/ENY/01M-05; No Copyright; Avail: CASI; A07, Hardcopy

This thesis explores the possibility of establishing an Australian indigenous space launch capability through developing and examining an Australian space launch program model. The model is based around launch site location, vehicle design, program duration, and the percentage Australian indigenous input into the program. The model was optimized in an effort maximize the benefits of such a capability, namely political prestige, security and in country technological base, while minimising the program's overall cost.
DTIC
Spacecraft Launching; Australian Space Program; Systems Engineering; Space Exploration

20010052920 NASA Goddard Space Flight Center, Greenbelt, MD USA
Interferometric Characterization of the Earth's Atmosphere from Lagrange Point 2
Herman, Jay R.; Komar, George, Technical Monitor; [2001]; In English; IGARSS 2001, Jul. 2001, Sydney, Australia; No Copyright; Avail: Other Sources; Abstract Only

Part of the NASA plans for future Earth Science missions calls for observations using novel vantage points that can produce science products otherwise unobtainable. Observations of the Earth from the Lagrange-2 point, L-2, (1.5 million km behind the Earth on the Earth-Sun line) affords a unique vantage point for atmospheric science. Spectral observation of the Earth's atmosphere using solar occultation techniques in the near infrared (1 to 4 microns) provides one of the most accurate methods of passively sensing attitude profiles of the major species (CO2, O3, O2, CH4, H2O N2O). While traditional polar orbiting occultation measurements can obtain about 14 measurements per day (2 per orbit), solar occultation observations from the Lagrange-2 point will yield hourly profile measurements at all latitudes. The expected spatial resolution is 2 km in altitude, 0.5 degrees in latitude, and 2 degrees in longitude. The result from 24 hours of observations will be a three-dimensional map of atmospheric composition. To accomplish this task from L-2 requires the development of a large moderate spectral resolution instrument whose entrance aperture is about 10 meters. Use of a standard telescope design with a 10-meter circular mirror or a 10-meter strip mirror would be prohibitively expensive and excessively massive. Instead, we are proposing the development of a 10-meter linear interferometer coupled to a Fourier transform imaging spectrometer. The result will be a highly efficient design with sufficient sensitivity, while having both spatial and spectral resolution to produce the desired results. Preliminary calculations show that seven species (CO2, O3, O2, CH4, H2O N2O) have clearly separated spectral features in the I to 4 microns range with sufficient absorption to produce profile information from near the Earth's surface to the middle stratosphere. For CO2 the estimated sensitivity to change is 0.33% or 1 part in 330. This should be sufficient to detect changes that are significant for the carbon cycle studies. Initial instrument design studies are underway to determine the optimum optical design for the interferometer-spectrometer as well as the necessary highly stable mechanical designs. Separate design studies are being conducted for the spacecraft. shuttle launch facility, low-light solar power design, thermal control, and unique navigation requirements to reach and maintain the tight halo orbit about L-2.
Author
Interferometry; Earth Sciences; Earth Atmosphere; Carbon Dioxide; Atmospheric Physics; Carbon Cycle; Methane; Near Infrared Radiation; Temperature Control; Oxygen

20010024038 Applied Research Associates, Inc., Littleton, CO USA

Development of a Predictive Model for Rocket Launch Noise Footprint

White, Michael J.; Nov. 27, 2000; In English

Contract(s)/Grant(s): F41624-99-C-6033

Report No.(s): AD-A384661; AFRL-HE-WP-0001AD; No Copyright; Avail: CASI; A04, Hardcopy

During rocket launch significant noise can be generated and propagated to the surrounding environment that can be disrupting to both communities and wildlife. Assessment of these impacts requires knowledge of the acoustic source mechanisms, propagation effects, and requirements under the National Environmental Policy Act. In Phase I we will draw heavily on the rocket engine acoustic source investigative testing that we recently completed as well as expand our recent literature source on rocket engine acoustic sources. Our far field acoustic propagation techniques, developed from explosive charge detonation and large calibre gun firing tests, will be combined with our knowledge of rocket (engine noise and vehicle bow shock) sources to form a preliminary far field noise footprint prediction method. It is anticipated the results would be shown graphically using Air Force developed software, NMPLOT. Also, we intend to add IBON to our current noise criteria database. In Phase II the noise footprint software will be formalized, tested with field measurements and graphical user interface will be added to complete the noise assessment tool.

DTIC

Noise Pollution; Computer Programs; Noise Reduction; Rocket Launching; Acoustic Propagation; Bow Waves; Noise Prediction; Prediction Analysis Techniques; Rocket Engine Noise

20010016758 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Use of Climatology to Predict Maximum Wintertime Wind Speeds at the Kennedy Space Center and Cape Canaveral Air Station

Coleman, Lisa K.; Mar. 2000; In English

Report No.(s): AD-A383834; AFIT/GM/ENP/00M-04; No Copyright; Avail: CASI; A04, Hardcopy

This thesis uses statistical analysis to forecast the probability of meeting or exceeding the maximum allowable wind speeds for each of the launch pads at the Kennedy Space Center (KSC) and Cape Canaveral Air Station (CCAS). Wind data were collected from the Weather Information Network Display System (WINDS), a collection of 47 meteorological towers located throughout KSC and CCAS, over a period of five winters. A Fortran program was written to calculate conditional probabilities of meeting or exceeding a given threshold speed during eight consecutive one-hour periods, using the current wind direction and peak wind speed as inputs. Forecast probabilities were displayed in a table according to time period and wind direction. Accuracy was measured by constructing contingency tables and calculating various measures of accuracy. Results were tested for significance by calculating p-values for the chi-square test. This method was found to have very little skill in forecasting maximum wind speeds. It is not recommended for operational use.

DTIC

Statistical Analysis; Wind Velocity; Wind Measurement; Weather Forecasting; Cape Kennedy Launch Complex; Wind Direction; Climatology; Weather

20010016756 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Timing of Thunderstorm Occurrence for Cape Canaveral Florida

Renwick, Thomas G.; Mar. 2000; In English

Report No.(s): AD-A383830; AFIT/GM/ENP/00M-10; No Copyright; Avail: CASI; A06, Hardcopy

This research is concerned with improving an existing algorithm to accurately forecast thunderstorm starting times for Cape Canaveral, Florida. This was accomplished by investigating different linear regression techniques than those used in the existing algorithm. The result is three new thunderstorm start time algorithms. The forecast start times of these new algorithms were then compared to actual thunderstorm start times to determine which method produced the most accurate results. The average thunderstorm starting time was also calculated from the data. This time was also compared to actual thunderstorm starting time. Upon examination of the various start times produced, it was found that all algorithms, including the original algorithm, performed worse than using the average thunderstorm start time.

DTIC

Algorithms; Thunderstorms; Weather Forecasting; Regression Analysis

20000120141 NASA Langley Research Center, Hampton, VA USA

Improvements To Progressive Wave Tube Performance Through Closed-Loop Control

Rizzi, Stephen A.; October 2000; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 522-63-11-03

Report No.(s): NASA/TM-2000-210623; L-18040; NAS 1.15:210623; No Copyright; Avail: CASI; A04, Hardcopy

This report documents recent improvements to the acoustic and thermal control systems of the Thermal Acoustic Fatigue Apparatus (TAFA), a progressive wave tube test facility at the NASA Langley Research Center, Hampton, Virginia. A brief summary of past acoustic performance is given first to serve as a basis for comparison with the new performance data using a multiple-input, closed-loop, narrow-band controller. Performance data in the form of test section acoustic power spectral densities and coherence are presented in three of six facility configurations for a variety of input spectra. Tested spectra include uniform, two cases of pink noise, three cases of narrow-band random, a simulated launch payload bay environment for an expendable launch vehicle, and a simulated external acoustic load for the aft section of a reusable launch vehicle. In addition, a new closed-loop temperature controller and thermocouple data acquisition system are described.

Author

Performance Tests; Test Chambers; Test Facilities; Research and Development; Experimentation; Research Facilities

20000114867 Army Research Lab., White Sands Missile Range, NM USA

An Evaluation of Three-Dimensional Weather Hazards Using Sounding Data and Model Output Data

Passner, Jeffrey E.; Aug. 2000; In English

Report No.(s): AD-A382550; ARL-TR-1046; No Copyright; Avail: CASI; A04, Hardcopy

The Atmospheric Sounding Program (ASP) is initialized by upper-air observations, either from standard rawinsonde observations (RAOB)s or output from a numerical model, the Battlescale Forecast Model (BFM). These data are decoded and processed before calculations are performed, giving the forecaster an overview of the atmospheric conditions at or near the ROAB launch site or the BFM grid point. The ASP uses these data to produce a series of weather-hazard products that can be used for analysis or forecasting to 24 h from the initial time of the BFM run. Included in these weather hazards are turbulence, icing, and clouds - three parameters, which have major influence in military operations.

DTIC

Atmospheric Sounding; Proving; Three Dimensional Models; Mathematical Models; Weather Forecasting; Meteorological Services; Hazards

20000114828 NASA Goddard Space Flight Center, Greenbelt, MD USA

Spacecraft Communications System Verification Using On-Axis Near Field Measurement Techniques

Keating, Thomas; Baugh, Mark; Gosselin, R. B.; Lecha, Maria C.; Krebs, Carolyn A., Technical Monitor; [2000]; In English; 24th Antenna Applications, Monticello, IL, USA; No Copyright; Avail: CASI; A03, Hardcopy

Determination of the readiness of a spacecraft for launch is a critical requirement. The final assembly of all subsystems must be verified. Testing of a communications system can mostly be done using closed-circuits (cabling to/from test ports), but the final connections to the antenna require radiation tests. The Tropical Rainfall Measuring Mission (TRMM) Project used a readily available 'near-field on-axis' equation to predict the values to be used for comparison with those obtained in a test program. Tests were performed in a 'clean room' environment at both Goddard Space Flight Center (GSFC) and in Japan at the Tanegashima Space Center (TnSC) launch facilities. Most of the measured values agreed with the predicted values to within 0.5 dB. This demonstrates that sometimes you can use relatively simple techniques to make antenna performance measurements when use of the 'far field ranges, anechoic chambers, or precision near-field ranges' are neither available nor practical. Test data and photographs are provided.

Author

Launching Bases; Near Fields; Spacecraft Communication; Spacecraft Launching; Prelaunch Tests

20000113670 Hawaii Univ., Honolulu, HI USA

Construction of a Lightning Index Using Integrated Precipitable Water Derived From the Global Positioning System

Mazany, Robert A.; Dec. 2000; In English

Report No.(s): AD-A381840; No Copyright; Avail: CASI; A05, Hardcopy

A new approach is presented to forecasting the Kennedy Space Center's primary weather challenge, lightning. After examining the first years worth of integrated precipitable water data derived from Global Positioning System (GPS) and surface stations, two periods were chosen to develop a GPS lightning prediction model. Statistical regression methods were

used to identify predictors that added skill in forecasting a lightning event. Four predictors proved important in forecasting lightning events; maximum electric field mill values, GPS Integrated Precipitable Water (IPW), nine hour change (V9 - hr) in IPW, and K index. Using the coefficients for these predictors along with a logistic regression equation, a running time series was plotted for the predictand. A common pattern emerged several hours prior to a lightning event. Whenever the predictand log value was 0.7 or below, lightning occurred within the next 12.5 hours. Lightning events were predicted using a logistic threshold value of 0.7 and forecasting time constraints based on the Kennedy Space Center (KSC) criteria. Forecast verification results obtained by using a contingency table revealed a 26.2% decrease from the Cape's previous season false alarm rates for a non-independent period, and a 13.2% decrease in false alarm rates for an independent test season using the GPS lightning model. Additionally, the model improved the KSC's desired lead-time by nearly 10%. Although a lightning strike window of 12 hours is quit lengthy, forecasters will now have an additional forecasting tool that can be implemented in their lightning forecast process. Once the value of the GPS lightning model has been confirmed using data from the 2000 season, it is anticipated that the model will enhance mission readiness and save valuable time and dollars by helping forecasters anticipate and improve forecast lightning events at the KSC.

DTIC

Weather Forecasting; Lightning; Launching Sites; Global Positioning System; Statistical Analysis; Space Weather; Water Vapor; Time Series Analysis

20000052472 NASA Marshall Space Flight Center, Huntsville, AL USA

Modeling of Nonacoustic Combustion Instability in Simulations of Hybrid Motor Tests

Rocker, M.; February 2000; In English

Report No.(s): NASA/TP-2000-209905; M-960; NAS 1.60:209905; No Copyright; Avail: CASI; A04, Hardcopy

A transient model of a hybrid motor was formulated to study the cause and elimination of nonacoustic combustion instability. The transient model was used to simulate four key tests out of a series of seventeen hybrid motor tests conducted by Thiokol, Rocketdyne, and Martin Marietta at NASA Marshall Space Flight Center (MSFC). These tests were performed under the Hybrid Propulsion Technology for Launch Vehicle Boosters (HPTLVB) program. The first test resulted in stable combustion. The second test resulted in large-amplitude, 6.5-Hz chamber pressure oscillations that gradually damped away by the end of the test. The third test resulted in large-amplitude, 7.5-Hz chamber pressure oscillations that were sustained throughout the test. The seventh test resulted in elimination of combustion instability with the installation of an orifice immediately upstream of the injector. Formulation and implementation of the model are the scope of this presentation. The current model is an independent continuation of modeling presented previously by joint Thiokol-Rocketdyne collaborators Boardman, Hawkins, Wassom. and Claflin. The previous model simulated an unstable independent research and development (IR&D) hybrid motor test performed by Thiokol. There was very good agreement between the model and test data. Like the previous model, the current model was developed using Matrix-x simulation software. However, tests performed at MSFC under the HPTLVB program were actually simulated. ln the current model, the hybrid motor, consisting of the liquid oxygen (lox) injector, the multiport solid fuel grain, and nozzle, was simulated. The lox feedsystem, consisting of the tank, venturi. valve, and feed lines, was also simulated in the model. All components of the hybrid motor and lox feedsystem are treated by a lumped-parameter approach. Agreement between the results of the transient model and actual test data was very good. This agreement between simulated and actual test data indicated that the combustion instability in the hybrid motor was due to two causes: 1. a lox feed system of insufficient stiffness, and 2. a lox injector with an impedance (it pressure drop that was too low to provide damping against the feed system oscillations. Also, it was discovered that testing with a new grain of solid fuel sustained the combustion instability. However, testing with a used grain of solid fuel caused the combustion instability to gradually decay.

Author

Computerized Simulation; Mathematical Models; Pressure Oscillations; Injectors; Hybrid Propulsion; Combustion Stability; Frequency Stability

Transformational Spaceport and Range Technologies: 2000-2004

This custom bibliography from the NASA Scientific and Technical Information Program lists a sampling of records found in the NASA Aeronautics and Space Database. The scope of this topic is divided into two parts and includes technologies for launch site infrastructure and range capabilities for the crew exploration vehicle and advanced heavy lift vehicles. This area of focus is one of the enabling technologies as defined by NASA's *Report of the President's Commission on Implementation of United States Space Exploration Policy*, published in June 2004.

Part Two: Range Technologies

Part One

20040121116 University of Central Florida, Orlando, FL, USA

The Virtual Test Bed Project

Rabelo, Luis; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, R-1 - R-8; In English; No Copyright; Avail: CASI; A02, Hardcopy

This is a report of my activities as a NASA Fellow during the summer of 2003 at the NASA Kennedy Space Center (KSC). The core of these activities is the assigned project: the Virtual Test Bed (VTB) from the Spaceport Engineering and Technology Directorate. The VTB Project has its foundations in the NASA Ames Research Center (ARC) Intelligent Launch & Range Operations program (ILRO). The objective of the VTB project is to develop a unique collaborative computing environment where simulation models can be hosted and integrated in a seamless fashion. This collaborative computing environment will have as emphasis operational models. This report will focus on the decisions about the different simulation modeling environments considered, simulation platform development, technology and operational models assessment, and computing infrastructure implementation.

Author

Computerized Simulation; Systems Simulation; Launching Bases

20040121101 Florida Inst. of Tech., FL, USA

Analysis of Return and Forward Links from STARS' Flight Demonstration 1

Gering, James A.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, J-1 - J-9; In English; No Copyright; Avail: CASI; A02, Hardcopy

Space-based Telemetry And Range Safety (STARS) is a Kennedy Space Center (KSC) led proof-of-concept demonstration, which utilizes NASA's space network of Tracking and Data Relay Satellites (TDRS) as a pathway for launch and mission related information streams. Flight Demonstration 1 concluded on July 15,2003 with the seventh flight of a Low Power Transmitter (LPT) a Command and Data Handler (C&DH), a twelve channel GPS receiver and associated power supplies and amplifiers. The equipment flew on NASA's F-I5 aircraft at the Dryden Flight Research Center located at Edwards Air Force Base in California. During this NASA-ASEE Faculty Fellowship, the author participated in the collection and analysis of data from the seven flights comprising Flight Demonstration 1. Specifically, the author examined the forward and return links bit energy E(sub B) (in Watt-seconds) divided by the ambient radio frequency noise N(sub 0) (in Watts / Hertz). E(sub b)/N(sub 0) is commonly thought of as a signal-to-noise parameter, which characterizes a particular received radio frequency (RF) link. Outputs from the data analysis include the construction of time lines for all flights, production of graphs of range safety values for all seven flights, histograms of range safety E(sub b)/N(sub 0) values in five dB increments, calculation of associated averages and standard deviations, production of graphs of range user E(sub b)/N(sub 0) values for the all flights, production of graphs of AGC's and E(sub b)/N(sub 0) estimates for flight 1, recorded onboard, transmitted directly to the launch head and transmitted through TDRS. The data and graphs are being used to draw conclusions related to a lower than expected signal strength seen in the range safety return link.

Author

Data Acquisition; Telemetry; Electromagnetic Noise; Flight Tests; Noise (Sound); Spacecraft Tracking

20040084663 NASA Marshall Space Flight Center, Huntsville, AL, USA

Toxic Gas Exposure Risks Associated With Potential Shuttle Catastrophic Failures

Anderson, B. Jeffrey; McCaleb, Rebecca C.; June 2004; In English

Report No.(s): NASA/TP-2004-213284; M-1116; No Copyright; Avail: CASI; A06, Hardcopy

From early in the Shuttle program, the National Aeronautics and Space Administration has modeled hydrogen chloride (HCl) release by burning solid propellant in the solid rocket boosters. In 1998, the USA Air Force 45th Space Wing instituted more stringent launch commit criteria (LCC) for the Titan and Delta vehicles and proposed that the same LCC be applied to the Shuttle to enhance safety of onsite visitors and offsite public. Two types of health and safety standards were applicable: (1) Expected casualties and risk and (2) air quality emergency response. This study addresses the issues using the U.S. Environmental Protection Agency-recommended model, CALPUFF. Results were compared to those produced by the USAF model, REEDM, developed for projecting air quality from nominal launches. Model performance was also evaluated against results of a Kennedy Space Center-sponsored study at the Los Alamos National Laboratory (LANL) using a computer intensive, wild-fire model. CALPUFF and the LANL model are capable of multipuff modeling of multiple sources. REEDM is a single-source, single-puff model. This study revealed significant deficiencies in REEDM when applied to the catastrophic failure problem. CALPUFF results indicate that, if a Shuttle abort were to occur over land, serious levels of HCl exposure could occur out to distances of at least 10 km, sufficient range to include major onsite visitor viewing areas. A preliminary survey of mitigation alternatives indicates cost-effective measures could be implemented that are sufficiently protective. Recent safety initiatives in response to the Columbia Accident Investigation Board report are not reflected here.

Derived from text

Toxicity; Space Shuttle Boosters; Casualties; Combustion; Atmospheric Models; Exposure

20040081174 Computer Sciences Corp., USA

Space-Based Telemetry and Range Safety (STARS) Study

Hogie, Keith; Crisuolo, Ed; Parise, Ron; [2004]; In English, 8-10 Jun. 2004, Hanover, MD, USA

Contract(s)/Grant(s): NASA Order S-43981-G; No Copyright; Avail: Other Sources; Abstract Only

This presentation will describe the design, development, and testing of a system to collect telemetry, format it into UDP/IP packets, and deliver it to a ground test range using standard IP technologies over a TDRSS link. This presentation will discuss the goal of the STARS IP Formatter along with the overall design. It will also present performance results of the current version of the IP formatter. Finally, it will discuss key issues for supporting constant rate telemetry data delivery when using standard components such as PCI/104 processors, the Linux operating system, Internet Protocols, and synchronous serial interfaces.

Author

Telemetry; Ground Tests; TDR Satellites; Range Safety; Protocol (Computers)

20040079331 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Research and Technology: 2003 Annual Report of the John F Kennedy Space Center

November 2003; In English; Original contains color illustrations

Report No.(s): NASA/TM-2003-211190; No Copyright; Avail: CASI; A10, Hardcopy

The John F. Kennedy Space Center (KSC) is America's Spaceport Technology Center. The KSC technology development program encompasses the efforts of the entire KSC team, consisting of Government and contractor personnel, working in partnership with academic institutions and commercial industry. KSC's assigned mission areas are space launch operations and spaceport and range technologies. KSC's technology development customers include current space transportation programs, future space transportation programs / initiatives, and enabling technical programs. The KSC Research and Technology 2003 Annual Report encompasses the efforts of contributors to the KSC advanced technology development program and KSC technology transfer activities. Dr. Dave Bartine, KSC Chief Technologist, (321) 867-7069, is responsible for publication of this report and should be contacted for any desired information regarding KSC's research and technology development activities.

Author

Research and Development; Space Transportation; Spacecraft Launching; Technology Transfer

20040070714 NASA Ames Research Center, Moffett Field, CA, USA

Debris Dispersion Model Using Java 3D

Thirumalainambi, Rajkumar; Bardina, Jorge; 2004; In English, 2004, Magdeburg, Germany; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes web based simulation of Shuttle launch operations and debris dispersion. Java 3D graphics provides geometric and visual content with suitable mathematical model and behaviors of Shuttle launch. Because the model is so heterogeneous and interrelated with various factors, 3D graphics combined with physical models provides mechanisms to understand the complexity of launch and range operations. The main focus in the modeling and simulation covers orbital dynamics and range safety. Range safety areas include destruct limit lines, telemetry and tracking and population risk near range. If there is an explosion of Shuttle during launch, debris dispersion is explained. The shuttle launch and range operations in this paper are discussed based on the operations from Kennedy Space Center, Florida, USA.

Author

Computerized Simulation; Spacecraft Launching; Mathematical Models; Debris

20040070707 NASA Ames Research Center, Moffett Field, CA, USA

Modeling and Simulation of Shuttle Launch and Range Operations

Bardina, Jorge; Thirumalainambi, Rajkumar; [2004]; In English, Magdeburg, Germany; No Copyright; Avail: CASI; A02, Hardcopy

The simulation and modeling test bed is based on a mockup of a space flight operations control suitable to experiment physical, procedural, software, hardware and psychological aspects of space flight operations. The test bed consists of a weather expert system to advise on the effect of weather to the launch operations. It also simulates toxic gas dispersion model, impact of human health risk, debris dispersion model in 3D visualization. Since all modeling and simulation is based on the internet, it could reduce the cost of operations of launch and range safety by conducting extensive research before a particular launch. Each model has an independent decision making module to derive the best decision for launch.

Author

Spacecraft Launching; Computerized Simulation; Mathematical Models; Space Flight; Flight Operations

20040031734 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Flight Test Results from the Low Power Transceiver Communications and Navigation Demonstration on Shuttle (CANDOS)

Rush, John; Israel, David; Harlacher, Marc; Haas, Lin; September 23, 2003; In English, 23 Sep. 2003, Long Beach, CA, USA Report No.(s): AIAA Paper 2003-6337; No Copyright; Avail: CASI; A03, Hardcopy

The Low Power Transceiver (LPT) is an advanced signal processing platform that offers a configurable and reprogrammable capability for supporting communications, navigation and sensor functions for mission applications ranging from spacecraft TT&C and autonomous orbit determination to sophisticated networks that use crosslinks to support communications and real-time relative navigation for formation flying. The LPT is the result of extensive collaborative research under NASNGSFC s Advanced Technology Program and ITT Industries internal research and development efforts. Its modular, multi-channel design currently enables transmitting and receiving communication signals on L- or S-band frequencies and processing GPS L-band signals for precision navigation. The LPT flew as a part of the GSFC Hitchhiker payload named Fast Reaction Experiments Enabling Science Technology And Research (FREESTAR) on-board Space Shuttle Columbia s final mission. The experiment demonstrated functionality in GPS-based navigation and orbit determination, NASA STDN Ground Network communications, space relay communications via the NASA TDRSS, on-orbit reconfiguration of the software radio, the use of the Internet Protocol (IP) for TT&C, and communication concepts for space based range safety. All data from the experiment was recovered and, as a result, all primary and secondary objectives of the experiment were successful. This paper presents the results of the LPTs maiden space flight as a part of STS- 107.

Author

Flight Tests; Transmitter Receivers; Navigation Instruments; Signal Processing; Platforms; Space Communication

20030065982 NASA Ames Research Center, Moffett Field, CA, USA

Web-based Weather Expert System (WES) for Space Shuttle Launch

Bardina, Jorge E.; Rajkumar, T.; [2003]; In English, 5-8 Oct. 2003, Washington, DC, USA; Copyright; Avail: CASI; A02, Hardcopy

The Web-based Weather Expert System (WES) is a critical module of the Virtual Test Bed development to support ‘go/no

go' decisions for Space Shuttle operations in the Intelligent Launch and Range Operations program of NASA. The weather rules characterize certain aspects of the environment related to the launching or landing site, the time of the day or night, the pad or runway conditions, the mission durations, the runway equipment and landing type. Expert system rules are derived from weather contingency rules, which were developed over years by NASA. Backward chaining, a goal-directed inference method is adopted, because a particular consequence or goal clause is evaluated first, and then chained backward through the rules. Once a rule is satisfied or true, then that particular rule is fired and the decision is expressed. The expert system is continuously verifying the rules against the past one-hour weather conditions and the decisions are made. The normal procedure of operations requires a formal pre-launch weather briefing held on Launch minus 1 day, which is a specific weather briefing for all areas of Space Shuttle launch operations. In this paper, the Web-based Weather Expert System of the Intelligent Launch and range Operations program is presented.
Author
Internet Resources; Weather Forecasting; Flight Conditions; Spacecraft Launching; Decision Support Systems

20030065309 Range Commanders Council, White Sands Missile Range, NM, USA
Enhanced Flight Termination System Study Phase I - IV Reports
Nov. 2002; In English; Original contains color illustrations
Report No.(s): AD-A413201; RCC/RSG-RS-38; No Copyright; Avail: CASI; A11, Hardcopy

The goal of the Enhanced Flight Termination System (EFTS) study was to investigate more robust command links for flight termination including message formats and modulation methods. This study was structured into four phases: Phase I. Requirements Definition/Range Infrastructure: The goal of this phase was to research current flight termination systems (FTSs). The Phase I report was completed in September 2000. Phase II. Technology Assessment: This phase explored and analyzed current analog and digital modulation techniques available for FTS applications. Several manageable solutions were identified that would meet the guidelines and requirements established in Phase I. Based upon the best overall value, the modulation schemes that were determined to warrant additional analysis in Phase III were the continuous phase frequency shift keying (CPFSK) and modified high alphabet (MHA) schemes. The Phase II report was completed in March 2001. Phase III. Technology Demonstration: Based upon the information gathered from Phase I and II of the study, further analysis was conducted during Phase III to determine the optimal modulation scheme and the layout of the digital message to be sent from the ground transmitting system to the flight termination receiver. The Phase III report was completed in January 2002. Phase IV. RCC Standards Recommendations: The objectives of Phase IV were to wrap-up all tasks associated with RS-38 and to prepare and initiate the design validation phase. The tasks included generating the RCC tasks necessary to update the RCC standards affected by EFTS, addressing the TEMPEST requirements for security, implementing EFTS with different scenarios, developing new system performance specifications for validation and development, and estimating the costs for developing EFTS and upgrading the country's ground infrastructure.
DTIC
Flight Control; Range Safety; Abort Apparatus

20030062828 University of Central Florida, Orlando, FL, USA
The Virtual Test Bed Project
Rabelo, Luis C.; 2002 Research Reports: NASA/ASEE Fellowship Program; December 2002, 119-130; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This is a report of my activities as a NASA Fellow during the summer of 2002 at the NASA Kennedy Space Center (KSC). The core of these activities is the assigned project: the Virtual Test Bed (VTB) from the Spaceport Engineering and Technology Directorate. The VTB Project has its foundations in the NASA Ames Research Center (ARC) Intelligent Launch & Range Operations program. The objective of the VTB project is to develop a new and unique collaborative computing environment where simulation models can be hosted and integrated in a seamless fashion. This collaborative computing environment will be used to build a Virtual Range as well as a Virtual Spaceport. This project will work as a technology pipeline to research, develop, test and validate R&D efforts against real time operations without interfering with the actual operations or consuming the operational personnel s time. This report will also focus on the systems issues required to conceptualize and provide form to a systems architecture capable of handling the different demands.
Author
NASA Programs; Virtual Reality; Space Transportation; Systems Engineering; Technology Utilization

20030032429 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Space Based Communications

Simpson, James; Denson, Erik; Valencia, Lisa; Birr, Richard; [2003]; In English, 29 Ap. - 1 May 2003, Cape Canaveral, FL, USA; Original contains black and white illustrations

Report No.(s): KSC-2003-024; No Copyright; Avail: CASI; A02, Hardcopy

Current space lift launches on the Eastern and Western Range require extensive ground-based real-time tracking, communications and command/control systems. These are expensive to maintain and operate and cover only limited geographical areas. Future spaceports will require new technologies to provide greater launch and landing opportunities, support simultaneous missions, and offer enhanced decision support models and simulation capabilities. These ranges must also have lower costs and reduced complexity while continuing to provide unsurpassed safety to the public, flight crew, personnel, vehicles and facilities. Commercial and government space-based assets for tracking and communications offer many attractive possibilities to help achieve these goals. This paper describes two NASA proof-of-concept projects that seek-to exploit the advantages of a space-based range: Iridium Flight Modem and Space-Based Telemetry and Range Safety (STARS). Iridium Flight Modem uses the commercial satellite system Iridium for extremely low cost, low rate two-way communications and has been successfully tested on four aircraft flights. A sister project at Goddard Space Flight Center's (GSFC) Wallops Flight Facility (WFF) using the Globalstar system has been tested on one rocket. The basic Iridium Flight Modem system consists of a L1 carrier Coarse/Acquisition (C/A)-Code Global Positioning System (GPS) receiver, an on-board computer, and a standard commercial satellite modem and antennas. STARS uses the much higher data rate NASA owned Tracking and Data Relay Satellite System (TDRSS), a C/A-Code GPS receiver, an experimental low-power transceiver, custom built command and data handler processor, and digitized flight termination system (FTS) commands. STARS is scheduled to fly on an F-15 at Dryden Flight Research Center in the spring of 2003, with follow-on tests over the next several years.

Author

Spacecraft Launching; Satellite Communication; Flight Tests; Command and Control; Ground Support Systems; Spacecraft Tracking; Space Surveillance (Spaceborne); Spacecraft Landing

20030020715 NASA Ames Research Center, Moffett Field, CA, USA

Intelligent Launch and Range Operations Virtual Test Bed (ILRO-VTB)

Bardina, Jorge; Rajkumar, T.; [2003]; In English, Orlando, FL, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

Intelligent Launch and Range Operations Virtual Test Bed (ILRO-VTB) is a real-time web-based command and control, communication, and intelligent simulation environment of ground-vehicle, launch and range operation activities. ILRO-VTB consists of a variety of simulation models combined with commercial and indigenous software developments (NASA Ames). It creates a hybrid software/hardware environment suitable for testing various integrated control system components of launch and range. The dynamic interactions of the integrated simulated control systems are not well understood. Insight into such systems can only be achieved through simulation/emulation. For that reason, NASA has established a VTB where we can learn the actual control and dynamics of designs for future space programs, including testing and performance evaluation. The current implementation of the VTB simulates the operations of a sub-orbital vehicle of mission, control, ground-vehicle engineering, launch and range operations. The present development of the test bed simulates the operations of Space Shuttle Vehicle (SSV) at NASA Kennedy Space Center. The test bed supports a wide variety of shuttle missions with ancillary modeling capabilities like weather forecasting, lightning tracker, toxic gas dispersion model, debris dispersion model, telemetry, trajectory modeling, ground operations, payload models and etc. To achieve the simulations, all models are linked using Common Object Request Broker Architecture (CORBA). The test bed provides opportunities for government, universities, researchers and industries to do a real time of shuttle launch in cyber space.

Author

Launching; Command and Control; Ground Operational Support System; Spacecraft Launching; Control Simulation

20030006795

Intelligent Launch and Range Operations Testbed

Davis, Rodney D.; Brown, Kevin R.; AIP Conference Proceedings; January 28, 2003; ISSN 0094-243X; Volume 654, Issue no. 1, 304-312; In English; SPACE TECHNOLOGY and APPLICATIONS INT.FORUM-STAIF 2003: Conf.on Thermophysics in Microgravity; Commercial/Civil Next Generation Space Transportation; Human Space Exploration, 2-5 February 2003, Albuquerque, New Mexico, USA; Copyright

Today's space operations rely on a vast network of manual activities and human decisions to safely plan missions, configure systems, conduct flights, and support mission analysis. Literally hundreds of range and launch operations personnel

are required to plan and execute each mission. The cost of operations is a significant portion of the total lifecycle cost of space flight, but it is difficult and risky to experiment with new, potentially lower-cost operational approaches during actual space flight operations. A capability for investigating new operational approaches that promise to significantly reduce cost and complexity for future launch vehicles is needed. This paper will describe the concept of an 'Operations Testbed' that would provide such a capability. [copyright] 2003 American Institute of Physics
Author (AIP)
Cost Estimates; Ground Support Systems; Manual Control; Network Analysis; Personnel; Research Projects; Simulation; Spacecraft Launching; Test Facilities

20030002493 Florida Inst. of Tech., FL USA
Space-Based Encoded Telemetry for Range Safety
Kozaitis, Samuel P.; 2000 Final Administrative Report NASA/ASEE Summer Faculty Fellowship Program; June 2002; In English
Contract(s)/Grant(s): NAG10-280; No Copyright; Avail: Other Sources; Abstract Only

This work involves the analysis of a communication system that uses the NASA Tracking and Data Relay Satellite/space Network (TDRSS/SN) to provide range safety and flight termination system support for expendable launch vehicles and the space shuttle. We examined the high-alphabet scheme for flight termination, and considered an analogous digital system. We also considered the bit-rate needed for a flight termination system using the TDRSS system based on the received signal-to-noise ratio, and link margin. We found that a TDRSS spread-spectrum communication system operating in the vicinity of 150 bits/second could satisfy the requirements for flight termination.
Author
Telemetry; Safety Management; Signal to Noise Ratios; Satellite Networks; Range Safety; Telecommunication

20020080252 ENSCO, Inc., Springfield, VA USA
Safety on Earth From MARSS
Spinoff 2002; 2002, 100-101; In English; Original contains color illustrations; No Copyright; Avail: CASI; E99, Hardcopy; There is no charge for this publication. Shipping and handling charges may apply.

ENSCO, Inc., developed the Meteorological and Atmospheric Real-time Safety Support (MARSS) system for real-time assessment of meteorological data displays and toxic material spills. MARSS also provides mock scenarios to guide preparations for emergencies involving meteorological hazards and toxic substances. Developed under a Small Business Innovation Research (SBIR) contract with Kennedy Space Center, MARSS was designed to measure how safe NASA and Air Force range safety personnel are while performing weather sensitive operations around launch pads. The system augments a ground operations safety plan that limits certain work operations to very specific weather conditions. It also provides toxic hazard prediction models to assist safety managers in planning for and reacting to releases of hazardous materials. MARSS can be used in agricultural, industrial, and scientific applications that require weather forecasts and predictions of toxic smoke movement. MARSS is also designed to protect urban areas, seaports, rail facilities, and airports from airborne releases of hazardous chemical substances. The system can integrate with local facility protection units and provide instant threat detection and assessment data that is reportable for local and national distribution.
Author
Chemical Release Modules; Toxic Hazards; Spilling; Weather Forecasting; Hazards; Emergencies; Protection

20020068019 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The Horizontal Extent of Lightning Based on Altitude and Atmospheric Temperature
Vollmer, David R.; Mar. 26, 2002; In English
Report No.(s): AD-A404049; AFIT/GM/ENP/02M-10; No Copyright; Avail: CASI; A05, Hardcopy

Lightning poses a threat to aircraft in flight. To mitigate this threat, the U.S. Air Force requested a study of lightning distances. Three-Dimensional lightning data were examined for this study, spanning 1 March 1997 to 31 May 2001 and obtained from the Lightning Detection and Ranging System (LDAR) at the Kennedy Space Center, FL. The LDAR data points were first grouped into lightning flashes and branches using spatial and temporal criteria. Rawinsonde data were vertically interpolated to determine the temperature at the flash source point and each branch end point. The horizontal distance from flash sources to branch end was calculated. Percentiles of branch distance were examined as a function of altitude and temperature of the flash source and branch end points. The longest 99th percentile of branch distance (35 to 40 km) was found at 2 to 7 km altitude and between 10 and -20C. The altitude range of the longest branches remained similar by season, but

the longest branches were found in the winter and spring months, with summer and autumn distances shorter by 5 to 10 km. Summer results showed longer branch distances to the south and the winter data showed a significant elongation to the north. DTIC

Lightning; Atmospheric Temperature; Temperature Profiles

20020065046 ACTA, Inc., Torrance, CA USA

Real-Time Debris Footprint

Carbon, Steven L.; Collins, Jon D.; 19th JANNAF Safety and Environmental Protection Subcommittee Meeting; March 2002; Volume 1, 75-84; In English

Contract(s)/Grant(s): FO4703-91-C-0112; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3320

During the launch of a rocket, range safety typically has used the track/locus of the vacuum instantaneous impact point (VIIP) as the indicator of vehicle position. When this track crosses pre-established abort lines, the Mission Flight Control Officer (MFCO) issues a command to abort the launch. The problem with the use of the IIP is that it does not actually show where the debris will impact. Thus decisions to abort are not based on a realistic depiction of the consequences, but rather the crossing of a point and a line, where the position of the line is adjusted to protect the public. There are situations where a more accurate display of the instantaneous debris impact dispersion will permit the MFCO more latitude. This is particularly important with manned launches such as the Space Shuttle and, in fact, a debris footprint has been used by the safety office at the Eastern Range to control the launch for some time. This paper describes a new footprint program, CRTF (Common Real-Time Footprint) that was developed under the joint sponsorship of the Eastern and Western Ranges. The footprint differs in that it is probabilistically based and develops all of the dispersion data in real-time so that it can use the actual state vector as the starting point for the dispersion analysis. The resulting footprint can provide a statistical basis for the MFCO decision. Instead of an abort line, an Impact Limit Line (ILL) can be used for the abort decision, with probabilistic statements such as '99% sure that no fragment will land on the opposite side of the Impact Limit line if abort is initiated when the footprint touches the Impact Limit Line.' The program is designed to compute very quickly and, as part of the RSA real-time system, it will update ten times/second. The method uses a series of bi-variate normal distributions, with each representing the impact distribution for a different debris category. These distributions provide the basis of the probabilistic model. These same bi-variate normal distributions are also used in a risk model in the program to compute risk in real-time. CRTF also has a number of other features that can be used for various vehicle and tracking system failure modes.

Author

Real Time Operation; Debris; Flight Control; Footprints; Range Safety; Trajectory Control

20020065037 Johns Hopkins Univ., Columbia, MD USA

19th JANNAF Safety and Environmental Protection Subcommittee Meeting, Volume 1

Cocchiaro, J. E., Editor; Becker, D. L., Editor; March 2002; In English, 18-21 Mar. 2002, Colorado Springs, CO, USA

Contract(s)/Grant(s): SPO700-97-D-4004

Report No.(s): CPIA-Publ-709-Vol-1; Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3320

This volume, the first of two volumes, is a compilation of 22 unclassified/unlimited technical papers presented at the 19th Joint Army-Navy-NASA-Air Force (JANNAF) Safety & Environmental Protection Subcommittee Meeting. The meeting was held 18-21 March 2002 at the Sheraton Colorado Springs Hotel, Colorado Springs, Colorado. Topics covered include green energetic materials and life cycle pollution prevention; space launch range safety; propellant/munitions demilitarization, recycling, and reuse: and environmental and occupational health aspects of propellants and energetic materials.

Author

Environment Protection; Pollution Control; Health

20020060112 NASA Goddard Space Flight Center, Greenbelt, MD USA

Flight Performance Evaluation of Three GPS Receivers for Sounding Rocket Tracking

Bull, Barton; Diehl, James; Montenbruck, Oliver; Markgraf, Markus; Bauer, Frank, Technical Monitor; [2002]; In English; ION Conference, 24-30 Jan. 2002, San Diego, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

In preparation for the European Space Agency Maxus-4 mission, a sounding rocket test flight was carried out at Esrange, near Kiruna, Sweden on February 19, 2001 to validate existing ground facilities and range safety installations. Due to the absence of a dedicated scientific payload, the flight offered the opportunity to test multiple GPS receivers and assess their

performance for the tracking of sounding rockets. The receivers included an Ashtech G12 HDMA receiver, a BAE (Canadian Marconi) Allstar receiver and a Mitel Orion receiver. All of them provide C/A code tracking on the L1 frequency to determine the user position and make use of Doppler measurements to derive the instantaneous velocity. Among the receivers, the G12 has been optimized for use under highly dynamic conditions and has earlier been flown successfully on NASA sounding rockets. The Allstar is representative of common single frequency receivers for terrestrial applications and received no particular modification, except for the disabling of the common altitude and velocity constraints that would otherwise inhibit its use for space application. The Orion receiver, finally, employs the same Mitel chipset as the Allstar, but has received various firmware modifications by DLR to safeguard it against signal losses and improve its tracking performance. While the two NASA receivers were driven by a common wrap-around antenna, the DLR experiment made use of a switchable antenna system comprising a helical antenna in the tip of the rocket and two blade antennas attached to the body of the vehicle. During the boost a peak acceleration of roughly l7g's was achieved which resulted in a velocity of about 1100 m/s at the end of the burn. At apogee, the rocket reached an altitude of over 80 km. A detailed analysis of the attained flight data is given together with a evaluation of different receiver designs and antenna concepts.
Author
Global Positioning System; Receivers; Sounding Rockets; Flight Tests; Antenna Design; Tracking (Position)

20020050539 Florida Inst. of Tech., Melbourne, FL USA
Signal Characterization for TDRSS Support of Range Safety
Kozaitis, Sam; NASA/ASEE Summer Faculty Fellowship Program; October 2001, 123-131; In English
Contract(s)/Grant(s): NAG10-299; No Copyright; Avail: CASI; A02, Hardcopy

This work involves the analysis of signal attenuation using the NASA Tracking and Data Relay Satellite/Space Network to provide range safety and flight termination system support for expendable launch vehicles and the space shuttle. We found that at least one of the two operational TDRSS satellites could provide flight termination operating at about 250bps. Lowering the data rate could provide a larger link margin. The other satellite's signal would be attenuated below an acceptable link margin due to rocket exhaust. Lowering the data rate could provide a larger link margin.
Author
Launch Vehicles; Satellite Networks; Tracking (Position); Range Safety; TDR Satellites

20020050380 NASA Marshall Space Flight Center, Huntsville, AL USA
Range Safety Systems
Schrock, Kenneth W.; Humphries, Ricky H., Technical Monitor; [2002]; In English; No Copyright; Avail: Other Sources; Abstract Only

The high kinetic and potential energy of a launch vehicle mandates there be a mechanism to minimize possible damage to provide adequate safety for the launch facilities, range, and, most importantly, the general public. The Range Safety System, sometimes called the Flight Termination System or Flight Safety System, provides the required level of safety. The Range Safety System section of the Avionics chapter will attempt to describe how adequate safety is provided, the system's design, operation, and it's interface with the rest of the launch vehicle.
Author
Avionics; Systems Engineering; Range Safety

20020022508 NASA Marshall Space Flight Center, Huntsville, AL USA
Space Launch and Temperature System: Avionics System
Gillis, Amelia; Luna, Steve; Schrock, Ken; Howard, Ricky; Kilpatrick, John, Technical Monitor; [2001]; In English; SLaTS Book Symposium, 6 Sep. 2001, Huntsville, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

This paper outlines the approach needed to develop the avionics system for a Space Launch and Transportation System. Avionics systems development, power, range safety, and simulations considerations are covered. Each of these topics includes the project design inputs that must be considered on the outset. Process steps are then provided to obtain the desired outputs. This paper discusses the importance of starting and staying with an overall systems plan that ensures that all avionics internal and external requirements are fulfilled. Key design, development, testing and implementations considerations are provided.
Author
Spacecraft Launching; Space Transportation; Avionics

20020022489 NASA Marshall Space Flight Center, Huntsville, AL USA

Preliminary Design of a Lightning Optical Camera and ThundEr (LOCATE) Sensor

Phanord, Dieudonne D.; Koshak, William J.; Rybski, Paul M.; Arnold, James E., Technical Monitor; [2001]; In English; AGU Meeting, 10-14 Dec. 2001, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The preliminary design of an optical/acoustical instrument is described for making highly accurate real-time determinations of the location of cloud-to-ground (CG) lightning. The instrument, named the Lightning Optical Camera And ThundEr (LOCATE) sensor, will also image the clear and cloud-obscured lightning channel produced from CGs and cloud flashes, and will record the transient optical waveforms produced from these discharges. The LOCATE sensor will consist of a full (360 degrees) field-of-view optical camera for obtaining CG channel image and azimuth, a sensitive thunder microphone for obtaining CG range, and a fast photodiode system for time-resolving the lightning optical waveform. The optical waveform data will be used to discriminate CGs from cloud flashes. Together, the optical azimuth and thunder range is used to locate CGs and it is anticipated that a network of LOCATE sensors would determine CG source location to well within 100 meters. All of this would be accomplished for a relatively inexpensive cost compared to present RF lightning location technologies, but of course the range detection is limited and will be quantified in the future. The LOCATE sensor technology would have practical applications for electric power utility companies, government (e.g. NASA Kennedy Space Center lightning safety and warning), golf resort lightning safety, telecommunications, and other industries.

Author

Acousto-Optics; Cloud-to-Ground Discharges; Cameras; Microphones; Photodiodes

20020020446 NASA Goddard Space Flight Center, Greenbelt, MD USA

Flight Performance Evaluation of Three GPS Receivers for Sounding Rocket Tracking

Bull, Barton; Diehl, James; Montenbruck, Oliver; Markgraf, Markus; Bauer, Frank, Technical Monitor; [2001]; In English; ION National Technical Meeting, 28-30 Jan. 2002, San Diego, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

In preparation for the European Space Agency Maxus-4 mission, a sounding rocket test flight was carried out at Esrange,, near Kiruna, Sweden on February 19, 2001 to validate existing ground facilities and range safety installations. Due to the absence of a dedicated scientific payload, the flight offered the opportunity to test multiple GPS receivers and assess their performance for the tracking of sounding rockets. The receivers included an Ashtech G12 HDMA receiver, a BAE (Canadian Marconi) Allstar receiver and a Mitel Orion receiver. All of them provide CIA code tracking on the L1 frequency to determine the user position and make use of Doppler measurements to derive the instantaneous velocity. Among the receivers, the G12 has been optimized for use under highly dynamic conditions and has earlier been flown successfully on NASA sounding rockets [Bull, ION-GPS-2000]. The Allstar is representative of common single frequency receivers for terrestrial applications and received no particular modification, except for the disabling of the common altitude and velocity constraints that would otherwise inhibit its use for space application. The Orion receiver, finally, employs the same Mitel chipset as the Allstar, but has received various firmware modifications by DLR to safeguard it against signal losses and improve its tracking performance [Montenbruck et al., ION-GPS-2000]. While the two NASA receivers were driven by a common wrap-around antenna, the DLR experiment made use of a switchable antenna system comprising a helical antenna in the tip of the rocket and two blade antennas attached to the body of the vehicle. During the boost a peak acceleration of roughly 17g's was achieved which resulted in a velocity of about 1100 m/s at the end of the burn. At apogee, the rocket reached a maximum altitude of over 80 km. A detailed analysis of the attained flight data will be given in the paper together with a evaluation of different receiver designs and antenna concepts.

Author

Flight Tests; Global Positioning System; Receivers; Sounding Rockets; Space Missions; Antenna Design

20010110021 Florida Inst. of Tech., Melbourne, FL USA

Space-based Encoded Telemetry for Range Safety

Kozaitis, Sam; 2000 Research Reports: NASA/ASEE Summer Faculty Fellowship Program; October 2001, 131-140; In English; No Copyright; Avail: CASI; A02, Hardcopy

This work involves the analysis of a communication system that uses the NASA Tracking and Data Relay Satellite/Space Network (TDRSS/SN) to provide range safety and flight termination system support for expendable launch vehicles and the space shuttle. We examined the high-alphabet scheme for flight termination, and considered an analogous digital system. We also considered the bit-rate needed for a flight termination system using the TDRSS system based on the received signal-to-noise ratio, and link margin. We found that a TDRSS spread-spectrum communication system operating in the

vicinity of 150 bits/second could satisfy the requirements for flight termination.
Author
Telemetry; Launch Vehicles; Space Shuttles; Digital Systems; Range Safety; Abort Apparatus; Spread Spectrum Transmission

20010092718 Range Commanders Council, White Sands Missile Range, NM USA
Test Standards for Flight Termination Receivers/Decoders
May 2001; In English
Report No.(s): AD-A391997; IRIG-STANDARD-313-01; No Copyright; Avail: CASI; A06, Hardcopy

This standard provides the methodology for testing range safety flight termination receivers (FTRs). It will outline the requirements for each test and establish the pass or fail criteria.
DTIC
Decoders; Flight Tests; Range Safety; Receivers

20010071248 ENSCO, Inc., Cocoa Beach, FL USA
The Evaluation of the Regional Atmospheric Modeling System in the Eastern Range Dispersion Assessment System
Case, Jonathan; May 2001; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS10-96018
Report No.(s): NASA/CR-2001-210259; NAS 1.26:210259; Rept-01-001; No Copyright; Avail: CASI; A04, Hardcopy

The Applied Meteorology Unit (AMU) evaluated the Regional Atmospheric Modeling System (RAMS) contained within the Eastern Range Dispersion Assessment System (ERDAS). ERDAS provides emergency response guidance for Cape Canaveral Air Force Station and Kennedy Space Center operations in the event of an accidental hazardous material release or aborted vehicle launch. The RAMS prognostic data are available to ERDAS for display and are used to initialize the 45th Space Wing/Range Safety dispersion model. Thus, the accuracy of the dispersion predictions is dependent upon the accuracy of RAMS forecasts. The RAMS evaluation consisted of an objective and subjective component for the 1999 and 2000 Florida warm seasons, and the 1999-2000 cool season. In the objective evaluation, the AMU generated model error statistics at surface and upper-level observational sites, compared RAMS errors to a coarser RAMS grid configuration, and benchmarked RAMS against the nationally-used Eta model. In the subjective evaluation, the AMU compared forecast cold fronts, low-level temperature inversions, and precipitation to observations during the 1999-2000 cool season, verified the development of the RAMS forecast east coast sea breeze during both warm seasons, and examined the RAMS daily thunderstorm initiation and precipitation patterns during the 2000 warm season. This report summarizes the objective and subjective verification for all three seasons.
Author
Atmospheric Models; Weather Forecasting; Computerized Simulation; Evaluation

20010069267 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Low Cost GPS System for Real-Time Tracking of Sounding Rockets
Markgraf, M.; Montenbruck, O.; Hassenpflug, F.; Turner, P.; Bull, B.; Bauer, Frank, Technical Monitor; [2001]; In English; 15th ESA Symposium on European Rocket and Balloon, Biarritz, France; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes the development as well as the on-ground and the in-flight evaluation of a low cost Global Positioning System (GPS) system for real-time tracking of sounding rockets. The flight unit comprises a modified ORION GPS receiver and a newly designed switchable antenna system composed of a helical antenna in the rocket tip and a dual-blade antenna combination attached to the body of the service module. Aside from the flight hardware a PC based terminal program has been developed to monitor the GPS data and graphically displays the rocket's path during the flight. In addition an Instantaneous Impact Point (IIP) prediction is performed based on the received position and velocity information. In preparation for ESA's Maxus-4 mission, a sounding rocket test flight was carried out at Esrange, Kiruna, on 19 Feb. 2001 to validate existing ground facilities and range safety installations. Due to the absence of a dedicated scientific payload, the flight offered the opportunity to test multiple GPS receivers and assess their performance for the tracking of sounding rockets. In addition to the ORION receiver, an Ashtech G12 HDMA receiver and a BAE (Canadian Marconi) Allstar receiver, both connected to a wrap-around antenna, have been flown on the same rocket as part of an independent experiment provided by the Goddard Space Flight Center. This allows an in-depth verification and trade-off of different receiver and antenna concepts.
Author
Global Positioning System; Tracking (Position); Radio Receivers; Hardware-in-the-Loop Simulation

20010068926 NASA Marshall Space Flight Center, Huntsville, AL USA

A Diagnostic Analysis of the Kennedy Space Center LDAR Network, 1, Data Characteristics

Boccippio, D. J.; Heckman, S.; Goodman, S. J.; Journal of Geophysical Research; Mar. 16, 2001; ISSN 0148-0227; Volume 106, Issue No. D5, 4769-4786; In English
Contract(s)/Grant(s): NRA-97-MTPE-03
Report No.(s): Paper-2000JD900687; Copyright; Avail: Other Sources

An analytic framework is developed in which to analyze climatological VHF (66 MHz) radiation measurements taken by the Kennedy Space Center Lightning Detection and Ranging (LDAR) network. A 19 month noise-filtered sample of LDAR observations is examined using this framework. It is found that the climatological impulsive VHF source density as observed by LDAR falls off approximately 10 dB every 71 km of ground range away from the network centroid (a 31 km e-folding scale). The underlying vertical distribution of impulsive VHF sources is approximately normally distributed with a mean altitude of 9 km and a standard deviation of 2.7 km; this implies that the loss of below-horizon sources has a negligible effect on column-integrated source densities within a 200 km ground range. At medium to far ranges, location errors are primarily radial and have a slightly asymmetric distribution whose standard deviation increases as r(exp 2). Error moments estimated from observed lightning are significantly higher than those from aircraft-based signal generator or analytic estimates. LDAR bulk flash detection efficiency is predicted to be above 90% to 94-113 km range from the network centroid and to fall below 10% at ranges greater than 200-240 km.
Author

Climatology; Detection; Lightning

20010068349 NASA Wallops Flight Center, Wallops Island, VA USA

A Space Based Internet Protocol System for Launch Vehicle Tracking and Control

Bull, Barton; Grant, Charles; Morgan, Dwayne; Streich, Ron; Bauer, Frank, Technical Monitor; [2001]; In English; ION 57th Annual Meeting, 11-13 Jun. 2001, Albuquerque, NM, USA; No Copyright; Avail: CASI; A01, Hardcopy

Personnel from the Goddard Space Flight Center Wallops Flight Facility (GSFC/WFF) in Virginia are responsible for the overall management of the NASA Sounding Rocket and Scientific Balloon Programs. Payloads are generally in support of NASA's Space Science Enterprise's missions and return a variety of scientific data as well as providing a reasonably economical means of conducting engineering tests for instruments and devices used on satellites and other spacecraft. Sounding rockets used by NASA can carry payloads of various weights to altitudes from 50 km to more than 1,300 km. Scientific balloons can carry a payload weighing as much as 3,630 Kg to an altitude of 42 km. Launch activities for both are conducted not only from established ranges, but also from remote locations worldwide requiring mobile tracking and command equipment to be transported and set up at considerable expense. The advent of low earth orbit (LEO) commercial communications satellites provides an opportunity to dramatically reduce tracking and control costs of these launch vehicles and Unpiloted Aerial Vehicles (UAVs) by reducing or eliminating this ground infrastructure. Additionally, since data transmission is by packetized Internet Protocol (IP), data can be received and commands initiated from practically any location. A low cost Commercial Off The Shelf (COTS) system is currently under development for sounding rockets that also has application to UAVs and scientific balloons. Due to relatively low data rate (9600 baud) currently available, the system will first be used to provide GPS data for tracking and vehicle recovery. Range safety requirements for launch vehicles usually stipulate at least two independent tracking sources. Most sounding rockets flown by NASA now carry GP~ receivers that output position data via the payload telemetry system to the ground station. The Flight Modem can be configured as a completely separate link thereby eliminating the requirement for tracking radar. The system architecture that integrates antennas, GPS receiver, commercial satellite packet data modem, and a single board computer with custom software is described along with the technical challenges and the plan for their resolution. These include antenna development, high Doppler rates, reliability, environmental ruggedness, hand over between satellites, and data security. An aggressive test plan is included which, in addition to environmental testing, measures bit error rate, latency and antenna patterns. Actual launches on a sounding rocket and various aircraft flights have taken place. Flight tests are planned for the near future on aircraft, long duration balloons and sounding rockets. These results, as well as the current status of the project, are reported.
Author (revised)

Antenna Radiation Patterns; Architecture (Computers); Computer Information Security; Global Positioning System; Internets; Launch Vehicles; Tracking Radar

20010067485 NASA Marshall Space Flight Center, Huntsville, AL USA

A Diagnostic Analysis of the Kennedy Space Center LDAR Network 2. Cross-Sensor Studies

Boccippio, D. J.; Heckman, S.; Goodman, S. J.; Journal of Geophysical Research; Mar. 16, 2001; ISSN 0148-0227; Volume 106, Issue No. D5, 4787-4796; In English

Contract(s)/Grant(s): NRA 97-MTPE-03

Report No.(s): Paper-2000JD900688; Copyright; Avail: Other Sources

Range dependencies in total (intracloud and cloud to ground) lightning observed by the Kennedy Space Center Lightning Detection and Ranging (LDAR) network are established through cross comparison with other lightning sensors. Using total lightning observed from space by the Lightning Imaging Sensor (LIS), MAR flash detection efficiency is shown to remain above 90% out to 90-100 km range, and to be below 25% at 200 km range. MAR VHF source location error distributions are also determined as a function of range and are found to be asymmetric with standard deviation increasing roughly as r 2 . Range normalization schemes for total VHF source density are tested and shown to yield significant improvements in correlation with National Lightning Detection Network (NLDN) ground flash density at hourly, daily, monthly, and climatological timescales (up to 50% over uncorrected source densities using an exponential-in-range correction factor with 40-50 km e-folding scale).

Author

Rangefinding; Cloud-to-Ground Discharges; Imaging Techniques; Climatology

20010029164 NASA Goddard Space Flight Center, Greenbelt, MD USA

Telemetry Tracking and Control Through Commercial LEO Satellites

Streich, Ronald C.; Morgan, Dwayne R.; Bull, Barton B.; Grant, Charles E.; Powers, Edward I., Technical Monitor; [2001]; In English; ITC 2001: GPS/DGPS Applications, 22-25 Oct. 2001, Las Vegas, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

Personnel from the Goddard Space Flight Center Wallops Flight Facility (GSFC/WFF in Virginia have successfully tested commercial LEO communications satellites for sounding rocket, balloon and aircraft flight TT&C. The Flight Modern became a GSFC/WFF Advanced Range Technology Initiative (ARTI) in an effort to streamline TT&C capability to the user community at low cost. Ground tests of the Flight Modem verified duplex communications quality of service and measured transmission latencies. These tests were completed last year and results reported in the John Hopkins University (JHU) Applied Physics Laboratory (APL) 4th International Symposium on Reducing Spacecraft Costs for Ground Systems and Operations. The second phase of the Flight Modem baseline test program was a demonstration of the ruggedized version of the WFF Flight Modem flown on a sounding rocket launched it the Swedish rocket range (Esrangc) near Kiruna, Sweden, with results contained in this paper. Aircraft flight tests have been and continue to be conducted. Flights of opportunity are being actively pursued with other centers, ranges and users at universities. The WFF Flight Modem contains a CPS receiver to provide vehicle position for tracking and vehicle recovery. The system architecture, which integrates antennas, CPS receiver, commercial satellite packet data modem and a single board computer with custom software, is described. Small satellite use of the WFF Flight Modem is also being investigated, The Flight Modem provides an independent vehicle position source for Range Safety applications. The LEO communication system contains a coarse position location system, which is compared to GPS ace acy. This comparison allows users, to determine the need for a CPS receiver in addition to the satellite packet data modem for their application.

Author

Telemetry; Global Positioning System; Performance Tests; Communication Satellites; Commercial Spacecraft; Flight Tests; Architecture (Computers)

20010021601 NASA Marshall Space Flight Center, Huntsville, AL USA

LIS Validation at The KSC-ER

Koshak, William J.; Krider, E. P.; Arnold, James E., Technical Monitor; [2000]; In English; 2000 Fall Meeting, 15-19 Dec. 2000, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Each year, thousands of lightning electric field disturbances are recorded and archived by the ground-based field mill (FM) network at the NASA Kennedy Space Center (KSC) and USAF Eastern Range (ER). The FM network has a range of several tens of kilometers, and a digital accuracy of 4 V/m. It has provided years of continuous lightning warning surveillance to KSC-ER space vehicle launch operations, and has undergone one major hardware upgrade since its inception in the early 1970s. Additional KSC lightning warning data is derived from a multistation radio time-of-arrival system called Lightning Detection and Ranging (LDAR). This system provides the location and space-time mapping of individual lightning channels (for both cloud and ground flashes). Additional lightning information for the KSC region is available from the National

Lightning Detection Network (NLDN) and a 5-station local magnetic direction finder network. In this study, all of the above mentioned data are used to ground-validate data derived from the Lightning Imaging Sensor (LIS) onboard the Tropical Rainfall Measuring Mission (TRMM). The FM network can be used to retrieve the charges deposited in a lightning flash, provided the flash is within a few kilometers of the FM Network. Although it is rare to obtain a TRMM overpass of thunderstorms hat occur this close to the FM network, seven such storms have been found and examined in this study. We compare the times and locations of LIS optical pulses with the spatial-temporal character of the FM, LDAR, and magnetic direction finder data. We also inter-compare LIS optical pulse amplitude data with FM-derived charge magnitudes, number of LDAR radio sources, and peak current values from magnetic direction finder data. Generally speaking, LIS lightning locations and times agree favorably with the KSC ground-based systems for most cases, but little correlation appears to exist between optical pulse amplitude and any of charge, # LDAR sources, peak current), owing possibly to the effects of source complexity and/or cloud multiple scattering.
Author
Imaging Techniques; Lightning; Electric Fields; Detection; Sensors

20010002151 ENSCO, Inc., Cocoa Beach, FL USA
An Objective and Subjective Evaluation of RAMS in the Eastern Range Dispersion Assessment System
Applied Meteorology Unit; Wheeler, Mark M.; Manobianco, John; Dianic, Allan V.; Harms, Dewey E.; Rosati, Paul N.; JANNAF 18th Safety and Environmental Protection Subcommittee Meeting; May 2000, 71-81; In English; 18th Safety and Environmental Protection, 8-12 May 2000, Cocoa Beach, FL, USA
Contract(s)/Grant(s): NAS10-96018; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3320

This paper describes the Applied Meteorology Unit's (AMU) evaluation of the Regional Atmospheric Modeling System (RAMS) contained within the Eastern Range Dispersion Assessment System (ERDAS). ERDAS is designed to provide emergency response guidance for space operations at the Cape Canaveral Air Force Station (CCAFS) and Kennedy Space Center (KSC) in the event of an accidental hazardous material release or an aborted vehicle launch. The evaluation protocol is based on the operational needs of the USA Air Force (USAF) 45th Range Safety (45 SW/SE) and 45th Weather Squadron (45 WS), and designed to provide specific information about the capabilities, limitations, and daily use of RAMS in ERDAS for operations at KSC/CCAFS. The ERDAS RAMS evaluation consists of both an objective and subjective component. The objective component verifies the RAMS numerical weather forecasts at a variety of surface and upper-air observational sensors, focusing on temperature, moisture, and wind. In addition, the AMU compared point error statistics for two different configurations of RAMS in order to quantify the impact of a reduction in the model's horizontal resolution. The subjective component verifies the RAMS predicted onset and movement of the central Florida East Coast Sea Breeze (ECSB) and also validates the forecast precipitation over east-central Florida. A portion of the objective and subjective results from the 1999 Florida warm season evaluation is presented in this paper.
Author
Atmospheric Models; Range Safety; Weather; Hazardous Materials; Launching Sites; Accidents; Safety Factors; Warning; Toxicity and Safety Hazard

20000098584 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Space Range Scheduling and the Lean Aerospace Initiative
Matuszak, Alan M.; Mar. 2000; In English
Report No.(s): AD-A380350; AFIT/GSO/ENY/00M-02; No Copyright; Avail: CASI; A05, Hardcopy

This study describes how lean principles and thinking can be applied to space range operations. The 'lean' concepts of the right thing, right place, and the right time are applicable and relevant to this study. The basis for the lean concepts and principles considered is the Lean Aerospace Initiative (LAI). The LAI originated from the International Motor Vehicle Program (IMVP) that was conducted by a team from the Massachusetts Institute of Technology (MIT). The LAI is a collaborative research program involving government, industry, labor, and academia (primarily MIT). The partnership began in 1993 through support of the U.S. Air Force as the Lean Aircraft Initiative and was renamed in 1997 as the Lean Aerospace Initiative when it was realized that lean principles can and should be applied to test and space activities. The partnership allows the exchange of knowledge and research. As a result, it is expected that there will be fundamental improvements and added value in industry and government operations.
DTIC
Space Missions; Aerospace Industry; Scheduling; Information

20000094557 ENSCO, Inc., Cocoa Beach, FL USA

Delta 2 Explosion Plume Analysis Report

Evans, Randolph J.; July 2000; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS10-96018

Report No.(s): NASA/CR-2000-208582; NAS 1.26:208582; Rept-00-004; No Copyright; Avail: CASI; A06, Hardcopy

A Delta II rocket exploded seconds after liftoff from Cape Canaveral Air Force Station (CCAFS) on 17 January 1997. The cloud produced by the explosion provided an opportunity to evaluate the models which are used to track potentially toxic dispersing plumes and clouds at CCAFS. The primary goal of this project was to conduct a case study of the dispersing cloud and the models used to predict the dispersion resulting from the explosion. The case study was conducted by comparing mesoscale and dispersion model results with available meteorological and plume observations. This study was funded by KSC under Applied Meteorology Unit (AMU) option hours. The models used in the study are part of the Eastern Range Dispersion Assessment System (ERDAS) and include the Regional Atmospheric Modeling System (RAMS), HYbrid Particle And Concentration Transport (HYPACT), and Rocket Exhaust Effluent Dispersion Model (REEDM). The primary observations used for explosion cloud verification of the study were from the National Weather Service's Weather Surveillance Radar 1988-Doppler (WSR-88D). Radar reflectivity measurements of the resulting cloud provided good estimates of the location and dimensions of the cloud over a four-hour period after the explosion. The results indicated that RAMS and HYPACT models performed reasonably well. Future upgrades to ERDAS are recommended.

Author

Explosions; Plumes; Dispersing; Diffusion; Cloud Cover; Meteorological Parameters; Hazardous Materials; Toxic Hazards

20000085909 ENSCO, Inc., Cocoa Beach, FL USA

Evaluation of the Regional Atmospheric Modeling System in the Eastern Range Dispersion Assessment System

Case, Jonathan; June 2000; In English

Contract(s)/Grant(s): NAS10-96018

Report No.(s): NASA/CR-2000-208576; NAS 1.26:208576; Rept-00-003; No Copyright; Avail: CASI; A06, Hardcopy

The Applied Meteorology Unit is conducting an evaluation of the Regional Atmospheric Modeling System (RAMS) contained within the Eastern Range Dispersion Assessment System (ERDAS). ERDAS provides emergency response guidance for operations at the Cape Canaveral Air Force Station and the Kennedy Space Center in the event of an accidental hazardous material release or aborted vehicle launch. The prognostic data from RAMS is available to ERDAS for display and is used to initialize the 45th Range Safety (45 SW/SE) dispersion model. Thus, the accuracy of the 45 SW/SE dispersion model is dependent upon the accuracy of RAMS forecasts. The RAMS evaluation task consists of an objective and subjective component for the Florida warm and cool seasons of 1999-2000. The objective evaluation includes gridded and point error statistics at surface and upper-level observational sites, a comparison of the model errors to a coarser grid configuration of RAMS, and a benchmark of RAMS against the widely accepted Eta model. The warm-season subjective evaluation involves a verification of the onset and movement of the Florida east coast sea breeze and RAMS forecast precipitation. This interim report provides a summary of the RAMS objective and subjective evaluation for the 1999 Florida warm season only.

Author

Atmospheric Models; Evaluation; Range Safety; Hazardous Materials

20000064012 NASA Marshall Space Flight Center, Huntsville, AL USA

A Comparison of the Automated Meteorological Profiling System High Resolution Flight Element to the Kennedy Space Center 50 MHz Doppler Wind Profiler

Roberts, Barry C.; Leahy, Frank; [2000]; In English; 9th, 11-15 Sep. 2000, Orlando, FL, USA; No Copyright; Avail: CASI; A01, Hardcopy

Wind profile measurement and the simulation of aerodynamic loads on a launch vehicle play an important role in determining launch capability and post launch assessment of the vehicle's performance. To date, all USA range certified wind profile measurement systems have been based on balloon tracking. Since the 1960's, the standard used by the National Aeronautics and Space Administration and the Air Force at the Cape Canaveral Air Station (CCAS) for detailed wind profile measurements has been the radar tracked, aerodynamically stabilized Jimsphere balloon system. Currently, the Air Force is nearing certification and operational implementation of the Automated Meteorological Profiling System (AMPS) at CCAS and Vandenburg Air Force Base (VAFB). AMPS uses the Global Positioning System for tracking the Jimsphere balloon. It is anticipated that the AMPS/Jimsphere, named the High Resolution Flight Element (HRFE), will have equivalent, or better resolution than the radar tracked Jimsphere, especially when the balloon is far downrange, at a low elevation angle. By the 1980's, the development of Doppler Wind Profilers (DWP) had become sufficiently advanced to justify an experimental

measurement program at Kennedy Space Center (KSC). In 1989 a 50 MHz DWP was installed at KSC. In principal, the 50 MHz DWP has the capability to track the evolution of wind profile dynamics within 5 minutes of a launch. Because of fundamental differences in the measurement technique, there is a significant time and space differential between 50 MHz DWP and HRFE wind profiles. This paper describes a study to quantify these differences from a sample of 50 MHz DWP/HRFE pairs obtained during the AMPS certification test program.
Author
Aerodynamic Loads; High Resolution; Wind Profiles; Jimsphere Balloons; Wind (Meteorology); Automatic Control; Doppler Radar

20000063521 ENSCO, Inc., Cocoa Beach, FL USA
IRIS Product Recommendations
Short, David A.; March 2000; In English
Contract(s)/Grant(s): NAS10-96018
Report No.(s): NASA/CR-2000-208572; NAS 1.26:208572; Rept-00-001; No Copyright; Avail: CASI; A03, Hardcopy

This report presents the Applied Meteorology Unit's (AMU) evaluation of SIGMET Inc.'s Integrated Radar Information System (IRIS) Product Generator and recommendations for products emphasizing lightning and microburst tools. The IRIS Product Generator processes radar reflectivity data from the Weather Surveillance Radar, model 74C (WSR-74C), located on Patrick Air Force Base. The IRIS System was upgraded from version 6.12 to version 7.05 in late December 1999. A statistical analysis of atmospheric temperature variability over the Cape Canaveral Air Force Station (CCAFS) Weather Station provided guidance for the configuration of radar products that provide information on the mixed-phase (liquid and ice) region of clouds, between 0 C and -20 C. Mixed-phase processes at these temperatures are physically linked to electrification and the genesis of severe weather within convectively generated clouds. Day-to-day variations in the atmospheric temperature profile are of sufficient magnitude to warrant periodic reconfiguration of radar products intended for the interpretation of lightning and microburst potential of convectively generated clouds. The AMU also examined the radar volume-scan strategy to determine the scales of vertical gaps within the altitude range of the 0 C to -20 C isotherms over the Kennedy Space Center (KSC)/CCAFS area. This report present's two objective strategies for designing volume scans and proposes a modified scan strategy that reduces the average vertical gap by 37% as a means for improving radar observations of cloud characteristics in the critical 0 C to -20 C layer. The AMU recommends a total of 18 products, including 11 products that require use of the IRIS programming language and the IRIS User Product Insert feature. Included is a cell trends product and display, modeled after the WSR-88D cell trends display in use by the National Weather Service.
Author
Information Systems; Meteorological Radar; Reflectance; Weather Forecasting; Products; Radar Data

20000040113 NASA Goddard Space Flight Center, Greenbelt, MD USA
GPS Sounding Rocket Development at NASA with Simultaneous Multi-Payload Tracking Application
Bull, Barton; Martel, Hugh; [2000]; In English, Breckenridge, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

An inverse differential GPS system has been developed for Sounding Rocket use which includes the flight unit and a ground station capable of extracting GPS data from sounding rocket telemetry, performing a real time differential solution and graphically displaying the rocket's path relative to a predicted trajectory plot. Accuracy has been proven to within less than 10 meters. Postprocessing has increased the precision to within 10 - 20 centimeters. The system has been successfully flown several times and delivered to the Sounding Program Office for routine field use. In addition to providing position, velocity and time GPS data has been used on sounding rockets for vehicle performance analysis, effecting a one hundred fold improvement in data time tagging, and steering an optical tracking device to intercept payloads launched from over the horizon. Precise velocity separation information and timing has been provided to multiple payload systems. Future plans include its use for Range Safety and enabling of interferometric techniques. The technology and software developed also has potential application to small satellite navigation and formation flying.
Author
Global Positioning System; Fabrication; Sounding Rockets; Reliability Analysis; Optical Tracking; Data Acquisition

Subject Terms

Corporate Sources

Document Authors