

Satellite Watcher

United States. National Aeronautics and Space Administration

"Read You Loud and Clear!" Sunny Tsiao,2008 From the Dust Jacket: Regardless of how sophisticated it may be, no spacecraft is of any value unless it can be tracked accurately to determine where it is and how it is performing. At the height of the space race, 6,000 men and women operated NASA's Spaceflight Tracking and Data Network at some two dozen locations across five continents. This network, known as the STDN, began its operation by tracking Sputnik 1, the world's first artificial satellite that was launched into space by the former Soviet Union. Over the next 40 years, the network was destined to play a crucial role on every near-Earth space mission that NASA flew. Whether it was receiving the first television images from space, tracking Apollo astronauts to the Moon and back, or data acquiring for Earth science, the STDN was that intricate network behind the scenes making the missions possible. Some called it the Invisible Network, a hallmark of which was that no NASA mission has ever been compromised due to a network failure. Read You Loud and Clear! is a historical account of the STDN, starting with its formation in the late 1950s to what it is today in the first decade of the twenty-first century. It traces the roots of the tracking network from its beginnings at the White Sands Missile Range in New Mexico to the Tracking and Data Relay Satellite System (TDRSS) space-based constellation of today. The story spans the early days of satellite tracking using the Minitrack Network, through the expansion of the Satellite Tracking And Data Acquisition Network (STADAN) and the Manned Space Flight Network (MSFN), and finally, to the Space and Ground Networks of today. Written from a nontechnical perspective, the author has translated a highly technical subject into historical accounts told within the framework of the U.S. space program. These accounts tell how international goodwill and foreign cooperation were crucial to the operation of the network and why the space agency chose to build the STDN the way it did. More than anything else, the story of NASA's STDN is about the unsung heroes of the space program.

Satellite Tracking Facilities Shirley Thomas,1963 Discusses, for the general reader, the many facets of this system of tracking and receiving stations that constitute our link with the traveler far out in space.

Sinews from Space United States. National Aeronautics and Space Administration,1965

Tracking Our Space Explorers Goddard Space Flight Center,1966

Global Gravity Field Modeling from Satellite-to-Satellite Tracking Data Majid Naeimi,Jakob Flury,2017-02-10 This book provides a sound theoretical basis for the the different gravity field recovery methods and the numerics of satellite-to-satellite tracking data. It represents lectures given at the 'Wilhelm and Else Heraeus Autumn School' in Bad Honnef, Germany, October 4-9, 2015. The emphasis of the school was on providing a sound theoretical basis for the different gravity field recovery methods and the numerics of data analysis. The approaches covered here are the variational equations (classical approach), the acceleration approach and the energy balance approach, all of which are used for global gravity field recovery on the basis of satellite observations. The theory of parameter estimation in satellite gravimetry and concepts for orbit determination are also included. The book guides readers through a broad range of topics in satellite gravimetry, supplemented by the necessary theoretical background and numerical examples. While it provides a comprehensive overview for those readers who are already familiar with satellite gravity data processing, it also offers an essential reference guide for graduate and undergraduate students interested in this field.

Automatic Solar Tracking Sun Tracking Satellite Tracking rastreador solar seguimiento solar seguidor solar automático de seguimiento solar Gerro Prinsloo,Robert Dobson,2015-11-01 Automatic Solar Tracking Sun Tracking : This book details Automatic Solar-Tracking, Sun-Tracking-Systems, Solar-Trackers and Sun Tracker Systems. An intelligent automatic solar tracker is a device that orients a payload toward the sun. Such programmable computer based solar tracking device includes principles of solar tracking, solar tracking systems, as well as microcontroller, microprocessor and/or PC based solar tracking control to orientate solar reflectors, solar lenses, photovoltaic panels or other optical configurations towards the sun. Motorized space frames and kinematic systems ensure motion dynamics and employ drive technology and gearing principles to steer optical configurations such as mangin, parabolic, conic, or cassegrain solar energy collectors to face the sun and follow the sun movement contour continuously (seguimiento solar y automatización, automatización seguidor solar, tracking solar e automação, automação seguidor solar, inseguimento solare, inseguitore solare, energia termica, sole seguito, posizionatore motorizzato) In harnessing power from the sun through a solar tracker or practical solar tracking system, renewable energy control automation systems require automatic solar tracking software and solar position algorithms to accomplish dynamic motion control with control automation architecture, circuit boards and hardware. On-axis sun tracking system such as the altitude-azimuth dual axis or multi-axis solar tracker systems use a sun tracking algorithm or ray tracing sensors or software to ensure the sun's passage through the sky is traced with high precision in automated solar tracker applications, right through summer solstice, solar equinox and winter solstice. A high precision sun position calculator or sun position algorithm is this an important step in the design and construction of an automatic solar tracking system. The content of the book is also applicable to communication antenna satellite tracking and moon tracking algorithm source code for which links to free download links are provided. From sun tracing software perspective, the sonnet Tracing The Sun has a literal meaning. Within the context of sun track and trace, this book explains that the sun's daily path across the sky is directed by relatively simple principles, and if grasped/understood, then it is relatively easy to trace the sun with sun following software. Sun position computer software for tracing the sun are available as open source code, sources that is listed in this book. The book also describes the use of satellite tracking software and mechanisms in solar tracking applications. Ironically there was even a system called sun chaser, said to have been a solar positioner system known for chasing the sun throughout the day. Using solar equations in an electronic circuit for automatic solar tracking is quite simple, even if you are a novice, but mathematical solar equations are over complicated by academic experts and professors in text-books, journal articles and internet websites. In terms of solar hobbies, scholars, students and Hobbyist's looking at solar tracking electronics or PC programs for solar tracking are usually overcome by the sheer volume of scientific material and internet resources, which leaves many developers in frustration when search for simple experimental solar tracking source-code for their on-axis sun-tracking systems. This booklet will simplify the search for the mystical sun tracking formulas for your sun tracker innovation and help you develop your own autonomous solar tracking controller. By directing the solar collector directly into the sun, a solar harvesting means or device can harness sunlight or thermal heat. This is achieved with the help of sun angle formulas, solar angle formulas or solar tracking procedures for the calculation of sun's position in the sky. Automatic sun tracking system software includes algorithms for solar altitude azimuth angle calculations required in following the sun across the sky. In using the longitude, latitude GPS coordinates of the solar tracker location, these sun tracking software tools supports precision solar tracking by determining the solar altitude-azimuth coordinates for the sun trajectory in altitude-azimuth tracking at the tracker location, using certain sun angle formulas in sun vector calculations. Instead of follow the sun software, a sun tracking sensor such as a sun sensor or webcam or video camera with vision based sun following image processing software can also be used to determine the position of the sun optically. Such optical feedback devices are often used in solar panel tracking systems and dish tracking systems. Dynamic sun tracing is also used in solar surveying, DNI analyser and sun surveying systems that build solar infographics maps with solar radiance, irradiance and DNI models for GIS (geographical information system). In this way geospatial methods on solar/environment interaction makes use use of geospatial technologies (GIS, Remote Sensing, and Cartography). Climatic data and weather station or weather center data, as well as queries from sky servers and solar resource database systems (i.e. on DB2, Sybase, Oracle, SQL, MySQL) may also be associated with solar GIS maps. In such solar resource modelling systems, a pyranometer or solarimeter is normally used in addition to measure direct and indirect, scattered, dispersed, reflective radiation for a particular geographical location. Sunlight analysis is important in flash photography where photographic lighting are important for photographers. GIS systems are used by architects who add sun shadow applets to study architectural shading or sun shadow analysis, solar flux calculations, optical modelling or to perform weather modelling. Such systems often employ a computer operated telescope type mechanism with ray tracing program software as a solar navigator or sun tracer that determines the solar position and intensity. The purpose of this booklet is to assist developers to track and trace suitable source-code and solar tracking algorithms for their application, whether a hobbyist, scientist, technician or engineer. Many open-source sun following and tracking algorithms and source-code for solar tracking programs and modules are freely available to download on the internet today. Certain proprietary solar tracker kits and solar tracking controllers include a software development kit SDK for its application programming interface API attributes (Pebble). Widget libraries, widget toolkits, GUI toolkit and UX libraries with graphical

control elements are also available to construct the graphical user interface (GUI) for your solar tracking or solar power monitoring program. The solar library used by solar position calculators, solar simulation software and solar contour calculators include machine program code for the solar hardware controller which are software programmed into Micro-controllers, Programmable Logic Controllers PLC, programmable gate arrays, Arduino processor or PIC processor. PC based solar tracking is also high in demand using C++, Visual Basic VB, as well as MS Windows, Linux and Apple Mac based operating systems for sun path tables on Matlab, Excel. Some books and internet webpages use other terms, such as: sun angle calculator, sun position calculator or solar angle calculator. As said, such software code calculate the solar azimuth angle, solar altitude angle, solar elevation angle or the solar Zenith angle (Zenith solar angle is simply referenced from vertical plane, the mirror of the elevation angle measured from the horizontal or ground plane level). Similar software code is also used in solar calculator apps or the solar power calculator apps for IOS and Android smartphone devices. Most of these smartphone solar mobile apps show the sun path and sun-angles for any location and date over a 24 hour period. Some smartphones include augmented reality features in which you can physically see and look at the solar path through your cell phone camera or mobile phone camera at your phone's specific GPS location. In the computer programming and digital signal processing (DSP) environment, (free/open source) program code are available for VB, .Net, Delphi, Python, C, C+, C++, PHP, Swift, ADM, F, Flash, Basic, QBasic, GBasic, KBasic, SIMPL language, Squirrel, Solaris, Assembly language on operating systems such as MS Windows, Apple Mac, DOS or Linux OS. Software algorithms predicting position of the sun in the sky are commonly available as graphical programming platforms such as Matlab (Mathworks), Simulink models, Java applets, TRNSYS simulations, Scada system apps, Labview module, Beckhoff TwinCAT (Visual Studio), Siemens SPA, mobile and iphone apps, Android or iOS tablet apps, and so forth. At the same time, PLC software code for a range of sun tracking automation technology can follow the profile of sun in sky for Siemens, HP, Panasonic, ABB, Allan Bradley, OMRON, SEW, Festo, Beckhoff, Rockwell, Schneider, Endress Hauser, Fudji electric. Honeywell, Fuchs, Yokonawa, or Muthibishi platforms. Sun path projection software are also available for a range of modular IPC embedded PC motherboards, Industrial PC, PLC (Programmable Logic Controller) and PAC (Programmable Automation Controller) such as the Siemens S7-1200 or Siemens Logo, Beckhoff IPC or CX series, OMRON PLC, Ercam PLC, AC500plc ABB, National Instruments NI PXI or NI cRIO, PIC processor, Intel 8051/8085, IBM (Cell, Power, Brain or Truenorth series), FPGA (Xilinx Altera Nios), Intel, Xeon, Atmel megaAVR, MPU, Maple, Teensy, MSP, XMOS, Xbee, ARM, Raspberry Pi, Eagle, Arduino or Arduino AtMega microcontroller, with servo motor, stepper motor, direct current DC pulse width modulation PWM (current driver) or alternating current AC SPS or IPC variable frequency drives VFD motor drives (also termed adjustable-frequency drive, variable-speed drive, AC drive, micro drive or inverter drive) for electrical, mechatronic, pneumatic, or hydraulic solar tracking actuators. The above motion control and robot control systems include analogue or digital interfacing ports on the processors to allow for tracker angle orientation feedback control through one or a combination of angle sensor or angle encoder, shaft encoder, precision encoder, optical encoder, magnetic encoder, direction encoder, rotational encoder, chip encoder, tilt sensor, inclination sensor, or pitch sensor. Note that the tracker's elevation or zenith axis angle may measured using an altitude angle-, declination angle-, inclination angle-, pitch angle-, or vertical angle-, zenith angle- sensor or inclinometer. Similarly the tracker's azimuth axis angle be measured with a azimuth angle-, horizontal angle-, or roll angle- sensor. Chip integrated accelerometer magnetometer gyroscope type angle sensors can also be used to calculate displacement. Other options include the use of thermal imaging systems such as a Fluke thermal imager, or robotic or vision based solar tracker systems that employ face tracking, head tracking, hand tracking, eye tracking and car tracking principles in solar tracking. With unattended decentralised rural, island, isolated, or autonomous off-grid power installations, remote control, monitoring, data acquisition, digital datalogging and online measurement and verification equipment becomes crucial. It assists the operator with supervisory control to monitor the efficiency of remote renewable energy resources and systems and provide valuable web-based feedback in terms of CO2 and clean development mechanism (CDM) reporting. A power quality analyser for diagnostics through internet, WiFi and cellular mobile links is most valuable in frontline troubleshooting and predictive maintenance, where quick diagnostic analysis is required to detect and prevent power quality issues. Solar tracker applications cover a wide spectrum of solar applications and solar assisted application, including concentrated solar power generation, solar desalination, solar water purification, solar steam generation, solar electricity generation, solar industrial process heat, solar thermal heat storage, solar food dryers, solar water pumping, hydrogen production from methane or producing hydrogen and oxygen from water (HHO) through electrolysis. Many patented or non-patented solar apparatus include tracking in solar apparatus for solar electric generator, solar desalinators, solar steam engine, solar ice maker, solar water purifier, solar cooling, solar refrigeration, USB solar charger, solar phone charging, portable solar charging tracker, solar coffee brewing, solar cooking or solar drying means. Your project may be the next breakthrough or patent, but your invention is held back by frustration in search for the sun tracker you require for your solar powered appliance, solar generator, solar tracker robot, solar freezer, solar cooker, solar drier, solar pump, solar freezer, or solar dryer project. Whether your solar electronic circuit diagram include a simplified solar controller design in a solar electricity project, solar power kit, solar hobby kit, solar steam generator, solar hot water system, solar ice maker, solar desalinators, hobbyist solar panels, hobby robot, or if you are developing professional or hobby electronics for a solar utility or micro scale solar powerplant for your own solar farm or solar farming, this publication may help accelerate the development of your solar tracking innovation. Lately, solar polygeneration, solar trigeneration (solar triple generation), and solar quad generation (adding delivery of steam, liquid/gaseous fuel, or capture food-grade CO₂) systems have need for automatic solar tracking. These systems are known for significant efficiency increases in energy yield as a result of the integration and re-use of waste or residual heat and are suitable for compact packaged micro solar powerplants that could be manufactured and transported in kit-form and operate on a plug-and play basis. Typical hybrid solar power systems include compact or packaged solar micro combined heat and power (CHP or mCHP) or solar micro combined, cooling, heating and power (CCHP, CHPC, mCCHP, or mCHPC) systems used in distributed power generation. These systems are often combined in concentrated solar CSP and CPV smart microgrid configurations for off-grid rural, island or isolated microgrid, minigrid and distributed power renewable energy systems. Solar tracking algorithms are also used in modelling of trigeneration systems using Matlab Simulink (Modelica or TRNSYS) platform as well as in automation and control of renewable energy systems through intelligent parsing, multi-objective, adaptive learning control and control optimization strategies. Solar tracking algorithms also find application in developing solar models for country or location specific solar studies, for example in terms of measuring or analysis of the fluctuations of the solar radiation (i.e. direct and diffuse radiation) in a particular area. Solar DNI, solar irradiance and atmospheric information and models can thus be integrated into a solar map, solar atlas or geographical information systems (GIS). Such models allows for defining local parameters for specific regions that may be valuable in terms of the evaluation of different solar in photovoltaic of CSP systems on simulation and synthesis platforms such as Matlab and Simulink or in linear or multi-objective optimization algorithm platforms such as COMPOSE, EnergyPLAN or DER-CAM. A dual-axis solar tracker and single-axis solar tracker may use a sun tracker program or sun tracker algorithm to position a solar dish, solar panel array, heliostat array, PV panel, solar antenna or infrared solar nanterenna. A self-tracking solar concentrator performs automatic solar tracking by computing the solar vector. Solar position algorithms (TwinCAT, SPA, or PSA Algorithms) use an astronomical algorithm to calculate the position of the sun. It uses astronomical software algorithms and equations for solar tracking in the calculation of sun's position in the sky for each location on the earth at any time of day. Like an optical solar telescope, the solar position algorithm pin-points the solar reflector at the sun and locks onto the sun's position to track the sun across the sky as the sun progresses throughout the day. Optical sensors such as photodiodes, light-dependant-resistors (LDR) or photoresistors are used as optical accuracy feedback devices. Lately we also included a section in the book (with links to microprocessor code) on how the PixArt Wii infrared camera in the Wii remote or Wiimote may be used in infrared solar tracking applications. In order to harvest free energy from the sun, some automatic solar positioning systems use an optical means to direct the solar tracking device. These solar tracking strategies use optical tracking techniques, such as a sun sensor means, to direct sun rays onto a silicon or CMOS substrate to determine the X and Y coordinates of the sun's position. In a solar mems sun-sensor device, incident sunlight enters the sun sensor through a small pin-hole in a mask plate where light is exposed to a silicon substrate. In a web-camera or camera image processing sun tracking and sun following means, object tracking software performs multi object tracking or moving object tracking methods. In an solar object tracking technique, image processing software performs mathematical processing to box the outline of the apparent solar disc or sun blob within the captured image frame, while sun-localization is performed with an edge detection algorithm to determine the solar vector coordinates. An

automated positioning system help maximize the yields of solar power plants through solar tracking control to harness sun's energy. In such renewable energy systems, the solar panel positioning system uses a sun tracking techniques and a solar angle calculator in positioning PV panels in photovoltaic systems and concentrated photovoltaic CPV systems. Automatic on-axis solar tracking in a PV solar tracking system can be dual-axis sun tracking or single-axis sun solar tracking. It is known that a motorized positioning system in a photovoltaic panel tracker increase energy yield and ensures increased power output, even in a single axis solar tracking configuration. Other applications such as robotic solar tracker or robotic solar tracking system uses robotica with artificial intelligence in the control optimization of energy yield in solar harvesting through a robotic tracking system. Automatic positioning systems in solar tracking designs are also used in other free energy generators, such as concentrated solar thermal power CSP and dish Stirling systems. The sun tracking device in a solar collector in a solar concentrator or solar collector Such a performs on-axis solar tracking, a dual axis solar tracker assists to harness energy from the sun through an optical solar collector, which can be a parabolic mirror, parabolic reflector, Fresnel lens or mirror array/matrix. A parabolic dish or reflector is dynamically steered using a transmission system or solar tracking slew drive mean. In steering the dish to face the sun, the power dish actuator and actuation means in a parabolic dish system optically focusses the sun's energy on the focal point of a parabolic dish or solar concentrating means. A Stirling engine, solar heat pipe, thermosyphin, solar phase change material PCM receiver, or a fibre optic sunlight receiver means is located at the focal point of the solar concentrator. The dish Stirling engine configuration is referred to as a dish Stirling system or Stirling power generation system. Hybrid solar power systems (used in combination with biogas, biofuel, petrol, ethanol, diesel, natural gas or PNG) use a combination of power sources to harness and store solar energy in a storage medium. Any multitude of energy sources can be combined through the use of controllers and the energy stored in batteries, phase change material, thermal heat storage, and in cogeneration form converted to the required power using thermodynamic cycles (organic Rankin, Brayton cycle, micro turbine, Stirling) with an inverter and charge controller.

Radio Interferometry and Satellite Tracking Seiichiro Kawase,2012 Worldwide growth of space communications has caused a rapid increase in the number of satellites operating in geostationary orbits, causing overcrowded orbits. This practical resource is designed to help professionals overcome this problem. This timely book provides a solid understanding of the use of radio interferometers for tracking and monitoring satellites in overcrowded environments. Practitioners learn the fundamentals of radio interferometer hardware, including antennas, receiving equipment, signal processing and phase detection, and measurement accuracies. This in-depth volume describes the nature of the targets to be tracked by the interferometer, helping to clarify the movement of target satellites and what specific information has to be caught by the interferometer. Additionally, engineers find details on applications to practical cases of satellite tracking, covering different types of interferometers, recent technical developments, orbital monitoring and safety control.

Discussion of U. S. Satellite Tracking System United States. Congress. House. Committee on Science and Astronautics,1961

A Digital Recording System for Satellite Tracking Data Thomas P. Sifferlen,William M. Hocking,1961

Determination of the Geopotential from Satellite-to-satellite Tracking Data Bruce C. Douglas,Clyde C. Goad,Foster Morrison,1980

Solution of the Angles-only Satellite Tracking Problem R. E. Burns,1997

Meteorological Satellites United States. Congress. House. Committee on Science and Astronautics,United States. Congress. House. Committee on Science and Astronautics. Subcommittee on Applications and Tracking and Data Acquisition,1962

A New Satellite Tracking System for Use in Satellite Triangulation and Related Geodetic Research U.S. Coast and Geodetic Survey,1962

Tracking Wildlife by Satellite Richard B. Harris,1990

Read You Loud and Clear! the Story of NASA's Spaceflight Tracking and Data Network Sunny Tsiao,National Aeronautics and Space Administration,2020-06-19 Regardless of how sophisticated it may be, no spacecraft is of any value unless it can be tracked accurately to determine where it is and how it is performing. At the height of the space race, 6,000 men and women operated NASA's Spaceflight Tracking and Data Network at some two dozen locations across five continents. This network, known as the STDN, began its operation by tracking Sputnik 1, the world's first artificial satellite that was launched into space by the former Soviet Union. Over the next 40 years, the network was destined to play a crucial role on every near-Earth space mission that NASA flew. Whether it was receiving the first television images from space, tracking Apollo astronauts to the Moon and back, or data acquiring for Earth science, the STDN was that intricate network behind the scenes making the missions possible. Some called it the Invisible Network, a hallmark of which was that no NASA mission has ever been compromised due to a net-work failure. Read You Loud and Clear! is a historical account of the STDN, starting with its formation in the late 1950s to what it is today in the first decade of the twenty-first century. It traces the roots of the tracking network from its beginnings at the White Sands Missile Range in New Mexico to the Tracking and Data Relay Satellite System (TDRSS) space-based constellation of today. The story spans the early days of satellite tracking using the Minitrack Network, through the expansion of the Satellite Tracking And Data Acquisition Network (STADAN) and the Manned Space Flight Network (MSFN), and finally, to the Space and Ground Networks of today. Written from a nontechnical perspective, the author has translated a highly technical subject into historical accounts told within the framework of the U.S. space program. These accounts tell how international goodwill and foreign cooperation were crucial to the operation of the network and why the space agency chose to build the STDN the way it did. More than anything else, the story of NASA's STDN is about the unsung heroes of the space program.

You Are the World's Best Satellite Watcher Keep That Shit Up M. F,2020-10-28 Gift this beautiful sleek Funny Satellite Watcher Journal Note Book to the Satellite Watcher in your life. This book is the perfect gift, present or party prize for a Satellite Watcher friend, colleague, family member or loved one. Enjoy the book!

Missile defense alternate approaches to Space Tracking and Surveillance System need to be considered. ,

Radiometric Tracking Techniques for Deep-Space Navigation Catherine L. Thornton,James S. Border,2005-03-04 Radiometric Tracking Techniques for Deep-Space Navigation focuses on a broad array of technologies and concepts developed over the last four decades to support radio navigation on interplanetary spacecraft. In addition to an overview of Earth-based radio navigation techniques, the book includes a simplified conceptual presentation of each radiometric measurement type, its information content, and the expected measeurement accuracy. The methods described for both aquiring and calibrating radiometric measurements also provide a robust system to support guidance and navigation for future robotic space exploration.

Navigation and Tracking in Space: Analysis and Algorithms Sanat K. Biswas,2023-12-31 This book focuses on the navigation and tracking of artificial space objects, with emphasis on modelling the dynamics in a wide range of space missions, including: earth-orbiting satellite missions, launch and re-entry missions as well as interplanetary missions. The book guides you in designing suitable estimation algorithms for each type of mission. It also helps you in addressing non-linearity in designing navigation algorithms for space missions, and walks you through the process for choosing estimators for navigation and tracking of space vehicles. You'll find specific details on earth-orbiting satellite tracking and navigation that helps you determine precise orbit, and will understand how to get navigation and tracking results using the Least Square Estimation and the Extended Kalman Filter (EKF) for simulated observations. You also learn how to address tracking performance of spacecraft in interplanetary trajectories that are affected by a diverse set of problems, such low signal power, intermittent observations, observations at low rate and delays. Techniques for designing navigation and tracking algorithms to address these problems are delineated. The book also provides in-depth coverage of multi-object tracking, relevant data association and estimation algorithms in the Situational Space Awareness context. MATLAB /Simulink based software is provided for simulation and simulated data set. This is an excellent reference and practical tool for professionals in the field of Guidance, Navigation and Control, along with researchers and advanced students in the field of space vehicle navigation, tracking, guidance and control.

Read You Loud and Clear! National Aeronautics and Space Administration,Sunny Tsiao,2014-10-11 At the height of the space race, 6,000 men and women operated NASA's Spaceflight Tracking and Data Network at some two dozen locations across five continents. This network, known as the STDN, began its operation by tracking Sputnik 1, the world's first artificial satellite that was launched into space by the former Soviet Union. Over the next 40 years, the network was destined to play a crucial role on every near-Earth space mission that NASA flew. Whether it was receiving the first television images from space, tracking Apollo astronauts to the Moon and back, or data acquiring for Earth science, the STDN was that intricate network behind the scenes making the missions possible. Some called it the “Invisible Network,” a hallmark of which was that no NASA mission has ever been compromised due to a net-work failure. Read You Loud and Clear! is a historical account of the STDN, starting with its formation in the late 1950s to what it is today in the first decade of the twenty-first century. It traces the roots of the tracking network from its beginnings at the White Sands Missile Range in New Mexico to the Tracking and Data Relay Satellite System (TDRSS) space-based constellation of today. The story spans the early days of satellite tracking using the Minitrack Network, through the expansion of the Satellite Tracking And Data Acquisition Network (STADAN) and the Manned Space Flight Network (MSFN), and finally, to the Space and Ground Networks of today. Written from a nontechnical perspective, the author has translated a highly technical subject into historical accounts told within the framework of the U.S. space program. These accounts tell how international goodwill and foreign cooperation were crucial to the operation of the network and why the space agency chose to build the STDN the way it did. More than any-thing else, the story of NASA's STDN is about the “unsung heroes of the space program.”

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