

1 Overview

This document describes the format and usage of NMEA messages for Orion GPS navigation software. It also details the implementation specifics of NMEA input commands and output sentences supported by Orion.

2 Message Format

Orion NMEA messages conform to the NMEA-0183 Ver. 3.01 (January 1, 2002) standard with implementation specifics as noted below.

Commands start with a dollar-sign ("\$\$"), followed by "PUNV", and a comma (","). The command text (which is defined in section 4) comes next, followed by an asterisk ("*"), two-digit hexadecimal checksum, and the <carriage return> <new line> characters.

Example:

```
$PUNV,<command>*cc<carriage return><new line>
```

2.1 Checksum Calculation

In accordance with NMEA-0183, the checksum is calculated by taking the 8 bit exclusive OR of all characters between (but not including) the "\$" and the "*". The checksum is then appended after the "*" as a 2 character hexadecimal number.

If a command's checksum is omitted or illegal the command will be rejected and an error message issued.

A command with the checksum value "cc" (two lower case "c" characters) will be accepted as valid (this is primarily used for testing purposes).

2.2 Sentence Termination Delimiter

All sentences end with the sentence termination delimiter <carriage return><new line>. This combination is "\n" in C-language format and hexadecimal ASCII values are 0Dh 0Ah. Both characters are required for a command to be recognized.

2.3 NMEA Message Sizes

In accordance with NMEA-0183, the maximum number of characters between the starting delimiter "\$" and the terminating <CR><LF> should be 79. That is, the maximum needed buffer size should be 82 for one output sentence.

For input NMEA commands, the maximum size accepted is 128 characters.

Orion Gps Manual

Richard Jiwoong Hwang



Orion Gps Manual:

Admiralty Navigation Manual ... Great Britain. Admiralty, 1954 The NexStar User's Guide Michael Swanson, 2004-01-30 Michael Swanson's online discussions with literally thousands of NexStar owners made it clear that there was a desperate need for a book such as this one that provides a complete detailed guide to buying using and maintaining NexStar telescopes Although this book is highly comprehensive it is suitable for beginners there is a chapter on Astronomy Basics and experts alike Celestron's NexStar telescopes were introduced in 1999 beginning with their first computer controlled go to model a 5 inch More models appeared in quick succession and Celestron's new range made it one of the two dominant manufacturers of affordable go to telescopes **Cornell CubeSat GPS System - Design of Cougar Receiver for Ionospheric Scintillation Research** Samson Yao, 2002 **Contributions to on-board navigation on 1U CubeSats** Weiß, Sascha, 2022-04-07 This thesis investigates the use of GNSS receivers on 1U CubeSats using the example of BEESAT 4 and BEESAT 9 The integration of such a device on satellites enables highly precise time synchronization position acquisition and orbit determination and prediction The application fields that depend on an accurate attitude control and orbit determination system and can also be processed by CubeSats are highlighted Therefore the state of the art of GNSS receivers is described which are suitable for the use on satellites and could be integrated into 1U CubeSats Further on it is investigated which subsystems of a small satellite are particularly affected and what the special challenges are to realize a precise positioning with a GNSS receiver In addition some developments are presented that have significantly increased the performance of 1U CubeSats in recent years The system concept of BEESAT satellites is introduced and the evolution of the payload board including the use of the latest sensor technologies for attitude control is described It is shown how the verification of the satellite's subsystems was performed on the ground with the focus on testing and simulating the attitude control and the GNSS receiver The necessary integration steps the calibration and environmental test campaign are discussed Both satellites were successfully operated and the results of the on orbit experiments are presented It is shown how a three axis stabilized attitude control was first verified on BEESAT 4 and then a GNSS receiver was successfully operated on BEESAT 9 for more than one year In addition the inter satellite link between BEESAT 4 and BIROS will be analyzed since it is essential for the relative navigation of satellites The acquired navigation data was sent to the ground and the identification of BEESAT 9 was carried out using this data A qualitative analysis of the orbital elements TLE of BEESAT 9 was performed systematically due to a daily operation of the GNSS receiver Furthermore it was investigated how a small GNSS antenna affects the received signal strength from GNSS satellites and whether this antenna or its amplifier degrades over time Additionally an orbit determination and propagation based on the navigation data could be performed and the results are evaluated The analyzed questions allow a statement about the continuous use of GNSS receivers on 1U CubeSats and if it is necessary to achieve the mission objectives Diese Arbeit untersucht den Einsatz von GNSS Empfängern auf 1U

CubeSats am Beispiel von BEESAT 4 und BEESAT 9 Das Integrieren einer solchen Komponente auf Satelliten ermöglicht eine hochgenaue Zeitsynchronisation Positions und Orbitbestimmung sowie deren Vorhersage Es werden die Anwendungsfelder beleuchtet die auf ein akkurates Lageregelungs und Orbitbestimmungssystem angewiesen sind und außerdem auch von CubeSats bearbeitet werden können Dazu wird der Stand der Technik von GNSS Empfängern beschrieben die für den Einsatz auf Satelliten geeignet sind und von ihren Eigenschaften auch auf 1U CubeSats integriert werden können Weitergehend wird untersucht welche Subsysteme eines Kleinstsatelliten besonders betroffen sind und was die speziellen Herausforderungen sind um eine präzise Positionsbestimmung mithilfe eines GNSS Empfängers zu realisieren Dazu werden auch einige Entwicklungen vorgestellt die in den letzten Jahren die Leistungsfähigkeit von 1U CubeSats signifikant erhöht haben Das Systemkonzept der BEESAT Satelliten wird eingeführt und die Evolution der Nutzlastplattform inklusive der Verwendung der jeweils neuesten Sensortechnologien für die Lageregelung beschrieben Es wird gezeigt wie die Verifikation der Subsysteme des Satelliten am Boden erfolgte wobei der Fokus auf dem Testen und Simulieren der Lageregelung und dem GNSS Empfänger liegt Dazu werden die notwendigen Integrationsschritte die Kalibrations und die Umwelttestkampagne diskutiert Beide Satelliten wurden erfolgreich betrieben und die Ergebnisse der on orbit Experimente werden vorgestellt Es wird gezeigt wie zunächst eine dreiaachsenstabilisierte Lageregelung auf BEESAT 4 verifiziert und anschließend auf BEESAT 9 über mehr als ein Jahr ein GNSS Empfänger erfolgreich betrieben wurde Zusätzlich wird der Intersatelliten Link zwischen BEESAT 4 und BIROS analysiert da dieser für die Relativnavigation von Satelliten essentiell ist Die akquirierten Navigationsdaten wurden zum Boden gesendet und die Identifizierung von BEESAT 9 erfolgte mithilfe dieser Daten Eine qualitative Analyse der Orbitalelemente TLE von BEESAT 9 konnte systematisch durchgeführt werden durch einen typischen Einsatz des GNSS Empfängers Weiterhin wurde erforscht wie sich eine kleine GNSS Antenne auf die empfangenen Signalstrahlen der GNSS Satelliten auswirkt und ob diese Antenne oder ihr Verstärker mit der Zeit degradieren Zusätzlich konnte eine Orbitbestimmung und propagation auf Basis der Navigationsdaten durchgeführt und die Ergebnisse ausgewertet werden Die analysierten Fragestellungen erlauben eine Aussage über den durchgängigen Einsatz von GNSS Empfängern auf 1U CubeSats und ob dieser notwendig ist um die Missionsziele zu erreichen

Radiation Effects on Integrated Circuits and Systems for Space

Applications Raoul Velazco, Dale McMorro, Jaime Estela, 2019-04-10 This book provides readers with invaluable overviews and updates of the most important topics in the radiation effects field enabling them to face significant challenges in the quest for the insertion of ever higher density and higher performance electronic components in satellite systems Readers will benefit from the up to date coverage of the various primary classical sub areas of radiation effects including the space and terrestrial radiation environments basic mechanisms of total ionizing dose digital and analog single event transients basic mechanisms of single event effects system level SEE analysis device level circuit level and system level hardening approaches and radiation hardness assurance Additionally this book includes in depth discussions of several newer areas of

investigation and current challenges to the radiation effects community such as radiation hardening by design the use of Commercial Off The Shelf COTS components in space missions CubeSats and SmallSats the use of recent generation FPGA s in space and new approaches for radiation testing and validation The authors provide essential background and fundamentals in addition to information on the most recent advances and challenges in the sub areas of radiation effects Provides a concise introduction to the fundamentals of radiation effects latest research results and new test methods and procedures Discusses the radiation effects and mitigation solutions for advanced integrated circuits and systems designed to operate in harsh radiation environments Includes coverage of the impact of Small Satellites in the space industry [Back to the Moon](#) Travis S. Taylor,Les Johnson,2010-12-01 THE SECOND TIME AROUND IS HARDER Decades after the last footprints were left on the Moon the U S was preparing to return to the Lunar surface in a new class of rockets when the mission suddenly became much more urgent It would have to be a rescue mission Unbeknownst to the rest of the world China had sent its own Lunar expedition A manned expedition Until a distress call was received no human outside of China even knew that the mission was manned or that their ship had crash landed and couldn t take off again Time was running out and if the four Chinese astronauts were to be rescued the American lunar mission would have to launch immediately with only a skeleton crew Once the heroic U S astronauts were underway the army of engineers and scientists back home had the daunting task of deciding what equipment could be left on the Moon to permit the Lunar lander vehicle vehicle to lift safely from the Moon with the two U S astronauts and the four stranded Chinese taikonauts Could the U S mount such a mission successfully and would thousands of years of instilled honor _allow the Chinese astronauts to accept a rescue At the publisher s request this title is sold without DRM Digital Rights Management **Study of a GPS Receiver for the Investigation of Ionospheric Scintillations** Zhuoyan Cai,2002 **Orion Surfacing** I.James Forrest,2015-08-12 With rich and colourful detail Orion Surfacing takes its readers from the cold darkness of space to the lush greenery and welcoming waters of the tropics as a brilliant young scientist delves into a mystery that has been unravelling in the jungles of Guatemala and beneath the ocean s waves for more than a thousand years But just as the pieces start to fall together the realization that he is not alone in his search threatens to blow his world apart in a hail of bullets and the fiery whoosh of gasoline igniting on the water s surface Undeterred he continues on with the help of unlikely allies and mysterious beings whom he struggles to understand When the dust settles everything he knows about the world and himself will be called into question and nothing will ever be the same [Guidance and Control 2008](#) Michael E. Drews,Robert D. Culp,2008 **Our Navy, the Standard Publication of the U.S. Navy** ,1923 **Queen of the Road** Doreen Orion,2008-06-03 A pampered Long Island princess hits the road in a converted bus with her wilderness loving husband travels the country for one year and brings it all hilariously to life in this offbeat and romantic memoir Doreen and Tim are married psychiatrists with a twist She s a self proclaimed Long Island princess grouchy couch potato and shoe addict He s an affable though driven outdoorsman When Tim

suggests chucking it all to travel cross country in a converted bus Doreen asks Why can t you be like a normal husband in a midlife crisis and have an affair or buy a Corvette But she soon shocks them both agreeing to set forth with their sixty pound dog two querulous cats and no agenda in a 340 square foot bus Queen of the Road is Doreen s offbeat and romantic tale about refusing to settle about choosing the unconventional road with all the misadventures it brings fire flood armed robbery and finding themselves in a nudist RV park to name just a few The marvelous places they visit and delightful people they encounter have a life changing effect on all the travelers as Doreen grows to appreciate the simple life Tim mellows and even the pets pull together Best of all readers get to go along for the ride through forty seven states in this often hilarious and always entertaining memoir in which a boisterous marriage of polar opposites becomes stronger than ever Ley Lines Uncovered Conrad Riker, Are you tired of feeling disconnected from the world around you Are you seeking a deeper understanding of the spiritual energy that flows through us and the Earth itself If so this book is for you Ley Lines Uncovered Ancient Energy Modern Discovery delves into the world of ley lines exploring their ancient roots and modern significance This comprehensive guide answers the following questions 1 What are ley lines and how do they affect our world 2 How can understanding ley lines enhance my spiritual journey 3 Can ley lines be used for healing or personal growth 4 What is the connection between ley lines and ancient structures like pyramids and temples 5 How did indigenous peoples like the Maori use ley lines for navigation and trade 6 Are ley lines truly a global phenomenon 7 What is the psychological impact of ley lines on our minds and emotions 8 How can I practically apply knowledge of ley lines in my daily life Whether you are a spiritual seeker a newcomer to energy work or a curious explorer this book offers valuable insights into the mysterious world of ley lines If you want to reconnect with the Earth s energy and discover a powerful source of spiritual growth buy this book today *Empires Of The Sea* Radhika Seshan, 2024-02-21 An enthralling journey through 2 000 years of India s steadfast relations with the seas The Indian Ocean world s significance in human history is impossible to dismiss The 1 000 odd kilometres of the subcontinent s coastline which underpinned some of the world s greatest empires and shaped countless human lives therefore make for the perfect dock from which to embark on a journey through the centuries for a vital reappraisal of India s history In this eye opening book noted historian Radhika Seshan sets out to map our age old connections with the seas tracing maritime linkages from the Harappan period all the way to the long colonial era Her re examination of India s past through the prism of water reveals the extent to which this conduit enabled trade and the movement of people often leading to the establishment of crucial ports communities kingdoms and empires The Chola Chalukya and Vijayanagar empires historic ports such as Muziris and Bharuch and accounts of travellers explorers merchants and monarchs who frequented India s shores are explored here in vivid detail with the sea providing a riveting backdrop of adventure migration invasion and rich cultural networks While the arrival of the Europeans the subsequent Raj and their consolidation of terrestrial networks marked the gradual decline of our maritime dominance the seas hold sway

over our geopolitics even today Combining scholarly rigour with a storyteller s flair Empires of the Sea presents India afresh as a nation of pluralities made possible by virtue of its long standing maritime relations with the world at large

Proceedings of the 44th Annual American Astronautical Society Guidance, Navigation, and Control Conference, 2022 Matt Sandnas, David B. Spencer, 2024-03-30 This conference attracts GN C specialists from across the globe The 2022 Conference was the 44th Annual GN C conference with more than 230 attendees from six different countries with 44 companies and 28 universities represented The conference presented more than 100 presentations and 16 posters across 18 topics This year the planning committee wanted to continue a focus on networking and collaboration hoping to inspire innovation through the intersection of diverse ideas These proceedings present the relevant topics of the day while keeping our more popular and well attended sessions as cornerstones from year to year Several new topics including Autonomous Control of Multiple Vehicles and Results and Experiences from OSIRIS REx were directly influenced by advancements in our industry In the end the 44th Annual GN C conference became a timely reflection of the current state of the GN C ins the space industry The annual American Astronautical Society Rocky Mountain Guidance Navigation and Control GN C Conference began 1977 as an informal exchange of ideas and reports of achievements among guidance and control specialists local to the Colorado area Bud Gates Don Parsons and Bob Culp organized the first conference and began the annual series of meetings the following winter In March 1978 the First Annual Rocky Mountain Guidance and Control Conference met at Keystone Colorado It met there for eighteen years moving to Breckenridge in 1996 where it has been for over 25 years

Riding the Wild Ocean: Around Cape Cod in a Small Sloop and Other Adventures Paul S. Krantz Jr., 2018 Riding the Wild Ocean is a compilation of author Paul Krantz s wildest adventures over the years which takes us from coastal New England to the Dry Tortugas all in small boats under twenty feet in length Beyond the sheer thrill of adventure Riding the Wild Ocean is a how to manual for the serious sailor contemplating trying his or her hand at such open ocean adventuring in small boats including how to select and equip a boat for all weather day and night sailing and how to prepare one s self as well through gradual exposure to extreme conditions in controlled situations

Technical Reports Awareness Circular : TRAC. , 1988-02 **CubeSat** Richard Jiwoong Hwang, 2004 **Beyond the Wound** Conrad Riker, 101-01-01 Transform Existential Crisis into Unbreakable Purpose Struggling to find meaning in a world that mocks your masculinity Trapped between societal lies and your soul s call to lead Fearful that progress has made men weak lost and replaceable Unlock the ancient blueprint for masculine rebirth hidden in spiritual traditions Shatter the double binds of modern ideology that keep you weak and divided Harness pain as the catalyst for ego death and evolutionary growth Reclaim your role as a leader protector and truth seeker in a broken world Forge unbreakable brotherhoods that transcend cultural decay Discover why feminine support thrives under strong masculine sovereignty Master shadow work techniques to integrate darkness into unstoppable power Align with cosmic order through rituals that anchor biological truth If you re

ready to rise from the ashes of modern deception as the sovereign man you were born to be buy this book today Your rebirth starts now *The Seventh Landing* Michael Carroll, 2009-08-15 It's been thirty five years since people last trod the dusty plains of the Moon Over the course of six landings from 1969 to 1972 twelve men explored four wheeled dug and hiked across the lunar surface Now NASA has plans for a seventh landing on the Moon This time they want to stay NASA's plans dubbed the Constellation architecture involve the largest launch vehicle ever built new types of propulsion and a six person vehicle to ferry crews from Earth to the Moon But NASA's plans go far beyond Luna Eventually the lessons learned on the Moon's outpost at Shackleton Crater will teach us how to live permanently on the most Earthlike world in our solar system Mars NASA will have company plans for future lunar exploration are being drawn by Europe Japan China and India While specific hardware and mission details will be in flux for some time the overarching goals strategies and inspiration for the seventh landing will not change This book will choose a typical scenario for getting to the Moon that embraces the spirit of exploration embodied by NASA's Constellation architecture Each chapter moves from a general description to the specific nuts and bolts of engineering and science The Seventh Landing reveals the very latest strategies for how we'll get to the Moon what we know today what we want to find out and what life will be like at the first true outposts on the Moon and Mars

Safety Design for Space Systems Tommaso Sgobba, Gary Eugene Musgrave, Gary Johnson, Michael T. Kezirian, 2023-07-25 The lack of widespread education in space safety engineering and management has profound effects on project team effectiveness in integrating safety during design On one side it slows down the professional development of junior safety engineers while on the other side it creates a sectarian attitude that isolates safety engineers from the rest of the project team To speed up professional development bridge the gap within the team and prevent hampered communication and missed feedback the entire project team needs to acquire and develop a shared culture of space safety principles and techniques The second edition of Safety Design for Space Systems continues to address these issues with substantial updates to chapters such as battery safety life support systems robotic systems safety and fire safety This book also features new chapters on crew survivability design and nuclear space systems safety Finally the discussion of human rating concepts safety by design principles and safety management practices have also been revised and improved With contributions from leading experts worldwide this second edition represents an essential educational resource and reference tool for engineers and managers working on space projects Provides basic multidisciplinary knowledge on space systems safety design Addresses how space safety engineering and management can be implemented in practice Includes new chapters on crew survivability design and nuclear space systems safety Fully revised and updated to reflect the latest developments in the field

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