



National Aeronautics and Space
Administration Goddard Earth Science Data
Information and Services Center (GES)

README Document for the Geodynamics Experimental Ocean Satellite (GEOS 3) Satellite-to-Satellite Tracking Data

GEOS3STST

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Goddard Earth Sciences Data and Information Services Center (GES DISC)
<http://disc.gsfc.nasa.gov>
NASA Goddard Space Flight Center
Code 610.2
Greenbelt, MD 20771 USA

Prepared By:

James E. Johnson

01/24/2024

Name

GES DISC

GSFC Code 610.2

Date

Reviewed By:

Name

mm/dd/yyyy

Name

GSFC Code xxx

Date

Name

mm/dd/yyyy

Name

GSFC Code xxx

Date

Goddard Space Flight Center
Greenbelt, Maryland

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01/24/2024	Original	James E. Johnson

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1. Introduction

This document provides basic information on using the GEOS-3 Satellite-to-Satellite Tracking Data product.

1.1 Data Product Description

The GEOS 3 Satellite-to-Satellite Tracking Data product contains geodetic observations obtained from GEOS 3 relayed by the ATS 6 spacecraft to various ground stations. The data were written to sixteen data files which were then copied and archived on a single 3480 cartridge tape using an IBM 9021 computer.

The 16 data files consist of multiple data records, each written in ASCII text. A data record is 1800 bytes in size and contains 25 lines of text of length 72 bytes (the last record may be shorter than 1800 bytes). These data files were written using the ATSR teletype where two lines are required for each measurement. The two lines contain: two angle measurements, four range rate measurements, four range measurements, a single time tag, a satellite identification code, a station identification code, and four additional codes. The data for this product cover the time period from April 13, 1975 through April 28, 1976.

This product was previously available from the NASA National Space Science Data Center (NSSDC) under the name GEOS 3 Satellite-to-Satellite Tracking, with the identifier ESGP-00088 (old id 75-027A-06A).

1.1.1 Instrument

The satellite-to-satellite tracking system consisted of: (1) the ground-based Application Technology Satellite ranging system (modified for satellite-to-satellite tracking); (2) the wideband communication transponder on the ATS 6 geosynchronous spacecraft; and, (3) the ranging transponder on the low-orbiting satellite. The ATS 6 was stationed over both the Pacific near continental U.S. and Africa. ATS 6 ground stations at various times were operated at Rosman, North Carolina; Mojave, California; and Madrid, Spain. The low-orbiting satellites tracked via ATS 6 were GEOS 3, Apollo-Soyuz, and Nimbus 6.

The principal investigator for the Satellite-to-Satellite Tracking experiment was Indalecio Galicinao from NASA/GSFC.

1.1.2 Satellite

The third Geodetic and Earth Orbiting Satellite or GEOS 3, later renamed Geodynamics Experimental Ocean Satellite, was an octahedron spacecraft, topped by a truncated pyramid, with a parabolic reflector for a radar altimeter on the flat bottom side. A metal ribbon boom with end mass extended upward approximately 6.1 m from the top of the pyramid. Passive laser retroreflector cubes were mounted in a ring around the parabolic reflector with the normal vector from each cube facing 45 deg outward from the direction of the earth. A turnstile antenna for VHF and UHF frequencies and separate antennae for earth-viewing 324-MHz Doppler, C-band, and S-band transponders were mounted separately on flat surfaces next to the parabolic reflector. The dimension across the flats of the octahedron was 1.22 m, and the spacecraft was 1.11 m high.

The mission provided the stepping stone between the National Geodetic Satellite Program (NGSP) and the Earth and Ocean Physics Application Program. It provided data to refine the geodetic and geophysical results of the NGSP and served as a test for new systems. Mission objectives were to perform a satellite altimetry experiment in orbit, to support further the calibration and position determination of NASA and other agency C-band radar systems, and to perform a satellite-to-satellite tracking experiment with the ATS 6 spacecraft using an S-band transponder system. This system was also used for periodic GEOS 3 telemetry data relay through ATS 6, to support further the intercomparison of tracking systems, to investigate the solid-earth dynamic phenomena through precision laser tracking, to refine further orbit determination techniques and determine interdatum ties and gravity models, and to support the calibration and position determination of NASA Spaceflight Tracking and Data Network (STDN) S-band tracking stations.

The orbit of the satellite can be characterized by the following:

- perigee: 818 km / apogee: 858 km
- period: 101.82 minutes
- inclination: 115.0 degrees
- eccentricity: 0.00277

1.2 Data Disclaimer

Users should cite this data product in their research.

Galicinao, I. (2024), GEOS-3 Satellite to Satellite Tracking V001, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [Data Access Date], <https://doi.org/10.5067/3FGX7G40IDDP>.

1.3 Known Issues

Please review the GEOS-C: User's Guide for Satellite To Satellite System Observations and Data Formats before using these data.

2. Data Organization

2.1 File Naming Convention

The data product files are named according to the following convention:

<Platform>-<Product>_<StartDate>-<EndDate>_<Tape>-<File>.<Suffix>

where:

- o Platform = name of the satellite (GEOS3)
- o Product = abbreviation of the product (STST)
- o StartDate/EndDate = Data start and end date in format <YYYY>m<MMDD> where
 - 1 YYYY = 4 digit year (1972)
 - 2 MM = 2 digit month (01-12)
 - 3 DD = 2 digit day of month (01-31)
- o Tape = tape number (DR primary tape, DS backup tape plus 4 digit number)
- o File = file number on tape (2 digit number)
- o Suffix = the file format (always TAP, indicating binary data tape file)

File name example: GEOS3-STST_1975m0413-1975m0422_DR5901-01.TAP

2.2 File Format and Structure

The GEOS-3 Satellite-to-Satellite Tracking product spans the time period from April 13, 1975 through April 28, 1976. There are sixteen files with several hundred data records, where each is twenty-five 72 byte lines of ASCII text. The first 72 byte line of text within a block of measurements indicates the format type, satellite identifier code, and date. This is followed by the measurements, each of which consists of two lines of text. Below is an example showing the first 9 lines of text in a block of measurements (4 shown) within in a file:

```
..ATSR 7403901 750413
 3332 0010847751202001"103080030 0010833451201907
-3696 0010833051201893/600473050 0010832651201923
 3332 0010832251201952"103080034 0010831851201986
-3695 0010831451201947/600473050 0010831051201892
 3332 0010830751201902"103080038 0010830351201965
-3695 0010829951201975/600473050 0010829551201959
 3333 0010829151201930"103080042 0010828851201865
-3695 0010828351201954/600473050 0010827951201988
```

This data collection consisted of data from a single primary tape (designated with a DR and four digits) containing sixteen data files.

3. Data Contents

3.1 Data Records

The data file contains multiple data records each with a size of up to 1800 bytes. Each record is made up of twenty-five lines of ASCII text of length 72 bytes.

Table 3-1-1: Measurement Block Header

Column	Description
1 - 6	Format (always “..ATSR”)
7	Blank
8 - 14	Satellite International Identifier Code: “7403901” (ATS-6)
15	Blank
16 - 21	Date of Tracking (yymmdd format)
22 - 72	Unused

Table 3-1-2: Measurement Line 1

Column	Description
1 - 5	Antenna Position (sign and 4 digits)
6	Quality Data Space (indicates all loops locked)
7 - 14	Range Data 1
15 - 22	Range Rate Data 1
23	Line 1 ID = “ (double quote character)
24 - 32	Time Stamp (dddhhmmss)
33	Quality Data Space (indicates all loops locked)
34 - 41	Range Data 2
42 - 49	Range Rate Data 2
50 - 72	Unused

Table 3-1-3: Measurement Line 2

Column	Description
1 - 5	Antenna Position (sign and 4 digits)
6	Quality Data Space (indicates all loops locked)
7 - 14	Range Data 3
15 - 22	Range Rate Data 3
23	Line 2 ID = / (forward slash character)
24 - 26	Relay Satellite Code: digit 1 = satellite, digit 2,3 = equipment mode, target object (see tabled below)
27 - 28	Station ID
29	Code 1 = Ambiguity and Resolution
30	Code 2 = Sample Rate
31	Code 3 = Frequency Indicator
32	Code 4 = Spare
33	Quality Data Space (indicates all loops locked)
34 - 41	Range Data 4
42 - 49	Range Rate Data 4
50 - 72	Unused

Table 3-1-4: ATS Satellite Identification

SAT	ATS Series
0xx	ATS-1 VHF
1xx	ATS-1
2xx	ATS-3 VHF
3xx	ATS-3
5xx	ATS-5
6xx	ATS-6

Table 3-1-5: Satellite To Satellite Identification

Equipment Mode	Target Object							
	= 0	= 1	= 2	= 3	= 4	= 5	= 6	= 7
0 = Sidetone	ATS-6			Boresite				
1 = Coherent	Nimbus	GEOS	ASTP	Boresite				
2 = PLL Satellite	GEOS	ASTP						
3 = Crystal Satellite	Nimbus							
4 = Crystal Ground	Rosman	Mojave	Santiago	Mobile	NTTF	Houston	Madrid	Ascension
5 = PLL Ground	Rosman	Mojave	Santiago	Mobile	NTTF	ASTP Houston	ASTP Madrid	

(PLL = Phase Locked Loop, ATS = Applications Technology Satellite, ASTP = Apollo Soyus Test Project, NTTF = NASA/GSFC Network Testing and Training Facility)

Table 3-1-6: Station Identification

Station Name	Type	ID No.
Rosman	Transmitter	58
Mojave Mobile	Transmitter	66
Madrid Mobile	Transmitter	99
Rosman	Crystal Transponder	40
Rosman	Phase Locked Loop Transponder	50
Mojave	Crystal Transponder	41
Mojave	Phase Locked Loop Transponder	51
Santiago	Crystal Transponder	42
Santiago	Phase Locked Loop Transponder	52
Boresite	Crystal Transponder	43
Boresite	Phase Locked Loop Transponder	53
NTTF	Crystal Transponder	44
NTTF	Phase Locked Loop Transponder	54
Port Loc	Crystal Transponder	45
Port Loc	Phase Locked Loop Transponder	55
Ascension Island	Crystal Transponder	46 (assumed)
Johannesburg	Crystal Transponder	47 (assumed)

3.2 Metadata

The metadata are contained in a separate XML formatted file having the same name as the data file with .xml appended to it.

Table 3-2: Metadata attributes associated with the data file.

Name	Description
LongName	Long name of the data product.
ShortName	Short name of the data product.
VersionID	Product or collection version.
GranuleID	Granule identifier, i.e. the name of the file.
Format	File format of the data file.
ChecksumType	Type of checksum used.
ChecksumValue	The value of the calculated checksum.
SizeBytesDataGranule	Size of the file or granule in bytes.
InsertDateTime	Date and time when the granule was inserted into the archive. The format for date is YYYY-MM-DD and time is hh-mm-ss.
RangeBeginningDate	Begin date when the data was collected in YYYY-MM-DD format.
RangeBeginningTime	Begin time of the date when the data was collected in hh-mm-ss format.
RangeEndingDate	End date when the data was collected in YYYY-MM-DD format.
RangeEndingTime	End time of the date when the data was collected in hh-mm-ss format.
PlatformShortName	Short name or acronym of the platform or satellite
InstrumentShortName	Short name or acronym of the instrument
SensorShortName	Short name or acronym of the sensor
WestBoundingCoordinate	The westernmost longitude of the bounding rectangle (-180.0)
NorthBoundingCoordinate	The northernmost latitude of the bounding rectangle (+90.0)
EastBoundingCoordinate	The easternmost longitude of the bounding rectangle (+180.0)
SouthBoundingCoordinate	The southernmost latitude of the bounding rectangle (-90.0)
Elapsed_Days	Duration in days of data collected during mission

4. Reading the Data

The data are written in a binary record-oriented format called TAP. Each 1800 byte record is written in ASCII text consisting of twenty-five lines of text of length 72 bytes. The last record may be less than 1800 bytes, but will be an increment of 72 bytes.

5. Data Services

5.1 GES DISC Search

The GES DISC provides a keyword, spatial, temporal and advanced (event) searches through its unified search and download interface:

<https://disc.gsfc.nasa.gov/>

5.2 Documentation

The data product landing page provides information about the data product, as well as links to download the data files and relevant documentation:

https://disc.gsfc.nasa.gov/datacollection/GEOS3STST_001.html

5.3 Direct Download

The data product is available for users to download directly using HTTPS:

<https://acdisc.gesdisc.eosdis.nasa.gov/data/GEOS/GEOS3STST.001/>

6. More Information

6.1 Contact Information

Name: GES DISC Help Desk

URL: <https://disc.gsfc.nasa.gov/>

E-mail: gsfc-help-disc@lists.nasa.gov

Phone: 301-614-5224

Fax: 301-614-5228

Address: Goddard Earth Sciences Data and Information Services Center
Attn: Help Desk
Code 610.2
NASA Goddard Space Flight Center
Greenbelt, MD 20771, USA

6.2 References

H. Ray Stanley, "The Geos 3 Project", J. Geophys. Res., v. 84, n. B8, pp 3779-3783, 1979

P. Argentiero, et al., "Results of GEOS 3/ATS 6 Satellite-to-Satellite Tracking Orbit Determination Experiment", J. Geophys. Res., v. 84, n. B8, pp. 3921-3925, 1979.

J. W. Bryan, J. J. Lynn, and A. O. Hinely, "GEOS-C: A User's Guide for Satellite to Satellite System Observations and Data Formats", NASA/GSFC, March 1979

7. Appendices

7.1 Acknowledgements

The Nimbus data recovery task at the GES DISC is funded by NASA's Earth Science Data and Information System program.

7.2 Acronyms

EOS: Earth Observing System

ESDIS: Earth Science and Data Information System

GEOS: Geodetic Earth Orbiting Satellite/Geodynamics Experimental Ocean Satellite

GES DISC: Goddard Earth Sciences Data and Information Services Center

GSFC: Goddard Space Flight Center

NASA: National Aeronautics and Space Administration

NGSP: National Geodetic Satellite Program

EDSC: Earthdata Search Client

QA: Quality Assessment

UT: Universal Time