Interior Exploration Using Seismic Investigations, Geodesy, and Heat Transport (InSight) Mission

Insight Fluxgate Magnetometer (IFG)

PDS Archive

Software Interface Specification

Rev. 1.7

September 28, 2023

Prepared by

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InSight

Insight Fluxgate Magnetometer

PDS Archive

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September 28, 2023

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Contents

1 Introduction

This software interface specification (SIS) describes the format and content of data acquired by the Insight Fluxgate Magnetometer (IFG) instrument for the Planetary Data System (PDS) data archive. It includes descriptions of the data products and associated metadata, and the archive format, content, and generation pipeline.

1.1 Document Change Log

Table 1: Document change log

Version	Change	Date	Affected portion
0.1	Initial draft	Sept 24, 2018	All
1.0	Updated discussions of calibration and data processing.	November 02, 2018	2.6, 3,4,5,Appendix A
1.1	Significant update, responding to cruise data peer review comments, updates to the structure of the raw and partially processed data products, and the addition of the section on calibrated data	April 19, 2019	All
1.2	Updated to respond to Mars calibrated data peer review – lots of fairly minor edits	June 20, 2018	All
1.3	Additional peer review comment corrections; Reformatted sample labels	September 19, 2019	2.6.3, 4.4.3, 5.1.2, added section 4.5.8 Versions in file names
1.4	Added discussion of updated housekeeping data return frequency and its inclusion in the data processing pipeline	March 16, 2020	2.6.2 Calibration, 3.2.3.2 Raw data, 4.5.8 Version numbers in file names
1.5	Updated data product description tables to include new TLST (true local solar time) column.	June 15, 2020	3.2.3.2 Raw data 3.3.1 Time Standards 4.5.8.6 IFG pipeline version v06 section added 5.11 Tables 9,10 5.12 Tables 12,13 5.13 Table 14
1.6	Updated to discuss new data processing and the new Maven fly-over data collection.	June 20, 2023	2.3 Applicable docs 3.2.3.3 Partially Proc Data 3.2.3.5 Calibrated 20Hz MAVEN flyover section added 4.4.1 File naming 4.5.4 Calibrated 20Hz MAVEN flyover collection added 4.5.9.7 v07 pipeline section added Appendix B added

1.7	Responded to peer review comments	September 12, 2023	Added section 3.2.3.4 Raw to Partially Calibrated Data Procedure. Numerous other small changes.

1.2 TBD Items

Table 2 lists items that are not yet finalized.

Table 2: List of TBD items

Item	Section(s)	Page(s)

1.3 Abbreviations

Table 3: Abbreviations and their meanings

Abbreviation	Meaning
AOBT	APSS Onboard Time
APSS	Auxiliary Payload Sensor Suite
ASCII	American Standard Code for Information Interchange
CNES	Centre National d'Etudes Spatiales
CODMAC	Committee on Data Management, Archiving, and Computing
EDR	Experiment Data Record
FEI	File Exchange Interface
FIR	Finite Impulse Response (filter)
FSW	Flight Software
GB	Gigabyte(s)
GEO	PDS Geosciences Node (Washington University, St. Louis, Missouri)
HP^3	Heat-Flow and Physical Properties Probe
ICC	Instrument Context Camera
ICD	Interface Control Document
IDA	Instrument Deployment Arm
IDC	Instrument Deployment Camera
IDS	Instrument Deployment System

Abbreviation	Meaning
IFG	Insight Fluxgate Magnetometer
IGPP	Institute of Geophysics and Planetary Physics
IOC	IFG Operation Center
IM	Information Model
ISO	International Standards Organization
JPL	Jet Propulsion Laboratory (Pasadena, CA)
LID	Logical Identifier
LIDVID	Versioned Logical Identifier
MAVEN	Mars Atmosphere and Volatile EvolutioN spacecraft
MB	Megabyte(s)
MD5	Message-Digest Algorithm 5
NAIF	Navigation and Ancillary Information Facility (JPL)
NASA	National Aeronautics and Space Administration
NSSDCA	National Space Science Data Coordinated Archive (GSFC)
PAE	Payload Ancillary Electronics
PDS	Planetary Data System
PDS4	Planetary Data System Version 4
RAD	Radiometer
RISE	Rotation and Interior Structure Experiment
SCLK	Spacecraft Clock
SEED	Standard for the Exchange of Earthquake Data
SEIS	Seismic Experiment for Investigating the Subsurface
SIS	Software Interface Specification
SISMOC	SEIS on Mars Operation Center
SP	Short Period
TBD	To Be Determined
TWINS	Temperature and Wind for InSight Subsystem
UCLA	University of California, Los Angeles
URN	Uniform Resource Name
UTC	Universal Time Coordinated

Abbreviation	Meaning
VBB	Very Broad Band
WU	Washington University in St. Louis
XML	eXtensible Markup Language

1.4 Glossary

Many of these definitions are taken from Appendix A of the PDS4 Concepts Document, pds.nasa.gov/pds4/doc/concepts. The reader is referred to that document for more information.

Archive – A place in which public records or historical documents are preserved; also the material preserved – often used in plural. The term may be capitalized when referring to all of PDS holdings – the PDS Archive.

Basic Product – The simplest product in PDS4; one or more data objects (and their description objects), which constitute (typically) a single observation, document, etc. The only PDS4 products that are *not* basic products are collection and bundle products.

Bundle Product – A list of related collections. For example, a bundle could list a collection of raw data obtained by an experiment during its mission lifetime, a collection of the calibration products associated with the experiment, and a collection of all documentation relevant to the first two collections.

Class – The set of attributes (including a name and identifier) which describes an item defined in the PDS Information Model. A class is generic – a template from which individual items may be constructed.

Collection Product – A list of closely related basic products of a single type (e.g. observational data, browse, documents, etc.). A collection is itself a product (because it is simply a list, with its label), but it is not a *basic* product.

Data Object – A generic term for an object that is described by a description object. Data objects include both digital and non-digital objects.

Description Object – An object that describes another object. As appropriate, it will have structural and descriptive components. In PDS4 a 'description object' is a digital object – a string of bits with a predefined structure.

Digital Object – An object which consists of real electronically stored (digital) data.

Identifier – A unique character string by which a product, object, or other entity may be identified and located. Identifiers can be global, in which case they are unique across all of PDS (and its federation partners). A local identifier must be unique within a label.

Label – The aggregation of one or more description objects such that the aggregation describes a single PDS product. In the PDS4 implementation, labels are constructed using XML.

Logical Identifier (**LID**) – An identifier which identifies the set of all versions of a product.

Versioned Logical Identifier (LIDVID) – The concatenation of a logical identifier with a version identifier, providing a unique identifier for each version of product.

Manifest - A list of contents.

Metadata – Data about data – for example, a 'description object' contains information (metadata) about an 'object.'

Object – A single instance of a class defined in the PDS Information Model.

PDS Information Model – The set of rules governing the structure and content of PDS metadata. While the Information Model (IM) has been implemented in XML for PDS4, the model itself is implementation independent.

Product – One or more tagged objects (digital, non-digital, or both) grouped together and having a single PDS-unique identifier. In the PDS4 implementation, the descriptions are combined into a single XML label. Although it may be possible to locate individual objects within PDS (and to find specific bit strings within digital objects), PDS4 defines 'products' to be the smallest granular unit of addressable data within its complete holdings.

Tagged Object – An entity categorized by the PDS Information Model, and described by a PDS label.

Registry – A data base that provides services for sharing content and metadata.

Repository – A place, room, or container where something is deposited or stored (often for safety).

XML – eXtensible Markup Language.

XML schema – The definition of an XML document, specifying required and optional XML elements, their order, and parent-child relationships.

2 Overview

2.1 Purpose and Scope

The purpose of this SIS (Software Interface Specification) document is to provide users of the IFG archive with a detailed description of the data products and how they are generated, along with a description of the PDS4 archive bundle, the structure in which the data products, documentation, and supporting material are stored. The users for whom this document is intended are the scientists who will analyze the data, including those associated with the project and those in the general planetary science community.

This SIS covers raw, quick-look, and calibrated data products generated by IFG that are archived in the Planetary Data System (PDS). In particular, these products consist of the science measurements downlinked from the IFG instrument that have been time-tagged and formatted into ASCII text tables with detached XML labels in a PDS4-compatible format.

The **IFG_Calibration_Description** document describes the details of the IFG calibration process, and the creation of the files that used during the data processing. This SIS document focuses on the data processing pipeline and the content and structure of the archive files. The calibration description document discusses the issues with the raw data and the methods by which some of them have been corrected, and describes several issues that currently remain uncorrected in the data.

2.2 SIS Contents

This SIS describes how the IFG instrument acquires data, and how the data are processed, formatted, labeled, and uniquely identified. The document discusses standards used in generating the data products and software that may be used to access the products. The data structure and organization are described in sufficient detail to enable a user to read and understand the data.

Appendices include a description of the file naming conventions used in the SEIS archive, and a list of cognizant persons involved in generating the archive.

2.3 Applicable Documents

[1] Planetary Data System Standards Reference, Version 1.11.0, October 1, 2018.

[2] Planetary Science Data Dictionary Document, Version 1.11.0.0, September 23, 2018.

[3] Planetary Data System (PDS) PDS4 Information Model Specification, Version 1.11.0.0, September 23, 2018.

[4] Data Providers' Handbook: Archiving Guide to the PDS4 Data Standards, Version 1.11.0, October 1, 2018.

[5] IFG New Data Calibration Description, S. P. Joy, C. L. Johnson, A. Mittelholz, April, 2023.

[6] PPI PDS4 Best Practice, J. N. Mafi, T. A. King, June, 2019.

[7] InSight Archive Generation, Validation, and Transfer Plan, Version 1.1, April 30, 2014.

[8] Banfield, D., Rodriguez-Manfredi, J.A., Russell, C.T. et al. Space Sci Rev (2019) 215: 4.

https://doi.org/10.1007/s11214-018-0570-x

[9] Johnson, C. L., Mittelholz, A., Langlais, B., Russell, C. T., Ansan, V., Banfield, D., et al. (2020)., Crustal and time-varying magnetic fields at the InSight landing site on Mars., Nature Geo.,13: 3, https://doi.org/10.1038/s41561-020-0537-x

[10] Mittelholz, A., Johnson, C. L., Thorne, S. N., Joy, S., Barrett, E., Fillingim, M. O., et al. (2020), The origin of observed magnetic variability for a sol on Mars from InSight., J. Geophys. Res.: Planets, 125: 9, https://doi.org/10.1029/2020JE006505

[11] Thorne, S. N., Mittelholz, A., Johnson, C. L., Joy, S., Liu, X., Russell, C. T., et al. (2020)., InSIght fluxgate magnetometer data calibration assessment and implications., 51st Lunar and Planetary Science Conference, LPI Contribution No. 2326, id.1331, bibcode: 2020LPI....51.1331T

[12] Thorne, S. N., Johnson, C. L., Mittelholz, A., Langlais, B., Lorenz, R., Murdoch, N., et al. (2022), Investigation of magnetic field signals during vortex-induced pressure drops at InSight., Planetary and Space Sci., 217, 105487 https://doi.org/10.1016/j.pss.2022.105487

The PDS4 Documents [1] through [3] are subject to revision. The most recent versions may be found at pds.nasa.gov/pds4. The IFG PDS4 products specified in this SIS have been designed based on the versions current at the time, which are those listed above.

2.4 Audience

This document serves both as a Data Product SIS and an Archive SIS. It describes the format and content of IFG data products in detail, and the structure and content of the archive in which the data products, documentation, and supporting material are stored. This SIS is intended to be used both by the instrument teams in generating the archive, and by data users wishing to understand the format and content of the archive. Typically these individuals would include scientists, data analysts, and software engineers.

2.5 InSight Mission

InSight was launched on May 5, 2018 and placed a single geophysical lander on Mars on November 26, 2018, to study its deep interior. The Surface Phase consists of Deployment and Penetration, and Science Monitoring. It ends after one Mars year plus 40 sols.

The science payload comprises two experiments: the Seismic Experiment for Investigating the Subsurface (SEIS) and the Heat-Flow and Physical Properties Probe (HP^3). In addition, the Rotation and Interior Structure Experiment (RISE) will use the spacecraft X-band communication system to provide precise measurements of planetary rotation. SEIS and HP^3 were placed on the surface with an Instrument Deployment System (IDS) comprising an Instrument Deployment Arm (IDA), Instrument Deployment Camera (IDC), and Instrument Context Camera (ICC). There are also several supporting experiments. The Auxiliary Payload Sensor Subsystem (APSS) includes the pressure sensor, the magnetometer (IFG), and Temperature and Wind for InSight (TWINS) sensors and collects environmental data in support of SEIS. These data will be used by SEIS to reduce and analyze their data. The radiometer (RAD) will be used by the HP^3 team to measure surface temperature and thermal properties to support their data analysis.

2.6 IFG Instrument Description

The Insight Fluxgate (IFG) Magnetometer [7] built by UCLA produces 3 axis, 24bit, 20 samples per second data stream to measure the DC magnetic fields of +/-20,000nT, with measurements better than 0.1nT/√Hz from 0.1 to 1Hz on the Science Deck on the Insight Lander. The data are typically low-pass filtered before transmitting to Earth. After initial deployment, full rate data are only returned during short time intervals of scientific interest that have been selected by the science team. Continuous data were originally planned to be returned at a rate of 0.2Hz along with an "estaZ" channel that serves as a proxy for the high frequency variability in the band between 0.1 and 10 Hz. At the end of the commissioning phase it was decided that when sufficient downlink bandwidth was available, continuous data would be downlinked at 2 Hz, with the ESTA channel modified accordingly. The magnetometer consists of three matched elements, the precision fluxgate sensor, the interconnecting harness (2.5 m), and the electronics board. The magnetometer system has only one operational mode, "ON." Upon power application, the electronics synchronizes with the system clock, then provides continuous output data streams. No commanding is necessary.

The sensor is mounted on the bottom side, outside of the Insight Lander on the Science Deck, and the interconnecting harness is connected the sensor to the electronics. The connectors are labeled as J (male) and P (female) in Figure 1. The electronics fit inside the Auxiliary Payload Sensor System (APSS) and connect to the Payload Auxiliary Electronics (PAE), which provides power, timing, and collects the data.

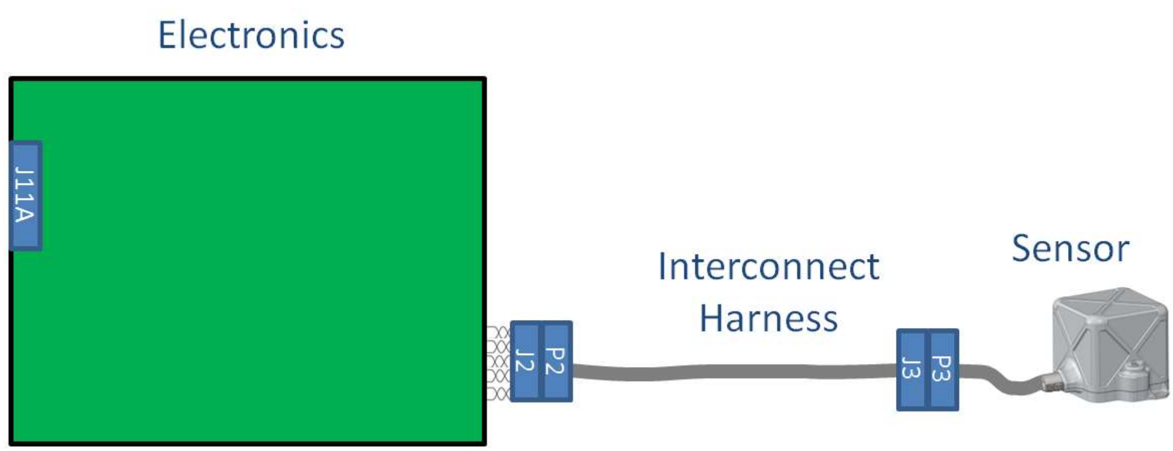


Figure 1: Overall block diagram of UCLA Magnetometer

2.6.1 Science Objectives

The prime scientific objective of the InSight mission is to determine the internal structure of Mars and its seismic activity. To guard against and possibly remove extraneous signals that are not associated with seismic sources, the InSight lander measures environmental conditions including magnetic signals in the passband of the seismometer. These magnetic signals can arise on the spacecraft and in the Mars ionosphere. During the pre-launch checkout period, the magnetometer on the InSight lander was tested in the laboratory to verify that it could detect signals expected from the Mars' ionosphere and determine what DC and AC magnetic fields may arise from the spacecraft. Based on these test data, the team expects to be able to distinguish the natural and spacecraft-associated DC and AC signals after landing successfully on the Martian surface.

Mars has a weak planetary magnetic field that is concentrated in magnetic "anomalies," crustal regions that became magnetized eons ago when Mars possessed an internal geomagnetic dynamo (Acuna et al., 1999, DOI: 10.1126/science.284.5415.790). The InSight landing site is in a region that satellite data show to be magnetized, albeit much less strongly than the southern highlands. Analysis of time variations in the magnetic field, specifically in the external field and the internal magnetic response to these might provide information on the interior electrical conductivity structure of Mars, including the core size. To calculate the magnetic field impressed on the ionosphere requires measurements in the solar wind or in the ionosphere with a spacecraft instrumented with plasma and field instruments such as those of MAVEN. At higher frequencies, the magnetometer might detect atmospheric phenomena at Mars, such as the transient electric currents associated with lightning and possibly electric currents associated with dust devils.

2.6.2 Ground Calibration

This section describes the conversion of raw telemetry data number (DN) values into values in physical units (nT, ºC, V, etc.). The result of these various operations is a set of new numbers that are in physical units. After this conversion, the magnetic field vectors are still in a raw state in sensor axes coordinates. However, they are formatted properly for a true calibration that removes spacecraft fields, applies gain factors, and orthogonalizes the field components. After orthogonalization, the field vectors can be rotated into spacecraft and geophysical coordinates.

There is a dependency in the magnetometer data calibration on the temperature of the IFG electronics as well as on the sensor temperature.

Mag Temperature: This is the sensor head temperature. Calibration:

(1) $st\ (^{o}C) = 9*10^{-5} * \mathbf{X}^2 - 0.576 * \mathbf{X} + 803.43$ where X is the raw value in DN

Electronics Temperature: This is the proximity electronics temperature, which affects the calibration. Calibration of this temperature:

(2) $et\ (^{o}C) = 1/-7.3 * \mathbf{X} + 333.5$ where **X** is the raw value in DN

Mag X (called Mag Ch1 in Figure 2):

(3) $MagX(nT) = ETGx(et)*STGx(st)*\mathbf{X}/145.6 + ETOx(et) + STOx(st)$

where:

- **X** is the raw value of ch1 in DN
- $STGx(st) = 1E\text{-}06*st^2 + 0.0004*st + 0.9916$, a function of the sensor temperature (st ºC).
- $STOx(st) = 0.0002*st^2 - 0.0904*st + 1.2953$, also a function of the sensor temperature.

- ETGx(et) = 3E-07*et^2 - 7E-05*et + 1.0017, a function of the electronics temperature (et °C).
- ETOx(et) = -0.0002*et^2 + 0.0073*et + 1.8809, also a function of the electronics temperature.

Mag Y (called IFG_2 in Tables 11-13):

(4) MagY (nT) = ETGy(et)*STGy(st)***X***/141.4 + ETOy(et) + STOy(st)

where:

- **X** is the raw value of ch2 in DN
- STGy(st) = 7E-07*st^2 + 0.0003*st + 0.991, a function of the sensor temperature.
- STOy(st) = -0.0003*st^2 - 0.0073*st + 1.75, also a function of the sensor temperature.
- ETGy(et) = 4E-07*et^2 - 6E-05*et + 1.0016, a function of the electronics temperature.
- ETOy(et) = 0.0005*et^2 - 0.0275*et - 0.1188, also a function of the electronics temperature.

Mag Z (called IFG_3 in Tables 11-13):

(5) MagZ (nT) = ETGz(et)*STGz(st)***X***/141.7 + ETOz(et) + STOz(st)

where:

- **X** is the raw value of ch3 in DN
- STGz(st) = 8E-07*st^2 + 0.0002*st + 0.9948, a function of the sensor temperature.
- STOz(st) = -0.0008*st^2 - 0.1203*st + 5.1656, also a function of the sensor temperature.
- ETGz(et) = 4E-07*et^2 - 6E-05*et + 1.0013, a function of the electronics temperature.
- ETOz(et) = 0.0009*et^2 - 0.1085*et - 3.0463, also a function of the electronics temperature.

The IFG calibration depends on both the electronics and sensor head temperature (st). The latter is a regular science channel in the PAE packet and in the output from the interface FSW, but prior to November 17, 2019, the IFG electronics temperature (et) was only reported in an engineering packet at the start of a packet processing session, or nominally three times/day. Thus the electronics temperature data available was not initially at a usable resolution. However, the sensitivities of the scale factors to ET are very slight: the Z-axis is the most effected by temperature, and it varies by about 0.017% over the range -30C - +50C. In order to mitigate against the loss of the IFG sampled electronics temperature, the PAE temperature of the electronics housing box (PAE T-0014) was used as a proxy for the actual IFG electronics temperature. The actual data samples for PAE T-0014 are provided in the spacecraft engineering and ancillary data files that are included with the archive. The use of this proxy should further reduce the impact of the loss of the high-rate IFG electronics temperature measurements. After November 17, 2019, IFG housekeeping data were returned every 900 seconds. From this date on, the actual ET temperature values, linearly interpolated to the IFG sample times, were used in the calibration process.

Once the ground calibration parameters are applied, additional inflight calibration corrections are applied. This processing is described in the IFG New Data Calibration Description document provided with this archive.

2.6.3 Magnetometer Zero Levels

Magnetometer zero levels were determined during ground testing after spacecraft integration is two separate tests using different methodology. The spacecraft field was measured by using a "swing" test (Nov. 2015) and a "gradiometer" test (Oct. 2017). In the swing test, the spacecraft was suspended on a cable and swung over a magnetometer that was placed beneath the swinging spacecraft. In the gradiometer test, many magnetometers were placed around the spacecraft at different distances and the field was measured. In both tests, fields that fell off with increasing distance from the spacecraft are attributed to the spacecraft. Both of these tests yielded similar but slightly different estimates of the spacecraft field. The swing test provides field estimates of (564, -515, 71) nT and the gradiometer test gave (534, -353, -18) nT. The average of the values from these two tests (549, -434, 26.5) nT in spacecraft coordinates is subtracted from the data.

2.6.4 Sample Timing

Upon power application, the IFG synchronizes with the system clock, and then provides continuous output data transmitted as vectors at the output cadence rate 20Hz. Each vector consists of a block of twelve bytes sent consecutively without a gap, other than the start bit at the beginning of each byte and stop bit at the end of each byte. The IFG team put considerable effort into accurately determining the precise timing offset of the magnetic field vector relative to the APSS Onboard Time (AOBT) time stamp but individual tests yielded different results. Eventually this effort was abandoned. The maximum timing offset observed in the tests conducted was less than 2ms, and this value should be considered the upper limit on the timing error. Since there is no clear determination of the time delays introduced internal to the IFG data processing, no timing adjustments are applied to the 20Hz data during routine data processing. Vectors are assigned Coordinated Universal Time (UTC) time values by converting the AOBT clock counts to SCLK values by using the AOBT_SCLK file that tabulates the offset between these two clocks. The relative drift rate between the two clock files is used to compute the offset AOBT-SCLK offset between samples. Once computed, the SCLK value is then converted to UTC using standard SPICE time conversion functions. Originally it was anticipated that the time conversion could be performed using the time correlation tool (TCT) provided by SEIS on Mars Operations Center (SISMOC). Unfortunately the IFG team was not able to incorporate this tool into their data processing pipeline.

In routine operations, the spacecraft does not return magnetic fields vectors at the full 20Hz rate. Data are filtered by using one or more Finite Impulse Response (FIR) filters prior to down sampling the data to lower rates (10, 5, 4, 2, 0.5, and 0.2 Hz). Normally, only the 0.2Hz data are returned and these data are then analyzed to determine intervals when higher time resolution (usually 20 Hz or 2 Hz) data are required for detailed event analysis. Each FIR filter applied introduces a time delay in the output data. The delay associated with a given filter depends on the input data cadence (rate) and the number of coefficients (N) in filter applied. The FIR filter delay can be computed using equation 6.

(6) Delay (sec) = rate (sec) * (N+1)/2

There are three different FIR filters that can be applied to the data: div2, div4, and div5 which are used when down sampling the data by factors of two, four, or five respectively. Each filter has a different number of coefficients as shown in Table 4.

Table 4:Number of coefficients for each FIR filter

Filter Name	Coefficients	Comment
div2	121	Reduce cadence by a factor of two
div4	221	Reduce cadence by a factor of four
div5	241	Reduce cadence by a factor of five

On InSight, FIR filters are applied sequentially to the IFG data prior to down sampling the data with each filter contributing to the total time delay in the resulting data samples. In order to create the standard 0.2 Hz data, three filter steps are required. Initially, the data are reduced from the 20Hz cadence to the 4 Hz cadence after applying the “div5” filter that has 241 coefficients and the time delay introduced into resulting data is 6.05 seconds. Next, 1 Hz data are created from the 4 Hz data, by applying the “div4” filter. This process adds another 27.75 seconds of time delay to the 1Hz data. Finally, the “div5” filter is applied again before down sampling the 1Hz data to generate the 0.2 Hz data and this process introduces a further 121 seconds of time delay. Since the filters are applied successively, the delays introduced are cumulative. Table 5 summarizes the total time delay corrections applied to each of the different output cadences.

Table 5: Time Delay Correction in IFG data

Rate	Delay (seconds)	Comment
20 Hz	0	No time correction applied.
10 Hz	3.05	Correction required for div2 filter applied to 20Hz input.
5 Hz	5.55	Correction required for div4 filter applied to 20Hz input.
4 Hz	6.05	Correction required for div5 filter applied to 20Hz input.
2 Hz	21.30	Sum of div5 and div2 corrections when applied successively.
1 Hz	33.80	Sum of div5 and div4 corrections when applied successively.
0.5 Hz	94.80	Sum of div5, div4, div2 corrections when applied successively.
0.2 Hz	154.8	Sum of div5, div4, div5 corrections when applied successively.
0.01 Hz	6915	Filter delay introduced into IFG temperature data

Timing corrections are applied only to the UTC times associated with each IFG vector. The AOBT clock values assigned to each vector are unchanged from the values returned by the spacecraft.

The IFG sensor temperature data are filtered to an even lower data rate (0.01 Hz) and these data have very long filter delay time offsets.

3 IFG Data Products

3.1 Data Product Overview

The IFG data are organized by data processing level and include raw, partially processed, and calibrated magnetic field vectors. In addition, the spacecraft engineering and housekeeping data are included with the archive since some of these items might be used in the identification and removal of spacecraft magnetic interference during the calibration process.

3.2 Data Processing

This section describes the processing of IFG data products, their structure and organization, and their labeling.

3.2.1 Data Processing Levels

Data processing levels mentioned in this SIS refer to PDS4 processing levels. Table 6 provides a description of these levels along with the equivalent designations used in other systems.

Table 6: Data processing level definitions

PDS4 processing level	PDS4 processing level description	CODMAC Level (used in PDS3)	NASA Level (used in PDS3)
Raw	Original data from an experiment. If compression, reformatting, packetization, or other translation has been applied to facilitate data transmission or storage, those processes are reversed so that the archived data are in a PDS approved archive format. Often call EDRs (Experimental Data Records).	2	0
Partially Processed	Data that have been processed beyond the raw stage but which have not yet reached calibrated status. Some spacecraft or instrumental artifacts remain in the data.	3	1A
Calibrated	Data converted to physical units, which makes values independent of the experiment.	3	1B
Derived	Results that have been distilled from one or more calibrated data products (for example, maps, gravity or magnetic fields, or ring particle size distributions). Supplementary data, such as calibration tables or tables of viewing geometry, used to interpret observational data should also be classified as 'derived' data if not easily matched to one of the other three categories.	4+	2+

IFG data products described in this SIS are raw, partially calibrated, and calibrated. If any derived data products are created, they will be described in another SIS document or this document will be revised to include their description.

3.2.2 Data Product Generation

The IFG Operation Center at UCLA (IOC) has developed a data processing pipeline that reads in the raw ASCII, comma separated value (CSV) files that contain channelized data from the TWINS and IFG instruments and outputs raw and partially calibrated ASCII tables of magnetic field vectors.

3.2.3 Data Flow

Raw data are retrieved from the InSight File Exchange Interface (FEI) data storage system. The IFG and TWINS data are stored in the “twins_ops” folder of the FEI system. In addition, the raw APSS ancillary data are downloaded from the “seis_ancillary_data_gds_report” FEI folder. The ancillary data are likely to provide a window into the underlying state of the spacecraft that can be used in the identification and removal of spacecraft sources during the calibration process.

3.2.3.1 Ancillary Data

The ancillary data are tabulated first. Values from the various ancillary data channels are returned at different rates. The software that extracts these data initializes the output data structure setting all channels to the missing data value which is -1. As the software reads the raw data, it collects values of the various channels in the output data array until the spacecraft clock value updates. At this point it writes out a row of data in the output file. Channels that have not yet been populated with a spacecraft value retain the missing data value. Channel values are repeated in the output data file until a new value is received.

3.2.3.2 Raw Data

The first step is to read in the raw data extracted from FEI, and then reconstruct the magnetic field vectors from the channelized axes and sensor temperature data. The AOBT time tag associated with each channel record is used for this reconstruction. Once the data are again organized as a time-series of field vectors, the AOBT time tag is converted to UTC using the method previously described in section 2.6.4 (Sample Timing). The UTC time tag is then corrected for the FIR filter delays (2.6.4). As described in the section on IFG calibration, the conversion of the raw data to nanoTesla requires both sensor and electronics temperatures for every sample. The sensor temperature is included in the IFG data stream every 100 seconds, prior to May 15, 2019, and then every 1 second thereafter. These data are linearly interpolated between samples to provide the required value for each sample. However, because of the very long FIR filter delay, the first sample is not available for several hours following the instrument power on or a PAE reset when the data were downsampled to the 100 second cadence. During these time periods, a Mars true local time (TLST) model of the sensor temperature is used as a proxy for the required data. This model and its computation are described in detail in the IFG calibration document [5]. Prior to 11/18/2019, the IFG electronics temperature (ET) was only available a few times per day at the start of each spacecraft data processing session. These data were too sparse to be used directly for the instrument calibration. Fortunately, there is a temperature sensor affixed to the side of the PAE electronics box and its data are available more frequently, although not continuously. This sensor value is contained in the spacecraft engineering and ancillary data in channel T-0014. Data from this channel were fit with a running 3rd order polynomial and the polynomial fit values are used in the data calibration process. Again, this is described in much greater detail in the calibration document [5]. Once actual ET values became available, these data were linearly interpolated to the IFG sample times like the sensor temperature data.

In addition, the raw IFG data have been found to be well correlated with the low frequency, diurnal variations in the fixed (E-0771, E-0791) and total (E-0772, E-0792) solar array currents are provided in the spacecraft engineering and ancillary data in channels listed. Unfortunately, these data are not provided continuously, nor at sufficient time resolution to be used directly in the decorrelation process. Mars true local time dependent models of these current systems have been developed. These current systems also vary in UTC time, as additional systems were powered on, dust covered and uncovered the solar arrays, etc. The model values of the currents from these sources are included in the raw data file so that they can be used in the data processing pipeline. The detail of how these models are derived are included in the calibration document [5].

3.2.3.3 Partially Processed Data

The term partially processed data is intentionally vague in the PDS data dictionary so that it can be used to describe many different data sets with differing degrees of data processing. The term is used here to mean data that have been processed into physical units (nT) and that have been processed so as to remove as much of the low frequency variations in the data as possible that can be directly attributed to variations of temperature or current systems on the spacecraft. The primary purpose of the IFG is to provide a data set to the SEIS team that can be used to decorrelate the high frequency seismic signals from any high frequency variations in the local magnetic field. All high frequency variations remain in this dataset. In addition, it is anticipated that the high frequency fluctuations attributable to spacecraft sources, such as currents associated with heater cycling, will be most readily identifiable in the mechanical reference frame of the spacecraft while the IFG instrument frame is ideal for identifying instrumental artifacts. Accordingly, this dataset is provided in these two frames.

The first step in processing is to convert from engineering units to nanoTesla using the equations in section 2.6.2 (Calibration) using the temperature values that have been included in the raw data files. The next step is to subtract the spacecraft field. The average of the values from these two tests (549, -434, 26.5) nT in spacecraft coordinates is subtracted from the data. However, in order to make this correction properly, the spacecraft field values must first be transformed back into sensor coordinates. This requires both the sensor axes orthogonalization and the IFG to spacecraft frame transformation matrices. As built, the three axes of the sensor are not quite orthogonal. The orthogonalization matrix was determined during ground testing in 2014.

Orthogonalization Matrix
$$\begin{bmatrix} 0.9999338 & -0.0083392 & -0.0028278 \\ 0.0122568 & 0.9999740 & 0.0015478 \\ 0.0009358 & -0.0001125 & 0.9999976 \end{bmatrix}$$

After the axes data are orthogonal, the data can be rotated into spacecraft coordinates by applying a 57.9° rotation about axis 3 (z).

Sensor to Spacecraft Rotation Matrix
$$\begin{bmatrix} \cos(57.9) & \sin(57.9) & 0 \\ -\sin(57.9) & \cos(57.9) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

The actual mounting of the IFG sensor has several sources of uncertainty that are not considered in the transformation from sensor to spacecraft coordinates. The major source of uncertainty is how flush the deck inserts are with the S/C deck and is estimated to be ±0.10 degrees. This estimate is based on +0.005/-0.000 inch insert height uncertainty above the deck, and a 2.76" span between mounting bolts. Other contributing factors to the mounting uncertainty are insert orthogonality to the deck, and the S/C coordinate-defining fiducials with relation to the deck. These errors are expected to be less than ± 0.05° for the former and less than ±0.001° for the latter**. Errors associated with the landed spacecraft attitude (~1°) will be much larger than any of the sensor mounting or orthogonality errors.**

In practice, additional corrections are applied in the IFG frame before the data are transformed into spacecraft coordinates. Even after the IFG ground calibration temperature corrections have been applied, there are large, low frequency variations in the field that are highly correlated with the sensor and electronics temperatures, and with the various solar array currents. Data are initially processed by applying the ground calibration and then they are decorrelated with the temperatures and currents by using a linear least-squares fitting process. The thermal characterization of the IFG is best at sensor temperatures above about -50 to -75 degrees Celsius and the solar array currents are not present after sundown. From these facts, we attempt to normalize the IFG data to the mean value observed at TLST = 20:00. This is generally a quiet time in the data. We found that the mean field over several weeks in December 2018 in IFG coordinates was (-1645, -500, -1045) nT. These values are subtracted from the data and then the residuals (dB_i) are corrected for temperature and solar array currents.

Old Method (v06)

Previously, the dBi residuals were simultaneously fit as a linear function of the temperatures and solar array currents of the form:

$$dB_i = C_{0,i} + C_{1,i} *ST + C_{2,i} * ET + C_{3,i} * FSAC + C_{4,i} * TSAC \text{ and}$$
$$B_i = B_{gc,i} - dB_i$$

where the C_i are the constants determined by the fit, ST and ET are the sensor and electronics temperatures in the ºC respectively, and FSAC (modelSA) and TSAC (modSACT) are the fixed and total solar array currents in Amps respectively. The B_i are the corrected field data and the $B_{gc,i}$ are the ground calibrated field data. During the spacecraft commissioning, the spacecraft environment was changing frequently. We found that a set of coefficients could be used for only a few days to weeks. We were hopeful that the frequency at which new fits and models of the current systems used in the fitting process would decrease once commissioning is complete.

Persisting Issues

The frequency at which new calibration correction coefficients need to be computed did not reduce as expected as the mission progressed. Furthermore, the amplitude of the IFG temperature correction coefficients varied widely over time scales of days. This is not the way that fluxgate magnetometers behave. The problem is that the daily temperature variations are highly correlated with the solar array current variations and the least-squares method does not distinguish between the two. Thus, we introduced a new method in which we separated the temperature and solar array current corrections.

New Method (v07)

First, large steps were removed from the ground calibrated data since these steps are clearly not related to temperature effects. Then night-time only data were selected for fitting in order to isolate temperature and solar array current effects. Data were considered to be night-time data when the total solar array current was less than 0.15 Amps. A base value of 0.075 Amps is observed at midnight local time. The sensor (ST) and electronics (ET) temperature fit coefficients were simultaneously determined once for each release or about 90 days. Longer and shorter time intervals were explored but the differences were small and the data processing pipeline was designed to process a full data release. The temperature correction coefficients are included in the archive documents collection (TemperatureFits.tab) and the corrections are called $dBtemp_i$.

$$dBtemp_i = C_{1,i} * ST + C_{2,i} * ET$$

The amplitude and shape of the daily solar array current variation changes on fairly short time scales. These curves reflect spacecraft power usage, battery charging and discharing, aging, and dust accumulation of the arrays. Temperature corrected full-day data were then fit to linear functions of the solar arrary currents every few days. A new set of coefficients was calculated whenever the existing set no longer fit the observations. Solar array current correction coefficients are provided with the archive documents collection (SA_Current_Fits.tab) and the corrections are called $dBcurr_i$.

$$dBcurr_i = C_{0,i} + C_{3,i} * FSAC + C_{4,i} * TSAC$$

Finally,

$$B_i = B_{gc,i} - dBtemp_i - dBcurr_i$$

As one might expect, the data are not substantially changed by the new processing method but now the temperature corrections are slowly varying as one might expect for a fluxgate magnetometer.

Both Methods

After the offsets and fit field variations were removed from the data in the IFG frame, the data were rotated into the spacecraft frame using the matrix provided above. Partially processed data are archived in sensor and spacecraft coordinates. Data are provided in ASCII tables with PDS4 labels. Partially processed data retain all of the high frequency spacecraft and environmental magnetic field sources that are observed by the IFG instrument. These data are likely to be most useful to the SEIS team for decorrelating the seismic data with fluctuations in the local magnetic field.

Cruise data are not processed beyond the partially processed level. No attempt will be made to remove the substantial residual spacecraft signatures from the cruise data, nor will they be provided in geophysically meaningful coordinates. Cruise data are acquired with the spacecraft stowed in the aeroshell that is discarded before deployment and magnetic sources associated with this transport device are not relevant to the main mission.

3.2.3.4 Raw to Partially Calibrated Data Procedure

1) Read in the raw data files and apply ground calibration using the equations in section 2.6.2 and the model sensor and electronics temperatures.
2) Orthogonalized the data using the matrix provided in section 3.2.3.3 to get the data into IFG coordinates.
3) Subtract the offsets from the orthogonalized data in IFG coordinates. Values provided in section 3.2.3.3 (549,-434, 26.5) are in spacecraft coordinates where they were measured. In order to get them into IFG coordinates, these values must be multiplied by the inverse (transpose) of the IFG to spacecraft transformation matrix. In the IFG frame, the values are (667.2, 244.3, 26.5).
4) Remove large, long duration steps from the data using information in the file "destep.txt" that is provided in the documents collection of the archive. After all steps have been removed, there may be a residual step that we attribute to normal daily field variation. In order for this residual to not appear as a step in the data, the residual is distributed linearly over the duration of the series of steps at the end of the process. At the step boundaries small time intervals (typically about 10 second centered on the steps) of data are flagged and then the flags are removed by linear interpolation by our data processing pipeline. This prevents small residual steps from occurring do to imprecise remova. The destep file contains pseudo-code that removes, removes long period residual, and flags intervals taken from our data processing pipeline. In order to compute temperature and solar array current corrections properly large steps in the data not attributable to these sources needed to be removed.
5) Merge in the data from the "calib_relXX.tab" files (calibration collection) that contain the dBX_temp and dBX_curr, X=1,2,3) values. Remove any flags and create values at every data time step by linearly interpolating the dB values to the time steps of the data.
6) Remove any records where the BX_IFG (X=x,y,z) values are flagged. Extra records can be inserted by the merge process if the dBs are created from 2Hz playback data and pt2Hz data are being processed.

7) Subtract the temperature and solar array current dB's from the data in the IFG frame (i.e. Bx_IFG = Bx_IFG - dB1_temp - dB1_curr, etc.).
8) Rotate data into the spacecraft frame creating the columns Bx_SC, By_SC, and Bz_SC.
9) Write the data out as ASCII files with the column order and format required.

3.2.3.5 Calibrated Data

The calibrated dataset is derived from the partially processed dataset. These data differ from the partially processed data in that the team has attempted to identify and remove various high frequency artifacts that are found in the data, and the data are provided in a geophysical reference frame (lander local vertical, local horizontal = INSIGHT_LL) in addition to the spacecraft mechanical frame. Step identification and removal is an automated process and the Python codes used in this identification are included in document collection.

At the time of this writing, four types of high frequency interferences had been identified in the low resolution (0.2 Hz) filtered dataset. These include:

1. Single point data spikes in a single sensor, typically on the order of 3-5 nT;
2. Nearly square steps up down (3-10 nT) occurring simultaneously in multiple axes and returning to the baseline value in 10 – 50 minutes;
3. Nearly square steps up down (3-10 nT) occurring simultaneously in multiple axes and returning to the baseline value in 10 – 30 minutes, but with high frequency oscillations near the onset, termination, or both edges of the step;
4. Irregular steps and oscillations in all three axes, but largest and longest in the vertical component, that occur every day, sometime between 11:00 and 12:30 MLST and typically lasting for 30-50 minutes.

In addition, the high time resolution data show high frequency square wave variations that have a rapid onset and slow decay in amplitude that occurs in the morning hours (onset near 09:00 MLST) and lasting for several hours. We expect that as additional data are acquired and the team has had more time for analysis, that other interference types will be identified, and some of the existing types may be split into different types.

A data quality flag (dqf) is included in the calibrated data that gives the user information about which types of interference are present, and what, if anything has been done to correct the problem. This flag is a string of digits between zero and 5 where the location (offset) in the string defines the interference type and the value at that location indicates whether or not any action has been taken.

The dqf values for data quality are:

0. Good sample, no issue found
1. Issue identified and fully corrected in any/all components
2. Issue identified and partially corrected in all components
3. Issue identified and partially corrected in at least one component
4. Issue identified, no action taken
5. Sample not evaluated for data quality

The dqf values for data sources are:

0 Data value
1 Fit to available data values to fill in coverage gaps

2 Model – insufficient data reliably fill in gaps by fitting

Determining sources of spacecraft magnetic interference and techniques for their removal is expected to be a lengthy process, much longer than the time allowed for the initial archive deliveries. In order to meet the required schedule, data will be released with the best available calibration at the time of the first archive delivery. As the calibration is improved over time, data from the entire landed mission will be reprocessed and released with the updated calibration. This is likely to occur about once each year. Details of the interference removal process are described in the calibration document. The output of the interference removal process is a calibrated data set provided as ASCII data tables and PDS4 labels.

3.2.3.6 Calibrated 20 Hz Maven Fly-over Data

During the course of the mission, the MAVEN spacecraft flew over the InSight landing site several times. For many of these fly-overs, 20Hz data playback was requested and those data are included in the bundle as a separate data collection. To be included in this collection, the MAVEN spacecraft must have passed within a fifteen degree cicle of Mars latitude and longitues centered on the InSight landing site at an altitude less than 250 km. All of the files contained in this collection are also included in the calibrated data collection and have additional data processing. Since the number of files was fairly small and the time-span of each file was fairly short (tens of minutes) it was possible to hand correct many of the instrument artifacts out of these data. This level of file-by-file processing was not feasible for the full set of 20 Hz data. However some of the files (24 of 98) were so badly contaminated by "high frequency toggling" that complete hand processing was not possible. Examples of toggling are shown in the data calibration document in this archive.

Figure 2: MAVEN flyover times using SPICE kernels and IFG Power State

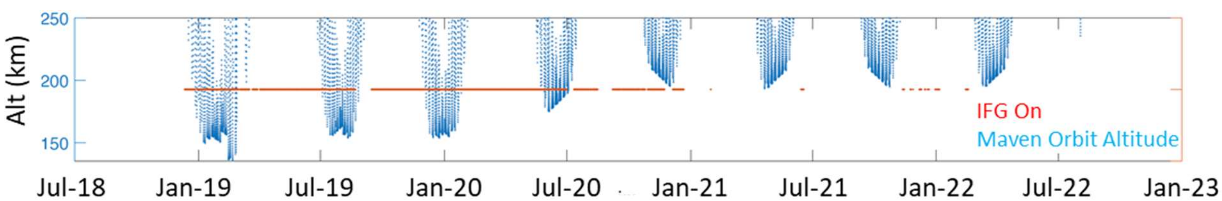
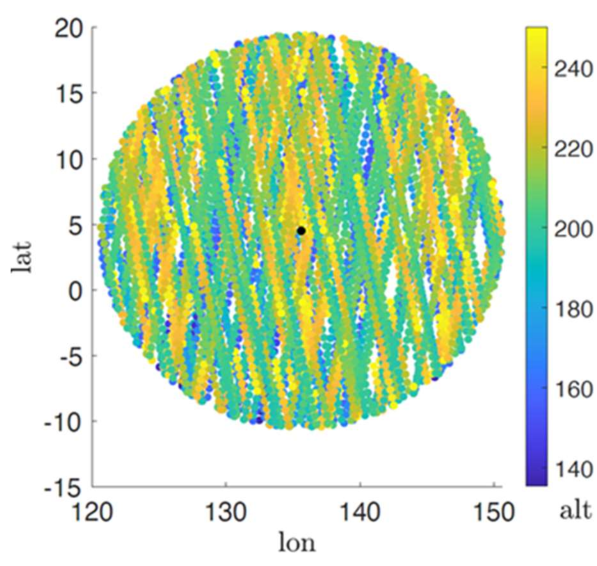


Figure 3: MAVEN flyover altitude coverage around Insight landing site



Once long-duration steps were removed (part of hand cleaning), these highly contaminated files were cleaned by subtracting 5-point running medians from the data. The low-frequency content was added back to the data files in the form of 1000-point running medians.

Figure 2 shows the altitude of the MAVEN spacecraft near periapsis and the power state of the IFG instrument. Starting in 2021, IFG was not powered on when MAVEN was in the vicinity of the landing site. Figure 3 shows the latitude/longitude coverage near the landing site as a function of altitude. InSight was powered on for the lowest altitude flyovers in 2019 and 2020 but mostly not for the later flyovers whose periapsis did not drop below 200 km. In general, 20 Hz IFG data were not transmitted back to Earth. The only intervals returned were the result of special requests by the IFG team. All special data requests were prioritized by the InSight science team and IFG requests were granted only when they rose to the top of the priority stack and downlink was available.

3.3 Standards Used in Generating Data Products

IFG products and labels comply with Planetary Data System standards, including the PDS4 data model, as specified in applicable documents [1], [2] and [3].

3.3.1 Time Standards

The IFG data are time stamped with AOBT, UTC, and to Mean and True Local Solar Time (MLST, TLST). For the FIR filtered and down-sampled data, the UTC values are corrected for the filter delays as described in section 2.6.4. The corrected UTC values are then used to compute the MLST and TLST values assigned to each sample using the SPICE toolkit and the insight_lmst_ops181206_v1.tsc clock kernel. The AOBT values will be the uncorrected times assigned by the instrument.

3.3.2 Coordinate Systems

The IFG data are provided in multiple reference frames, depending on the data processing level. The raw data are provided in the non-orthogonal frame of the individual axes of the sensor. The partially processed data takes the raw data and applies the orthogonalization matrix to get the data into the IFG frame (SPICE name is INSIGHT_APSS_MAG). In addition, the partially processed data are rotated into the spacecraft mechanical frame (INSIGHT_LANDER). The calibrated data are provided in the spacecraft frame and in the landed local vertical, local horizontal coordinate system (INSIGHT_LL). In this frame, +Z points along local gravity vector, +X points towards local north, and +Y points towards local east. The transformation from the INSIGHT_LANDER frame to the INSIGHT_LL is assumed to be static and will be unless the landed spacecraft settles or shifts on the surface after landing. The transformation matrix between the two frames was computed using the WebGeocalc (https://wgc.jpl.nasa.gov:8443/webgeocalc/#NewCalculation) provided by the SPICE team using the following parameters:

Input time: 2019-02-28T00:00:00.000 UTC
Light propagation: None
Kernels input by manual selection:

INSIGHT/kernels/ck/insight_surf_ops_v1.bc
INSIGHT/kernels/fk/insight_v05.tf
INSIGHT/kernels/lsk/naif0012.tls
INSIGHT/kernels/sclk/NSY_SCLKSCET.00025.tsc
INSIGHT/kernels/spk/de430s.bsp
INSIGHT/kernels/spk/insight_ls_ops181206_iau2000_v1.bsp
INSIGHT/kernels/spk/mar097s.bsp
INSIGHT/kernels/fk/insight_tp_ops181206_iau2000_v1.tf

Which gives the resulting matrix:

0.99886589;	-0.00622313;	0.04720395;
0.00862136;	0.99867298;	-0.05077360;
-0.04682533;	0.05112297;	0.99759402.

3.3.3 Data Storage Conventions

All IFG archive data will be described in the PDS4 metadata as fixed column width ASCII tables with a one-line header that provides the column names.

3.4 Applicable Software

No software is provided with these data.

3.5 Backups and duplicates

The PPI Node of the PDS keeps two copies of each archive product. One copy is the primary online archive copy, another is a backup copy. Once the archive products are fully validated and approved for inclusion in the archive, a third copy of the archive is sent to the National Space Science Data Coordinated Archive (NSSDCA) for long-term preservation in a NASA-approved deep-storage facility. PPI may maintain additional copies of the archive products, either on or off-site as deemed necessary.

4 IFG Archive Organization, Identifiers and Naming Conventions

This section describes the basic organization of the IFG data archives under the PDS4 Information Model (IM) (Applicable Documents [1] and [3]), including the naming conventions used for the bundle, collection, and product unique identifiers.

4.1 Bundles

The highest level of organization for a PDS archive is the bundle. A bundle is a set of one or more related collections which may be of different types. A collection is a set of one or more related basic products which are all of the same type. Bundles and collections are logical structures, not necessarily tied to any physical directory structure or organization.

The InSight IFG archive is currently organized into two bundles (Cruise and Mars) as described in Table 7. The Cruise bundle contains raw and partially calibrated data. The Mars bundle contains a calibrated data collection in addition to the two cruise data collections. If the IFG team determines that additional data collections are useful (derived data, etc.), these may either be added to the Mars bundle or a new bundle could be defined. The original insight-ifg-mars bundle is available from the PDS for those users who wish to compare data from the old and new data processing methods. However, users should only use data from the “newcal” for science.

Table 7: IFG Bundles

Bundle Logical Identifier	PDS4 Processing Level	Description
urn:nasa:pds:insight-ifg-cruise	Raw, Partially Processed	IFG Cruise Bundle
urn:nasa:pds:insight-ifg-mars-newcal	Raw, Partially Processed, Calibrated	New IFG Mars Bundle

4.2 Collections

Collections consist of basic products all of the same type. The IFG Bundles contain the collections listed in Table 8. The collections are described in section 4.5.

Table 8: Collections in the IFG Bundles

Collection Logical Identifier	Collection Type	Description
urn:nasa:pds:insight-ifg-cruise:document urn:nasa:pds:insight-ifg-mars-newcal:document	Document	Contains electronic documents including this SIS. Other documents that may be of interest to the user may be added later. Many of the documents in these collections will be secondary products, not

		physically stored with the data in the bundle(s).
urn:nasa:pds:insight-ifg-cruise:browse urn:nasa:pds:insight-ifg-mars-newcal:browse	Browse	Contains PNG plots of the IFG data for quick-look purposes
urn:nasa:pds:insight-ifg-cruise:data-sc-engineering urn:nasa:pds:insight-ifg-mars:data- sc-engineering	Ancillary Data	Spacecraft engineering and housekeeping data in fixed-width ASCII table format.
urn:nasa:pds:insight-ifg-cruise:data-ifg-raw urn:nasa:pds:insight-ifg-mars-newcal:data-ifg-raw	Raw Data	Raw data files in fixed-width ASCII table format.
urn:nasa:pds:insight-ifg-cruise:data-partially-processed urn:nasa:pds:insight-ifg-mars-newcal:data-partially-processed	Partially Processed Data	Partially processed data files in fixed-width ASCII table format.
urn:nasa:pds:insight-ifg-mars-newcal:data-ifg-calibrated	Calibrated Data	New calibrated data files in fixed-width ASCII table format.
urn:nasa:pds:insight-ifg-mars-newcal:data-ifg-calibrated-maven-20hz	Calibrated Data	New calibrated 20 Hz data files associated with MAVEN fly-overs in fixed-width ASCII table format (same as other calibrated data files).

4.3 Products

A PDS product consists of one or more digital objects and an accompanying PDS label file. PDS labels provide identification and description information for labeled objects. The PDS label includes a Logical Identifier (LID) by which any PDS labeled product is uniquely identified throughout all PDS archives. PDS4 labels are XML-formatted ASCII files.

4.4 Logical Identifiers

Every product in PDS is assigned an identifier which allows it to be uniquely identified across the system. This identifier is referred to as a Logical Identifier or LID. A LIDVID (Versioned Logical Identifier) includes product version information, and allows different versions of a specific product to be referenced uniquely. A product's LID and VID are defined as separate attributes in the product label. LIDs and VIDs are assigned by PDS and are formed according to the conventions described in sections 4.4.2 and 4.4.3 below. The uniqueness of a product's LIDVID may be verified using the PDS Registry and Harvest tools. More information on LIDs and VIDs may be found in section 6d of the PDS Standards Reference [1] and in chapter 5 of the Data Providers' Handbook [4].

4.4.1 File Naming Conventions

For nominal science operations, a single file is created per sol (mlst) for each data rate returned. Usually this will be just the 0.2 Hz rate data. However, higher rate data (1, 2, 4, 10, or 20 Hz) from selected time intervals will occasionally be returned when downlink resources and science priorities permit.

The filename convention for IFG data is

ifg_level_SOLssss_startdatetime_stopdatetime_rate_vers.tab, where:

- ifg is literal and indicates that the data are from the IFG instrument;
- level is the data processing level and can be one of raw, pcal, or cal;
- SOL is literal
- ssss is the SOL number
- startdatetime is the Earth UTC start date and time of the data file in the format YYYYMMDDThhmmss where "YYYY" is the 4 digit year, "MM" is the month, "DD" is the day, "T" is literal and is used to separate date and time, "hh" is the hour of day, "mm" is the minute of hour, and "ss" is the second of minute;
- stopdatetime is the Earth UTC stop date and time of the data file in the same format as the startdatetime field;
- rate is the IFG data rate and may be one of pt2Hz, gpt2Hz 1Hz, 2Hz, 4Hz, 10Hz, or 20Hz;
- vers is the IFG file version number (v01 – v99)
- ".tab" is literal and denotes that the data are stored in an ASCII table.

Note: The "gpt2Hz" rate is assigned to 0.2z data created on the ground by FIR filtering 2Hz data (div5, div2) and only applies to calibrated data. The file naming convention for IFG browse data follows the convention for the data files except that the file extension is ".png" rather than ".tab". The start/stop date/times are those of the plots rather than the data. The plots typically extend a bit beyond the data in both directions.

The filename convention for spacecraft engineering data is

ancil_SOLssss_startdatetime_stopdatetime_vers.tab, where:

- "ancil" is literal and identifies that data as ancillary;
- SOL is literal
- ssss is the SOL number
- startdatetime is the Earth UTC start date and time of the data file in the format YYYYDDDThhmmss where "YYYY" is the 4 digit year, "DDD" is the day of year where Jan 01 = 001, "T" is literal and is used to separate date and time, "hh" is the hour of day, "mm" is the minute of hour, and "ss" is the second of minute;

- stopdatetime is the Earth UTC stop date and time of the data file in the same format as the startdatetime field;

- vers is the IFG file version number (v01 – v99)

- ".tab" is literal and denotes that the data are stored in an ASCII table.

Note

The MAVEN fly-over data file names insert either a "_maven_cln_" or a "_maven_mdcln_" into the standard convention between the SOLssss and startdatetime elements. All MAVEN fly-over data have been hand cleaned to the extent possible. The median cleaned data have been additionally processed.

4.4.2 LID Formation

LIDs take the form of a Uniform Resource Name (URN). LIDs are restricted to ASCII lower case letters, digits, dash, underscore, and period. Colons are also used, but only to separate prescribed components of the LID. Within one of these prescribed components dash, underscore, or period are used as separators. LIDs are limited in length to 255 characters.

InSight IFG LIDs are formed according to the following conventions:

- Bundle LIDs are formed by appending a bundle specific ID to the PDS base ID:

  urn:nasa:pds:<bundle ID>

  Example: urn:nasa:pds:insight-ifg-mars-newcal

  The bundle ID must be unique across all bundles archived with the PDS.

- Collection LIDs are formed by appending a collection specific ID to the collection's parent bundle LID:

  urn:nasa:pds:<bundle ID>:<collection ID>

  Example: urn:nasa:pds:insight-ifg-mars-newcal:data-ifg-raw

  Since the collection LID is based on the bundle LID, which is unique across PDS, the only additional condition is that the collection ID must be unique across the bundle. Collection IDs correspond to the collection type (e.g. "browse", "data", "document", etc.). Additional descriptive information may be appended to the collection type (e.g. "data-ifg-raw", "data-ifg-calibrated", etc.) to insure that multiple collections of the same type within a single bundle have unique LIDs.

- Basic product LIDs are formed by appending a product-specific ID to the product's parent collection LID:

  urn:nasa:pds:<bundle ID>:<collection ID>:<product ID>

  Example: urn:nasa:pds:insight-ifg-cruise:data-ifg-raw: ifg-raw-sol0054-20190120t174229-20190121t182158-pt2hz-v01

  Since the product LID is based on the collection LID, which is unique across PDS, the only additional condition is that the product ID must be unique across the collection. For IFG data products, the product LID is nearly the same as the data file name without the extension. The changes are that the underscores and “dot” in the file name have been converted to dashes and the uppercase “SOL”, “T” and “H” in the SOL, time and rate elements have been replaced with lowercase “sol”, “t” or “h”. Uppercase letters are not allowed in the PDS4 LID and the underscores are replaced with dashes in order to conform to the PDS-PPI “best practices” for LID formation. See section 4.5 below for examples of IFG data product LIDs.

4.4.3 VID Formation

Product Version IDs consist of major and minor components separated by a “.” (M.n). Both components of the VID are integer values. The major component is initialized to a value of “1”, and the minor component is initialized to a value of “0”. The minor component resets to “0” when the major component is incremented. The first time a file (basic product) is publicly released, it has version 1.0. Updates to the metadata associated with a product causes a minor version update (v1.1). Updates to the data (document, etc.) that are described by the metadata cause the major element of the version number to increment, resetting the minor version (2.0). PDS collections follow similar versioning rules. If members are added to a collection, such as a new data release in an active mission, the minor component of the version is incremented. However, if the structure/content of the collection members changes (i.e. redelivery of previously released products), then the major version is updated. The PDS Standards Reference [1] specifies rules for incrementing major and minor components.

4.5 Data Collections

4.5.1 IFG Raw Data Collection

The IFG raw data, regardless of the sample rate, are included in the raw data collection. Data are separated into data files by date and sample rate. The data file granularity is one file per SOL.

4.5.2 IFG Partially Processed Data Collection

The IFG partially processed data are directly linked to the raw data. This collection contains one file for each raw data file.

4.5.3 IFG Calibrated Data Collection

The IFG calibrated data are also directly linked to the raw data. This collection contains one file for each raw data file in the Mars bundle. This collection is not included in the IFG cruise data bundle.

4.5.4 IFG Calibrated 20hz MAVEN Flyover Data Collection

The IFG calibrated 20hz MAVEN flyover data are directly linked to the calibrated data. This collection contains a subset of the files in the calibrated data collection that are associated with

MAVEN spacecraft flyovers. These data have had additional artifact removal. This collection is not included in the IFG cruise data bundle.

4.5.5 Ancillary Data Collection

The ancillary data collection contains spacecraft engineering and housekeeping data files. Ancillary data files are only provided when IFG science data are being acquired.

4.5.6 IFG Browse Collection

PNG plots are provided for each of the partially processed (cruise bundle) or calibrated (Mars bundle) data files. These plots are included in a browse data collection. Each plot file is described by a PDS label that identifies the primary data file used to create the plot.

4.5.7 IFG Document Collection

The IFG documents will be physically included in the document collection of the Mars data bundle and remotely referenced in the document collection of the cruise data bundle. Using the PDS4 terminology, these documents will be primary members of the document collection in the Mars bundle and secondary members in the document collection for the cruise bundle. In PDS4, only a single version of a document is allowed, but the document can be remotely referenced any number of times. Documents from the InSight document bundle (an archive of documents that apply to multiple experiments, such as those that describe the mission and spacecraft) will also be remotely referenced as secondary members of the IFG document collections.

4.5.8 Other Collections

Many PDS4 bundles contain a variety of other collections such as “schema” or “context” that are not normally included on bundles at the PPI Node of the PDS. These archives are built according to the best practices of the PPI Node

4.5.9 Versions in File Names

PDS assigns a version to each product in the archive as discussed in Section 4.5.3 VID Formation. However, the version number that the IFG team assigns to the files that are provided internally and then archived reflects the version of the data processing pipeline used to create the data. IFG and spacecraft engineering data have separated data processing pipelines. The latter hasn’t changed and is, and likely always be, version v01. The IFG data processing pipeline has gone through several versions which are described below.

4.5.9.1 IFG pipeline version v01

Initial version, mostly used to process cruise data and data shortly after landing. This version assumed that AOBT=SCLK for UTC time conversion. In addition, since sensor and electronics temperature values were sparse or unavailable, models of these temperature variations were developed and used for calibration.

4.5.9.2 IFG pipeline version v02

UTC time tags correctly computed by properly accounting for the AOBT drift relative to SCLK. Removal of the diurnal variations in the data correlated with solar array fixed and total currents was added. Models of temperature and current variations were replaced by polynomial fits to these values in order to track temporal variations in the MLST signatures.

4.5.9.3 IFG pipeline version v03

An error in the time tag associated with the IFG sensor temperature values was discovered and corrected. This error most strongly affected data acquired between about 06:30 and 09:30 MLST when the temperature was rising quickly.

4.5.9.4 IFG pipeline version v04

An initial version of a data spike and square-wave step removal process was added to the calibration procedure of the 0.2 Hz data in spacecraft coordinates. These features remain in the partially processed data. The difference between the values of (Bx_SC, By_SC, and Bz_SC) in the calibrated versus partially processed data is the correction that has been applied.

4.5.9.5 IFG pipeline version v05

An error in the temperature and solar array current column orders occurred in the v04 during release 2. This error was corrected in release 3, v05. Since the impacted columns do not exist in the calibrated data the version number of this pipeline was not incremented.

4.5.9.6 IFG pipeline version v06

Prior to pipeline version v06, the column in the data files labeled MLST actually contain TLST values. This error was discovered in late April, 2020. After some internal discussion, the IFG team decided that the best path forward was to include both local times, mean and true, in the data files and to redeliver to the PDS all data to date with the value in the MLST column correctly computed. This error did not impact the ancillary data files.

4.5.9.7 IFG pipeline version v07

The v07 pipeline changed the way that instrument temperature and solar array current corrections were applied to the data. In addition, there was a lot of work put into cleaning up the model temperature and SA current values used for these corrections. Since the raw data products include these model values, new raw data products are provided in the v07 delivery. A new bundle was created (insight-ifg-mars-newcal) and data from the entire mission were reprocessed using the v07 data pipeline. There are no changes to the spacecraft engineering data so these products are only included in the new bundle as a secondary data collection.

5 IFG Data Product Formats

Data that comprise the IFG data archive are formatted in accordance with PDS specifications (see Applicable Documents [1], [2] and [3]. This section provides details on the formats used for each of the products included in the archive.

5.1 Data Product Formats

The following sections describe the structures of the various IFG data files.

5.1.1 Raw Data File Structures

The IFG raw data files contain the IFG data returned from the spacecraft as data numbers, organized as a set of time-tagged and time-ordered data. The filtered and down-sampled data have three more columns (estaZ, IFGT_DN, SensorT) than the full 20Hz data. The structure of the raw data files are given in Tables 9 and 10.

Table 9: IFG Raw 20 Hz Data File Structure

Column Name	Type	Units	Start Byte	Bytes	Description
SCET_UTC	ASCII_ Date_ Time_ YMD	N/A	1	23	Sample S/C event time UTC in YYYY-MM-DDThh:mm:ss.sss format
AOBT	ASCII_ Real	N/A	25	14	PPS onboard time (AOBT) value of sample. This is the spacecraft clock time used by the APSS instruments.
frequency	ASCII_ Real	Hz	40	8	IFG sample frequency (Hz) – column headings in the data tables use “freq” to fit in the allowed space
Conf	ASCII_ Integer	N/A	49	4	Configuration table number used to define onboard processing including IFG down-sampling rate and the computation of the estimated parameters.
Off	ASCII_ Integer	N/A	54	4	Sample offset within the downlink packet (samples 1 - 1024).
IFG1_DN	ASCII_ Integer	N/A	59	8	IFG axis 1 value in data numbers.
IFG2_DN	ASCII_ Integer	N/A	68	8	IFG axis 2 value in data numbers.
IFG3_DN	ASCII_ Integer	N/A	77	8	IFG axis 3 value in data numbers.
MLST	ASCII_ Real	hours	86	12	Mean local time represented as decimal SOLs with the format SSSS.xxxxxxx where SSSS is the SOL number and xxxxxxx is the fractional SOL.
TLST	ASCII_ Real	hours	99	12	Mean local time represented as decimal hours (0 - 24)
HR_Angle	ASCII_ Real	deg	112	8	Solar hour angle in degrees (0-360) with 0 at noon and 90 at dusk.

Column Name	Type	Units	Start Byte	Bytes	Description
modelET	ASCII_ Real	deg	121	8	Prior to 2019-11-18, the actual IFG electronics temperature (ET) was only available a few times per SOL. Since a value is required for every IFG vector for calibration purposes, a spline fit to the PAE temperature T-0014 was used as a proxy. T-0014 is sometimes available every minute or so, but is only infrequently returned at night. The observed values of T-0014 were spline fit to produce data set that is sampled at 5 minute resolution or better and then the values between those samples are derived by linear interpolation. After 2019-11-18, ET data became available every 15 minutes and data were linearly interpolated between samples to provide continuous data. This value is given in units of degrees Celsius. See the IFG calibration document for additional details
modelST	ASCII_ Real	deg	130	8	Since the value of the actual IFG sensor temperature is not available in the high rate data, a model value of the sensor temperature derived from low rate data [deg C] is used for the calibration.
modelSA	ASCII_ Real	A	139	8	TLST and UTC dependent model of the fixed solar array current [A] derived from the values of the E-0771 from selected time intervals. Actual data values are sparsely sampled.
ModSACT	ASCII_ Real	A	148	8	TLST and UTC dependent model of the solar array current [A] total (SACT) derived from the sum of E-0772 and E-0772 from selected time intervals. Actual data values are sparsely sampled.

Table 10: IFG Raw Down-sampled Data (0.2, 2.0, and 10 Hz) File Structure

Column Name	Type	Units	Start Byte	Bytes	Description
SCET_UTC	ASCII_ Date_ Time_ YMD	N/A	1	23	Sample S/C event time UTC in YYYY-MM-DDThh:mm:ss.sss format
AOBT	ASCII_ Real	N/A	25	14	PPS onboard time (AOBT) value of sample. This is the spacecraft clock time used by the APSS instruments.
frequency	ASCII_ Real	Hz	40	8	IFG sample frequency (Hz)
conf	ASCII_ Integer	N/A	49	4	Configuration table number used to define onboard processing including IFG down-sampling rate and the computation of the estimated parameters.
off	ASCII_ Integer	N/A	54	4	Sample offset within the downlink packet (samples 1 - 1024).
IFG1_DN	ASCII_ Integer	N/A	59	8	IFG axis 1 value in data numbers.

Column Name	Type	Units	Start Byte	Bytes	Description
IFG2_DN	ASCII_ Integer	N/A	68	8	IFG axis 2 value in data numbers.
IFG3_DN	ASCII_ Integer	N/A	77	8	IFG axis 3 value in data numbers.
estaZ	ASCII_ Integer	N/A	86	8	Estimated IFG parameter. The meaning of this value depends on the configuration table used. In the projection configuration the value is the sum of constants (1, 2, 3) times the corresponding IFG axes values. In the norm configuration, the value is the square-root of the sum of constants (1, 2, 3) times the square of the corresponding IFG axes values.
IFGT_DN	ASCII_ Integer	N/A	95	8	IFG sensor temperature value in data numbers.
MLST	ASCII_ Real	hours	104	12	Mean local time represented as decimal SOLs with the format SSSS.xxxxxxx where SSSS is the SOL number and xxxxxxx is the fractional SOL.
TLST	ASCII_ Real	hours	117	12	True local time represented as decimal hours (0 - 24)
HR_Angle	ASCII_ Real	Deg	130	8	Solar hour angle in degrees (0-360) with 0 at noon and 90 at dusk.
SensorT	ASCII_ Real	Deg C	139	8	IFG sensor temperature [deg C] computed from the value of IFGT_DN in order to provide a comparison with the model sensor temperature.
ModelET	ASCII_ Real	Deg C	148	8	Prior to 2019-11-18, the actual IFG electronics temperature (ET) was only available a few times per SOL. Since a value is required for every IFG vector for calibration purposes, a spline fit to the PAE temperature T-0014 was used as a proxy. T-0014 is sometimes available every minute or so, but is only infrequently returned at night. The observed values of T-0014 were spline fit to produce data set that is sampled at 5 minute resolution or better and then the values between those samples are derived by linear interpolation. After 2019-11-18, ET data became available every 15 minutes and data were linearly interpolated between samples to provide continuous data. This value is given in units of degrees Celsius. See the IFG calibration document for additional details

Column Name	Type	Units	Start Byte	Bytes	Description
ModelST	ASCII_ Real	Deg C	157	8	Prior to 2019-11-18, the actual IFG electronics temperature (ET) was only available a few times per SOL. Since a value is required for every IFG vector for calibration purposes, a spline fit to the PAE temperature T-0014 was used as a proxy. T-0014 is sometimes available every minute or so, but is only infrequently returned at night. The observed values of T-0014 were spline fit to produce data set that is sampled at 5 minute resolution or better and then the values between those samples are derived by linear interpolation. After 2019-11-18, ET data became available every 15 minutes and data were linearly interpolated between samples to provide continuous data. This value is given in units of degrees Celsius. See the IFG calibration document for additional details
ModelSA	ASCII_ Real	A	166	8	TLST and UTC dependent model of the fixed solar array current [A] derived from the values of the E-0771 from selected time intervals.
ModSACT	ASCII_ Real	A	175	8	TLST and UTC dependent model of the solar array current [A] total (SACT) derived from the sum of E-0772 and E-0772 from selected time intervals.

5.1.2 Partially Processed Data File Structure

The IFG partially processed data files contain the IFG data returned from the spacecraft with the temperature dependent gains and offsets applied and the estimated zero levels removed. Once the individual axes data are converted to nanoTesla, they are orthogonalized (sensor coordinates) and rotated into spacecraft coordinates.

Table 11: IFG Partially Processed Down-sampled Data (0.2 Hz) File Structure (Cruise)

Column Name	Type	Units	Start Byte	Bytes	Description
SCET_UTC	ASCII_Date_Time_YMD	N/A	1	23	Sample S/C event time UTC in YYYY-MM-DDThh:mm:ss.sss format
AOBT	ASCII_Real	N/A	26	14	APSS onboard time (AOBT) value of sample. This is the spacecraft clock time used by the APSS instruments.
IFG_1	ASCII_Real	nT	41	9	IFG axis 1 data in nT with offsets and MLST variations subtracted
IFG_2	ASCII_Real	nT	51	9	IFG axis 2 data in nT with offsets and MLST variations subtracted
IFG_3	ASCII_Real	nT	61	9	IFG axis 3 data in nT with offsets and MLST variations subtracted
Bx_SC	ASCII_Real	nT	71	9	B field component in the spacecraft coordinate X direction in nT.
By_SC	ASCII_Real	nT	81	9	B field component in the spacecraft coordinate Y direction in nT.
Bz_SC	ASCII_Real	nT	91	9	B field component in the spacecraft coordinate Z direction in nT.
|B|	ASCII_Real	nT	101	9	Field magnitude equals sqrt($Bx^2 + By^2 + Bz^2$)
SenTemp	ASCII_Real	Deg C	111	9	Measured sensor temperature in degrees C
estElcTmp	ASCII_Real	Deg C	121	9	Estimated electronics temperature in degrees C

Table 12: IFG Partially Processed High Resolution (20Hz) Data File Structure (Mars)

Column Name	Type	Units	Start Byte	Bytes	Description
SCET_UTC	ASCII_ Date_ Time_ YMD	N/A	1	23	Sample S/C event time UTC in YYYY-MM-DDThh:mm:ss.sss format
AOBT	ASCII_ Real	N/A	26	14	APSS onboard time (AOBT) value of sample. This is the spacecraft clock time used by the APSS instruments.
IFG_1	ASCII_ Real	nT	41	9	IFG axis 1 data in nT with offsets and LST variations subtracted
IFG_2	ASCII_ Real	nT	51	9	IFG axis 2 data in nT with offsets and LST variations subtracted
IFG_3	ASCII_ Real	nT	61	9	IFG axis 3 data in nT with offsets and LST variations subtracted
Bx_SC	ASCII_ Real	nT	71	9	Spacecraft mechanical coordinate system Bx component in nT. This frame is called the INSIGHT Lander Frame in SPICE and is described in the insight_v02.tf file as: FRAME_INSIGHT_LANDER = -189001, FRAME_-189001_NAME = INSIGHT_LANDER.
By_SC	ASCII_ Real	nT	81	9	Spacecraft mechanical coordinate system By component in nT
Bz_SC	ASCII_ Real	nT	91	9	Spacecraft mechanical coordinate system Bz component in nT
MLST	ASCII_ Real	hours	101	12	Mean local time represented as decimal SOLs with the format SSSS.xxxxxxx where SSSS is the SOL number and xxxxxxx is the fractional SOL.
TLST	ASCII_ Real	hours	114	12	True local time represented as decimal hours (0 - 24)
HR_Angle	ASCII_ Real	deg	127	9	Solar hour angle in degrees (0-360) with 0 at noon and 90 at dusk.
modelET	ASCII_ Real	Deg C	137	9	Prior to 2019-11-18, the actual IFG electronics temperature (ET) was only available a few times per SOL. Since a value is required for every IFG vector for calibration purposes, a spline fit to the PAE temperature T-0014 was used as a proxy. T-0014 is sometimes available every minute or so, but is only infrequently returned at night. The observed values of T-0014 were spline fit to produce data set that is sampled at 5 minute resolution or better and then the values between those samples are derived by linear interpolation. After 2019-11-18, ET data became available every 15 minutes and data were linearly interpolated between samples to provide continuous data. This value is given in units of degrees Celsius. See the IFG calibration document for additional details

Column Name	Type	Units	Start Byte	Bytes	Description
modelST	ASCII_ Real	Deg C	141	9	Value of the actual IFG sensor temperature [SensorT] when available, otherwise a TLST and UTC dependent model of the IFG sensor temperature [deg C] derived from the measured values from selected time intervals is provided. The FIR filter applied to the temperature data is longer than the one applied to the IFG data so there is a roughly two hour gap in the temperature data whenever the IFG powers on (i.e. following a spacecraft safing or PAE reset). The value in this column is used for the IFG calibration since it is available for all samples. See the IFG calibration document for additional details.
modelSA	ASCII_ Real	A	151	9	TLST and UTC dependent model of the fixed solar array current [A] derived from the values of the E-0771 from selected time intervals. Actual data values are sparsely sampled.
ModSACT	ASCII_ Real	A	161	9	TLST and UTC dependent model of the solar array current [A] total (SACT) derived from the sum of E-0772 and E-0772 from selected time intervals. See the IFG calibration document for additional details.

Table 13: IFG Partially Processed Down-sampled Data (0.2, 2, 10 Hz) File Structure (Mars)

Column Name	Type	Units	Start Byte	Bytes	Description
SCET_UTC	ASCII_ Date_ Time_ YMD	N/A	1	23	Sample S/C event time UTC in YYYY-MM-DDThh:mm:ss.sss format
AOBT	ASCII_ Real	N/A	26	14	APSS onboard time (AOBT) value of sample. This is the spacecraft clock time used by the APSS instruments.
IFG_1	ASCII_ Real	nT	41	9	IFG axis 1 data in nT with offsets and LST variations subtracted
IFG_2	ASCII_ Real	nT	51	9	IFG axis 2 data in nT with offsets and LST variations subtracted
IFG_3	ASCII_ Real	nT	61	9	IFG axis 3 data in nT with offsets and LST variations subtracted
Bx_SC	ASCII_ Real	nT	71	9	Spacecraft mechanical coordinate system Bx component in nT. This frame is called the INSIGHT Lander Frame in SPICE and is described in the insight_v02.tf file as: FRAME_INSIGHT_LANDER = -189001, FRAME_-189001_NAME = INSIGHT_LANDER.
By_SC	ASCII_ Real	nT	81	9	Spacecraft mechanical coordinate system By component in nT
Bz_SC	ASCII_ Real	nT	91	9	Spacecraft mechanical coordinate system Bz component in nT
MLST	ASCII_ Real	hours	101	12	Mean local time represented as decimal SOLs with the format SSSS.xxxxxxx where SSSS is the SOL number and xxxxxxx is the fractional SOL.

Column Name	Type	Units	Start Byte	Bytes	Description
TLST	ASCII_ Real	hours	114	12	True local time represented as decimal hours (0 - 24)
HR_Angle	ASCII_ Real	deg	127	9	Solar hour angle in degrees (0-360) with 0 at noon and 90 at dusk.
modelET	ASCII_ Real	Deg C	137	9	Prior to 2019-11-18, the actual IFG electronics temperature (ET) was only available a few times per SOL. Since a value is required for every IFG vector for calibration purposes, a spline fit to the PAE temperature T-0014 was used as a proxy. T-0014 is sometimes available every minute or so, but is only infrequently returned at night. The observed values of T-0014 were spline fit to produce data set that is sampled at 5 minute resolution or better and then the values between those samples are derived by linear interpolation. After 2019-11-18, ET data became available every 15 minutes and data were linearly interpolated between samples to provide continuous data. This value is given in units of degrees Celsius. See the IFG calibration document for additional details
modelST	ASCII_ Real	Deg C	141	9	Value of the actual IFG sensor temperature [SensorT] when available, otherwise a MLST and UTC dependent model of the IFG sensor temperature [deg C] derived from the measured values from selected time intervals is provided. The FIR filter applied to the temperature data is longer than the one applied to the IFG data so there is a roughly two hour gap in the temperature data whenever the IFG powers on (i.e. following a spacecraft safing or PAE reset). The value in this column is used for the IFG calibration since it is available for all samples. See the IFG calibration document for additional details.
modelSA	ASCII_ Real	A	151	9	TLST and UTC dependent model of the fixed solar array current [A] derived from the values of the E-0771 from selected time intervals. Actual data values are sparsely sampled.
ModSACT	ASCII_ Real	A	161	9	TLST and UTC dependent model of the solar array current [A] total (SACT) derived from the sum of E-0772 and E-0772 from selected time intervals. See the IFG calibration document for additional details.

Note, the Mars data do not have the same structure as the cruise data. After landing, it was determined that additional columns would need to be included to model spacecraft currents and instrument temperatures. Actual temperature data are not always available and the temperature is highly variable.

5.1.3 Calibrated Data File Structure

The IFG calibrated data files contain the best estimates of the actual field values at the surface of Mars. All identified sources of spacecraft interference have been removed to the best of the current ability of the IFG team. Each record contains a data quality flag that both indicates the IFG team assessment of the quality of that vector, a list of interference corrections applied to the data, and a list of interference signatures that remain but have yet to be characterized well enough to be removed from the data. The data are provided in units of nanoTesla in INSIGHT_LL coordinates (see section 3.3.2 for details). The structure of the calibrated data, including the MAVEN flyover calibrated data is given in Table 14. MAVEN flyover data are subsets of the calibrated data collection and the file structure is unchanged.

Table 14: IFG Calibrated Data File Structure (for all data rates)

Column Name	Type	Units	Start Byte	Bytes	Description
SCET_UTC	ASCII_ Date_ Time_ YMD	N/A	1	23	Sample S/C event time UTC in YYYY-MM-DDThh:mm:ss.sss format
MLST	ASCII_ Real	N/A	25	12	Mean local time represented as decimal SOLs with the format SSSS.xxxxxxx where SSSS is the SOL number and xxxxxxx is the fractional SOL.
TLST	ASCII_ Real	N/A	38	12	True local time represented as decimal hours (0 - 24)
HR_Angle	ASCII_ Real	deg	51	9	Solar hour angle in degrees (0-360) with 0 at noon and 90 at dusk.
Bx_SC	ASCII_ Real	nT	61	9	B field component in the spacecraft X direction in nT.
By_SC	ASCII_ Real	nT	71	9	B field component in the spacecraft Y direction in nT.
Bz_SC	ASCII_ Real	nT	81	9	B field component in the spacecraft Z direction in nT.
B_north	ASCII_ Real	nT	91	9	B_north (+X) field component [nT] in the Landed Local Vertical, Local Horizontal Coordinate System. In this frame, +Z points along local gravity vector, +X points towards local North, and +Y points east. This frame is called the INSIGHT_LL Frame in SPICE and is described in the insight_v02.tf file as: FRAME_INSIGHT_LL = -189003, FRAME_-189003_NAME = INSIGHT_LL.
B_east	ASCII_ Real	nT	101	9	The B_east (+Y) field component [nT] in the INSIGHT_LL frame.
B_down	ASCII_ Real	nT	111	9	The B_down (+Z) field component [nT] in the INSIGHT_LL frame.

Column Name	Type	Units	Start Byte	Bytes	Description
dqf	ASCII_ String	N/A	121	14	Data quality flag – a string of 14 characters (numbers) that define the data quality and contamination associated with this field vector. In addition, some items describe the source of the temperature or current values used in the data processing. Starting from the right (least significant), an increasing one character for each item: 1. Overall data quality assessment 2. Source of sensor temperature data 3. Source of electronics temperature data 4. Source of fixed solar array current 5. Source of total solar array current 6. Not used at this time 7. Not used at this time 8. Single point data spike at least one component 9. Square wave step in one or more components 10. Square wave step in one or more components with fluctuations or the leading or trailing edge, or both 11. Irregular steps, ramps, and other structures occurring between 11 and 12.5 hours MLST 12. "33" hour steps in IFG1_DN beginning in April 2019 13. Not used at this time 14. Other unidentified issues may be present. Data Source values: 0 Data value 1 Fit to data value to fill in coverage gaps 2 Model Data Quality Values: 0. Good sample, no issue found 1. Issue identified and fully corrected in any/all components 2. Issue identified and partially corrected in all components 3. Issue identified and partially corrected in at least one component 4. Issue identified, no action taken 5. Sample not evaluated for data quality

5.1.4 Ancillary Data File Structure

Table 15 describes the structure and content of the spacecraft engineering and housekeeping data. These data are provided in physical units (amps, Volts, degrees Celsius, etc.). Individual channel values repeat until the next value is received. Values are set to -1 until the first value is received.

Table 15: Ancillary Data File Structure

Column Name	Type	Units	Start Byte	Bytes	Description
SCLK	ASCII_ Real	N/A	1	14	Spacecraft clock counter. The fractional portion of the SCLK value (0-255) are the 8 most significant bits of the 16 bit value (nominally 1/256 of a second).
SCET_UTC	ASCII_ Date_ Time_ DOY	N/A	16	21	Sample S/C event time UTC in YYYY-DDDThh:mm:ss.sss format
ERT_UTC	ASCII_ Date_ Time_ DOY	N/A	38	24	Sample Earth receive time UTC in YYYY-MM-DDThh:mm:ss.ssssss format
SOL/MLST	ASCII_ String	N/A	63	21	Sample SOL and Mars local solar time (SOL-xxxxMhh:mm:ss.sss)
E-0114	ASCII_ Real	Volts	85	8	PDDU AAC (analog acquisition card) AIV (analog input voltage) channel 14. Bus voltage monitor 1A signal.
E-0126	ASCII_ Real	Volts	94	8	PDDU AAC (analog acquisition card) AIV (analog input voltage) channel 26. Bus voltage monitor 2A signal.
E-0606	ASCII_ Real	amps	103	8	DDU AAC (analog acquisition card) OFC (off card) 00 channel 06. USM 1 (universal switch module 1) upstream switch DPC 0 (discrete power controller 0) current. Corresponds to C-0606
E-0607	ASCII_ Real	amps	112	8	DDU AAC (analog acquisition card) OFC (off card) 00 channel 07. USM 1 (universal switch module 1) upstream switch DPC 1 (discrete power controller 1) current. Corresponds to C-0607
E-0608	ASCII_ Real	amps	121	8	DDU AAC (analog acquisition card) OFC (off card) 00 channel 08. USM 1 (universal switch module 1) upstream switch DPC 2 (discrete power controller 2) current. Corresponds to C-0608 (USM1usD2Ccio)
E-0609	ASCII_ Real	amps	130	8	DDU AAC (analog acquisition card) OFC (off card) 00 channel 09. USM 1 (universal switch module 1) upstream switch DPC 3 (discrete power controller 3) current. Corresponds to C-0609
E-0610	ASCII_ Real	amps	139	8	DDU AAC (analog acquisition card) OFC (off card) 00 channel 10. USM 1 (universal switch module 1) upstream switch DPC 4 (discrete power controller 4) current. Corresponds to C-0610 (USM1usD4Ccio)
E-0611	ASCII_ Real	amps	148	8	DDU AAC (analog acquisition card) OFC (off card) 00 channel 11. USM 1 (universal switch module 1) upstream switch DPC 5 (discrete power controller 5) current. Corresponds to C-0611 (USM1usD5Ccio)
E-0623	ASCII_ Real	amps	157	8	PDDU AAC (analog acquisition card) OFC (off card) 01 channel 03. USM 1 (universal switch module 1) upstream switch latching switch current. Corresponds to C-0623 (USM1usLTCcio).

Column Name	Type	Units	Start Byte	Bytes	Description
E-0624	ASCII_ Real	amps	166	8	PDDU AAC (analog acquisition card) OFC (off card) 01 channel 04. USM 1 (universal switch module 1) upstream switch latching switch current. Corresponds to C-0624 (USM1usLCCcio).
E-0625	ASCII_ Real	amps	175	8	PDDU AAC (analog acquisition card) OFC (off card) 01 channel 05. USM 1 (universal switch module 1) upstream switch latching switch current. Corresponds to C-0625 (USM1usHCCcio).
E-0646	ASCII_ Real	amps	184	8	PDDU AAC (analog acquisition card) OFC (off card) 02 channel 06. USM 2 (universal switch module 2) upstream switch DPC 0 (discrete power controller 0) current. Corresponds to C-0646 (USM2usD0Ccio).
E-0647	ASCII_ Real	amps	193	8	PDDU AAC (analog acquisition card) OFC (off card) 02 channel 07. USM 2 (universal switch module 2) upstream switch DPC 1 (discrete power controller 1) current. Corresponds to C-0647 (USM2usD1Ccio).
E-0648	ASCII_ Real	amps	202	8	PDDU AAC (analog acquisition card) OFC (off card) 02 channel 08. USM 2 (universal switch module 2) upstream switch DPC 2 (discrete power controller 2) current. Corresponds to C-0648 (USM2usD2Ccio).
E-0649	ASCII_ Real	amps	211	8	PDDU AAC (analog acquisition card) OFC (off card) 02 channel 09. USM 2 (universal switch module 2) upstream switch DPC 3 (discrete power controller 3) current. Corresponds to C-0649 (USM2usD3Ccio).
E-0650	ASCII_ Real	amps	220	8	PDDU AAC (analog acquisition card) OFC (off card) 02 channel 10. USM 2 (universal switch module 2) upstream switch DPC 4 (discrete power controller 4) current. Corresponds to C-0650 (USM2usD4Ccio).
E-0651	ASCII_ Real	amps	229	8	PDDU AAC (analog acquisition card) OFC (off card) 02 channel 11. USM 2 (universal switch module 2) upstream switch DPC 5 (discrete power controller 5) current. Corresponds to C-0651 (USM2usD5Ccio).
E-0663	ASCII_ Real	amps	238	8	PDDU AAC (analog acquisition card) OFC (off card) 03 channel 03. USM 2 (universal switch module 2) upstream switch latching switch current. Corresponds to C-0663 (USM2usLTCcio).
E-0664	ASCII_ Real	amps	247	8	PDDU AAC (analog acquisition card) OFC (off card) 03 channel 04. USM 2 (universal switch module 2) upstream switch low current switch current. Corresponds to C-0664 (USM2usLCCcio).
E-0665	ASCII_ Real	amps	256	8	PDDU AAC (analog acquisition card) OFC (off card) 03 channel 05. USM 2 (universal switch module 2) upstream switch high current switch current. Corresponds to C-0665 (USM2usHCCcio).
E-0686	ASCII_ Real	amps	265	8	PDDU AAC (analog acquisition card) OFC (off card) 04 channel 06. USM 3 (universal switch module 3) upstream switch DPC 0 (discrete power controller 0) current. Corresponds to C-0686 (USM2usD0Ccio).

Column Name	Type	Units	Start Byte	Bytes	Description
E-0687	ASCII_ Real	amps	274	8	PDDU AAC (analog acquisition card) OFC (off card) 04 channel 07. USM 3 (universal switch module 3) upstream switch DPC 1 (discrete power controller 1) current. Corresponds to C-0687 (USM2usD1Ccio).
E-0688	ASCII_ Real	amps	283	8	PDDU AAC (analog acquisition card) OFC (off card) 04 channel 08. USM 3 (universal switch module 3) upstream switch DPC 2 (discrete power controller 2) current. Corresponds to C-0688 (USM2usD2Ccio).
E-0689	ASCII_ Real	amps	292	8	PDDU AAC (analog acquisition card) OFC (off card) 04 channel 09. USM 3 (universal switch module 3) upstream switch DPC 3 (discrete power controller 3) current. Corresponds to C-0689 (USM2usD3Ccio).
E-0690	ASCII_ Real	amps	301	8	PDDU AAC (analog acquisition card) OFC (off card) 04 channel 10. USM 3 (universal switch module 3) upstream switch DPC 4 (discrete power controller 4) current. Corresponds to C-0690 (USM2usD4Ccio).
E-0691	ASCII_ Real	amps	310	8	PDDU AAC (analog acquisition card) OFC (off card) 04 channel 11. USM 3 (universal switch module 3) upstream switch DPC 5 (discrete power controller 5) current. Corresponds to C-0691 (USM2usD5Ccio).
E-0703	ASCII_ Real	amps	319	8	PDDU AAC (analog acquisition card) OFC (off card) 05 channel 03. USM 3 (universal switch module 3) upstream switch latching switch current. Corresponds to C-0703 (USM3usLTCcio).
E-0704	ASCII_ Real	amps	328	8	PDDU AAC (analog acquisition card) OFC (off card) 05 channel 04. USM 3 (universal switch module 3) upstream switch low current switch current. Corresponds to C-0704 (USM3usLCCcio).
E-0705	ASCII_ Real	amps	337	8	PDDU AAC (analog acquisition card) OFC (off card) 05 channel 05. USM 3 (universal switch module 3) upstream switch high current switch current. Corresponds to C-0705 (USM3usHCCcio).
E-0726	ASCII_ Real	amps	346	8	PDDU AAC (analog acquisition card) OFC (off card) 06 channel 06. USM 4 (universal switch module 4) upstream switch DPC 0 (discrete power controller 0) current. Corresponds to C-0726 (USM4usD0Ccio).
E-0727	ASCII_ Real	amps	355	8	PDDU AAC (analog acquisition card) OFC (off card) 06 channel 07. USM 4 (universal switch module 4) upstream switch DPC 1 (discrete power controller 1) current. Corresponds to C-0727 (USM4usD1Ccio).
E-0728	ASCII_ Real	amps	364	8	PDDU AAC (analog acquisition card) OFC (off card) 06 channel 08. USM 4 (universal switch module 4) upstream switch DPC 2 (discrete power controller 2) current. Corresponds to C-0728 (USM4usD2Ccio).
E-0729	ASCII_ Real	amps	373	8	PDDU AAC (analog acquisition card) OFC (off card) 06 channel 09. USM 4 (universal switch module 4) upstream switch DPC 3 (discrete power controller 3) current. Corresponds to C-0729 (USM4usD3Ccio).

Column Name	Type	Units	Start Byte	Bytes	Description
E-0730	ASCII_Real	amps	382	8	PDDU AAC (analog acquisition card) OFC (off card) 06 channel 10. USM 4 (universal switch module 4) upstream switch DPC 4 (discrete power controller 4) current. Corresponds to C-0730 (USM4usD4Ccio).
E-0731	ASCII_Real	amps	391	8	PDDU AAC (analog acquisition card) OFC (off card) 06 channel 11. USM 4 (universal switch module 4) upstream switch DPC 5 (discrete power controller 5) current. Corresponds to C-0731 (USM4usD5Ccio).
E-0743	ASCII_Real	amps	400	8	PDDU AAC (analog acquisition card) OFC (off card) 07 channel 03. USM 4 (universal switch module 4) upstream switch latching switch current. Corresponds to C-0743 (USM4usLTCcio).
E-0744	ASCII_Real	amps	409	8	PDDU AAC (analog acquisition card) OFC (off card) 07 channel 04. USM 4 (universal switch module 4) upstream switch low switch current. Corresponds to C-0744 (USM4usLCCcio).
E-0745	ASCII_Real	amps	418	8	PDDU AAC (analog acquisition card) OFC (off card) 07 channel 05. USM 4 (universal switch module 4) upstream switch high switch current. Corresponds to C-0745 (USM4usHCCcio).
E-0769	ASCII_Real	Volts	427	8	PDDU AAC (analog acquisition card) OFC (off card) 08 channel 09. This channel is used for the SABC_1 VBATT signal. Corresponds to C-0769 (Sabc1VBAcio).
E-0770	ASCII_Real	amps	436	8	PDDU AAC (analog acquisition card) OFC (off card) 08 channel 10. This channel is used for the SABC_1 IBATT signal. Corresponds to C-0770 (Sabc1IBAcio).
E-0771	ASCII_Real	amps	445	8	PDDU AAC (analog acquisition card) OFC (off card) 08 channel 11. This channel is used for the SABC_1 solar array current signal. Corresponds to C-0771.
E-0772	ASCII_Real	amps	454	8	PDDU AAC (analog acquisition card) OFC (off card) 08 channel 12. This channel is used for the SABC_1 solar array current signal.
E-0789	ASCII_Real	Volts	463	8	PDDU AAC (analog acquisition card) OFC (off card) 09 channel 09. This channel is used for the SABC_2 VBATT signal. Corresponds to C-0789 (Sabc2VBAcio).
E-0790	ASCII_Real	amps	472	8	PDDU AAC (analog acquisition card) OFC (off card) 09 channel 10. This channel is used for the SABC_2 IBATT signal. Corresponds to C-0790 (Sabc2IBAcio).
E-0791	ASCII_Real	amps	481	8	PDDU AAC (analog acquisition card) OFC (off card) 09 channel 11. This channel is used for the SABC_2 solar array current signal. Corresponds to C-0791,
E-0792	ASCII_Real	amps	490	8	PDDU AAC (analog acquisition card) OFC (off card) 09 channel 12. This channel is used for the SABC_2 solar array current signal.
G-0036	ASCII_Real	amps	499	8	Total Solar Array Current (ground computed channel).
G-1715	ASCII_Real	N/A	508	8	The state of the telecom SDST 1 X band exciter (0=off, 1=on).
T-0003	ASCII_Real	deg C	517	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 03. Landed solar array -Y temperature 1.

Column Name	Type	Units	Start Byte	Bytes	Description
T-0004	ASCII_ Real	deg C	526	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 04. Landed solar array -Y temperature 1.
T-0007	ASCII_ Real	deg C	535	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 07. SEIS Ebox temperature.
T-0009	ASCII_ Real	deg C	544	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 09. SEIS sensor temperature 1.
T-0010	ASCII_ Real	deg C	553	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 10. HP3 BEE temperature.
T-0014	ASCII_ Real	deg C	562	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 14. PAE temperature.
T-0015	ASCII_ Real	deg C	571	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 15. Science deck temperature.
T-0018	ASCII_ Real	deg C	580	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 18. Landed solar array -Y temperature 2.
T-0019	ASCII_ Real	deg C	589	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 19. Landed solar array +Y temperature 2.
T-0021	ASCII_ Real	deg C	598	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 21. SEIS frangibolt 1 temperature. Corresponds to C-0021 (SeisFb1Tcio).
T-0022	ASCII_ Real	deg C	607	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 22. TWINS +Y temperature.
T-0027	ASCII_ Real	deg C	616	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 27. PEB temperature.
T-0036	ASCII_ Real	deg C	625	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 36. 330 FT (fuel tank) fuel temperature 3. Corresponds to C-0036 (FT330F_T3cio).
T-0037	ASCII_ Real	deg C	634	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 37. Descent REM lines temperature 5. Corresponds to C-0037 (DeRemL_T5cio).
T-0039	ASCII_ Real	deg C	643	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 39. HP3 frangibolt 1 temperature. Corresponds to C-0039 (Hp3Fb1Tcio).
T-0042	ASCII_ Real	deg C	652	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 42. SEIS TB frangibolt temperature. Corresponds to C-0042 (SeisTbFbTcio).
T-0045	ASCII_ Real	deg C	661	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 45. IFG sensor temperature.
T-0046	ASCII_ Real	deg C	670	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 46. Pressure sensor electronics temperature.
T-0048	ASCII_ Real	deg C	679	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 48. SEIS frangibolt 3 temperature. Corresponds to C-0048 (SeisFb3Tcio).
T-0049	ASCII_ Real	deg C	688	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 49. HP3 frangibolt 2 temperature. Corresponds to C-0049 (Hp3Fb2Tcio).

Column Name	Type	Units	Start Byte	Bytes	Description
T-0052	ASCII_Real	deg C	697	8	PDDU AAC (analog acquisition card) AIP (analog input passive) channel 52. SSPA 3 internal temperature.
T-0202	ASCII_Real	deg C	706	8	CDH AAC (analog acquisition card) AIP (analog input passive) channel 02. Thermal enclosure temperature 1.
T-0216	ASCII_Real	deg C	715	8	CDH AAC (analog acquisition card) AIP (analog input passive) channel 16. Thermal enclosure temperature 2.
T-0229	ASCII_Real	deg C	724	8	CDH AAC (analog acquisition card) AIP (analog input passive) channel 29. 150 FT (fuel tank) ullage temperature 1. Corresponds to C-0229 (FT150U_T1cio).
T-0230	ASCII_Real	deg C	733	8	CDH AAC (analog acquisition card) AIP (analog input passive) channel 30. 330 FT (fuel tank) ullage temperature 1. Corresponds to C-0230 (FT330U_T1cio).
V-3518	ASCII_Real	N/A	742	8	Indicates whether science processing is OK.
V-3531	ASCII_Real	N/A	751	8	Indicates whether the spacecraft is in an active UHF session.
V-3644	ASCII_Real	N/A	760	8	Written by IDA software and is available for use by IDA and interoperability sequences/blocks. Indicates the Cartesian Target X coordinate.
V-3645	ASCII_Real	N/A	769	8	Written by IDA software and is available for use by IDA and interoperability sequences/blocks. Indicates the Cartesian Target Y coordinate.
V-3646	ASCII_Real	N/A	778	8	Written by IDA software and is available for use by IDA and interoperability sequences/blocks. Indicates the Cartesian Target Z coordinate.

5.2 Document Product Formats

Documents in this archive are provided as PDF/A (www.pdfa.org/download/pdfa-in-a-nutshell) or as plain ASCII text if no special formatting is required. Figures that accompany documents are embedded in the PDF/A.

5.3 PDS Labels

Each IFG product is accompanied by a PDS4 label. PDS4 labels are ASCII text files written in the eXtensible Markup Language (XML). Product labels are detached from the files they describe (with the exception of the Product_Bundle label). There is one label for every product. A PDS4 label file usually has the same name as the data product it describes, but always with the extension ".xml".

Documents are also considered products, and have PDS4 labels just as basic observational data products do. For the InSight mission, the structure and content of PDS labels will conform to the PDS master schema and schematron based upon the PDS Information Model [3]. By use of an XML editor the schema and schematron may be used to validate the structure and content of the product labels. In brief, the schema is the XML model that PDS4 labels must follow, and the schematron is a set of validation rules that are applied to PDS4 labels.

The PDS master schema and schematron documents are produced, managed, and supplied to InSight by the PDS. In addition to these documents, the InSight mission has produced additional XML schema and schematron files which govern the products in this archive. These documents contain attribute and parameter definitions specific to the InSight mission.

Appendix A Support Staff and Cognizant Persons

Table 16: Archive Support Staff

IFG Team		
Name	**Affiliation**	**Email**
Christopher Russell	UCLA – IFG principal investigator	ctrussell@igpp.ucla.edu
Steven Joy	UCLA – programmer/archivist	sjoy@igpp.ucla.edu
PDS Planetary Plasma Interactions Node		
Name	**Affiliation**	**Email**
Raymond Walker, manager	UCLA	rwalker@igpp.ucla.edu
Joseph Mafi	UCLA	jmafi@igpp.ucla.edu

Appendix B Maven Flyover Times and IFG Data Products

Table 17 shows the time when the MAVEN altitude was less than 250 km and angular distance was within 15 degrees of the InSight landing site. If an IFG 20Hz product is available, its file name is provided.

Table 17 MAVEN Flyover times and IFG Data Products

MAVEN Flyover Info	IFG 20 Hz file name
start: 16-Dec-2018 22:31:30 end: 16-Dec-2018 22:32:00 at LMST: 1/00020:04:02:44:39022	ifg_cal_SOL0020_maven_cln_20181216T221604_20181216T224604_20Hz_v07.tab
start: 22-Dec-2018 01:40:10 end: 22-Dec-2018 01:41:50 at LMST: 1/00025:03:54:51:17938	
start: 24-Dec-2018 02:02:40 end: 24-Dec-2018 02:04:00 at LMST: 1/00027:02:59:22:20894	
start: 27-Dec-2018 04:47:50 end: 27-Dec-2018 04:50:20 at LMST: 1/00030:03:45:40:10900	
start: 29-Dec-2018 05:09:40 end: 29-Dec-2018 05:12:40 at LMST: 1/00032:02:50:20:87100	
start: 31-Dec-2018 05:32:10 end: 31-Dec-2018 05:32:50 at LMST: 1/00034:01:52:55:11124	
start: 01-Jan-2019 07:56:10 end: 01-Jan-2019 07:58:40 at LMST: 1/00035:03:36:19:30617	
start: 03-Jan-2019 08:20:10 end: 03-Jan-2019 08:24:20 at LMST: 1/00037:02:44:14:71703	
start: 05-Jan-2019 08:43:50 end: 05-Jan-2019 08:47:20 at LMST: 1/00039:01:49:34:40880	

MAVEN Flyover Info	IFG 20 Hz file name
start: 08-Jan-2019 11:31:20 end: 08-Jan-2019 11:36:30 at LMST: 1/00042:02:38:37:76039	
start: 10-Jan-2019 11:54:40 end: 10-Jan-2019 12:00:00 at LMST: 1/00044:01:44:26:64949	
start: 12-Jan-2019 12:19:10 end: 12-Jan-2019 12:19:50 at LMST: 1/00046:00:46:41:42485	
start: 13-Jan-2019 14:43:10 end: 13-Jan-2019 14:48:00 at LMST: 1/00047:02:32:21:87397	
start: 15-Jan-2019 15:07:50 end: 15-Jan-2019 15:14:30 at LMST: 1/00049:01:41:05:94705	
start: 17-Jan-2019 15:33:00 end: 17-Jan-2019 15:38:40 at LMST: 1/00051:00:47:33:76592	
start: 20-Jan-2019 18:23:50 end: 20-Jan-2019 18:30:30 at LMST: 1/00054:01:39:12:83660	
start: 22-Jan-2019 18:49:30 end: 22-Jan-2019 18:56:40 at LMST: 1/00056:00:47:37:44479	
start: 24-Jan-2019 19:17:40 end: 24-Jan-2019 19:20:10 at LMST: 1/00057:23:53:26:33389	
start: 25-Jan-2019 21:43:30 end: 25-Jan-2019 21:47:40 at LMST: 1/00059:01:38:27:85325	
start: 27-Jan-2019 22:07:30 end: 27-Jan-2019 22:14:50	

MAVEN Flyover Info	IFG 20 Hz file name
at LMST: 1/00061:00:47:50:85609	
start: 29-Jan-2019 22:33:40 end: 29-Jan-2019 22:39:40 at LMST: 1/00062:23:54:57:60474	
start: 02-Feb-2019 01:24:50 end: 02-Feb-2019 01:31:10 at LMST: 1/00066:00:46:17:21053	
start: 04-Feb-2019 01:51:00 end: 04-Feb-2019 01:58:20 at LMST: 1/00067:23:55:40:21338	
start: 06-Feb-2019 02:19:50 end: 06-Feb-2019 02:24:00 at LMST: 1/00069:23:03:35:62424	
start: 07-Feb-2019 04:48:20 end: 07-Feb-2019 04:50:30 at LMST: 1/00071:00:47:38:74894	
start: 09-Feb-2019 05:12:50 end: 09-Feb-2019 05:19:50 at LMST: 1/00072:23:59:08:27354	
start: 11-Feb-2019 05:39:30 end: 11-Feb-2019 05:46:20 at LMST: 1/00074:23:07:52:34662	
start: 14-Feb-2019 08:14:40 end: 14-Feb-2019 08:21:00 at LMST: 1/00077:23:42:48:97566	
start: 16-Feb-2019 08:07:20 end: 16-Feb-2019 08:11:40 at LMST: 1/00079:22:16:40:57350	
start: 17-Feb-2019 10:07:00 end: 17-Feb-2019 10:12:20 at LMST: 1/00080:23:35:35:16954	

MAVEN Flyover Info	**IFG 20 Hz file name**
start: 20-Feb-2019 11:15:30 end: 20-Feb-2019 11:21:20 at LMST: 1/00083:22:47:09:32289	
start: 21-Feb-2019 12:56:40 end: 21-Feb-2019 12:56:50 at LMST: 1/00084:23:41:34:32004	ifg_cal_SOL0084_maven_cln_20190221T124149_20190221T131149_20Hz_v07.tab
start: 24-Feb-2019 12:59:10 end: 24-Feb-2019 13:04:00 at LMST: 1/00087:21:52:57:73705	
start: 25-Feb-2019 14:15:20 end: 25-Feb-2019 14:20:00 at LMST: 1/00088:22:28:24:03837	
start: 26-Feb-2019 15:26:10 end: 26-Feb-2019 15:29:10 at LMST: 1/00089:22:57:11:30953	
start: 11-Mar-2019 22:33:00 end: 11-Mar-2019 22:34:10 at LMST: 1/00102:21:29:57:03430	
start: 12-Mar-2019 22:22:50 end: 12-Mar-2019 22:24:30 at LMST: 1/00103:20:42:00:85993	
start: 17-Mar-2019 00:36:20 end: 17-Mar-2019 00:37:00 at LMST: 1/00107:20:16:51:38138	
start: 26-Jun-2019 21:17:10 end: 26-Jun-2019 21:17:40 at LMST: 1/00206:23:32:58:72636	
start: 29-Jun-2019 22:22:10 end: 29-Jun-2019 22:23:00 at LMST: 1/00209:22:40:58:76597	
start: 30-Jun-2019 23:56:40 end: 30-Jun-2019 23:57:40	

MAVEN Flyover Info	IFG 20 Hz file name
at LMST: 1/00210:23:34:35:10090	
start: 04-Jul-2019 01:01:00 end: 04-Jul-2019 01:03:30 at LMST: 1/00213:22:43:04:33784	ifg_cal_SOL0213_maven_cln_20190704T004631_20190704T011519_20Hz_v07.tab
start: 07-Jul-2019 02:04:40 end: 07-Jul-2019 02:07:10 at LMST: 1/00216:21:49:27:05302	
start: 08-Jul-2019 03:39:00 end: 08-Jul-2019 03:42:20 at LMST: 1/00217:22:43:32:58528	ifg_cal_SOL0217_maven_cln_20190708T032447_20190708T035019_20Hz_v07.tab
start: 11-Jul-2019 04:42:10 end: 11-Jul-2019 04:46:30 at LMST: 1/00220:21:50:24:49779	ifg_cal_SOL0220_maven_cln_20190711T042834_20190711T045834_20Hz_v07.tab
start: 12-Jul-2019 06:16:10 end: 12-Jul-2019 06:19:10 at LMST: 1/00221:22:42:04:04341	ifg_cal_SOL0221_maven_cln_20190712T060240_20190712T063240_20Hz_v07.tab
start: 14-Jul-2019 05:45:00 end: 14-Jul-2019 05:48:40 at LMST: 1/00223:20:55:19:62099	ifg_cal_SOL0223_maven_cln_20190714T053104_20190714T060034_20Hz_v07.tab
start: 15-Jul-2019 07:18:50 end: 15-Jul-2019 07:24:10 at LMST: 1/00224:21:49:44:61813	ifg_cal_SOL0224_maven_cln_20190715T070545_20190715T073545_20Hz_v07.tab
start: 18-Jul-2019 08:21:00 end: 18-Jul-2019 08:26:40 at LMST: 1/00227:20:54:59:20621	ifg_cal_SOL0227_maven_cln_20190718T080912_20190718T083802_20Hz_v07.tab
start: 19-Jul-2019 09:54:50 end: 19-Jul-2019 10:00:40 at LMST: 1/00228:21:47:56:61137	ifg_cal_SOL0228_maven_cln_20190719T094247_20190719T101021_20Hz_v07.tab
start: 21-Jul-2019 09:23:40 end: 21-Jul-2019 09:26:40 at LMST: 1/00230:19:57:47:80765	ifg_cal_SOL0230_maven_cln_20190721T091010_20190721T094001_20Hz_v07.tab

MAVEN Flyover Info	IFG 20 Hz file name
start: 22-Jul-2019 10:56:20 end: 22-Jul-2019 11:03:30 at LMST: 1/00231:20:53:30:66434	
start: 23-Jul-2019 12:34:00 end: 23-Jul-2019 12:34:30 at LMST: 1/00232:21:43:32:88553	ifg_cal_SOL0232_maven_cln_20190723T121914_20190723T124914_20Hz_v07.tab
start: 25-Jul-2019 11:58:00 end: 25-Jul-2019 12:04:20 at LMST: 1/00234:19:57:07:92799	ifg_cal_SOL0234_maven_cln_20190725T114607_20190725T121607_20Hz_v07.tab
start: 26-Jul-2019 13:32:00 end: 26-Jul-2019 13:39:00 at LMST: 1/00235:20:50:44:26292	ifg_cal_SOL0235_maven_cln_20190726T132035_20190726T135035_20Hz_v07.tab
start: 29-Jul-2019 14:32:50 end: 29-Jul-2019 14:40:10 at LMST: 1/00238:19:54:40:99146	ifg_cal_SOL0238_maven_cln_20190729T142130_20190729T145130_20Hz_v07.tab
start: 30-Jul-2019 16:08:00 end: 30-Jul-2019 16:13:20 at LMST: 1/00239:20:46:49:73441	ifg_cal_SOL0239_maven_cln_20190730T155540_20190730T162540_20Hz_v07.tab
start: 01-Aug-2019 15:35:30 end: 01-Aug-2019 15:38:40 at LMST: 1/00241:18:56:02:00091	
start: 02-Aug-2019 17:07:20 end: 02-Aug-2019 17:15:00 at LMST: 1/00242:19:51:15:66027	ifg_cal_SOL0242_maven_cln_20190802T165609_20190802T172609_20Hz_v07.tab
start: 03-Aug-2019 18:44:00 end: 03-Aug-2019 18:45:00 at LMST: 1/00243:20:40:19:48680	ifg_cal_SOL0243_maven_cln_20190803T182932_20190803T185932_20Hz_v07.tab
start: 05-Aug-2019 18:04:40 end: 05-Aug-2019 18:10:20 at LMST: 1/00245:18:49:31:75330	ifg_cal_SOL0245_maven_cln_20190805T175232_20190805T181535_20Hz_v07.tab
start: 06-Aug-2019 19:36:10 end: 06-Aug-2019	ifg_cal_SOL0246_maven_cln_20190806T192446_20190806T194522_20Hz_v07.tab

MAVEN Flyover Info	IFG 20 Hz file name
19:43:30 at LMST: 1/00246:19:41:40:49625	
start: 09-Aug-2019 20:31:20 end: 09-Aug-2019 20:38:00 at LMST: 1/00249:18:39:07:92707	ifg_cal_SOL0249_maven_cln_20190809T201946_20190809T204521_20Hz_v07.tab
start: 10-Aug-2019 22:03:20 end: 10-Aug-2019 22:10:10 at LMST: 1/00250:19:30:18:27535	ifg_cal_SOL0250_maven_cln_20190810T214500_20190811T223500_20Hz_v07.tab
start: 13-Aug-2019 22:54:40 end: 13-Aug-2019 23:01:20 at LMST: 1/00253:18:24:31:05731	ifg_cal_SOL0253_maven_cln_20190813T224316_20190813T231316_20Hz_v07.tab
start: 15-Aug-2019 00:26:00 end: 15-Aug-2019 00:31:10 at LMST: 1/00254:19:13:25:15140	ifg_cal_SOL0254_maven_cln_20190815T001408_20190815T004408_20Hz_v07.tab
start: 18-Aug-2019 01:15:50 end: 18-Aug-2019 01:21:30 at LMST: 1/00257:18:06:49:27114	ifg_cal_SOL0257_maven_cln_20190818T010000_20190818T013700_20Hz_v07.tab
start: 19-Aug-2019 02:47:20 end: 19-Aug-2019 02:50:50 at LMST: 1/00258:18:55:14:16790	ifg_cal_SOL0258_maven_cln_20190819T023200_20190819T030500_20Hz_v07.tab
start: 22-Aug-2019 03:35:50 end: 22-Aug-2019 03:40:10 at LMST: 1/00261:17:47:39:89298	
start: 23-Aug-2019 05:07:10 end: 23-Aug-2019 05:09:10 at LMST: 1/00262:18:35:45:32486	
start: 25-Aug-2019 04:27:30 end: 25-Aug-2019 04:28:50 at LMST: 1/00264:16:39:26:68830	
start: 26-Aug-2019 05:54:40 end: 26-Aug-2019 05:57:40 at LMST: 1/00265:17:27:22:38773	

MAVEN Flyover Info	**IFG 20 Hz file name**
start: 27-Aug-2019 07:26:10 end: 27-Aug-2019 07:26:30 at LMST: 1/00266:18:15:18:08715	
start: 29-Aug-2019 06:45:00 end: 29-Aug-2019 06:45:40 at LMST: 1/00268:16:18:30:25327	
start: 30-Aug-2019 08:12:30 end: 30-Aug-2019 08:14:20 at LMST: 1/00269:17:06:16:22025	
start: 03-Sep-2019 10:29:30 end: 03-Sep-2019 10:30:00 at LMST: 1/00273:16:44:11:65812	
start: 24-Nov-2019 20:07:10 end: 24-Nov-2019 20:07:20 at LMST: 1/00353:21:26:46:04094	ifg_cal_SOL0353_maven_cln_20191124T195130_20191124T202129_20Hz_v07.tab
start: 28-Nov-2019 21:39:00 end: 28-Nov-2019 21:39:30 at LMST: 1/00357:20:22:21:31120	ifg_cal_SOL0357_maven_cln_20191128T185421_20191129T010712_20Hz_v07.tab
start: 29-Nov-2019 22:56:30 end: 29-Nov-2019 22:58:10 at LMST: 1/00358:21:00:23:33160	ifg_cal_SOL0358_maven_cln_20191129T224129_20191129T231129_20Hz_v07.tab
start: 01-Dec-2019 00:13:50 end: 01-Dec-2019 00:13:50 at LMST: 1/00359:21:35:30:16804	
start: 04-Dec-2019 00:28:30 end: 04-Dec-2019 00:30:40 at LMST: 1/00362:19:56:18:06674	ifg_cal_SOL0362_maven_cln_20191204T001352_20191204T004352_20Hz_v07.tab
start: 05-Dec-2019 01:46:30 end: 05-Dec-2019 01:49:40 at LMST: 1/00363:20:34:39:55203	ifg_cal_SOL0363_maven_cln_20191205T013221_20191205T020220_20Hz_v07.tab
start: 09-Dec-2019 03:21:20 end: 09-Dec-2019 03:25:00	ifg_cal_SOL0367_maven_cln_20191209T030727_20191209T033727_20Hz_v07.tab

MAVEN Flyover Info	IFG 20 Hz file name
at LMST: 1/00367:19:33:19:73870	
start: 10-Dec-2019 04:39:00 end: 10-Dec-2019 04:43:40 at LMST: 1/00368:20:11:21:75911	ifg_cal_SOL0368_maven_cln_20191210T042534_20191210T045534_20Hz_v07.tab
start: 13-Dec-2019 04:56:40 end: 13-Dec-2019 04:58:30 at LMST: 1/00371:18:30:12:86850	
start: 14-Dec-2019 06:15:20 end: 14-Dec-2019 06:20:40 at LMST: 1/00372:19:11:39:27020	ifg_cal_SOL0372_maven_cln_20191214T060212_20191214T063212_20Hz_v07.tab
start: 15-Dec-2019 07:34:00 end: 15-Dec-2019 07:39:50 at LMST: 1/00373:19:50:10:48794	ifg_cal_SOL0373_maven_cln_20191215T072128_20191215T075128_20Hz_v07.tab
start: 18-Dec-2019 07:52:50 end: 18-Dec-2019 07:57:30 at LMST: 1/00376:18:11:47:04886	ifg_cal_SOL0376_maven_cln_20191218T074449_20191218T081007_20Hz_v07.tab
start: 19-Dec-2019 09:12:10 end: 19-Dec-2019 09:19:00 at LMST: 1/00377:18:52:34:52080	ifg_cal_SOL0377_maven_cln_20191219T090011_20191219T093011_20Hz_v07.tab
start: 20-Dec-2019 10:32:50 end: 20-Dec-2019 10:38:20 at LMST: 1/00378:19:31:15:47098	ifg_cal_SOL0378_maven_cln_20191220T102037_20191220T105010_20Hz_v07.tab
start: 23-Dec-2019 10:53:10 end: 23-Dec-2019 10:59:20 at LMST: 1/00381:17:56:06:68075	ifg_cal_SOL0381_maven_cln_20191223T104121_20191223T111121_20Hz_v07.tab
start: 24-Dec-2019 12:12:40 end: 24-Dec-2019 12:20:10 at LMST: 1/00382:18:36:15:22292	ifg_cal_SOL0382_maven_cln_20191224T120125_20191224T123052_20Hz_v07.tab
start: 25-Dec-2019 13:35:20 end: 25-Dec-2019 13:38:40 at LMST: 1/00383:19:14:07:51088	ifg_cal_SOL0383_maven_cln_20191225T132159_20191225T135002_20Hz_v07.tab

MAVEN Flyover Info	**IFG 20 Hz file name**
start: 28-Dec-2019 13:56:20 end: 28-Dec-2019 14:03:30 at LMST: 1/00386:17:42:42:56685	
start: 29-Dec-2019 15:17:20 end: 29-Dec-2019 15:24:20 at LMST: 1/00387:18:22:51:10902	ifg_cal_SOL0387_maven_cln_20191229T150548_20191229T153045_20Hz_v07.tab
start: 01-Jan-2020 15:41:30 end: 01-Jan-2020 15:45:40 at LMST: 1/00390:16:48:01:78368	ifg_cal_SOL0390_maven_cln_20200101T152829_20200101T155829_20Hz_v07.tab
start: 02-Jan-2020 17:01:00 end: 02-Jan-2020 17:08:40 at LMST: 1/00391:17:30:16:84761	ifg_cal_SOL0391_maven_cln_20200102T164951_20200102T171506_20Hz_v07.tab
start: 03-Jan-2020 18:23:20 end: 03-Jan-2020 18:29:00 at LMST: 1/00392:18:09:56:19244	ifg_cal_SOL0392_maven_cln_20200103T181112_20200103T183545_20Hz_v07.tab
start: 06-Jan-2020 18:46:30 end: 06-Jan-2020 18:52:50 at LMST: 1/00395:16:37:32:85375	ifg_cal_SOL0395_maven_cln_20200106T183436_20200106T190044_20Hz_v07.tab
start: 07-Jan-2020 20:07:00 end: 07-Jan-2020 20:14:30 at LMST: 1/00396:17:18:30:05813	
start: 08-Jan-2020 21:30:30 end: 08-Jan-2020 21:33:00 at LMST: 1/00397:17:56:22:34609	
start: 11-Jan-2020 21:51:00 end: 11-Jan-2020 21:57:30 at LMST: 1/00400:16:24:37:93718	ifg_cal_SOL0400_maven_cln_20200111T220928_20200111T220939_20Hz_v07.tab
start: 12-Jan-2020 23:13:10 end: 12-Jan-2020 23:18:40 at LMST: 1/00401:17:05:05:94423	ifg_cal_SOL0401_maven_cln_20200112T225800_20200112T233400_20Hz_v07.tab
start: 15-Jan-2020 23:39:30 end: 15-Jan-2020 23:44:20	ifg_cal_SOL0404_maven_cln_20200115T232708_20200115T235044_20Hz_v07.tab

MAVEN Flyover Info	IFG 20 Hz file name
at LMST: 1/00404:15:34:29:66241	
start: 17-Jan-2020 01:00:00 end: 17-Jan-2020 01:05:10 at LMST: 1/00405:16:14:38:20458	ifg_cal_SOL0405_maven_cln_20200117T004826_20200117T011826_20Hz_v07.tab
start: 18-Jan-2020 02:23:20 end: 18-Jan-2020 02:26:00 at LMST: 1/00406:16:54:46:74674	ifg_cal_SOL0406_maven_cln_20200118T021031_20200118T023550_20Hz_v07.tab
start: 21-Jan-2020 02:46:40 end: 21-Jan-2020 02:50:50 at LMST: 1/00409:15:23:21:80271	ifg_cal_SOL0409_maven_cln_20200121T023434_20200121T030026_20Hz_v07.tab
start: 22-Jan-2020 04:08:00 end: 22-Jan-2020 04:11:20 at LMST: 1/00410:16:03:10:87999	ifg_cal_SOL0410_maven_cln_20200122T035529_20200122T042006_20Hz_v07.tab
start: 25-Jan-2020 04:33:30 end: 25-Jan-2020 04:35:10 at LMST: 1/00413:14:30:47:54130	ifg_cal_SOL0413_maven_cln_20200125T042007_20200125T042144_20Hz_v07.tab
start: 26-Jan-2020 05:53:20 end: 26-Jan-2020 05:55:50 at LMST: 1/00414:15:10:46:35102	ifg_cal_SOL0414_maven_cln_20200126T053800_20200126T061100_20Hz_v07.tab
start: 27-Jan-2020 07:16:10 end: 27-Jan-2020 07:17:00 at LMST: 1/00415:15:51:14:35807	
start: 30-Jan-2020 07:40:50 end: 30-Jan-2020 07:42:10 at LMST: 1/00418:14:20:08:87892	ifg_cal_SOL0418_maven_cln_20200130T073155_20200130T073851_20Hz_v07.tab
start: 31-Jan-2020 09:01:50 end: 31-Jan-2020 09:02:50 at LMST: 1/00419:15:00:07:68865	
start: 04-Feb-2020 10:47:10 end: 04-Feb-2020 10:47:20 at LMST: 1/00423:14:07:43:15968	ifg_cal_SOL0423_maven_cln_20200204T103200_20200204T110300_20Hz_v07..tab

MAVEN Flyover Info	IFG 20 Hz file name
start: 17-May-2020 07:04:30 end: 17-May-2020 07:04:50 at LMST: 1/00523:16:22:46:00240	
start: 18-May-2020 08:16:40 end: 18-May-2020 08:18:00 at LMST: 1/00524:16:55:26:85219	ifg_cal_SOL0524_maven_cln_20200518T080000_20200518T083300_20Hz_v07.tab
start: 19-May-2020 09:28:40 end: 19-May-2020 09:28:50 at LMST: 1/00525:17:25:51:44778	
start: 22-May-2020 09:28:20 end: 22-May-2020 09:28:40 at LMST: 1/00528:15:30:06:63730	ifg_cal_SOL0528_maven_cln_20200522T091240_20200522T094240_20Hz_v07.tab
start: 23-May-2020 10:39:50 end: 23-May-2020 10:42:20 at LMST: 1/00529:16:03:16:68442	
start: 24-May-2020 11:52:20 end: 24-May-2020 11:54:50 at LMST: 1/00530:16:35:18:60443	
start: 28-May-2020 13:07:00 end: 28-May-2020 13:10:00 at LMST: 1/00534:15:14:21:16550	ifg_cal_SOL0534_maven_cln_20200528T125242_20200528T132242_20Hz_v07.tab
start: 29-May-2020 14:19:30 end: 29-May-2020 14:23:40 at LMST: 1/00535:15:47:31:21262	ifg_cal_SOL0535_maven_cln_20200529T140543_20200529T142714_20Hz_v07.tab
start: 30-May-2020 15:32:00 end: 30-May-2020 15:35:20 at LMST: 1/00536:16:18:44:47042	ifg_cal_SOL0536_maven_cln_20200530T151804_20200530T154714_20Hz_v07.tab
start: 02-Jun-2020 15:32:50 end: 02-Jun-2020 15:35:50 at LMST: 1/00539:14:23:38:58971	ifg_cal_SOL0539_maven_cln_20200602T152244_20200602T154835_20Hz_v07.tab
start: 03-Jun-2020 16:45:00 end: 03-Jun-2020 16:50:10	ifg_cal_SOL0540_maven_cln_20200603T170110_20200603T170144_20Hz_v07.tab

MAVEN Flyover Info	IFG 20 Hz file name
at LMST: 1/00540:14:57:27:56660	
start: 04-Jun-2020 17:57:00 end: 04-Jun-2020 18:02:40 at LMST: 1/00541:15:29:29:48662	
start: 08-Jun-2020 19:09:10 end: 08-Jun-2020 19:14:50 at LMST: 1/00545:14:05:36:86371	ifg_cal_SOL0545_maven_cln_20200608T185400_20200608T193000_20Hz_v07.tab
start: 09-Jun-2020 20:21:00 end: 09-Jun-2020 20:28:00 at LMST: 1/00546:14:38:17:71350	ifg_cal_SOL0546_maven_cln_20200609T200910_20200609T201236_20Hz_v07.tab
start: 10-Jun-2020 21:34:00 end: 10-Jun-2020 21:39:30 at LMST: 1/00547:15:09:21:23886	
start: 13-Jun-2020 21:33:50 end: 13-Jun-2020 21:37:00 at LMST: 1/00550:13:11:20:17418	ifg_cal_SOL0550_maven_cln_20200613T211800_20200613T215200_20Hz_v07.tab
start: 14-Jun-2020 22:44:10 end: 14-Jun-2020 22:51:30 at LMST: 1/00551:13:45:18:88351	
start: 15-Jun-2020 23:56:30 end: 16-Jun-2020 00:03:50 at LMST: 1/00552:14:17:11:07108	
start: 17-Jun-2020 01:11:00 end: 17-Jun-2020 01:14:00 at LMST: 1/00553:14:46:56:73690	
start: 20-Jun-2020 01:07:50 end: 20-Jun-2020 01:13:20 at LMST: 1/00556:12:50:42:72909	ifg_cal_SOL0556_maven_cln_20200620T010200_20200620T012531_20Hz_v07.tab
start: 21-Jun-2020 02:18:50 end: 21-Jun-2020 02:26:30 at LMST: 1/00557:13:23:23:57888	ifg_cal_SOL0557_maven_cln_20200621T020300_20200621T024200_20Hz_v07.tab

MAVEN Flyover Info	**IFG 20 Hz file name**
start: 22-Jun-2020 03:31:40 end: 22-Jun-2020 03:38:10 at LMST: 1/00558:13:54:36:83668	ifg_cal_SOL0558_maven_cln_20200622T034644_20200622T034953_20Hz_v07.tab
start: 26-Jun-2020 04:41:10 end: 26-Jun-2020 04:47:50 at LMST: 1/00562:12:28:18:22713	ifg_cal_SOL0562_maven_cln_20200626T042930_20200626T045930_20Hz_v07.tab
start: 27-Jun-2020 05:52:40 end: 27-Jun-2020 05:59:10 at LMST: 1/00563:12:59:12:02005	ifg_cal_SOL0563_maven_cln_20200627T054552_20200627T061130_20Hz_v07.tab
start: 28-Jun-2020 07:05:40 end: 28-Jun-2020 07:10:10 at LMST: 1/00564:13:29:46:34808	ifg_cal_SOL0564_maven_cln_20200628T070551_20200628T071247_20Hz_v07.tab
start: 01-Jul-2020 07:04:10 end: 01-Jul-2020 07:06:40 at LMST: 1/00567:11:30:46:88874	
start: 02-Jul-2020 08:13:40 end: 02-Jul-2020 08:18:40 at LMST: 1/00568:12:02:19:61142	
start: 03-Jul-2020 09:25:20 end: 03-Jul-2020 09:29:30 at LMST: 1/00569:12:32:44:20701	
start: 04-Jul-2020 10:38:40 end: 04-Jul-2020 10:40:30 at LMST: 1/00570:13:03:18:53504	
start: 07-Jul-2020 10:34:40 end: 07-Jul-2020 10:37:10 at LMST: 1/00573:11:04:28:80815	
start: 08-Jul-2020 11:44:40 end: 08-Jul-2020 11:47:50 at LMST: 1/00574:11:34:43:67129	
start: 09-Jul-2020 12:56:30 end: 09-Jul-2020 12:58:30	

MAVEN Flyover Info	IFG 20 Hz file name
at LMST: 1/00575:12:04:58:53443	
start: 13-Jul-2020 14:04:20 end: 13-Jul-2020 14:05:20 at LMST: 1/00579:10:35:54:47335	ifg_cal_SOL0579_maven_cln_20200713T140916_20200713T142045_20Hz_v07.tab
start: 14-Jul-2020 15:14:40 end: 14-Jul-2020 15:15:50 at LMST: 1/00580:11:05:59:60405	ifg_cal_SOL0580_maven_cln_20200714T150958_20200714T153114_20Hz_v07.tab
start: 24-Oct-2020 11:15:40 end: 24-Oct-2020 11:16:30 at LMST: 1/00679:13:43:11:16272	ifg_cal_SOL0679_maven_cln_20201024T105954_20201024T112954_20Hz_v07.tab
start: 25-Oct-2020 12:29:50 end: 25-Oct-2020 12:31:20 at LMST: 1/00680:14:17:29:33693	ifg_cal_SOL0680_maven_cln_20201025T121426_20201025T124426_20Hz_v07.tab
start: 29-Oct-2020 13:50:30 end: 29-Oct-2020 13:52:30 at LMST: 1/00684:13:02:22:26595	ifg_cal_SOL0684_maven_cln_20201029T133526_20201029T140505_20Hz_v07.tab
start: 30-Oct-2020 15:04:40 end: 30-Oct-2020 15:07:40 at LMST: 1/00685:13:36:59:90505	ifg_cal_SOL0685_maven_cln_20201030T145006_20201030T151932_20Hz_v07.tab
start: 31-Oct-2020 16:18:50 end: 31-Oct-2020 16:20:30 at LMST: 1/00686:14:09:21:28995	ifg_cal_SOL0686_maven_cln_20201031T160402_20201031T163402_20Hz_v07.tab
start: 03-Nov-2020 16:25:00 end: 03-Nov-2020 16:28:00 at LMST: 1/00689:12:21:04:17185	ifg_cal_SOL0689_maven_cln_20201103T161000_20201103T164300_20Hz_v07.tab
start: 04-Nov-2020 17:39:00 end: 04-Nov-2020 17:43:40 at LMST: 1/00690:12:56:11:00829	ifg_cal_SOL0690_maven_cln_20201104T172515_20201104T175515_20Hz_v07.tab
start: 05-Nov-2020 18:53:10 end: 05-Nov-2020 18:57:30 at LMST: 1/00691:13:29:30:78785	ifg_cal_SOL0691_maven_cln_20201105T183955_20201105T190846_20Hz_v07.tab

MAVEN Flyover Info	IFG 20 Hz file name
start: 08-Nov-2020 18:59:20 end: 08-Nov-2020 19:03:10 at LMST: 1/00694:11:39:26:61287	ifg_cal_SOL0694_maven_cln_20201108T184536_20201108T191426_20Hz_v07.tab
start: 09-Nov-2020 20:13:20 end: 09-Nov-2020 20:19:30 at LMST: 1/00695:12:15:12:37908	ifg_cal_SOL0696_maven_mdcln_20201110T213339_20201110T214035_20Hz_v07.tab
start: 10-Nov-2020 21:27:30 end: 10-Nov-2020 21:33:50 at LMST: 1/00696:12:49:01:35596	ifg_cal_SOL0696_maven_cln_20201110T213339_20201110T214035_20Hz_v07.tab
start: 13-Nov-2020 21:35:30 end: 13-Nov-2020 21:37:00 at LMST: 1/00699:10:56:31:19435	ifg_cal_SOL0699_maven_cln_20201113T212059_20201113T215059_20Hz_v07.tab
start: 14-Nov-2020 22:47:20 end: 14-Nov-2020 22:54:40 at LMST: 1/00700:11:33:34:82009	ifg_cal_SOL0700_maven_cln_20201114T223539_20201114T230311_20Hz_v07.tab
start: 16-Nov-2020 00:02:10 end: 16-Nov-2020 00:09:40 at LMST: 1/00701:12:08:02:72676	ifg_cal_SOL0701_maven_cln_20201115T235001_20201116T001820_20Hz_v07.tab
start: 17-Nov-2020 01:20:50 end: 17-Nov-2020 01:22:20 at LMST: 1/00702:12:40:14:37921	ifg_cal_SOL0702_maven_cln_20201117T010531_20201117T013420_20Hz_v07.tab
start: 20-Nov-2020 01:28:20 end: 20-Nov-2020 01:35:10 at LMST: 1/00705:10:57:08:69929	ifg_cal_SOL0705_maven_cln_20201120T010800_20201120T013800_20Hz_v07.tab
start: 21-Nov-2020 02:44:30 end: 21-Nov-2020 02:51:40 at LMST: 1/00706:11:33:04:19794	ifg_cal_SOL0706_maven_cln_20201121T022241_20201121T025214_20Hz_v07.tab
start: 22-Nov-2020 04:03:10 end: 22-Nov-2020 04:06:40 at LMST: 1/00707:12:07:32:10460	ifg_cal_SOL0707_maven_cln_20201122T033839_20201122T040636_20Hz_v07.tab
start: 25-Nov-2020 04:11:40 end: 25-Nov-2020	

MAVEN Flyover Info	IFG 20 Hz file name
04:17:50 at LMST: 1/00710:10:22:49:10024	
start: 26-Nov-2020 05:27:30 end: 26-Nov-2020 05:33:20 at LMST: 1/00711:10:57:46:20423	
start: 27-Nov-2020 06:45:40 end: 27-Nov-2020 06:49:10 at LMST: 1/00712:11:33:02:77311	
start: 30-Nov-2020 06:54:50 end: 30-Nov-2020 06:59:30 at LMST: 1/00715:09:47:31:10653	
start: 01-Dec-2020 08:10:30 end: 01-Dec-2020 08:15:00 at LMST: 1/00716:10:22:28:21052	
start: 02-Dec-2020 09:28:10 end: 02-Dec-2020 09:30:40 at LMST: 1/00717:10:57:35:04696	
start: 05-Dec-2020 09:38:00 end: 05-Dec-2020 09:41:00 at LMST: 1/00720:09:12:03:38039	
start: 06-Dec-2020 10:53:10 end: 06-Dec-2020 10:56:30 at LMST: 1/00721:09:47:00:48438	ifg_cal_SOL0721_maven_cln_20201206T100846_20201206T102808_20Hz_v07.tab
start: 07-Dec-2020 12:10:30 end: 07-Dec-2020 12:12:10 at LMST: 1/00722:10:22:07:32081	ifg_cal_SOL0722_maven_cln_20201207T111122_20201207T114122_20Hz_v07.tab
start: 10-Dec-2020 12:21:10 end: 10-Dec-2020 12:22:20 at LMST: 1/00725:08:36:25:92179	ifg_cal_SOL0723_maven_cln_20201208T122531_20201208T125531_20Hz_v07.tab
start: 11-Dec-2020 13:35:50 end: 11-Dec-2020 13:37:50 at LMST: 1/00726:09:11:23:02578	ifg_cal_SOL0726_maven_cln_20201211T124357_20201211T130029_20Hz_v07.tab

MAVEN Flyover Info	IFG 20 Hz file name
start: 12-Dec-2020 14:52:50 end: 12-Dec-2020 14:53:20 at LMST: 1/00727:09:46:20:12977	ifg_cal_SOL0727_maven_cln_20201212T135739_20201212T141242_20Hz_v07.tab
start: 16-Dec-2020 16:18:10 end: 16-Dec-2020 16:18:50 at LMST: 1/00731:08:35:26:10231	
start: 09-Apr-2021 18:56:10 end: 09-Apr-2021 18:57:00 at LMST: 1/00842:09:57:09:22533	
start: 10-Apr-2021 20:11:00 end: 10-Apr-2021 20:12:20 at LMST: 1/00843:10:31:56:59687	
start: 14-Apr-2021 21:34:10 end: 14-Apr-2021 21:36:00 at LMST: 1/00847:09:19:15:51253	
start: 15-Apr-2021 22:49:00 end: 15-Apr-2021 22:51:50 at LMST: 1/00848:09:54:32:08141	
start: 17-Apr-2021 00:03:50 end: 17-Apr-2021 00:04:50 at LMST: 1/00849:10:27:03:19875	
start: 20-Apr-2021 00:12:00 end: 20-Apr-2021 00:14:50 at LMST: 1/00852:08:41:12:06730	
start: 21-Apr-2021 01:26:50 end: 21-Apr-2021 01:31:00 at LMST: 1/00853:09:16:48:10106	
start: 22-Apr-2021 02:41:30 end: 22-Apr-2021 02:45:00 at LMST: 1/00854:09:50:17:61306	
start: 25-Apr-2021 02:49:40 end: 25-Apr-2021 02:53:20	

MAVEN Flyover Info	**IFG 20 Hz file name**
at LMST: 1/00857:08:02:49:15717	
start: 26-Apr-2021 04:04:30 end: 26-Apr-2021 04:09:50 at LMST: 1/00858:08:38:44:65582	
start: 27-Apr-2021 05:19:10 end: 27-Apr-2021 05:24:30 at LMST: 1/00859:09:12:53:09760	
start: 30-Apr-2021 05:27:10 end: 30-Apr-2021 05:31:20 at LMST: 1/00862:07:23:57:04972	
start: 01-May-2021 06:42:00 end: 01-May-2021 06:48:30 at LMST: 1/00863:08:00:31:47814	
start: 02-May-2021 07:57:00 end: 02-May-2021 08:03:40 at LMST: 1/00864:08:35:09:11725	
start: 05-May-2021 08:07:00 end: 05-May-2021 08:08:50 at LMST: 1/00867:06:44:35:74494	
start: 06-May-2021 09:19:50 end: 06-May-2021 09:27:10 at LMST: 1/00868:07:22:18:30046	
start: 07-May-2021 10:35:30 end: 07-May-2021 10:42:50 at LMST: 1/00869:07:57:25:13690	
start: 11-May-2021 11:59:00 end: 11-May-2021 12:05:50 at LMST: 1/00873:06:44:05:12279	
start: 12-May-2021 13:14:10 end: 12-May-2021 13:21:00 at LMST: 1/00874:07:18:42:76189	

MAVEN Flyover Info	IFG 20 Hz file name
start: 13-May-2021 14:31:40 end: 13-May-2021 14:35:30 at LMST: 1/00875:07:52:41:47122	
start: 16-May-2021 14:38:00 end: 16-May-2021 14:43:40 at LMST: 1/00878:06:05:03:28289	
start: 17-May-2021 15:52:50 end: 17-May-2021 15:58:20 at LMST: 1/00879:06:39:11:72467	
start: 18-May-2021 17:09:30 end: 18-May-2021 17:13:00 at LMST: 1/00880:07:13:20:16644	
start: 21-May-2021 17:17:10 end: 21-May-2021 17:20:40 at LMST: 1/00883:05:25:12:78078	
start: 22-May-2021 18:31:20 end: 22-May-2021 18:35:20 at LMST: 1/00884:05:59:21:22256	
start: 23-May-2021 19:47:30 end: 23-May-2021 19:50:10 at LMST: 1/00885:06:33:39:39678	
start: 26-May-2021 19:56:50 end: 26-May-2021 19:57:50 at LMST: 1/00888:04:45:32:01112	
start: 27-May-2021 21:10:00 end: 27-May-2021 21:12:30 at LMST: 1/00889:05:19:40:45289	
start: 28-May-2021 22:25:50 end: 28-May-2021 22:27:10 at LMST: 1/00890:05:53:48:89467	
start: 01-Jun-2021 23:48:50 end: 01-Jun-2021 23:49:40	

MAVEN Flyover Info	IFG 20 Hz file name
at LMST: 1/00894:04:39:59:68323	
start: 03-Jun-2021 01:04:10 end: 03-Jun-2021 01:04:20 at LMST: 1/00895:05:14:08:12500	
start: 11-Sep-2021 20:49:00 end: 11-Sep-2021 20:49:30 at LMST: 1/00993:08:14:46:25915	
start: 15-Sep-2021 22:12:30 end: 15-Sep-2021 22:13:30 at LMST: 1/00997:07:02:24:63969	
start: 16-Sep-2021 23:27:30 end: 16-Sep-2021 23:29:40 at LMST: 1/00998:07:38:00:67345	
start: 18-Sep-2021 00:42:30 end: 18-Sep-2021 00:43:20 at LMST: 1/00999:08:11:10:72057	
start: 21-Sep-2021 00:50:50 end: 21-Sep-2021 00:53:00 at LMST: 1/01002:06:25:00:12423	
start: 22-Sep-2021 02:05:50 end: 22-Sep-2021 02:09:30 at LMST: 1/01003:07:00:55:62287	
start: 23-Sep-2021 03:20:50 end: 23-Sep-2021 03:24:00 at LMST: 1/01004:07:34:54:33221	
start: 26-Sep-2021 03:29:20 end: 26-Sep-2021 03:32:30 at LMST: 1/01007:05:47:35:60876	
start: 27-Sep-2021 04:44:10 end: 27-Sep-2021 04:49:30 at LMST: 1/01008:06:24:00:30474	

MAVEN Flyover Info	IFG 20 Hz file name
start: 28-Sep-2021 05:59:20 end: 28-Sep-2021 06:04:30 at LMST: 1/01009:06:58:28:21140	
start: 01-Oct-2021 06:07:50 end: 01-Oct-2021 06:12:00 at LMST: 1/01012:05:10:11:09330	
start: 02-Oct-2021 07:22:50 end: 02-Oct-2021 07:29:30 at LMST: 1/01013:05:47:04:98660	
start: 03-Oct-2021 08:38:10 end: 03-Oct-2021 08:44:50 at LMST: 1/01014:06:21:52:35815	
start: 06-Oct-2021 08:48:50 end: 06-Oct-2021 08:50:50 at LMST: 1/01017:04:32:07:64806	
start: 07-Oct-2021 10:01:50 end: 07-Oct-2021 10:09:20 at LMST: 1/01018:05:09:59:93603	
start: 08-Oct-2021 11:17:50 end: 08-Oct-2021 11:25:00 at LMST: 1/01019:05:45:06:77246	
start: 12-Oct-2021 12:41:50 end: 12-Oct-2021 12:48:50 at LMST: 1/01023:04:32:35:42056	
start: 13-Oct-2021 13:57:20 end: 13-Oct-2021 14:04:00 at LMST: 1/01024:05:07:13:05967	
start: 14-Oct-2021 15:15:10 end: 14-Oct-2021 15:18:40 at LMST: 1/01025:05:41:21:50144	
start: 17-Oct-2021 15:21:50 end: 17-Oct-2021 15:27:20	

MAVEN Flyover Info	IFG 20 Hz file name
at LMST: 1/01028:03:54:12:51044	
start: 18-Oct-2021 16:36:50 end: 18-Oct-2021 16:42:20 at LMST: 1/01029:04:28:40:41710	
start: 19-Oct-2021 17:54:00 end: 19-Oct-2021 17:57:20 at LMST: 1/01030:05:03:08:32376	
start: 22-Oct-2021 18:02:00 end: 22-Oct-2021 18:06:00 at LMST: 1/01033:03:15:59:33276	
start: 23-Oct-2021 19:16:40 end: 23-Oct-2021 19:20:50 at LMST: 1/01034:03:50:17:50698	
start: 24-Oct-2021 20:33:20 end: 24-Oct-2021 20:36:00 at LMST: 1/01035:04:24:55:14608	
start: 27-Oct-2021 20:42:40 end: 27-Oct-2021 20:44:30 at LMST: 1/01038:02:37:36:42264	
start: 28-Oct-2021 21:56:40 end: 28-Oct-2021 21:59:30 at LMST: 1/01039:03:12:04:32930	
start: 29-Oct-2021 23:12:50 end: 29-Oct-2021 23:14:30 at LMST: 1/01040:03:46:32:23596	
start: 03-Nov-2021 00:36:30 end: 03-Nov-2021 00:38:10 at LMST: 1/01044:02:33:51:15162	
start: 04-Nov-2021 01:52:20 end: 04-Nov-2021 01:53:00 at LMST: 1/01045:03:08:09:32584	

MAVEN Flyover Info	IFG 20 Hz file name
start: 08-Nov-2021 03:16:30 end: 08-Nov-2021 03:16:30 at LMST: 1/01049:01:55:18:50905	
start: 27-Feb-2022 04:16:20 end: 27-Feb-2022 04:16:20 at LMST: 1/01157:03:36:54:56875	
start: 28-Feb-2022 05:30:30 end: 28-Feb-2022 05:31:40 at LMST: 1/01158:04:11:41:94030	
start: 04-Mar-2022 06:51:10 end: 04-Mar-2022 06:52:00 at LMST: 1/01162:02:55:46:20710	
start: 05-Mar-2022 08:05:20 end: 05-Mar-2022 08:07:50 at LMST: 1/01163:03:31:02:77598	
start: 06-Mar-2022 09:19:40 end: 06-Mar-2022 09:21:40 at LMST: 1/01164:04:04:22:55554	
start: 09-Mar-2022 09:26:00 end: 09-Mar-2022 09:27:20 at LMST: 1/01167:02:14:18:38056	
start: 10-Mar-2022 10:40:10 end: 10-Mar-2022 10:43:40 at LMST: 1/01168:02:50:04:14677	
start: 11-Mar-2022 11:54:20 end: 11-Mar-2022 11:58:10 at LMST: 1/01169:03:24:02:85610	
start: 14-Mar-2022 12:00:40 end: 14-Mar-2022 12:01:40 at LMST: 1/01172:01:31:52:15937	
start: 15-Mar-2022 13:15:00 end: 15-Mar-	

MAVEN Flyover Info	IFG 20 Hz file name
2022 13:19:30 at LMST: 1/01173:02:09:05:51756	
start: 16-Mar-2022 14:29:10 end: 16-Mar-2022 14:34:30 at LMST: 1/01174:02:43:33:42422	
start: 17-Mar-2022 15:45:00 end: 17-Mar-2022 15:46:40 at LMST: 1/01175:03:15:15:87935	
start: 20-Mar-2022 15:49:40 end: 20-Mar-2022 15:55:10 at LMST: 1/01178:01:27:57:15590	
start: 21-Mar-2022 17:03:50 end: 21-Mar-2022 17:10:40 at LMST: 1/01179:02:02:54:25989	
start: 22-Mar-2022 18:19:20 end: 22-Mar-2022 18:24:10 at LMST: 1/01180:02:35:54:57457	
start: 25-Mar-2022 18:25:00 end: 25-Mar-2022 18:30:20 at LMST: 1/01183:00:46:19:59692	
start: 26-Mar-2022 19:38:50 end: 26-Mar-2022 19:46:30 at LMST: 1/01184:01:21:55:63068	
start: 27-Mar-2022 20:54:30 end: 27-Mar-2022 21:00:50 at LMST: 1/01185:01:55:44:60757	
start: 30-Mar-2022 21:02:00 end: 30-Mar-2022 21:05:00 at LMST: 1/01188:00:04:12:84061	
start: 31-Mar-2022 22:14:50 end: 31-Mar-2022 22:22:10 at LMST: 1/01189:00:40:47:26903	

MAVEN Flyover Info	IFG 20 Hz file name
start: 01-Apr-2022 23:30:00 end: 01-Apr-2022 23:36:30 at LMST: 1/01190:01:14:36:24592	
start: 06-Apr-2022 00:51:00 end: 06-Apr-2022 00:56:50 at LMST: 1/01193:23:58:40:51272	
start: 07-Apr-2022 02:05:40 end: 07-Apr-2022 02:11:00 at LMST: 1/01195:00:32:19:75717	
start: 08-Apr-2022 03:22:20 end: 08-Apr-2022 03:25:10 at LMST: 1/01196:01:05:59:00161	
start: 11-Apr-2022 03:27:20 end: 11-Apr-2022 03:31:20 at LMST: 1/01198:23:16:24:02397	
start: 12-Apr-2022 04:41:30 end: 12-Apr-2022 04:45:20 at LMST: 1/01199:23:49:53:53597	
start: 13-Apr-2022 05:57:20 end: 13-Apr-2022 05:59:30 at LMST: 1/01201:00:23:32:78042	
start: 16-Apr-2022 06:04:10 end: 16-Apr-2022 06:05:40 at LMST: 1/01203:22:33:57:80277	
start: 17-Apr-2022 07:17:20 end: 17-Apr-2022 07:19:40 at LMST: 1/01204:23:07:27:31477	
start: 18-Apr-2022 08:32:40 end: 18-Apr-2022 08:33:50 at LMST: 1/01205:23:41:06:55922	
start: 22-Apr-2022 09:53:20 end: 22-Apr-2022 09:54:10	

MAVEN Flyover Info	IFG 20 Hz file name
at LMST: 1/01209:22:25:10:82602	
start: 23-Apr-2022 11:08:10 end: 23-Apr-2022 11:08:20 at LMST: 1/01210:22:58:50:07047	