**[NOTE – Part to be merged back to 651x2g0-[1-5,8]-core.docx document]**

## ISEE – A Typical Use Case

### CONTEXT AND BENEFITS

This ISEE use case is based on data acquired by the NASA ISEE 1 and ISEE 2 “tandem” spacecrafts launched in 1977. The use case is designed to exercise the major features of the PAIS standard. It covers the following:

* consideration of the data and its organization in the Producer’s environment,
* how the Producer plans to describe and organize subsets of it into individual Transfer Objects, and
* how the Transfer Objects should be put into SIPs (i.e., Submission Information Packages, or SIPs) for transmission to an Archive.

It also briefly covers the role of the Archive in reviewing and approving the planned descriptions of the data and the organization of the data into SIPs. This allows both the Producer and Archive to have a common understanding of the data and its organization to ensure it meets the objective of both parties. This gives the Archive the ability to apply some automation in reviewing the received SIPs so they can be checked for conformance to the agreed plans, and this helps to reduce errors. It also covers the role of the Producer in using software to create the SIPs according to the agreed plans.

### OBJECTS TO BE TRANSFERRED

The data chosen were resident on a NSSDCA (National Space Science Data Coordinating Archive) server, however they were truncated prior to building the SIPs and therefore at that point no longer bore any real resemblance to the actual ISEE data.

The organization of the data in the Producer’s (NSSDCA) environment is as shown in Figure 6-1



Figure 6-1: ISEE 1 / ISEE 2 Data Repository Layout

The hierarchical levels correspond to different directory levels. There are many more directories present than are shown in Figure 6-1. Only the directories in ‘yellow’ are to be included in the transmission to the Archive. The data used for the testing are from the ISEE 1 and ISEE 2 spacecrafts selected from the 60 second ASCII magnetometer data under the ‘mag’ directories. These are shown in ‘green’ and include the actual observations with file extension ‘.asc-gz’ and corresponding attribute files with file extension ‘.asc-gz-att’. The ‘asc-gz’ file is a zip file containing many 60 second ASCII files for a given day. The ‘asc-gz-att’ file is also a daily zip file containing many attribute files, each corresponding to a single 60 second file of the same day.

NOTE – The file extensions are those inherited from the original repository. They do not correspond to any practice recommended by the present report. Probably, the use of extensions such as ‘.txt.gz’ or ‘-att.txt.gz’ would have improved the usability of these files on present computer environments.

The Producer needs to decide:

* what data is to be transferred,
* how it should be divided into Transfer Objects,
* what Transfer Objects should go into what SIPs, and
* whether some SIPs should be sent to the Archive prior to sending others.

Since a Transfer Object can not be split across SIPs, determining what is to constitute a Transfer Object is a key consideration. Generally it will be most convenient for the Producer, when constructing one or more Transfer Objects, to maintain the same hierarchical and sequential relationships among the data files as exist in the Producer’s environment. However in some cases the Producer may want to re-organize the data as they are instantiated as Transfer Objects and put into SIPs in order to better support agreements with the Archive as to how the data will be made available to future users. As noted earlier, for this use case some directories are to be skipped and thus are not to be included in the Transfer Objects.

Additionally, the Producer needs to consider the mechanism, or transfer protocol, that will be used to transfer the SIPs as this may put a limit on the size of the SIPs and thus on the size or number of Transfer Objects in a given SIP. A size limitation may also be imposed by the Archive based on its data ingest handling capabilities.

The sequence in which the SIPs are received may be important to the Archive for validation purposes, or for management of the ingest process generally. For example, the Producer may be sending a formal description of formats which the Archive needs to have to support validation requirements, and thus the Archive wants the format information prior to receiving and processing the related data files.

In this test case, the Producer is proposing to send a small sample of 60 second magnetometer data from each spacecraft. It was decided that there should be two types of Transfer Objects, with multiple instances of each type, and there should be two distinct SIPs. One type of Transfer Object, referred to as ‘data’, should have both ISEE 1 and ISEE 2 files, with extension .asc-gz, taken from **one** of the years in the range 1978-1980. The result will be three Transfer Objects as there are three years in the range 1978-1980. To limit the size of these Transfer Objects, the daily files are restricted to days in the range 001 – 007. Note that these decisions will result in Transfer Objects whose data organization will not be a direct extraction of the organization in the Producer’s environment shown in Figure 6-1. Rather there will be the equivalent of an ISEE1 directory containing a year 1978 directory containing several data files with days in the range 001-007. This will be followed by an ISEE2 directory containing a year 1978 directory containing several data files with days in the range 001-007. These restrictions can be met by examining the directory and file names in the Producer’s environment and instructing the SIP creation software accordingly. This is a capability supported by the software (see section 7.2) that will be used to automate the creation of these SIPs.

The second type of Transfer Object, referred to as ‘metadata’, should have the same restrictions except its files will have the extension .asc-gz\_att. These metadata files provide a number of attributes about the primary data files. One type of SIP will be used to send the ‘data’ Transfer Objects and the second type of SIP will be used to send the ‘metadata’ Transfer Objects. The ‘metadata’ SIP will be sent prior to sending the ‘data’ SIP.

To achieve the above objectives, the Transfer Object types, types of SIPs, and the SIP sequencing constraints need to be formally defined. This is discussed in the next section.

### MODEL OF OBJECTS FOR TRANSFER and SIP Contraints

#### MOT

The Producer and the Archive jointly define the MOT, taking into consideration the level of detail needed for understanding and the level of validation desired. Considerations include what objects are to be transferred, their frequency of occurrence, what relationships exist among the objects, and under what format they will be provided to the Archive. The Producer and Archive also specify the naming rules for the different identifiers of Collections, Transfer Object Types, Producer Sources, etc. The practical generation of most MOTs will require supporting software. The MOT for this use case was generated with such software and it presents a graphical user interface.

The schematic of the MOT for the ISEE use case, as shown in Figure 6-2, involves one Collection Descriptor as the parent of two Transfer Object Descriptors. The Collection Descriptor semantics calls for ISEE 1 and ISEE 2 magnetic field data and metadata grouped by spacecraft. The term ‘metadata’ is used here to refer to the attribute files with extension ‘.asc-gz-att’ as shown in Figure 6-1. The Collection size is specified to lie between 9 and 22 MB. Two association relationships, which are optional in the standard, of ‘contains’ are specified corresponding to the data and metadata Transfer Object Descriptors. The XML content of the Collection Descriptor is provided in annex B1.



Figure 6-2: ISEE 1 / ISEE 2 MOT

The **data** Transfer Object Descriptor (whose parent is NASA\_ESA\_CNES\_Test\_Data\_Exchange\_02 as shown in Figure 6-1) is an XML object that is fully specified in Annex B2. Its semantics calls for each Transfer Object to contain two satellite groups (ISEE 1 and ISEE 2) with each group containing a single yearly directory group taken from the range 1978 through 1980. The yearly directory group will hold data for days 001-007 inclusive. The relevant excerpt is as follows:

 <transferObjectTypeTitle>Annual Directory of ISEE 1,2 Magnetic\_Field Data</transferObjectTypeTitle>
 <transferObjectTypeDescription>Annual Directory of ISEE 1,2 magnetic field data (no metadata) grouped by Spacecraft (ISEE 1 and ISEE 2) and then for a Yearly Directory in range 1978 through 1980 for days 001-007 inclusive. </transferObjectTypeDescription>

 The Descriptor also specifies that there shall be 3 Transfer Objects, corresponding to the three years 1978-1980, and each will have a size between 3 and 7 MB. The relevant excerpt is as follows:

 <transferObjectTypeOccurrence>
 <minOccurrence>3</minOccurrence>
 <maxOccurrence>3</maxOccurrence>
 </transferObjectTypeOccurrence>
 <transferObjectTypeSize>
 <minSize>3</minSize>
 <maxSize>7</maxSize>
 <unitsType>MB</unitsType>
 </transferObjectTypeSize>

Inside each yearly group there shall be between 2 and 4 data objects. The data objects are specified to be plain text that have been gzip encoded. The relevant excerpt is as follows:

<groupType>
 <groupTypeID>Yearly\_Group</groupTypeID>
 <groupTypeDescription>Each group will contain 1 year taken from range 1978-1980</groupTypeDescription>
 <groupTypeStructureName>directory</groupTypeStructureName>
 <groupTypeOccurrence>
 <minOccurrence>1</minOccurrence>
 <maxOccurrence>1</maxOccurrence>
 </groupTypeOccurrence>
 <dataObjectType>
 <dataObjectTypeID>ISEE\_Mag\_Data\_File</dataObjectTypeID>
 <dataObjectTypeDescription>ISEE magnetometer data file whose file name contains a day identifier in the range 001-007.</dataObjectTypeDescription>
 <dataObjectTypeOccurrence>
 <minOccurrence>2</minOccurrence>
 <maxOccurrence>4</maxOccurrence>
 </dataObjectTypeOccurrence>
 <dataObjectTypeFormat>
 <mimeType>text/plain</mimeType>
 </dataObjectTypeFormat>
 <dataObjectTypeEncoded>
 <encodingName>gzip</encodingName>
 <encodingDescription>application/x-gzip</encodingDescription>
 </dataObjectTypeEncoded>

It also specifies an association relationship of ‘data’ with respect to a referenced group of metadata (attribute) files. The relevant excerpt is as follows:

 <relation>
 <parentCollection>NASA\_ESA\_CNES\_Test\_Data\_Exchange\_02</parentCollection>
 <association>
 <targetID>NSSDC\_Attributes\_ISEE\_Mag\_Data\_TC2</targetID>
 <relationDescription>
 <relationType>Data</relationType>
 <relationTextualDescription>group of data files corresponding to the Target Id's group of metadata files</relationTextualDescription>
 </relationDescription>
 </association>
 </relation>

The **metadata** Transfer Object Descriptor (whose parent is also NASA\_ESA\_CNES\_Test\_Data\_Exchange\_02 as shown in Figure 6-1) is an XML object that is fully specified in Annex B3. Its semantics calls for each Transfer Object to contain two satellite groups (ISEE 1 and ISEE 2) with each group containing a single yearly directory group taken from the range 1978 through 1980. The yearly directory group will hold metadata for days 001-007 inclusive. The relevant excerpt is as follows:

 <description>
 <transferObjectTypeTitle>Annual Directory of NSSDC Attributes for ISEE 1,2 Magnetic\_Field Data</transferObjectTypeTitle>
 <transferObjectTypeDescription>Annual Directory of NSSDC Attributes for ISEE 1,2 magnetic field data grouped by Spacecraft (ISEE 1 and ISEE 2) and then for a Yearly Directory (in range 1978 through 1980) for days 001-007 inclusive. </transferObjectTypeDescription>

The Descriptor also specifies that there shall be 3 Transfer Objects, corresponding to the three years 1978-1980, and each will have a size between 8 and 24 KB. The relevant excerpt is as follows:

 <transferObjectTypeOccurrence>
 <minOccurrence>3</minOccurrence>
 <maxOccurrence>3</maxOccurrence>
 </transferObjectTypeOccurrence>
 <transferObjectTypeSize>
 <minSize>8</minSize>
 <maxSize>24</maxSize>
 <unitsType>KB</unitsType>
 </transferObjectTypeSize>

Inside each yearly group there shall be between 2 and 4 data objects (referred to as metadata objects). The metadata objects are specified to be plain text. The relevant excerpt is as follows:

 <groupType>
 <groupTypeID>Satellite\_Group</groupTypeID>
 <groupTypeDescription>There are 2 satellite groups, ISEE1 and ISEE 2</groupTypeDescription>
 <groupTypeStructureName>directory</groupTypeStructureName>
 <groupTypeOccurrence>
 <minOccurrence>2</minOccurrence>
 <maxOccurrence>2</maxOccurrence>
 </groupTypeOccurrence>
 <groupType>
 <groupTypeID>Yearly\_Group</groupTypeID>
 <groupTypeDescription>Each group will contain 1 year taken from range 1978 - 1980</groupTypeDescription>
 <groupTypeStructureName>directory</groupTypeStructureName>
 <groupTypeOccurrence>
 <minOccurrence>1</minOccurrence>
 <maxOccurrence>1</maxOccurrence>
 </groupTypeOccurrence>
 <dataObjectType>
 <dataObjectTypeID>NSSDC\_Attributes\_ISEE\_Mag\_Data\_File</dataObjectTypeID>
 <dataObjectTypeDescription>NSSDC generated metadata file, corresponding to ISEE magnetometer data file, whose file name contains a day identifier in the range 001-007.</dataObjectTypeDescription>
 <dataObjectTypeOccurrence>
 <minOccurrence>2</minOccurrence>
 <maxOccurrence>4</maxOccurrence>
 </dataObjectTypeOccurrence>
 <dataObjectTypeFormat>
 <mimeType>text/plain</mimeType>
 </dataObjectTypeFormat>

It also specifies an association relationship of ‘metadata’ with respect to a referenced group of data files. The relevant excerpt is as follows:

 <relation>
 <parentCollection>NASA\_ESA\_CNES\_Test\_Data\_Exchange\_02</parentCollection>
 <association>
 <targetID>ISEE\_Mag\_Data\_TC2</targetID>
 <relationDescription>
 <relationType>Metadata</relationType>
 <relationTextualDescription>group of metadata files corresponding to the Target Id's group of data files</relationTextualDescription>
 </relationDescription>
 </association>
 </relation>

#### ISEE SIP Constraints

The ISEE use case also includes a SIP constraints file that identifies two types of SIPs. SIP\_01 is allowed to contain from 1 to 3 data Transfer Objects while SIP\_02 is allowed to contain from 1 to 3 metadata Transfer Objects. In addition, it specifies that the SIP\_02 metadata Transfer Objects are to be transferred to the Archive prior to sending the SIP\_01 data Transfer Objects. The XML content of the SIP Constraints is provided in annex B4.

### SIPs

The PAIS specifies a standard packaging mechanism for the implementation of PAIS SIPs. It is based on use of the XFDU packaging standard. When this is followed, and the semantics of PAIS section 5 are followed, the resulting implementation is said to be ‘XFDU PAIS SIP Conformant’. However it is acceptable to use other packaging mechanisms. In this case the resulting SIP implementation can be said to be ‘Abstract PAIS SIP Conformant’ provided it also adheres to the semantics of PAIS section 5.

These ISEE SIPs are based on the XFDU standard as extended by the PAIS schema (see Section 6 of the PAIS standard) and therefore consists of:

* An **xfdumanifest.xml** file providing the following information:
	+ The packageHeader containing in particular the PAIS sipGlobalInformation: sipID, producerSourceID, producerArchiveProjectID, sipContentTypeID, sipSequenceNumber,
	+ The informationPackageMap describing the contained PAIS sipTransferObject corresponding to the Transfer Object Types authorized within the SIP,
	+ The dataObjectSection listing the different transferred objects: a unique identifier, the size in bytes of the file, its location within the SIP, its MD5 checksum for integrity validation.
* The **different transferred objects** as files or directories/subdirectories containing files.

As noted in section 6.1.3.2, two types of SIPs are generated for this use case. The first type, whose SIP Content Type ID is ‘SIP\_01’, can contain from 1 to 3 data Transfer Objects. As noted in section 6.1.3.1 and also in the data Transfer Object Descriptor in Annex B2 these data Transfer Objects will ranges in size from 3 to 7 MB. Therefore the decision was made to put all three data Transfer Objects into a single SIP. Only the SIP\_01 type will be described as the SIP\_02 type has a parallel construction.

The practical generation of most SIPs will require the use of supporting software. Such software, called the ESA SIP Builder (see section 7.2), was used to generate the manifest for the data SIP (SIP\_01) as given in Annex B5. A tabular view is given in Figure 6-3. Items in bold correspond to terms from the standards (PAIS and XFDU) while non-bold items are values explicit to this use case.

The first section of the manifest contains the SIP Global Information. It contains a number of identifiers. Annex D of the PAIS provides an informative summary of the various PAIS identifiers including references to relevant sections of the standard.

The SIP ID is provided by the Producer and it is checked by the Archive to ensure it is unique within this particular Producer-Archive Project. In this case, the SIP ID is given as ‘NASA\_ESA\_CNES\_Test\_Data\_Exchange\_02-SIP-0002’ where the Producer has decided to append the term SIP followed by a sequence number to ensure uniqueness.

It is possible that there may be multiple actual Producers submitting SIPs for a given Producer-Archive Project. The Archive needs to understand who has submitted each SIP in case there are issues that need to be resolved. This is handled by providing a Producer-Source ID which is agreed to jointly by the Producer and Archive. In this case there is only one source and the ID agreed is ‘NASA\_ESA\_Source1’.

When the Archive receives a SIP, it needs to understand which Producer-Archive Project it is associated with. The Archive establishes the Producer-Archive Project ID to ensure uniqueness within its environment. In this case it chose ‘NASA\_ESA\_CNES\_Test\_Data\_Exchange\_02’. Note that the Producer then used this ID as the basis for its generation of SIP IDs. There is no requirement to do this but it is more informative than simply using something like a sequence number for the SIP ID.

When the Archive receives a SIP, it also needs to understand what type of SIP it conforms to because each type of SIP has different constraints. This is handled by including a SIP Content Type ID that is jointly decided between the Producer and Archive when there is agreement on the SIP Constraints file, which is an XML object (see Annex B4). In this case the allowed IDs are SIP\_01 and SIP\_02. SIP\_01 identifies the SIP as containing ISEE data (but not metadata).

The PAIS also specifies an optional ‘SIP Sequence Number’ that can be useful in identifying missing SIP deliveries. This is particularly useful when the exact number of Transfer Objects of each type has not been specified in the Descriptors. Although the exact number of Transfer Objects has been specified in this ISEE use case, the Producer decided to include the SIP Sequence Number. Note that it is given as ‘2’ because this data SIP is sent after the metadata SIP.

The next section starts with the first Transfer Object. Following the specifications and semantics of the Transfer Object Descriptor, it contains two top level Transfer Object Groups corresponding to ISEE1 data and ISEE2 data respectively. Each of these groups contains another group corresponding to data for the first year, or 1978. Within each of these secondary groups are three SIP Data Objects. Each corresponds to a daily data file taken from the day range 1 to 7. Each Data Object uses the XFDU dataObjectPointer to give an identifier of a set of information that can be found later in the manifest under the XFDU dataObject section. This section, shown in the tabular view, has a number of XFDU dataObject elements. Each dataObject has an identifier that matches one of those given by the dataObjectPointer. It also gives information about the Data Object such as size, file location, checksum. It could also refer to multiple files but in this use case each Data Object is a single file. Because the actual files used to create the SIPs were very truncated versions of the original data, the file sizes of 128 bytes each result in Transfer Objects very much smaller than the minimum size of 3 MB as specified in the corresponding Transfer Object Descriptor. As a result, the Archive would find that these Transfer Objects fail a validation check on Transfer Object sizes. The Archive would be expect to contact the Producer (NASA\_ESA\_Source1) to resolve the issue.

The second Transfer Object is much like the first, but it corresponds to data for the year 1979. For brevity, only the beginning elements are shown. For the same reason the third Transfer Object, for 1980, is not shown.

The complete SIP for this use case consists of a zip file containing the manifest file and the directories and files consistent with those given by the file location information in the XFDU dataObject elements

|  |  |
| --- | --- |
| **PAIS elements/items** | **Contents** |
| **SIPGlobalInformation** |  |
|  | **sipID :** NASA\_ESA\_CNES\_Test\_Data\_Exchange\_02-SIP-0002**producerSourceID :** NASA\_ESA\_Source1**producerArchiveProjectID:** NASA\_ESA\_CNES\_Test\_Data\_Exchange\_02**sipContentTypeID:** SIP\_01**sipSequenceNumber:** 2 |
| **sipTransferObject** |  |
|  | **descriptorID:** ISEE\_Mag\_Data\_TC2**transferObjectID:** ISEE\_Mag\_Data\_TC2-0001**sipTransferObjectGroup** |
|  | **associatedDescriptorGroupTypeID:** Satellite\_Group |
| **transferObjectGroupInstanceName:** isee1 |
| **sipTransferObjectGroup** |
|  | **associatedDescriptorGroupTypeID:**Yearly\_Group **transferObjectGroupInstanceName:**1978 |
| **sipDataObject** |
|  | **associatedDescriptorDataID:**ISEE\_Mag\_Data\_File |
| **dataObjectPointer:dataObjectID**="DO-ISEE\_Mag\_Data\_File-0001” |
|  | **sipDataObject** |
|  | **associatedDescriptorDataID:** ISEE\_Mag\_Data\_File |
| **dataObjectPointer:dataObjectID**="DO-ISEE\_Mag\_Data\_File-0002” |
|  | **sipDataObject** |
|  | **associatedDescriptorDataID:** ISEE\_Mag\_Data\_File |
| **dataObjectPointer:dataObjectID**="DO-ISEE\_Mag\_Data\_File-0003” |
| **sipTransferObjectGroup** |
|  | **associatedDescriptorGroupTypeID:** Satellite\_Group |
| **transferObjectGroupInstanceName:** isee2 |
| **sipTransferObjectGroup** |
|  | **associatedDescriptorGroupTypeID:**Yearly\_Group **transferObjectGroupInstanceName:**1978 |
| **sipDataObject** |
|  | **associatedDescriptorDataID:**ISEE\_Mag\_Data\_File |
| **dataObjectPointer:dataObjectID**="DO-ISEE\_Mag\_Data\_File-0004” |
|  | **sipDataObject** |
|  | **associatedDescriptorDataID:** ISEE\_Mag\_Data\_File |
| **dataObjectPointer:dataObjectID**="DO-ISEE\_Mag\_Data\_File-0005” |
|  | **sipDataObject** |
|  | **associatedDescriptorDataID:** ISEE\_Mag\_Data\_File |
| **dataObjectPointer:dataObjectID**="DO-ISEE\_Mag\_Data\_File-0006” |
| **sipTransferObject** |  |
|  | **descriptorID:** ISEE\_Mag\_Data\_TC2**transferObjectID:** ISEE\_Mag\_Data\_TC2-0002**sipTransferObjectGroup** |
|  |  | **associatedDescriptorGroupTypeID:** Satellite\_Group |
| **transferObjectGroupInstanceName:** isee1 |
|  |  | **associatedDescriptorGroupTypeID:**Yearly\_Group **transferObjectGroupInstanceName:**1979 |
| *The subsequent organization for 1979 and 1980 follows that above for 1978, but is not shown here for brevity. Following this is the dataObject section which is shown below only for 1978.* |
|  |  |
| **dataObject** |  |
|  | **ID=**"DO-ISEE\_Mag\_Data\_File-0001" **size=**"128” |
| **byteStream** |
|  | **size=**"128”**fileLocation locatorType="URL" href=" file:**isee1/1978/isee1\_mag\_60s\_0031\_1978\_002.asc-gz **"****checksum checksumName="**MD5**"** 7cc53dd29fb89105352e5f50f9af06b5 |
| **dataObject** |  |
|  | **ID=**"DO-ISEE\_Mag\_Data\_File-0002" **size=**"128” |
| **byteStream** |
|  | **size=**"128”**fileLocation locatorType="URL" href="file:** isee1/1978/isee1\_mag\_60s\_0032\_1978\_004.asc-gz **"****checksum checksumName="**MD5**"** 8b1e38c7109f4b39ae5f0ec456ba1569 |
| **dataObject** |  |
|  | **ID=**"DO-ISEE\_Mag\_Data\_File-0003" **size=**"128” |
| **byteStream** |
|  | **size=**"128”**fileLocation locatorType**="**URL**" **href="file:** isee1/1978/isee1\_mag\_60s\_0033\_1978\_007.asc-gz**"****checksum checksumName="**MD5**"** 92f7668852b9006f4091becd3b3e7ab7 |
| **dataObject** |  |
|  | **ID=**"DO-ISEE\_Mag\_Data\_File-0004" **size=**"128” |
| **byteStream** |
|  | **size=**"128”**fileLocation locatorType="URL" href=" file:**isee2/1978/isee2\_mag\_60s\_0031\_1978\_002.asc-gz **"****checksum checksumName="**MD5**"** 15e56b31c9c576f7ca50785f31bc8528 |
| **dataObject** |  |
|  | **ID=**"DO-ISEE\_Mag\_Data\_File-0005" **size=**"128” |
| **byteStream** |
|  | **size=**"128”**fileLocation locatorType="URL" href=" file:**isee2/1978/isee2\_mag\_60s\_0032\_1978\_002.asc-gz **"****checksum checksumName="**MD5**"** 0aa1312e75d78a68c98cf0063c6115a6 |
| **dataObject** |  |
|  | **ID=**"DO-ISEE\_Mag\_Data\_File-0006" **size=**"128” |
| **byteStream** |
|  | **size=**"128”**fileLocation locatorType="URL" href=" file:**isee2/1978/isee2\_mag\_60s\_0033\_1978\_002.asc-gz **"****checksum checksumName="**MD5**"** 06b5550d1907056737992c60530045be |

Figure 6-3: Tabular view of an ISEE data SIP manifest file

As noted above, building the Transfer Objects within a SIP requires examining the associated Descriptor and mapping its specifications to the organization of data within the Producer’s environment so that proper Transfer Objects are generated. When the initial SIPs were generated for this use case, the semantics within the Description elements of the Descriptor’s groups were not closely followed. In particular, when groups contain other groups, and they have multiple occurrences, it can be ambiguous as to the order in which the groups and subgroups are instantiated. This lead to the initial SIPs having Transfer Objects that had various mixtures of ISEE1 and ISEE 2, instead of each Transfer Object having both ISEE1 and ISEE2 satellite groups. This is shown schematically in Figure 6-4, where TO stands for Transfer Object and view (a) is the correct view as described above, while (b) is the initial view that was inconsistent with the Descriptor semantics.

When there are multiple occurrences, it is important to be sure the needed semantics regarding instantiation of the groups is clear. This could also involve the use of a user defined element to more formally define the order of group instantiations, leading to greater automation in correctly generating Transfer Objects and SIPs.



Figure 6-4: Views of correct and incorrect ordering of ISEE satellite group instantiations

**Annex B**

ISEE Use Case Descriptors

B1 ISEE Collection Descriptor

<?xml version="1.0" encoding="UTF-8"?>
<collectionDescriptor xmlns:x0="http://www.w3.org/2001/XMLSchema">
 <identification>
 <descriptorModelID>CCSD0015</descriptorModelID>
 <descriptorModelVersion>V1.0</descriptorModelVersion>
 <descriptorID>NASA\_ESA\_CNES\_Test\_Data\_Exchange\_02</descriptorID>
 </identification>
 <description>
 <collectionTitle>Selection 2 of ISEE 1,2 Magnetic\_Field Data and Metadata</collectionTitle>
 <collectionDescription>Selected ISEE 1,2 Magnetic\_Field Data and Metadata grouped by Spacecraft and then by Yearly Directories (1978 through 1980 only) for days 001-007 inclusive. </collectionDescription>
 <collectionSize>
 <minSize>9</minSize>
 <maxSize>22</maxSize>
 <unitsType>MB</unitsType>
 </collectionSize>
 </description>
 <relation>
 <parentCollection>none</parentCollection>
 <association>
 <targetID>ISEE\_Mag\_Data\_TC2</targetID>
 <relationDescription>
 <relationType>Contains</relationType>
 <relationTextualDescription>Collection contains data Transfer Objects of this type</relationTextualDescription>
 </relationDescription>

</association>

<association>
 <targetID>NSSDC\_Attributes\_ISEE\_Mag\_Data\_TC2</targetID>
 <relationDescription>
 <relationType>Contains</relationType>
 <relationTextualDescription>Collection contains metadata Transfer Objects of this type</relationTextualDescription>
 </relationDescription>
 </association>
</relation>
</collectionDescriptor>

B2 ISEE Data Descriptor

<?xml version="1.0" encoding="UTF-8"?>
<transferObjectTypeDescriptor xmlns:x0="http://www.w3.org/2001/XMLSchema">
 <identification>
 <descriptorModelID>CCSD0014</descriptorModelID>
 <descriptorModelVersion>V1.0</descriptorModelVersion>
 <descriptorID>ISEE\_Mag\_Data\_TC2</descriptorID>
 <producerSourceID>NASA\_ESA\_Source1</producerSourceID>
 </identification>
 <description>
 <transferObjectTypeTitle>Annual Directory of ISEE 1,2 Magnetic\_Field Data</transferObjectTypeTitle>
 <transferObjectTypeDescription>Annual Directory of ISEE 1,2 magnetic field data (no metadata) grouped by Spacecraft (ISEE 1 and ISEE 2) and then for a Yearly Directory in range 1978 through 1980 for days 001-007 inclusive. </transferObjectTypeDescription>
 <transferObjectTypeOccurrence>
 <minOccurrence>3</minOccurrence>
 <maxOccurrence>3</maxOccurrence>
 </transferObjectTypeOccurrence>
 <transferObjectTypeSize>
 <minSize>3</minSize>
 <maxSize>7</maxSize>
 <unitsType>MB</unitsType>
 </transferObjectTypeSize>
 <namePreservationRule>Use the Source names</namePreservationRule>
 </description>
 <relation>
 <parentCollection>NASA\_ESA\_CNES\_Test\_Data\_Exchange\_02</parentCollection>
 <association>
 <targetID>NSSDC\_Attributes\_ISEE\_Mag\_Data\_TC2</targetID>
 <relationDescription>
 <relationType>Data</relationType>
 <relationTextualDescription>group of data files corresponding to the Target Id's group of metadata files</relationTextualDescription>
 </relationDescription>
 </association>
 </relation>
 <groupType>
 <groupTypeID>Satellite\_Group</groupTypeID>
 <groupTypeDescription>There are 2 satellite groups, ISEE1 and ISEE 2</groupTypeDescription>
 <groupTypeStructureName>directory</groupTypeStructureName>
 <groupTypeOccurrence>
 <minOccurrence>2</minOccurrence>
 <maxOccurrence>2</maxOccurrence>
 </groupTypeOccurrence>
 <groupType>
 <groupTypeID>Yearly\_Group</groupTypeID>
 <groupTypeDescription>Each group will contain 1 year taken from range 1978-1980</groupTypeDescription>
 <groupTypeStructureName>directory</groupTypeStructureName>
 <groupTypeOccurrence>
 <minOccurrence>1</minOccurrence>
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 <dataObjectTypeDescription>ISEE magnetometer data file whose file name contains a day identifier in the range 001-007.</dataObjectTypeDescription>
 <dataObjectTypeOccurrence>
 <minOccurrence>2</minOccurrence>
 <maxOccurrence>4</maxOccurrence>
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 <mimeType>text/plain</mimeType>
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 <encodingName>gzip</encodingName>
 <encodingDescription>application/x-gzip</encodingDescription>
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 <dataObjectTypeAssociation>
 <targetID>NSSDC\_Attributes\_ISEE\_Mag\_Data\_File</targetID>
 <relationDescription>
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 <relationTextualDescription>Data file corresponding to the Target ID's metadata file</relationTextualDescription>
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 </groupType>
 </groupType>
</transferObjectTypeDescriptor>

B3 ISEE Metadata Descriptor

<?xml version="1.0" encoding="UTF-8"?>
<transferObjectTypeDescriptor xmlns:x0="http://www.w3.org/2001/XMLSchema">
 <identification>
 <descriptorModelID>CCSD0014</descriptorModelID>
 <descriptorModelVersion>V1.0</descriptorModelVersion>
 <descriptorID>NSSDC\_Attributes\_ISEE\_Mag\_Data\_TC2</descriptorID>
 <producerSourceID>NASA\_ESA\_Source1</producerSourceID>
 </identification>
 <description>
 <transferObjectTypeTitle>Annual Directory of NSSDC Attributes for ISEE 1,2 Magnetic\_Field Data</transferObjectTypeTitle>
 <transferObjectTypeDescription>Annual Directory of NSSDC Attributes for ISEE 1,2 magnetic field data grouped by Spacecraft (ISEE 1 and ISEE 2) and then for a Yearly Directory (in range 1978 through 1980) for days 001-007 inclusive. </transferObjectTypeDescription>
 <transferObjectTypeOccurrence>
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 <maxOccurrence>3</maxOccurrence>
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 <transferObjectTypeSize>
 <minSize>8</minSize>
 <maxSize>24</maxSize>
 <unitsType>KB</unitsType>
 </transferObjectTypeSize>
 <namePreservationRule>Use the Source names</namePreservationRule>
 </description>
 <relation>
 <parentCollection>NASA\_ESA\_CNES\_Test\_Data\_Exchange\_02</parentCollection>
 <association>
 <targetID>ISEE\_Mag\_Data\_TC2</targetID>
 <relationDescription>
 <relationType>Metadata</relationType>
 <relationTextualDescription>group of metadata files corresponding to the Target Id's group of data files</relationTextualDescription>
 </relationDescription>
 </association>
 </relation>
 <groupType>
 <groupTypeID>Satellite\_Group</groupTypeID>
 <groupTypeDescription>There are 2 satellite groups, ISEE1 and ISEE 2</groupTypeDescription>
 <groupTypeStructureName>directory</groupTypeStructureName>
 <groupTypeOccurrence>
 <minOccurrence>2</minOccurrence>
 <maxOccurrence>2</maxOccurrence>
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 <groupType>
 <groupTypeID>Yearly\_Group</groupTypeID>
 <groupTypeDescription>Each group will contain 1 year taken from range 1978 - 1980</groupTypeDescription>
 <groupTypeStructureName>directory</groupTypeStructureName>
 <groupTypeOccurrence>
 <minOccurrence>1</minOccurrence>
 <maxOccurrence>1</maxOccurrence>
 </groupTypeOccurrence>
 <dataObjectType>
 <dataObjectTypeID>NSSDC\_Attributes\_ISEE\_Mag\_Data\_File</dataObjectTypeID>
 <dataObjectTypeDescription>NSSDC generated metadata file, corresponding to ISEE magnetometer data file, whose file name contains a day identifier in the range 001-007.</dataObjectTypeDescription>
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 </dataObjectTypeFormat>
 <dataObjectTypeAssociation>
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 <relationDescription>
 <relationType>Metadata</relationType>
 <relationTextualDescription>Metadata files corresponding to the Target ID's data files</relationTextualDescription>
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</transferObjectTypeDescriptor>

B4 ISEE SIP Constraints

<?xml version="1.0" encoding="UTF-8"?>
<sipConstraints xmlns:x0="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNamespaceSchemaLocation="D:\PUBLIC\PAIS\_DATA\projectsV2.7\NASA1\conf\sip\_constraints\_RB1.xsd">
 <producerArchiveProjectID>NASA\_ESA\_CNES\_Test\_Data\_Exchange\_02</producerArchiveProjectID>
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 <descriptorID>ISEE\_Mag\_Data\_TC2</descriptorID>
 <occurrence>
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 <constraintItem>
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 </sipSequencingConstraintGroup>
</sipConstraints>

B5. Manifest of the ISEE Data SIP

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<xfdu:XFDU xmlns:xfdu="urn:ccsds:schema:xfdu:1" xmlns:sip="urn:ccsds:schema:pais:1">
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 <specificationVersion>1.0</specificationVersion>
 </volumeInfo>
 <environmentInfo>
 <extension>
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 </environmentInfo>
 </packageHeader>
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 <dataObjectSection>
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 <byteStream size="128">
 <fileLocation locatorType="URL" href="file:isee1/1978/isee1\_mag\_60s\_0031\_1978\_002.asc-gz"/>
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