

**SCIENCE INSTRUMENT
AIRWORTHINESS AND CERTIFICATION PROCEDURES
MANUAL
Section 200:
Documentation**

200 Documentation

200.1 Airworthiness Logbook

Communication during the certification process is one of the most critical components of achieving an STC in a reasonable time. In order to simplify communications between the DER and the SI team, all documentation regarding certification should be stored in a certification logbook. These documents include conceptual and detailed designs for mechanical and electrical systems, as well as functional hazard analysis (FHA), operational analysis, and correspondence with the SI Airworthiness IPT and DERs and DARs.

It will aid in the certification of all instruments if the documentation packages that accompany each instrument look similar. This gives credence to the idea that all the instruments are similar on the outside, and it is in the internal NON-CRITICAL components that instruments begin to differ. If all teams use the logbook, it will simplify the review process for the reviewers (the SIA-IPT and the DERs/DARs) as all instruments will have similar documents in a similar order. This should also reduce the time it takes to review each documentation package.

200.1.1 Documentation Logbook Layout

The items on this list are a sample of what will be kept in your SOFIA Certification Logbook. This list may change depending on your instrument needs.

- 100 Introduction and General Instrument Specifications
- 150 Reviews
- 200 Documentation
- 300 Mechanical Specifications
- 350 Manufacturing: Process Specifications, test setup, etc.
- 400 Electrical Specifications
- 500 Functional Hazard Analysis
- 600 Operations and maintenance documents
- 800 Stress Analysis
- 900 Correspondence with the SIA-IPT
- 1000 Correspondence with the DERs
- 1100 Correspondence with the DARs
- 1200 Drawing log and actual drawings
- 1400 Conformity paperwork

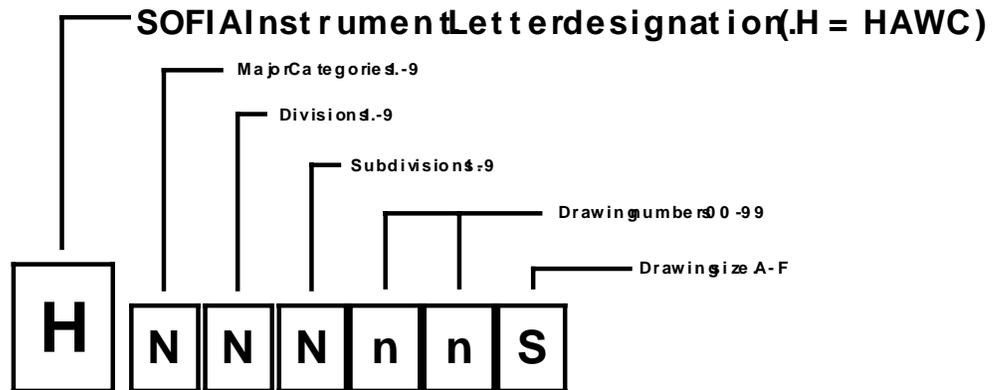
200.2 Numbering Guidelines

It will be easier for your documents to be quickly reviewed if they are in a standard format. In the next section, there is a detailed discussion of drawing

standards such as title block, process, and material call out, etc. A uniform numbering format will allow engineers reviewing the document, whether a drawing or some analysis, to easily identify which part of the system is to be addressed in that particular document. You may implement your own numbering scheme or use a format developed by the HAWC instrument team.

Figure 200.2-1 shows an example of a numbering scheme that SI teams are encouraged to implement.

G. Instrument documentation numbering system.



* Category, division and subdivision titles are chosen by the IPT leaders for those groups.

* The "1" digit place in each category, division and subdivision will always be kept for the lists of contents, indices, or block diagrams of that category or division.

Thus, an outline of all project documentation could be compiled under an outline of the this type:

H.N.N.N.

where H is the SOFIA instrument letter designator, (H = HAWC for example), and N.N.N is the list of tables of contents for each documentation category or division.

* Size designators permit recovery of odd sized documents from various "B-F" size storage drawers.

Figure 200.2-1a. Numbering format example

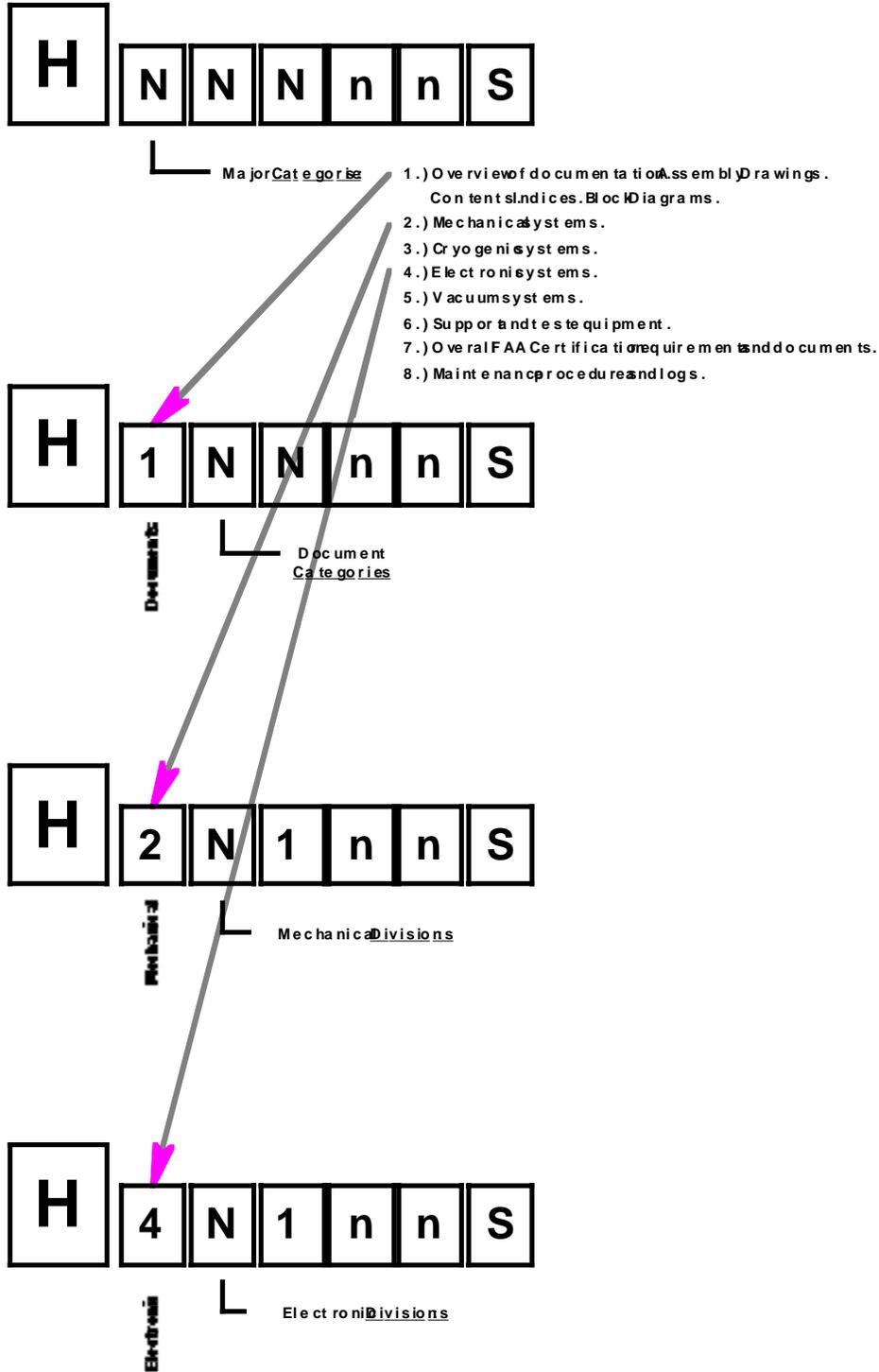
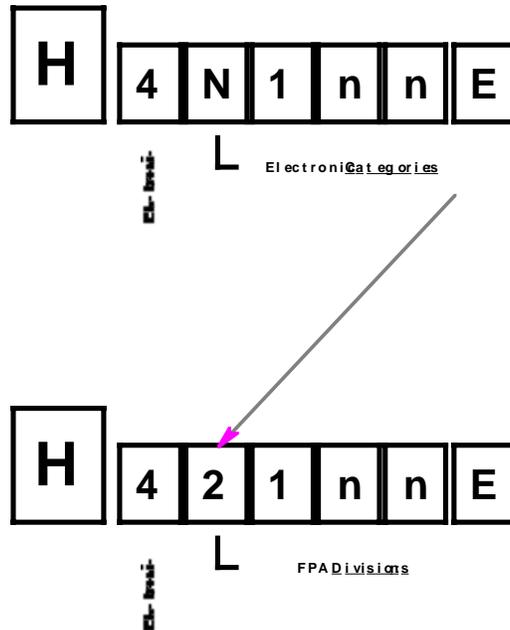


Figure 200.2-1b. Numbering format example continued



pg. 3

Figure 200.2-1c. Numbering format example continued.

200.3 Drawings

Detail drawings will be required for each certified mechanical part. Each drawing must have a title block, which includes the following:

- a) Name of the institution - e.g. Cornell University, USRA, etc.
- b) Location - City and State.
- c) Drawing Number - your choice.
- d) Drawing Date - usually the date it is released.
- e) Revision Status and date.
- f) Signature blocks for Drawn By, Checked By, Stress By, Mech Sys By, Approved By
- g) Page No. - page 1 of 1, page 2 of 4, etc.
- h) Scale - one half, full, as noted, etc.
- i) List of Materials – including the part number and manufacturer of the material or part.

Figure 200.3-1 is an example of what a standard title block should look like and will be available for use as a DXF file by SI teams if desired.

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ITEM	QUANTITY	DESCRIPTION OF MATERIAL
Next Assembly:		S O F I A H A W C <i>High Resolution Airborne Wideband Camera</i> <i>University of Chicago Yerkes Observatory</i> <i>373 Geneva Williamian Bay, Wisconsin 53191</i>
Comments:		
Calculated Weights:		Drawing Name:
Tolerances as below unless stated: Fractions Decimals Angles 0" to 6" + / - 1/8 2 .xx + / - .01" + / - 10 minutes 6" and up + / - 1/16 .xxx + / - .001" + / - 10 minutes		Drawing No. H N N N n n S <i>see example</i>
All surfaces machined flat, square or parallel unless otherwise specified. RMS FINISH EXCEPT AS NOTED		Drawn by: Date: (DD/MM/YY) To be manufactured by:
		Checked by: Date:
		Revised by: Date:
		Revised by: Date:
		Deliver to:

Figure 200.3-1. Title Block Example

Drawings must be clear and legible with sufficient views and dimensions so that the components can be analyzed, built, and inspected. All materials and processes must be called out. Clearly call out tap drill size, tap and thread size, hole depth, etc., so that it is clear what is required. Purchased items (i.e., screws, nuts, fittings, etc.) must have the vendor identified unless they are standard aircraft parts such as AN, MS, or NAS standards.

Be careful when designing and dimensioning a part that is to be conformed. If a part has a tight tolerance (such as +/- 0.001), then the part has to be conformed to that tolerance. If the part does not need a tight tolerance, then do not specify it as such. Keep in mind that some parts will need to be conformed by a DAR before they can be welded together into an assembly.

200.4 Reports

Each drawing and analysis can be thought of as a report. Whenever a document is created it should be filed in the Logbook under the appropriate section. The cryostat drawings should be kept together and available whenever necessary. Likewise the analysis that is performed on various parts should be indexed and filed in the Notebook. It is best to have too much material filed than to not have enough.

200.5 Schedule

Refer to the schedule that has been provided by Schwartz Engineering in the Introduction. In general top level drawings of the system along with drawings

specific enough to do initial stress analysis are due by the PADR. Final drawings that are ready to be sent to the shop should be reviewed by the DER before the CADR can be completed for any component (the cryostat, for example). Each group will be responsible for completion of a drawing package and scheduling the CADR before construction of that system can begin. Note that the facility science instrument must have completed a scientific critical design review prior to the critical airworthiness design review. The design and drawings of an entire system need to be complete before the CADR. If there is a critical long-lead item such as a cryostat that must be manufactured prior to the formal CADR, it is possible to have a critical airworthiness design review of this type of subsystem. However, it should be noted that it is best to have a mature overall design before a 'mini' CADR of any subsystem in case subsequent changes would impact the overall system design.

200.5.1 Deliverables

The following items are required as deliverables to the FAA (via the DER) in order to obtain certification. These materials will comprise a SOFIA science instrument Critical Airworthiness Design Review Data Package. These documents should be kept in the Airworthiness log book. Some of these items will probably be written for the Observatory (EMI test plan, for example) and included in a particular SI logbook.

Drawings

Weight and Balance Report (Section 300)

Structural Substantiation (Section 300)

Electrical load Analysis (Section 400)

EMI Test Plan (ground and flight) (See Section 400)

Function Hazard Analysis/Failure Mode and Effects Analysis (Section 500)

Operational (Functional) Test Plans (Section 600)

Continued Airworthiness Report (Section 600)