AUSROC II-2

DEVELOPMENT

DOCUMENTATION

SYSTEM

AUSROC II-2

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1. INTRODUCTION

On Thursday 22nd October 1992, the Ausroc II rocket vehicle failed in its maiden launch attempt at the Woomera Rocket Range in South Australia. Whilst the launch attempt was a failure, the program as a whole was regarded to be a great success. Ausroc II was the largest liquid fuelled rocket designed and built in Australia and done so by an amateur group of qualified engineers, scientists, technicians and enthusiasts.

Following the failed launch attempt, a decision was made by the Ausroc Projects Group to build a second Ausroc II vehicle to be known as Ausroc II-2. The Ausroc II-2 vehicle will essentially be a revised and improved Ausroc II. Design elements that caused the failure of the Ausroc II launch attempt were isolated and a redesign of components and system layouts has been undertaken by the new Ausroc II-2 project team.

This document has been formed and is being utilised to fill in the information gap that existed in the original Ausroc II program. The design documentation for the original Ausroc II was sparsely distributed throughout the original design team, if it existed at all, and caused delays and misinformation to be circulated throughout the program duration. It is intended that this document will contain the design specifications, technical calculations, component drawings and layouts, interfaces, circuit diagrams and assembly, test and launch procedures for the entire Ausroc II-2 program. This document is to be updated regularly to provide the most current information for all persons in the design team.

At the completion of the Ausroc II-2 program, this document will become the final project report to be a permanent record of the project.

2. DEVELOPMENT DOCUMENTATION SYSTEM

2.1 Introduction

The main purposes of the Development Documentation System (DDS) are:

1. To ensure that details of the design and development of a particular project are not lost in the recesses of the design engineers' minds, but are assembled and recorded in a standard form which is readily available at all times and provides a means of communicating information throughout the whole project team.

2. To provide documentation that is easily updated to incorporate design changes that occur during the development of the project.

3. To provide an explanation of the system and background design information for new personnel becoming associated with the project. This is particularly beneficial during a lengthy development period where personnel changes may occur.

2.2 Co-ordination

Material for the DDS is generated initially by design engineers and associated personnel who describe their designs and present the information in a standard way to a DDS Co-ordinator. The responsibilities of the DDS Co-ordinator are:

1. To collect material for the DDS
2. To control the production of drawings of a standard size and form.
3. To compile a reference file of DDS contents
4. To compile a distribution list and issue and issue copies of the DDS sets to persons on the list
5. To ensure that necessary changes are incorporated in master drawings and distribute updated sheets as per the distribution list.
6. To maintain a modification record if required.

2.3 Functional Breakdown

Descriptions in the DDS are based on a functional breakdown rather than physical, although physical locations are indicated on the diagrams. In the DDS a complex system is broken down into separate functions which are presented in a hierarchical structure and identified by a function code. The level breakdown and function identification are shown in figure 1. Information is presented in the order in which it is generated, ie. from the most general to the most particular. The levels are:

Highest or Master Level
The highest or master level information shows the functions in a system and their inter-relations

Intermediate Levels
Intermediate level information shows the inter-relation of the sub-functions comprising a function. This information may be broken down into several levels.

Lowest Level
Lowest level information shows the relationship of component parts.

2.4 Functional Code

The separate functions in a system are shown on a master level drawing (FM) and are identified by a functional code. The main functional elements of a system are identified as F1, F2, F3 etc. This functional identification is at intermediate level 1. At intermediate level 1 the functions can be broken down into sub-functions, ie. F2 could be broken down into F2.1, F2.2 etc. Intermediate levels can be broken down further until no further division is required. The final breakdown is the lowest level and takes the lowest functional identification.

2.5 Functional Block Diagrams (BD)

These are generated at all levels in a system by a design staff, to a standard form, emphasising main signal flow or interface lines and indicating functional and physical boundaries. The construction of a functional block diagram varies at

different levels, being general blocks at master level down to component parts, circuit diagrams or software listings at lowest level. There are 2 types of block diagrams:

Blocked Text (BT)
The blocked text diagram can be used from master level to lowest level. In addition the functional blocks will contain descriptive text which may be supplemented by explanatory diagrams.

Blocked Schematic (BS)
The blocked schematic diagram can be used at all levels, although the type of detail presented at master level may not lend itself readily to this format. As the title suggests, symbolic representation of detail within the functional blocks is used, together with interconnecting signal flow information.

2.6 Other Formats

The functional block diagrams, mentioned above, can be supplemented by the following other types of diagrams and documentation formats such that a complete description can be provided :

General Text (GT)
A general text is used at any level to supplement the brief text form of the functional block diagrams and smooths the process of information release as the design proceeds from 1 level to the next.

Signal Specification (SS)
Signal specifications list, in tabular form, the purpose and behaviour of significant signals, flows or interfaces within a system. They permit a more thorough approach to the development of equipment interfaces by allowing more complete descriptions of the signal and interface requirements than are possible on the block diagrams.

Technical Drawing (TD)
Technical drawings are the technical design drawings showing fully dimensioned components or assemblies. The component drawing should be such that the component could be manufactured from the information provided and should include tolerances and material lists.

Data Flow Diagram (DFD)
Data flow diagrams are intended to assist in the development of software prior to program coding.

Structure Chart (SC)
Structure Charts are also utilised to assist in the development of software.

Design Record (DR)
The design record is used to present the results of the design theory and analysis. This includes the calculations that assisted in or led to the final design of a component.

List Of Decisions (LOD)
The LOD is used to record all of the decisions made against the reasons for each decision. LOD's are important because they record the prevailing conditions under which decisions are made.

Test Procedures (TP)
These are to be provided, where required, at the assembly and sub-assembly levels to ensure that equipment is functioning correctly. These would generally take the form of step by step table and provide expected performance figures.

Supporting Information (SI)
This is used to present, in various forms, any other information required but not included in the formats outlined above.

2.7 Document Structure

The various sheets are filed in the DDS with all master level documentation first followed by F1 then F2 etc. Within each functional group (ie. F1 or F1.2 etc), the information sub-sets, where applicable, are filed in the following order:

1. General Text (GT)
2. Functional Blocked Text (BT)
3. Functional Blocked Schematic (BS)
4. Signal Specification (SS)
5. Technical Drawing (TD)
6. Data Flow Diagram (DFD)
7. Structure Chart (SC)
8. Design Record (DR)
9. List Of Decisions (LOD)
10. Test Procedures (TP)
11. Supporting Information (SI)

The first page in each section of the DDS must contain the following reference information:

1. Project Identification (ie. Ausroc III)
2. Title (ie. 'Lox Valve')
3. Function Number (ie. F1.2.3-BT or F1.2-TP)
4. Level (ie. Master, Intermediate 2, Lowest)
5. Number of Pages in the Section (ie. 1 of 4)
6. Author's Name/s
7. Issue Status & Date (ie. 'Issue: 2 - 10/1/93')

An example of this reference information is as follows:

All other DDS sheets should be labelled with the appropriate functional group number followed by the 2 or 3 letter suffix of the type of block diagram or other format as described in sections 2.5 and 2.6 respectively and the relevant page number. For example, the label for the second page of the supporting information of functional group F1.3 is F1.3-SI-2. Some typical sheet layouts can be seen in Appendix: A

2.8 Conclusion

The requirements for adhering to the DDS increase the initial workload of the people involved. However, in the long run, the overall workload should be reduced due to the ease with information can be communicated throughout the project. This system provides an up to date reference for the entire program which is readily available to all involved.

APPENDIX: A

DDS SHEET FORMATS