GEMINI 8-m TELESCOPE PROJECT

Specification

SPE-ASA-G0008

TITLE: Gemini Electronic Design Specification

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DATE: February 23, 1994

Gemini Contract No: 47990-GEM00048


GEMINI

Introduction to the Gemini Electronic Design Specification

Most of us who have worked for any length of time on Mauna Kea develop a real appreciation for reliable and easy to maintain equipment and instruments. Four o'clock in the morning on Mauna Kea, with temperatures around zero degrees, is not the time to discover that changing the cable between the cryostat and detector controller required the hands and dexterity of a 5 year old, a microscope to read the connector label and the strength of U of A football player -- and you still manage to skin your knuckles on the other mil-spec. connectors sticking out of the cryostat.

Consequently the Gemini Project asked ASA Automation Systems Associates to find out what common practices and approaches to electronic design and construction have been adopted amongst the Mauna Kea observatories. The result is this document "The Gemini Electronic Design Specification". As you flick through these pages, hopefully your reaction will be, "well that's obvious", and that's the point - this is supposed to be a guide to common sense and good practice. It also contains a lot of useful information like what kind of cables have been found to stiffen and degrade on Mauna Kea and what levels of static discharge can be experienced at 14,000 feet when the humidity is less than 10%. To quote from the introduction;

> *"This document is intended for use by both experienced and designers and those not so experienced in electronic design. Therefore, an effort has been made to set out fundamental guidelines for all of the expected design topics. Although experienced designers will not need to read all the sections in detail, we encourage you to at least browse through all sections which contain more fundamental topics to see the direction Gemini is taking on these issues"*

If you have better or alternative suggestions than those contained in this document -- we would like to here about them. If you feel these approaches are going to significantly drive costs up, we would like to discuss that as well.

Ultimately, from my perspective, it comes down to the science we all ultimately want to do on Gemini. On these telescopes the reliability and maintainability of instruments will be a key factor in the scientific productivity of the Observatory.

Also, please do not forget about that person, who will be sitting 14,000 feet, probably in the middle of the night, trying to get your instrument working.

Matt Mountain
Gemini Project Scientist

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1. Introduction

This document gives the overall Electronic Specifications for Gemini Telescope Electronic Equipment. These specifications outline the required electrical characteristics of the equipment, including operational, design and fabrication requirements.

1.1. Scope

This document is intended to outline the overall Electronics Specifications for all electrical equipment used in the Gemini telescopes. This includes all electrical equipment mounted on or near the telescope and in the telescope control room(s). This document does not contain specifications for the installation of the telescope power distribution system or associated equipment.

1.2. Document Organization

This document works from the outside of the facility inward, starting with overall Site Facilities Characteristics and Requirements in Section 2. Section 3 deals with overall Operational Requirements that all equipment must meet. Sections 4 gives Detailed Equipment Specifications. Section 5 gives the Workmanship Requirements that are to be used as appropriate. Sections 6 outlines the Documentation Requirements that ensure the proper transfer of information occurs between the contractor and Gemini staff. Section 7 outlines the Quality Assurance standards required to ensure high equipment reliability and conformance to the requirements.

Within each section the topics are presented in order of importance or from the most general specifications to most the specific specifications.

For a List of Tables, see Appendix 1.

For a List of Illustrations see Appendix 2

1.3. Presentation of Duplicate Information

This document purposely contains duplicate information on selected topics in different sections. This is done for completeness and ease of use. For example, although some items on personnel safety are included in numerous sections relevant to a particular topic, these items have been collected and expanded in a section dedicated to personnel safety to ensure all the required information can be found easily.

1.4. Source Material

This document is an extraction from many standards, including UL, NEMA, EIA, ANSI-IEEE and MIL standards. In addition, the experience of many Electronic Engineers and Technicians familiar with telescope equipment has been solicited, most notably those of CFHT and Keck of Hawaii, NOAO and Gemini and MMT of Tucson, DAO of Victoria, Canada, the Royal Observatory, Edinburgh, England and others.

1.5. Level of Detail

This document is intended for use both by experienced designers and those not so experienced in electronic design. Therefore, an effort has been made to set out fundamental guidelines for all of the expected basic design topics. Although experienced designers will not need to read all sections in detail, we encourage you to at least browse through all sections which contain more fundamental topics to see the direction Gemini is taking on these issues.

1.6. Recommendations & Notation "Rec"

Where a specification has an associated recommended (but not mandatory) design or fabrication practice the notation "(Rec)" is placed beside the section title. These recommendations are found in **X**. The entries in this appendix have the same section numbers corresponding as those in the main body of this document. This appendix has its own Table of Contents and page numbers.

1.7. Standards & Specifications

1.7.1. General

The primary standards in preparation of this document have been:

1. National Electrical Code - 1990.
2. OSHA 2206, 20 CFR 1910, Safety & Health Standards.
3. NEMA ICS 1-1988 - General Standards for Industrial Control Systems.
4. UL 508, Standard for Safety - Industrial Control Equipment.
5. MIL-STD 242G, (Navy) Electronic Equipment Parts, Selected Standards.
6. MIL-STD-454, Standard Electrical Requirements for Electronic Equipment.
7. MIL-T-28800E, Test Equipment For Use With Electrical and Electronic Equipment, General Specification For.

A detailed list of all Standards used in the preparation of this document are listed in **X**.

1.7.2. Engineering Units

Metric units shall be used.

1.7.3. International Standards

Non-US laboratories will be permitted to work to International Standards in addition to or instead of certain sections of this standard provided a waiver is received in writing from Gemini.

1.8. RFP Dependent Specifications

The following specifications will be addressed on a project by project basis within the associated RFP:

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1.9. Interface Requirements

The following systems/subsystems require interfaces with other systems/subsystems. Therefore the designer should contact the appropriate designers of the other systems/subsystems to ensure design compatibility:

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