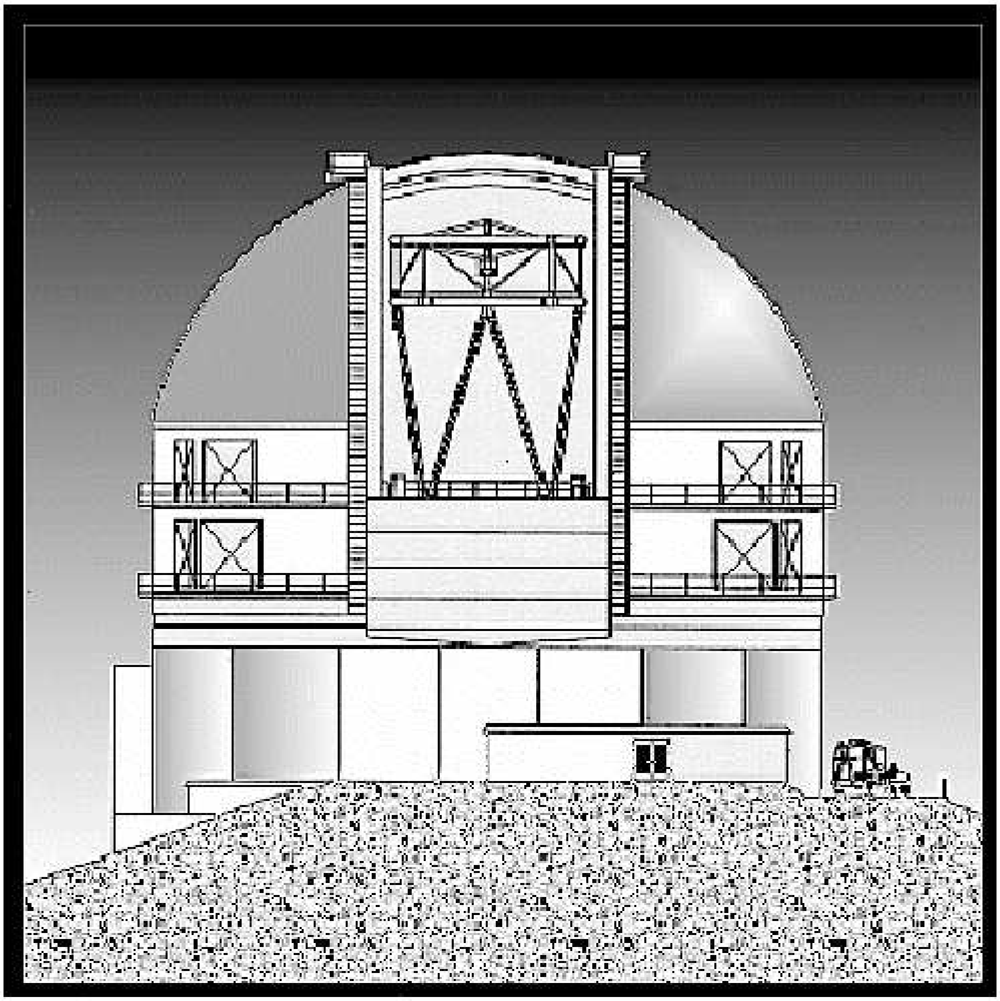
GEMINI
8-M Telescopes
Project

SPE-O-G0058

M2 Deployable Baffle
Design Requirements Document



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1.0 Scope

This document details the requirements of the M2 Deployable Baffle for the f/16 Secondary Assembly of the Gemini eight meter Telescopes. The M2 Deployable Baffle is mounted to the M2 Positioning Mechanism of the f/16 Secondary Assembly.

The M2 Deployable Baffle is deployed to four positions. In the first position, the M2 Deployable Baffle is retracted behind the f/16 Secondary Mirror. In the second position, the M2 Deployable Baffle is partially extended for operation of the Telescope in some infrared observations. In the third position, the M2 Deployable Baffle is extended to its maximum operating diameter for operation of the Telescope in some observations in the visible spectrum. The fourth position is fully extended and is used for maintenance only.

1.1 Paragraph References

When a paragraph within this Design Requirements Document is referenced each applicable subindentured paragraph shall be considered as referenced also.

1.2 Definitions

The following terms and their use throughout this Design Requirements Document will be consistent with these definitions.

(a) Actuator - An "Actuator" is a device used to extend or retract of the M2 Deployable Baffle.

(b) c.g. - The term "c.g." means center of gravity.

(c) Exterior Surface - The "Exterior Surface" of the Leaves is the surface of each Leaf that faces outward when the M2 Deployable Baffle is retraced and faces away from the primary mirror when the M2 Deployable Baffle is extended.

(d) f/16 Secondary Assembly - The "f/16 Secondary Assembly" consists of the f/16 Secondary Mirror, the M2 Tilt System, the M2 Positioning System and the M2 Deployable Baffle.

(e) f/16 Secondary Mirror - The "f/16 Secondary Mirror" is defined on drawing 85-GP-3200-0004.

(f) Horizon pointing - "Horizon pointing" is defined as the mechanical axes, as defined in section 1.3, below, oriented with the X and Z axes in the horizontal direction and the Y axis oriented vertically up.

(g) Interior Surface - The "Interior Surface" of the Leaves is the surface of each Leaf that faces inward when the M2 Deployable Baffle is retracted and faces the primary mirror when the M2 Deployable Baffle is extended.

(h) Leaf - An M2 Deployable Baffle "Leaf" is one Leaf as shown on drawing 85-GP-3300-0001. More than one Leaf shall be referred to as "Leaves".

(i) M2 Positioning Drive Amplifier Module - The "M2 Positioning Drive Amplifier Module" is a single enclosure. Its size, location mounting details and interfaces are specified on drawing 85-GP-3400-0001.

(j) M2 Positioning Mechanism - The "M2 Positioning Mechanism" contains the Actuators and Sensors used to produce the required motion of the f/16 Secondary Mirror Position. It is contained in the envelope specified by drawing 85-GP-3400-0001.

(k) M2 Tilt Mechanism - The "M2 Tilt Mechanism" is the mechanism used to tilt and focus the f/16 Secondary Mirror. Its envelope is shown on drawing 85-GP-3100-0004.

(l) Mounting Features - The M2 Deployable Baffle shall be mounted on the "Mounting Features" as shown on drawing 85-GP-3300-0001.

(m) Non-repeatability - Use of the term "non-repeatability" in this document is defined as the event being between ±3 standard deviations, six (6) standard deviations total, of a Gaussian frequency distribution. The value stated is the full six (6) standard deviation range.

(n) Telescope - The "Telescope" is the Gemini 8 meter telescope.

(o) Zenith pointing - "Zenith pointing" is defined as the mechanical axes, as defined in section 1.3, below, oriented with the X and Y axes in the horizontal direction and the Z axis oriented vertically up.

1.3 Coordinate axes and directions

Coordinate axes and directions will be referenced in this document. The coordinate system used is a right handed Cartesian coordinate system. The Z axis is the optical axis of the Telescope positive from the primary mirror towards the f/16 Secondary Mirror. The X axis is parallel to the Telescope elevation axis. The Y axis forms the third axis of the right handed Cartesian coordinate system and is pointed vertically up with the Telescope in the horizon pointing orientation.

2.0 Applicable Documents

The following documents form a part of this specification to the extent referenced.

2.1 U. S. Government Documents

2.1.1 Military Standards

MIL-STD-810E, July 1989

2.2 AURA Documents

2.2.1 Drawings

85-GP-3100-0004	ENVELOPE, TIP-TILT SYSTEM, f/16 SECONDARY MIRROR
85-GP-3400-0001	ASSEMBLY, M2 POSITIONING SYSTEM
85-GP-3200-0004	ASSEMBLY, f/16 SECONDARY MIRROR
85-GP-3300-0001	ASSEMBLY, M2 DEPLOYABLE BAFFLE
90-GP-0003-0004	ICD, M2 ASSEMBLY TO TOP END STRUCTURE

2.2.2 Requirements Documents

SPE-ASA-G0008	GEMINI ELECTRONICS DESIGN SPECIFICATION

3.0 Requirements

3.1 Mechanical Requirements

3.1.1 Physical Requirements The M2 Deployable Baffle shall conform to the envelope defined by drawing 85-GP-3300-0001.

3.1.1.1 The M2 Deployable Baffle shall mount on the features shown and as specified on drawing 90-GP-0003-0004.

3.1.1.2 The Leaves of the M2 Deployable Baffle shall incorporate features that allow the Leaves to be readily removed and installed.

3.1.1.3 The Interior Surfaces and the Exterior Surfaces of the M2 Deployable Baffle Leaves shall be treated to obtain the properties in this paragraph 3.1.1.3. The surface treatment shall maintain these properties after 1000 cycles of deployment between the three (3) positions, and shall withstand cleaning with normally used materials and techniques.

3.1.1.3.1 The Interior Surfaces of the Leaves of the M2 Deployable Baffle shall be coated with Aeroglaze Z306 or better. Aeroglaze Z306 is available from:

Lord Corporation
Chemical Products Division
2000 W. Grandview Blvd.
P.O. Box 10038
Erie, PA 16514-0038

3.1.1.3.2 The Exterior Surfaces of the Leaves of the M2 Deployable Baffle shall be coated with LO/MIT or better.

3.1.2 Deployment Range The M2 Deployable Baffle shall be capable of extending from the retracted position to a fully extended disk, as shown on drawing 85-3300-0001. The M2 Deployable Baffle shall meet all of the performance requirements of this Design Requirements document when extended to either of the positions contained in sections 3.3.1.2 and 3.3.1.3 below.

3.1.3 Mechanical Accuracies The M2 Deployable Baffle shall meet the requirements contained in this paragraph 3.1.3 after initial alignment of the f/16 Secondary Assembly to the Telescope optical system.

3.1.3.1 Inaccuracy of M2 Deployable Baffle in decenter, shall be no greater than 0.010 m total, over the full range of deployment in 3.1.2, above.

3.1.4 Natural Frequencies The minimum natural frequency of the M2 Deployable Baffle when mounted on the Mounting Features shown on drawing 85-3300-0001 shall be 15 Hz.

3.1.5 Deflection Under Load With the M2 Deployable Baffle installed in accordance with drawing 85-GP-3000-0002, the M2 Deployable Baffle shall not decenter more than 0.010 m nor depart from a round condition more than 0.010 m due to deflection. Deflection may be due to, including, without limitation, changing gravity orientation and wind loading of 3.4.1, below.

3.2 Electrical Requirements

The electrical drivers for the M2 Deployable Baffle Actuators shall reside in the M2 Positioning Drive Amplifier Module. Electronic components that must be in close proximity to the M2 Deployable Baffle for it to meet the requirements of this Design Requirements Document shall be contained in the M2 Positioning Sensor Electronics Module.

3.2.1 Power Consumption The M2 Deployable Baffle shall meet the following requirements with no active cooling.

3.2.1.1 Power input to the M2 Deployable Baffle shall not exceed 30 watts rms over any 1 minute period while operating in accordance with any requirement in this Design Requirements Document.

3.2.1.2 The total power transferred to the atmosphere by the M2 Deployable Baffle shall not exceed TBD watts rms over any 1 minute period when operated in accordance with any requirements of this Design Requirements Document.

3.2.2 Encoder Accuracy The position of the M2 Deployable Baffle shall be encoded to indicate the current position of the M2 Deployable Baffle.

3.2.3 Electro-Magnetic Interference (EMI) The M2 Deployable Baffle shall comply with the requirements of SPE-ASA-G0008.

3.2.4 Static Sensitive Devices The M2 Deployable Baffle shall comply with the requirements of SPE-ASA-G0008.

3.2.5 Cables and Connectors Electronic cables and connectors shall comply with the requirements of SPE-ASA-G0008.

3.2.6 Control System Interface The control functions for the M2 Deployable Baffle are performed by the M2 Tilt System. Drive amplifiers for the M2 Deployable Baffle are contained in the M2 Positioning Drive Amplifier Module.

3.3 Operation/Performance

3.3.1 M2 Deployable Baffle Deployment Positions The M2 Deployable Baffle shall, on command, retract or extend to one of four predetermined positions.

3.3.1.1 The M2 Deployable Baffle shall retract to an outside diameter of 0.990 m maximum when in the retracted position, position 1. The Interior Surfaces of the M2 Deployable Baffle shall not contact the M2 Positioning Mechanism not the M2 Tilt Mechanism when in the retracted position.

3.3.1.2 In position 2, the M2 Deployable Baffle shall extend to a diameter of 1.125 m ±0.010 m. The tolerance on diameter includes, without limitation, departure from a round condition.

3.3.1.3 In position 3, the M2 Deployable Baffle shall extend to a diameter of 2.000 m ±0.010 m. The tolerance on diameter includes, without limitation, departure from a round.

3.3.1.4 In position 4, the M2 Deployable Baffle shall be fully extended. There is no diameter tolerance associated with this position.

3.3.2 Deployment Speed The M2 Deployable Baffle shall move from any one of the three (3) positions to any other of the three (3) positions within 180 seconds maximum.

3.4 Environmental Requirements

3.4.1 Operating Environment The M2 Deployable Baffle shall operate and meet the requirements of this Design Requirements Document when subjected to any combination of the following environmental conditions:

Condition	***Requirement***
altitude	sea level to 4300 m
air temperature	-15° to +25° C
relative humidity	0% to 95%
wind speed	0 to 15 m/sec
gravity orientation	Z axis vertical up to vertical down

3.4.2 Survival Environment The M2 Deployable Baffle shall survive any combination of the following environmental conditions without permanent damage and be capable of meeting all of the requirements of this Design Requirements Document after removal of these conditions:

Condition	***Requirement***
altitude	sea level to 15,500 m
air temperature	-20° to +40° C
relative humidity	0% to 100% with condensation
wind speed	0 to 35 m/sec in +Z direction0 to 18 m/sec in -Z direction
seismic	12 g, .5 Hz to 100 Hz, all axes

The M2 Deployable Baffle shall also meet these requirements when suspended by its Lifting Points. The M2 Deployable Baffle shall also meet these requirements when packaged in its storage/shipping containers. Above these levels, the M2 Deployable Baffle should be designed to sustain limited damage if necessary to protect other hardware. The M2 Deployable Baffle should be capable of resuming normal operation with only moderate repair.

3.4.3 Transportation Environment The M2 Deployable Baffle shall survive any combination of the following environmental conditions without permanent damage when package in its storage/shipping containers:

Condition	***Requirement***
altitude	sea level to 15,500 m
air temperature	-20° to +40° C
relative humidity	0% to 100% with condensation
wind speed	0 to 67 m/sec
vibration	IAW MIL-STD-810E, July '89 section 514.4
shock	IAW MIL-STD-810E, July '89 section 516.4

The M2 Deployable Baffle shall be capable of meeting all of the requirements of this Design Requirements Document after removal from its storage/shipping containers.

3.4.5 Handling Environment The M2 Deployable Baffle shall survive any combination of the following environmental conditions without permanent damage when suspended by its Lifting Points or its Mounting Features. The M2 Deployable Baffle shall also survive any combination of the following environmental conditions when packaged in its storage/shipping containers:

Condition	***Requirement***
altitude	sea level to 4300 m
air temperature	-20° to +40° C
relative humidity	0% to 100% with condensation
wind speed	0 to 67 m/sec
shock and vibration	10 g, 0.5 Hz to 100 Hz, any axis

The M2 Deployable Baffle shall be capable of meeting all of the requirements of this Design Requirements Document after being subjected to these environmental conditions.

3.5 Reliability/Maintainability

3.5.1 Reliability The M2 Deployable Baffle shall have a shelf life of 1 year minimum. Mean time between failures of the M2 Deployable Baffle shall be 2000 hours of normal operation minimum.

3.5.2 Maintainability Repairs of all failures arising as a result of normal operations of the M2 Deployable Baffle shall be accomplished in no more than 6 hours by trained personnel.

4.0 Quality Assurance Provisions

4.1 General Requirements A quality assurance plan will be developed and for the performance of all inspections and tests required to meet the detail requirements of this Design Requirements Document.

5.0 Preparation for Delivery

The M2 Deployable Baffle shall be packaged suitable for transport by commercial carrier. Packaging materials/containers shall be reusable for repackaging and transportation of M2 Deployable Baffle. Containers and packaging materials shall meet the requirements of sections 3.4.3, 3.4.4 and 3.4.5 above. The M2 Deployable Baffle Leaves shall be packaged and shipped in a separate container.