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MCR-78-1331B

HAZARD ANALYSIS

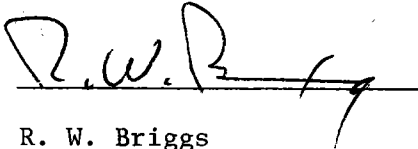
FOR

10 MW_e SOLAR THERMAL CENTRAL RECEIVER PILOT PLANT

PRELIMINARY REPORT

4 MARCH 1980

Prepared by:



R. W. Briggs
System Safety Program Rep.

Approved by:



P. R. Brown
Program Manager
Collector Systems

Prepared under Contract No. DE-AC03-80SF10539

by

Martin Marietta Corporation

for

Department of Energy

MARTIN MARIETTA AEROSPACE

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February 29, 1980

7.2210

Refer to: 80-Y-64041

To: Department of Energy
Solar Ten Megawatt Project Office
9550 Flair Park Drive
El Monte, California 91731

Attn: Mr. Richard Schweinberg

Subj: Contract DE-AC03-80SF10539, Transmittal of Data

Ref: (a) Task B4 of Exhibit I SOW of Contract DE-AC03-80SF10539

Encl: (1) MCR-78-1331B, Hazard Analysis Preliminary Report for
10 MWe Solar Thermal Central Receiver Pilot Plant.
dated March 4, 1980.

(2) MCR-80-1304, System Safety Plan for 10 MWe Solar
Thermal Central Receiver Pilot Plant, dated February 1980

The Enclosure (1) and (2) documentation is submitted in accordance with the Reference (a) contract requirement.

Questions concerning this documentation should be directed to Mr. Paul Brown at (303) 973-5998.

Very truly yours,

MARTIN MARIETTA CORPORATION

James L. Meeks

James L. Meeks
Contract Requirements
and Documentation
Solar Energy Programs
Denver Division

JLM:MG:gp

Distribution:

DOE/SAN, Ms. Kathy Day (Ltr. only)
STMPO, Mr. Bill Morehouse (2 cys. Encls.)
SLL, Mr. Duncan Tanner (2 cys. Encls.)

FOREWORD

This document is prepared in compliance with Phase II
Collector Subsystem Statement of Work Task B-4.

10 MW_e

SOLAR CONNECTOR SUBSYSTEM

PRELIMINARY HAZARD ANALYSIS

The attached Hazard Analysis consists of a systematic hazard identification and qualitative analysis of the collector subsystem and components in all operational modes and anticipated natural environments. The analysis identified design criteria and operational constraints to eliminate or control accident potentials caused by human error, environment, deficiency/inadequacy of design, or component malfunction.

Conditions that are suspect of having accident potential are indicated by a unique number (example, 1.001) and are documented on the "Potential Hazard Matrix".

The Hazard Analysis is summarized on the "Hazard Catalog", Part I Hazards List, to provide current status of all identified hazards.

Finally, the potential Hazard Matrix and the Hazard Catalog each trace through the unique number to the individual "Hazard Analysis", a complete assessment of the accident potential of each identified hazard.

This System Safety Hazards Analysis is submitted in accordance with Exhibit I Statement of Work, Task B4.

Questions or comments relative to this analysis effort may be directed to Richard W. Briggs, System Safety Specialist, Martin Marietta Aerospace, Denver Division, (303) 973-4783.

HAZARD CATALOG

PART 1 - HAZARDS LIST

4 March 1980

SECTION: 10 MW SOLAR THERMAL CENTRAL RECEIVER PILOT PLANT

PAGE: 1 of 1

HAZARD NUMBER	HAZARD	ELIMINATED	RESIDUAL	HAZARD LEVEL	ACCEPTED	OPEN
1.001	Concentrated Solar Beam with Potential for Damage to: 1. Unprotected Structures 2. Retina of the Eye 3. Exposed Skin Tissue			4	X	
2.001	Multiple Beam Hazard within Exclusion Regions			1		X
2.002	Loss of HC Communication from HFC			4	X	
2.003	Loss of HFC Communication from HAC			4	X	
2.003A	Failure of HFC			1		X
2.004	Heliostat Component Mechanical Failure			4	X	
2.005	Heliostat Component Electrical/Electronic Failure			4	X	
2.006	Flash Hazard outside Collector Field Boundary		X	3	X	
2.007	Heliostat Component Short Circuit/Equipment Burnout			4	X	
2.008	Tripping/Falling from Elevated Work Platform			4	X	
2.009	Crane or Lifting Sling Failure			4	X	
2.010	Cuts/Lacerations from Heliostat Mirror Edges			4	X	
2.011	Heliostat/Component Fire			4	X	
3.001	Natural Environment (3.001-3.007) Temperature Extremes			3		X
3.002	Wind Loads			4	X	
3.003	Rain			3		X
3.004	Snow/Ice Loads			4	X	
3.005	Hail			4	X	
3.006	Earthquake			4	X	
3.007	Lightning			4	X	
4.001	Lazer Radiation Exposure			1		X

1-Critical 2-Major 3-Minor 4-Controlled

HAZARD ANALYSIS

HAZARD LEVEL	CONTROLLED	NO.	1.001
STATUS	CLOSED	PAGE	1 of 2
PROGRAM PHASE	DESIGN CONFIRMATION	DATE	4 March 1980
SYSTEM: 10 MWe Solar Thermal Central Receiver Pilot Plant		SUBSYSTEM: Collector Subsystem Heliostat	
OPERATION/PHASE: Heliostat Stow/Acquisition Maneuvers			
HAZARD GROUP: Thermal Radiation			
REFERENCES: System Safety Design Criteria for the CRSTPS, April 1977			
HAZARD DESCRIPTION:			
<ol style="list-style-type: none"> 1. Location of personnel at or near heliostat(s) focal point. 2. Concentration of heat source on a surface structure. 			
POTENTIAL EFFECTS:			
<ol style="list-style-type: none"> 1. Skin, eye retina, and other ocular structure damage. 2. Facility damage, ignition of combustibles. 			
ASSUMPTIONS/RATIONALE:			
<ol style="list-style-type: none"> 1. Human tissue hazard does not exist if personnel are present at or near the focal point of an individual heliostat. 2. Serious hazards may exist to personnel and structures from the concentrated beam reflections from an array of heliostats. 3. Concentration of an intense heat source on a surface results in potential damage to the structure and potential personnel hazards from re-radiated energy as well as direct thermal damage to the retina of the eye and exposed 			
HAZARD CONTROL REQUIREMENTS: skin tissue.			REFERENCE
<u>DESIGN/OPERATIONAL</u>			
<ol style="list-style-type: none"> 1. Accomplishment of eye hazard calculations to define safe exposure distances within the overall Solar Thermal Pilot Plant facility is the responsibility of the integrating contractor. 2. Skin and corneal burn envelope when determined by the integrating contractor will be shown on the elevation and plot plans indicating extent and location of areas. 3. All flammable/combustible materials required for first or second level maintenance will be secured in a well-ventilated storage locker or shed outside the assembly building. 			<ol style="list-style-type: none"> 1) SFDI, Heliostat Beam Safety (Preliminary) 12 December 1979 2) Eye Hazard & Glint Evaluation for the 5 Mwt Solar Thermal Test Facility T.D. Brumeleve, SAND 76-8022 Sandia Laboratories May 1979
DISPOSITION: CLOSED			
<ol style="list-style-type: none"> 1. The SFDI will accomplish and publish eye hazard evaluation calculations for all subcontractors and associates prior to plant start up and operation. 			
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783			

HAZARD ANALYSIS (CONTINUED)

NO.	1.001
PAGE	2 of 2
DATE	4 March 1980

(LIST ADDITIONAL CONTENT IN THE ORDER OF SHEET 1)

Assumption/Rationale:

4. Exposures of the general public to these beam concentrations in the vicinity of the pilot plant or on the ground external to the individual collector field configuration boundary must be avoided.
5. Beam elevations in excess of the tower height plus 500 feet minimum altitude requirement for aircraft, must be determined to identify the necessary exclusion zone in the airspace above the plant facility site.
6. The eye hazard evaluation methodology employs four basic sets of calculations to analyze eye hazard potential and to define safe exposure distances in the vicinity of the Solar Thermal Pilot Plant. They are as follows:
 - a. Individual Heliostat Radiance Calculations
 1. Determines the source radiance for the collector surface, and,
 2. Determines the corresponding retinal irradiance produced by the heliostat design.
 - b. Safe Retinal Exposure Values
 1. Determines safe allowable irradiance which is a function of retinal image diameter, focal length of the eye and characteristics of the individual collector system. It is also based upon human blink reflex and the retinal image diameter for a daylight adapted eye.
 2. Determines the distance at which the safe retinal irradiance equals the heliostat design retinal irradiance. Any heliostat whose focal length is greater than the established "safe" distance will not be capable of producing an unsafe retinal irradiance at any distance (for an individual beam).
 - c. Coincident Multiple Beam Calculations
 1. Determines safe retinal irradiance limits for a line of adjacent heliostats, and,
 2. Determines safe retinal irradiance limits for a circular group of adjacent heliostats.
 - d. Exclusion Zone Calculations
 1. Determines exclusion zone dimensions for the airspace above the plant facility site calculated from the applicable expressions in Paragraph 6c above.
7. Pilot plant human tissue and combustible materials hazard evaluation.
 - a. Skin and corneal burns will occur at an irradiance of 2 w/CM^2 for 10 seconds. Blink reflex will probably protect the cornea.
 - b. Ignition of combustible materials will occur at app. the same irradiance level as the skin burn threshold value, (2 w/CM^2 for 10 sec.).

HAZARD ANALYSIS

HAZARD LEVEL	Critical	NO.	2.001
STATUS	Open	PAGE	1 of 1
PROGRAM PHASE	Design Confirmation	DATE	4 March 1980

SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant **SUBSYSTEM:** Collector Subsystem Heliostat

OPERATION/PHASE: Acquisition and Power Modes

HAZARD GROUP: Radiation, Thermal

REFERENCES: MCR-78-1331A, 14 August 1979

HAZARD DESCRIPTION:

1. Multiple beams in the area at the base of the tower out to the inner edge of the heliostat field.
2. Multiple beams during movement from stow to the lower point on the corridor.

POTENTIAL EFFECTS: Hazardous beam concentrations contributing to:

1. Skin, eye retina and other ocular structure damage.
2. Facility damage, ignition of combustibles.

ASSUMPTIONS/RATIONALE:

1. Beam safety requirements necessitate beam exclusion regions.
2. Exclusion region at the base of the tower results in a non-vertical corridor from stow to standby.
3. Exclusion region at the helicopter pad and south access road results in wire walk variations to be defined by the SFDI.

HAZARD CONTROL REQUIREMENTS:	REFERENCE
<u>Design</u> -	
1. Exclusion region capability has been included in the collector sub-system design.	1. DOE, STMPO Ltr., 12-78-317, Para. D, <u>Beam Safety</u> .
2. The HFS control requirements for movement of beams from stow to standby are not defined and may result in changes to control requirements and/or procedures for personnel.	2. SFDI Heliostat Beam Safety (Preliminary) 12 Dec. 1979

DISPOSITION: Open

- 1) Hazard evaluation will be conducted upon final definition of collector wire walk requirements by the SFDI.

ORIGINATOR/LOCATION:
R. W. Briggs, Martin Marietta Aerospace, Denver Division, (303) 973-4783

HAZARD ANALYSIS

HAZARD LEVEL	Controlled	NO.	2.002
STATUS	Closed	PAGE	1 of 1
PROGRAM PHASE	Design Confirmation	DATE	4 March 1980

SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant	SUBSYSTEM: Collector Subsystem HFC
OPERATION/PHASE: Heliostat Tracking	
HAZARD GROUP: Electrical Energy, Radiation, Thermal, Natural Environment	
REFERENCES: MCR 78-1331A, 14 August 1979	
HAZARD DESCRIPTION: Loss of Heliostat Controller communication from the Heliostat Field Controller could cause heliostat to fail in a hazardous angle of attack.	
POTENTIAL EFFECTS: Hazardous beam concentrations on/in: <ol style="list-style-type: none"> 1. Tower or other plant facility. 2. Regions beyond collector field boundary, or 3. Airspace above the plant facility beyond FAA minimums. 	
ASSUMPTIONS/RATIONALE: <ol style="list-style-type: none"> 1. Preliminary control system design calls for up to: <ol style="list-style-type: none"> a. 32 heliostats per HFC b. 8 HFCs per HAC/HFC data bus 2. HC fails to receive commands from the HFC, the heliostat will hold it's current position. 	
HAZARD CONTROL REQUIREMENTS:	REFERENCE
<u>DESIGN</u> <ol style="list-style-type: none"> 1. Assumption number 2 above has been imposed upon design of the pre-production and production heliostat, ref. DOE, STMPO, technical direction, correspondence no. 12-78-317. 	1. Technical Specification for the Collector Subsystem Para. 3.2.2 & 3.2.3. 2. DOE, STMPO Ltr. 12-78-317, Para. D, Beam Safety. 3. CS-MCS and CS-Plant Interface Requirements, MDC G7852, June of 1979.
<u>OPERATIONAL</u> <ol style="list-style-type: none"> 1. The angle of attack of the heliostat in the hold position will determine corrective action to be taken in conjunction with estimated time for maintenance repair or remove and replace action. 	
DISPOSITION: Closed. Upon loss of HFC communications, HC will do "nothing". Depending upon the heliostat hold position and duration of required maintenance, mirror covers will be used whenever possible to further enhance beam safety.	
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division, (303) 973-4873	

HAZARD ANALYSIS

HAZARD LEVEL	Controlled	NO.	2.003
STATUS	Closed	PAGE	1 of 1
PROGRAM PHASE	Design Confirmation	DATE	4 March 1980

SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant	SUBSYSTEM: Collector Subsystem HAC
OPERATION/PHASE: Heliostat Tracking	
HAZARD GROUP: Electrical Energy, Radiation, Thermal, Natural Environment	
REFERENCES: MCR 78-1331A in August of 1979	
HAZARD DESCRIPTION: Loss of HFC communication from the HAC could cause 32 heliostats to fail simultaneously in a hazardous angle of attack in the same corridor.	
POTENTIAL EFFECTS: Hazardous beam concentration in: <ol style="list-style-type: none"> 1. Tower or other plant facility, 2. Regions beyond the collector field boundary, or 3. Airspace above the plant facility beyond FAA minimums. 	
ASSUMPTIONS/RATIONALE: <ol style="list-style-type: none"> 1. Preliminary control system desing calls for up to: <ol style="list-style-type: none"> a. 32 heliostats per HFC b. 8 HFCs per HAC/HFC data bus 2. HFC fails to receive commands from the HAC, it's heliostats will be directed to stow in a beam safe manner. 3. HAC/HFC data buses will be redundant. 4. No single-point failure will cause the loss of more than one HFC. 	
HAZARD CONTROL REQUIREMENTS: <u>DESIGN</u> <ol style="list-style-type: none"> 1. Fail-safe response, the HFC will drive all heliostats in the track mode to the standby mode, and leave all other heliostats in the mode that they are in. 2. A time delay has been incorporated into design to allow time for the back-up HAC to restore communication prior to initiation of standby/stow actions. 	REFERENCE <ol style="list-style-type: none"> 1. Technical Specification for the Collector Subsystem Para. 3.2.2 and 3.2.3. 2. DOE-STMPO Ltr., 12-78-317, Para. A, Communication Loss HAC-HFC. 3. CS-MCS and CS-Plant Interface Requirements, MDC G7852, June of 1979.
DISPOSITION: Closed. This emergency requirement will insure that all field stows are coordinated in order to maintain an adequate beam safety configuration.	
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division, (303) 973-4783	

HAZARD ANALYSIS

HAZARD LEVEL	Critical	NO.	2.003A
STATUS	Open	PAGE	1 of 1
PROGRAM PHASE	Design Conformation	DATE	4 March 1980

SYSTEM: 10 MWe Solar Thermal Central Receiver Pilot Plant	SUBSYSTEM: Collector Subsystem HFC
OPERATION/PHASE: Heliostat Acquisition and Power Modes	
HAZARD GROUP: Radiation Thermal	
REFERENCES: MCR 78-1331A, August 14, 1980	
HAZARD DESCRIPTION: Failure of an HFC could cause 32 Heliostats to fail simultaneously in a hazardous angle of attack.	
POTENTIAL EFFECTS: Hazardous basic concentration in: <ol style="list-style-type: none"> 1. Tower or other plant facility 2. Regions beyond the collector boundary 3. Airspace above the plant facility beyond FAA minimums 	
ASSUMPTIONS/RATIONALE: <ol style="list-style-type: none"> 1. HFS design calls for up to 32 heliostats per HFC 2. If an HFC fails, it's heliostats will remain in the directed position 3. A failure can occur at anytime during field operation including track, standby, wirewalk, etc. 	
HAZARD CONTROL REQUIREMENTS: <ol style="list-style-type: none"> 1. Full definition of Hazard Potential and Hazard Control Requirements are the responsibility of the SFDI. 2. Existing Possible Hazard Controls: <ol style="list-style-type: none"> a. Replace failed HFC. Time app. 1 hour. b. Use the Motor Drive Tool to bring heliostat elevation down to a beam safe position. Time app. 10 min. per heliostat. <p style="margin-left: 40px;">Total time app. 3 hours.</p>	REFERENCE <ol style="list-style-type: none"> 1. Technical Specification for the CS Para. 3.2.2 and 3.2.3 2. CS-MCS and CS-Plant Interface Requirements MDC G 7852, June 1979
DISPOSITION: Open. Pending definition of Potential Hazardous Effects and Hazard Control Requirements.	
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783	

HAZARD ANALYSIS

HAZARD LEVEL	Controlled	NO.	2.004
STATUS	Closed	PAGE	1 of 1
PROGRAM PHASE	Design Confirmation	DATE	4 March 1980

SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant **SUBSYSTEM:** Collector Subsystem Heliostat

OPERATION/PHASE: Heliostat Tracking

HAZARD GROUP: Radiation, Thermal, Natural Environment

REFERENCES: MCR 78 1331A, 14 August 1979

HAZARD DESCRIPTION: Mechanical failure resulting from:

1. Bearing, gear, gear box failure
2. Broken control arm

POTENTIAL EFFECTS: Hazardous beam concentrations affecting:

1. Tower or other plant facility,
2. Regions beyond collector field boundary,
3. Airspace above the plant facility beyond FAA minimums.

ASSUMPTIONS/RATIONALE:

1. Bearings - Timken, tapered roller
2. Gear Drive Housing - Grade 30 case iron, sealed
3. Gears - 8620 heat-treated
4. Control arm casting - ductile iron

HAZARD CONTROL REQUIREMENTS:	REFERENCE
DESIGN	
<ol style="list-style-type: none"> 1. Bearing design limit load is 80% maximum of the manufacturers rated static capacity. Bearing design limit load range is from 16% to 80% of the manufacturer's rated capacity. 2. A design safety factor of 4 has been applied to the gear drive housing. 3. Bearings, gears, and gear drive housing were proof tested at 160% of the design limit load. Examination of the bearings and gear drive housing revealed no visual evidence of damage. The gear teeth broke at the 160% load but did not result in structural failure. 4. Control arm castings were proof load tested to 200% of the design limit load. There was no visual evidence of damage. 	Technical Specification for the Collector Subsystem Para. 3.2.2 and 3.2.3

DISPOSITION: Closed. Component Design has been verified, and proof load test results have demonstrated an adequate margin of safety in accordance with AISC.

ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division, (303) 973-4783

HAZARD ANALYSIS

HAZARD LEVEL	Controlled	NO.	2.005
STATUS	Closed	PAGE	1 of 1
PROGRAM PHASE	Design Confirmation	DATE	4 March 1980

SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant	SUBSYSTEM: Heliostat Components
OPERATION/PHASE: Heliostat Tracking	
HAZARD GROUP: Radiation, Thermal, Natural Environment	
REFERENCES: MCR 78 1331A, 14 August 1979	
HAZARD DESCRIPTION: Loss of control of a heliostat due to a single component failure such as an encoder or microcomputer.	
POTENTIAL EFFECTS: Hazardous beam concentrations affecting: <ol style="list-style-type: none"> 1. Tower or other plant facility. 2. Regions beyond collector field boundary, or 3. Airspace above the plant facility beyond FAA minimums. 	
ASSUMPTIONS/RATIONALE: <ol style="list-style-type: none"> 1. Loss of control of a heliostat due to any individual component failure will cause the heliostat to hold it's current position. 2. With the exception of hard failures, alarm and automatic action will generally not be provided. 3. Component failure rates and repair frequency estimates are to be determined. 	
HAZARD CONTROL REQUIREMENTS:	REFERENCE
<u>DESIGN</u> <ol style="list-style-type: none"> 1. Single component failure will cause the heliostat to hold it's current position pending maintenance response. 2. The probability of two concurrent component failures, on two adjacent heliostats which could produce a multiple beam hazard is extremely remote. 	1) Technical Specification for the Collector Subsystem Para. 3.2.2 & 3.2.3. 2) CS-MCS & CS-Plant Interface Requirements, MDC G7852, June, 1979.
<u>OPERATIONAL</u> <ol style="list-style-type: none"> 1. Maintenance action will be required to repair or remove and replace the failed components. 	
DISPOSITION: Closed. Depending on the heliostat hold position and duration of required maintenance, mirror covers will be used whenever possible to further enhance beam safety.	
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division, (303) 973-4783	

HAZARD ANALYSIS

HAZARD LEVEL	Minor	NO.	2.006
STATUS	Closed	PAGE	1 of 1
PROGRAM PHASE	Pre-CDR	DATE	4 March 1980

SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant	SUBSYSTEM: Collector Subsystem Heliostat
OPERATION/PHASE: Heliostat Tracking	
HAZARD GROUP: Human Capability (Nuisance Hazard)	
REFERENCES: System Safety Design Criteria for the CRSTPS, April 1977	
HAZARD DESCRIPTION: During heliostat positioning sequences such as increase or decrease during normal operation and defocus under emergency conditions, beam reflection could be perceived as a momentary flash by motorists on the nearby Barstow, CA, highway.	
POTENTIAL EFFECTS: Though not hazardous to the eye, momentary flash could be disruptive to the driver and could contribute to unsafe vehicle operation.	
ASSUMPTIONS/RATIONALE: <ol style="list-style-type: none"> 1. Distance from the collector field boundary to the passing motorist is great enough that beam intensity concentrations are well outside the safe retinal irradiance limit. 2. Distance is great enough such that there is no human tissue damage potential. 	
HAZARD CONTROL REQUIREMENTS: <u>OPERATIONAL</u> Since eye or skin tissue damage is not a concern and there appears to be no practical method to guard against or highlight this occasional "nuisance" hazard, no further action is considered appropriate at this time. During future contact with DOE system safety personnel, we may suggest that this item be publicized through the local media just prior to plant operation, and that consideration be given for a request to the California Highway Department for permission to erect highway caution signs in the vicinity of the plant.	REFERENCE 1) SFDI, Heliostat Beam Safety (Preliminary) 12 Dec. 1979 2) Eye Hazard & Glint evaluation for the 5 MW _t Solar Thermal Test Facility T.D. Brumeleve. SAND76-8022 Sandia Laboratories May 1979
DISPOSITION: Closed	
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783	

HAZARD ANALYSIS

HAZARD LEVEL	Controlled	NO.	2.007						
STATUS	Closed	PAGE	1 of 1						
PROGRAM PHASE	Maintenance Procedure Confirmation	DATE	4 March 1980						
SYSTEM: 10MW Solar Thermal Central Receiver Pilot Plant		SUBSYSTEM: Heliostat Components							
OPERATION/PHASE: Corrective Maintenance									
HAZARD GROUP: Electrical Energy									
REFERENCES: MCR 78 1331A, 14 August 1979									
HAZARD DESCRIPTION:									
<ol style="list-style-type: none"> 1) Overvoltage/Overcurrent, 2) Short circuits, electrical insulation breakdown, 3) Interconnecting cable mismatch between test equipment and component during electrical troubleshooting. 									
POTENTIAL EFFECTS:									
<ol style="list-style-type: none"> 1) Test equipment/component damage/burnout, 2) Personnel shock/electrocution, 3) Exposure of circuits to unexpected currents/out-of-sequence operations. 									
ASSUMPTIONS/RATIONALE:									
<ol style="list-style-type: none"> 1) Test equipment power requirements are verified compatible with components. 2) The following test equipment items will be utilized during Phase II of the Solar Pilot Plant Operation: <table style="width: 100%; margin-left: 20px;"> <tr> <td style="width: 50%;">a. Stimulator</td> <td style="width: 50%;">d. Drive Mechanism Checkout Console</td> </tr> <tr> <td>b. Manual Control Box</td> <td>e. Drive Motor-Direct Drive Control Box</td> </tr> <tr> <td>c. Encoder Zero Set Indicator</td> <td></td> </tr> </table> 				a. Stimulator	d. Drive Mechanism Checkout Console	b. Manual Control Box	e. Drive Motor-Direct Drive Control Box	c. Encoder Zero Set Indicator	
a. Stimulator	d. Drive Mechanism Checkout Console								
b. Manual Control Box	e. Drive Motor-Direct Drive Control Box								
c. Encoder Zero Set Indicator									
HAZARD CONTROL REQUIREMENTS:			REFERENCE						
<u>DESIGN/OPERATIONAL</u>									
<ol style="list-style-type: none"> 1. Electronic test equipment design safety criteria have been verified. 2. Safety procedures will be incorporated into the Phase II O&M Manual and other referenced Manufacturing Procedures and Instructions. 			<ol style="list-style-type: none"> 1) Title 8, CAL/OSHA 2) NFPA 70-1978 Edition of NEC. 3) MMC 40 0 500 2P Phase II Manufacturing Plan Rev. January 1980 						
DISPOSITION: Closed. Adherence to safety procedures and the applicable item technical instruction will reduce the potential for personnel injury or equipment damage.									
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783									

HAZARD ANALYSIS

HAZARD LEVEL	Controlled	NO.	2.008
STATUS	Closed	PAGE	1 of 2
PROGRAM PHASE	Maintenance Procedure Confirmation	DATE	4 March 1980

SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant **SUBSYSTEM:** Heliostat Components

OPERATION/PHASE: Corrective Maintenance

HAZARD GROUP: Human Capability, Human Hazards

REFERENCES: MCR 78 1331A, 14 August 1979

HAZARD DESCRIPTION:

- 1) Tripping/falling hazard while performing maintenance on the Fab-Tek, mobile work platform.
- 2) Movement of platform due to relative surface incline or as a result of applied forces/torques by operating personnel.

POTENTIAL EFFECTS:

- 1) Personnel injury - sprains, broken limbs, head injuries,
- 2) Component damage/personnel injury - overturning mobile work platform by operating in excess of the limits of the incline or in rough terrain.

ASSUMPTIONS/RATIONALE:

- 1) Elevated work platforms are often quite space-restricted and do not afford complete protection from falling hazards, or from the possibility of dropping tools or other objects onto personnel on the ground.
- 2) Mobile platforms are subject to movement, rolling or "creeping" dependent upon surface incline/applied forces by operating personnel.

HAZARD CONTROL REQUIREMENTS:	REFERENCE
<u>OPERATIONAL</u>	
<ol style="list-style-type: none"> 1) Manloading limits will be established for each work platform and will be stenciled or placarded on each platform. 2) Platform will be equipped with toeboards and safety chains or bars across the entrance area. 3) Platform will be placarded as to safe inclines on which to be operated. 4) Platform will be placarded as to the manner of securing the unit in the safe working position by chocking the wheels or applying the brake. 5) Tools and other objects will be adequately secured or stowed when not in use. Use of wrist lanyards for hand tools is recommended. 6) Hardhats will be worn by all personnel who will work on or in the immediate vicinity of the elevated work platform. 	<ol style="list-style-type: none"> 1) MMC Operations and Maintenance Manual, 4005007P, Sec. III. Aug. 1979 2) MMC 40 0 500 2P Phase II Manufacturing Plan Rev. January 1980

DISPOSITION: Closed. Operations and Maintenance Manual, Sec. III addresses the safety practices to be observed while driving and operating from the Fab-Tek.

ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division
(303) 973-4783

HAZARD ANALYSIS (CONTINUED)

NO.	2.008
PAGE	2 of 2
DATE	4 March 1980

(LIST ADDITIONAL CONTENT IN THE ORDER OF SHEET 1)

HAZARD DESCRIPTION (Continued)

3. Dropping tools or other loose objects from an elevated position contributing to personnel injury.

HAZARD ANALYSIS

HAZARD LEVEL	Controlled	NO.	2.009
STATUS	Closed	PAGE	1 of 2
PROGRAM PHASE	Design Confirmation	DATE	4 March 1980

SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant **SUBSYSTEM:** Heliostat Components

OPERATION/PHASE: Corrective Maintenance

HAZARD GROUP: Material Deterioration

REFERENCES: MCR 78-1331A, 14 August 1979

HAZARD DESCRIPTION: Crane or lifting sling could fail during lifting operationl.

POTENTIAL EFFECTS:

1. Personnel injury
2. Component damage

ASSUMPTIONS/RATIONALE: Items of lifting equipment include a 1) Drive Mechanism Handling Sling; 2) Reflective Assembly Handling Sling; 3) Pedestal Lifting Adapter. Maximum component weights (pounds) for which lifting equipment must be certified:

1. Pedestal Assembly	- 663	5. Drive Mechanism	- 1095
2. Drive Mechanism	- 725	6. Rack Assembly	- 1050
3. Pedestal Interface Adapter	- 200	7. Mirror Modules (12)	- 1380
4. Control Arms (2)	- 85 ea.	8. Reflective Assembly	- 2430

HAZARD CONTROL REQUIREMENTS:	REFERENCE
<p><u>DESIGN</u></p> <ol style="list-style-type: none"> 1. Lifting equipment proof load test specifications have been verified on MMC drawings, numbers: a) 40M5005132763; b) 40M5005132768; and c) 40M5005132779, respectively for each of the three items listed in assumptions/rationale above. <p><u>OPERATIONAL</u></p> <ol style="list-style-type: none"> 1. Proof-load tests will be accomplished for each lifting device in accordance with the applicable code. 2. Maximum load to be applied to each lifting device will be permanently stamped on a metal tag attached to the device. 3. Lifting device will initially be inspected for evidence of damage, deterioration, or corrosion. 4. Operator will perform a visual inspection prior to each usage. 	<ol style="list-style-type: none"> 1) Title 8, CAL/OSHA 2) OSHA Title 29 CFR 1910.184 3) MMC Operations and Maintenance Manual, 4005007P.

DISPOSITION: Closed. Proof load test specifications have been verified. Adherence to the safety procedures in Sec. III, Operations and Maintenance Manual will reduce the potential for personnel injury or equipment damage.

ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783

HAZARD ANALYSIS (CONTINUED)

NO.	2.009
PAGE	2 of 2
DATE	4 March 1980

(LIST ADDITIONAL CONTENT IN THE ORDER OF SHEET 1)

HAZARD CONTROL REQUIREMENTS: (Continued)

5. Preventive maintenance inspection will be performed periodically in accordance with work card requirements and approved technical operating procedures.

HAZARD ANALYSIS

HAZARD LEVEL	Controlled	NO.	2.010
STATUS	Closed	PAGE	1 of 1
PROGRAM PHASE	Maintenance Procedure Confirmation	DATE	4 March 1980

SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant	SUBSYSTEM: Collector Subsystem Heliostat
OPERATION/PHASE: Corrective Maintenance	
HAZARD GROUP: Human Hazards	
REFERENCES: MCR 78 1331A, 14 August 1980	
HAZARD DESCRIPTION: 1. Sharp edges and corners of heliostat mirrors.	
POTENTIAL EFFECTS: 1. Personnel cuts, gashes, lacerations.	
ASSUMPTIONS/RATIONALE: Corrective maintenance program will consist of: 1. Fault isolation and replacement of failed components. 2. Repair of failed components.	
HAZARD CONTROL REQUIREMENTS: <u>OPERATIONAL</u> 1. Gloves sized to provide adequate wrist and forearm protection will be worn by all personnel during removal and replacement of broken mirror assemblies.	REFERENCE 1) MMC Operations and Maintenance Manual, 4005007P, Sec. III August 1979 2) Title 8, CAL/OSHA 3) OSHA Title 29 CFR 1910.184
DISPOSITION: Closed. Operations and Maintenance Manual, Sec. III, addresses the wear of protective gloves while handling mirror assemblies.	
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783	

HAZARD ANALYSIS

HAZARD LEVEL	Controlled	NO.	2.011
STATUS	Closed	PAGE	1 of 2
PROGRAM PHASE	Pre-CDR	DATE	4 March 1980
SYSTEM: 10MW Solar Thermal Central Receiver Pilot Plant		SUBSYSTEM: Collector Subsystem Heliostat	
OPERATION/PHASE: Daily Operation			
HAZARD GROUP: Chemical Energy (fire)			
REFERENCES: MCR 78-1331A, 14 August 1980			
HAZARD DESCRIPTION: Potential for fire involving collector subsystem or individual components resulting from periodic/exceptional maintenance requirements.			
POTENTIAL EFFECTS:			
<ol style="list-style-type: none"> 1) Personnel injury 2) Subsystem/component damage, possible total loss 			
ASSUMPTIONS/RATIONALE:			
<ol style="list-style-type: none"> 1) Requirement for painting mirrors and structural members has been eliminated. 2) Requirement for welding structural members has been eliminated. 3) Requirement for cleaning and lubrication of drive units does not exist. The drive unit is completely environmentally sealed, eliminating the need for periodic servicing. (Continued) 			
HAZARD CONTROL REQUIREMENTS:			REFERENCE
<u>OPERATIONAL</u>			
<ol style="list-style-type: none"> 1) The absence of preventive or corrective maintenance operations requiring the use of flammable or combustible materials reduces the likelihood of a potential for fire from extremely remote to non-existent. In addition, operational controls for performing periodic visual field inspections, or any other required corrective maintenance will be provided for smoking, use of spark or flame-producing devices, and availability of portable fire extinguishing equipment. 			<ol style="list-style-type: none"> 1) Title 8, CAL/OSHA 2) NFPA National Fire Codes (1975)
DISPOSITION: Closed. Item will be monitored as design progresses and procedures are developed for subsystem installation and operation.			
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783			

HAZARD ANALYSIS (CONTINUED)

NO.	2.011
PAGE	2 of 2
DATE	4 March 1980

(LIST ADDITIONAL CONTENT IN THE ORDER OF SHEET 1)

ASSUMPTIONS/RATIONALE: (Continued)

4. The requirement for periodic sampling and chemical analysis of the lubricant will constitute 1% of the drive mechanisms each 5 years beginning at the 10th year.
5. The drive unit supplier will select a special type of synthetic lubricant which will have, among other properties, an extremely high flashpoint.

HAZARD ANALYSIS

HAZARD LEVEL	Minor	NO.	3.001
STATUS	Open	PAGE	1 of 2
PROGRAM PHASE	Test Confirmation	DATE	4 March 1980
SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant		SUBSYSTEM: Collector Subsystem Heliostat	
OPERATION/PHASE: Daily Operation			
HAZARD GROUP: Natural Environment (Temperature)			
REFERENCES: MCR 78 1331A, 14 August 1980			
HAZARD DESCRIPTION: Heliostat subsystem/component damage resulting from temperature extremes.			
POTENTIAL EFFECTS: <ol style="list-style-type: none"> 1) Dimension changes from solar heating 2) Distortion of parts 3) Expansion/contraction of solids 			
ASSUMPTIONS/RATIONALE: <ol style="list-style-type: none"> 1) Collector subsystem must operate and maintain structural integrity within temperature limits from 16°F to 122°F. 2) Collector subsystem must survive within temperature limits from -9°F to 122°F. 			
HAZARD CONTROL REQUIREMENTS:			REFERENCE
<u>DESIGN</u> <ol style="list-style-type: none"> 1) Compliance with subsystem environmental design criteria will be verified through Phase II thermal verification testing. 2) Subsystem/Component environmental tests in support of the verification testing process included the following: <ol style="list-style-type: none"> a. Temperature cycling. Demonstrates ability of the component to perform in an environment which simulates maximum and minimum predicted thermal environment plus a 10°F margin of safety, and to detect latent manufacturing defects which might not be detected by inspection and functional checks. The dc gear motors, encoders, and HFC/HC units will be tested in accordance with these criteria. 			<ol style="list-style-type: none"> 1) Technical Specification for the Collector Subsystem 2) Phase II Martin Marietta Corporation Denver Test Plan
DISPOSITION: Open - Pending Test Results			
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783			

HAZARD ANALYSIS (CONTINUED)

NO.	3.001
PAGE	2 of 2
DATE	4 March 1980

(LIST ADDITIONAL CONTENT IN THE ORDER OF SHEET 1)

HAZARD CONTROL REQUIREMENTS: (Continued)

2. a. (Continued)

Humidity, Demonstrates component design to resist humid environments during operational usage, shipment and storage. The dc gear motors, encoders, limit switches and HFC/HC units will be tested in accordance with test criteria.

b.

Burn-in. Detects material and workmanship defects which could occur early in the component life. A complete functional test of the units will be conducted at the required test temperatures. This included the encoders, limit switches and HFC/HC units.

HAZARD ANALYSIS

HAZARD LEVEL	Controlled	NO.	3.002
STATUS	Closed	PAGE	1 of 1
PROGRAM PHASE	Design Confirmation	DATE	4 March 1980
SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant		SUBSYSTEM: Collector Subsystem Heliostat	
OPERATION/PHASE: Daily Operation			
HAZARD GROUP: Natural Environment (Wind)			
REFERENCES: MCR 78 1331A, 14 August 1979			
HAZARD DESCRIPTION:			
<ul style="list-style-type: none"> 1) Heliostat damage resulting from extreme wind velocities, 2) Heliostat operational degradation due to variations in encoder bias caused by gear train variations. 			
POTENTIAL EFFECTS:			
<ul style="list-style-type: none"> 1) Structural deformation/damage 2) Displacement, separation, or loosening of parts 			
ASSUMPTIONS/RATIONALE:			
<ul style="list-style-type: none"> 1) Collector subsystem with simulated mirrors installed must maintain performance requirements operationally at wind speeds up to 27 MPH. 2) Collector subsystem must maintain structural integrity at wind speeds up to 50 MPH in any position, and must survive at 90 MPH in the stow position $\pm 10^\circ$ angle of attack. 			
HAZARD CONTROL REQUIREMENTS:			REFERENCE
<u>DESIGN</u>			
<ul style="list-style-type: none"> 1) Compliance with subsystem environmental design criteria has been verified through a test sequence in which the structural integrity of the mirror module was verified as a function of various wind loads. The face of the mirror was measured for stress throughout a range of wind velocities from 10 MPH through the 90 MPH survival limit. 2) Gear train failed to respond in accordance with technical specification. New gear train has been demonstrated satisfactory for safety. 			<ul style="list-style-type: none"> 1) Technical Specification for the Collector Subsystem 2) STMPO Test Plan
DISPOSITION: Closed. Minor degradation noted in gear train tests does not constitute a safety hazard.			
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783			

HAZARD ANALYSIS

HAZARD LEVEL	Minor	NO.	3.003
STATUS	Open	PAGE	1 of 1
PROGRAM PHASE	Design Confirmation	DATE	4 March 1980
SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant		SUBSYSTEM: Collector Subsystem Heliostat	
OPERATION/PHASE: Daily Operation			
HAZARD GROUP: Natural Environment (Rain)			
REFERENCES: MCR 78 1331A, 14 August 1979			
HAZARD DESCRIPTION: Heliostat damage resulting from protective covers, seals, or cases which leak or otherwise fail to shield equipment from rainfall up to the survival limits specified.			
POTENTIAL EFFECTS:			
<ol style="list-style-type: none"> 1) Degradation of materials, such as corrosion 2) Introduction of contaminants from raindrops into recessed areas or onto sensitive surfaces. 			
ASSUMPTIONS/RATIONALE:			
<ol style="list-style-type: none"> 1) Collector subsystem must survive during periods of rain accumulation of 3 in. per 24 hours with horizontal wind velocities up to 40 MPH. 2) Units to be tested during Phase II include: encoders, motors and limit switches. 			
HAZARD CONTROL REQUIREMENTS:			REFERENCE
<ol style="list-style-type: none"> 1) Compliance with subsystem environmental design criteria will be verified through wind-driven rain testing. Rain droplets having a diameter range between 0.5 and 4.5 millimeters at horizontal wind velocities up to 40 MPH, are driven against the unit with variations up to 45° from the horizontal to simulate blown rainfall. 2) The units will be subjected to a maximum rainfall rate of 5.9 inches per hour for 2 min. and 2.4 inches per hour for 30 min. Each side of the units that could be exposed to blown rain will be tested for not less than two hours. 			<ol style="list-style-type: none"> 1) Technical Specification for the Collector Subsystem 2) Phase II Martin Marietta Corporation Denver Test Plan
DISPOSITION: Open - Pending Test Results			
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783			

HAZARD ANALYSIS

HAZARD LEVEL	Controlled	NO.	3.004
STATUS	Closed	PAGE	1 of 1
PROGRAM PHASE	Design Confirmation	DATE	4 March 1980

SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant	SUBSYSTEM: Collector Subsystem Heliostat
OPERATION/PHASE: Daily Operation	
HAZARD GROUP: Natural Environment (Snow and Ice)	
REFERENCES: MCR 78-1331A, 14 August 1980	
HAZARD DESCRIPTION: Heliostat damage resulting from excessive snow/ice loads.	
POTENTIAL EFFECTS: 1) Distortion of parts 2) Expansion/contraction of solids	
ASSUMPTIONS/RATIONALE: 1) Collector subsystem must survive during periods of snow accumulation up to 5 lbs. per sq. ft. per 24 hours and ice build-up to 2 inches thick.	
HAZARD CONTROL REQUIREMENTS: <u>DESIGN</u> 1) Compliance with subsystem environmental design criteria was verified through snow/ice load testing. With the mirror module in the face-down position, the module was uniformly loaded in increments of 1, 2, and 2 1/2 inches of water which duplicated varying amounts of ice or snow. 2) Deflection measurements were taken at each loaded increment. The wind load test results (see Hazard Analysis 3.002) may be referred to for an analysis of the worst case structural loads directed against the mirror modules during the verification testing phase.	REFERENCE 1) Technical Specification for the Collector Subsystem 2) Phase I Martin Marietta Corporation Denver Test Plan
DISPOSITION: Closed. Test results indicated no degradation of the mirror module due to the above incremental loads.	
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783	

HAZARD ANALYSIS

HAZARD LEVEL	Controlled	NO.	3.005
STATUS	Closed	PAGE	1 of 1
PROGRAM PHASE	Test Confirmation	DATE	4 March 1980

SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant	SUBSYSTEM: Collector Subsystem Heliostat
OPERATION/PHASE: Daily Operation	
HAZARD GROUP: Natural Environment (Hail)	
REFERENCES: MCR 78-1331A, 14 August 1980	
HAZARD DESCRIPTION: Heliostat damage resulting from hail stone impact on the mirror assembly glass surface, steel back, or steel edge.	
POTENTIAL EFFECTS: <ol style="list-style-type: none"> 1) Cracking or breakage of glass surface by impact 2) Indentations (pock-mark damage) on steel surfaces. 	
ASSUMPTIONS/RATIONALE: <ol style="list-style-type: none"> 1) Collector subsystem must operate and survive within the following hailstorm environments: <ol style="list-style-type: none"> a. Operational - 0.75 inch diam. hailstone at 65 ft/sec. nominal velocity b. Survival - 1 inch diam. hailstone at 75 ft/sec. nominal velocity 	
HAZARD CONTROL REQUIREMENTS:	REFERENCE
<u>DESIGN</u> <ol style="list-style-type: none"> 1) Compliance with subsystem environmental design criteria has been verified through facet hail testing using frozen ice balls. 	<ol style="list-style-type: none"> 1) Technical Specification for the Collector Subsystem. 2) Phase I MMC, Denver Test Plan 3) Hail Test on Heliostat, Custom Engineering Inc., Job No. AA-722.
<u>TEST</u> <ol style="list-style-type: none"> 1) Tests on the glass face were conducted with 0.75 inch and 1.0 inch diameter ice balls at 65 ft/sec. and 75 ft/sec. respectively. No damage occurred to the glass surface as a result of either of the tests. 2) Tests on the back steel side with 1.0 inch diameter ice balls at 75 ft/sec nominal velocity revealed small indentations at the point of contact. These indentations were measured to be from 0.002 inch to 0.005 inch in depth. 3) Tests within 0.5 inch of the edge of the glass frame interface were conducted with 1.0 inch diameter ice balls at 75 ft/sec nominal velocity. No damage was noted. 	
DISPOSITION: Closed. Test results indicated that no damage or degradation to the operating capabilities of the mirror assembly surfaces occurred at worst case test conditions.	
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783	

HAZARD ANALYSIS

HAZARD LEVEL	Controlled	NO.	3.006
STATUS	Closed	PAGE	1 of 1
PROGRAM PHASE	Design Confirmation	DATE	4 March 1980
SYSTEM: 10MW Solar Thermal Central Receiver Pilot Plant		SUBSYSTEM: Collector Subsystem Heliostat	
OPERATION/PHASE: Daily Operation			
HAZARD GROUP: Natural Environment (Earthquake)			
REFERENCES: MCR 78-1331A			
HAZARD DESCRIPTION: Heliostat damage/destruction resulting from severe quake tremors/ ground upheavals.			
POTENTIAL EFFECTS:			
<ol style="list-style-type: none"> 1) Structural deformation, possible total destruction 2) Displacement/loosening of components or parts 3) Pressure/shock wave effects 			
ASSUMPTIONS/RATIONALE:			
<ol style="list-style-type: none"> 1) Collector subsystem must survive an earthquake intensity within seismic zone 3, which corresponds to intensity level 7 of the Uniform Building Code. 			
HAZARD CONTROL REQUIREMENTS:			REFERENCE
<u>DESIGN</u>			
<ol style="list-style-type: none"> 1) Subsystem structural design analysis has shown that an appreciably large margin of safety has been incorporated into the heliostat design to meet the Technical Specification criteria. 			<ol style="list-style-type: none"> 1) Technical Specification for the Collector Subsystem. 2) Uniform Building Code, Chapter 23, and Appropriate California State Supplement.
DISPOSITION: Closed.			
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783			

HAZARD ANALYSIS

HAZARD LEVEL	Controlled	NO.	3.007
STATUS	Closed	PAGE	1 of 1
PROGRAM PHASE	Design Confirmation	DATE	4 March 1980
SYSTEM: 10 MW Solar Thermal Central Receiver Pilot Plant		SUBSYSTEM: Collector Subsystem Heliostat	
OPERATION/PHASE: Daily Operation			
HAZARD GROUP: Natural Environment (Lightning)			
REFERENCES: MCR 78-1331A, 14 August 1979			
HAZARD DESCRIPTION: Heliostat destruction/damage from direct lightning hit/adjacent strike.			
POTENTIAL EFFECTS: <ol style="list-style-type: none"> 1) Total destruction of heliostat from direct strike. 2) Near total destruction of adjacent heliostat. 3) Controller burnout on adjacent heliostat. 			
ASSUMPTIONS/RATIONALE: <ol style="list-style-type: none"> 1) Destruction of one heliostat from direct strike is acceptable. 2) Damage to an adjacent heliostat must be minimized. 3) HACs, HFCs, and HCs adjacent to a direct strike must survive. 			
HAZARD CONTROL REQUIREMENTS:			REFERENCE
<u>DESIGN</u> <ol style="list-style-type: none"> 1) A lightning protection system has been incorporated into the heliostat design criteria and will be installed on Phase II Heliostats. Reference is made to Aerospace Report No. ATR-78 (7695-05)-05, Pilot Plant Environmental Conditions (OPDD Appendix C), written as a partial account of work performed for DOE, on the 10 MW Solar Thermal Pilot Plant Project. The proposed pilot plant site with a nominal 100 m tower may be expected to experience a direct lightning strike approximately once every 4 years. This is based on the assumption of 5 to 10 thunderstorms per year at the plant site. Heliostat electrical system design to include incorporation of a lightning protection system constitutes an acceptable level of protection within cost/risk considerations. 			<ol style="list-style-type: none"> 1) Technical Specification for the Collector Subsystem.
DISPOSITION: Closed. No further analyses are warranted.			
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783			

HAZARD ANALYSIS

HAZARD LEVEL	Critical	NO.	4.001
STATUS	Open	PAGE	1 of 3
PROGRAM PHASE	Design Conformation	DATE	4 March 1980
SYSTEM:		SUBSYSTEM:	
OPERATION/PHASE: Installation and Checkout			
HAZARD GROUP: Laser Radiation			
REFERENCES:			
HAZARD DESCRIPTION: During heliostat alignment a 15 MW Helium Neon Laser with 632.8 nanometer wavelength will be used to determine encoder bias. Exposure to the lazer beam constitutes a hazard to personnel.			
POTENTIAL EFFECTS: 1. Skin, eye retina, and other ocular structure damage.			
ASSUMPTIONS/RATIONALE: 1. The maximum permissable exposure to a lazer of 632.8 nm wavelength is 10^{-5} w/cm ² based on standards adopted by the American Medical Association 1948 Council on Physical Medicine.			
HAZARD CONTROL REQUIREMENTS:			REFERENCE
1. <u>Administrative Control</u> - Laser systems and installations shall be registered with the Personnel Safety Department. 2. <u>Medical Requirements</u> - An appropriate medical examination with special attention given to the eye and skin shall be given prior to occupational exposure to laser radiation and periodically thereafter. Additionally, a medical examination shall be given immediately following a suspected or actual exposure accident or incident. 3. Protection against laser radiation hazards shall be under the supervision of personnel knowledgeable in such hazards.			MMC-Denver M61-58 E-40 Rev.2 Mar. 72 Laser Beams
DISPOSITION: Open: Pending completion of operational testing at MMC.			
ORIGINATOR/LOCATION: R. W. Briggs, Martin Marietta Aerospace, Denver Division (303) 973-4783			

HAZARD ANALYSIS (CONTINUED)

NO.	4.001
PAGE	2 of 3
DATE	4 March 1980

(LIST ADDITIONAL CONTENT IN THE ORDER OF SHEET 1)

Assumptions/Rationale: (continued)

2. The laser power will exceed the maximum permissible exposure levels at all points between the source and the mirror.
3. Eye exposure of personnel to the laser beam must be avoided.

Hazard Control Requirements: (continued)

4. Personnel who may operate and/or use laser systems shall be provided with appropriate training, equipment, facilities and supervision for adequate control of laser radiation hazards.
5. The following general precautions shall be applied by the user for laser radiation control:
 - a. Personnel shall not look into the primary beam or at specular reflections of the beam when power or energy densities exceed the maximum permissible exposure levels.
 - b. Aiming the laser by eye while looking along the axis of the beam shall not be permitted if it is possible that maximum permissible exposure will be exceeded.
 - c. When the laser beam is not confined within an enclosure or apparatus, the laser beam shall be terminated by material that is nonspecular reflective and fireproof for the energy or power density involved.
 - d. Unnecessary reflective material shall not be placed in the beam path and good housekeeping shall be maintained.
 - e. Potentially hazardous areas shall be posted with suitable warning signs.
 - f. Protective gloves, clothing and shields shall be used where indicated to guard against damage to the skin.
 - g. When eye protection is necessary, personnel exposed to laser beams shall be furnished suitable protective eyewear of optical density (O.D.) adequate for parameters involved.
6. Operation of a laser system so that it's beam traverses outdoor air shall be done only if the radiation exposure due to primary, scattered, or reflected radiation is controlled so that exposure to the user and to the general public will not exceed the permissible values.

HAZARD ANALYSIS (CONTINUED)

NO.	4.001
PAGE	3 of 3
DATE	4 March 1980

(LIST ADDITIONAL CONTENT IN THE ORDER OF SHEET 1)

Hazard Control Requirements: (continued)

7. A closed installation which provides adequate shielding of the emitted laser radiation shall be used when practicable.

STMPO-290

MARTIN MARIETTA AEROSPACE

DENVER AEROSPACE
POST OFFICE BOX 178
DENVER, COLORADO 80201
TELEPHONE (303) 977-3000

May 3, 1982

Refer to: DAC-82-389

To: U. S. Department of Energy
P. O. Box 808
Livermore, California 94550

Attn: Roger S. Gaither, Esq.
Assistant Chief for Prosecution
Office of Patent Counsel, L-376

Subj: Contract DE-ACO3-80SF10539

1. Attached is the Patent Certification on the subject contract.
2. If you have any questions, please contact me at (303) 977-6109.

Very truly yours,

MARTIN MARIETTA CORPORATION

Phillip L. DeArment
Phillip L. DeArment
Assistant Patent Counsel

PLD:jes

PATENT CERTIFICATION

DOE CONTRACT NO. DE-ACO3-80SF10539

1. The following is a complete list of technical reports prepared during the course of the work under this contract and the DOE office to which the reports were sent:

See Attachment I

2. Technical data of this contract other than reports (i.e., notebooks, drawings, etc.) are completely listed, as follows:

See Attachment II

3. Each of the above-listed documents under paragraphs 1 and 2 has been examined for invention subject matter by me and/or technical personnel under my direction; to the best of my knowledge and belief, no inventions or discoveries were made or conceived in the course of or under this contract other than the following:

<u>CONTRACTOR NO.</u>	<u>TITLE</u>	<u>DATE REPORTED</u>	<u>DOE NO.</u>
Docket # 80YD41	FASTON TERMINAL INSTALLATION TOOLS	03/09/81	S-55,956, RL-8354
Docket # 81YD19	FASTON TERMINAL EXTRACTION TOOLS	05/03/82	S-59,046, RL-8843

4. There were no subcontracts or purchase orders involving research and development, except as follows:

NONE

5. The completion date of this contract is as follows: February 13, 1982

6. The following period is covered by this certification:

December	3,	1979	to	February	13,	1982
<u>Month</u>	<u>Day</u>	<u>Year</u>		<u>Month</u>	<u>Day</u>	<u>Year</u>

Martin Marietta Corporation
Contractor, Denver Aerospace
P. O. Box 179
Denver, Colorado 80201
Address

Phillip L. DeArment
Signature Phillip L. DeArment
Assistant Patent Counsel
Title

Submit in duplicate to:

Roger S. Gaither
Assistant Chief for Prosecution
California Patent Group, L-376
U. S. Department of Energy
P. O. Box 808
Livermore, California 94550

Form completed by: M. Frohardt
Date: Feb 23, 1982

Date of Certification

February 22, 1982
Attachment I
Patent Certification
DOE Contract No. DE-AC03-80SF10539

1. The following is a complete list of technical reports prepared during the course of the work under this contract and the DOE office to which the reports were sent:

<u>Report Type</u>	<u>Office Mailed</u>
Monthly Submittals	Huntington Beach
Technical Status Report Issue 1 through Issue 25	Huntington Beach
Design and Manufacturing Drawings	Huntington Beach and Canoga Park
Technical Correspondence	Huntington Beach and Canoga Park
Contract Correspondence	Oakland, CA.
Deliverables	Huntington Beach and Canoga Park
Periodic Reports	Huntington Beach and Canoga Park

2. Technical data of this contract other than reports (i.e., notebooks, drawings, etc.) are completely listed, as follows:

All correspondence, reports, etc., mailed to Huntington Beach office.

Monthly submittals, Issue 1 through 25 as follows:

- a. Milestone Schedule and Status Report
- b. Cost Management Report
- c. Project Status Report
- d. Documentation Tab Run
- e. List of active changes/modifications
- f. List of drawing revisions/levels
- g. Indentured Parts List

Minority Business Reports

Updated OPDD Documentation

Controls Hardware Drawings

Software Design Specification

Safety Plan

Hazard Analysis

Preliminary Design Review Package

Preliminary Design Review Package Final

Manufacturing Plan

Quality Assurance Plan

Functional Test Plan

Functional Test Report

C/S Integrated Acceptance Test Plan

February 22, 1982
Attachment II
Patent Certification
DOE Contract No. DE-AC03-80SF10539

Page Two

C/S Integrated Test Report
Supplemental Spares Plan
Two Copies of Drawings with Latest Revisions
Operational and Maintenance Manuals
Collector Subsystem Instrumentation
Maintenance Instructions
Control System Theory of Operations
Software/Firmware Design Specifications

STY 100-290

MARTIN MARIETTA AEROSPACE

DENVER DIVISION
POST OFFICE BOX 179
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10 November 1982

Ms. Mary Jane Holliday
Contract Examiner
Department of Energy
California Patent Group
San Francisco Operations Office
Oakland, California 94612

Re: Final Patent Certification for DOE
Contract DE-ACO3-80SF10539

Dear Ms. Holliday:


Pursuant to your letter of September 7, 1982, addressed to Mr. Cecil W. Duclon, I have made the corrections you requested thereon.

With respect to Invention Disclosures 81YD16, 81YD24 and 81YD25, please see our attached letters dated March 11, 1982 wherein you were notified that these inventions are not reportable. I am also attaching Mr. Carnahan's letter dated March 22, 1982.

If we can be of further assistance, please contact our office. Mr. DeArment may be reached at (303) 977-6109 and I may be reached at (303) 977-6501/6110.

Very truly yours,

MARTIN MARIETTA CORPORATION


(Miss) Josephine E. Salazar
Assistant to Phillip L. DeArment
Assistant Patent Counsel

cc: C. W. Duclon
W. A. Brevier
J. T. Weber



ST 4110-290

Department of Energy
San Francisco Operations Office
1333 Broadway
Oakland, California 94612

Reply to:
DOE Site Office
P.O. Box 366
Daggett, CA 92327
ATTN: S. D. Elliott, Jr.

Melvin W. Frohardt
Martin Marietta Aerospace
P.O. Box 179
Denver, CO 80201

JUN 25 1983

Subj.: Request for patent clearance and TIC Distribution of Documents from
DOE Contracts ET21007 and SF10539 (Solar One Heliostats, Phases I & II)

Dear Mel:

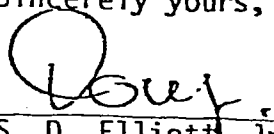
We are about to come out, with the help of EPRI, with a bibliography of key Project documents. To cope with anticipated requests for copies, I would like to arrange for properly cleared documents to be filed with and distributed through the DOE Technical Information Center at Oak Ridge. A check with TIC shows that only MCR-80-1377 has been cleared by them to date. Can you provide me with signed-off Patent Clearance Requests for:

- o The five indicated documents from the Phase I study (ET21007);
- o The twelve indicated documents from Phase II (SF10539);
- o The as-built drawing set provided via Sandia at the end of Phase II;
- o Any other Project documents generated by MMC you think the utility/industry community should have ?

I'd also appreciate a check on the Phase I CDR handout; was it MCR-78-1325?

Your help is greatly appreciated; it will save me (and you) a lot of running about once the bibliography comes out. I will insure that you get a copy; it lists about 500 documents, not including drawings (these we will provide to TIC in aperture card form at a later date, with a full index). Please call me ((619) 254-2672/-2142) if you have any questions or concerns.

Sincerely yours,


S. D. Elliott, Jr.
DOE Project Director



STMPD-290

Department of Energy
San Francisco Operations Office
1333 Broadway
Oakland, California 94612

Reply to:
DOE Site Office
Post Office Box 366
Daggett, CA 92327

Mr. Melvin T. Frohardt
Martin Marietta Aerospace
Post Office Box 179
Denver, CO 80201

DEC 06 1983

Subj.: Closeout Actions on Martin Marietta Contracts with DOE San Francisco Operations Office

Dear Mel:

Nearly six months ago, I requested your assistance in finalizing patent clearance on a number of the documents from the Collector Phase I and Phase II contracts which we wish to enter into the DOE Technical Information Center system. Thus far, I have not had any response to this request. We are about to issue the bibliography developed by Burns & McDonnell under the EPRI-funded "Lessons Learned and Project Documentation" study (I assume you have received a copy of Vol. 1, "Lessons Learned" - if not, let me know and I will send you one), and we and TIC anticipate a substantial number of requests for key documents, including yours.

In addition, SAN Contracts Closeout (Sonia Jackson) advises me that several of the final documents needed to complete closeout (and release final payment of withheld funds), ~~is~~ as yet lacking, not only on the above two contracts, but also on the old Preliminary Design contract. I would greatly appreciate your assistance (or your guidance as to who can assist us) in getting this wrapped up and off both of our desks. To recapitulate (adding the items needed by SAN) for the three contracts:

DE-AC03-76ET20422 (Old Contract -1110), Central Receiver System Prel. Design:

- o A "Final Invoice", to be submitted to Sonia Jackson, with copy to me;
- o "Contractors Assignment of Refunds and Rebates", to Sonia;
- o "Contractors Release", to Sonia;
- o "Contractor Request for Patent Clearance" (send to me, only), for:
 - MCR-77-161, "System Safety Design Criteria for Central Receiver...System",
 - MCR-77-162, "System Safety Program Requirements for Solar Thermal Systems".(These were done under an extension to the Preliminary Design contract, and are valuable background documents.)

DE-AC03-78ET21007 Collector System, Phase I:

- o "Final Invoice", to Sonia, copy to me;
- o "Assignment of Funds and Rebates", to Sonia;

- o "Contractors Release", to Sonia;
- o "Contractor Request for Patent Clearance", to me, for:
 - MCR-78-1323, "10-MWe Solar Thermal Pilot Plant Conceptual Design Review";
 - MTR-78-1330, "10-MWe Solar Thermal Pilot Plant Preliminary Design Review";
 - MCR-79-1302, "10-MWe Solar Thermal Pilot Plant Final Design Review (2 Vols.)";
 - 40-0-500-4P, "10-MWe Solar Thermal Pilot Plant Phase II O&M Equipment";
 - 40-0-500-6P, "10-MWe Solar Thermal Pilot Plant Phase II Planning."

DE-AC03-80SF10539, Collector System Phase II

- o "Final Invoice", to Sonia, copy to me;
- o "Assignment of Funds and Rebates", to Sonia;
- o "Contractors Release", to Sonia;
- o "Contractor Request for Patent Clearance", to me, for:
 - MCR-79-1352B*, "Quality Assurance Plan for 10-MWe Phase II Collector..";
 - MCR-80-1304, "10-MWe Solar Pilot Plant Collector Subsystem Safety Plan";
 - MCR-81-1331B, "Hazard Analysis for 10-MWe ...Pilot Plant";
 - 40-0-500-2P, "10-MWe ...Pilot Plant Phase II Mfg. Plan, Rev. 2";
 - MCR-80-1341A, "10-MWe Collector Sybsystem Software/Firmware Functional Req'ts.";
 - MCR-80-1362, "System Description Document, Collector Subsystem...";
 - MCR-80-1376*, "Heliostat Stimulator Operators' Manual";
 - MCR-81-1708, "Operation Instructions, Heliostat Field Subsystem...";
 - MCR-81-1709A, "Maintenance Instructions, Heliostat Field Subsystem...";
 - MTR-81-1769, "...Collector Subsystem Functional Test Report";
 - MCR-81-1770, "Supplemental Spares Plan, Heliostat Field...";
 - MCR-80-1377A, "Software/Firmware Design Specifications...";
 - MCR-82-1701, "Control System Theory of Operation";
 - Drawing Set, as Identified in "Drawing Tree 400500 5132701";
 - Source Listing of Code for Heliostat Controller ROM or EPROM*
 - Source Listing of Code for Heliostat Field Controller ROM/EPROM*

Our files do not have current copies of the following other items identified in the Drawing Tree (400500 5132701):

Documents: 40M500-2S, "Foundation Req'ts.", 40M500-1T, "Installation Instructions", 40M500-2M, "Canting Procedures", 40M500-5P, "Acceptance Plan", MCR-80-1361, "Collector System Functional Test Plan", and MCR-81-1715, "Collector System Integrated Acceptance Test Plan."

 * Current copies of these four items are lacking from the Project files; your assistance in obtaining at least one copy of each will be most appreciated.

Drawings: 40E500 5132788, "Adapter Plate/Control Arm Heat Tool", 40E500 5132771, "Field Canting Tool", and 40E500 5132776, "Drive Unit Checkout Console".

While these items are not carried in the current version of the Bibliography (none of the Plant as-built drawings have been entered as yet), many, if not all, of them may be expected to be of interest to the solar community. I would appreciate at least one copy of each, again with your release. To save you considerable effort in preparing the Patent Clearance Request forms (I am enclosing several copies of the form), you may combine many of the above by simply clearing the "Drawing Tree", with its contents.

If you need the other closeout forms cited above (your Contract Administration staff should have them in stock), please call Sonia Jackson at FTS 536-4179, or write her at:

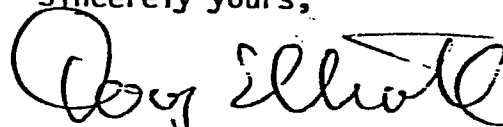
Ms. Sonia Jackson (CM)
 Department of Energy
 1333 Broadway
 Oakland, CA 94612

Finally, since we are required to forward two clean, reproducible copies of each document to DOE/TIC, as well as needing one clean copy for our on-site archives, any "extras" you can turn up around your offices would be greatly appreciated; certainly, rather than throw anything of possible interest out, send it to me.

Mel, I know (believe me!) that this is all a significant amount of work, and I wish I didn't have to ask you (or your staff) to go through it, but it will be to our mutual benefit in the end to get these three contracts all cleaned up, and a comprehensive package of Project documentation (currently, over 550 documents, plus drawings) into the archives. If there is anything further I can do to assist you in this effort, please call on me.

Encl.: DOE Proj. Ofc. ltr. 6/25/83
 Patent Clearance Req. Forms

Sincerely yours,



S. D. Elliott, Jr., Director,
 DOE Project Office, Barstow

cc: H. C. Wroton, MMC
 Sonia Jackson, DOE/SAN (CM)

PS: I keep running across references to a document I can't identify: MCR-78-1325; what was it?

MARTIN MARIETTA AEROSPACE

DENVER DIVISION
POST OFFICE BOX 179
DENVER, COLORADO 80201
TELEPHONE (303) 977-3000

STMPD-290

January 30, 1984

Mr. Doug Elliott
DOE Site Office
Post Office Box 366
Daggett, CA 92327

Subject: Closeout Actions on Martin Marietta Contracts with DOE San Francisco Operations Office

Reference: Letter of December 06, 1983, S.D. Elliott, Jr. to M. Frohardt, Closeout of Contracts

In regard to the referenced letter, following is the status and actions in process to close out these items:

1. Contract Closeout Status

In regard to the closeout of cost type contracts DE-AC03-76ET20422, Central Receiver Test Facility, and DE-AC03-78ET21007, Collector System Phase I, we include the "Contractors Assignment of Refunds and Rebates" and "Contractors Release" with our final invoice package. The final invoices for these two contracts will be submitted upon completion of final settlement negotiations for our 1979 overhead and G&A rates which is currently in progress. In reference to the closeout of contract DE-AC03-80SF10539, Collector System Phase II, please see Attachment 1, the letter to Ms. Joann Littlehales dated January 23, 1984, for the current status.

2. Patent Clearance

The following documents are in the process of being cleared by our Patent office. When this transmittal is available, I will send a copy to you.

MCR-78-1323, "10-MWe Solar Thermal Pilot Plant Conceptual Design Review"
MCR-78-1330, "10-MWe Solar Thermal Pilot Plant Preliminary Design Review"
MCR-79-1302, "10-MWe Solar Thermal Pilot Plant Final Design Review (2 Vols)"
40-0-500-4P, "10-MWe Solar Thermal Pilot Plant Phase II O&M Equipment"
40-0-500-6P, "10-MWe Solar Thermal Pilot Plant Phase II Planning"

Mr. Doug. Elliott
January 27, 1984
Page 2

The remainder of the documents have been previously cleared by the following letters, copies of which are included in Attachment 2.

Letters from Phillip DeArment to Roger Gaither:

DAC-83-417, dated May 24, 1983
80-Y-15555, dated July 28, 1980
DAC-82-389, dated May 3, 1982
Letter dated March 11, 1982
Letter dated November 10, 1982

3. Documents

You requested copies of some documents and drawings in the referenced letter. Copies of the following drawings and documents are being submitted under Attachment 3.


MCR-78-1330, "Preliminary Design Review Package"
MCR-79-1352B, "Quality Assurance Plan for 10-MWe Phase II
Collector"
MCR-80-1376, "Heliostat Stimulator Operators' Manual"
40M500-2S, "Foundation Requirements"
40M500-2M, "Canting Procedures"
40M500-1T, "Installation Instructions"
40M500-5P, "Acceptance Plan"
MCR-81-1715, "Collector System Integrated Acceptance Test Plan"
MCR-80-1361, "Collector System Functional Test Plan"
40M500 5132788, "Adapter Plate/Control Arm Heat Tool"
40M500 5132771, "Field Canting Tool"
Source Listing of Code for Heliostat Controller ROM or EPROM*
Source Listing of Code for Heliostat Field Controller ROM/EPROM

No drawing exists for 40E500 5132776, "Drive Unit Checkout Console" as this checkout console consisted of a stimulator to operate a production Drive Mechanism Assembly. Also MCR-78-1330 is the correct document number for the Preliminary Design Review Package rather than MCR-78-1325. MCR-78-1325 is the document number assigned to all the Monthly Progress Reports written during the Phase I contract.

Doug, I hope this will help in getting the documentation finalized. I will follow-up with the additional information identified. If you have any questions please call on me.

Sincerely yours,

MARTIN MARIETTA CORPORATION


Melvin W. Frohardt
Solar Programs

Enclosures

cc: H. Wroton
Sonia Jackson

U.S. DEPARTMENT OF ENERGY

memorandum

DATE: MAY 14 1984

REPLY TO
ATTN OF

S. D. Elliott, Jr., Director, DOE Solar One Project Office

SUBJECT

Submission of Thirteen Reports Prepared for 10-MWe Pilot Plant ("Solar One") Project by Martin Marietta Corporation under Contract DE-AC03-80SF10539

TO:

Roger S. Gaither, DOE/SAN Office of Patent Counsel
William D. Matheny, DOE/TIC Document Control

Enclosed are thirteen documents prepared by the Martin Marietta Corporation, Denver Aerospace Division, for the Solar Ten-Megawatt Project Office in conjunction with design and fabrication of the Pilot Plant Collector (Heliostat) System, under Contract DE-AC03-80SF10539:

<u>Primary Document No.</u>	<u>Secondary No.</u>	<u>Brief Title</u>
DOE/SF/10539-01	(STMP0-288)	"Quality Assurance Plan..."
DOE/SF/10539-02	(STMP0-289)	"...System Safety Plan"
DOE/SF/10539-03	(STMP0-290)	"Hazard Analysis..."
* DOE/SF/10539-04	(STMP0-291)	"Phase II Manufacturing Plan (Revision 2)"
DOE/SF/10539-05	(STMP0-292)	"Software/Firmware Functional Requirements..."
* DOE/SF/10539-06	(STMP0-293)	"System Description Document..."
DOE/SF/10539-07	(STMP0-294)	"Heliostat Stimulator Operator's Manual"
DOE/SF/10539-08	(STMP0-295)	"Operations Instructions, Heliostat Field..."
* DOE/SF/10539-09	(STMP0-296)	"Maintenance Instructions, Heliostat Field..."
DOE/SF/10539-10	(STMP0-297)	"...Functional Test Report"
DOE/SF/10539-11	(STMP0-298)	"Supplemental Spares Plan..."
* DOE/SF/10539-12	(STMP0-299)	"Software/Firmware Design Specification..."
DOE/SF/10539-13	(STMP0-300)	"Control System Theory of Operation"


One copy of each document, accompanied by a SAN Form 70 prepared by the Project Office (on the basis of Attachment 1, the Contractor's Patent Certification as submitted May 3, 1982), is provided for SAN/OPC review and clearance. The fabrication and maintenance materials indicated in the above list by an asterisk should be reviewed in the light of the two disclosures filed with Attch. 1, as well as the Martin Marietta Dockets 81YD16, -24, and -25, claimed as developed outside the scope of the contract in Attch. 2, MMC letter of November 10, 1982. Please return the "feedback" copies of the Form 70's to this office; the clearance copies of the documents themselves may be returned to Mr. Mike Lopez, SAN/FGS.

Two copies of each document, accompanied by a completed DOE Form RA-426, are submitted for archiving and announcement by the DOE Technical Information Center and for forwarding to the National Technical Information Service.

- Attchs.: 1. Martin Marietta Ltr. 5/3/82
- 2. Martin Marietta ltr. 11/10/82

Encls.: 13 Documents w/transmittal forms

- cc: Mike Lopez, DOE/SAN (FGS)
- Don Holz, DOE/SAN (ISEA)
- Mary Soderstrum, Burns & McDonnell


S. D. Elliott, Jr., Director,
DOE Solar One Project Office



**DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE**

**CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT**

Prime Contract No. DE-AC03-80SF10539
Subcontract No. (N/A)
Report No. DOE/SF/10539-03 (STMP0-290)
Date of Report March 1988 1980
Name & Phone No. of DOE Technical Representative S. D. Elliott, Jr. (619) 254-2672

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

FROM: DOE Solar One Project Office
Post Office Box 366
Daggett, CA 92327

- Document Title:
"Hazard Analysis for 10 MWe Solar Thermal Central Receiver Pilot Plant"
- Type of Document: Technical Report, Conference Paper, Journal Article, Abstract or Summary,
 Copy of Oral Presentation, Other (please specify): _____
- In order to meet a publication schedule or submission deadline, patent clearance by _____ (routine) would be desired.

SENDER IS TO CHECK BOX #4 OR #5 BELOW.

- I have reviewed (or have had reviewed by technically knowledgeable personnel) this document for possible inventive subject matter (Subject Inventions) and that no inventions or discoveries (Subject Inventions) are deemed to be disclosed in this document except as stated below:
 - Attention should be directed to pages _____ of this document.
 - This document describes matter relating to an invention:
 - Contractor Invention Docket No. _____
 - A disclosure of the invention was submitted to DOE on _____ (date)
 - A disclosure of the invention will be submitted shortly _____ (approximate date)
 - A waiver of DOE's patent rights to the contractor:
 has been granted, has been applied for; or will be applied for _____ (date) by me
- This document is being submitted, but no review has been made of this document for possible inventive subject matter.

6. Remarks: See Martin Marietta letter ^{5/3/82} ~~11/30/80~~ for Patent Certification

Reviewing/Submitting Official: Name (Print/Type) S. D. Elliott, Jr., Director
Title DOE Solar One Project Office
Signature *S. D. Elliott* Date 10 May, 1984

TO: INITIATOR OF REQUEST

FROM: ASSISTANT CHIEF FOR PROSECUTION
Office of Patent Counsel/Livermore Office

- No patent objection to above-identified release.
- Please defer release until advised by this office.

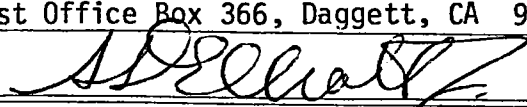
Signed _____ Date Mailed _____

U.S. DEPARTMENT OF ENERGY

DOE AND MAJOR CONTRACTOR RECOMMENDATIONS FOR
ANNOUNCEMENT AND DISTRIBUTION OF DOCUMENTS

See Instructions on Reverse Side

1. DOE Report No. DOE/SF/10539-03 (STMPO-290)	2. Contract No. DE-AC03-80SF10539	3. Subject Category No. UC-62
4. Title "HAZARD ANALYSIS FOR 10 MWe SOLAR THERMAL CENTRAL RECEIVER PILOT PLANT"		
5. Type of Document ("x" one) <input checked="" type="checkbox"/> a. Scientific and technical report <input type="checkbox"/> b. Conference paper: Title of conference _____ Date of conference _____ Exact location of conference _____ Sponsoring organization _____ <input type="checkbox"/> c. Other (specify planning, educational, impact, market, social, economic, thesis, translations, journal article manuscript, etc.) _____		
6. Copies Transmitted ("x" one or more) <input type="checkbox"/> a. Copies being transmitted for standard distribution by DOE-TIC. <input type="checkbox"/> b. Copies being transmitted for special distribution per attached complete address list. <input checked="" type="checkbox"/> c. Two completely legible, reproducible copies being transmitted to DOE-TIC. (Classified documents, see instructions) <input type="checkbox"/> d. Twenty-seven copies being transmitted to DOE-TIC for TIC processing and NTIS sales.		
7. Recommended Distribution ("x" one) <input type="checkbox"/> a. Normal handling (after patent clearance): no restraints on distribution except as may be required by the security classification. <input type="checkbox"/> b. To U.S. Government agencies and their contractors. <input type="checkbox"/> c. within DOE and to DOE contractors. <input type="checkbox"/> d. within DOE. <input type="checkbox"/> e. to those listed in item 13 below. <input checked="" type="checkbox"/> f. Other (Specify) Archive/issue on request		
8. Recommended Announcement ("x" one) <input checked="" type="checkbox"/> a. Normal procedure may be followed. <input type="checkbox"/> b. Recommend the following announcement limitations:		
9. Reason for Restrictions Recommended in 7 or 8 above. <input type="checkbox"/> a. Preliminary information. <input type="checkbox"/> b. Prepared primarily for internal use. <input type="checkbox"/> c. Other (Explain)		
10. Patent, Copyright and Proprietary Information Does this information product disclose any new equipment, process or material? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If so, identify page nos. _____ Has an invention disclosure been submitted to DOE covering any aspect of this information product? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If so, identify the DOE (or other) disclosure number and to whom the disclosure was submitted. Are there any patent-related objections to the release of this information product? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If so, state these objections. Does this information product contain copyrighted material? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If so, identify the page number _____ and attach the license or other authority for the government to reproduce. Does this information product contain proprietary information? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If so, identify the page numbers _____ ("x" one <input type="checkbox"/> a. DOE patent clearance has been granted by responsible DOE patent group. <input checked="" type="checkbox"/> b. Document has been sent to responsible DOE patent group for clearance.		
11. National Security Information (For classified document only; "x" one) Document <input type="checkbox"/> a. does <input type="checkbox"/> b. does not contain national security information		
12. Copy Reproduction and Distribution Total number of copies reproduced <u>25</u> Number of copies distributed outside originating organization <u>10</u>		
13. Additional Information or Remarks (Continue on separate sheet, if necessary)		

14. Submitted by (Name and Position) (Please print or type)
S. D. Elliott, Jr., Director, DOE Solar One Project Office
Organization
Post Office Box 366, Daggett, CA 92327 (619) 254-2672
Signature  Date _____



DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

Prime Contract No. DE-AC03-80SF 10539
Subcontract No. (N/A)
Report No. DOE/SF/10539-03 (STMPO-290)
Date of Report March 1980
Name & Phone No. of DOE Technical Representative S. D. Elliott, Jr. (619) 254-2672

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

FROM: DOE Solar One Project Office
Post Office Box 366
Daggett, CA 92327

- Document Title:
"Hazard Analysis for 10 MWe Solar Thermal Central Receiver Pilot Plant"
- Type of Document: Technical Report, Conference Paper, Journal Article, Abstract or Summary,
 Copy of Oral Presentation, Other (please specify): _____
- In order to meet a publication schedule or submission deadline, patent clearance by _____ (routine) would be desired.

SENDER IS TO CHECK BOX #4 OR #5 BELOW.

- I have reviewed (or have had reviewed by technically knowledgeable personnel) this document for possible inventive subject matter (Subject Inventions) and that no inventions or discoveries (Subject Inventions) are deemed to be disclosed in this document except as stated below:
 - Attention should be directed to pages _____ of this document.
 - This document describes matter relating to an invention:
 - Contractor Invention Docket No. _____
 - A disclosure of the invention was submitted to DOE on _____ (date)
 - A disclosure of the invention will be submitted shortly _____ (approximate date)
 - A waiver of DOE's patent rights to the contractor:
 has been granted, has been applied for; or will be applied for _____ (date) by me
- This document is being submitted, but no review has been made of this document for possible inventive subject matter.

6. Remarks: See Martin Marietta letter ^{5/3/82} ~~1/10/84~~ for Patent Certification

Reviewing/Submitting Official: Name (Print/Type) S. D. Elliott, Jr., Director
 Title DOE Solar One Project Office
 Signature [Signature] Date 10 May, 1984

TO: INITIATOR OF REQUEST
FROM: ASSISTANT CHIEF FOR PROSECUTION
Office of Patent Counsel/Livermore Office

- No patent objection to above-identified release.
- Please defer release until advised by this office.

Signed [Signature] Date Mailed 5/21/84

M. Lopez, SAN
[Signature]
5/21/84
5/21/84