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Produced by the NASA Center for Aerospace Information (CASI)
LOW CONCENTRATION RATIO
SOLAR ARRAY FOR LOW EARTH ORBIT
MULTI-100 kW APPLICATION

VOLUME 2—DRAWINGS

FINAL REPORT
"JLY 1983

Prepared for:
National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

Contract NAS8-34214
SSD83-0075-2

LOW CONCENTRATION RATIO
SOLAR ARRAY FOR LOW EARTH ORBIT
MULTI-190 KW APPLICATION
FINAL REPORT
VOLUME 2 - DRAWINGS
JULY 1983

PREPARED FOR:
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER,
AL 35812

CONTRACT NAS8-34214

Rockwell International
Shuttle Integration &
Satellite Systems Division
12214 Lakewood Boulevard
Downey, California 90241
Low Concentration Ratio Solar Array for Low Earth Orbit Multi-100 kW Application, Final Report, Vol. 2 - Drawings

Nalbandian, S. J.; French, E. P.; et al

The array module deployed area is 1320 square meters and consists of 4356 pyramidal concentrator elements. The module, when stowed in the Space Shuttle's payload bay, has a stowage volume of a cube with 3.24 meters on a side. The concentrator elements are sized for a geometric concentration ratio (GCR) of six with an aperture area of 0.5 meters x 0.5 meters.

Volume 1 discusses the structural analysis and design trades leading to the baseline design. It describes the configuration, as well as optical, thermal and electrical performance analyses that support the design and overall performance estimates for the array. Experimental results are also presented for a concentrator element using both silicon and gallium arsenide solar panels. They confirm the preliminary design analysis and performance estimates. Recommendations are provided for future development effort for low earth orbit application. Volume 2 provides drawings for the preliminary design configuration and for the test hardware that was fabricated for design evaluation and test.
This report describes the effort performed for the preliminary design of low-cost concentrator multi-hundred kilowatt solar arrays. The Volume 1 report summarizes activities performed between June 18, 1981 and July 1983, as required by Contract NAS8-34214 Statement of Work. Volume 2 contains drawings prepared describing the preliminary design configuration, test hardware and manufacturing flow concept. The report was prepared by the Shuttle Integration and Satellite Systems Division of Rockwell International Corporation for the NASA George C. Marshall Space Flight Center (MSFC), Huntsville, Alabama. The NASA technical Contractor Officer Representative for the activity is Mr. W. L. Crabtree. The contents of this document are not necessarily endorsed by the NASA-MSFC.

Mr. S. J. Nalbandian is the project supervisor. Dr. E. F. French is the assistant project supervisor. Principal contributors to the project were:

J. B. Adkins  Mechanism Design
H. C. Ayers  Reflector Design
Z. Backovsky  Testing and Thermal Analysis
R. A. Bellgardt  Electrical Test Equipment
M. S. Biss  Overall Preliminary Design
J. L. Edwards  Structural Analysis
J. D. Eliot  Mechanical Test Equipment
Dr. E. P. French  Optical and Thermal Analysis
G. C. Frey  Materials
R. V. Frost  Reflector Panel Fabrication
H. S. Greenberg  Initial Structural Design and Analysis
K. M. Hicks  Manufacturing Planning
Dr. L. Hau  Solar Cell Technology
R. L. Long  Materials
M. W. Mills  Electrical Testing and Analysis
Dr. T. S. Nishimoto  Structural Analysis
F. A. Perry  Structural Analysis
A. H. Pope  Development Plans
D. A. Reed  Initial Preliminary Design
A. A. Sileski  Test Planning
L. Vega  Test Hardware
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ILLUSTRATIONS

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<td>2</td>
<td>2-2</td>
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</tbody>
</table>

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SSD83-0075-2
1.0 PRELIMINARY DESIGN DRAWINGS

1.1 DISCUSSION

The solar array preliminary design developed under this program is described in a set of 30 level-one drawings. These drawings and their relationships are depicted in the drawing tree shown in Figure 1. Together with their associated callouts and specifications, the drawings provide a physical description of two variants of a 1320 m$^2$ solar array module (deployed area), one fitted with silicon solar cells and the other with gallium arsenide solar cells. The requirements, trades and analytical studies leading to the design are fully described in Volume 1 of this report.
1.2 DESIGN DRAWINGS

1. V416-935001
2. V416-935002, sheets 1 of 2 and 2 of 2
3. V416-935003
4. V416-935010
5. V416-935100, sheets 1 of 2 and 2 of 2
6. V416-935101, sheets 1 of 3, 2 of 3, and 3 of 3
7. V416-935102
8. V416-935103
9. V416-935200
10. V416-935201
11. V416-935202
12. V416-935203
13. V416-935204
14. V416-935205
15. V416-935400
16. V416-945.001
17. V416-945100
18. V416-945101
19. V416-945103
20. V416-945200
21. V416-945202
22. V416-945203
23. V416-945204A
24. V416-945301
25. V416-945302
26. V416-945303
27. V416-945304
28. V416-945305
29. V416-945400
30. V416-945401
FOLDOUT FRAME

ORIGINAL PAGE IS OF POOR QUALITY
CONCENTRATOR ELEMENT
(NO SCALE)

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2 FOLDOUT FRAME
FOLDOUT FRAME

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-003 SHOWN
FOOLDOUT FRAME

NOTES: UNLESS OTHERWISE SPECIFIED

- END CAP INTERMEDIATE BOLTS
- FOLDOUT INTERMEDIATE BOLTS
FOLDOUT FRAME

ORIGINAL PAGE 13
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5 FOLDOUT FRAME

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ORIGINAL PAGE 13
OF POOR QUALITY

CONCENTRATOR ELEMENT

SCREW

SLIDE HOUSING

NUT: SELF LOCKING

SLIDE HOUSING -

CONCENTRATOR ELEMENT

VIEW A A

SCALE \( \frac{1}{4} \)

12.7 (\( \text{mm} \))

18.8 (\( \text{mm} \))

12.7 (\( \text{mm} \))

FOLDOUT FRAME

2. FAB. FORM
1. ALL DIM.
NOTES: UN
2. Fab from graphite impregnated polysulfone
1. All dimensions are in mm, inches are in ( ).
Notes: Unless otherwise specified
### Parts List

#### Dimensions are in Inches

<table>
<thead>
<tr>
<th>QTY</th>
<th>QTY</th>
<th>QTY</th>
<th>QTY</th>
<th>CODE</th>
<th>PART OR IDENTIFICATION NUMBER</th>
<th>Nomenclature or Description</th>
<th>MATERIAL</th>
<th>DATA SPECIFICATIONS</th>
<th>SIZES</th>
<th>NOTES</th>
<th>SUPPLIERS</th>
</tr>
</thead>
</table>

**Concentrator Stack Translator Mechanism**

- **Manufacturer:** Rockwell International
- **Drawing No.:** V416-935204
- **Size Code:** 3-1-37, 3-1-38

**Specifications:**

- 1.001
- 2.000
- 0.100

**Notes:**

- Imregnated
- Foldout Frame
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OF POOR QUALITY

SECTION A-A
SCALE: 1
(TYPICAL CONSTRUCTION)

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ORIGINAL PAGE OF POOR QUALITY

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2 FOLDOUT FRAME
FOLDOUT FRAME

SILICON SOLAR ARRAY
- DOES NOT SHOW
**ORIGINAL PAGE IS OF POOR QUALITY**

**FOLDOUT FRAME**

1. All dimensions are in **mm**, inches in ( )

Notes: Unless otherwise specified

---

**1.29 (0.51) DIA WIRE**

(2.9 in lb max torque)

---

**UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES.**

Tolerances on:
- Decimals
- Angles
  - $\pm 0.03$
  - $\pm 0^\circ 30'$

- Holes noted “Drill”

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>NEXT ASSY</th>
<th>USED ON</th>
<th>END ITEM NO.</th>
<th>THRU</th>
</tr>
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<tbody>
<tr>
<td>.001</td>
<td>1/2</td>
<td>V416.945100</td>
<td>LCESSA</td>
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</table>

| REC'D PER | APPLICATION | EFFECTIVITY |
| END ITEM   |              |             |

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**QTY** | **REQ'D** | **QTY** | **REQ'D** | **QTY** | **REQ'D** | **QTY** | **IDENT** | **PART IDENTIFYING**
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2 FOLDOUT FRAME

1.29 (0.05) DIA WIRE
(2.9 IN LB MAX TORQUE)

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PARTS LIST

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.

TOLERANCES ON:
DECIMALS ANGLES
0.000 = ±0.003
0.001 = ±0.0005
0.002 = ±0.0003
0.003 = ±0.0002
0.004 = ±0.0001

HOLE Size NOTED "DRILL"
0.013 THRU 0.040
0.041 THRU 0.130
0.131 THRU 0.220
0.230 THRU 0.500
0.501 THRU 0.750
0.751 THRU 1.000
1.001 THRU 2.000

DR BY: MB155 3/4/83
CHK BY: APPOVED BY:
4.21.1982 2/4/82

TORSION SPRING
SOLAR PANEL
LCRSA

Rockwell International Corporation
Space Division
19214 Lakewood Boulevard - Downey, California 90241

Rocinmil International Corporation
Space Division

PART NO. 03953 V416-945200

SCALE FULL

EFFECTIVITY

1-51, 1-52
CONCENTRATOR ELEMENT REF

SCREW

SLIDE HOUSING

NUT - SELF LOCKING

SLIDE HOUSING

AFT C [ CH[En/T

SC [ AIC YI

NtJT- 5] [tF

r
c
2EF

4.33
(13)

12.7 (.50)

A

A

FOLDOUT FRAME

VIEW A A

SCALE 1/1

12.7 (.50)

4.33
(13)

12.7 (.50)

2 FAB A

I ALL DI

NOTES: U
2. Fab from graphite impregnated polysulfone
   l. All dimensions are in mm, inches are in ( ).
   Notes: Unless otherwise specified
3. Finish Per MF004-001, III 2 (White Silicone Paint
   k = .25, e = .04 Max, Service Temp 200°C)
2. Fab from 0.032 Al Heat Treat To T6 Cond
1. All Dimensions Are In mm, Inches In ()

Notes: Unless Otherwise Specified
### Parts List

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<tr>
<th>QTY REQD</th>
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<th>QTY REQD</th>
<th>QTY REQD</th>
<th>CODE IDENT</th>
<th>PART OR IDENTIFYING NUMBER</th>
<th>NOMENCLATURE OR DESCRIPTION</th>
<th>MATERIAL</th>
<th>DATA: SPECIFICATIONS SIZES, NOTES, SUPPLIERS</th>
<th>ZONE</th>
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<td></td>
<td></td>
<td>132:V416-945203-001 CLIP AL SHT</td>
<td>G01 O AL PEQ Q-A-25011 .81x12.7x38.1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Tolerances on:
- **Decimals:**
  - XX=±.03
  - XXX=±.010

- **Angles:** ±6° ±30′

- **Holes Noted “Drill”**
  - .003 THRU .004 ±.001 – .001
  - .043 THRU .044 ±.002 – .001
  - .063 THRU .064 ±.003 – .001
  - .113 THRU .123 ±.004 – .001
  - .131 THRU .132 ±.005 – .001
  - .229 THRU .230 ±.004 – .001
  - .501 THRU .502 ±.005 – .001
  - .511 THRU .512 ±.006 – .001

- **Thrus:**
  - .751 THRU 1.000 ±.007 – .001
  - 1.001 THRU 2.000 ±.010 – .001

### Rockwell International Corporation
Space Division

1214 La Brea Boulevard • Downey, California 90241

**CLIP RADIATOR PANEL / REFLECTOR PANEL**

<table>
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<tr>
<th>SIZE</th>
<th>CODE IDENT NO.</th>
<th>DRAWING NO.</th>
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<tr>
<td>C</td>
<td>03953</td>
<td>V416-945203</td>
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</table>

**Approved by:**

W.G. Maldonado 2-16-72
### PARTS LIST

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<td>PIN/BOLT ASSY</td>
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**SECTION C = C**

**DETAIL SCALE 1:2521**

---

**IN MM, NOES IN ()**
OTHERWISE SPECIFIED

---

**DIMENSIONS ARE IN INCHES**
TOLERANCES ON
DEMEALS
ANGLES
0.001 = 0.020
0.0005 = 0.005
HOLNES NOTED "TIGHT"
2 FOLDOUT FRAME

PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES

TOLERANCES ON
DEGREES = ± 5°
± .005
HOLE TOLERANCE "DRILL"

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WIRE HARNESS - DIRECTION REVERSAL

DRAWN BY

APPROVED BY

WIRE HARNESS - DIRECTION REVERSAL

LCRSA

D 03953 V416-945303

SCALE FULL SHEET

1-63, 1-64
DI

CI

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AWAL. NNGE T3

Of P

OOR

QV AL"

CCPPm

KQnON

2%2

aEr

SEEL7M

oWALE: 5/1

84x736

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7	 i	 6

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215x737

(7	 i

54x318

fcokmic

(►

TK %...

ism)

(Wwp 1t)

49	 j

337x251

Pt

204x180

i

157x160

FOLDOUT FRAME

Al

t &L amv.&O 4 N

rM ,

wnU mi ( )

Names:

UKISS CTHD% sf

VIECnW

1. ALL DIMENSIONS IN MM, INCHES IN ( )

NOTES: UNLESS OTHERWISE SPECIFIED
COPPER CONDUCTOR

KAPTON INSULATOR

PARTS LIST

- C/D V416-945305-000 WIRE HARNESS

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<th>NOMENCLATURE OR DESCRIPTION</th>
<th>MATERIAL</th>
<th>DATA SPECIFICATIONS</th>
</tr>
</thead>
</table>

WIRE HARNESS
HOUSING - HOUSING
LCRSA

ITEM QTY LEFT ARMY USED ON END ITEM NO THRU
1 700 THRU 2 000 + 010 - 001

RECO PER END ITEM APPLICATION EFFECTIVITY

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS
ANGLES
360 ± 0.01 = ± 5° 30'

Holes noted "Drill"

Simplified Drawing According to MIL-STD-606

STANDARD DRAWING

DEPT. B

03953 V416-945305

SCALE: 1/16" INCHES

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1-67, 1-68
ORIGINAL PAGE 13
OF POOR QUALITY

V4G-449301-001
V4G-449301-003
V4G-449301-002

VIEW BB
SCALE 2X1

VIEW A-A
SCALE 2X1

FOLDOUT FRAME
OF POOR QUALITY
-001 SHOWN
-002 SIMILAR EXCEPT AS SHOWN

VIEW C
SCALE ¼
(-002 ONLY)

SECTION AA
SCALE ¼
(FEMALE LUG REF)

SECTION BB
SCALE ¼
(MALE LUG REF)

ORIGINAL PAGE 13
OF POOR QUALITY

FOLDOUT FRAME
-003 SHOWN
-004 OPP EXCEPT AS SHOWN

ALUMINIZED SURFACE TO 500 A THICKNESS, SPECULAR REFLECTIVITY OF .90 AND AN EMISSIVITY OF 0.05

1. ALL DIMENSIONS ARE IN MILL, INCHES IN ()
2. ALL PARTS FROM GRANITE DESIGNATED AMSS 4101
3. FINISH AND WAVEFORM MAY VARY

NOTES: UNLESS OTHERWISE SPECIFIED

1-71, 1-72

REFLECTOR PANEL - CONCENTRATOR ELEMENT
LC35A
2.0 TEST HARDWARE DRAWINGS

2.1 DISCUSSION

The hardware required to carry out experimental activities under this program are listed in the drawing tree depicted in Figure 2. There are a total of 21 drawings, of several types. Some provide information for subcontractors; others were used to construct Rockwell-fabricated components. The tests and experiments performed using the resulting hardware are fully described in Vol. 1 of this report.

2.2 TEST HARDWARE DRAWINGS

1. D416-340010
2. D416-340020
3. D416-450000
4. D416-450001
5. D416-451000
6. D416-451001
7. D416-451002
8. D416-451003
9. D416-451004
10. D416-451005
11. D416-451006
12. D416-451007
13. D416-452000
14. D416-452001
15. D416-453000
16. D416-454000
17. D416-454001
18. D416-454002
19. D416-454003
20. D416-454004
21. D416-455000
FOLDOUT FRAME

7.00 DIA. HAND CRAWL ON ADJUJUSTABLE TENDED BAR/PIPE TO MOVE OUT CAP WHICH ALLOWS CONCENTRATOR ELEMENT TO UNFOLD AND FOLD.

NEGATIVE CONSTANT FORCE SPRING (CABLE/REEL ASSEMBLY) REFER NOTE C.

SHOW ON OUTSIDE SURFACE, IF SEWS OF CONCENTRATOR ELEMENTS EXCEED (22.878k).

CAP TRIM TO BE ADEQUATE TO COMPLETE OPENING OF OP CONCENTRATOR ELEMENTS EXCEED (22.878k).

ORIGINAL PAGE IS OF POOR QUALITY

NOTE:
1. FABRICATE PER AND MATERIALS ARE SPECIFIED.
2. OUTLINE OF THE OPENING TO BE ENLARGED (10%) FOR APPARENT MOLDING TO PROVIDE ROOM FOR CONCENTRATOR ELEMENTS.

8.3 MM TYP. WALL THICKNESS (0.32"")

28.025 MM X 25.746 MM (1.1062"") ALUMINUM FRAME

12.94 M (42.5078 ft.)
FOLDOUT FRAME

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FOLDOUT FRAME

ORIGINALL PAGE ##
OF POOR QUALITY
FOLDOUT FRAME
ORIGINAL PAGE IS OF POOR QUALITY

FOLDOUT FRAME
FOLDOUT FRAME

2. IDENTIFY PART REF. MAJOR 301
   CONTAMINATION CENTER. REF. MAJOR 301
   NOTES CALL CENTER CHECKED
D46-451003-001 Radiator, Solar Panel Substr. 2 REQD

5. Contamination Control Per MF0001-001
4. Identify Part Per MADC-301
3. Interconnect Shall Be Silver "EXMKT"
2. Bond Cells Using RTV677 Adhesive
1. Fab Per Statement of Work solar Panel ECRRA System Silicon

Notes: Unless Otherwise Specified
<table>
<thead>
<tr>
<th>PARTS LIST</th>
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<tbody>
<tr>
<td>MATERIAL</td>
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<tr>
<td>SILICON</td>
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<td>SILICON</td>
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</tbody>
</table>

**NOTES**

- 1.5 mm thick, 3 mm wide
- 2.5 mm thick, 5 mm wide

**REMARKS**

- Silicon is shown for reference.
- Insulated standoff is shown.

**REFERENCES**

- "Interface Area"
- "Silicon Solar Cells"
- "So 200"
**Glass Solar Cell 45 Read**

- **Kapton Insulator EEF**
- **Silver Foil**
- **Termination Strips 2 Mil Thick**
- **4PL**
- **13 4PL**
- **Wire/Termination Strip Interface Area 3 Wires Dee Insulated Stand-Off EEF**

### Parts List

<table>
<thead>
<tr>
<th>PART</th>
<th>DESCRIPTION</th>
<th>MATERIAL</th>
<th>QTY</th>
<th>QTY</th>
<th>QTY</th>
<th>QTY</th>
<th>QTY</th>
<th>CODE</th>
<th>IDENT</th>
<th>PART OR IDENTIFYING NUMBER</th>
<th>NOMENCLATURE OR DESCRIPTION</th>
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<tr>
<td>1</td>
<td>DEM-120-2KZ Connectors</td>
<td>Cannon</td>
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<td>45</td>
<td>Solar Cells</td>
<td>GaAs</td>
<td>6</td>
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<td>D46-451003 Phototubes</td>
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</table>

**Limit Wire Routing to This Area Only**

**Foldout Frame**
**PARTS LIST**

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<tr>
<th>ITEM</th>
<th>QTY</th>
<th>REQD</th>
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<tr>
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<td>1</td>
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<td>DEE-65002</td>
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<td>003</td>
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<td>DAE-65001</td>
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**TOLERANCES ON ANGLES**

<table>
<thead>
<tr>
<th>Angle Limit</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>X = 45</td>
<td>±0.004</td>
</tr>
<tr>
<td>X = 45</td>
<td>±0.004</td>
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</tbody>
</table>

**HOLE NOTES**

DRILL: 0.063

**COMMENTS**

RADIATOR/SOLAR PANEL ASSEMBLY

**REVISIONS**

<table>
<thead>
<tr>
<th>ZONE</th>
<th>LTH</th>
<th>DESCRIPTION</th>
<th>DATE</th>
<th>APPROVED</th>
</tr>
</thead>
</table>

**REFERENCES**

- D416-45004-001
- D416-45003

**NOTES**

- 001 SHOWN

**SCALE**

1/1
## Foldout Frame

Original Page is of Poor Quality

### Parts List

<table>
<thead>
<tr>
<th>Item</th>
<th>Qty</th>
<th>Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>.001</td>
<td>041-451005</td>
<td>EXHIT PANEL</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>.001</td>
<td>041-451006</td>
</tr>
<tr>
<td>3</td>
<td>.001</td>
<td>041-451008</td>
<td>BUCKET UNIVERAL HEAD</td>
</tr>
</tbody>
</table>

Tolerances:
- Decimals: 3
- Angles: 0° to 180°
- Half Holes: 0° to 180°

Unless Otherwise Specified, Dimensions Are In Inches.

Radiator Panel Assembly

**Test:**

- 313: THRU 300 ± 0.001 - 0.01
- 314: THRU 200 ± 0.001 - 0.01
- 315: THRU 100 ± 0.001 - 0.01
- 501: THRU 0.501 ± 0.001 - 0.01
- 751: THRU 1.001 ± 0.001 - 0.01

Size: 03953 046-451004

Scale: 1:1

Sheet 2/1

2-19, 2-20
7. Finish per MFO004-001, Item I-1
6. Mark part No. per MAB014-301 core BL-08-NG-16
5. Contamination control per MFO001-001
4. Inspect per MTO501-508 Class 2
3. Std. detail per MAB 102-305
2. Break sharp corners & edges
1. Bend radius 0.050 max

Notes: Unless otherwise specified
**REVISIONS**

<table>
<thead>
<tr>
<th>ZONE</th>
<th>LTR</th>
<th>DESCRIPTION</th>
<th>DATE</th>
<th>APPROVED</th>
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2. **FOLDOUT FRAME**

3. **ORIGINAL PAGE IS OF POOR QUALITY**

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### PARTS LIST

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<tr>
<th>PART OR IDENT</th>
<th>NOMENCLATURE OR DESCRIPTION</th>
<th>MATERIAL</th>
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<tr>
<td>D416-451006</td>
<td>BRACKET AL-SHT</td>
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<tr>
<td>.061-.74 AL QQ-A-250/1</td>
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<td>.032 x 1.2 x 1.75</td>
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---

**TOLERANCES ON:**

- DECIMALS: ±.010
- ANGLES: ± 0° 30'
- HOLES NOTED "DRILL":
  - .013 THRU .040 + .001 - .001
  - .041 THRU .130 + .002 - .001
  - .131 THRU .229 + .003 - .001
  - .230 THRU .500 + .004 - .001
  - .501 THRU .750 + .005 - .001
  - .751 THRU 1.000 + .007 - .001
  
**EFFECTIVITY**

- 1.001 THRU 2.000 + .010 - .001

---

**DRAWING NO.:**

D416-451006

**DRAWING SHEET:**

1/1

---

**SIZE:**

C 03953

**DRAWING NO.:**

D416-451006

**SCALE:**

1/1

---

**EFFECTIVITY:**

- 2-23, 2-24
6. Finish Panel Per MFC004-001, Item III-3
5. Mark Part No. Per MAC014-301 Code BL-08-KX-46
4. Contamination Control Per MFC001-001
3. Std Detail Per MAC02-305
2. Break Sharp Corners & Edges
1. Bend Radius .060 Max

Notes: Unless Otherwise Specified
<table>
<thead>
<tr>
<th>QTY</th>
<th>QTY</th>
<th>QTY</th>
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<th>QTY</th>
</tr>
</thead>
</table>
| CODE| PART| ORNOMENCLATURE| DATA-SPECIFICATIONS| READ REQD| EQC REQD| EQD (DENT IDENTIFYING NUMBER)
| Identification Number | OR DESCRIPTION | MATERIAL | SIZES | NOTES | SUPPLIERS | ZONE |

**Dimensions**

Dimensions are in inches.

**TOLERANCES ON:

- DECIMALS
- ANGLES

**NOTES**

- DRILL .013 THRU .040: +.001-.001
- .031 THRU .131: +.003-.001
- 23 THRU .5: +.004-.001
- .50 THRU 2: +.001

**Effecutivity**

- P.751 THRU 1.000: +.007-.001
- SHEET1 001 THRU 2: +.010-.001

**Remarks**

- OF POOR QUALITY
1.00 ---

---.00 ---

FOLDOUT FRAME

-001 SHOWN

6. STD DETAIL PER MA0102-305
5. INSPECT PER MT0501-508 CASS Z
4. CONTAMINATION CONTROL PER MF0001-001
3. FINISH PER MF0004-001, ITEM I-23
2. IDENTIFY PER MA0104-301
1. FAB TORSION SPRING FROM PART
NO. TC51-270-359-R ASSOCIATED SPRING
CATALOG PG.60, OR EQUIV

NOTES: UNLESS OTHERWISE SPECIFIED

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>NEXT ASSY</th>
<th>USED ON</th>
<th>END ITEM NO.</th>
<th>THRU</th>
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<tbody>
<tr>
<td>-001</td>
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<td>SPARE</td>
<td>UFBAT</td>
<td>TEST</td>
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<td>-001</td>
<td>2</td>
<td>D416-451000</td>
<td>ECPAT</td>
<td>TEST</td>
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UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES.

TOLERANCES ON:

DECIMALS ANGLES

XX= ±.03 ± 0° 30'

XXX= ±.010

HOLES NOTED "DRILL"

.013 THRU .040 +.001 +.000-

.041 THRU .130 +.002 -+.001

.131 THRU .229 +.003 +.000-

.230 THRU .500 +.004 -+.001

.501 THRU .750 +.005 +.000-

.751 THRU 1.000 +.007 +.000-

1.001 THRU 2.000 +.010 +.001

REQU PER END ITEM APPLICATION EFFECTIVITY
### Parts List

<table>
<thead>
<tr>
<th>QTY</th>
<th>QTY</th>
<th>QTY</th>
<th>QTY</th>
<th>QTY</th>
<th>CODE</th>
<th>OR PART</th>
<th>NOMENCLATURE OR DESCRIPTION</th>
<th>MATERIAL</th>
<th>DATA: SPECIFICATIONS SIZES, NOTES, SUPPLIERS</th>
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</thead>
</table>

- **001** SHOWN

---

**TOLERANCES ON:**
- DECIMALS: 
  - ± 0.001
- ANGLES: 
  - ± 0° 30' 
- HOLES NOTED "DRILL":
  - .013 THRU .040 +.001-.001
  - .041 THRU .130 +.002-.001
  - .230 THRU .500 +.004-.001
  - .501 THRU .750 +.005-.001
  - .751 THRU 1.000 +.007-.001
  - 1.001 THRU 2.000 +.010-.001

---

**Dimensions Are In Inches.**

---

**Effectivity:**

---

**Rockwell International Corporation**
**Space Division**
12014 Lancaster Boulevard • Downey, California 90241

---

**TOP SPRING**
**SOLAR PANEL**
**LCRSA**

---

**Scale:** 1:1

---

**Sheet:** 1

---

**Date:** 2-27, 2-28

---

**Approved By:**

---

**Copyright 1978**

---

**Original Page is of Poor Quality**
ORIGINAL PAGE 18
OF POOR QUALITY

FOLDOUT FRAME

NOTES:
1. PART NO. 23428-24
2. SCALE: 1/4"=1'-
3. CONTINUATION SHEET, FORM 52-A
4. DETAIL PER NAVSEA 360-50A CLS 2
5. DETAIL PER NAVSEA 360-50A CLS 2
6. DETAIL PER NAVSEA 360-50A CLS 2
ORIGINAL PAGE III
OF POOR QUALITY

VIEW B
SCALE 3/8
(FRAMES OMITTED FOR CLARITY)

SECTION AA
SCALE 1/8
(TYPICAL ALL 4 CORNERS)

FOLDOUT FRAME
Aluminum backside to an emissivity of 0.15 per MPR Edmats.

Aluminum surface to 500 A thickness, specular reflectivity of 0.80, and emissivity of 0.05, per MPR Edmats.

1. T.D. denotes thickness dimension.
2. Contamination control per MFC001-001.
3. Cover mirror with clear, crack LPCH-320 blue, 0.2 Edm
4. Mark part no. per MFC001-301 code BL-08-KG-16

Notes: Unless otherwise specified.
### Parts List

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>QTY</th>
<th>QTY</th>
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<th>MATERIAL</th>
<th>DATA SPECIFICATIONS</th>
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</tbody>
</table>

**UNLESS OTHERWISE SPECIFIED**

**DIMENSIONS ARE IN INCHES**

**TOLERANCES ON**

- DECIMALS
- ANGLES
- HOLE: ±0.001

**HOLE HOLES NOTED “DRILL”**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QNT</th>
<th>OUTP</th>
<th>ASY</th>
<th>LSGD</th>
<th>END ITEM</th>
<th>EFFECTIVITY</th>
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<tbody>
<tr>
<td>001</td>
<td>1001</td>
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<td>0416-454001</td>
<td>2-35, 2-36</td>
<td>D 03953 4016-454001</td>
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FOLDOUT FRAME

ORIGINAL PAGE 13
OF POOR QUALITY
3.0 PRELIMINARY MANUFACTURING FLOW AND BUILD PLAN

3.1 DISCUSSION

In Section 8.3 of Volume 1 a test plan is described for a ground and flight demonstration array. The following two diagrams show the fabrication sequence for assembling the basic unit of such an array (see Section 4.0 of Volume 1), consisting of one pair of canister-mast assemblies and eight rows of concentrators. The first diagram shows assembly of concentrator rows and solar panels. The second diagram describes construction of the structural elements and their integration with the rows of concentrator elements.

3.2 FLOW AND BUILD DIAGRAMS

1. Assembly of Concentrator Elements
2. Assembly Sequence for Flight Test Configuration
ALTERNATE REFLECTOR PANELS
RIGID PANEL - VAPOR DEPOSITED ALUMINUM ON MOLDED POLYSULFONE GRAPHITE

BASELINE REFLECTOR PANELS
V416-945401
STRETCHED FILM ON RIGID FRAME

FOLDOUT FRAME
**REFLECTOR PANEL ASSEMBLY**

**V416-945400**

**ASSEMBLY AND TAPING SEQUENCES**

**SEQUENCE #1**

1. Tape #1

**SEQUENCE #2**

1. Tape #2

**NOTE:**
- Tape in sequence
- Reverse taping two places

- Bond resilient buttons on -003 and -004

- Subassemble reflector panels with tape

**Panel - Radiator**

**V416-945101**

- Aluminize surfaces
- Physical emissivity and reflectivity inspect
- Bond resilient buttons on -003 and -004

- Apply metalized film

**Solar Panel Assembly**

**V416-945100**

- Bond solar cells to panels
- Assemble panel subassemblies with springs, bolts, washers and nuts

- Assemble
- Install

**Original page is of poor quality**

2 Foldout frame
ASSEMBLY 5400

- TAPE #1 REF.
- TAPE #2

IN SEQUENCE SHOWN, 4 PLCS USE TAPPING SEQUENCES, TWO PLACES

CONCENTRATOR TO CONCENTRATOR INTERFACE (TYPICAL, TWO PLACES, EACH PANEL JOINT)

WIRE HARNESS ASSEMBLIES
V416-945301
V416-945302

ASSEMBLE REFLECTOR PANELS
INSTALL AND ETC

ASSEMBLE AND BOND SOLAR PANEL ASSEMBLIES AND WIRE HARNESS
INSTALL DIODES

FOLDOUT FRAME

ORIGINAL PAGE 3
OF POOR QUALITY
PRELIMINARY MANUFACTURING FLOW AND BUILD PLAN
LOW CONCENTRATION RATIO SOLAR ARRAY

PREPARED BY: K.M. HICKS
DEPT.: 761    EXT.: 3618

CONCENTRATING ELEMENT STACK ASSEMBLY
V416-945001

ASSEMBLY OF
CONCENTRATOR
ELEMENTS

FOLDOUT FRAME

PRECEDING PAGE BLANK NOT FILMED
HOUSING ASSEMBLY
V416-935101

END CAP ASSEMBLIES

3.25 m
(128 APPROX.)

53.34 cm
(21 APPROX.)

MAIN HOUSING STRUCTURE

CROSS SECTION OF LAUNCH SUPPORT TUBE

FOLDOUT FRAME

- FABRICATE DETAILS
- ASSEMBLE STRUCTURE AND INSTALL LAUNCH SUPPORT
Representative riveted joint configuration

Solar panel tripwire mechanisms

Concentrator stack translation mechanism (CSTM)

Cable extension mechanism (CEM)

Structure

3.00 m (118 approx.)

Foldout frame
REFLECTOR PANEL TRIPWIRE MECHANISMS

(CSTM)

3

FOLDOUT FRAME

- FABRICATE AND ASSEMBLE BRACKETRY
- INSTALL BRACKETRY
- FABRICATE AND ASSEMBLE MECHANISMS
- INSTALL MECHANISMS

ORIGINAL PAGE 15
OF POOR QUALITY
- Install Wire Harness Assemblies
- Install Mast/Cannister Assemblies

Original page is of poor quality
- INSTALL CONCENTRATOR STACK ASSEMBLIES AND SLIDE ASSEMBLIES CONCURRENTLY
- PERFORM ELECTRICAL HOOKUP AND CHECKOUT
• INSTALL END CAP ASSEMBLIES - SECURE TO MAST/CANNISTER ASSEMBLIES
• SECURE CABLES TO END CAP ASSEMBLIES
• INSTALL ACCESS PANELS (TOP, BOTTOM AND ENDS, AS SHOWN)
• INSPECT COMPLETE

FOLDOUT FRAME
MANUFACTURING FLOW AND BUILD PLAN
LOW CONCENTRATION RATIO SOLAR COLLECTOR

ASSEMBLY SEQUENCE
FOR FLIGHT TEST CONFIGURATION

TIME TO MAST/CANNISTER ASSEMBLIES
(TOP AND ENDS, AS SHOWN)

PREPARED BY: K.M. HICKS
DEPT: 761