

**AD-A183 992**

LIGHTWEIGHT TOWED HOMITZER DEMONSTRATOR PHASE 1 AND  
PARTIAL PHASE 2 VOLUM (U) FMC CORP MINNEAPOLIS MINN  
NORTHERN ORDANCE DIV R RATHE ET AL APR 87

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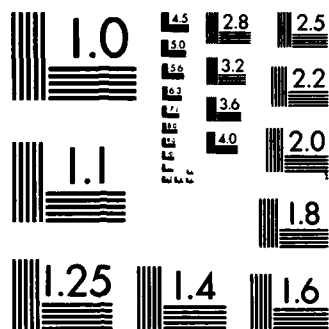
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FMC-E-3041-VOL-D2-PT-4 DAAA21-86-C-0047

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A 10x10 grid of 100 small images. The images show various patterns and textures, likely generated by a generative model. The patterns include solid colors, gradients, and abstract shapes. The colors are primarily black, white, and gray, with some images showing subtle variations in tone and texture. The overall effect is a dense, organized collection of diverse visual samples.



MICROCOPY RESOLUTION TEST CHART  
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Lightweight Towed Howitzer Demonstrator

Final Report

Volume D2 - Part IV

Structural Analysis of Cradle

April 1987

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AD-A183 992

Contract Number DAAA21-86-C-0047

FMC CORPORATION  
Northern Ordnance Division  
4800 East River Road  
Minneapolis, Minnesota 55421

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| 1. REPORT NUMBER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2. GOVT ACCESSION NO.<br><b>AD-A183 991</b> | 3. RECIPIENT'S CATALOG NUMBER                                                                                       |
| 4. TITLE (and Subtitle)<br>Final report for the Lightweight Towed<br>Howitzer Demonstrator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                             | 5. TYPE OF REPORT & PERIOD COVERED<br>Final: 20 December 1985 -<br>13 March 1987                                    |
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| 11. CONTROLLING OFFICE NAME AND ADDRESS<br>AMCCOM<br>AMSMC-PCW-A(D)<br>Dover NJ 07801-5001                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                             | 10. PROGRAM ELEMENT, PROJECT, TASK<br>AREA & WORK UNIT NUMBERS<br>Item 0001<br>LTHD Phase I and Partial<br>Phase II |
| 14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)<br>AMCCOM<br>AMSMC-FSA-F<br>Dover NJ 07801-5001                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                             | 12. REPORT DATE<br>April 1987                                                                                       |
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| 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)<br><br>Same as Block 16.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                             |                                                                                                                     |
| 18. SUPPLEMENTARY NOTES<br><br>None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                             |                                                                                                                     |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) 55mm towed gun howitzer, advanced weapons, composite cradle, composite hydraulic actuators, composite trails, field artillery weapon, firing stability analysis, howitzers, hydraulic control valves with force feedback, hydraulic joystick control of gun direction, hydraulic inertial rammer, hydraulic opening breech, hydraulic primer autoloader, <del>lightweight towed howitzer demonstrator (LTHD)</del> , load out of battery howitzer, mortar howitzer, recoil energy recovery, recoil mechanism, <del>using metal matrix compos-</del> sites, titanium muzzle brake, titanium platform, titanium spade, titanium walking beams, thermal stability, towing stability analysis, unconventional weapons, <del>and weight reduction of artillery</del> |                                             |                                                                                                                     |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number)<br><br>The LTHD (Lightweight Towed Howitzer Demonstrator) was to be a 9,000 lb equivalent to the M198, transportable via Blackhawk helicopter, with reduced emplacement time using fewer personnel. The FMC design achieved weight reduction via a mortar-like configuration, composites structure, and hydraulic actuators. Recovery of power from the recoil system, in turn, facilitated crew reduction via hydraulic emplacement, four-way joystick tube lay, and power ramming. FMC completed Concept Development (Ph I) and two-thirds of Detailed Design (Ph II) prior to funds running out. <i>Key...</i>                                                                                                                                                |                                             |                                                                                                                     |

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D2/350

CRADLE MODEL/PLOTS







LIST SELECTED CLING. IN MARCH 1961 TO 200 BY (LIST MODES)

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None (YES, NO OR CONTINUOUS) :-

| ELER | ROT | TPP | REL | MODES |
|------|-----|-----|-----|-------|
| 186  | 1   | 1   | 1   | 454   |
| 137  | 1   | 1   | 1   | 458   |
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| 458  | 464 | 461 | 454 | 461   |
| 461  | 439 | 443 | 454 | 463   |
| 454  | 461 | 454 | 461 | 454   |
| 474  | 458 | 370 | 382 | 474   |
| 476  | 458 | 456 | 474 | 483   |
| 472  | 454 | 458 | 476 | 478   |
| 476  | 458 | 472 | 478 | 483   |
| 482  | 472 | 478 | 483 | 486   |
| 486  | 482 | 483 | 486 | 500   |
| 500  | 485 | 483 | 505 | 518   |
| 503  | 481 | 505 | 506 | 514   |
| 496  | 503 | 506 | 514 | 516   |
| 516  | 508 | 492 | 430 | 521   |
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| 547  | 525 | 539 | 471 | 461   |
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|------|-----|------|-----|-------|------|------|------|------|------|------|------|--|--|
| 178  | 8   | 2    | 2   | 8045  | 8157 | 8125 | 8081 | 8045 | 8158 | 8127 | 8057 |  |  |
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|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8081  | 8157 | 8125 | 8081 | 8081 | 8158 | 8127 | 8057 |  |  |
|      |     |      |     | 8013  | 8157 | 8156 | 8073 | 8013 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     | 8047  | 8156 | 8156 | 8042 | 8047 | 8158 | 8040 | 8057 |  |  |
|      |     |      |     |       |      |      |      |      |      |      |      |  |  |

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LIST SELECTED ELEM. IN RANGE 800 TO 400 BY 1 (LIST MODES)

[illegible]

MODE (YES, NO OR CONTINUOUS) =

[illegible]

| ELER | PMAT | TYPE | REL | MODES |     |     |     |     |     |     |     |  |  |
|------|------|------|-----|-------|-----|-----|-----|-----|-----|-----|-----|--|--|
| 218  | 2    | 2    | 2   | 378   | 421 | 414 | 372 | 380 | 422 | 416 | 374 |  |  |
|      |      |      |     | 631   | 426 | 670 | 383 | 682 | 428 | 679 | 386 |  |  |
| 219  | 2    | 2    | 2   | 385   | 427 | 415 | 373 | 377 | 419 | 412 | 370 |  |  |
|      |      |      |     | 388   | 422 | 416 | 374 | 378 | 418 | 413 | 371 |  |  |
| 220  | 2    | 2    | 2   | 392   | 428 | 679 | 376 | 886 | 426 | 677 | 378 |  |  |
|      |      |      |     | 395   | 423 | 417 | 377 | 431 | 483 | 505 | 483 |  |  |
| 221  | 2    | 2    | 2   | 400   | 482 | 608 | 466 | 643 | 507 | 807 | 465 |  |  |
|      |      |      |     | 411   | 493 | 505 | 463 | 443 | 485 | 506 | 484 |  |  |
| 222  | 2    | 2    | 2   | 413   | 497 | 687 | 466 | 644 | 510 | 888 | 468 |  |  |
|      |      |      |     | 414   | 488 | 681 | 464 | 430 | 481 | 503 | 461 |  |  |
| 223  | 2    | 2    | 2   | 416   | 488 | 688 | 468 | 432 | 502 | 685 | 460 |  |  |
|      |      |      |     | 444   | 486 | 513 | 471 | 462 | 505 | 458 | 456 |  |  |
| 224  | 2    | 2    | 2   | 480   | 480 | 677 | 378 | 463 | 509 | 684 | 467 |  |  |
|      |      |      |     | 415   | 489 | 487 | 465 | 464 | 506 | 508 | 458 |  |  |
| 225  | 2    | 2    | 2   | 416   | 488 | 684 | 467 | 465 | 508 | 685 | 470 |  |  |
|      |      |      |     | 417   | 508 | 684 | 467 | 468 | 512 | 685 | 470 |  |  |
| 226  | 2    | 2    | 2   | 489   | 511 | 499 | 487 | 469 | 512 | 685 | 470 |  |  |

| CELLER | YEAR | TYPE | REL. | MODES | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 |
|--------|------|------|------|-------|------|------|------|------|------|------|
| 225    | 2    | 2    | 469  | 806   | 808  | 458  | 451  | 502  | 485  | 454  |
|        |      |      | 688  | 512   | 485  | 478  | 506  | 504  | 682  |      |
|        |      |      | 711  | 513   | 501  | 481  | 505  | 504  | 682  |      |
| 226    | 2    | 2    | 438  | 481   | 503  | 481  | 505  | 547  | 589  | 547  |
|        |      |      | 622  | 502   | 486  | 480  | 488  | 601  | 602  | 549  |
|        |      |      | 526  | 525   | 552  | 550  |      |      |      |      |

| ELLEN MAY |   | TYP |   | REL |   | MODES |   |
|-----------|---|-----|---|-----|---|-------|---|
| 227       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 228       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 229       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 230       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 231       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 232       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 233       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 234       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 235       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 236       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 237       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 238       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 239       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 240       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 241       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 242       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 243       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 244       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 245       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 246       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 247       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 248       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 249       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 250       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 251       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 252       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 253       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 254       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 255       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 256       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 257       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 258       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 259       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 260       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 261       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 262       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 263       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 264       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 265       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 266       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 267       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 268       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 269       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 270       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 271       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 272       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 273       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 274       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 275       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 276       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 277       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 278       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 279       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 280       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 281       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 282       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 283       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 284       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 285       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 286       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 287       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 288       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |

| ELLEN PART TYP REL |   |   | MODES |     |     |     |     |     |     |     |  |  |
|--------------------|---|---|-------|-----|-----|-----|-----|-----|-----|-----|--|--|
| 241                | 2 | 2 | 326   | 346 | 352 | 228 | 372 | 416 | 428 | 390 |  |  |
|                    |   |   | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
| 242                | 2 | 2 | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
|                    |   |   | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
| 243                | 2 | 2 | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
|                    |   |   | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
| 244                | 2 | 2 | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
|                    |   |   | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
| 245                | 2 | 2 | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
|                    |   |   | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
| 246                | 2 | 2 | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
|                    |   |   | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
| 247                | 2 | 2 | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
|                    |   |   | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |

[illegible][illegible]

| ELLEN MAY |   | TYP |   | REL |   | MODES |   |
|-----------|---|-----|---|-----|---|-------|---|
| 227       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 228       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 229       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 230       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 231       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 232       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 233       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 234       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 235       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 236       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 237       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 238       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 239       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 240       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 241       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 242       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 243       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 244       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 245       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 246       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 247       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 248       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 249       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 250       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 251       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 252       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 253       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 254       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 255       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 256       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 257       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 258       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 259       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 260       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 261       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 262       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 263       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 264       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 265       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 266       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 267       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 268       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 269       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 270       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 271       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 272       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 273       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 274       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 275       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 276       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 277       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 278       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 279       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 280       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 281       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 282       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 283       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 284       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 285       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 286       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 287       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |
| 288       | 2 | 2   | 2 | 2   | 2 | 2     | 2 |

| ELLEN PART TYP REL |   |   | MODES |     |     |     |     |     |     |     |  |  |
|--------------------|---|---|-------|-----|-----|-----|-----|-----|-----|-----|--|--|
| 241                | 2 | 2 | 326   | 346 | 352 | 228 | 372 | 416 | 428 | 390 |  |  |
|                    |   |   | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
| 242                | 2 | 2 | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
|                    |   |   | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
| 243                | 2 | 2 | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
|                    |   |   | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
| 247                | 2 | 2 | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |
|                    |   |   | 328   | 348 | 354 | 230 | 374 | 418 | 430 | 392 |  |  |

[illegible]

|      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|





1157 SUBJECTS (LEADS, IN RANGE 400 TO 600 BY 1 (1157 MODES)

| ELER | WAT | TYP | REL | MODES |
|------|-----|-----|-----|-------|
| 000  | 1   | 1   | 1   | 2458  |
| 001  | 1   | 1   | 1   | 176   |
| 002  | 1   | 1   | 1   | 2454  |
| 003  | 1   | 1   | 1   | 2850  |
| 004  | 1   | 1   | 1   | 2437  |
| 005  | 1   | 1   | 1   | 2452  |
| 006  | 1   | 1   | 1   | 2453  |
| 007  | 1   | 1   | 1   | 2455  |
| 008  | 1   | 1   | 1   | 2456  |
| 009  | 1   | 1   | 1   | 2457  |
| 010  | 1   | 1   | 1   | 2458  |
| 011  | 1   | 1   | 1   | 2459  |
| 012  | 1   | 1   | 1   | 2460  |
| 013  | 1   | 1   | 1   | 2461  |
| 014  | 1   | 1   | 1   | 2462  |
| 015  | 1   | 1   | 1   | 2463  |
| 016  | 1   | 1   | 1   | 2464  |
| 017  | 1   | 1   | 1   | 2465  |
| 018  | 1   | 1   | 1   | 2466  |
| 019  | 1   | 1   | 1   | 2467  |
| 020  | 1   | 1   | 1   | 2468  |
| 021  | 1   | 1   | 1   | 2469  |
| 022  | 1   | 1   | 1   | 2470  |
| 023  | 1   | 1   | 1   | 2471  |
| 024  | 1   | 1   | 1   | 2472  |
| 025  | 1   | 1   | 1   | 2473  |
| 026  | 1   | 1   | 1   | 2474  |
| 027  | 1   | 1   | 1   | 2475  |
| 028  | 1   | 1   | 1   | 2476  |
| 029  | 1   | 1   | 1   | 2477  |
| 030  | 1   | 1   | 1   | 2478  |
| 031  | 1   | 1   | 1   | 2479  |
| 032  | 1   | 1   | 1   | 2480  |
| 033  | 1   | 1   | 1   | 2481  |
| 034  | 1   | 1   | 1   | 2482  |
| 035  | 1   | 1   | 1   | 2483  |
| 036  | 1   | 1   | 1   | 2484  |
| 037  | 1   | 1   | 1   | 2485  |
| 038  | 1   | 1   | 1   | 2486  |
| 039  | 1   | 1   | 1   | 2487  |
| 040  | 1   | 1   | 1   | 2488  |
| 041  | 1   | 1   | 1   | 2489  |
| 042  | 1   | 1   | 1   | 2490  |
| 043  | 1   | 1   | 1   | 2491  |
| 044  | 1   | 1   | 1   | 2492  |
| 045  | 1   | 1   | 1   | 2493  |
| 046  | 1   | 1   | 1   | 2494  |
| 047  | 1   | 1   | 1   | 2495  |
| 048  | 1   | 1   | 1   | 2496  |
| 049  | 1   | 1   | 1   | 2497  |
| 050  | 1   | 1   | 1   | 2498  |
| 051  | 1   | 1   | 1   | 2499  |
| 052  | 1   | 1   | 1   | 2500  |
| 053  | 1   | 1   | 1   | 2501  |
| 054  | 1   | 1   | 1   | 2502  |
| 055  | 1   | 1   | 1   | 2503  |
| 056  | 1   | 1   | 1   | 2504  |
| 057  | 1   | 1   | 1   | 2505  |
| 058  | 1   | 1   | 1   | 2506  |
| 059  | 1   | 1   | 1   | 2507  |
| 060  | 1   | 1   | 1   | 2508  |
| 061  | 1   | 1   | 1   | 2509  |
| 062  | 1   | 1   | 1   | 2510  |
| 063  | 1   | 1   | 1   | 2511  |
| 064  | 1   | 1   | 1   | 2512  |
| 065  | 1   | 1   | 1   | 2513  |
| 066  | 1   | 1   | 1   | 2514  |
| 067  | 1   | 1   | 1   | 2515  |
| 068  | 1   | 1   | 1   | 2516  |
| 069  | 1   | 1   | 1   | 2517  |
| 070  | 1   | 1   | 1   | 2518  |
| 071  | 1   | 1   | 1   | 2519  |
| 072  | 1   | 1   | 1   | 2520  |
| 073  | 1   | 1   | 1   | 2521  |
| 074  | 1   | 1   | 1   | 2522  |
| 075  | 1   | 1   | 1   | 2523  |
| 076  | 1   | 1   | 1   | 2524  |
| 077  | 1   | 1   | 1   | 2525  |
| 078  | 1   | 1   | 1   | 2526  |
| 079  | 1   | 1   | 1   | 2527  |
| 080  | 1   | 1   | 1   | 2528  |
| 081  | 1   | 1   | 1   | 2529  |
| 082  | 1   | 1   | 1   | 2530  |
| 083  | 1   | 1   | 1   | 2531  |
| 084  | 1   | 1   | 1   | 2532  |
| 085  | 1   | 1   | 1   | 2533  |
| 086  | 1   | 1   | 1   | 2534  |
| 087  | 1   | 1   | 1   | 2535  |
| 088  | 1   | 1   | 1   | 2536  |
| 089  | 1   | 1   | 1   | 2537  |
| 090  | 1   | 1   | 1   | 2538  |
| 091  | 1   | 1   | 1   | 2539  |
| 092  | 1   | 1   | 1   | 2540  |
| 093  | 1   | 1   | 1   | 2541  |
| 094  | 1   | 1   | 1   | 2542  |
| 095  | 1   | 1   | 1   | 2543  |
| 096  | 1   | 1   | 1   | 2544  |
| 097  | 1   | 1   | 1   | 2545  |
| 098  | 1   | 1   | 1   | 2546  |
| 099  | 1   | 1   | 1   | 2547  |
| 100  | 1   | 1   | 1   | 2548  |

420 1 1 2542 2-  
MORE 1 VES. NO OR CONTINUOUS).

| CLER | POS | TYP | REL | MODES |
|------|-----|-----|-----|-------|
| 481  | 1   | 1   | 1   | 2645  |
| 482  | 1   | 1   | 1   | 2646  |
| 483  | 1   | 1   | 1   | 2647  |
| 484  | 1   | 1   | 1   | 2648  |
| 485  | 1   | 1   | 1   | 2649  |
| 486  | 1   | 1   | 1   | 2650  |
| 487  | 1   | 1   | 1   | 2651  |
| 488  | 1   | 1   | 1   | 2652  |
| 489  | 1   | 1   | 1   | 2653  |
| 490  | 1   | 1   | 1   | 2654  |
| 491  | 1   | 1   | 1   | 2655  |
| 492  | 1   | 1   | 1   | 2656  |
| 493  | 1   | 1   | 1   | 2657  |
| 494  | 1   | 1   | 1   | 2658  |
| 495  | 1   | 1   | 1   | 2659  |
| 496  | 1   | 1   | 1   | 2660  |
| 497  | 1   | 1   | 1   | 2661  |
| 498  | 1   | 1   | 1   | 2662  |
| 499  | 1   | 1   | 1   | 2663  |
| 500  | 1   | 1   | 1   | 2664  |
| 501  | 1   | 1   | 1   | 2665  |
| 502  | 1   | 1   | 1   | 2666  |
| 503  | 1   | 1   | 1   | 2667  |
| 504  | 1   | 1   | 1   | 2668  |
| 505  | 1   | 1   | 1   | 2669  |
| 506  | 1   | 1   | 1   | 2670  |
| 507  | 1   | 1   | 1   | 2671  |
| 508  | 1   | 1   | 1   | 2672  |
| 509  | 1   | 1   | 1   | 2673  |
| 510  | 1   | 1   | 1   | 2674  |
| 511  | 1   | 1   | 1   | 2675  |
| 512  | 1   | 1   | 1   | 2676  |
| 513  | 1   | 1   | 1   | 2677  |
| 514  | 1   | 1   | 1   | 2678  |
| 515  | 1   | 1   | 1   | 2679  |
| 516  | 1   | 1   | 1   | 2680  |
| 517  | 1   | 1   | 1   | 2681  |
| 518  | 1   | 1   | 1   | 2682  |
| 519  | 1   | 1   | 1   | 2683  |
| 520  | 1   | 1   | 1   | 2684  |
| 521  | 1   | 1   | 1   | 2685  |
| 522  | 1   | 1   | 1   | 2686  |
| 523  | 1   | 1   | 1   | 2687  |
| 524  | 1   | 1   | 1   | 2688  |
| 525  | 1   | 1   | 1   | 2689  |
| 526  | 1   | 1   | 1   | 2690  |
| 527  | 1   | 1   | 1   | 2691  |
| 528  | 1   | 1   | 1   | 2692  |
| 529  | 1   | 1   | 1   | 2693  |
| 530  | 1   | 1   | 1   | 2694  |
| 531  | 1   | 1   | 1   | 2695  |
| 532  | 1   | 1   | 1   | 2696  |
| 533  | 1   | 1   | 1   | 2697  |
| 534  | 1   | 1   | 1   | 2698  |
| 535  | 1   | 1   | 1   | 2699  |
| 536  | 1   | 1   | 1   | 2700  |
| 537  | 1   | 1   | 1   | 2701  |
| 538  | 1   | 1   | 1   | 2702  |
| 539  | 1   | 1   | 1   | 2703  |
| 540  | 1   | 1   | 1   | 2704  |
| 541  | 1   | 1   | 1   | 2705  |
| 542  | 1   | 1   | 1   | 2706  |
| 543  | 1   | 1   | 1   | 2707  |
| 544  | 1   | 1   | 1   | 2708  |
| 545  | 1   | 1   | 1   | 2709  |
| 546  | 1   | 1   | 1   | 2710  |
| 547  | 1   | 1   | 1   | 2711  |
| 548  | 1   | 1   | 1   | 2712  |
| 549  | 1   | 1   | 1   | 2713  |
| 550  | 1   | 1   | 1   | 2714  |
| 551  | 1   | 1   | 1   | 2715  |
| 552  | 1   | 1   | 1   | 2716  |
| 553  | 1   | 1   | 1   | 2717  |
| 554  | 1   | 1   | 1   | 2718  |
| 555  | 1   | 1   | 1   | 2719  |
| 556  | 1   | 1   | 1   | 2720  |
| 557  | 1   | 1   | 1   | 2721  |
| 558  | 1   | 1   | 1   | 2722  |
| 559  | 1   | 1   | 1   | 2723  |
| 560  | 1   | 1   | 1   | 2724  |
| 561  | 1   | 1   | 1   | 2725  |
| 562  | 1   | 1   | 1   | 2726  |
| 563  | 1   | 1   | 1   | 2727  |
| 564  | 1   | 1   | 1   | 2728  |
| 565  | 1   | 1   | 1   | 2729  |
| 566  | 1   | 1   | 1   | 2730  |
| 567  | 1   | 1   | 1   | 2731  |
| 568  | 1   | 1   | 1   | 2732  |
| 569  | 1   | 1   | 1   | 2733  |
| 570  | 1   | 1   | 1   | 2734  |
| 571  | 1   | 1   | 1   | 2735  |
| 572  | 1   | 1   | 1   | 2736  |
| 573  | 1   | 1   | 1   | 2737  |
| 574  | 1   | 1   | 1   | 2738  |
| 575  | 1   | 1   | 1   | 2739  |
| 576  | 1   | 1   | 1   | 2740  |
| 577  | 1   | 1   | 1   | 2741  |
| 578  | 1   | 1   | 1   | 2742  |
| 579  | 1   | 1   | 1   | 2743  |
| 580  | 1   | 1   | 1   | 2744  |
| 581  | 1   | 1   | 1   | 2745  |

| ELER | PMY | TPY | REL | MODES |
|------|-----|-----|-----|-------|
| 439  | 1   | 1   | 1   | 2893  |
| 440  | 1   | 1   | 1   | 4051  |
| 441  | 1   | 1   | 1   | 4177  |
| 442  | 1   | 1   | 1   | 4303  |
| 443  | 1   | 1   | 1   | 4429  |
| 444  | 1   | 1   | 1   | 4555  |
| 445  | 1   | 1   | 1   | 4681  |
| 446  | 1   | 1   | 1   | 4807  |
| 447  | 1   | 1   | 1   | 4933  |
| 448  | 1   | 1   | 1   | 5059  |
| 449  | 1   | 1   | 1   | 5185  |
| 450  | 1   | 1   | 1   | 5311  |
| 451  | 1   | 1   | 1   | 5437  |
| 452  | 1   | 1   | 1   | 5563  |
| 453  | 1   | 1   | 1   | 5689  |
| 454  | 1   | 1   | 1   | 5815  |
| 455  | 1   | 1   | 1   | 5941  |
| 456  | 1   | 1   | 1   | 6067  |
| 457  | 1   | 1   | 1   | 6193  |
| 458  | 1   | 1   | 1   | 6319  |
| 459  | 1   | 1   | 1   | 6445  |
| 460  | 1   | 1   | 1   | 6571  |
| 461  | 1   | 1   | 1   | 6697  |
| 462  | 1   | 1   | 1   | 6823  |
| 463  | 1   | 1   | 1   | 6949  |
| 464  | 1   | 1   | 1   | 7075  |
| 465  | 1   | 1   | 1   | 7201  |
| 466  | 1   | 1   | 1   | 7327  |
| 467  | 2   | 2   | 2   | 7453  |
| 468  | 2   | 2   | 2   | 7579  |
| 469  | 2   | 2   | 2   | 7705  |
| 470  | 2   | 2   | 2   | 7831  |
| 471  | 2   | 2   | 2   | 7957  |
| 472  | 2   | 2   | 2   | 8083  |
| 473  | 2   | 2   | 2   | 8209  |
| 474  | 2   | 2   | 2   | 8335  |
| 475  | 2   | 2   | 2   | 8461  |
| 476  | 2   | 2   | 2   | 8587  |
| 477  | 2   | 2   | 2   | 8713  |
| 478  | 2   | 2   | 2   | 8839  |
| 479  | 2   | 2   | 2   | 8965  |
| 480  | 2   | 2   | 2   | 9091  |
| 481  | 2   | 2   | 2   | 9217  |
| 482  | 2   | 2   | 2   | 9343  |
| 483  | 2   | 2   | 2   | 9469  |
| 484  | 2   | 2   | 2   | 9595  |
| 485  | 2   | 2   | 2   | 9721  |
| 486  | 2   | 2   | 2   | 9847  |
| 487  | 2   | 2   | 2   | 9973  |
| 488  | 2   | 2   | 2   | 10000 |

| ELER PMY TPY REL |   |   |   | NOSES |       |       |       |       |       |       |       |
|------------------|---|---|---|-------|-------|-------|-------|-------|-------|-------|-------|
| 456              | 2 | 2 | 2 | 2,415 | 2,487 | 2,481 | 2,432 | 2,534 | 2,576 | 2,587 | 2,526 |
|                  |   |   |   | 2,420 | 2,480 | 2,442 | 2,436 | 2,546 | 2,578 | 2,610 | 2,536 |
| 467              | 2 | 2 | 2 | 2,414 | 2,476 | 2,465 | 2,532 | 2,574 | 2,588 | 2,627 |       |
|                  |   |   |   | 2,416 | 2,478 | 2,449 | 2,555 | 2,647 | 2,679 | 2,688 | 2,637 |
|                  |   |   |   | 2,445 | 2,478 | 2,448 | 2,548 | 2,556 |       |       |       |
| 468              | 2 | 2 | 2 | 2,533 | 2,575 | 2,574 | 2,657 | 2,629 | 2,571 | 2,585 | 2,523 |
|                  |   |   |   | 2,532 | 2,574 | 2,569 |       |       |       |       |       |

| ELEM MAT TYP REL |   |   |   |   |   |   |   | NODES |      |      |      |      |      |      |      |
|------------------|---|---|---|---|---|---|---|-------|------|------|------|------|------|------|------|
| 450              | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2847  | 2579 | 2650 | 2637 | 2646 | 2572 | 2648 | 2530 |
| 451              | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2848  | 2580 | 2651 | 2638 | 2647 | 2573 | 2649 | 2531 |
| 452              | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2849  | 2581 | 2652 | 2639 | 2648 | 2574 | 2650 | 2532 |
| 453              | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2850  | 2582 | 2653 | 2640 | 2649 | 2575 | 2651 | 2533 |
| 454              | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2851  | 2583 | 2654 | 2641 | 2650 | 2576 | 2652 | 2534 |
| 455              | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2852  | 2584 | 2655 | 2642 | 2651 | 2577 | 2653 | 2535 |
| 456              | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2853  | 2585 | 2656 | 2643 | 2652 | 2578 | 2654 | 2536 |
| 457              | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2854  | 2586 | 2657 | 2644 | 2653 | 2579 | 2655 | 2537 |
| 458              | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2855  | 2587 | 2658 | 2645 | 2654 | 2580 | 2656 | 2538 |
| 459              | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2856  | 2588 | 2659 | 2646 | 2655 | 2581 | 2657 | 2539 |
| 460              | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2857  | 2589 | 2660 | 2647 | 2656 | 2582 | 2658 | 2540 |
| 461              | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2858  | 2590 | 2661 | 2648 | 2657 | 2583 | 2659 | 2541 |
| 462              | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2859  | 2591 | 2662 | 2649 | 2658 | 2584 | 2660 | 2542 |
| 463              | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2860  | 2592 | 2663 | 2650 | 2659 | 2585 | 2661 | 2543 |
| 464              | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2861  | 2593 | 2664 | 2651 | 2660 | 2586 | 2662 | 2544 |
| 465              | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2862  | 2594 | 2665 | 2652 | 2661 | 2587 | 2663 | 2545 |
| 466              | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2863  | 2595 | 2666 | 2653 | 2662 | 2588 | 2664 | 2546 |
| 467              | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2864  | 2596 | 2667 | 2654 | 2663 | 2589 | 2665 | 2547 |
| 468              | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2865  | 2597 | 2668 | 2655 | 2664 | 2590 | 2666 | 2548 |
| 469              | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2866  | 2598 | 2669 | 2656 | 2665 | 2591 | 2667 | 2549 |
| 470              | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2867  | 2599 | 2670 | 2657 | 2666 | 2592 | 2668 | 2550 |
| 471              | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2868  | 2600 | 2671 | 2658 | 2667 | 2593 | 2669 | 2551 |
| 472              | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2869  | 2601 | 2672 | 2659 | 2668 | 2594 | 2670 | 2552 |
| 473              | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2870  | 2602 | 2673 | 2660 | 2669 | 2595 | 2671 | 2553 |
| 474              | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2871  | 2603 | 2674 | 2661 | 2670 | 2596 | 2672 | 2554 |
| 475              | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2872  | 2604 | 2675 | 2662 | 2671 | 2597 | 2673 | 2555 |

| ELEN MAT TYP REL |   | MOSES |      |      |      |      |      |      |  |  |  |
|------------------|---|-------|------|------|------|------|------|------|--|--|--|
| 476              | 2 | 2     | 2245 | 2389 | 2347 | 2289 | 2310 | 2258 |  |  |  |
|                  |   |       | 2269 | 2311 | 2360 | 2330 | 2314 | 2272 |  |  |  |
|                  |   |       | 2246 | 2283 | 2260 | 2243 | 2265 | 2258 |  |  |  |
| 477              | 2 | 2     | 2247 | 2289 | 2310 | 2285 | 2297 | 2265 |  |  |  |
|                  |   |       | 2248 | 2287 | 2276 | 2268 | 2296 | 2264 |  |  |  |
| 478              | 2 | 2     | 2255 | 2310 | 2275 | 2275 | 2286 | 2264 |  |  |  |
|                  |   |       | 2251 | 2299 | 2266 | 2262 | 2283 | 2264 |  |  |  |
|                  |   |       | 2257 | 2310 | 2276 | 2268 | 2310 | 2262 |  |  |  |
| 479              | 2 | 2     | 2273 | 2313 | 2274 | 2274 | 2316 | 2274 |  |  |  |
|                  |   |       | 2272 | 2315 | 2283 | 2261 | 2285 | 2287 |  |  |  |
| 480              | 2 | 2     | 2282 | 2318 | 2284 | 2262 | 2282 | 2286 |  |  |  |
|                  |   |       | 2276 | 2317 | 2285 | 2263 | 2272 | 2288 |  |  |  |
| 481              | 2 | 2     | 2276 | 2317 | 2285 | 2263 | 2282 | 2286 |  |  |  |
|                  |   |       | 2283 | 2306 | 2278 | 2264 | 2287 | 2284 |  |  |  |
| 482              | 2 | 2     | 2282 | 2307 | 2283 | 2262 | 2287 | 2286 |  |  |  |
|                  |   |       | 2282 | 2307 | 2283 | 2262 | 2287 | 2286 |  |  |  |
|                  |   |       | 2282 | 2308 | 2284 | 2266 | 2287 | 2286 |  |  |  |
|                  |   |       | 2287 | 2317 | 2285 | 2263 | 2282 | 2286 |  |  |  |

| ALLEN UNIT | TYPE | WELL | MODELS | 2347 | 2341 | 2340 | 2336 | 2357 | 2389 | 2421 | 2370 |
|------------|------|------|--------|------|------|------|------|------|------|------|------|
| 483        | 2    | 2    | 2      | 2632 | 2348 | 2676 | 2334 | 2637 | 2423 | 2461 | 2341 |
| 484        | 2    | 2    | 2      | 2356 | 2348 | 2434 | 2370 | 2639 | 2491 | 2422 | 2340 |
| 485        | 2    | 2    | 2      | 2637 | 2359 | 2421 | 2370 | 2638 | 2426 | 2422 | 2344 |
| 486        | 2    | 2    | 2      | 2358 | 2400 | 2427 | 2366 | 2656 | 2387 | 2419 | 2377 |
| 487        | 2    | 2    | 2      | 2359 | 2401 | 2428 | 2366 | 2656 | 2418 | 2420 | 2376 |
| 488        | 2    | 2    | 2      | 2358 | 2400 | 2427 | 2366 | 2656 | 2418 | 2420 | 2376 |
| 489        | 2    | 2    | 2      | 2356 | 2397 | 2416 | 2377 | 2641 | 2423 | 2423 | 2443 |
| 490        | 2    | 2    | 2      | 2356 | 2397 | 2416 | 2377 | 2641 | 2423 | 2423 | 2443 |
| 491        | 2    | 2    | 2      | 2356 | 2397 | 2416 | 2377 | 2641 | 2423 | 2423 | 2443 |
| 492        | 2    | 2    | 2      | 2356 | 2397 | 2416 | 2377 | 2641 | 2423 | 2423 | 2443 |
| 493        | 2    | 2    | 2      | 2356 | 2397 | 2416 | 2377 | 2641 | 2423 | 2423 | 2443 |
| 494        | 2    | 2    | 2      | 2356 | 2397 | 2416 | 2377 | 2641 | 2423 | 2423 | 2443 |
| 495        | 2    | 2    | 2      | 2356 | 2397 | 2416 | 2377 | 2641 | 2423 | 2423 | 2443 |
| 496        | 2    | 2    | 2      | 2356 | 2397 | 2416 | 2377 | 2641 | 2423 | 2423 | 2443 |
| 497        | 2    | 2    | 2      | 2356 | 2397 | 2416 | 2377 | 2641 | 2423 | 2423 | 2443 |
| 498        | 2    | 2    | 2      | 2356 | 2397 | 2416 | 2377 | 2641 | 2423 | 2423 | 2443 |
| 499        | 2    | 2    | 2      | 2356 | 2397 | 2416 | 2377 | 2641 | 2423 | 2423 | 2443 |
| 500        | 2    | 2    | 2      | 2356 | 2397 | 2416 | 2377 | 2641 | 2423 | 2423 | 2443 |



[illegible]















[illegible]







[illegible]











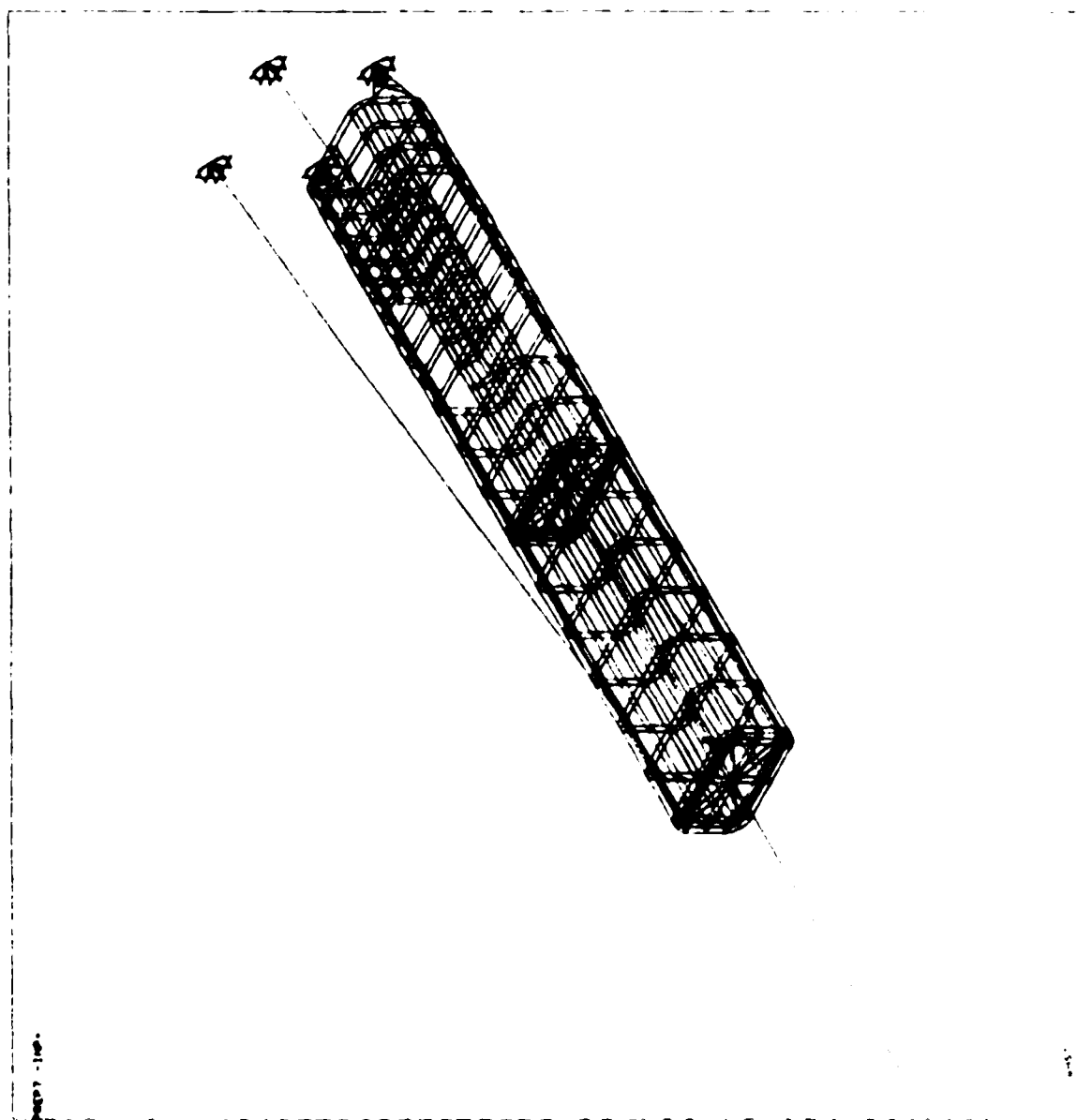








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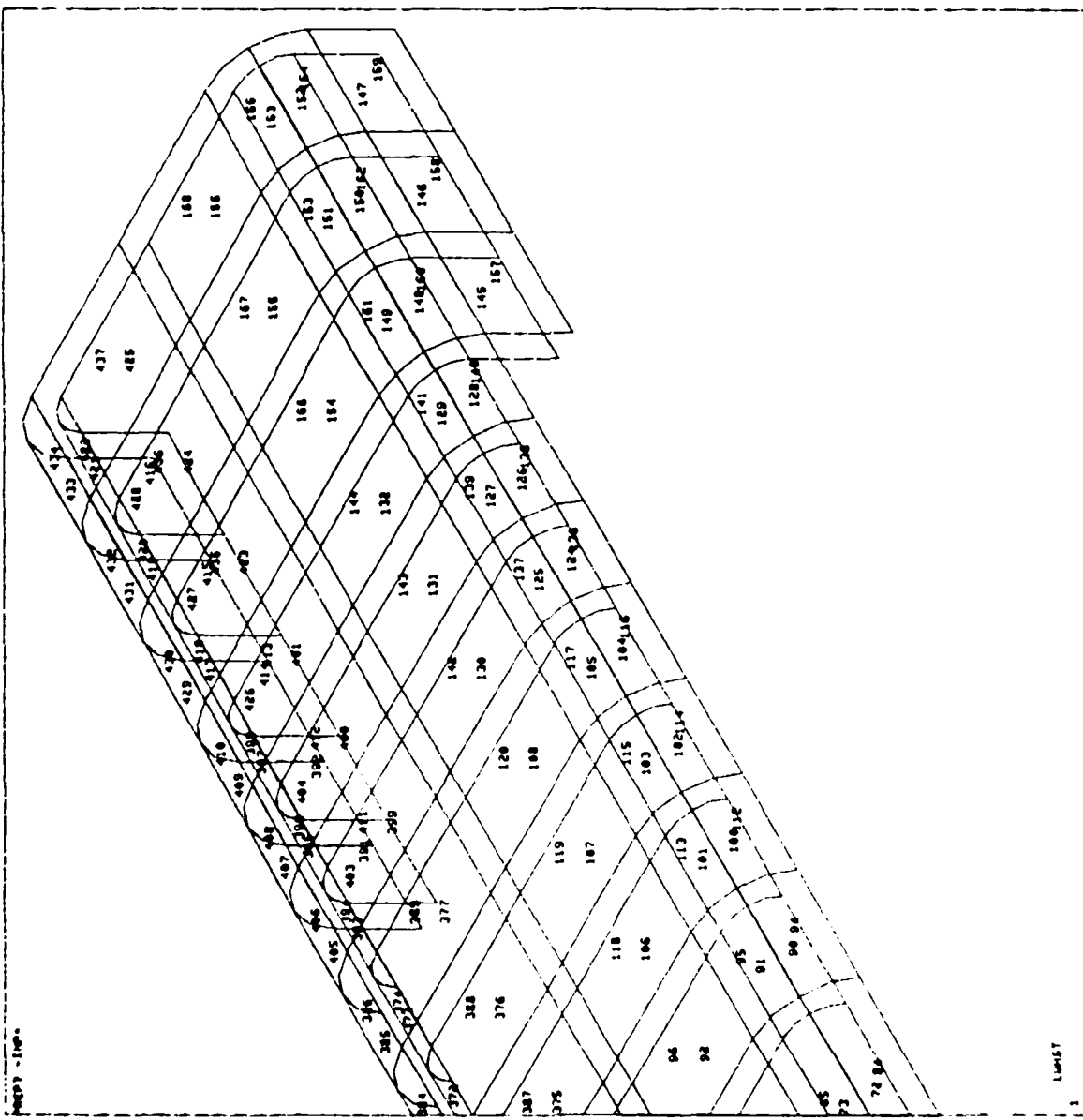






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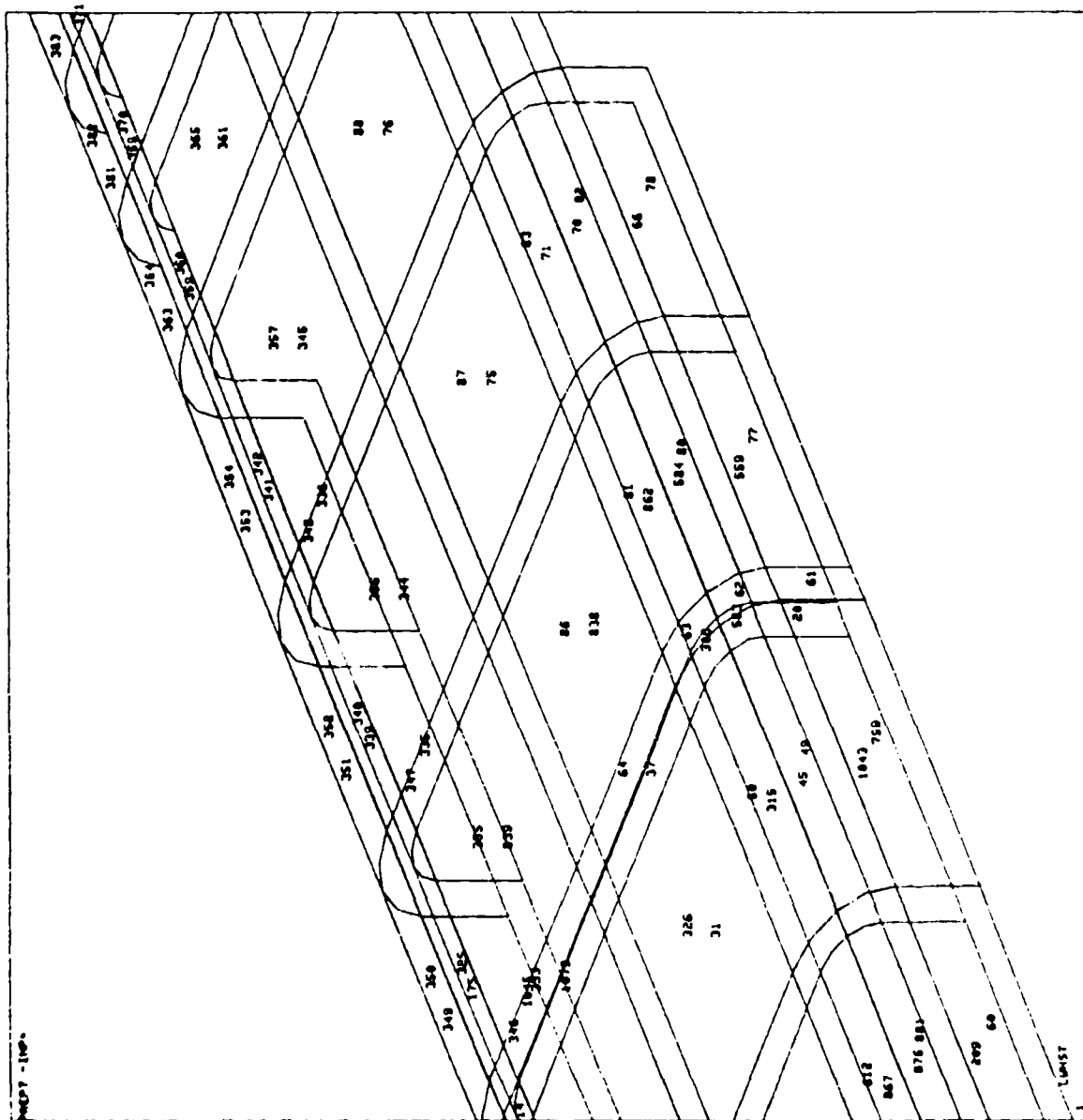
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 YU--1  
 ZU--1  
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1070-1.75

1070-1.75

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K8T0=1.22



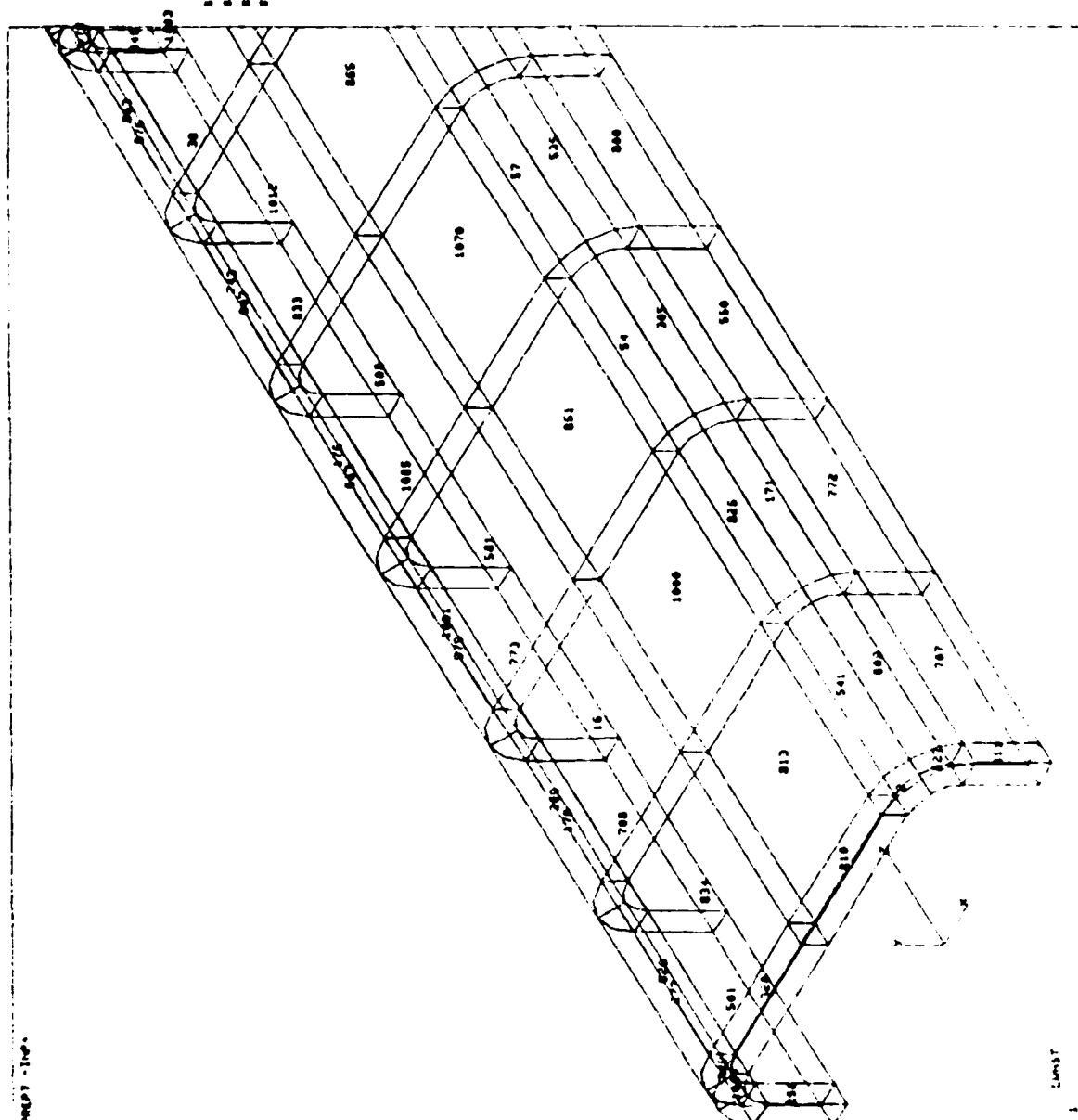




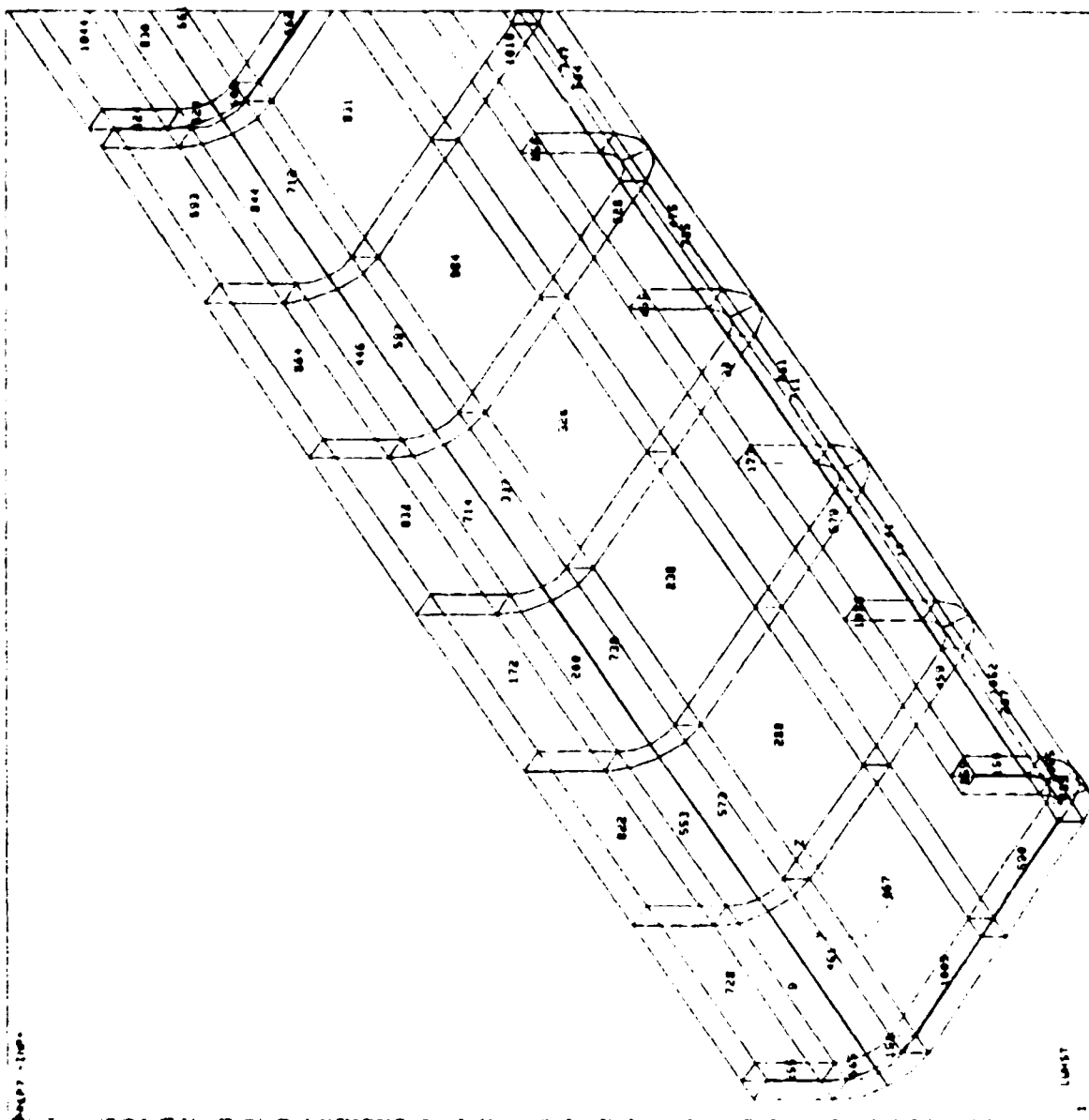




ANSYS 4.22  
 NOV 13 1986  
 15:47:27  
 PREP7 ELEMENTS  
 ENJO-1  
 2008  
 10--1  
 70--1  
 20-1  
 8155-00.4  
 4 10--25.3  
 8 10--16  
 2 20-66.1  
 8155-02.34  
 8155-02.55

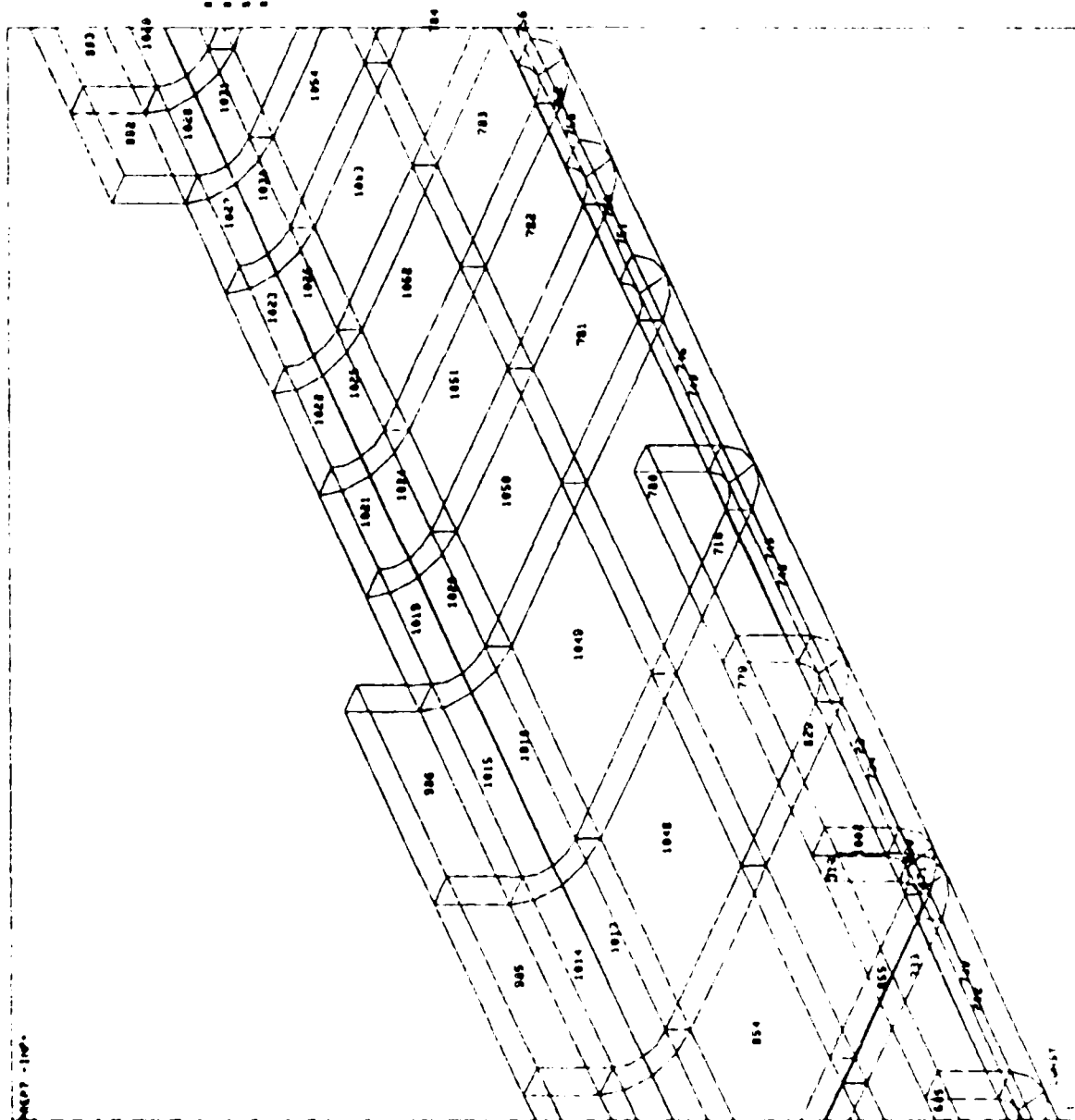


ANALYSIS 4.20  
 NOV 13 1985  
 15:54:07  
 PREP7 ELEMENTS  
 ENP-1  
 ZOOM  
 XMIN=1  
 XMAX=1  
 YMIN=1  
 YMAX=1  
 ZMIN=1  
 ZMAX=1  
 DIST=101  
 AT=20  
 VZ=23.2  
 ZF=22.0  
 NRTD=2.34  
 VRTG=2.82



ANALYSIS 4.43  
 NOV 13 1966  
 1518117  
 PROJECT ELEMENTS  
 LINDA-1

200P  
 R00-1  
 P00-1  
 Z00-1  
 DIST-106  
 AF-0.73  
 VE-0.37  
 VE-1.36  
 ABTO-2.48  
 ABTO-2.82

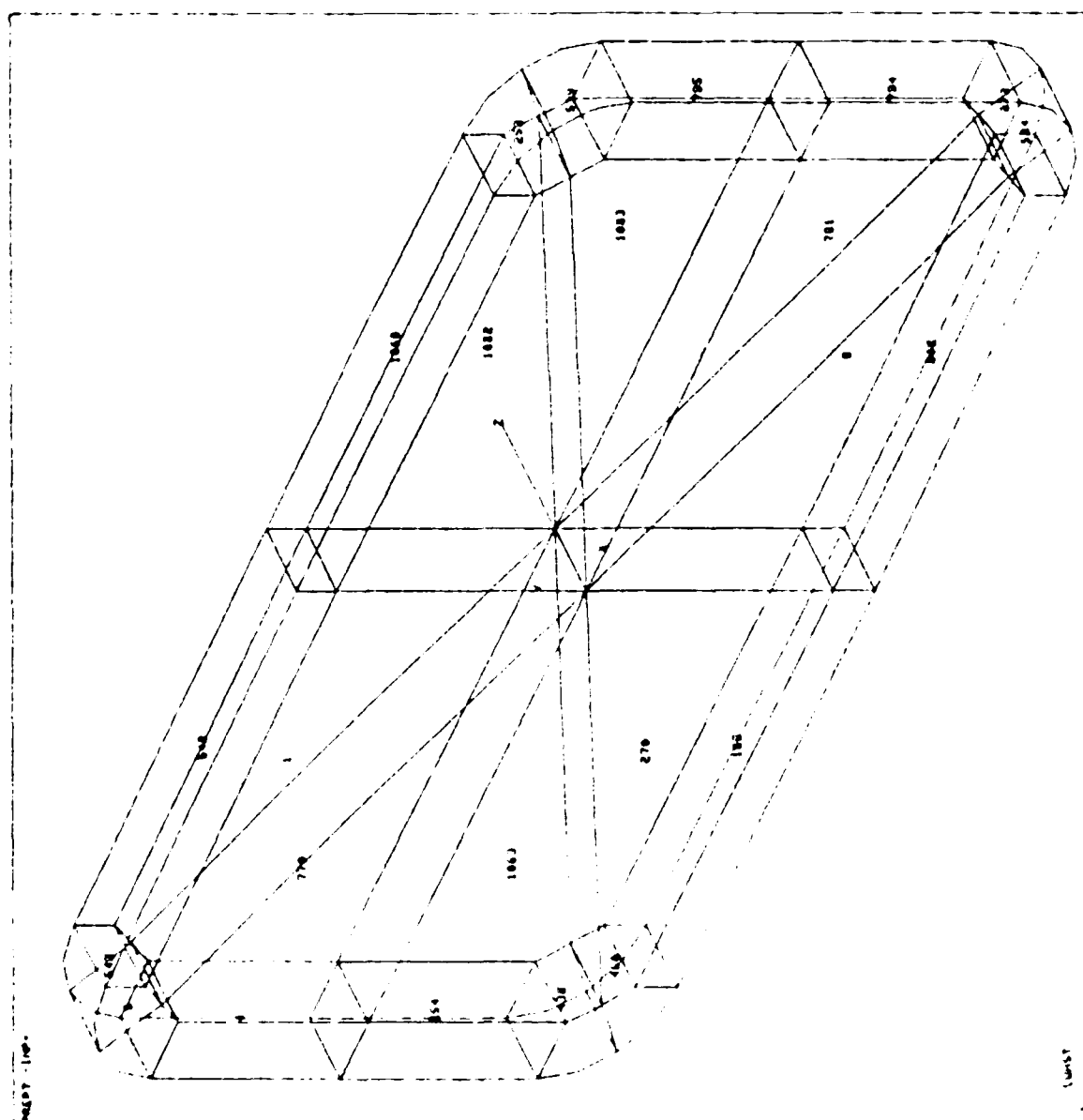








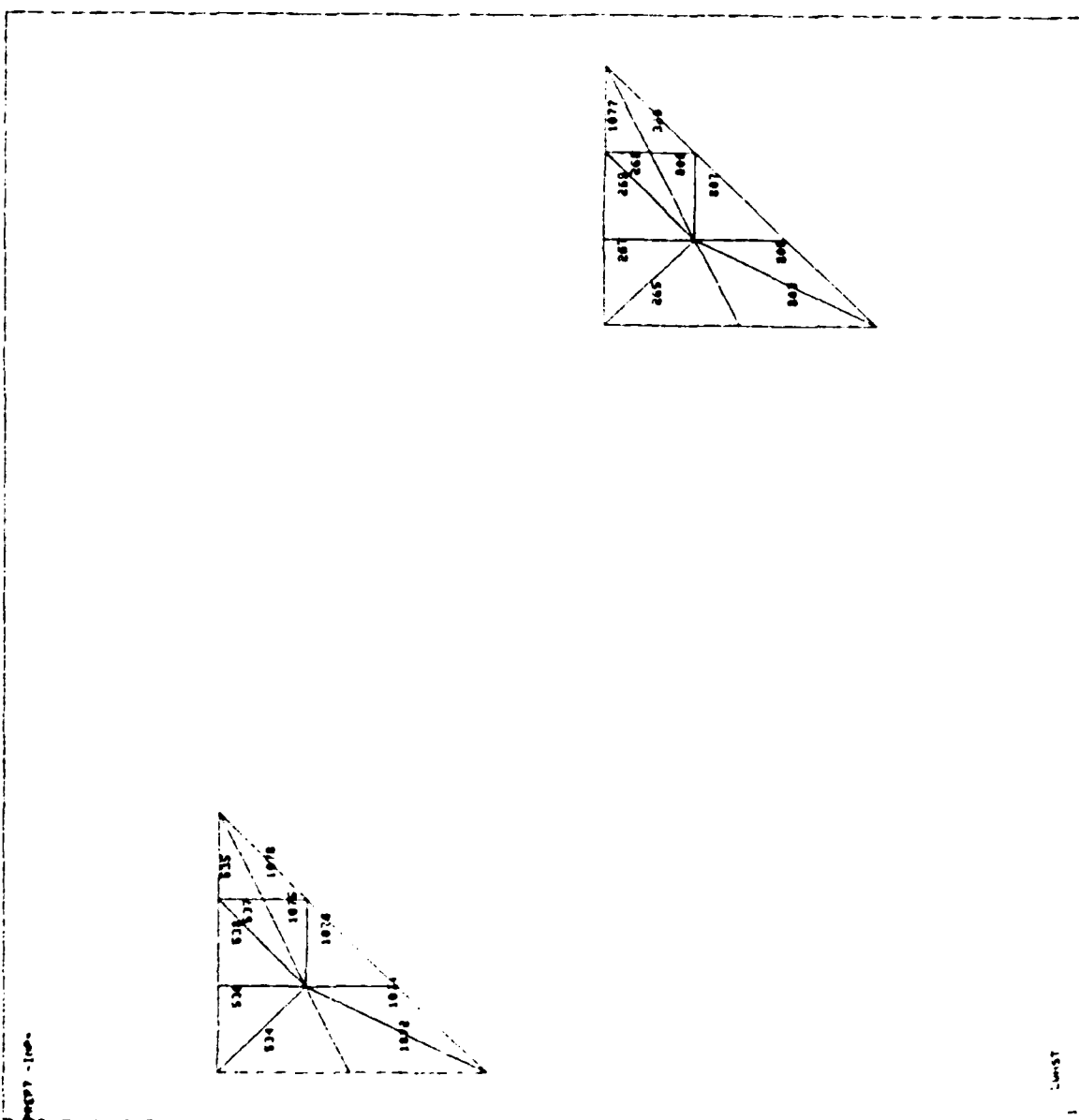
Prof. Muller



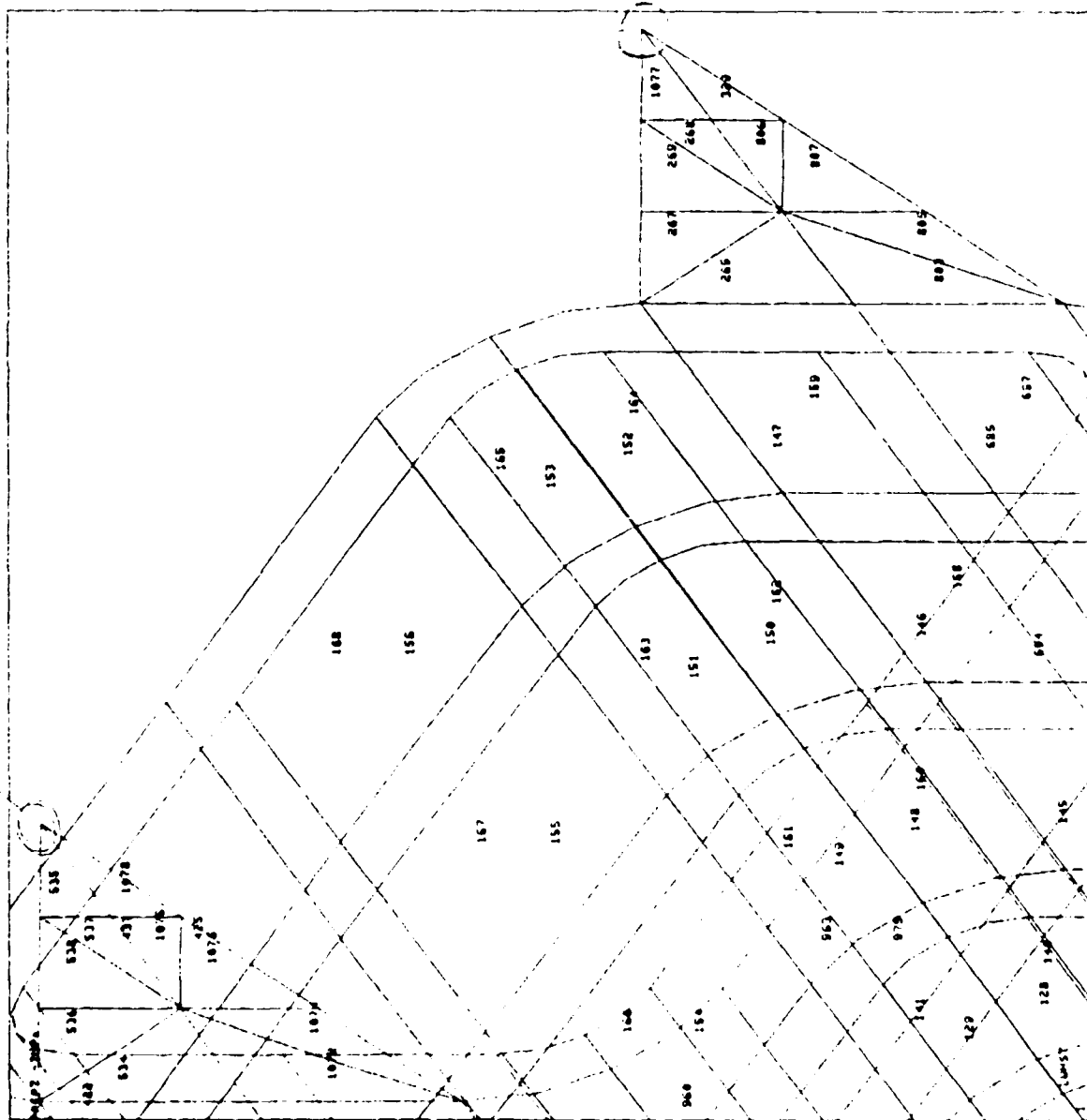
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[illegible]

ANALYS 4.28  
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1615544  
PROG7 ELEMENTS  
ELEM-1  
ZOOM  
MU--1  
VU--1  
ZU-1  
D157-73.8  
AF-2.1  
VF--1.82  
ZF-2.26  
MTQ-4.23  
VMTQ-3.84

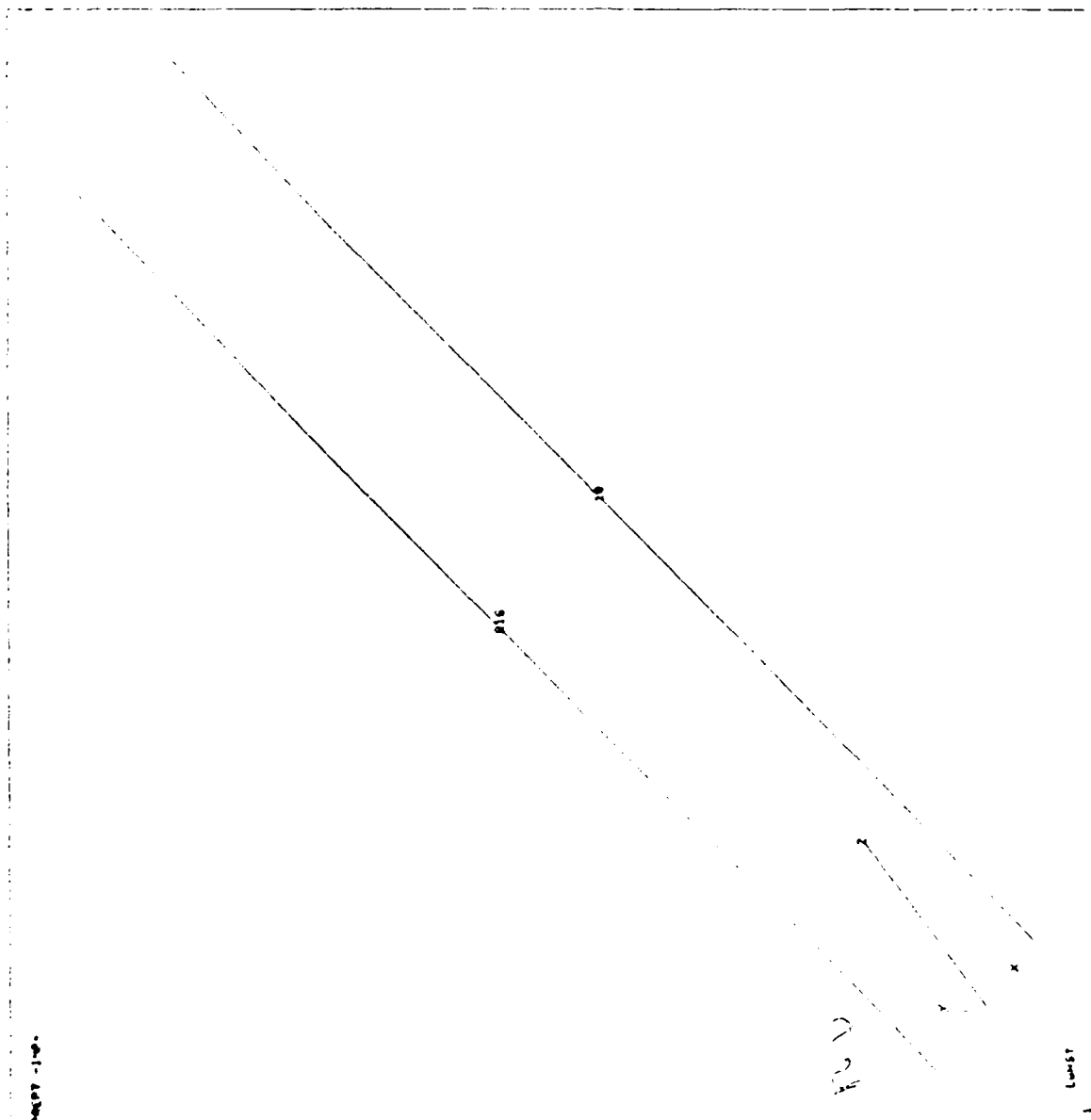


ANSYS 4.23  
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 ROT=1  
 WROT=1  
 ZW=1  
 DIST=74.9  
 M=4.88  
 VF=1.85  
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 PATS=4.23  
 WATC=5.65



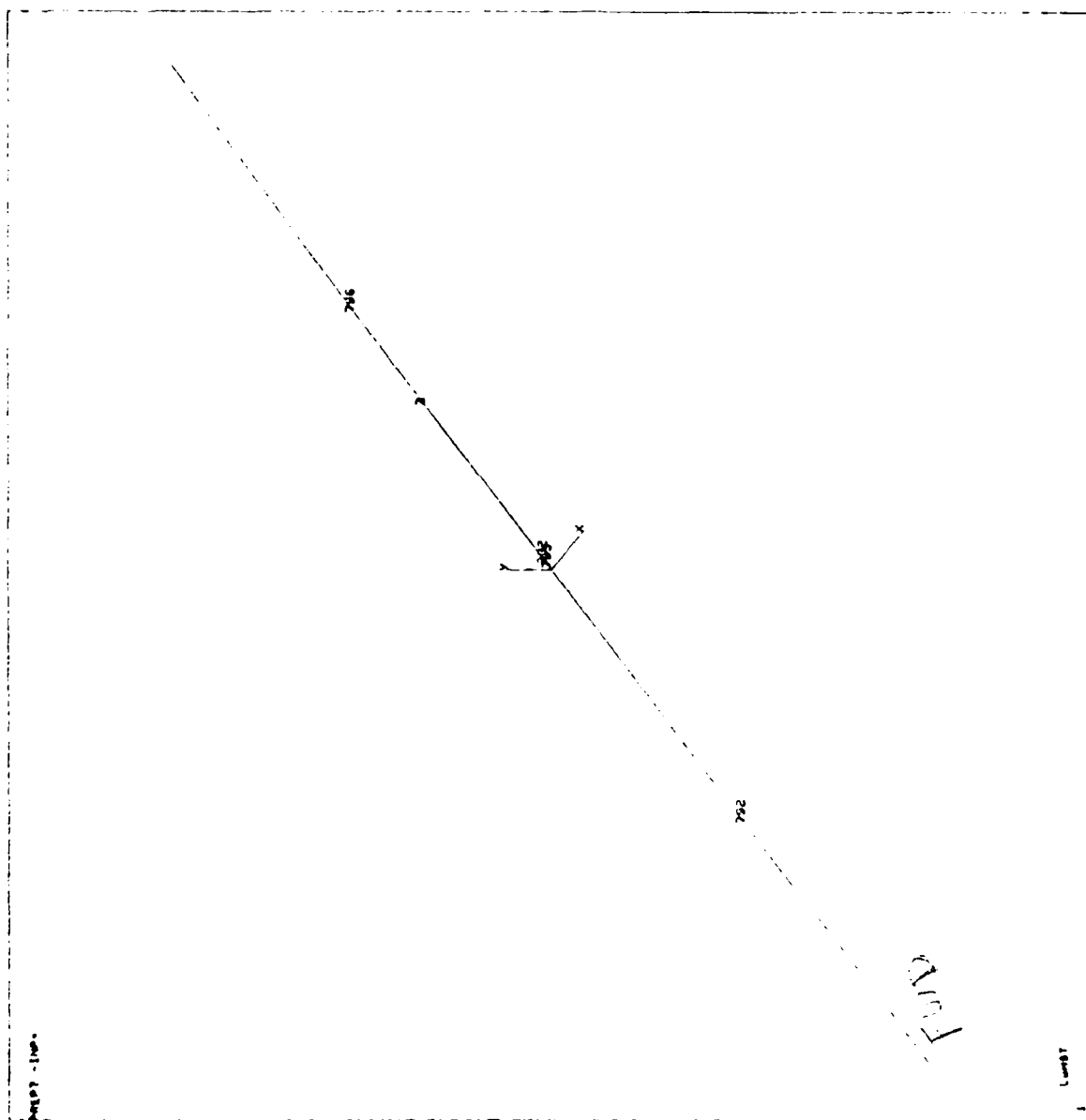
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ANALYSIS 4.28  
NOV 13 1966  
15:53:55  
PREP ELEMENTS  
(NUM=1)  
ZOOM  
XU--1  
YU--1  
ZU--1  
DIST=489  
VF=17.5  
ZF=122  
MTO=4.23  
VTO=5.66



ANSYS 4.20  
 NOV 13 1986  
 16:08:46  
 PREP7 ELEMENTS  
 ENUR=1  
 ZCOR  
 KU=1  
 KV=1  
 ZU=1  
 DIST=344  
 ZF=.5  
 ARTO=4.23  
 VRTO=5.66

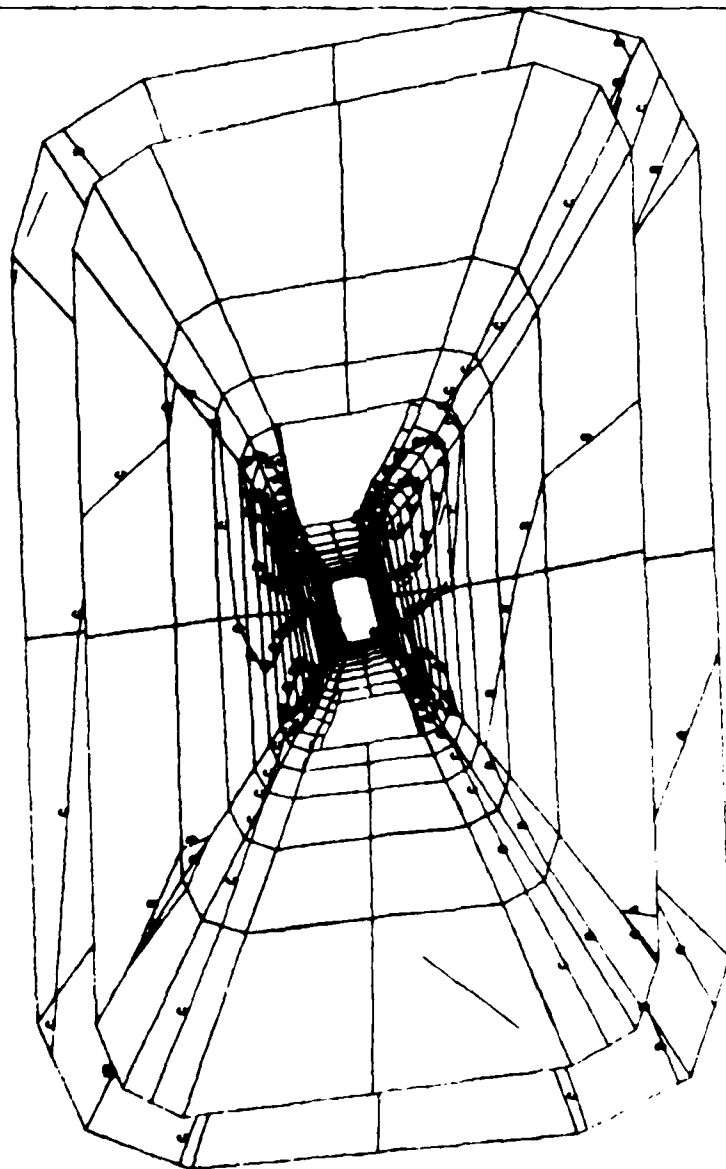
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D2/351

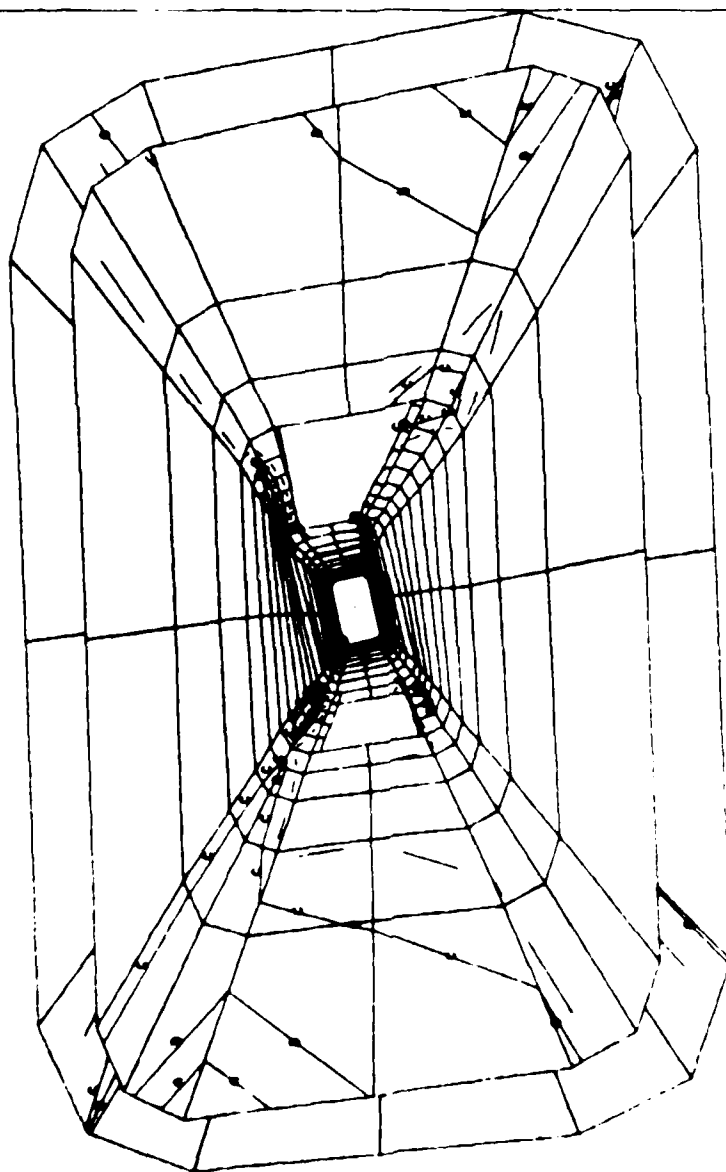
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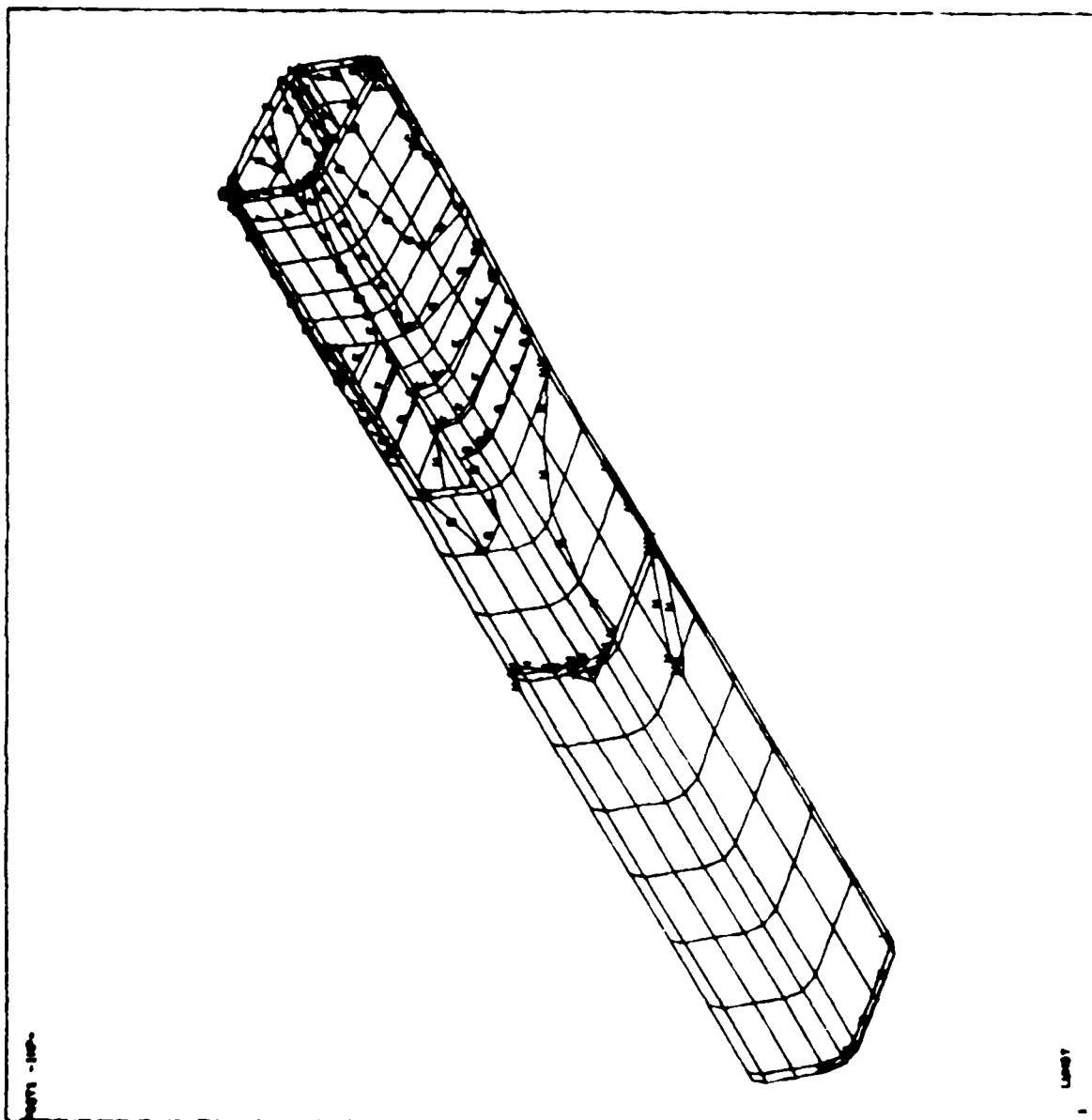
A perspective drawing of a complex, multi-layered, octagonal structure, possibly a tunnel or a large container, with a grid-like pattern on its walls and a central opening. The structure is composed of many concentric layers, creating a sense of depth and perspective. The walls are lined with a grid of lines, and there are small, dark, rectangular openings or windows along the sides. The central opening is a small, square-shaped void. The overall shape is octagonal, with the sides converging towards the center. The drawing is done in a simple, line-art style with black lines on a white background.



**1. Summary**

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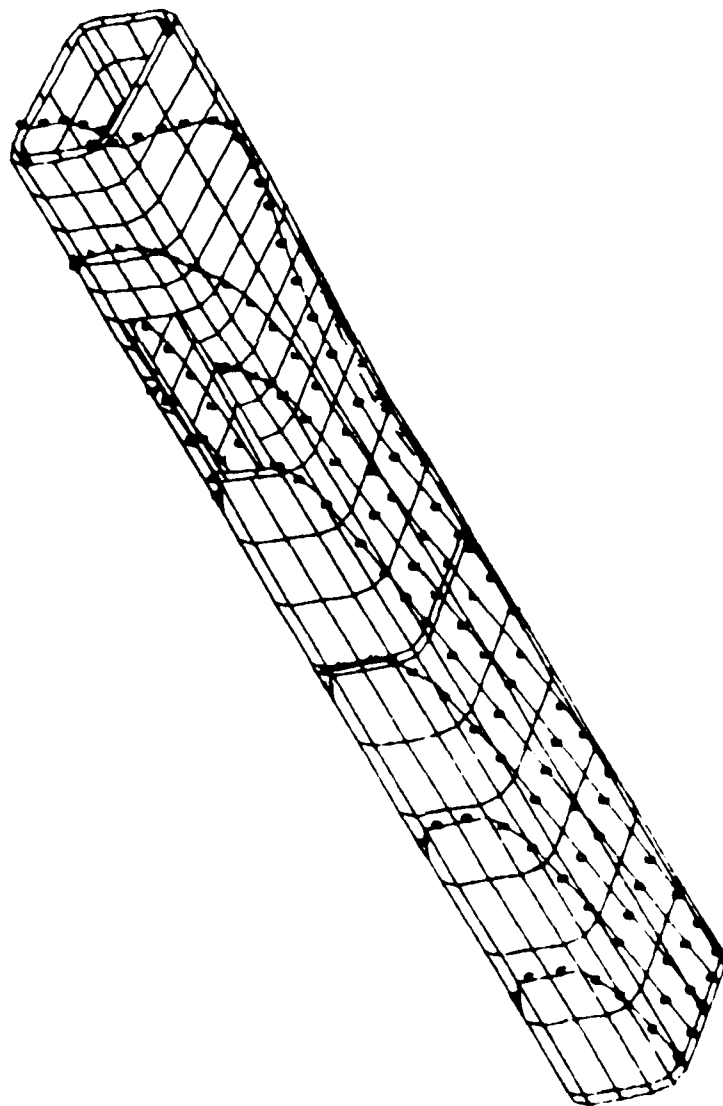
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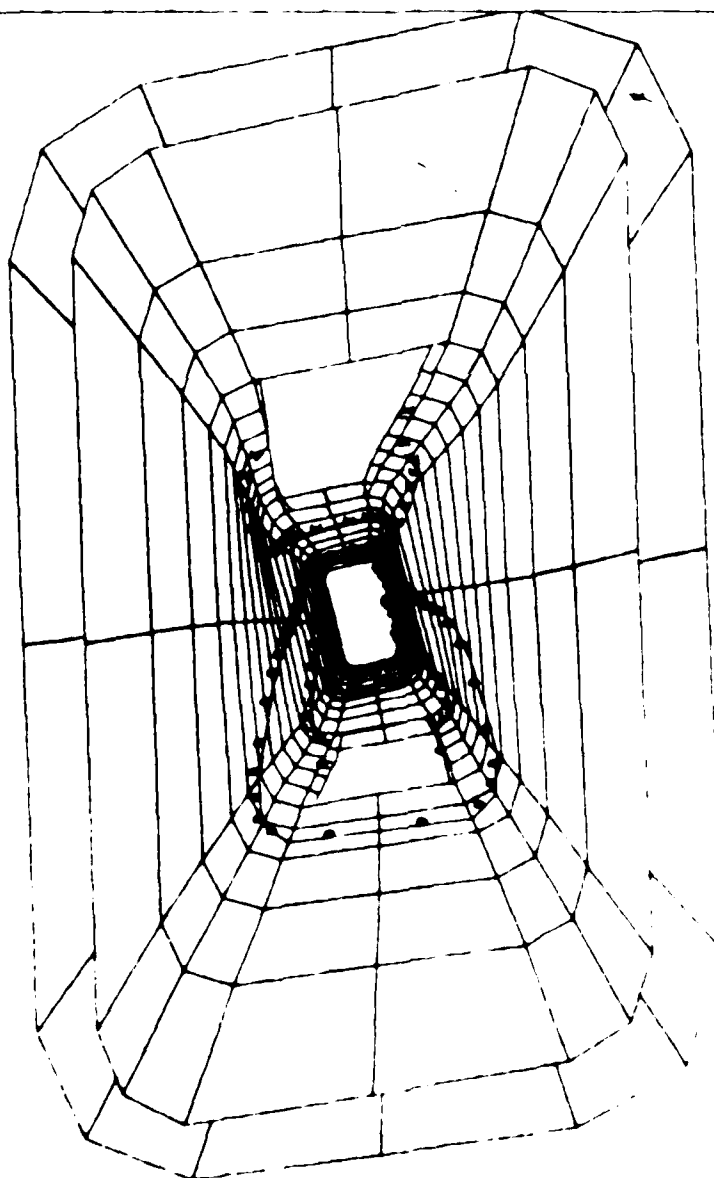
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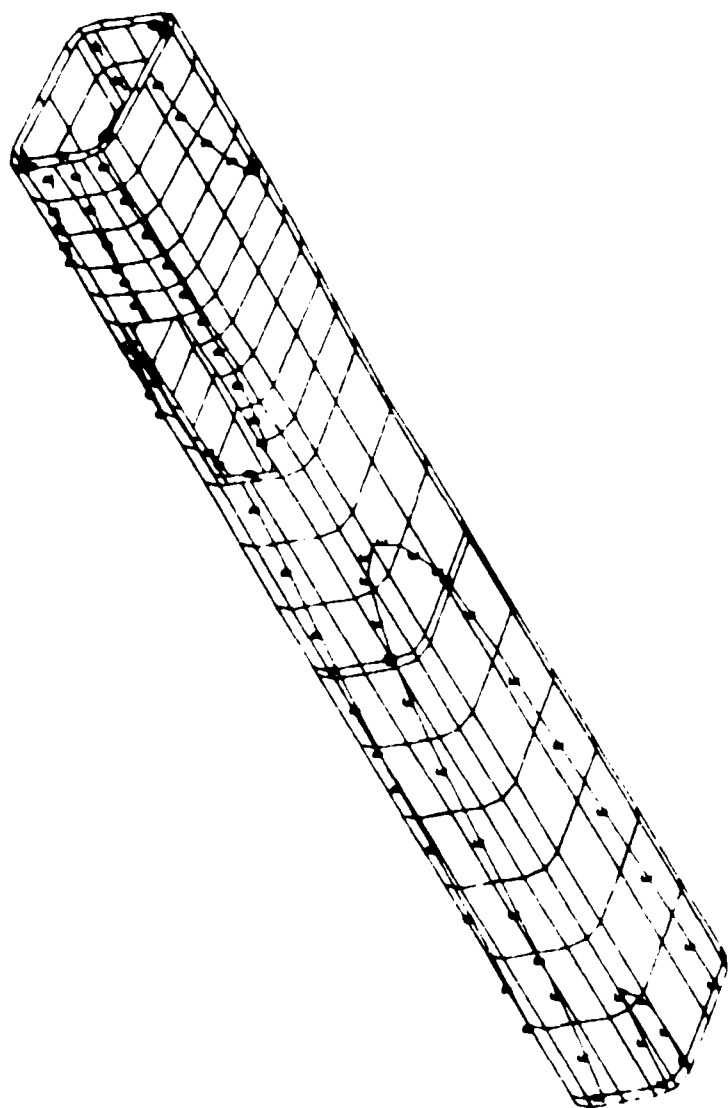
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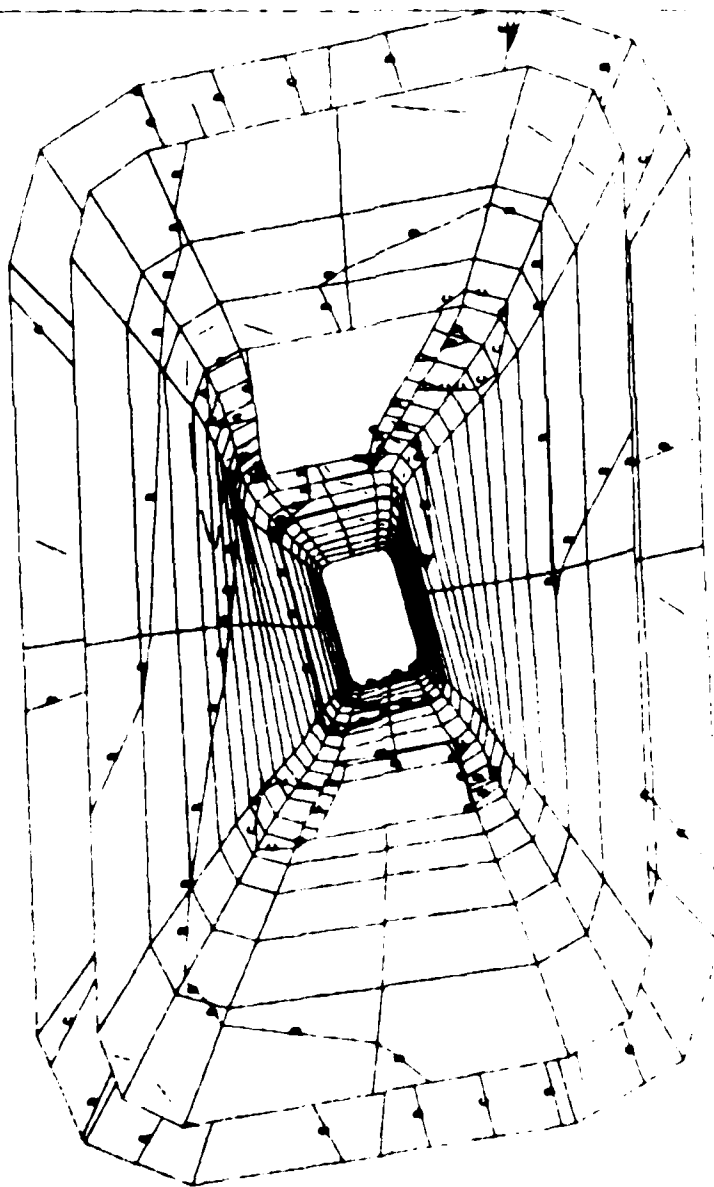
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**Umsatz**

11-15

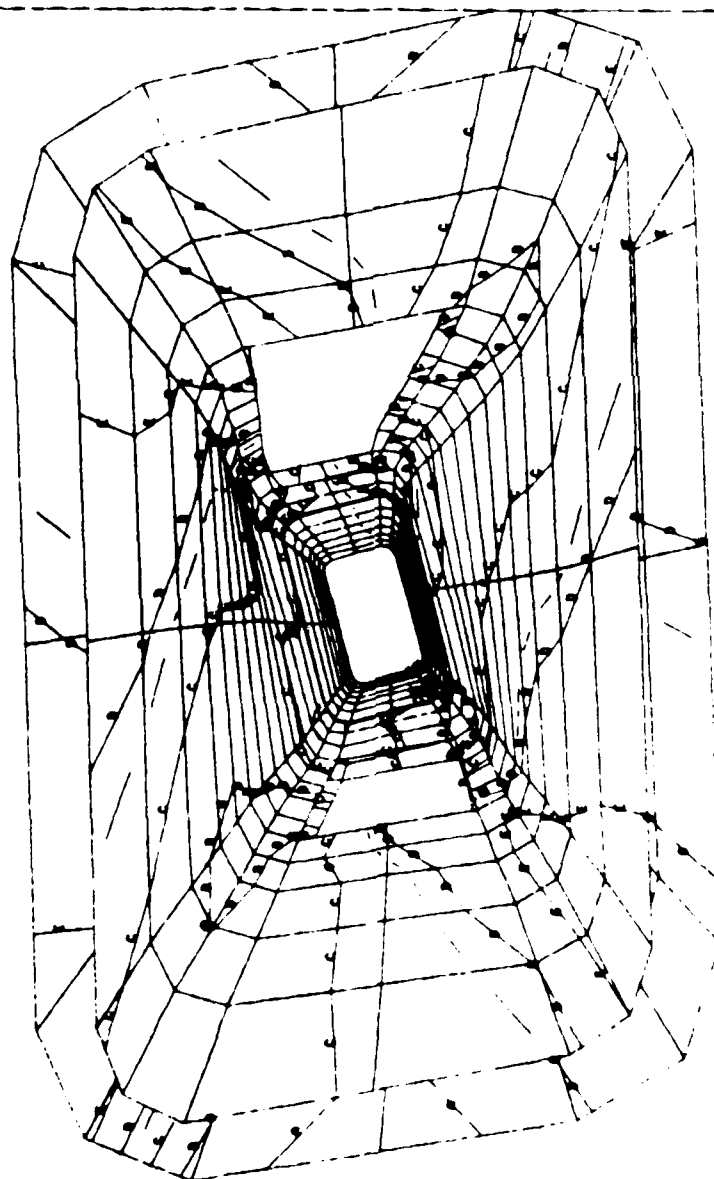


**Answer**

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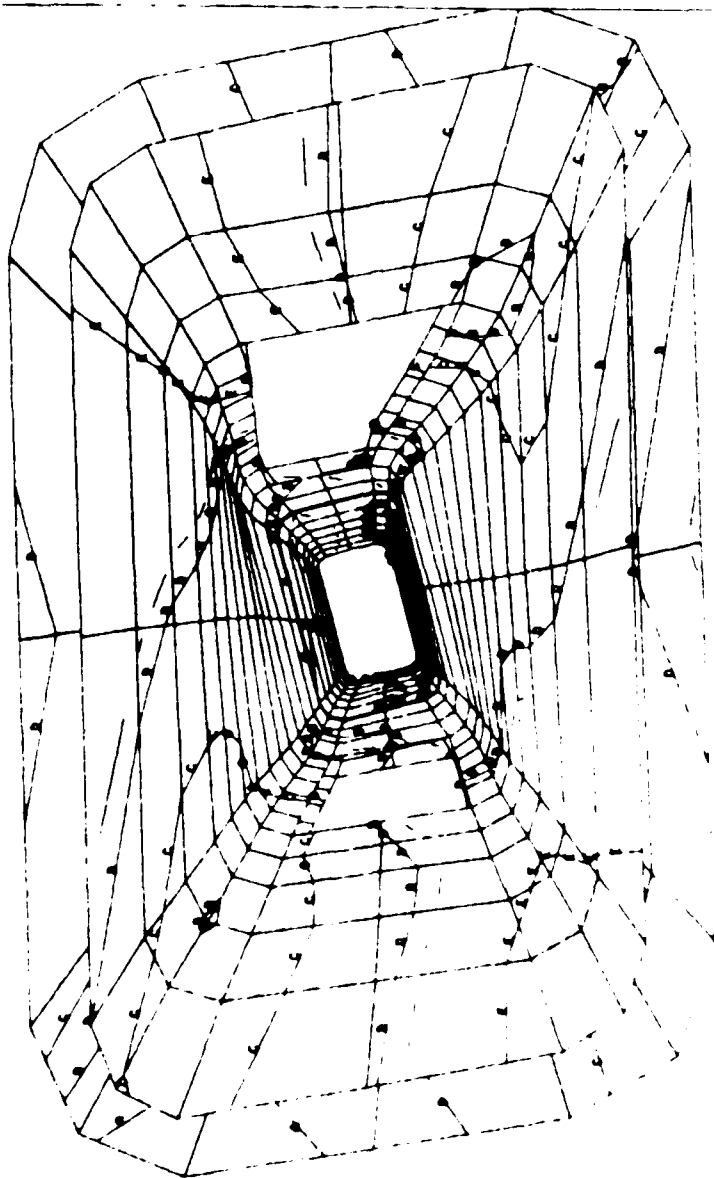
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**Wang**



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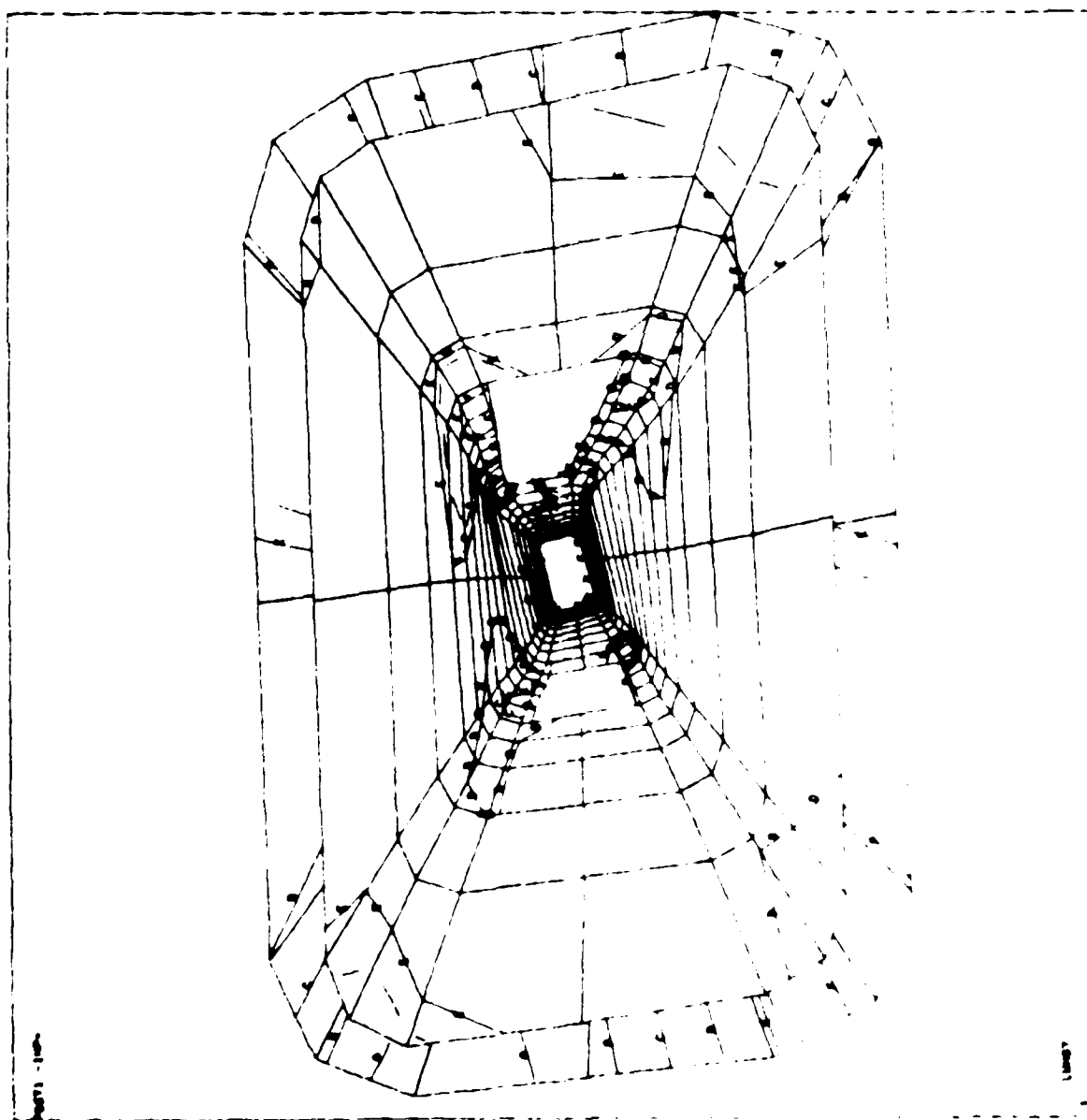
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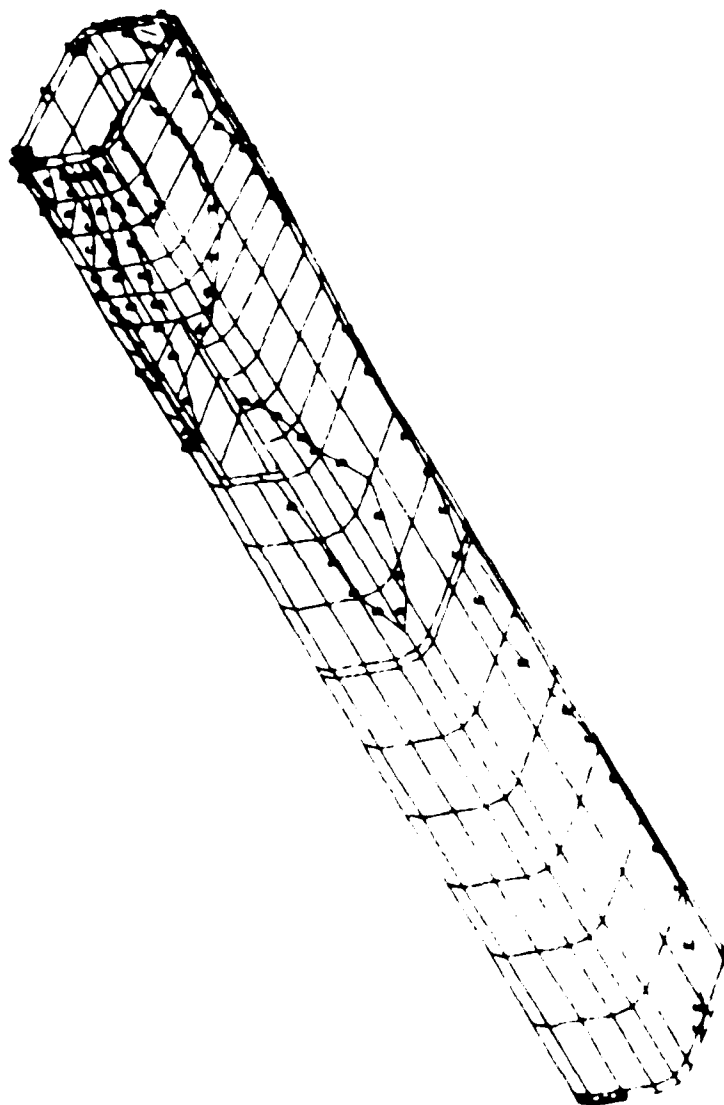


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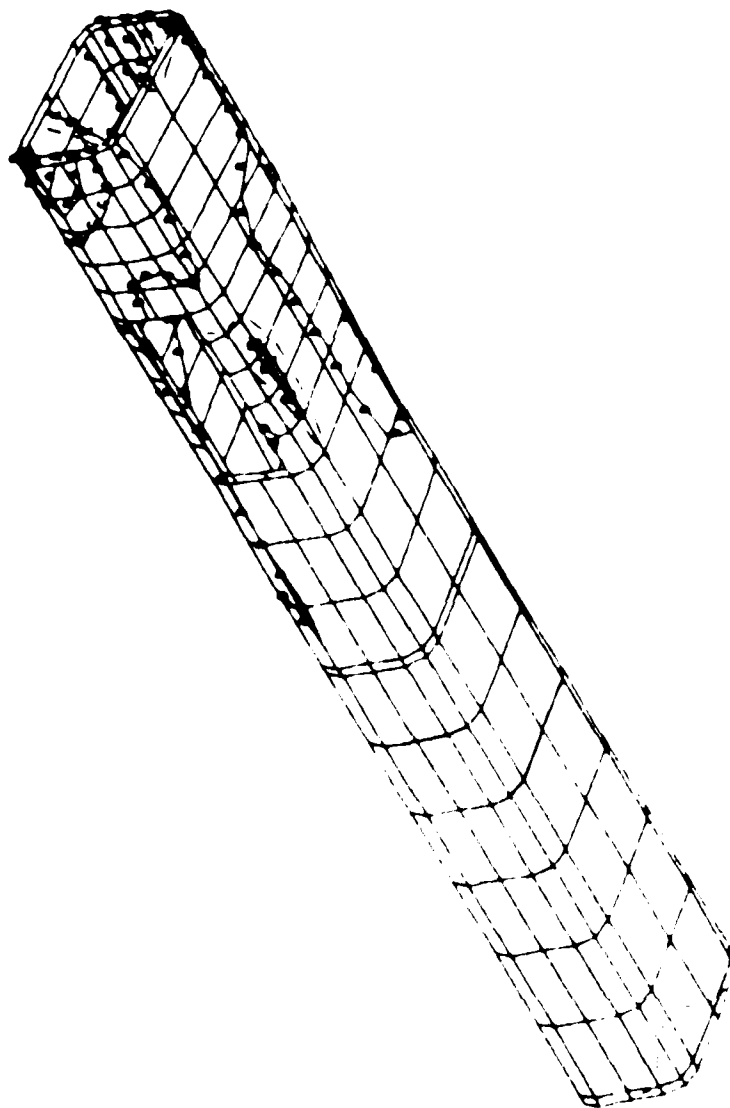


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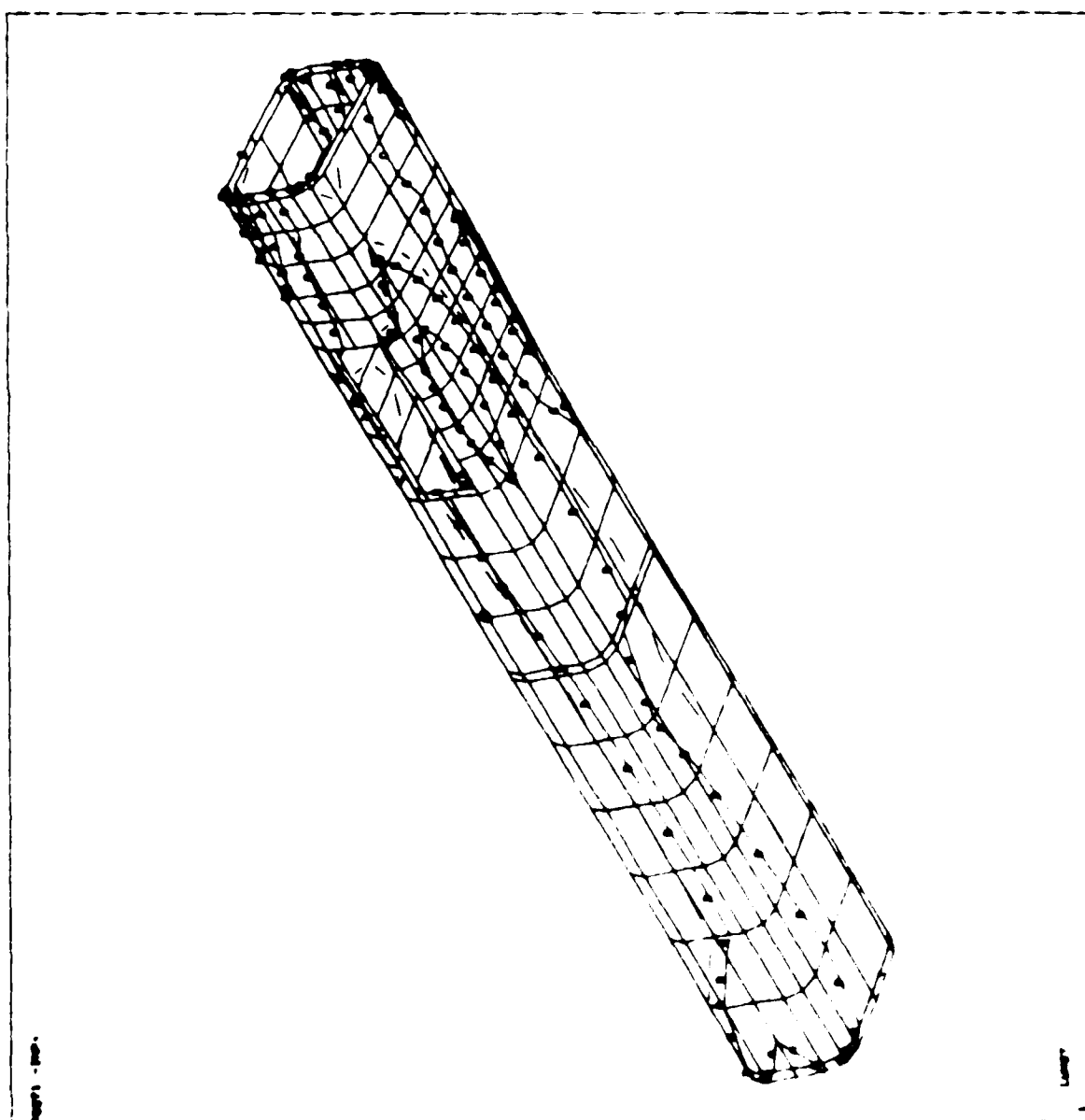




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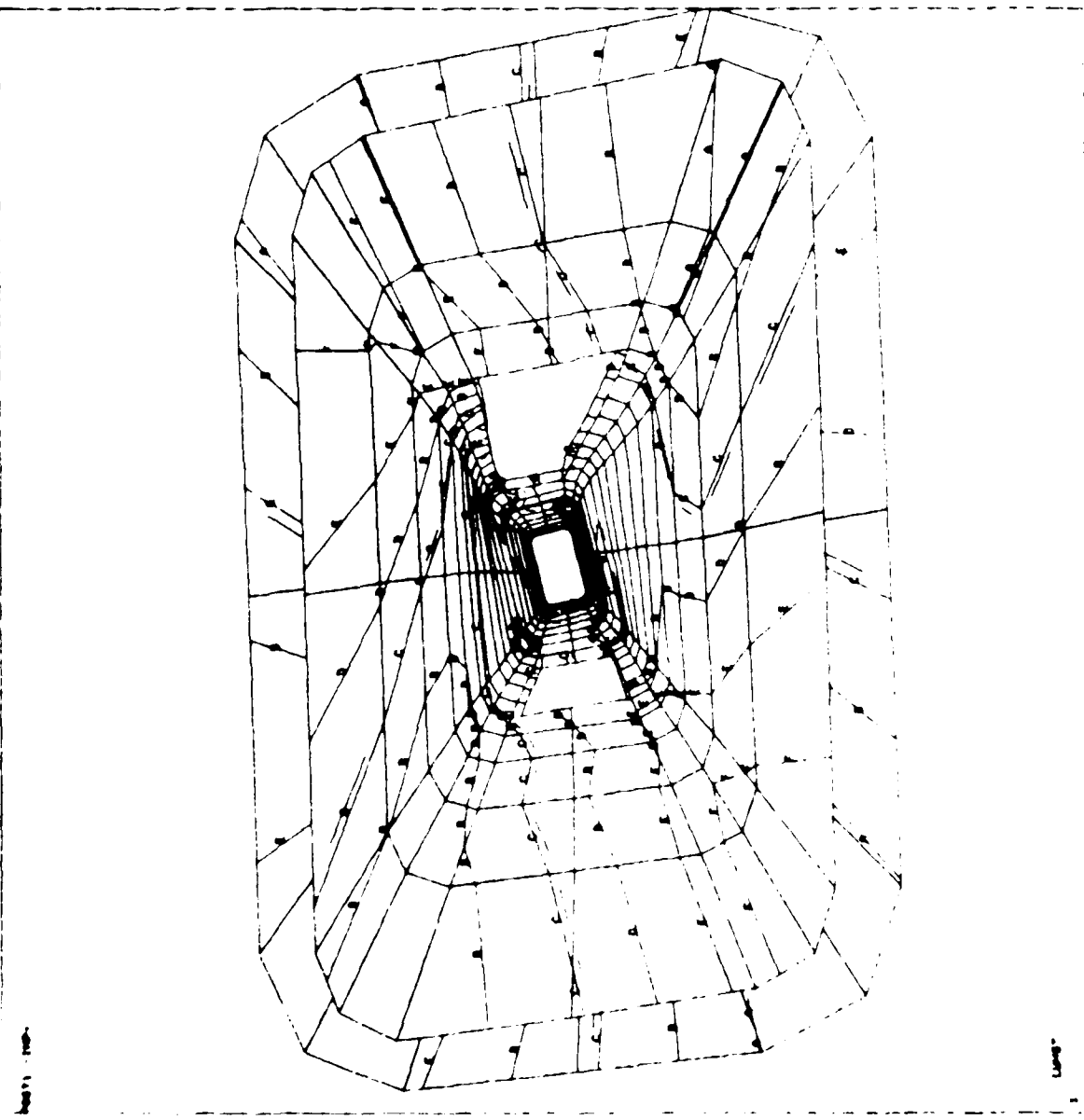


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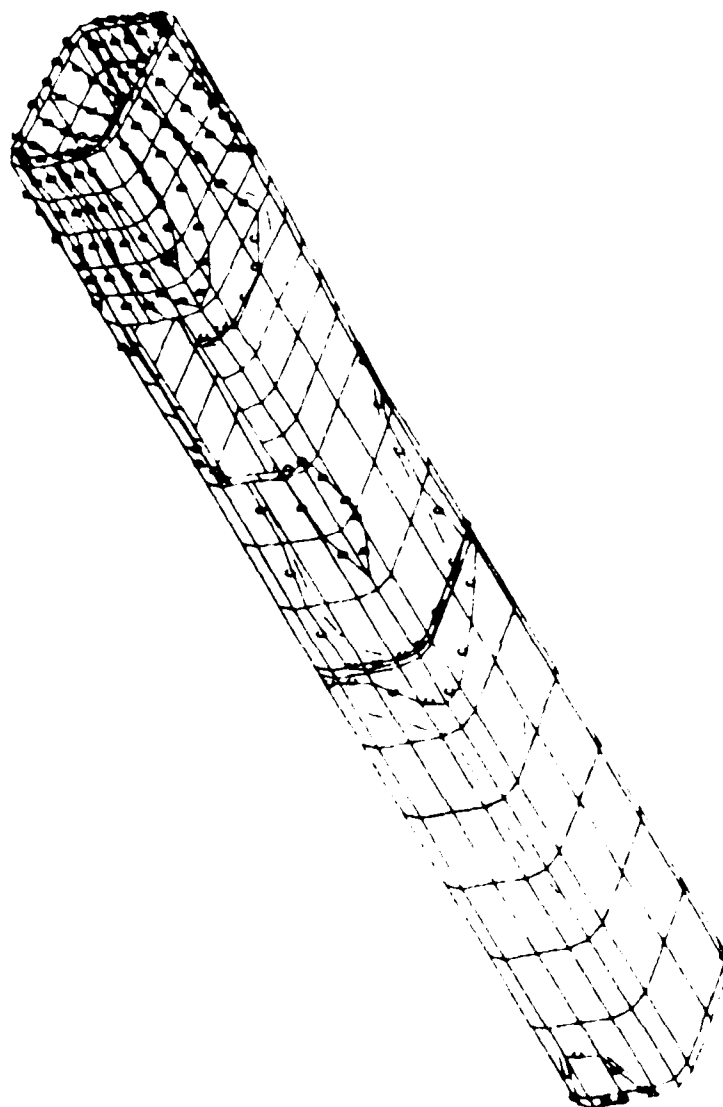
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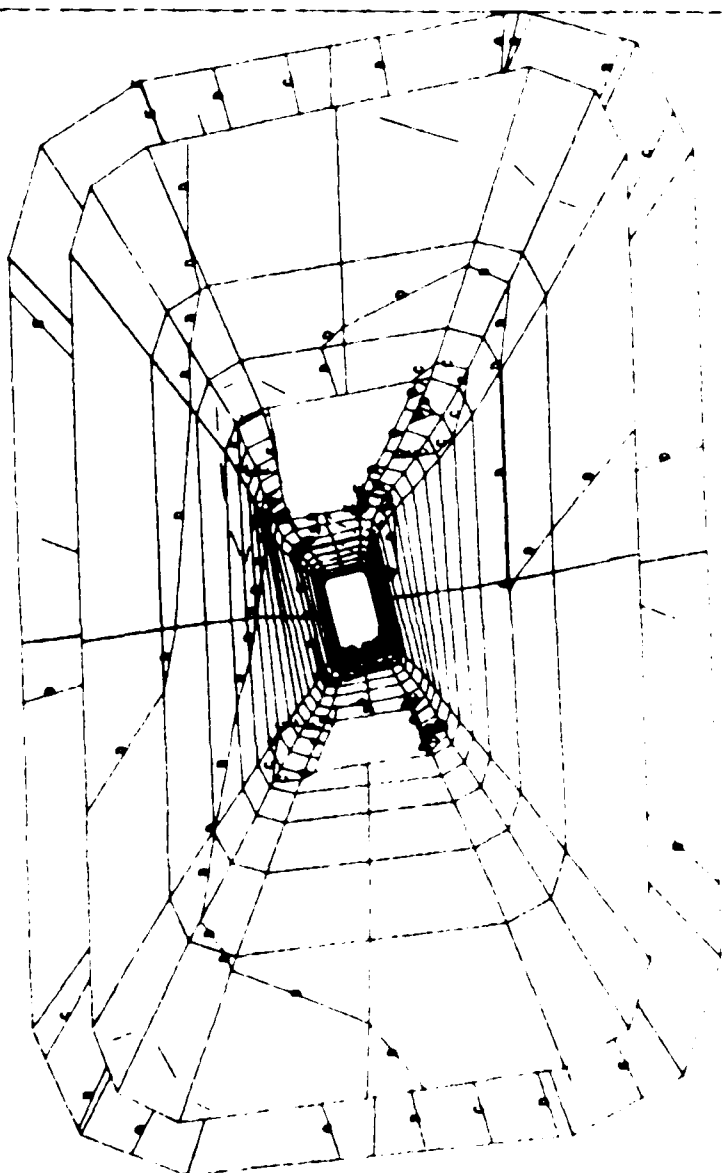
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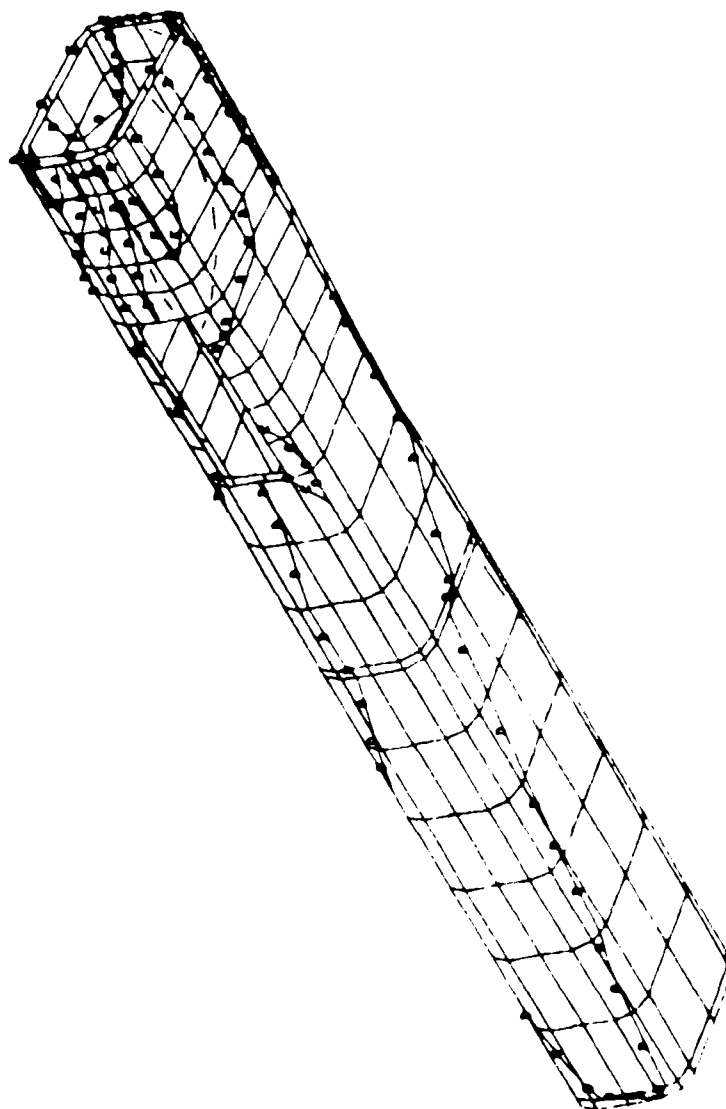
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2011-12



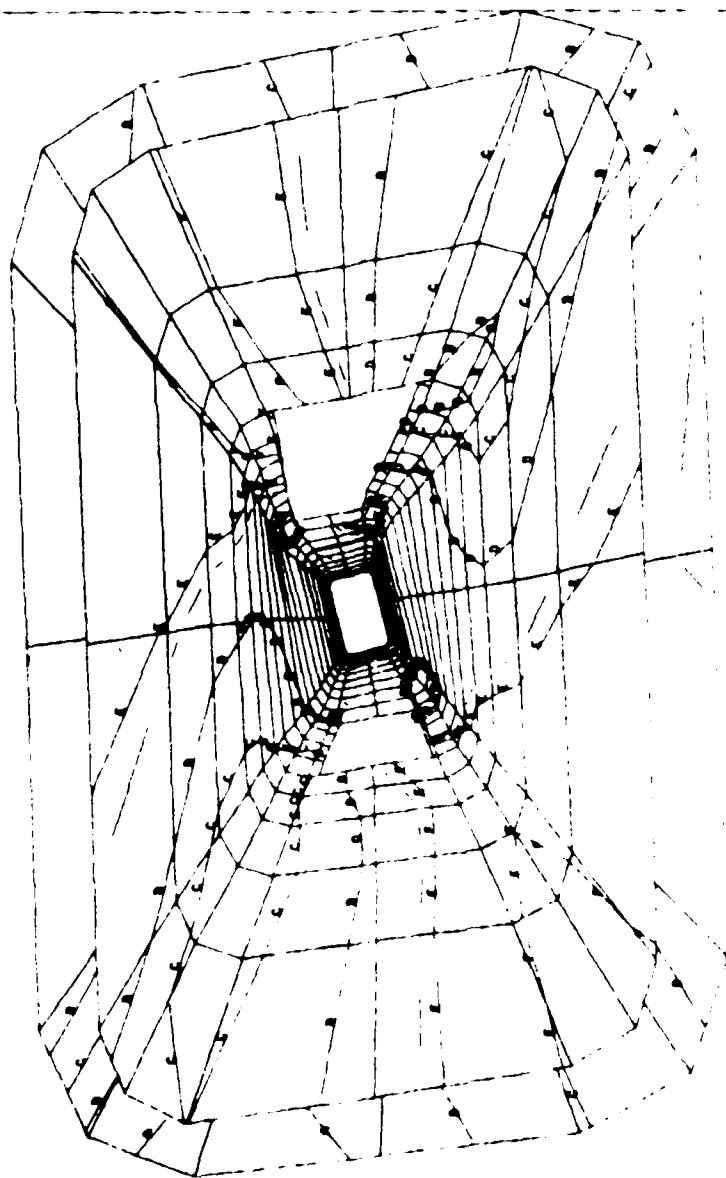
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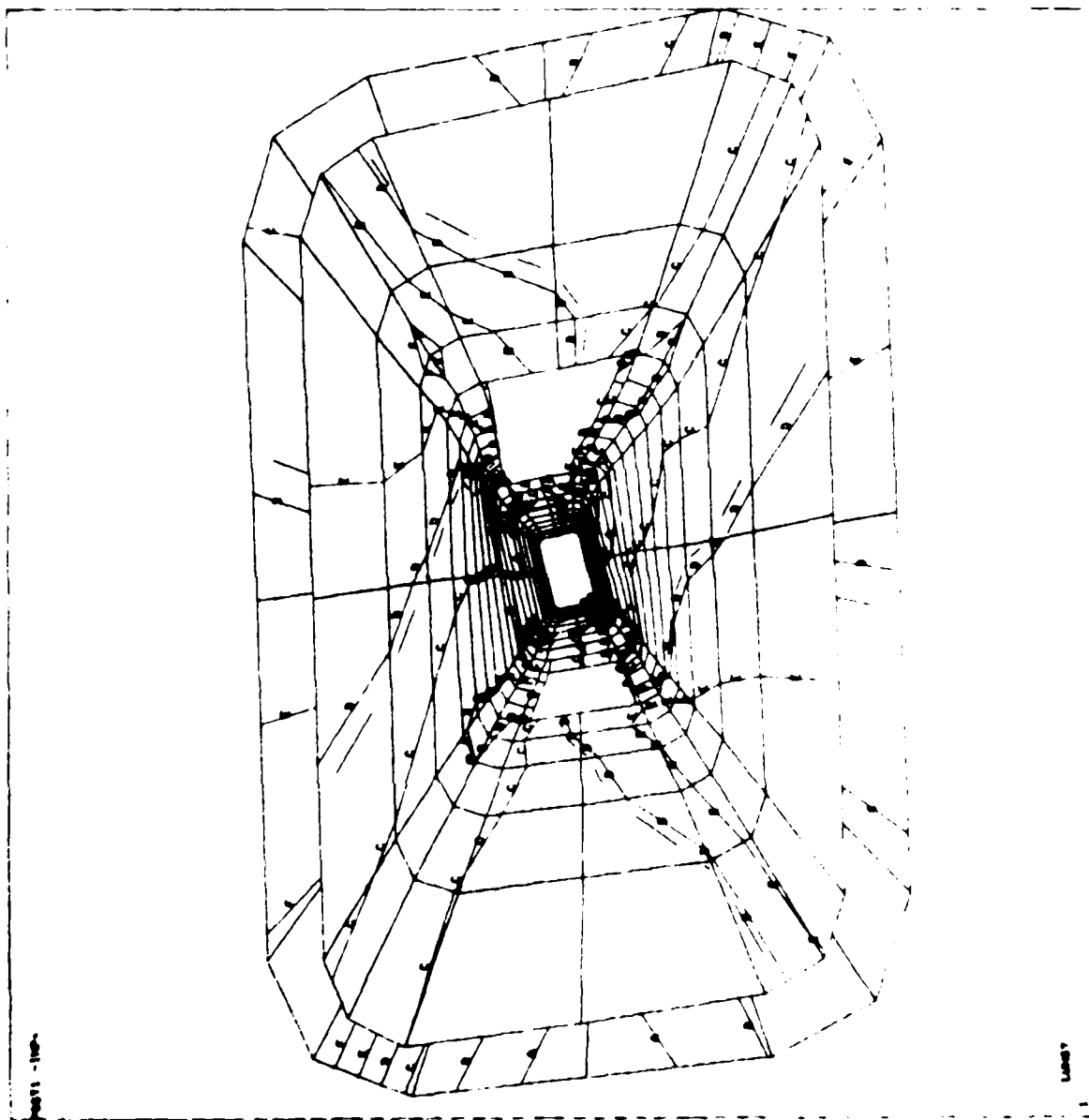
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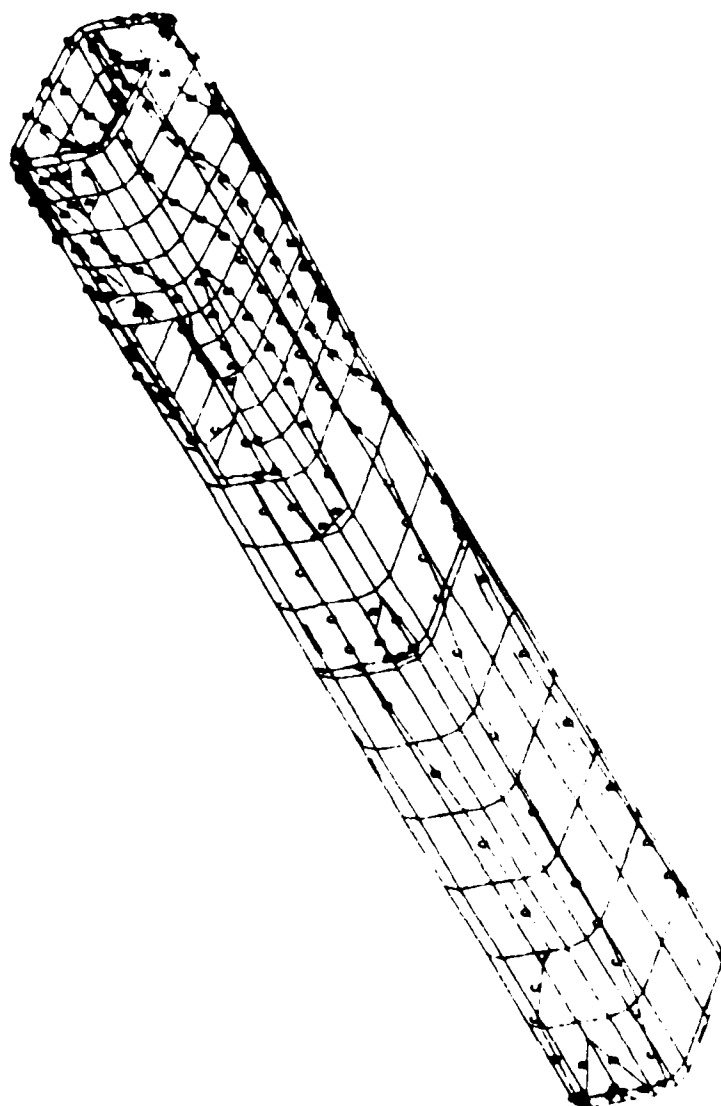
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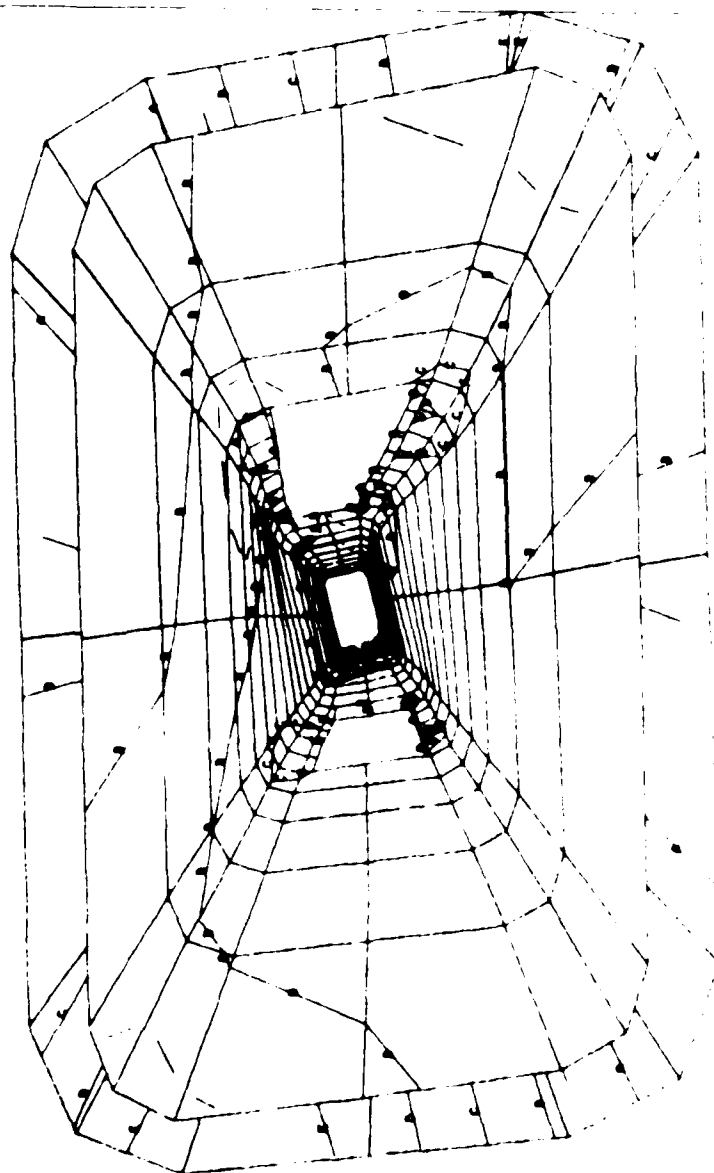
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**2**



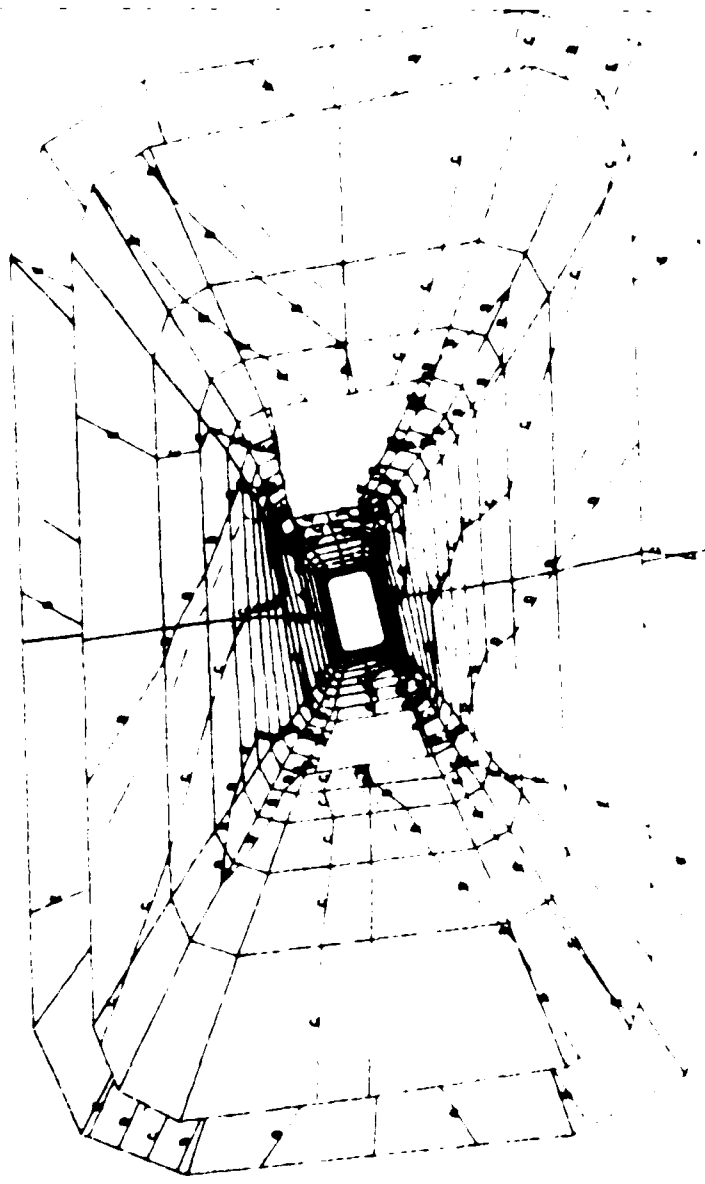
1-12



**Lucy**



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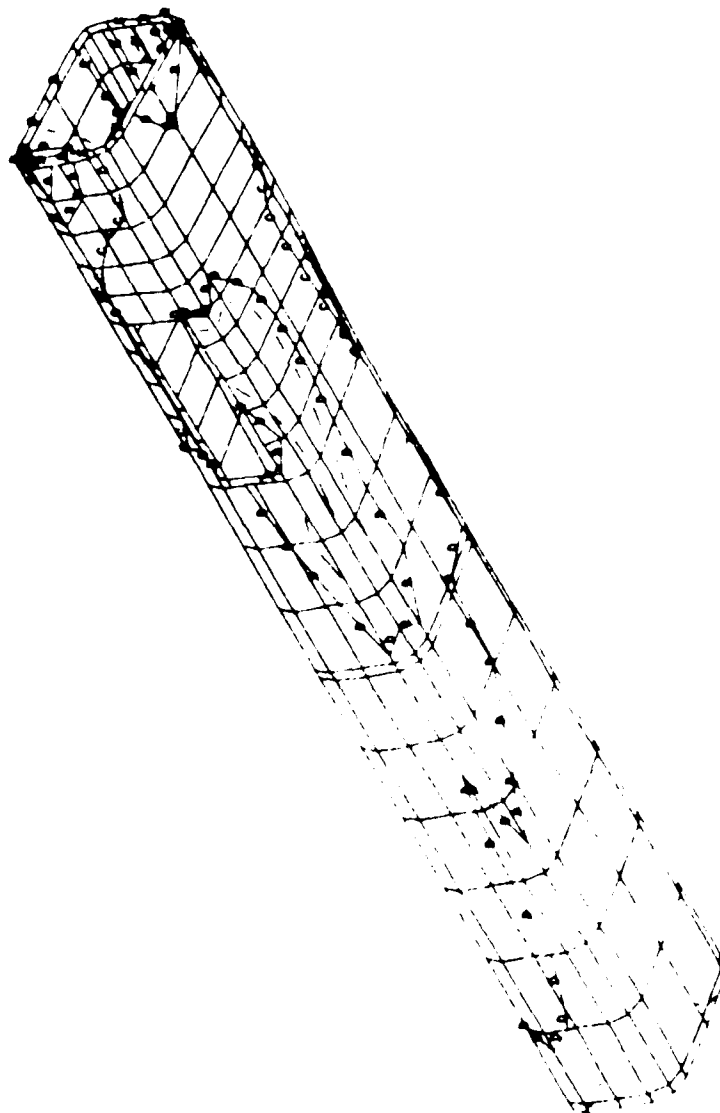
1

A perspective drawing of a cylindrical object, possibly a barrel or a container, covered in a dense, crisscrossing pattern of lines, resembling a wire mesh or a woven fabric. The object is tilted diagonally across the frame.

A complex 3D wireframe diagram of a hyperboloid of two sheets, showing the grid of lines and the distribution of points on the surface.

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AD-A183 992

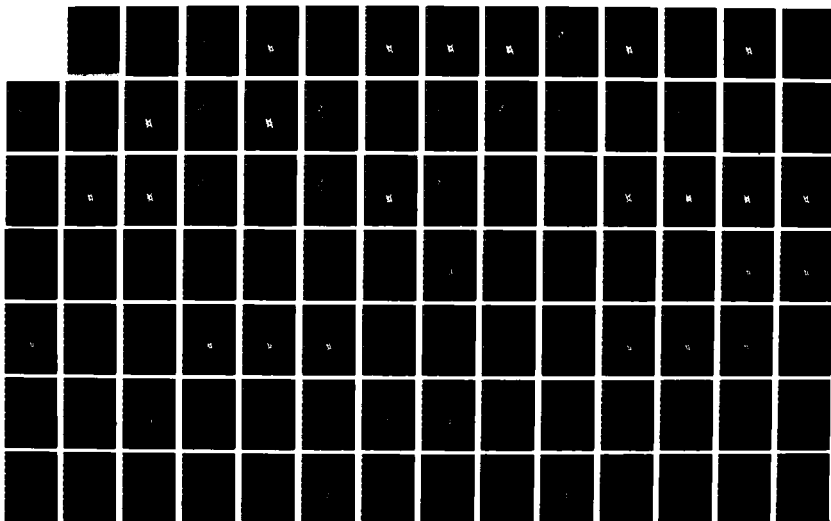
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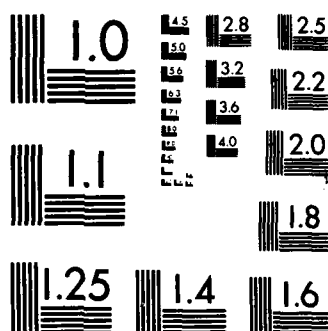
2/4

UNCLASSIFIED

F/G 19/6

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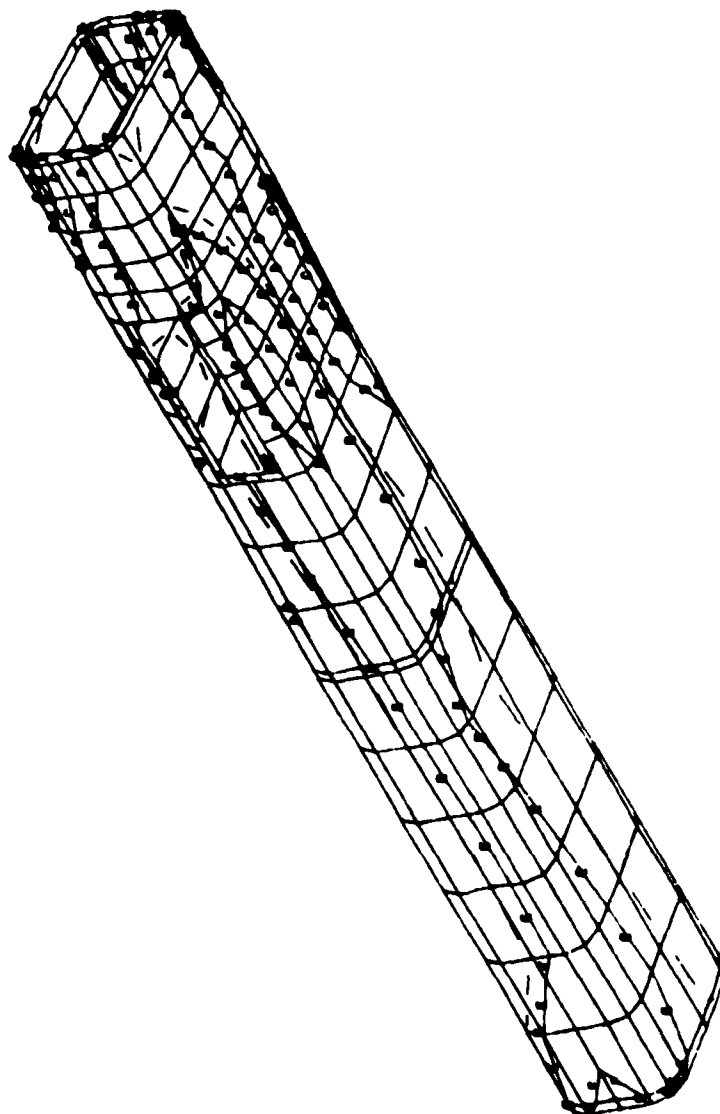




MICROCOPY RESOLUTION TEST CHART  
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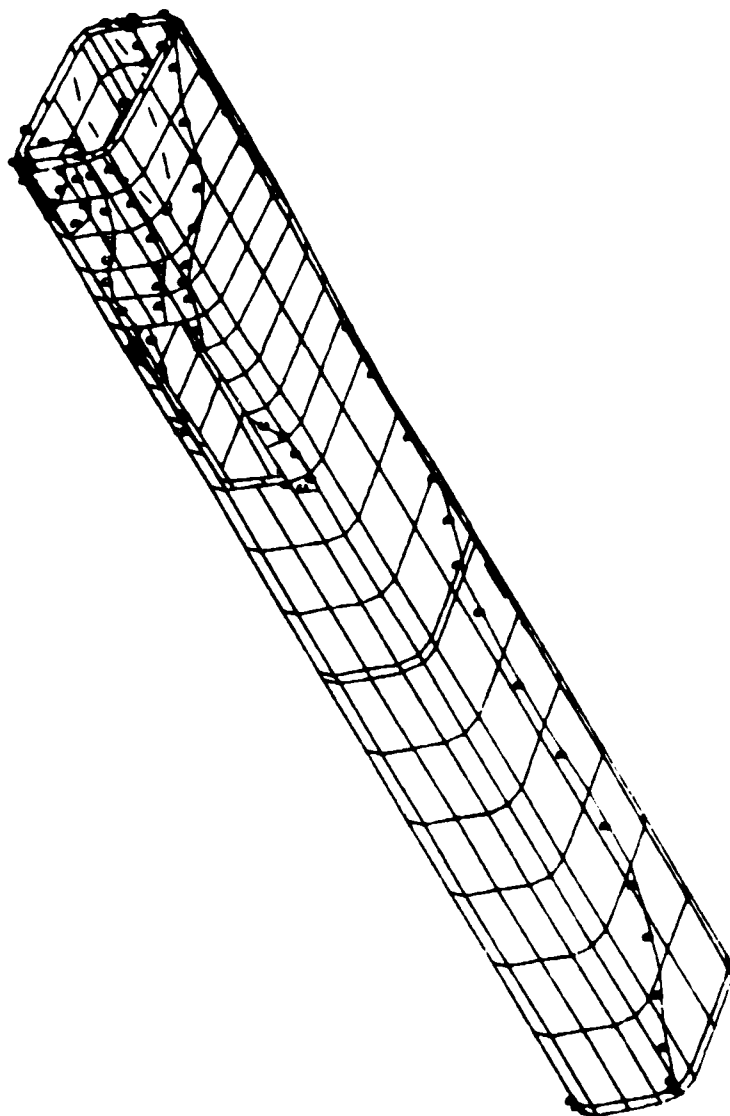


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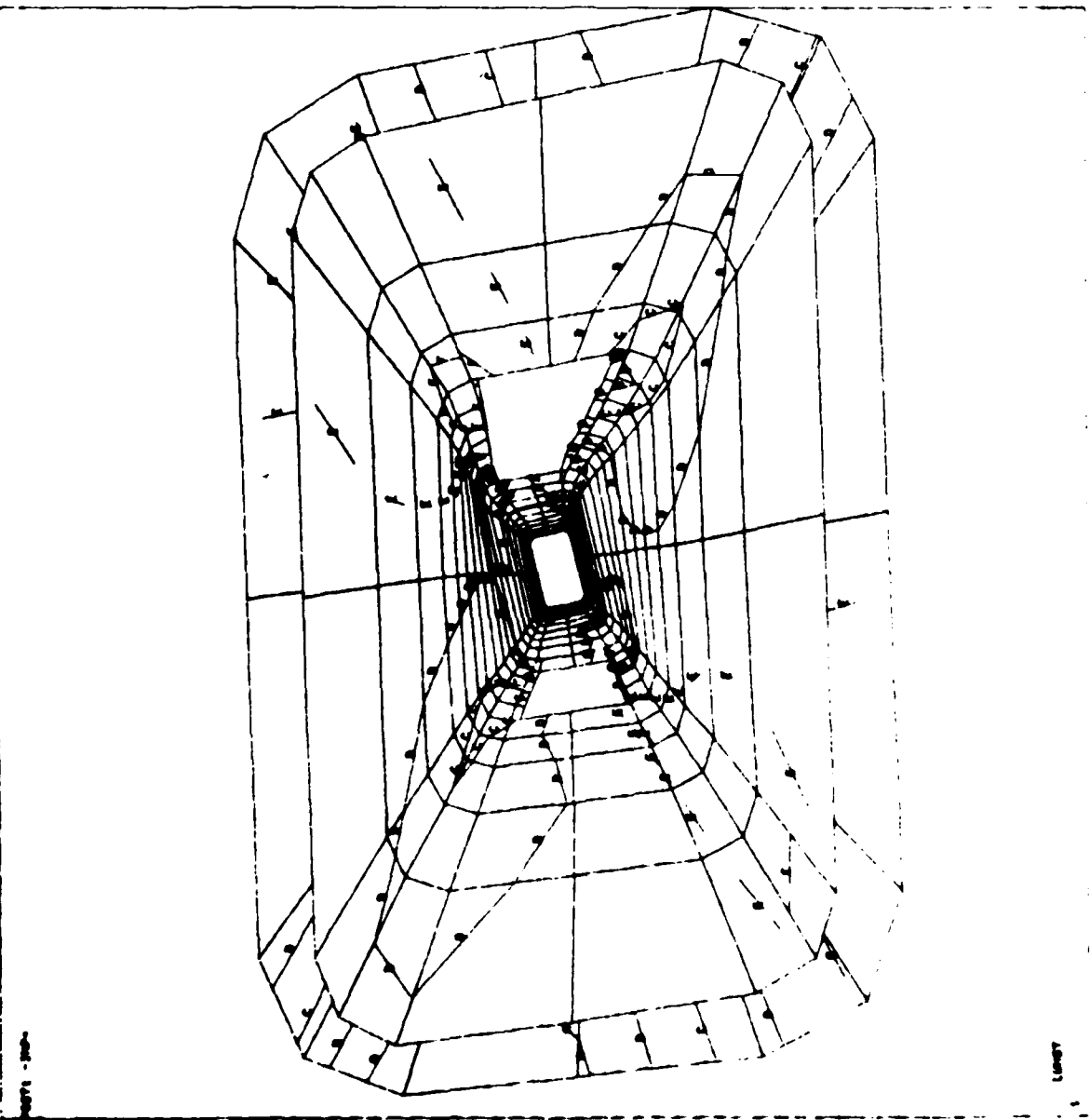
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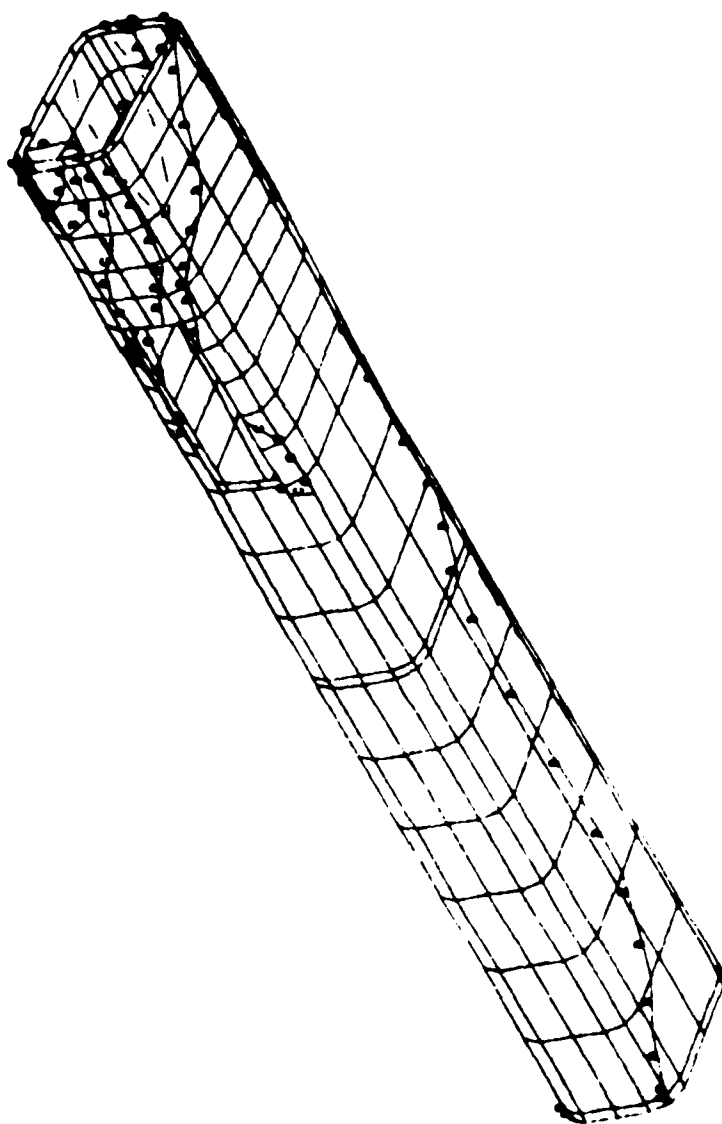
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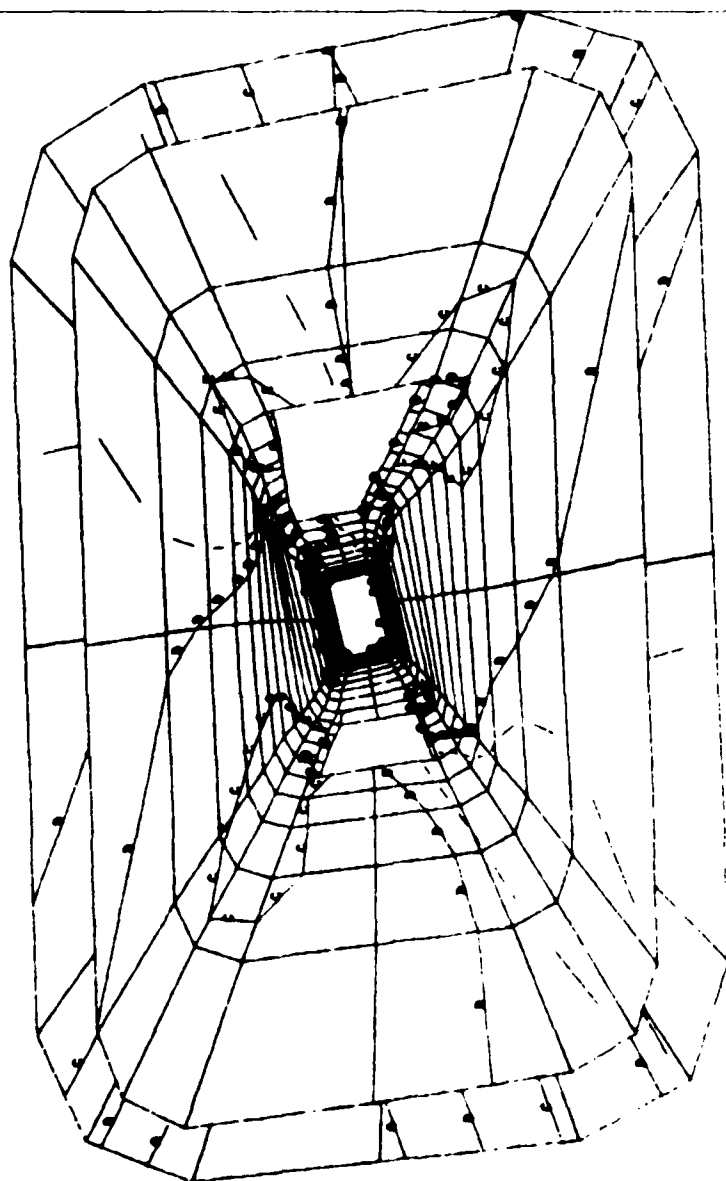
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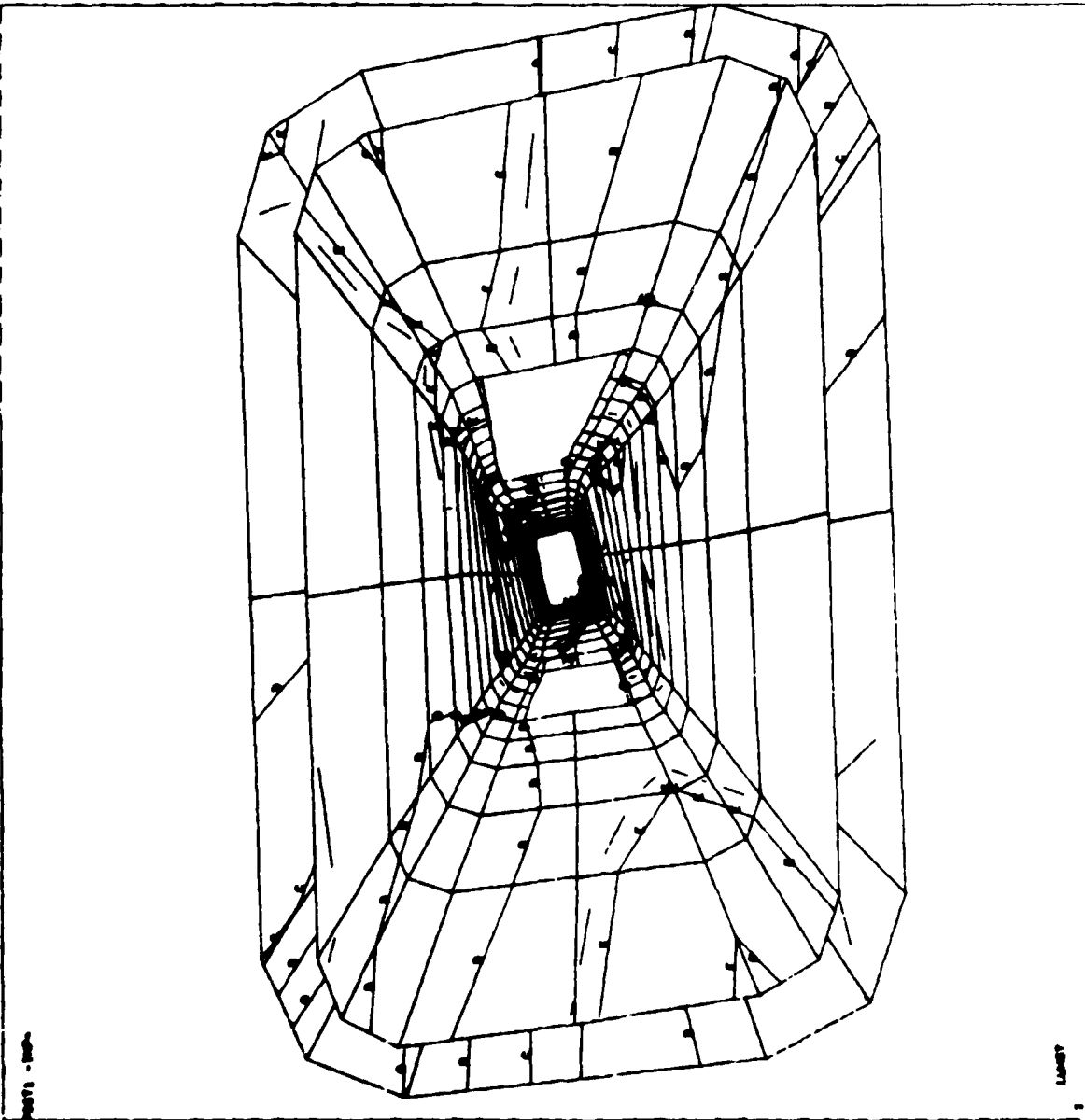
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**1. Background**

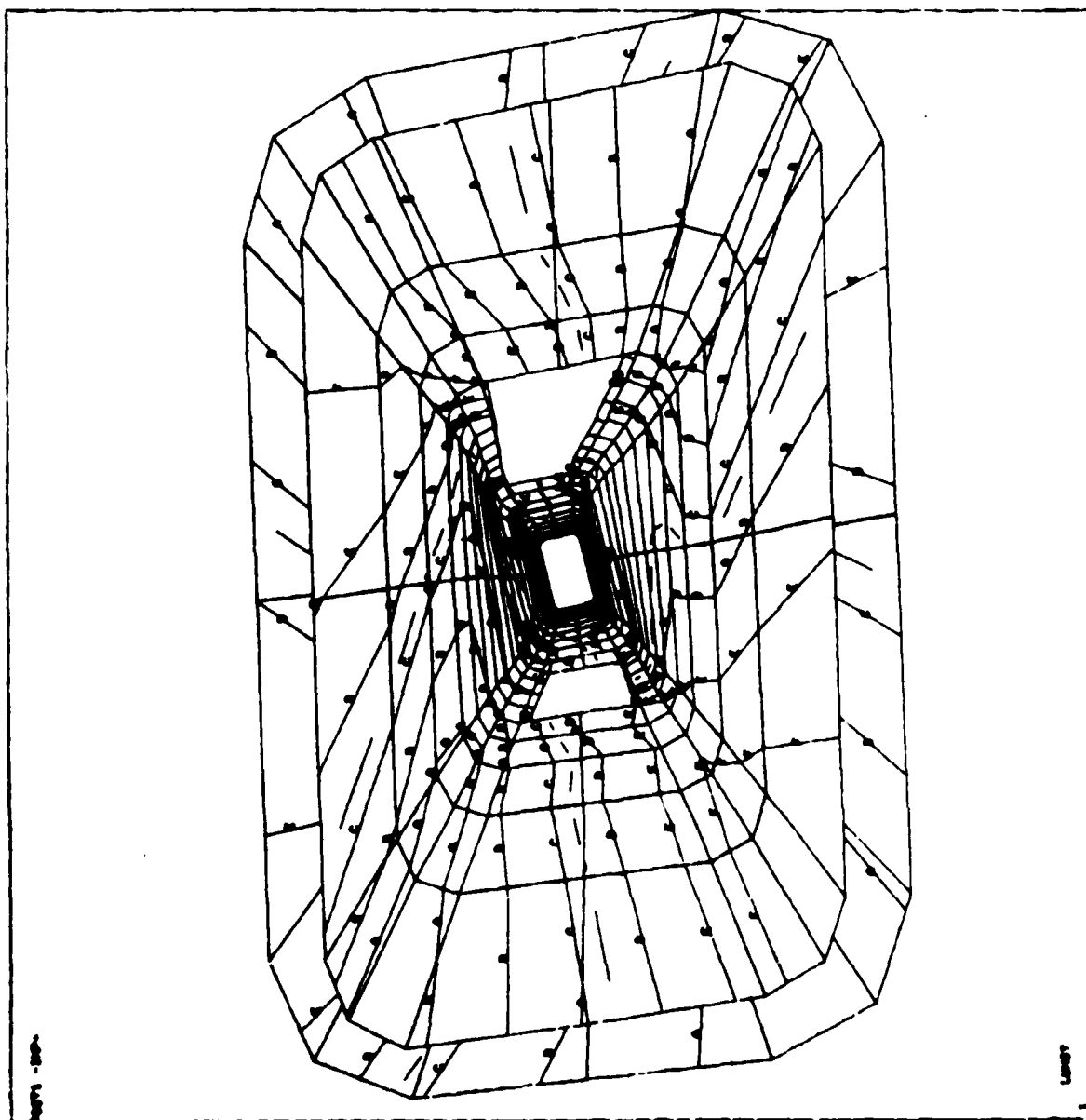
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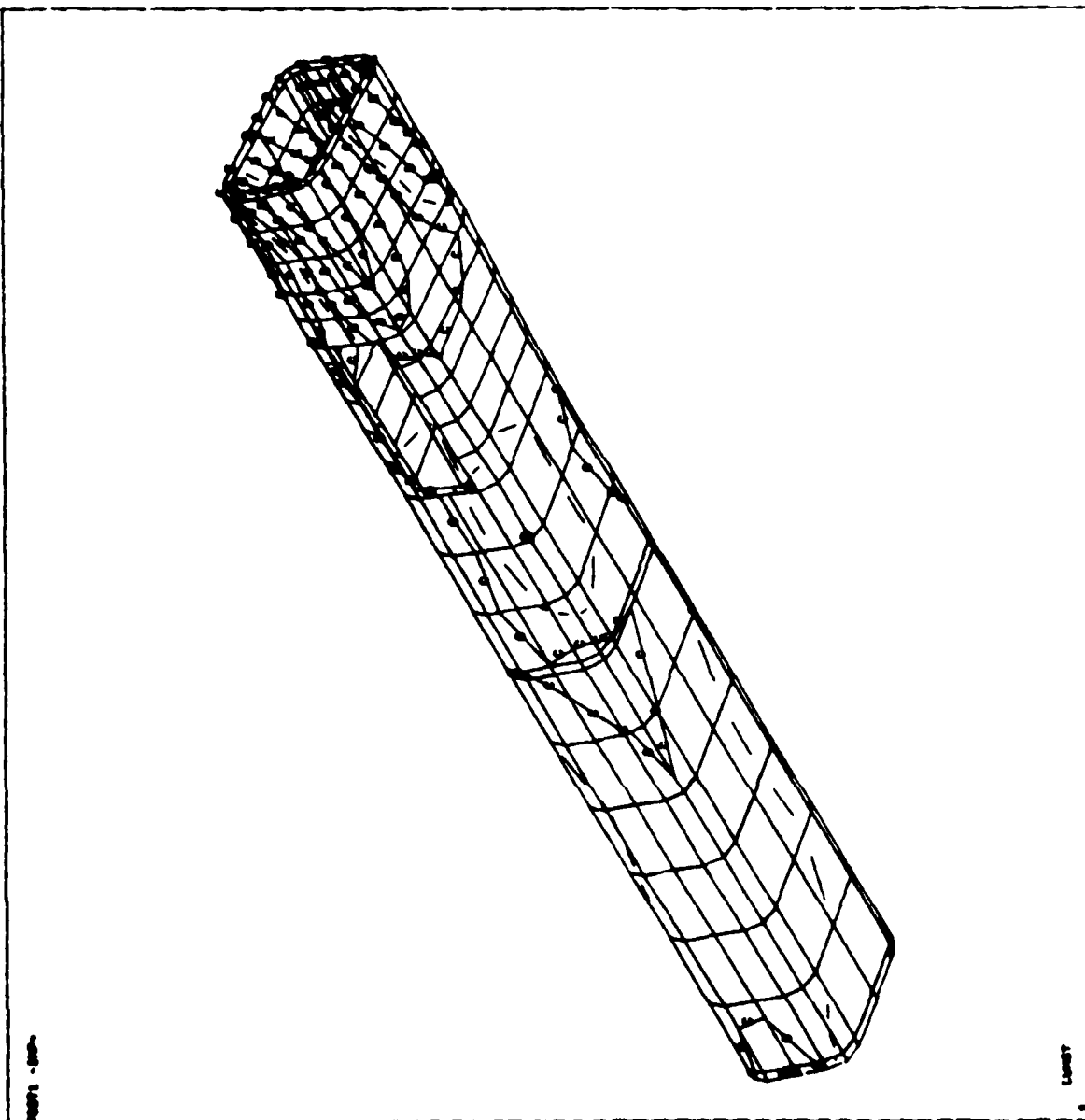
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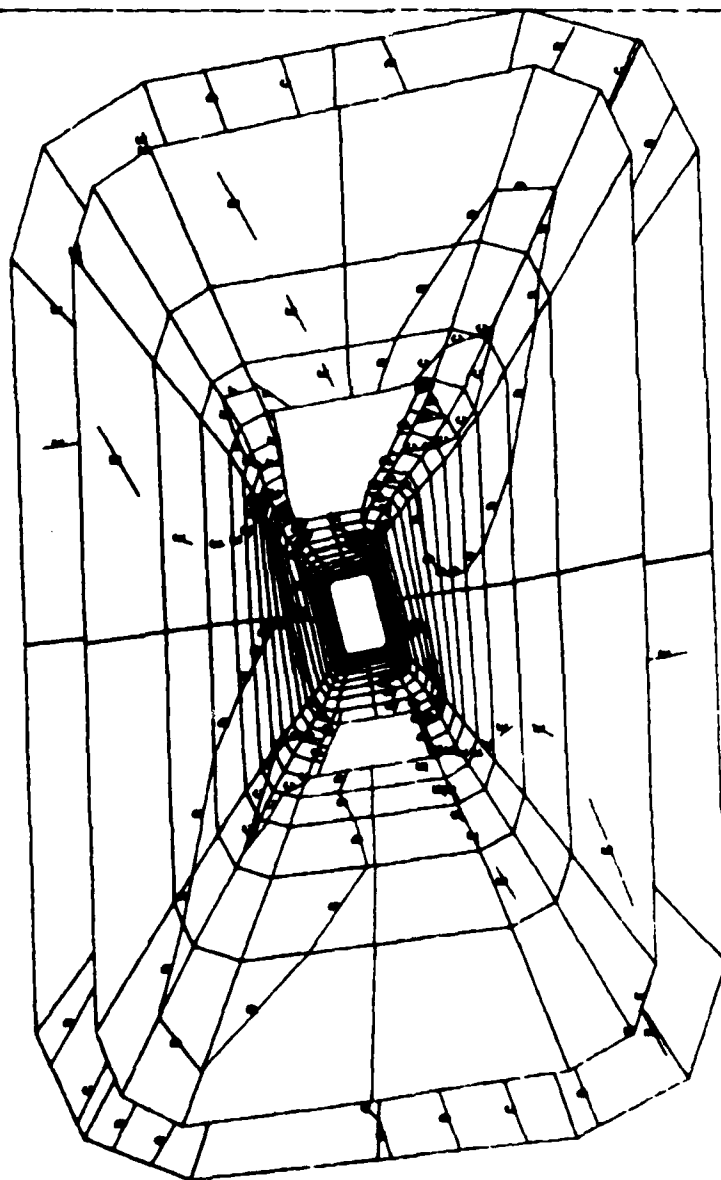
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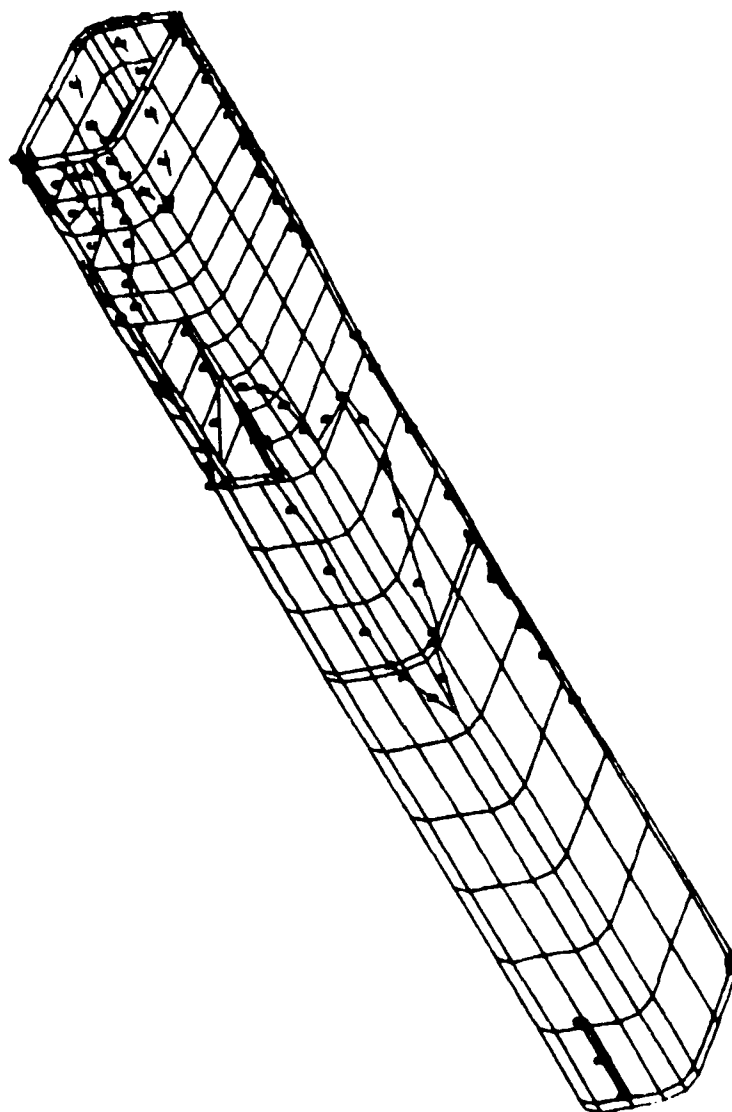
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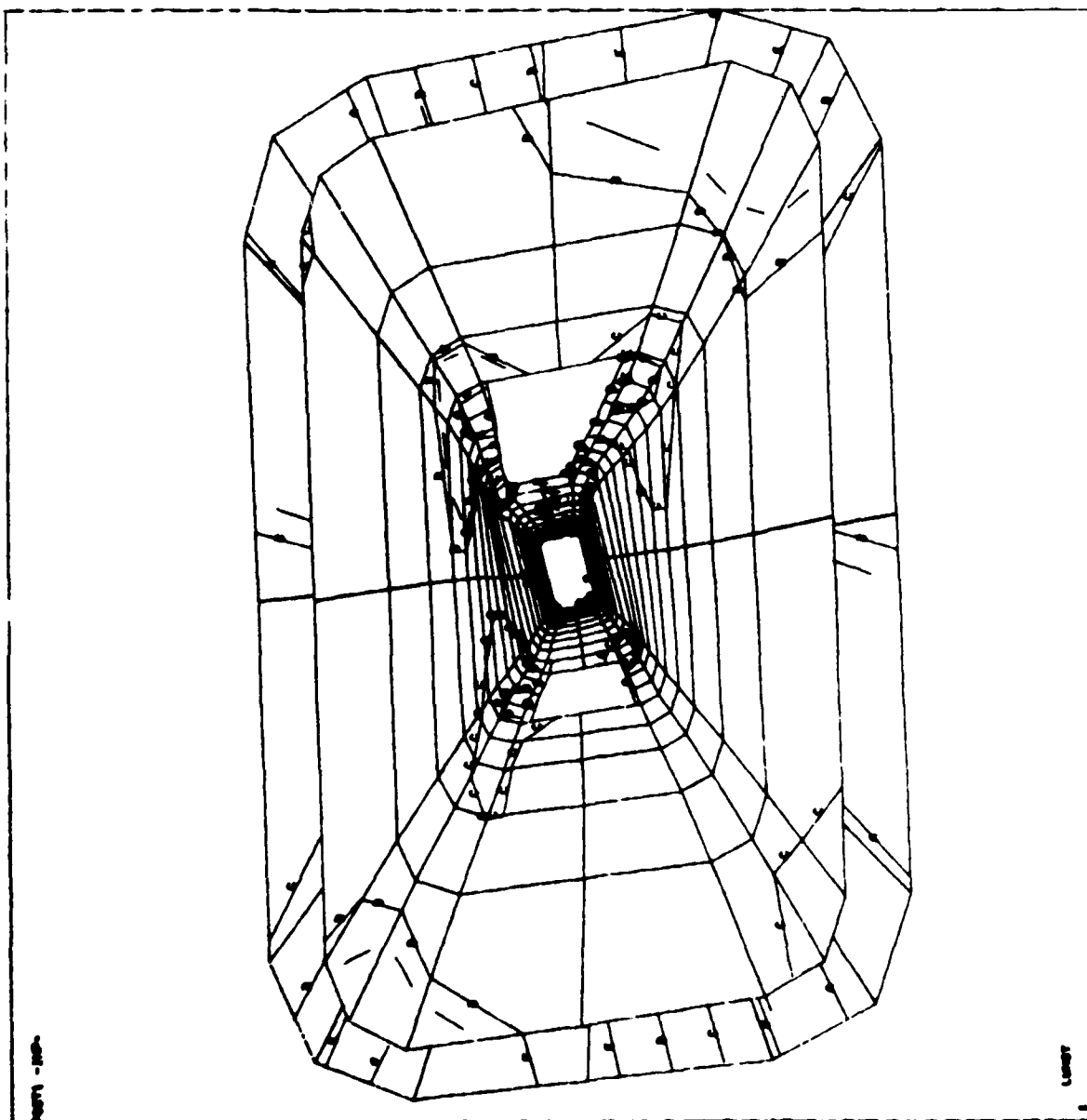
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**SECRET**



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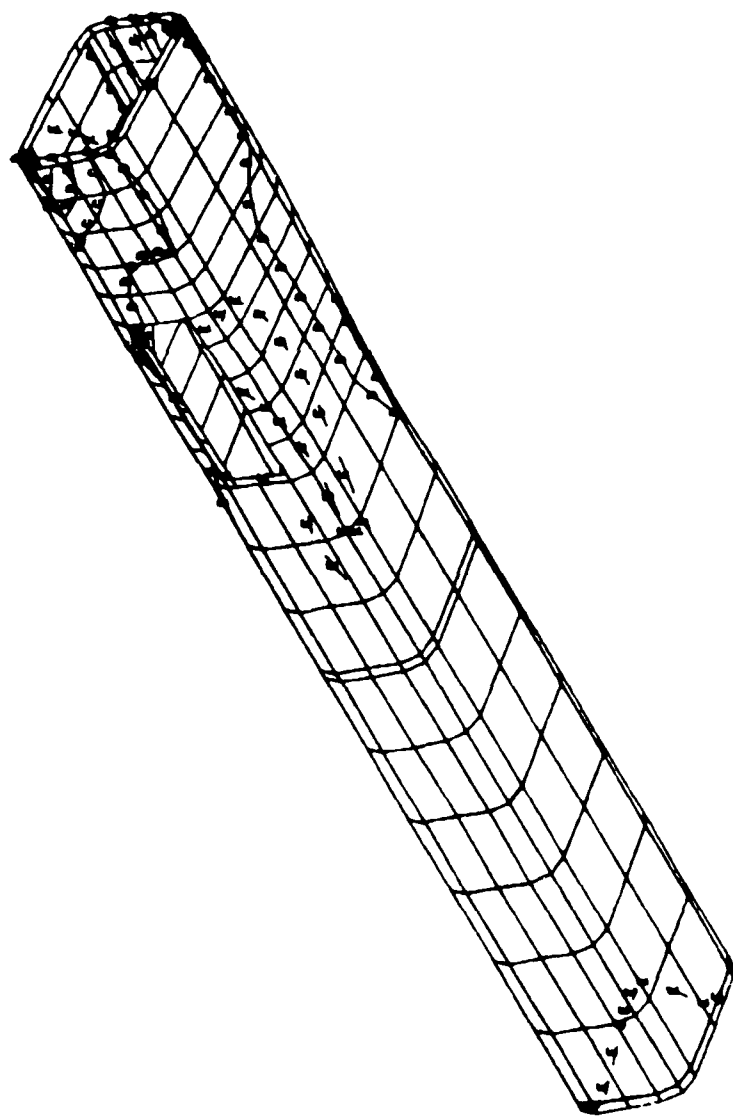
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4000 - 000

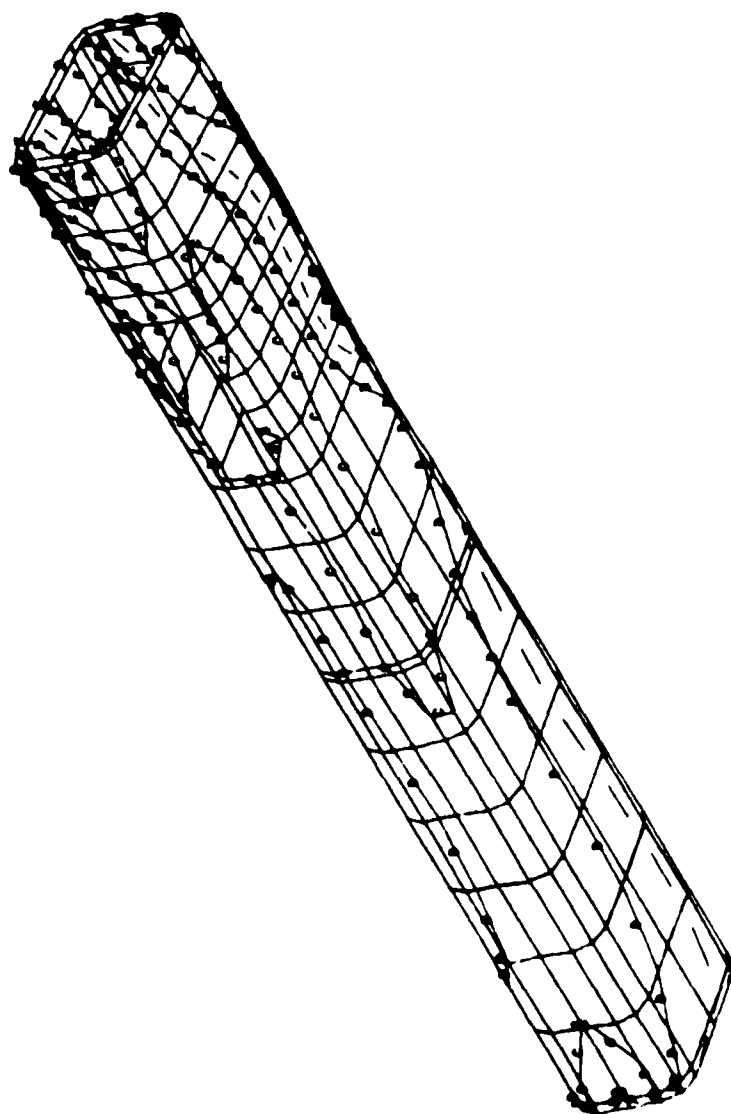
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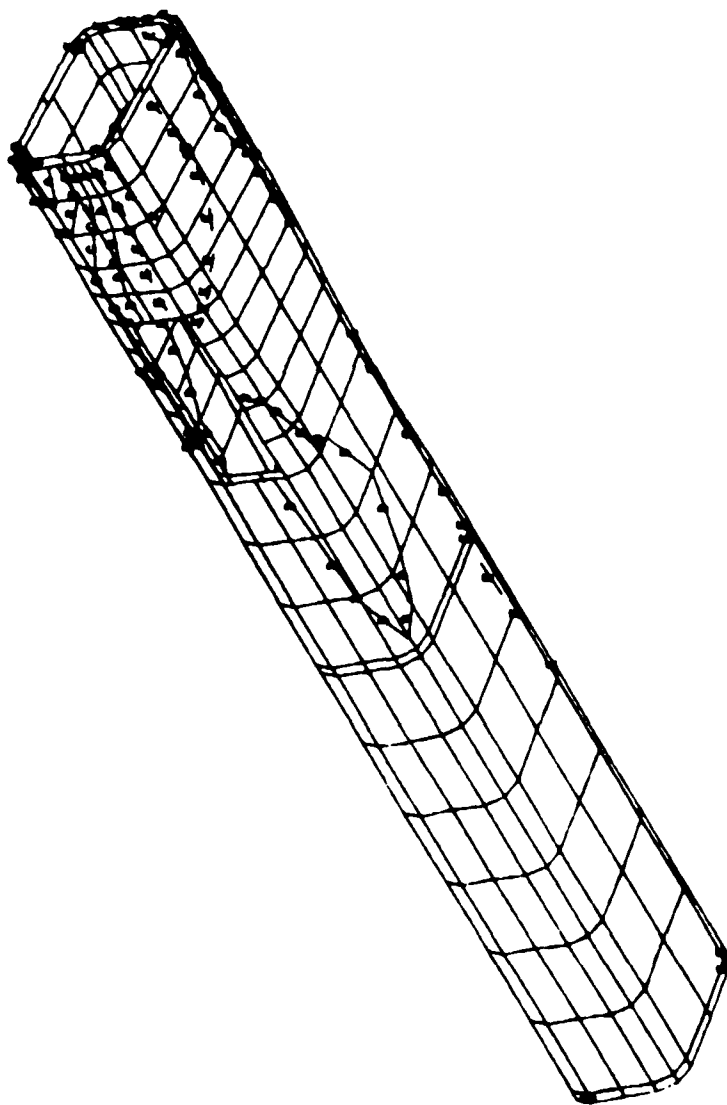
**1. Proof**

1-25



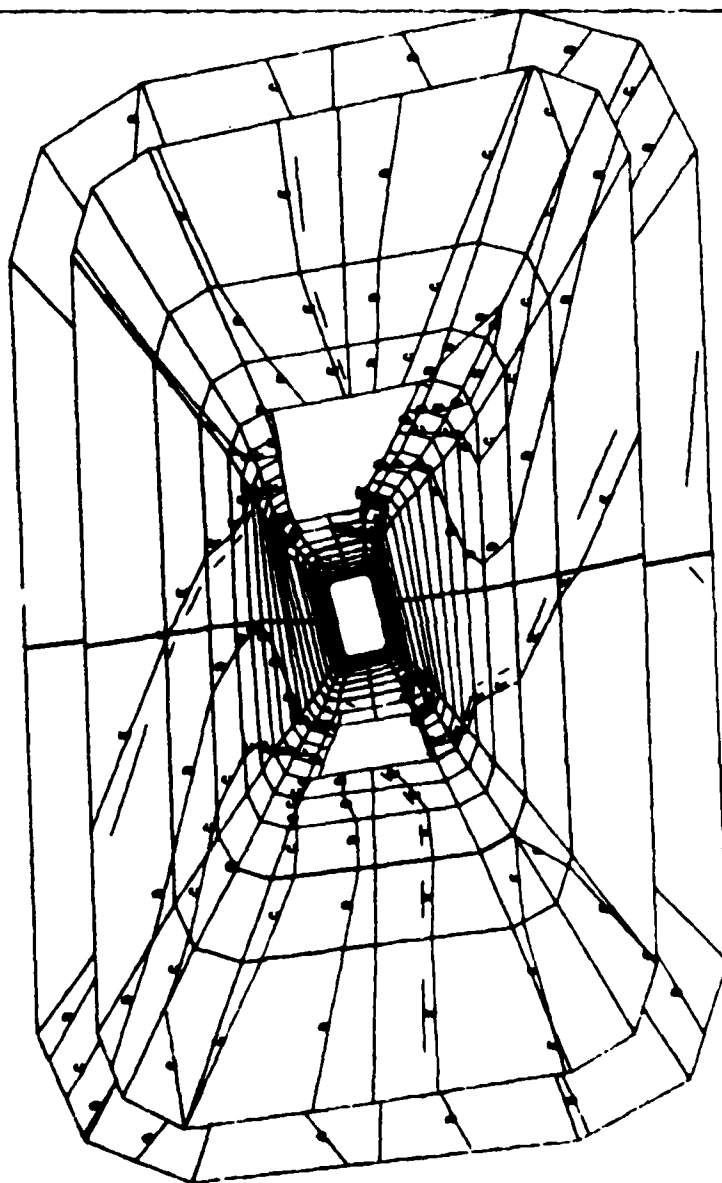
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12-15671



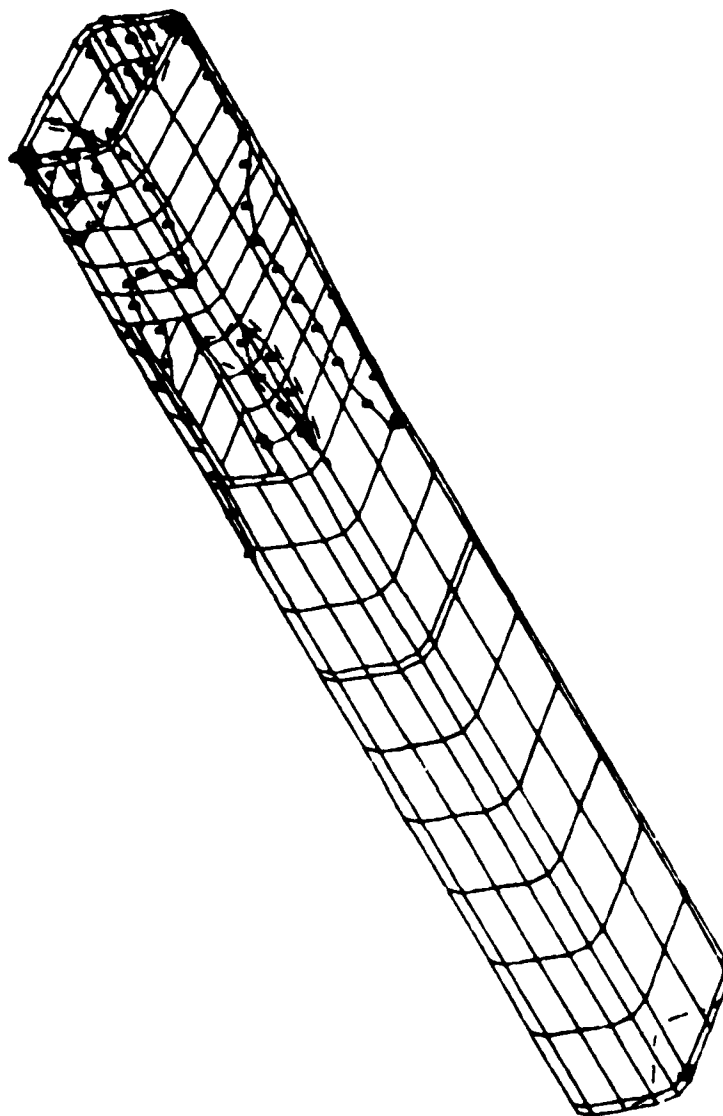
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**Answer:** D

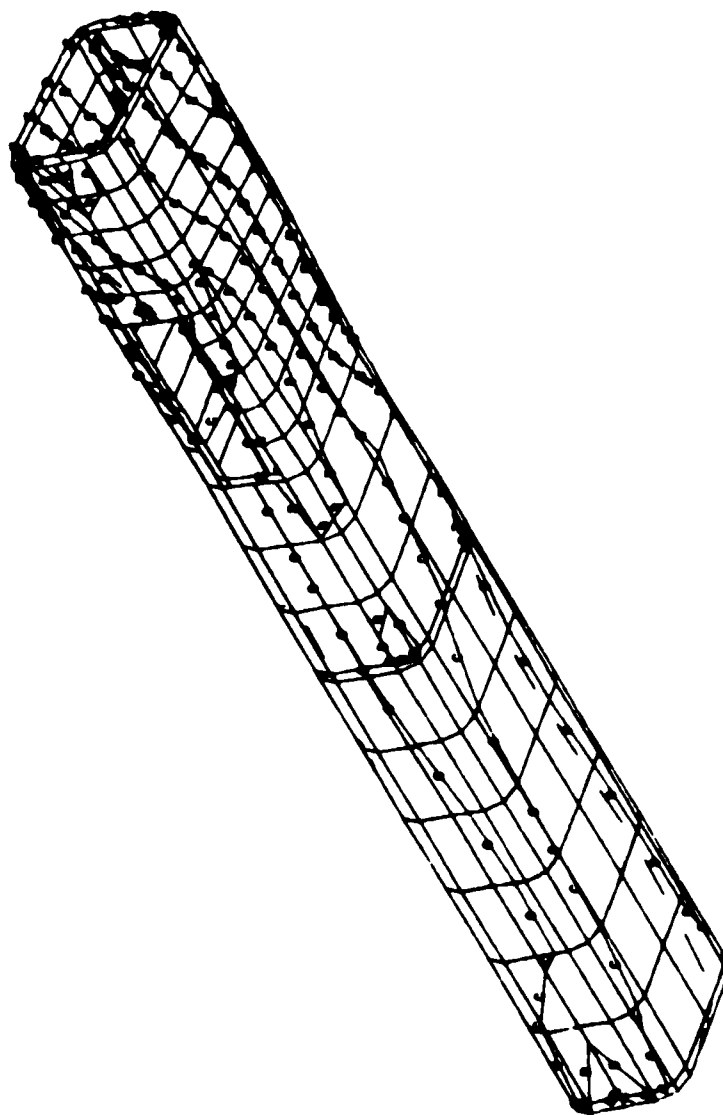


A complex 3D wireframe diagram of a rectangular structure, possibly a tunnel or a large container, viewed from an isometric perspective. The structure is defined by a grid of lines forming a rectangular prism. Inside this prism, there is a dense network of lines representing internal structural elements or a truss system. A central void is visible, shaped like a rectangular prism with a smaller rectangular prism inside it. The diagram is composed of black lines on a white background.

**Figure 1**

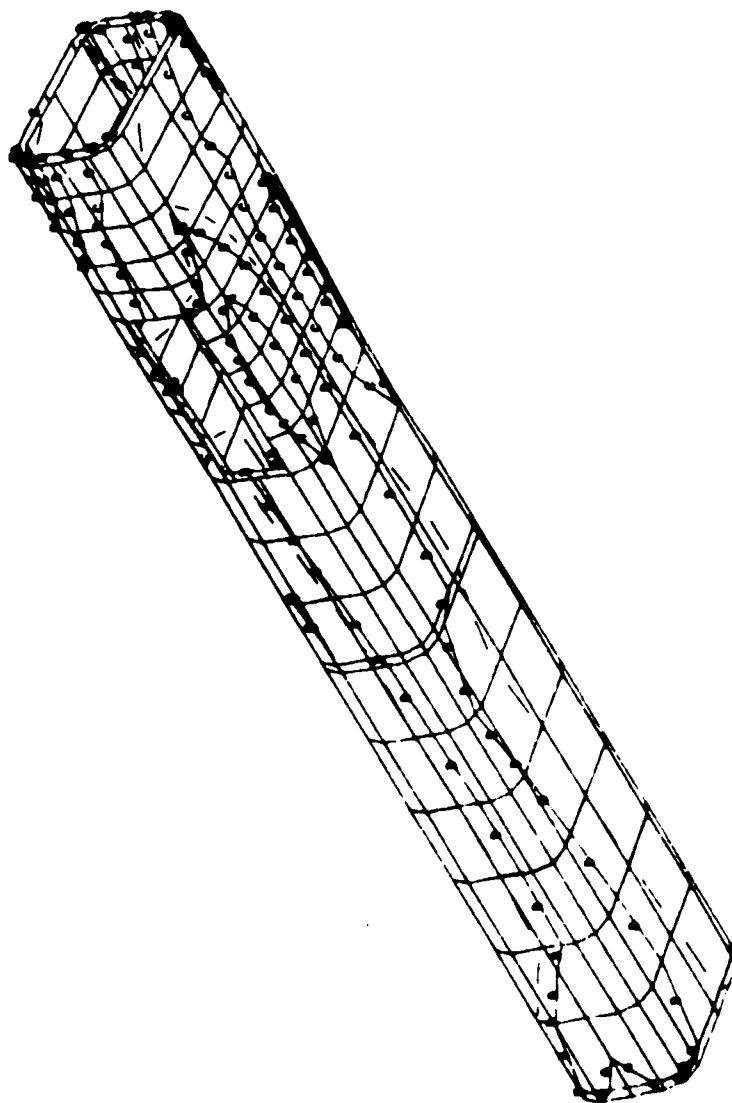
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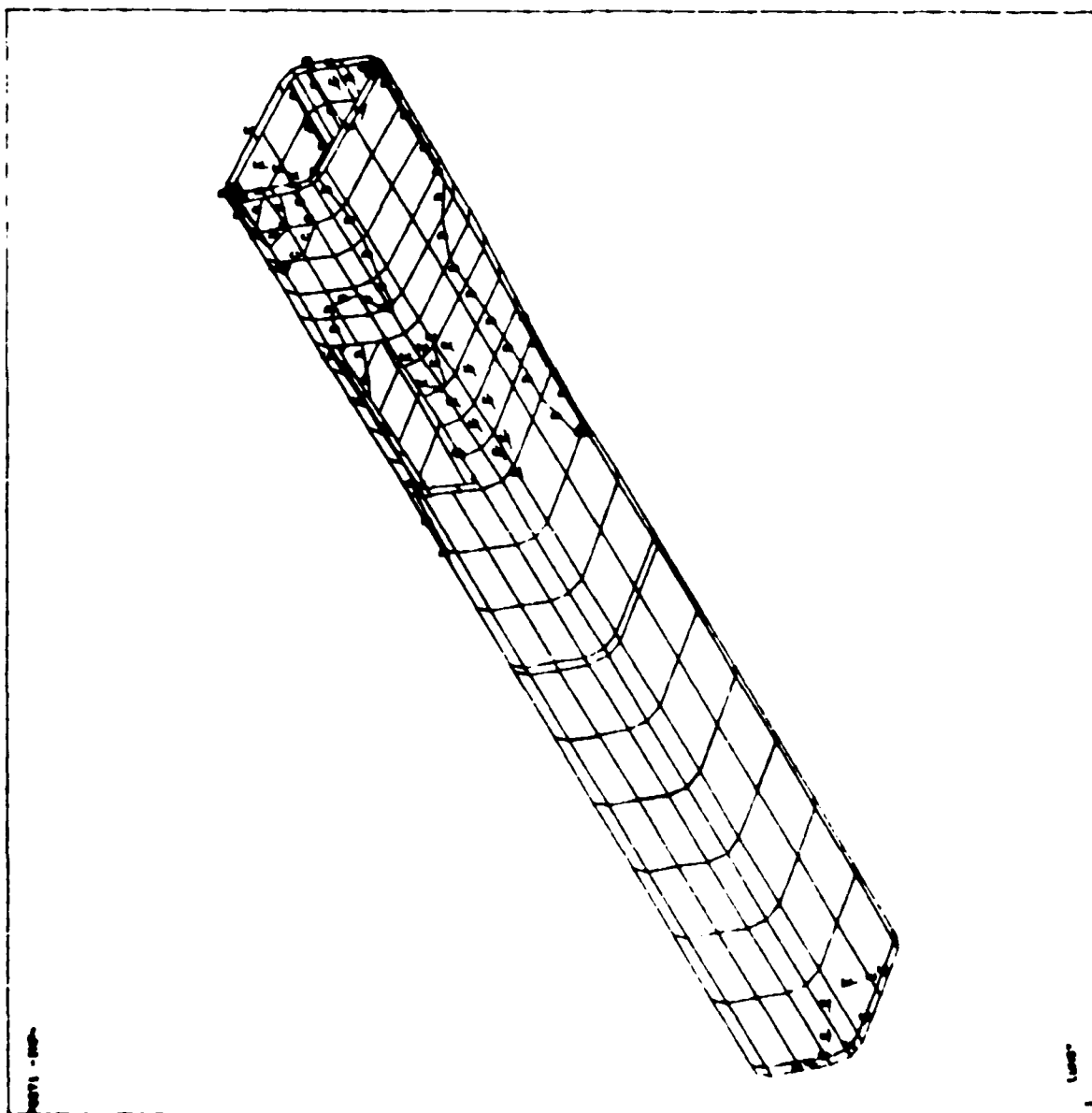
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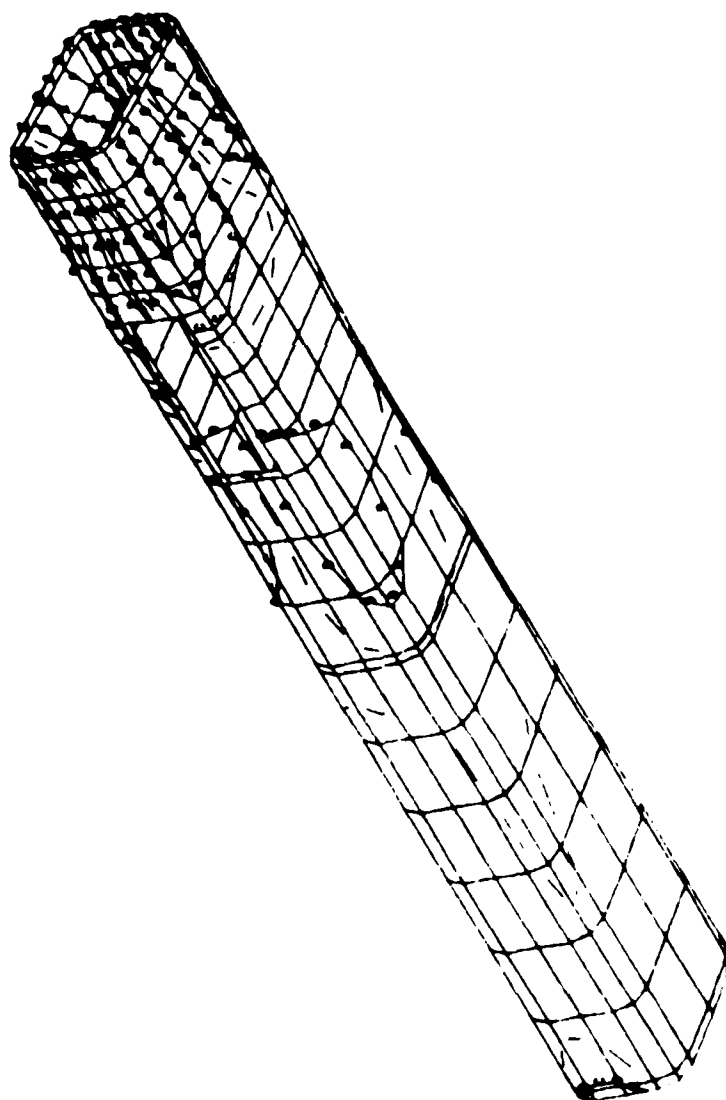
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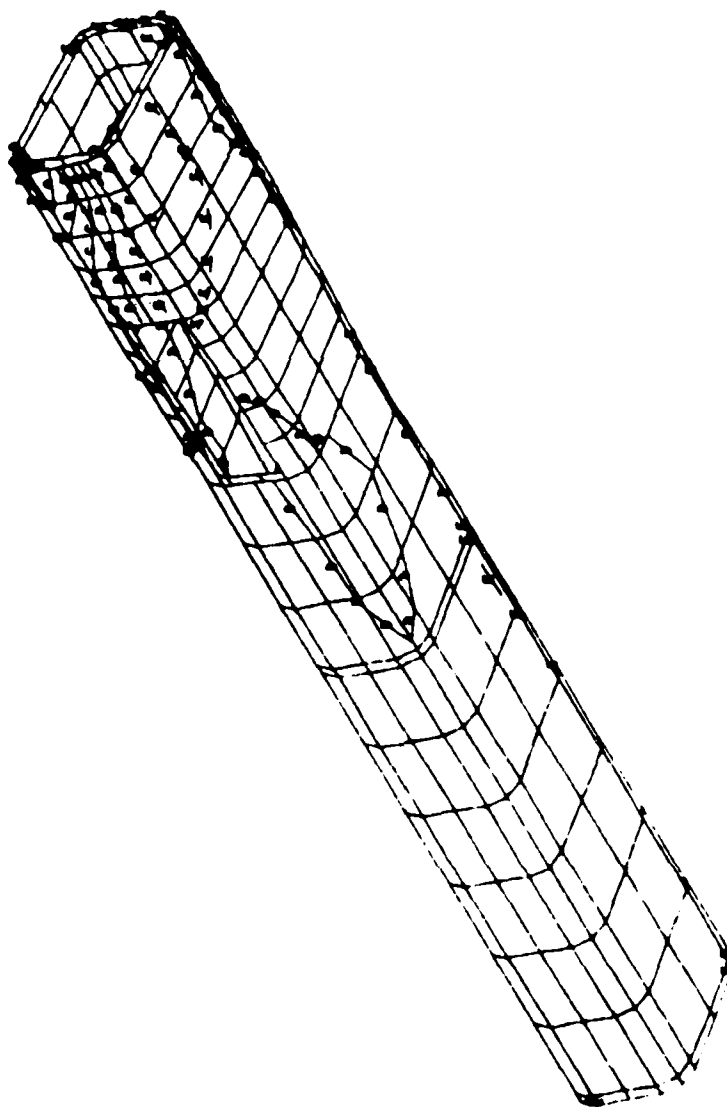
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[illegible]

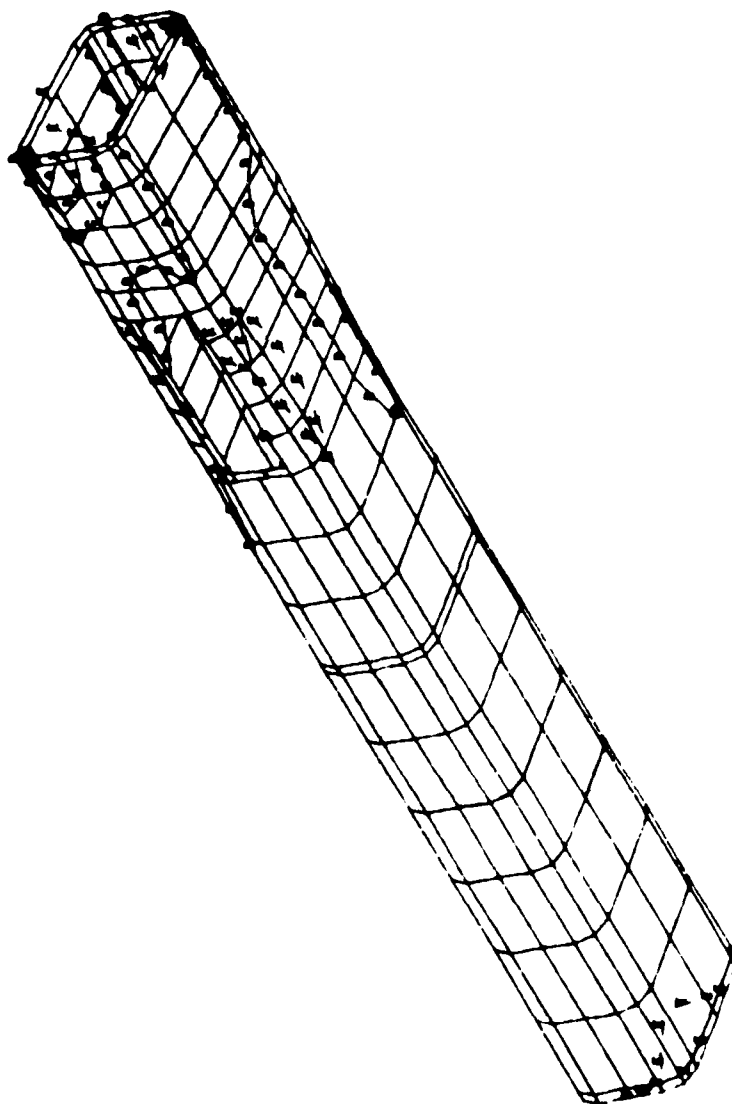
**1. Summary**

101-102



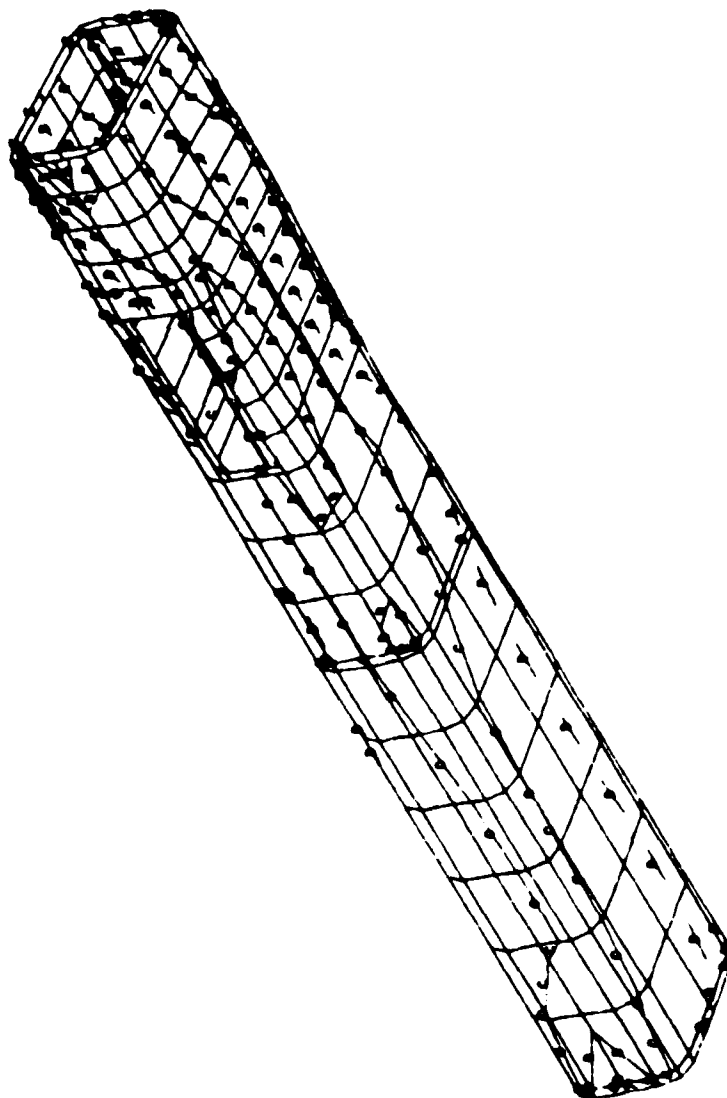
**1. Introduction**

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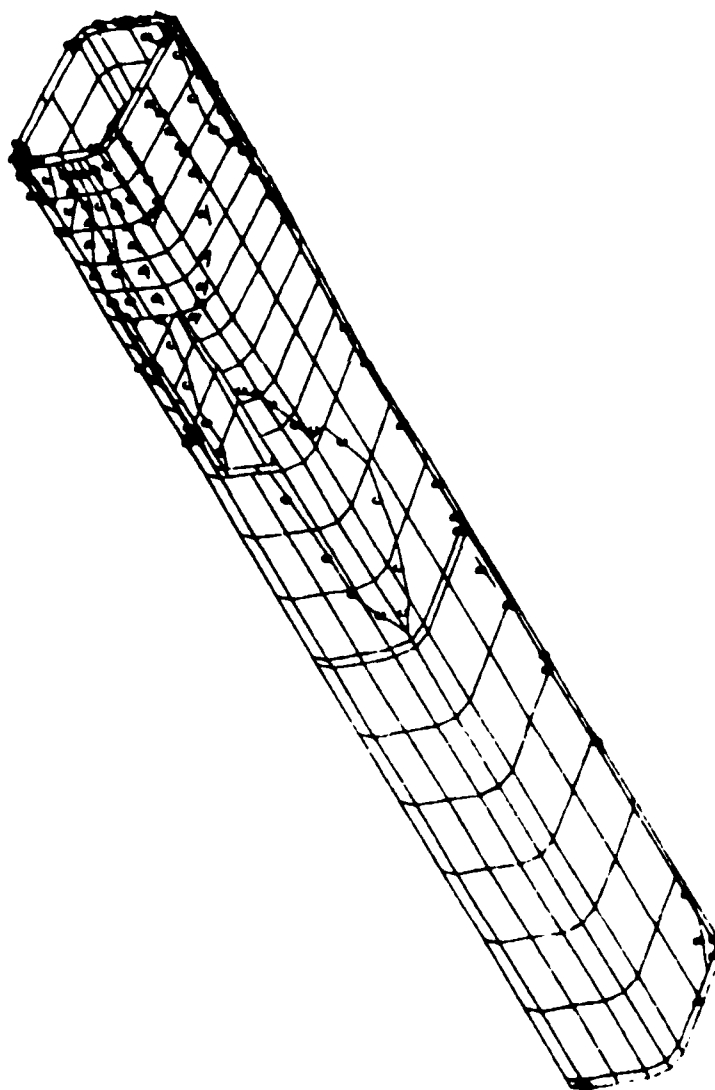
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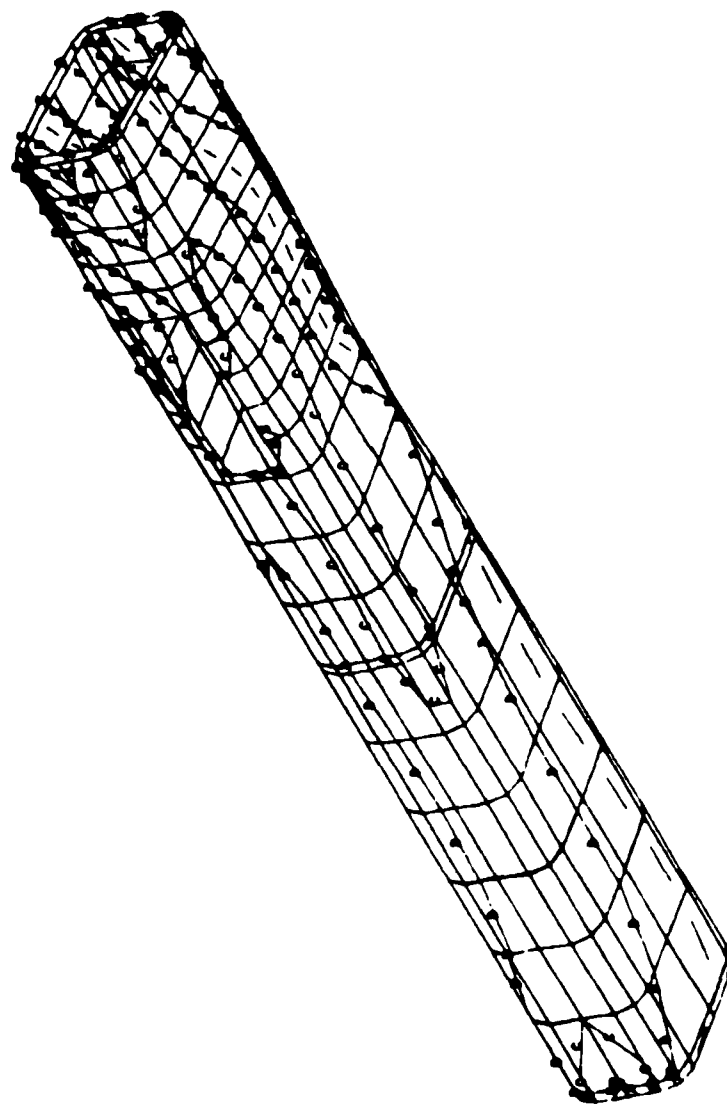


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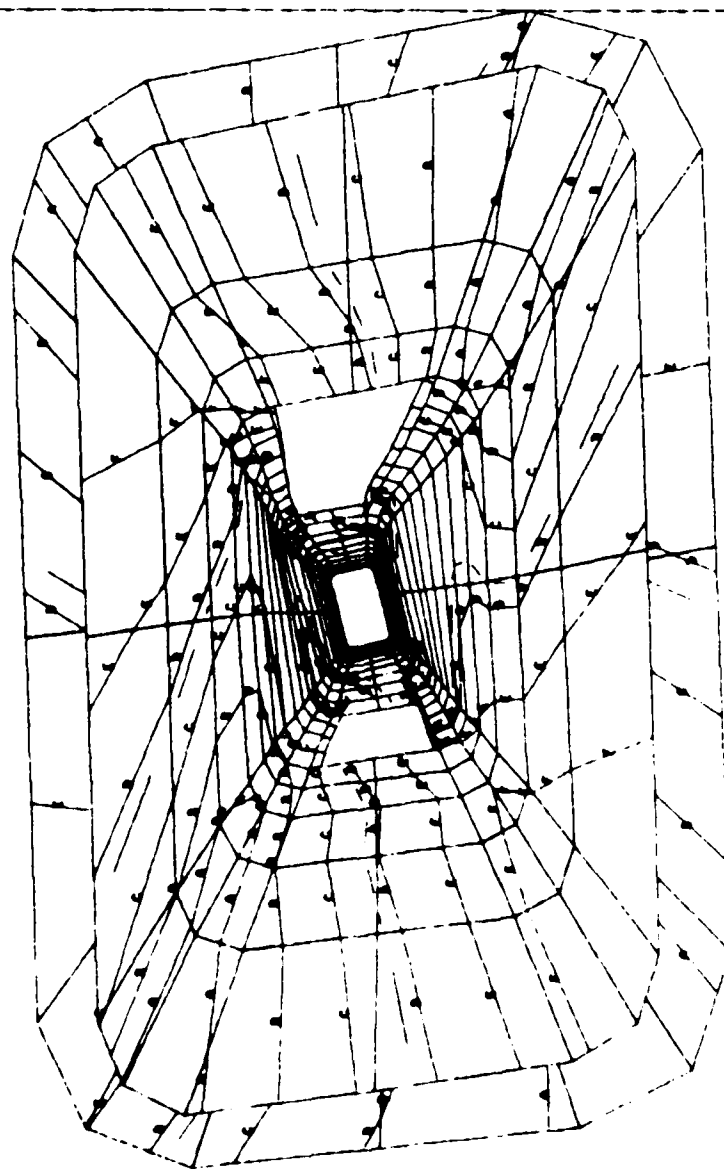
1-12-68



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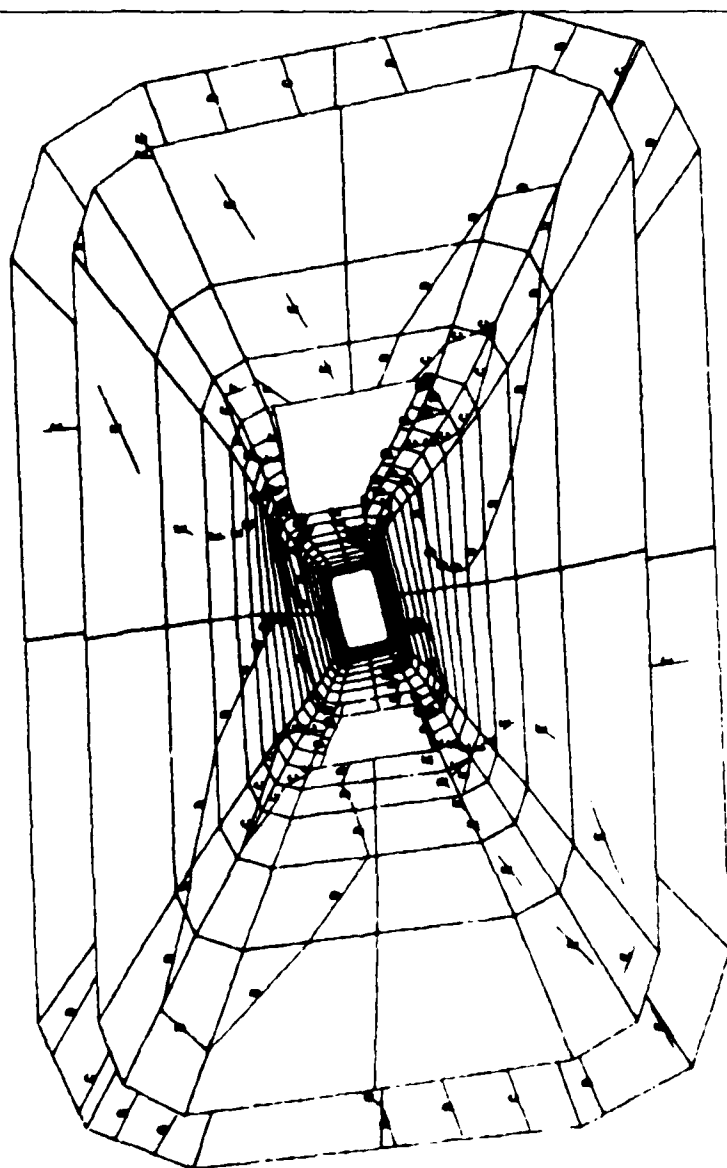


471 - 100



**150671**

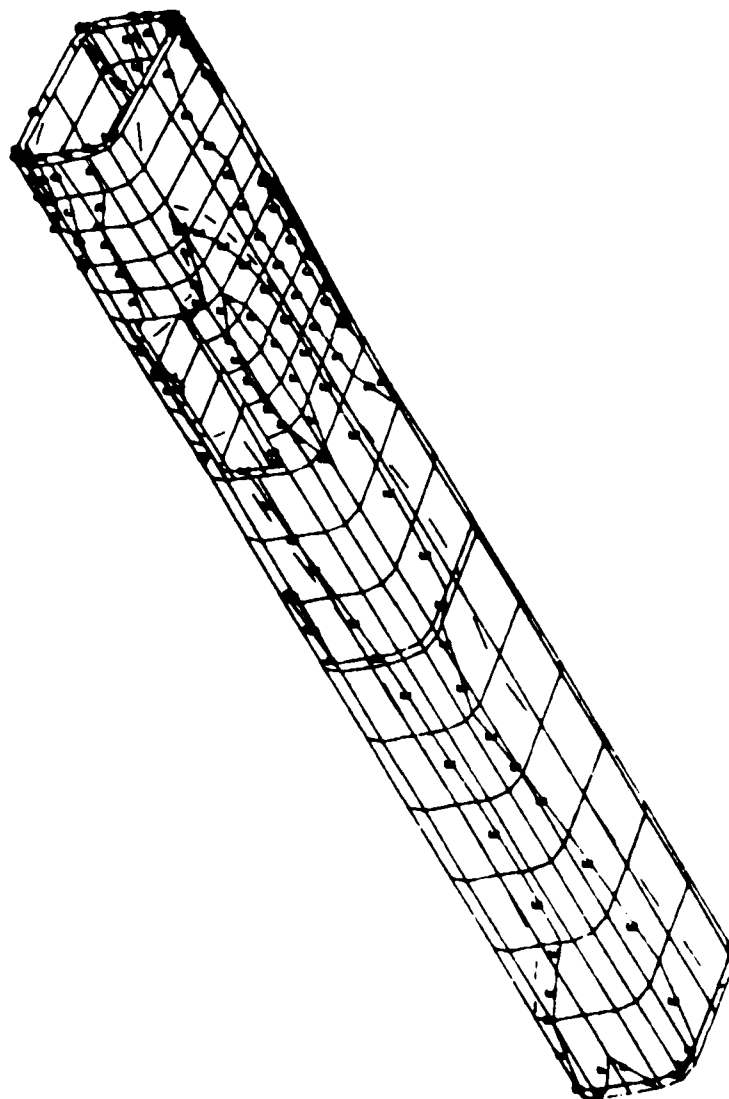
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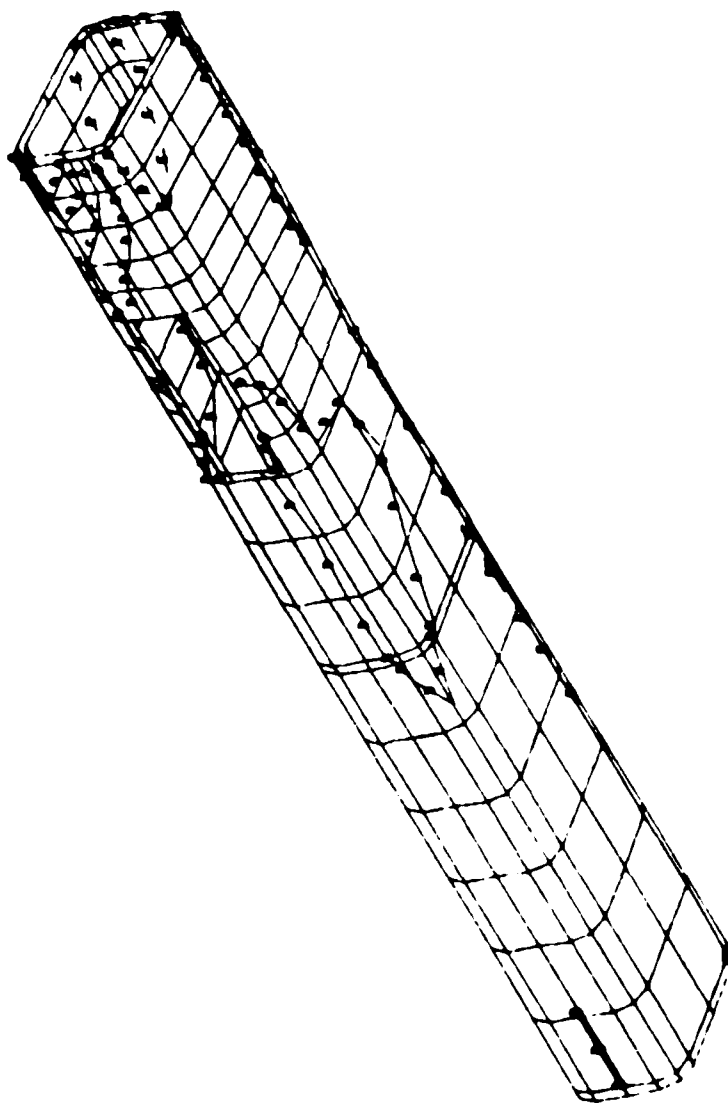
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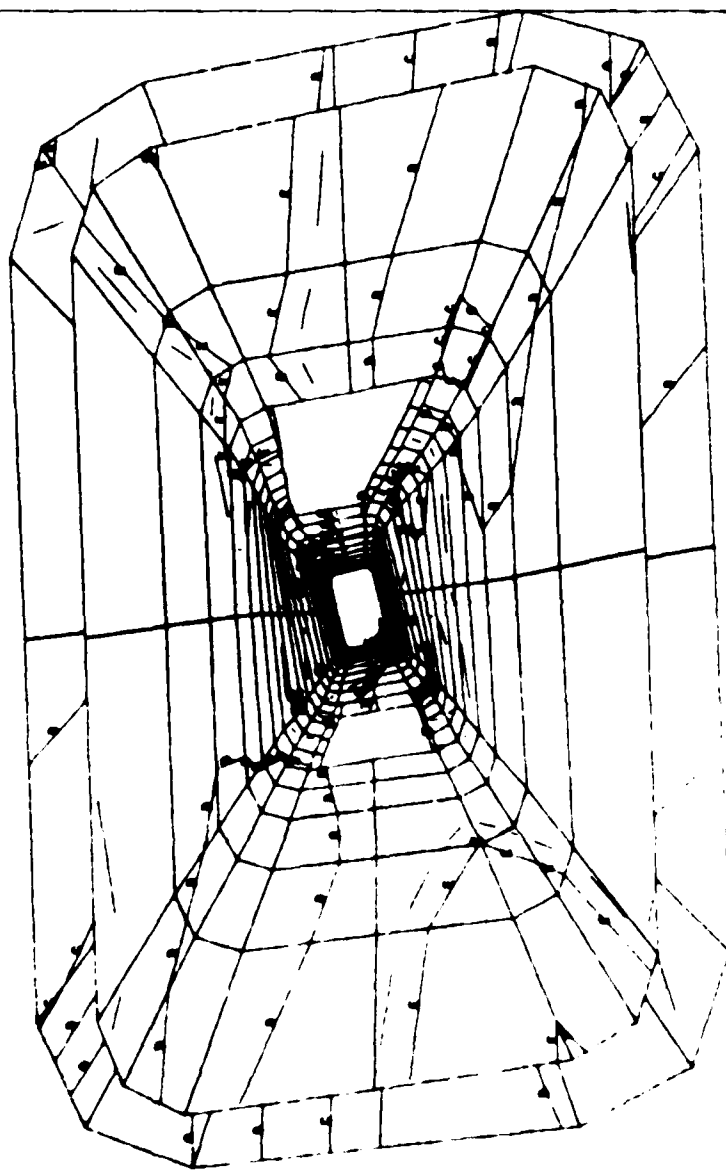


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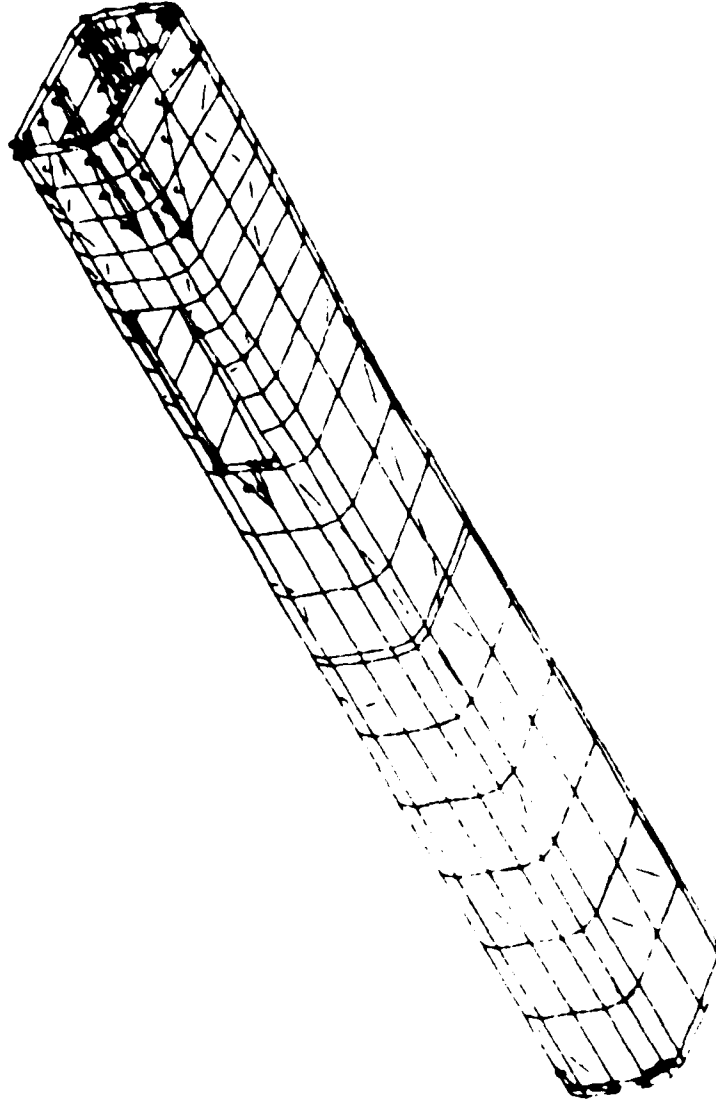


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A perspective drawing of a long, cylindrical object, possibly a telescope or a long tube, covered in a dense, crisscrossing grid pattern, resembling a woven mesh or a complex structural framework. The object is oriented diagonally across the frame.

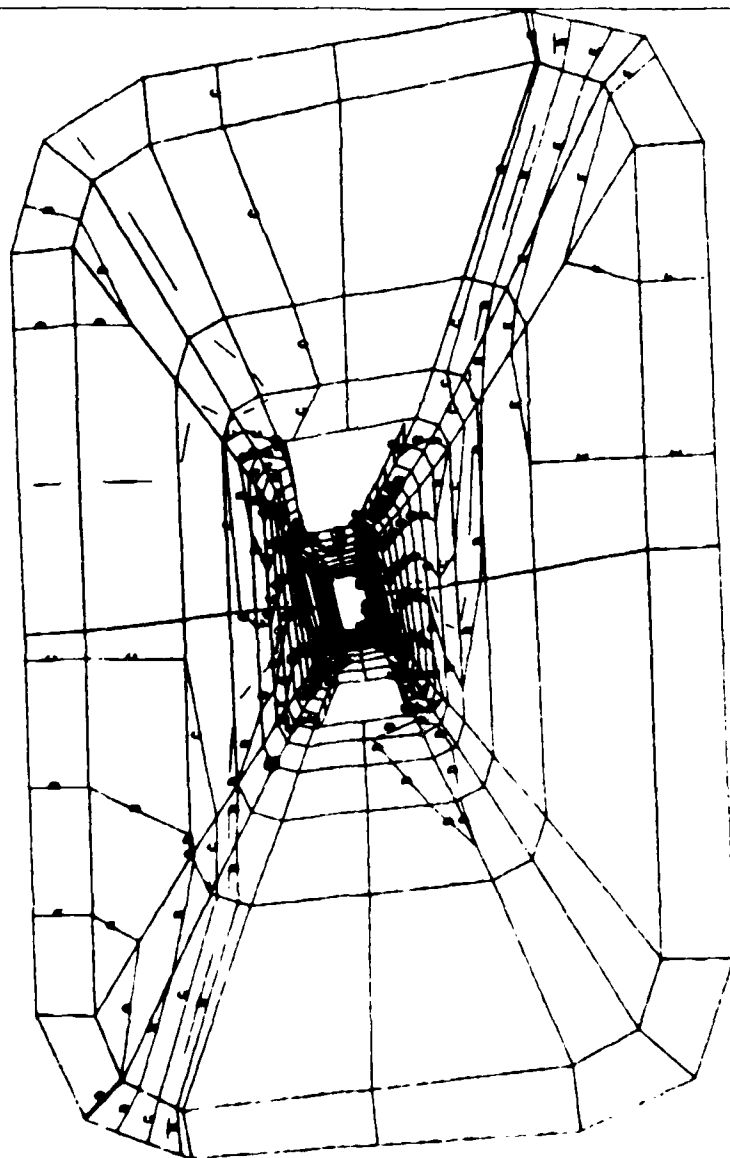
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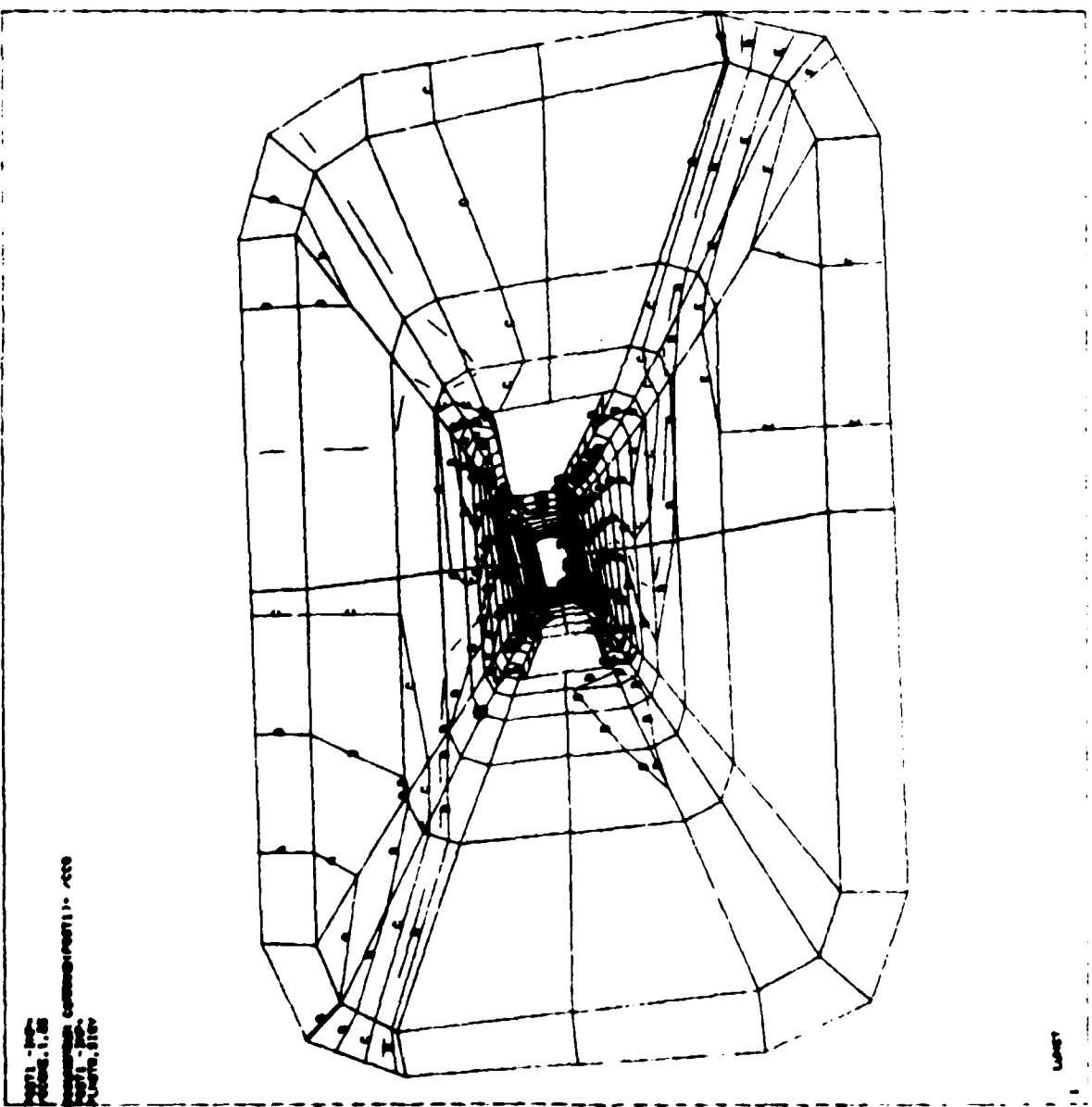
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LAYER: 2

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CONG-06  
WISCONS  
AM-31.0  
MAY-23.7  
C-0-06  
D-0-16  
C-0-5.05  
D-4.06  
C-0-14  
D-0-04

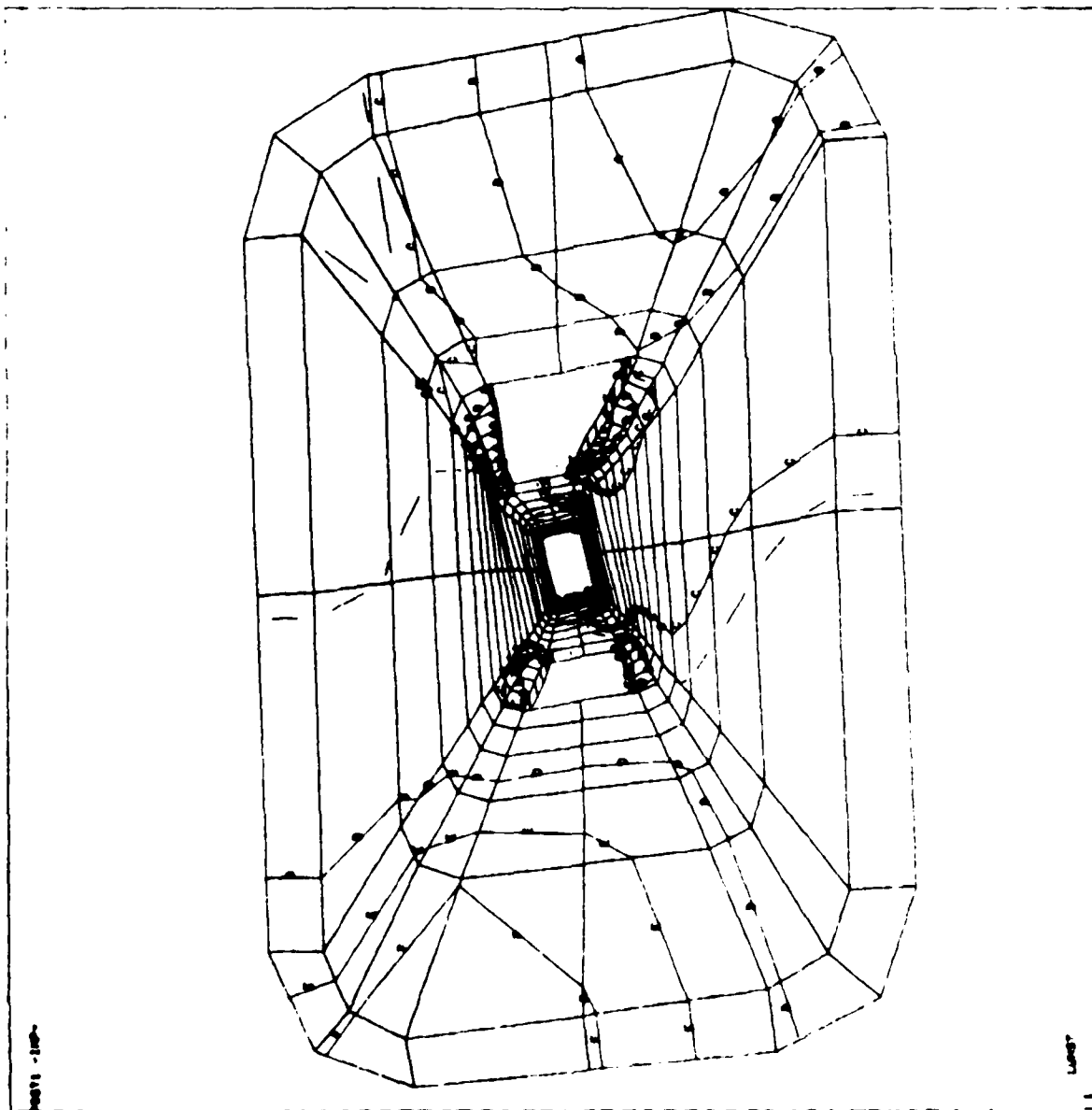


**Answer**

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D2/360

CEL MEMO: NOVEMBER 25, 1986

2

**FMC** Central Engineering Laboratories  
Santa Clara

Interoffice

Libbyvelt  
copy

To R. Rathe

From C. R. Ortloff

Subject **STATIC ANALYSIS RESULTS FOR  
THE LWHD COMPOSITE CRADLE-PROOF LOAD CONDITION**

Date Nov. 25, 1986

cc J. Ries\*  
A. Amberg  
R. Kazares  
E. Thuse  
B. Anderson  
E. Alexander  
B. Zierwick

\*one copy of figures only.

Attached are Figures 1-81 showing the static stress state in the composite Gr/Ep cradle FE model under proof loads. Use of 20-node solids (ANSYS STIF 95) and 8-node composite elements (STIF 91) are employed to examine stresses in each of the 28 Gr/Ep lamina and the internal core material. The recoil, firing torque and gravity loads are applied statically to the cradle. The dynamic load case results (to follow shortly) model the cable tension relaxation effect and dynamic input loads precisely. Results from the dynamic run (due 12/1) should provide the appropriate dynamic amplification factor (from 0.5 to 2) for displacements. This factor may then be used with the present static stress case to determine the dynamic stress state multiplication estimates based on ratio of dynamic to static deflections.

Materials properties have been changed to reflect new values provided on 11/13. Although a new cradle design was provided on 11/13, the present results reflect the old design prior to this date. Results should be close as the geometry changes between old and new designs are minor. The new FE model used for dynamic analysis has been upgraded to reflect the new design geometry but uses CMAP averaged equivalent layer properties for the composite shells. Consequently, only "averaged" stresses in the outer Gr/Ep layers can be determined rather than individual layer stresses. The displacement-time history, however, should be reasonably accurate and suitable for use in determining a stress amplification scale factor. No thermal expansion or moisture absorption loads are included in the analysis and proof firing load maximum amplitudes are used. The distributed masses of the gun barrel and cradle plus the concentrated mass of the hydraulic cylinders and equilibration device is also included.

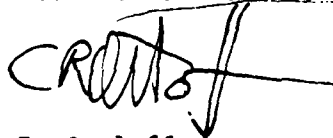
In the output, UY represents vertical deflection, SHL represents in-plane lamina shear stress, ROTZ represents rotation (radians) about the longitudinal axis, SXL is the fiber stress, SYL is the transverse fiber stress (epoxy) and L represents the layer number starting from the outer layer. Note that layer 1 is the outer layer for the Gr/Ep shells; layer 14 is the Gr/Ep layer closest to the core for both inner and outer laminates.

Preliminary results are summarized below for the static stress case. These results will be updated when results from the dynamic analysis when available.

- o Maximum in-plane lamina SXY (SHL) stress for the entire cradle is less than or equal to 6,000 psi (except for regions near the composite to metal attachments near the gimbal mounts). Allowed stress is 10,000 psi. Allowing for a total 2X factor due to thermal expansion effects, moisture absorption loads, local manufacturing defects and assuming a dynamic amplification factor greater than unity (or a stress safety factor (SF) of 2), SXY shear failure may be anticipated in layers 1, 2, 4, 5, 8, 11.
- o Maximum interlaminar shear stress for all elements is less than 100 psi consistent with the plane stress assumption used in STIF 91 formulation. Allowing for a factor of 2 for the above-mentioned considerations (or a stress SF=2), this stress is still less than the epoxy shear failure stress of 10 ksi.
- o Maximum longitudinal deflection under combined firing loads and gravity loads is about 4 inches vertical. This deflection seems excessive unless the gun rails are to be designed to provide large bending stiffness to add to that of the cradle and/or longitudinal stiffening is added to the cradle.
- o Maximum cradle rotation is about 4.0° end-to-end. As the cradle is relatively flexible in torsion, additional +45° layers in the region between the last internal plate and trunnion may provide additional torsional stiffness.
- o Maximum fiber stress (SXL) in regions away from the end connection region is about 120 ksi (Layers 6,7,13 for example). Allowing for a 2X factor for the above-mentioned effects (or a stress SF=2), stresses approach 240 ksi, and exceed the allowable stress of 180 ksi. Local fiber failure may be anticipated in a compressional mode.
- o Numerous cases exist for epoxy stress on the order of 5,000 psi (layers 2,10 for example) well away from the end connected to the gimbal mount. Allowing for a 2X factor (or a stress SF=2), the stresses are on the order of the 10 ksi, resulting in local epoxy failure under proof loads. This is cause for concern using the current resin system.
- o Foam core shear stresses appear less than 100 psi under proof load conditions. Normal stresses appear less than 100 psi also. A suitable core material with failure properties above these limits can easily be found.

Preliminary Recommendations:

- o Based on the total 2X assumption for stress amplification and other factors (which will be checked when the dynamic output is available) or a stress safety factor of 2, it appears that margins of safety for stress are exceeded for both fibers and epoxy in certain lamina under proof loads. The in-plane shear stress is likewise above the failure limit in certain lamina. Local failure can therefore be anticipated inside the Gr/Ep layers. Since all of the high stress regions are located in the zone between the gimbal mount points and last internal plate, this zone may need reinforcing by additional 0°, 90° and +45° layers or internal/external bonded-on sections.
- o The deflection and rotation seem excessive. Use of additional 0° and +45° fiber layers will improve the bending and torsional stiffness considerably especially in the region between the gimbal mount points and the rear internal plate. This zone has large cutouts and shows consistently high stress values. It is anticipated that this zone will require considerable reinforcement to achieve lower stress levels.
- o Failure criteria is based on maximum stress criteria. There may be other modes of failure (such as longitudinal buckling or torsional buckling and local fiber-resin separation) not accounted for in the present analysis. These investigations will be pursued by use of ANSYS buckling routines.
- o The high stress regions near the gimbal mount are indicative of what may be expected near the metal-to-composite joint in this region. The length from the core region should be reinforced to distribute stress over the Gr/Ep face sheets to low levels. It may be necessary to build up the connection zone Gr/Ep layers leading from the core end region to avoid high stress concentrations. A separate FE analysis of this end zone should be performed.
- o An internal metal space frame within the core connecting trunnion mount end plates to the internal rear plate may be of use to take out torsional stresses in the cut-out zone.

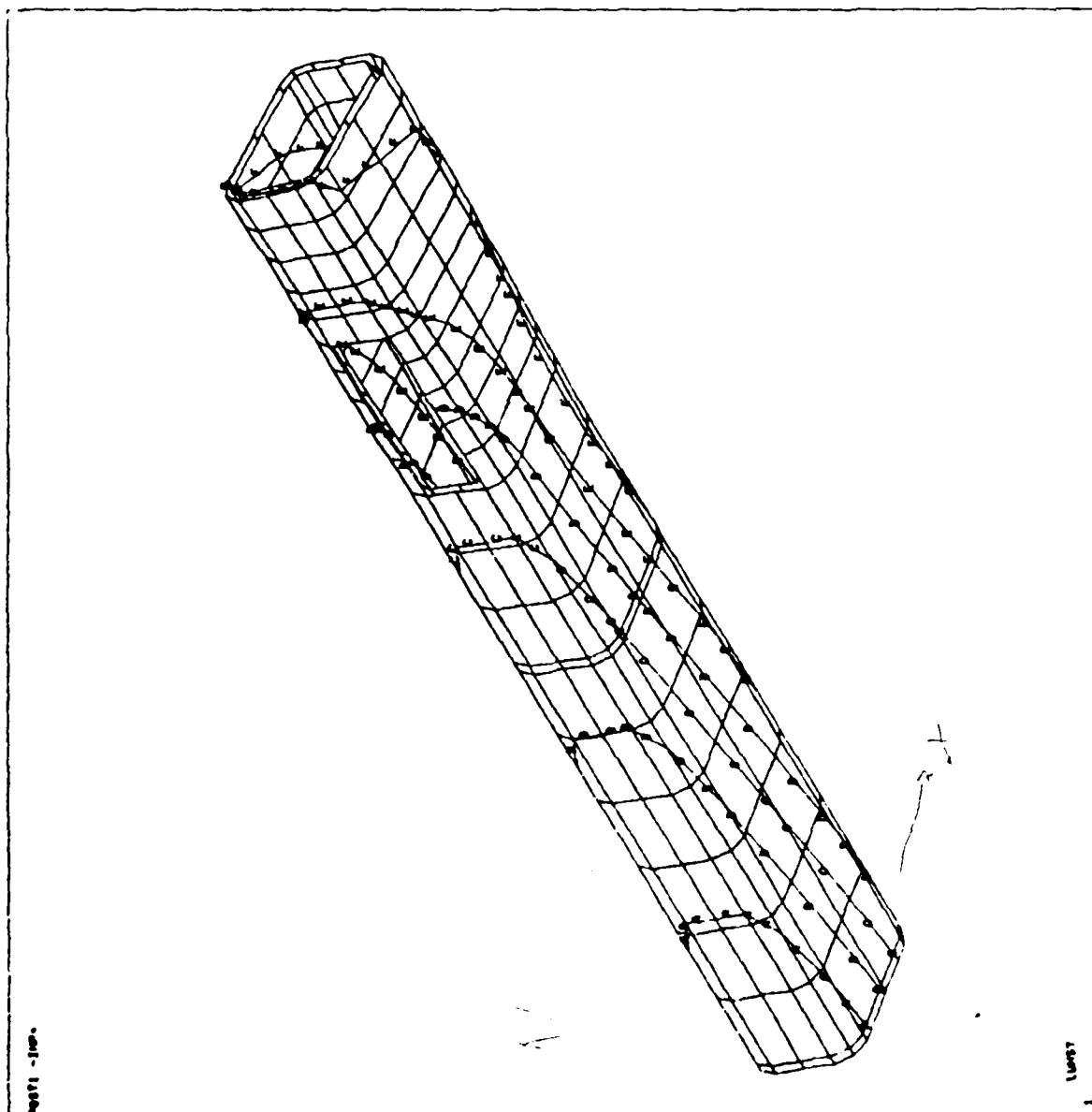
  
C. R. Ortloff

File 1-5

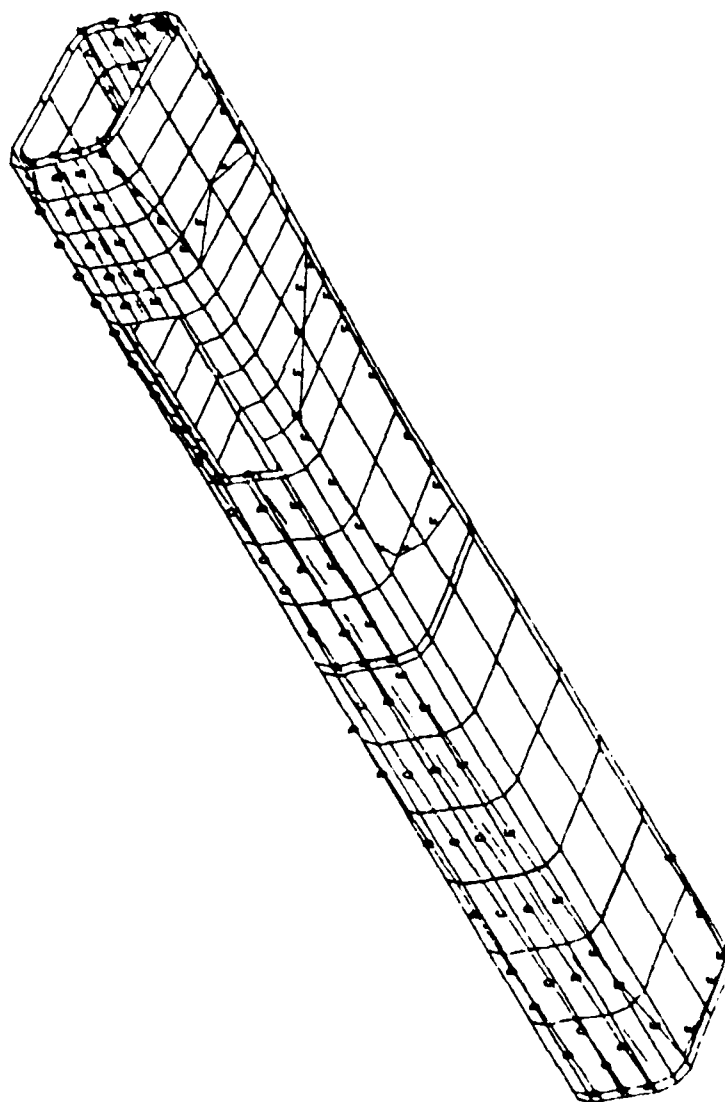
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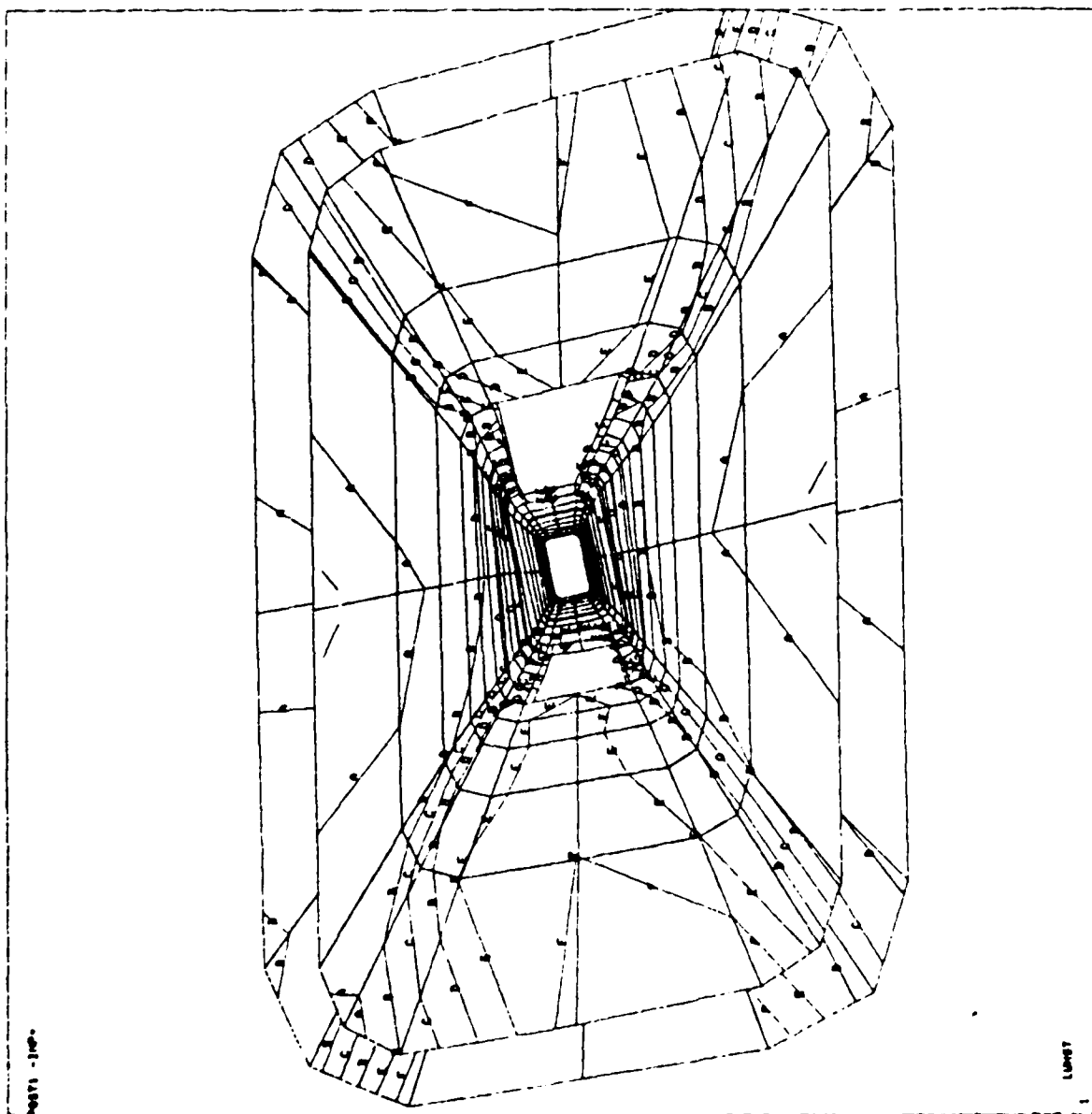


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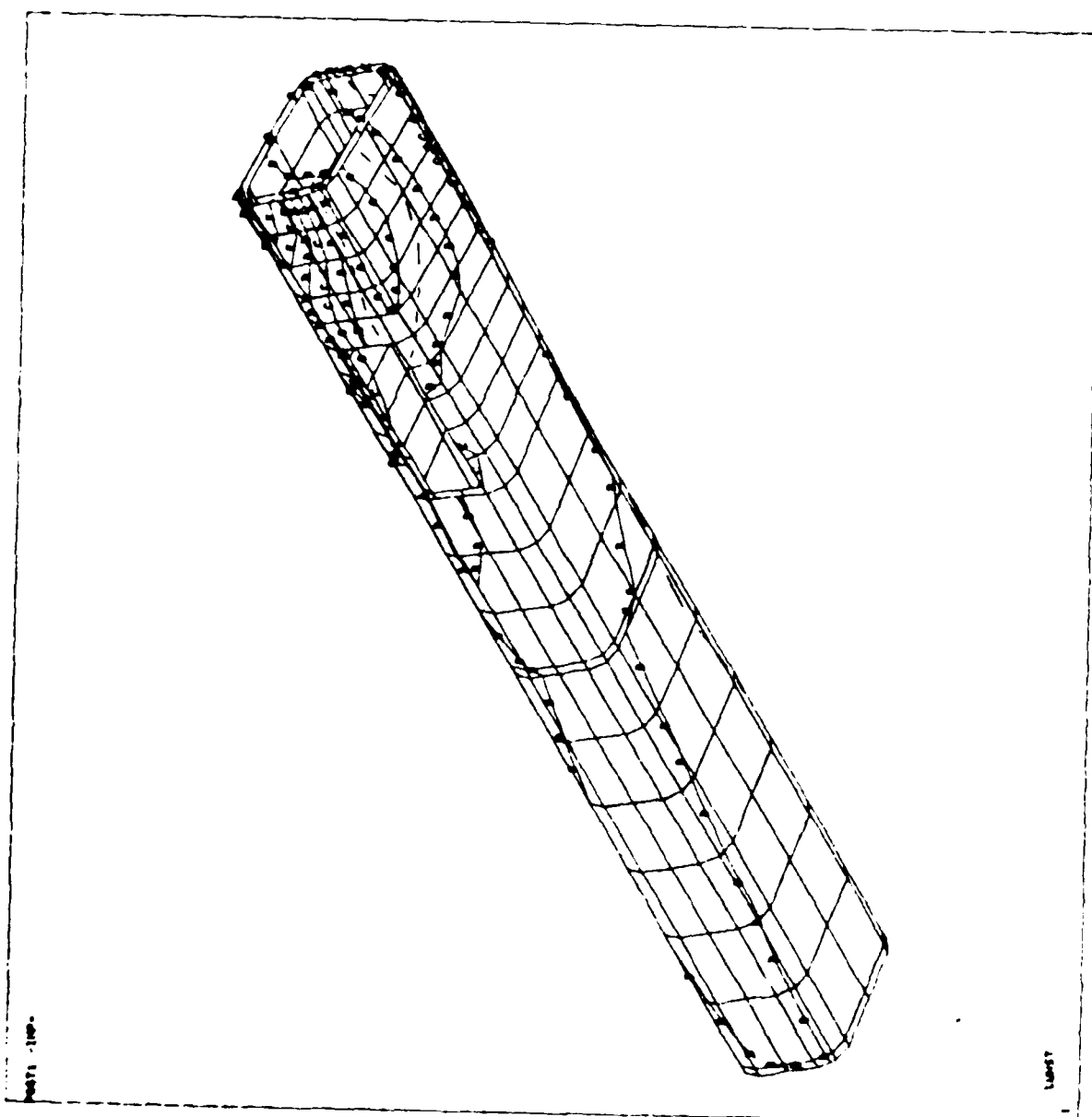




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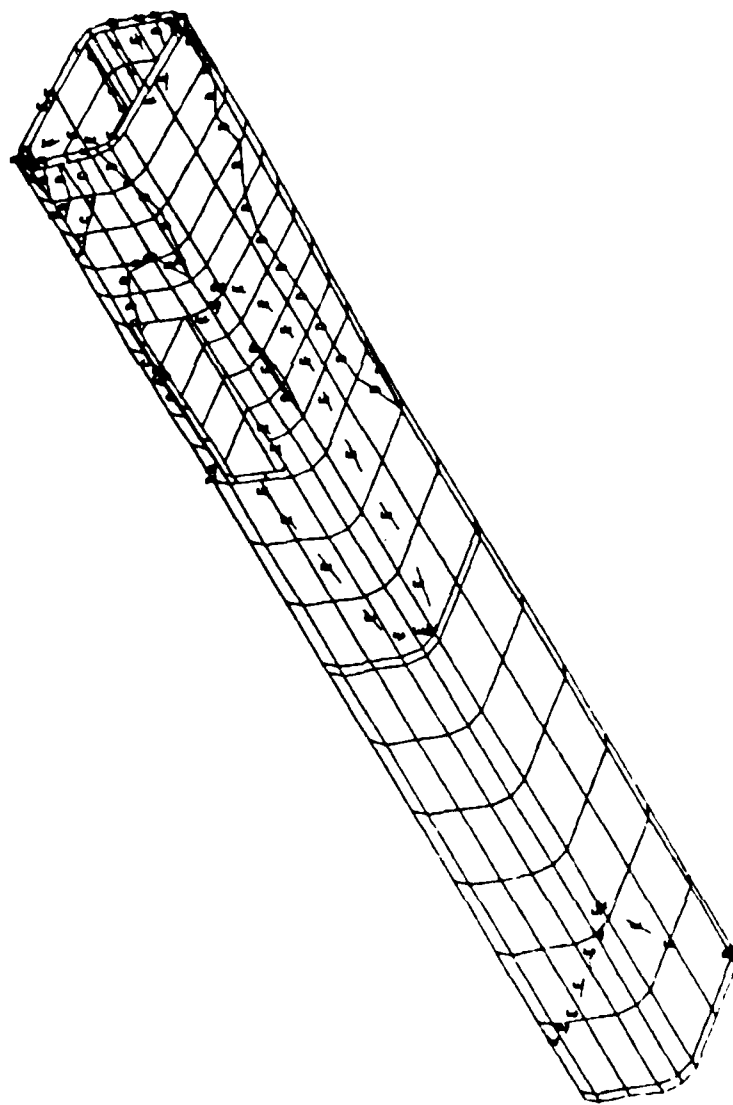
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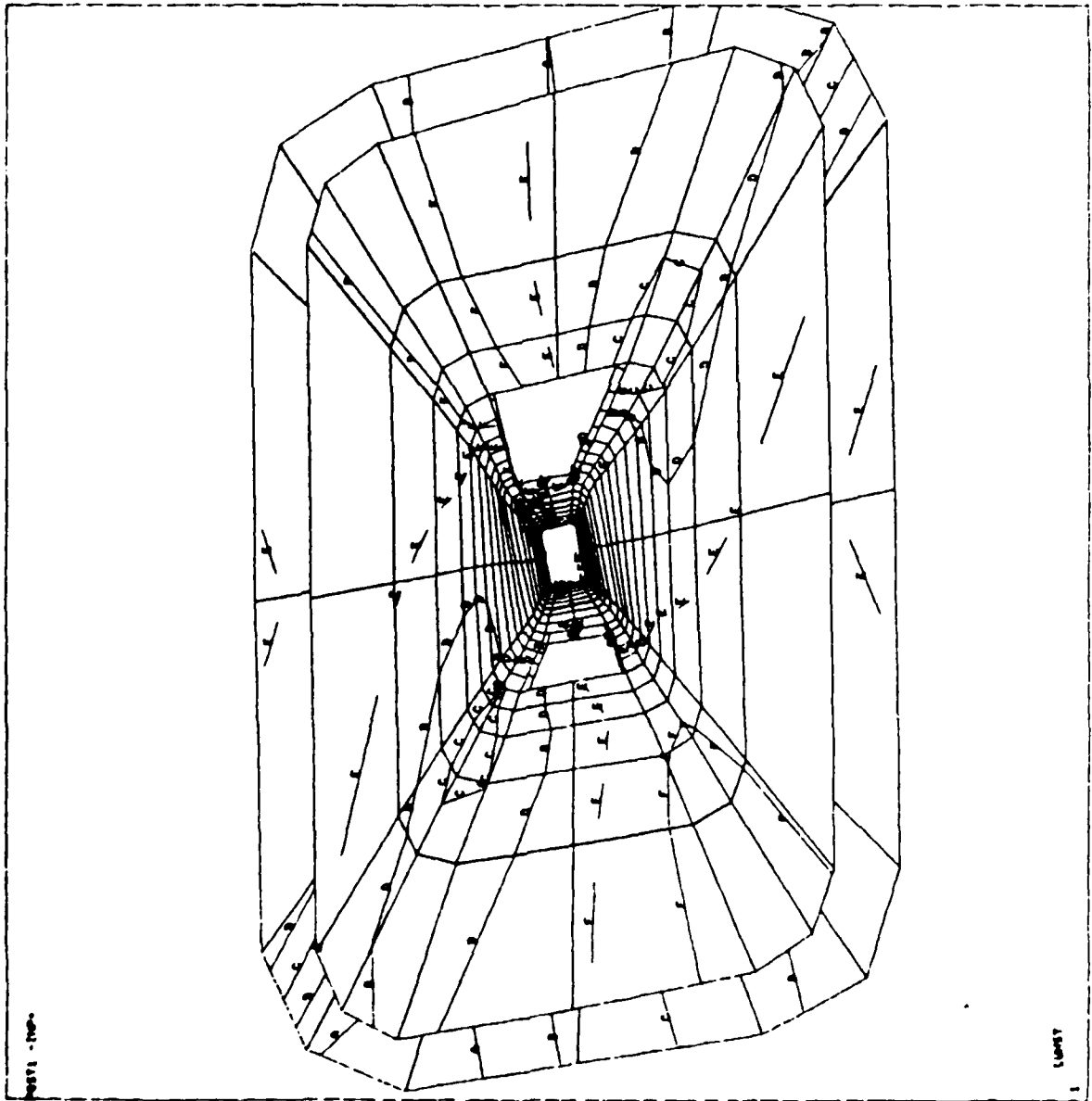
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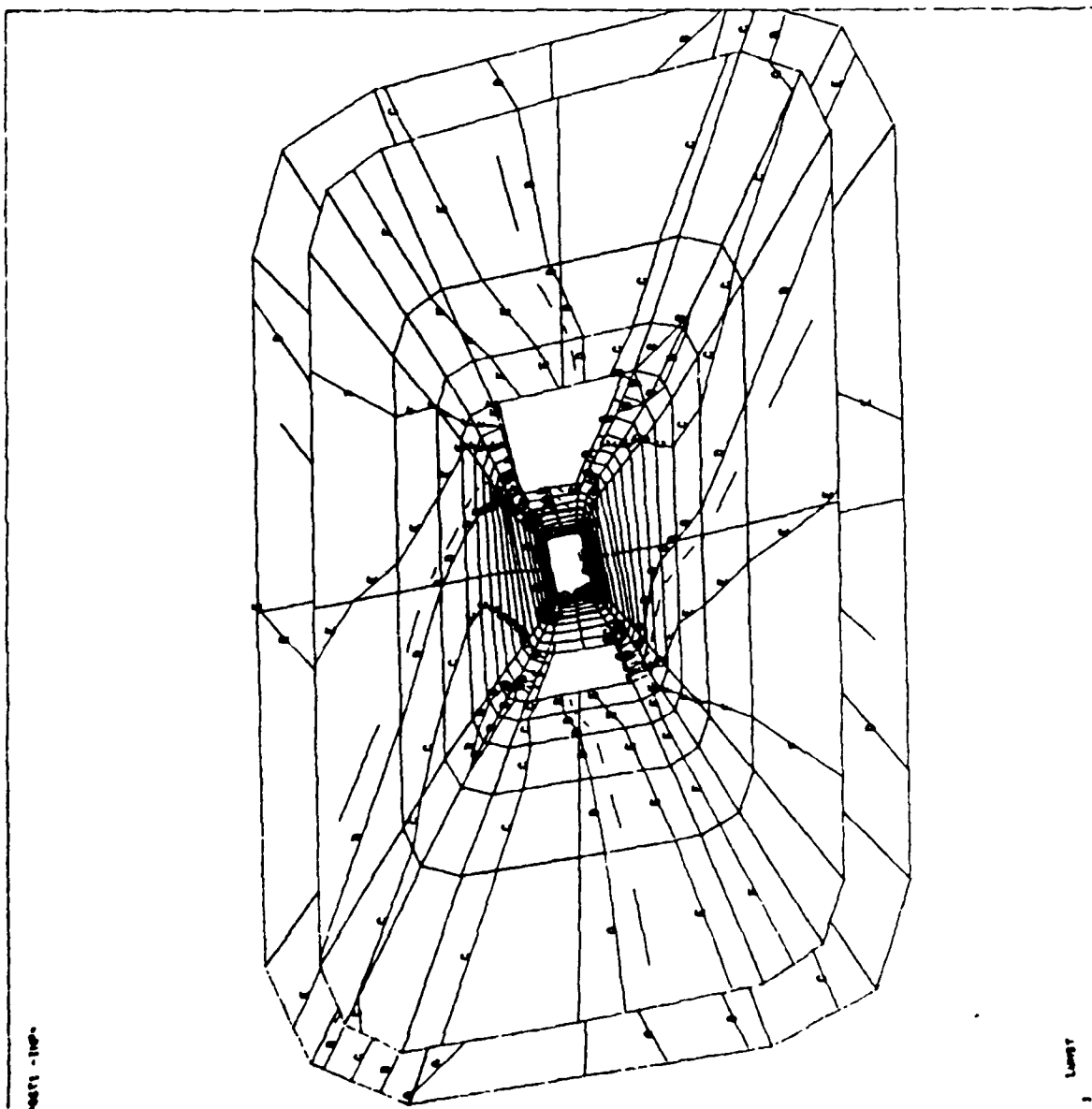
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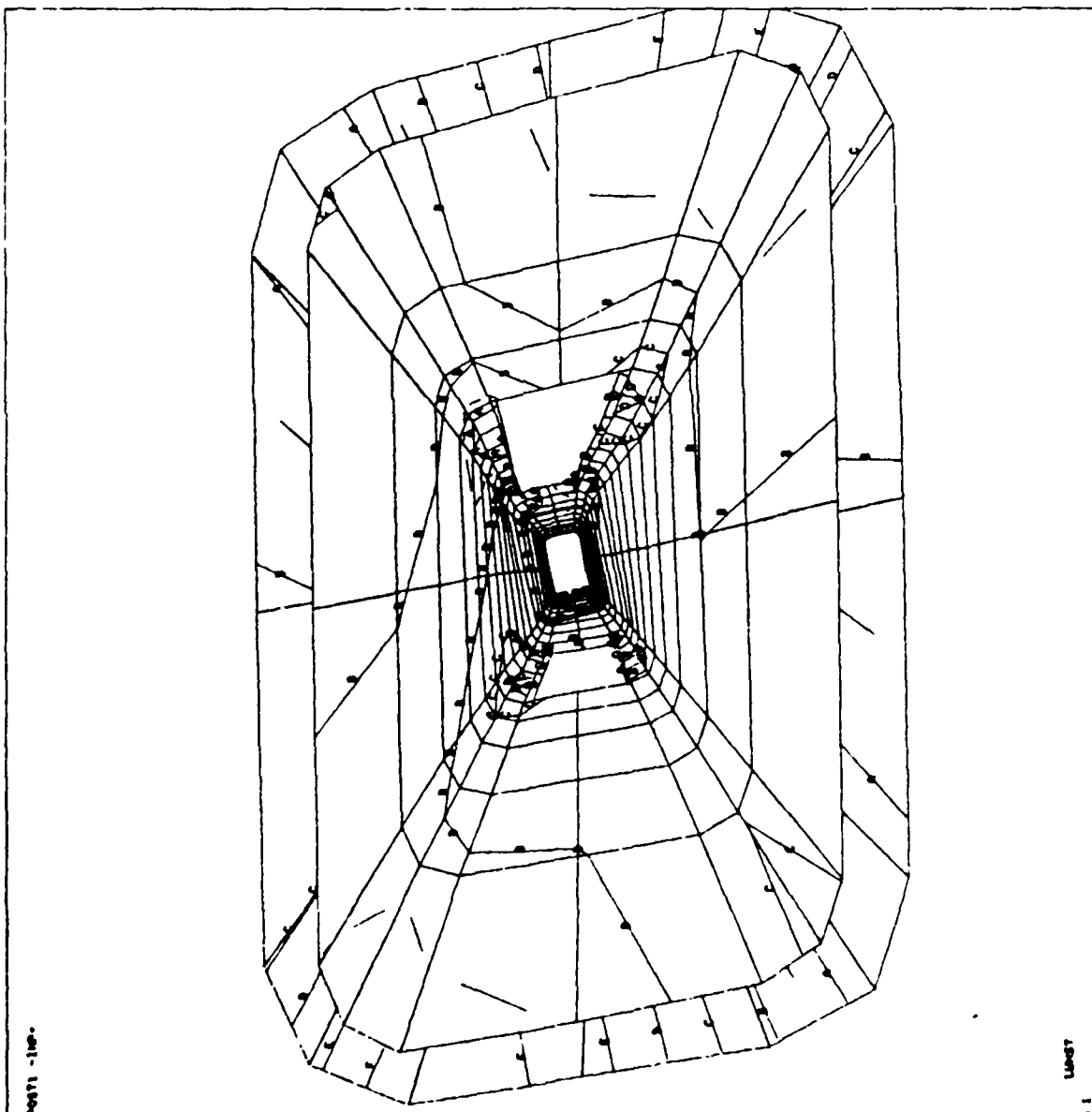
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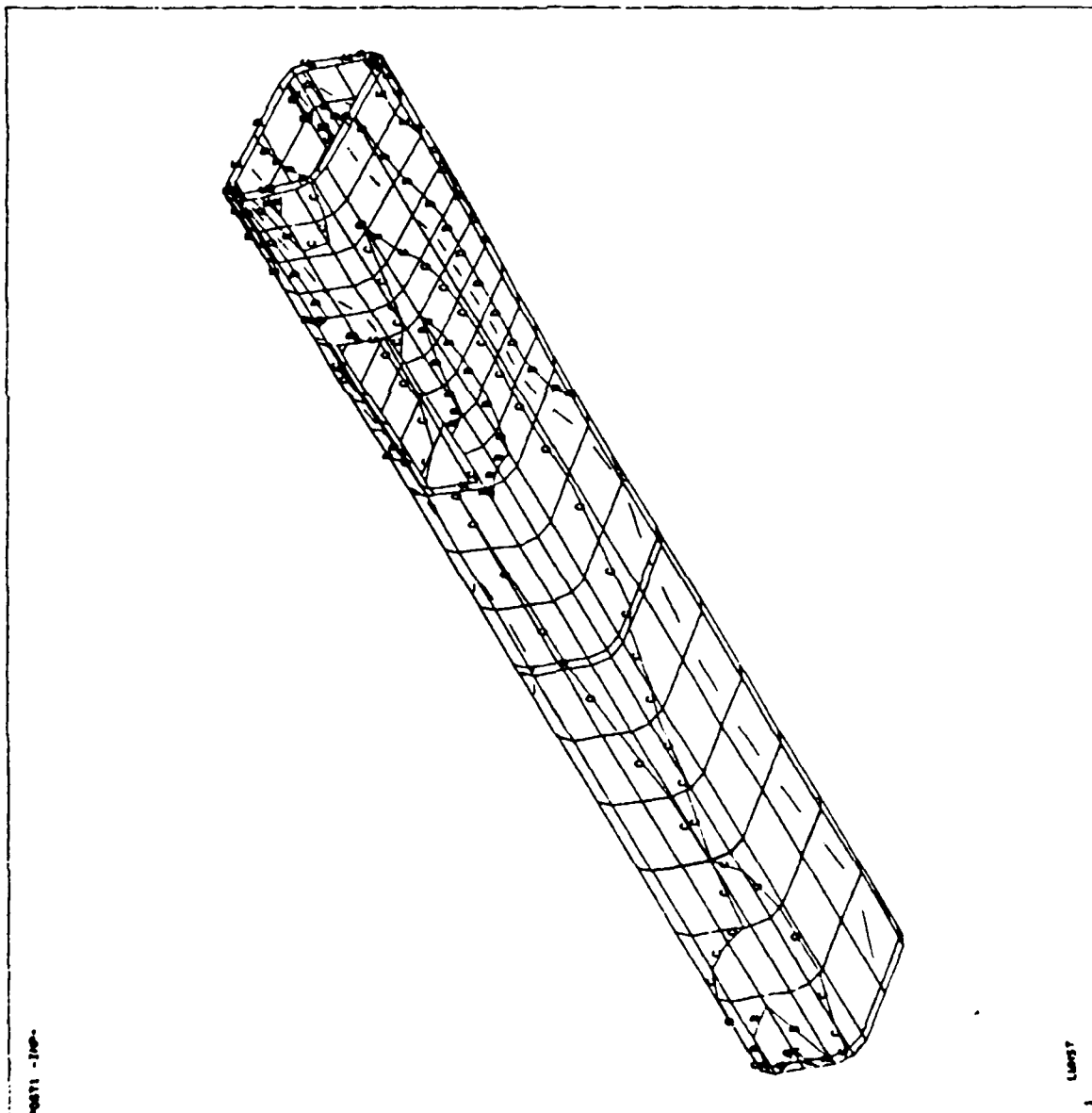
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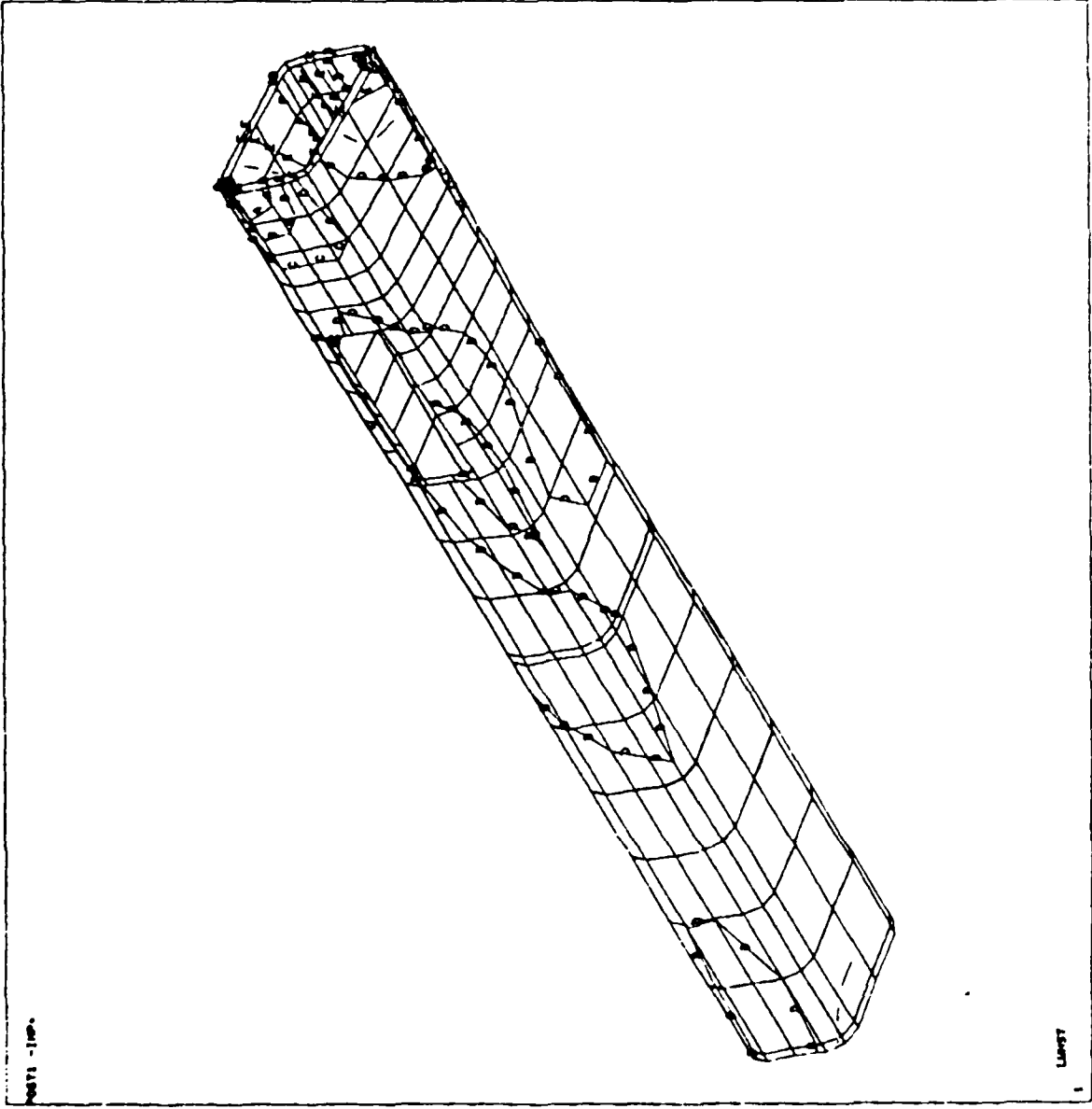


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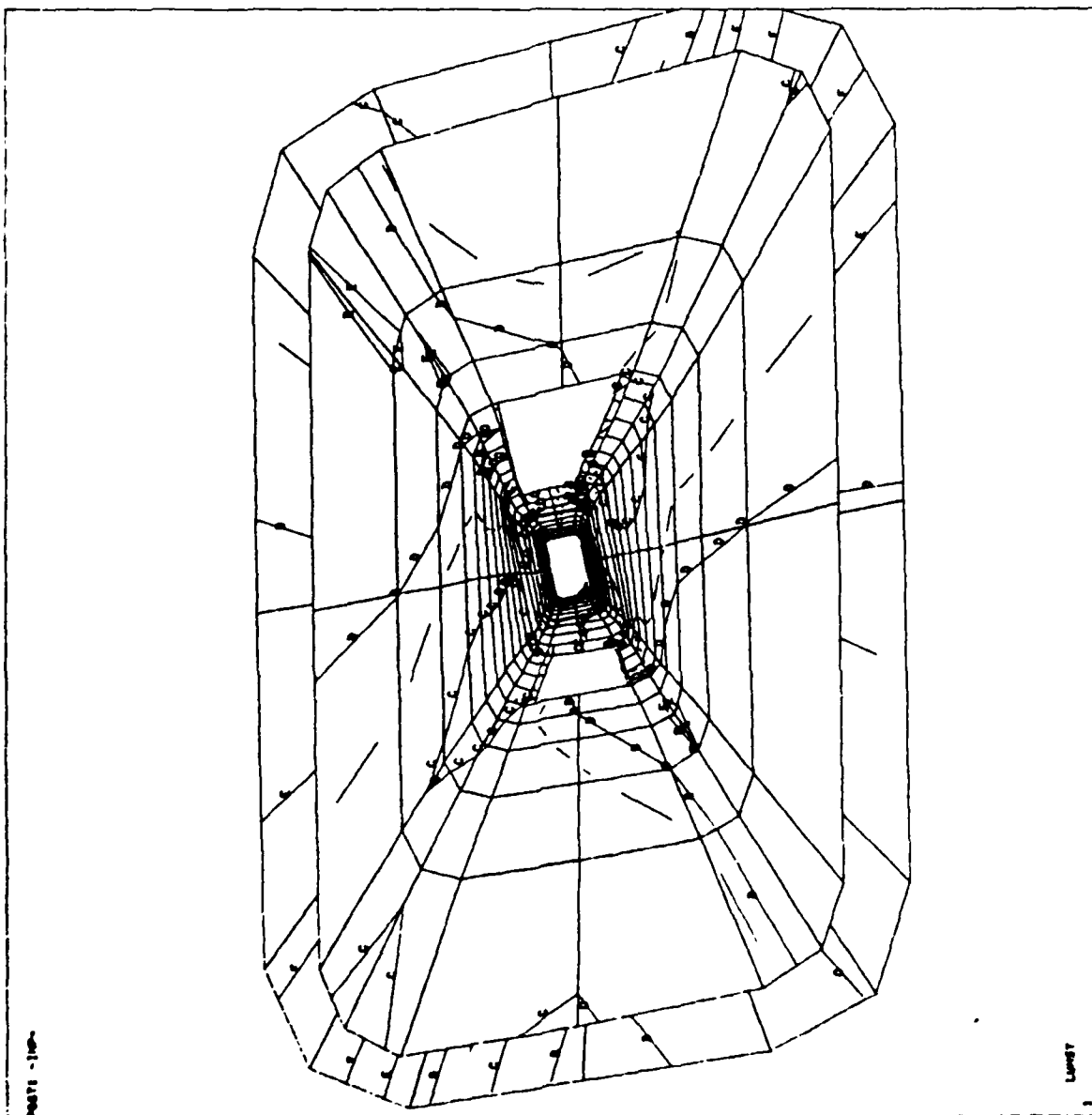




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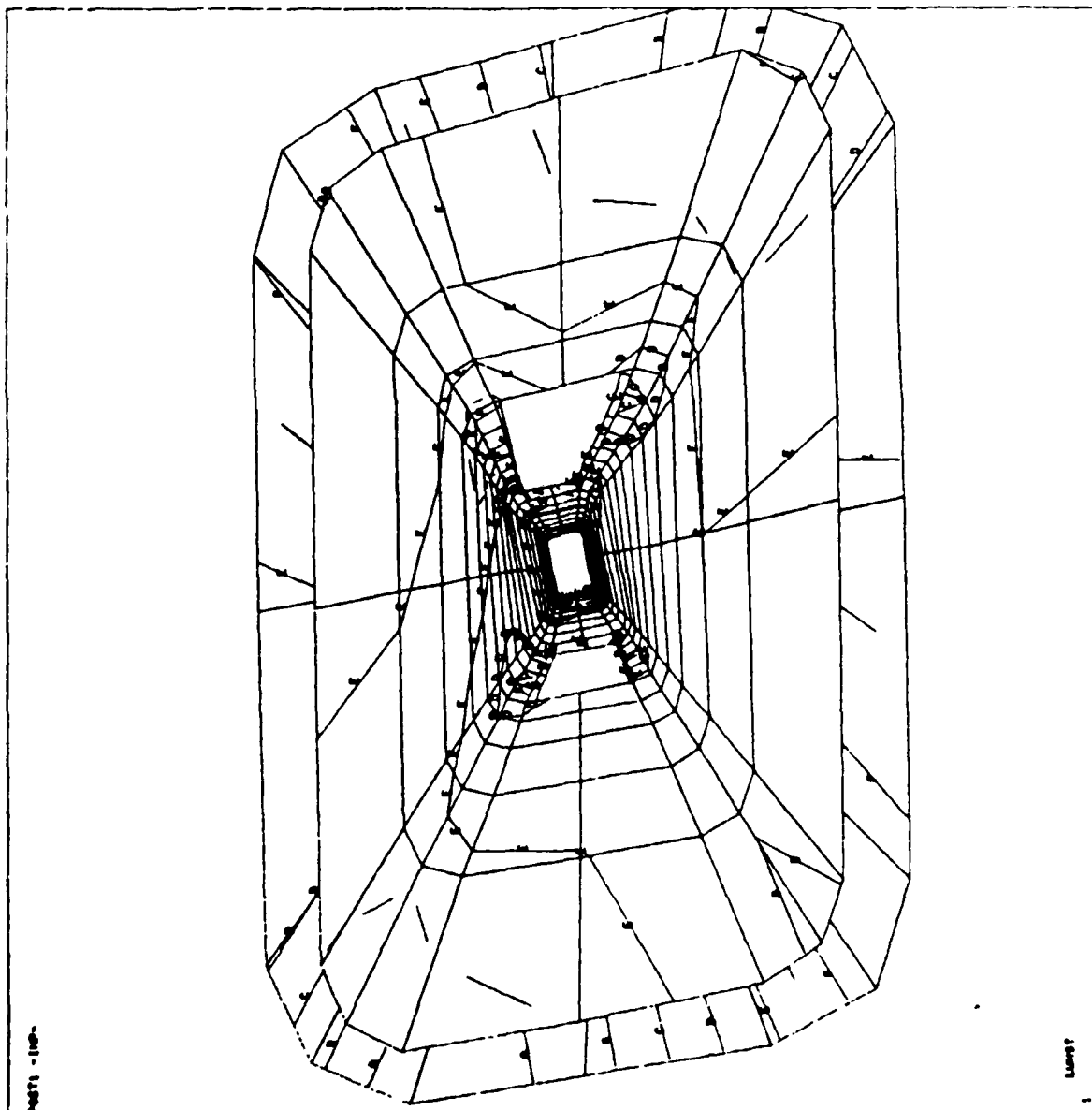


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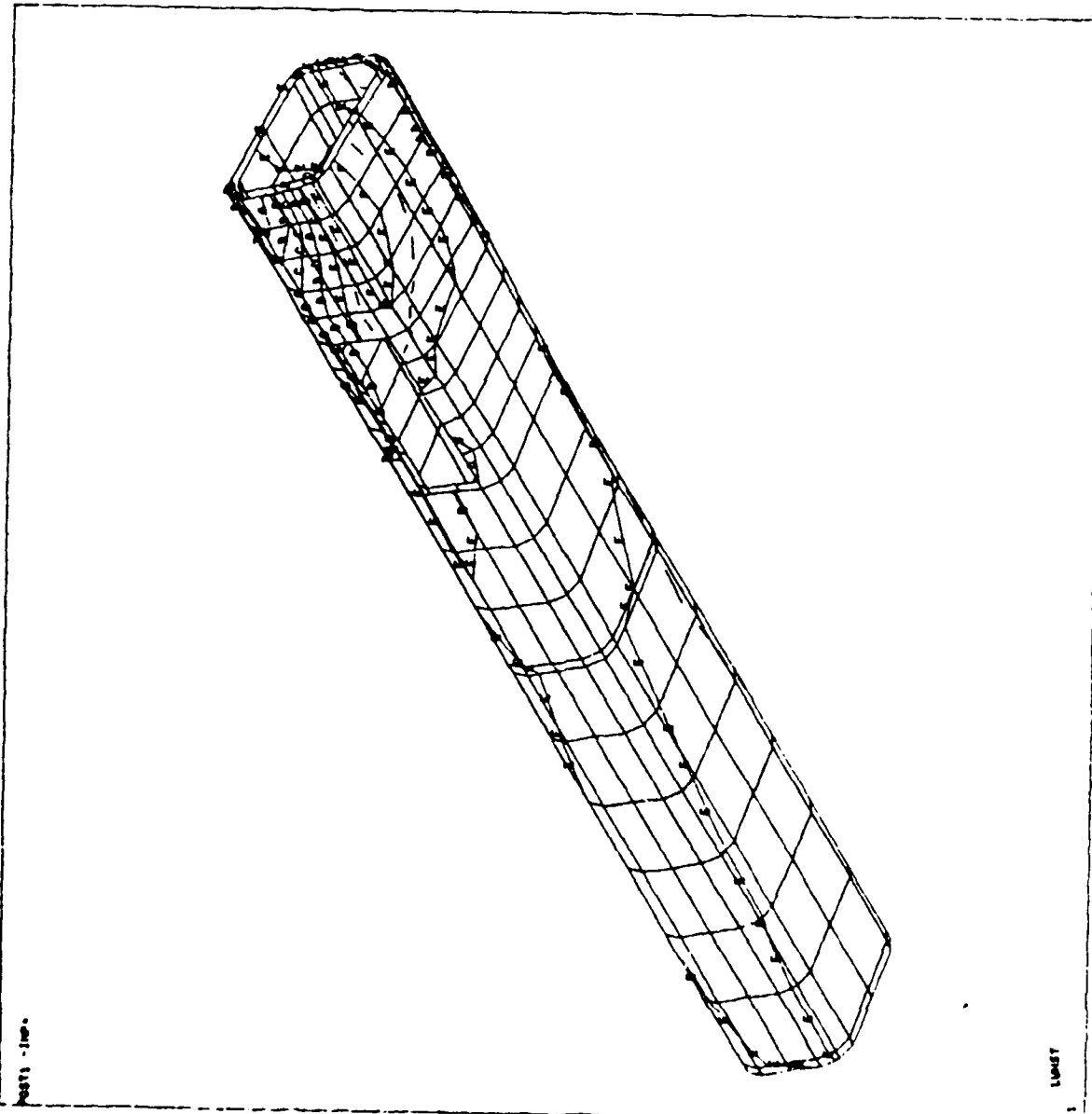


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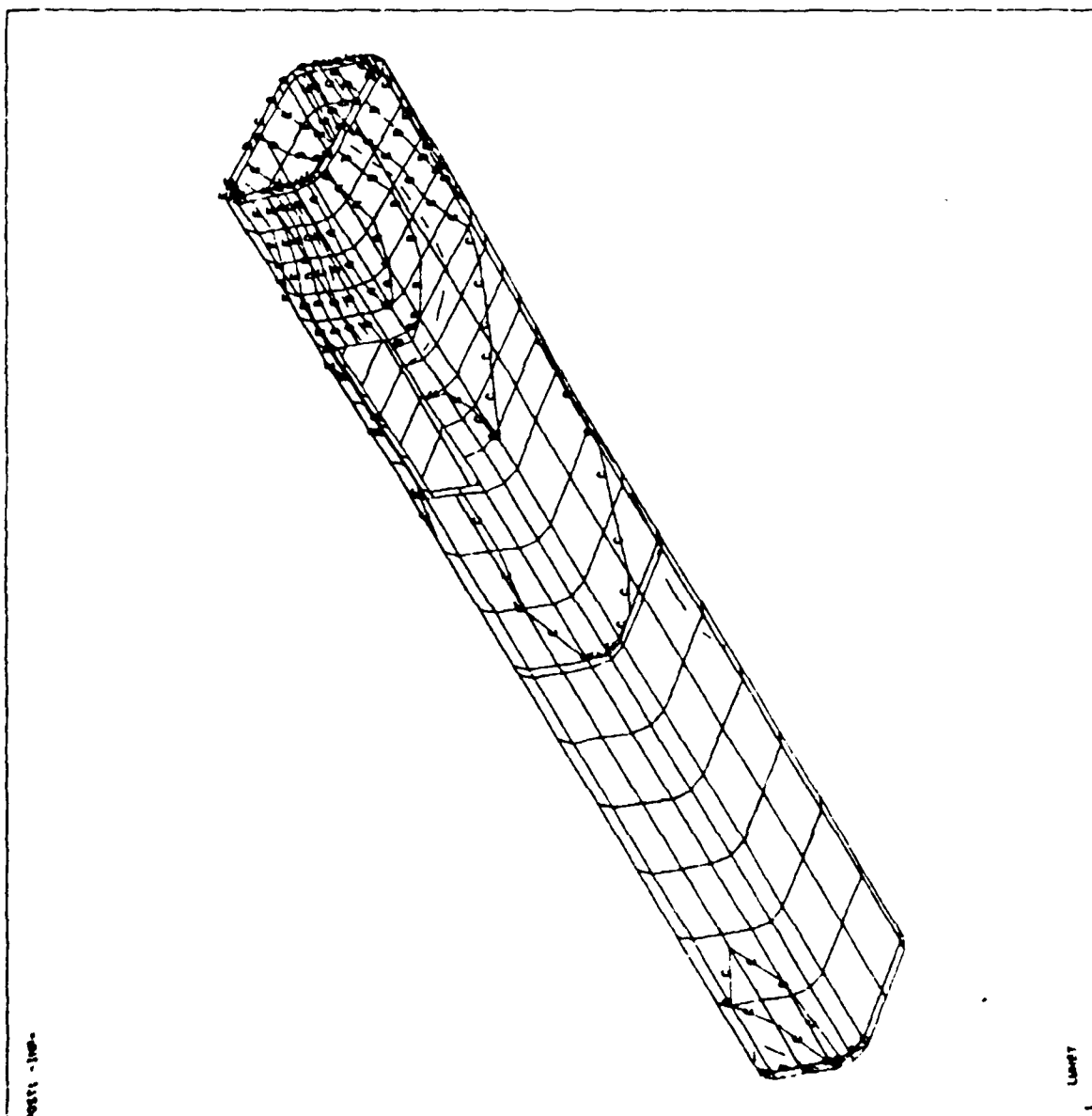


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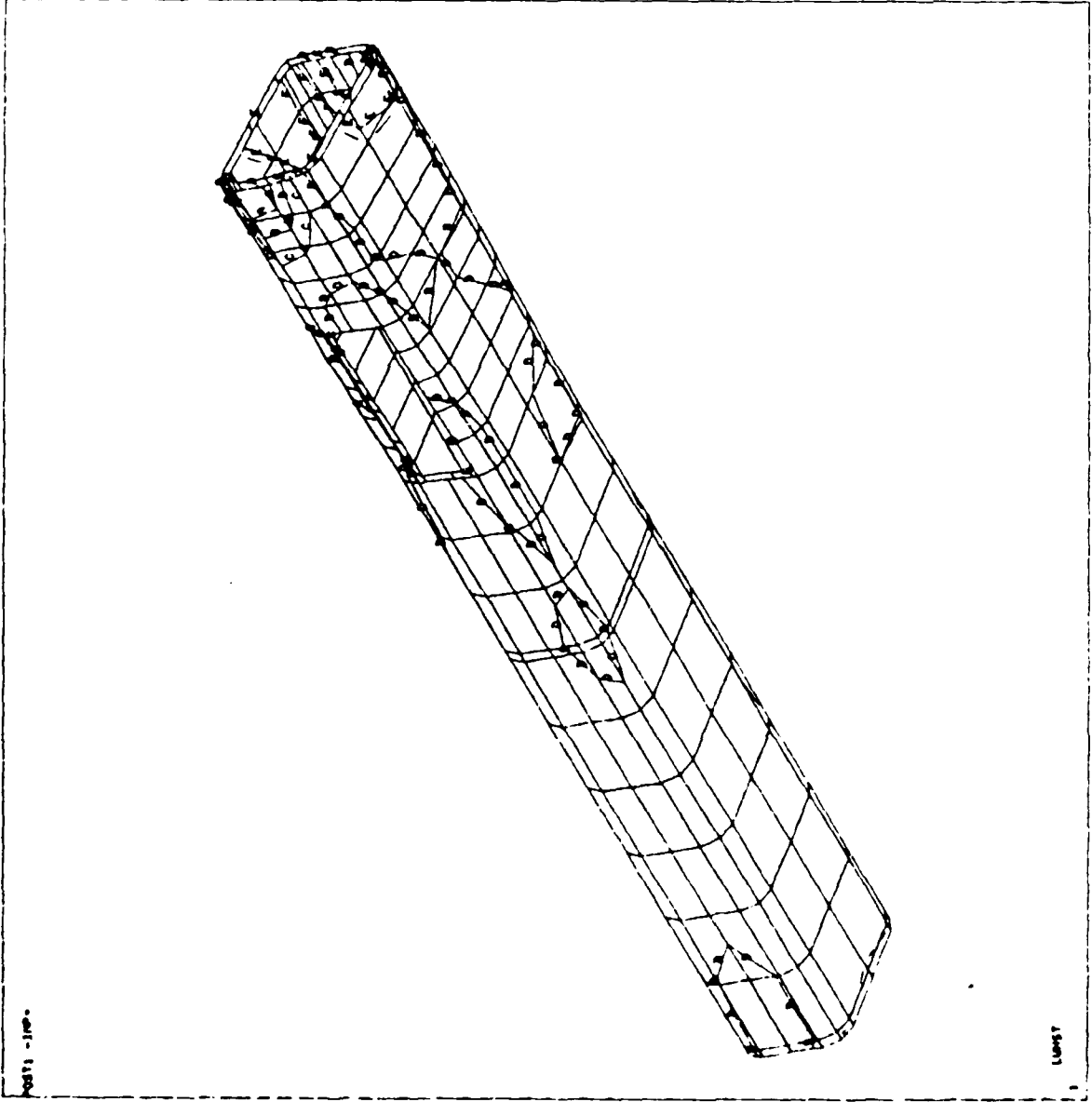


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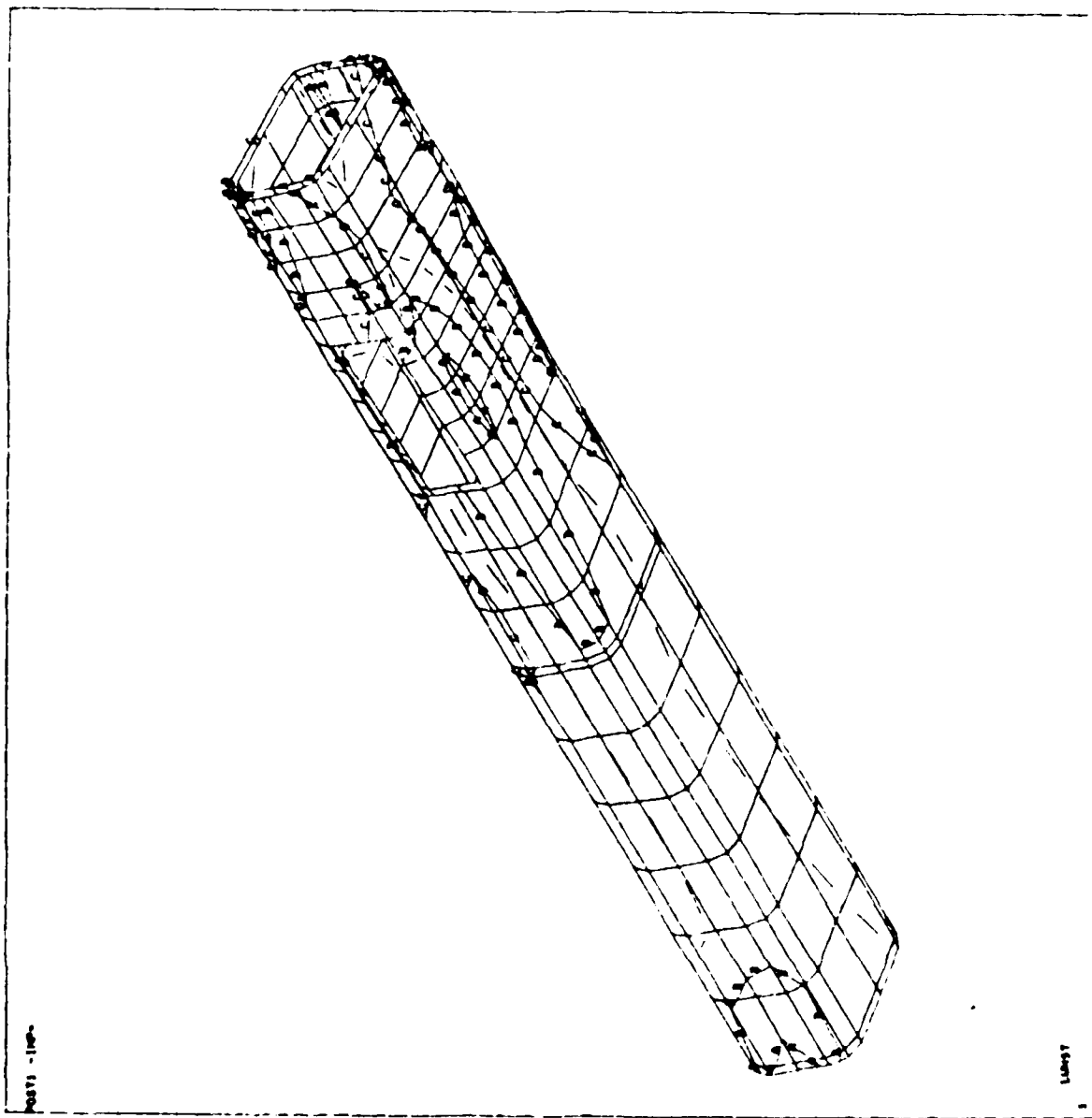


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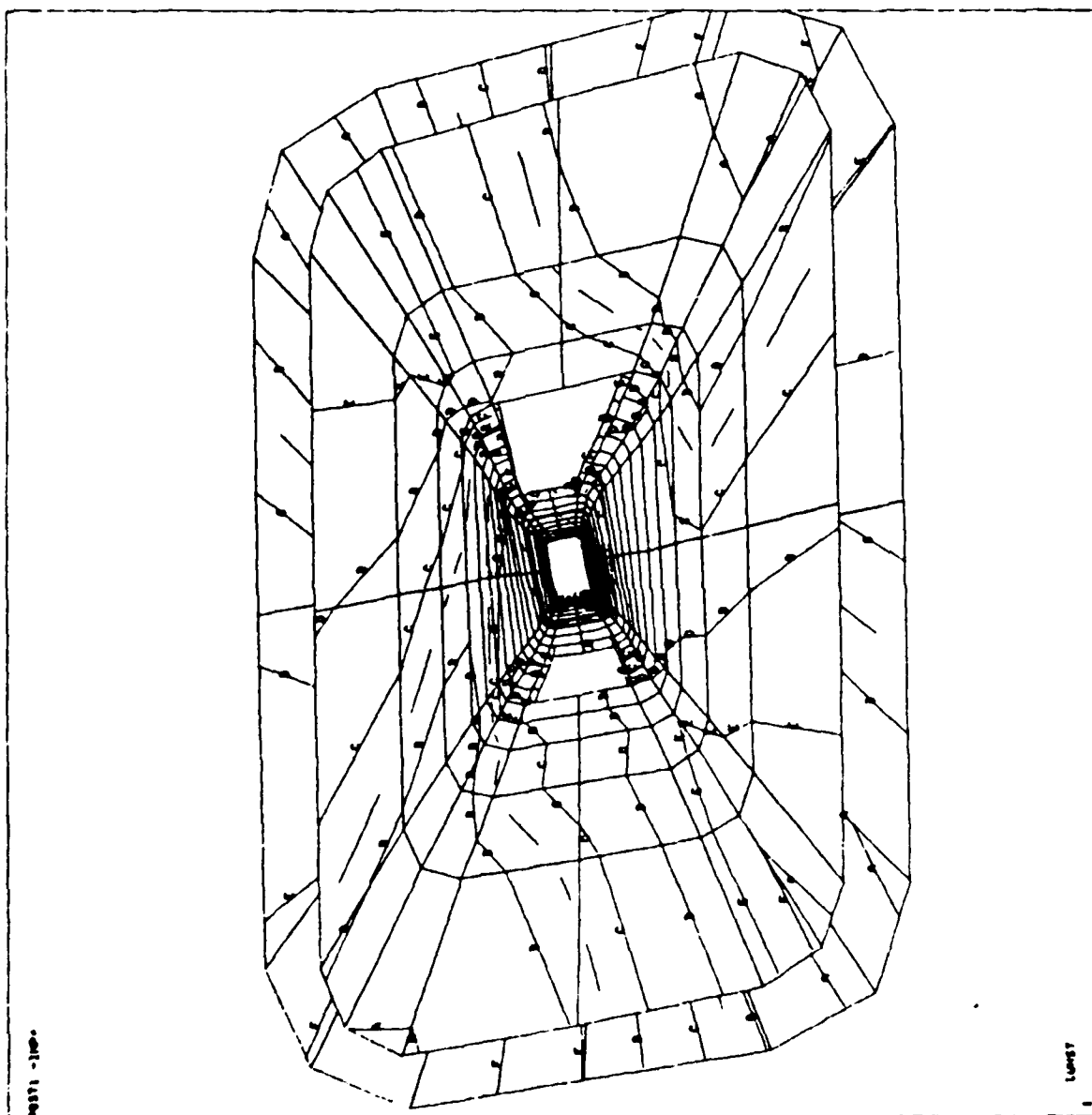


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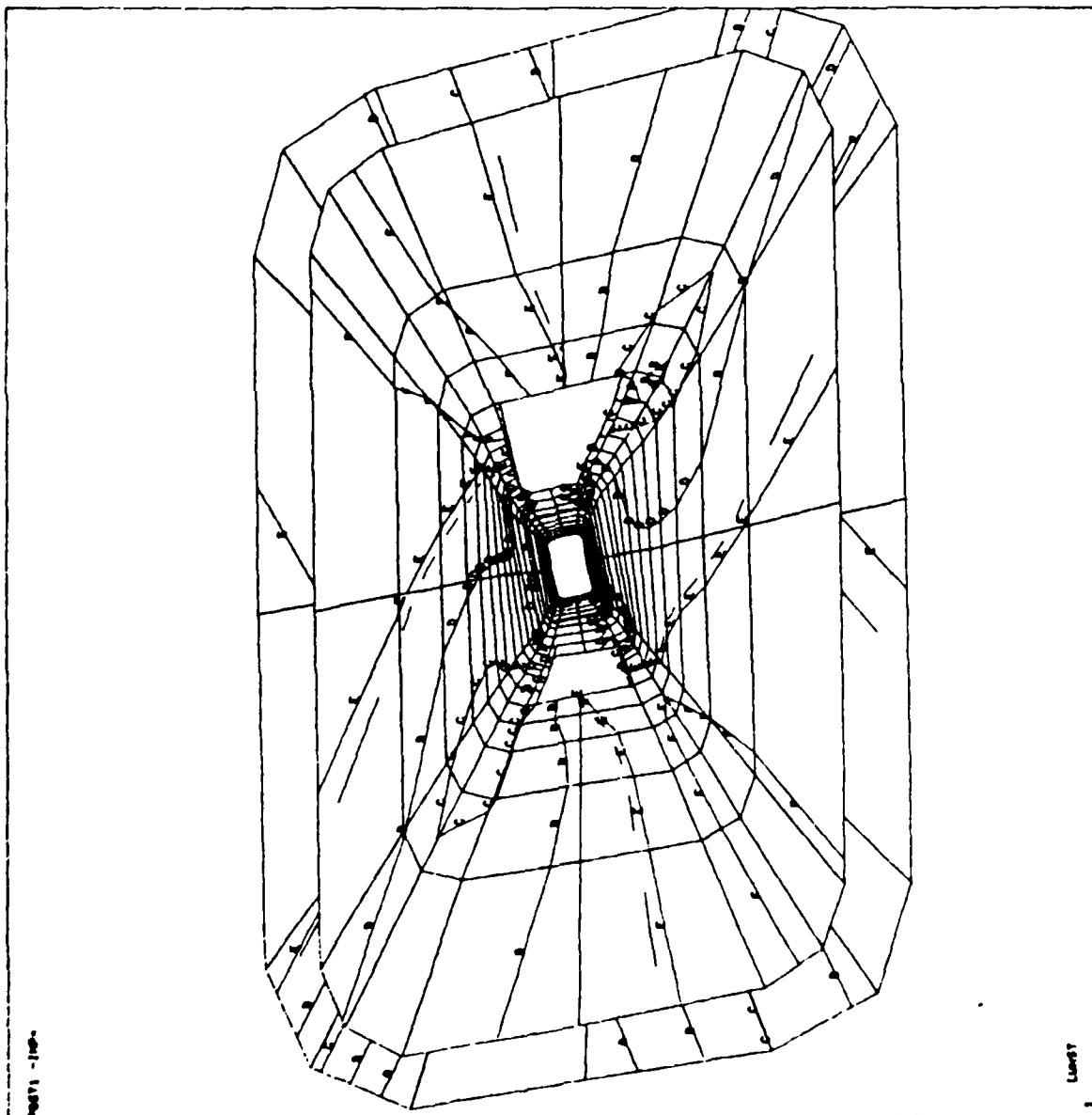
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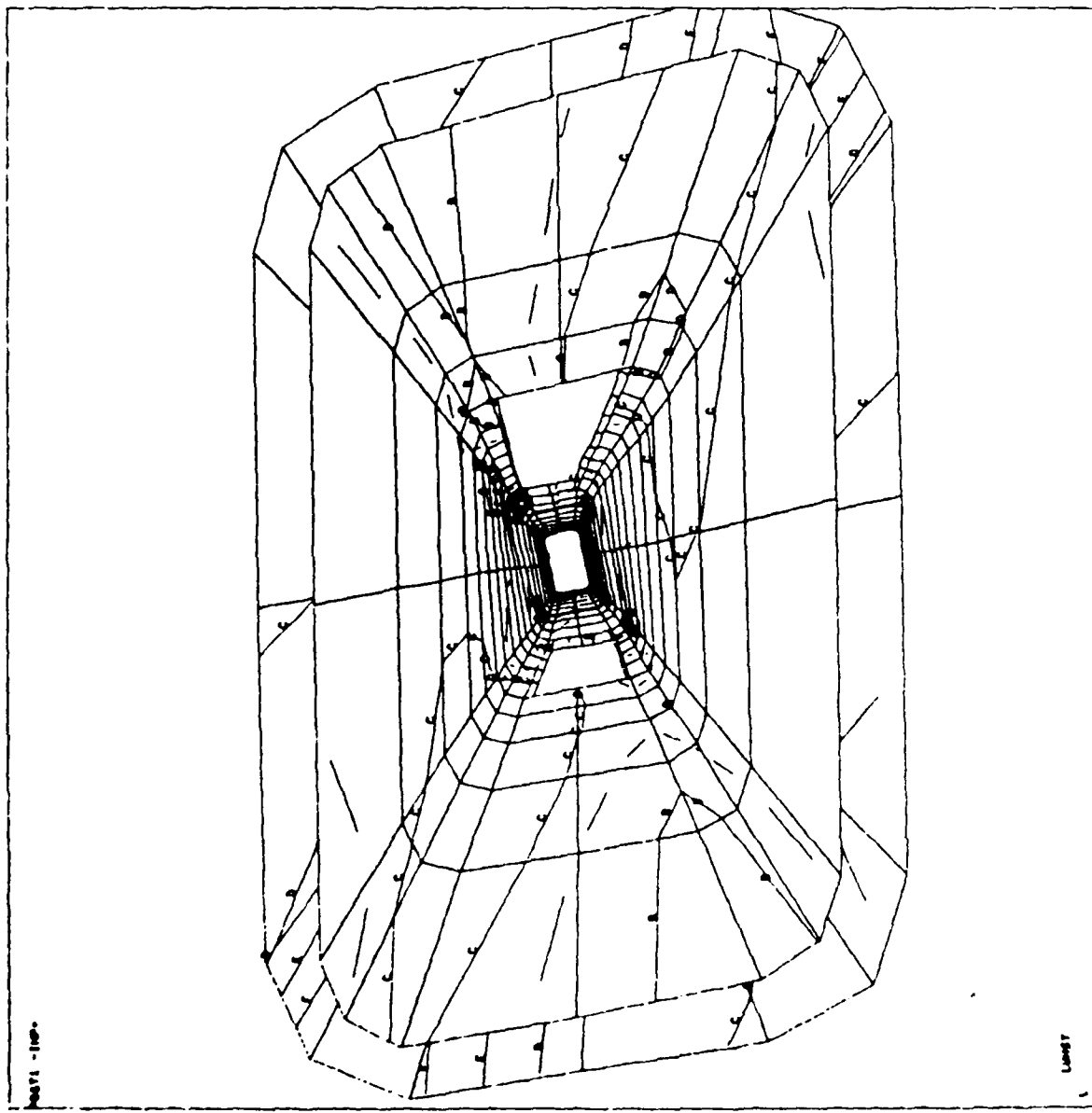
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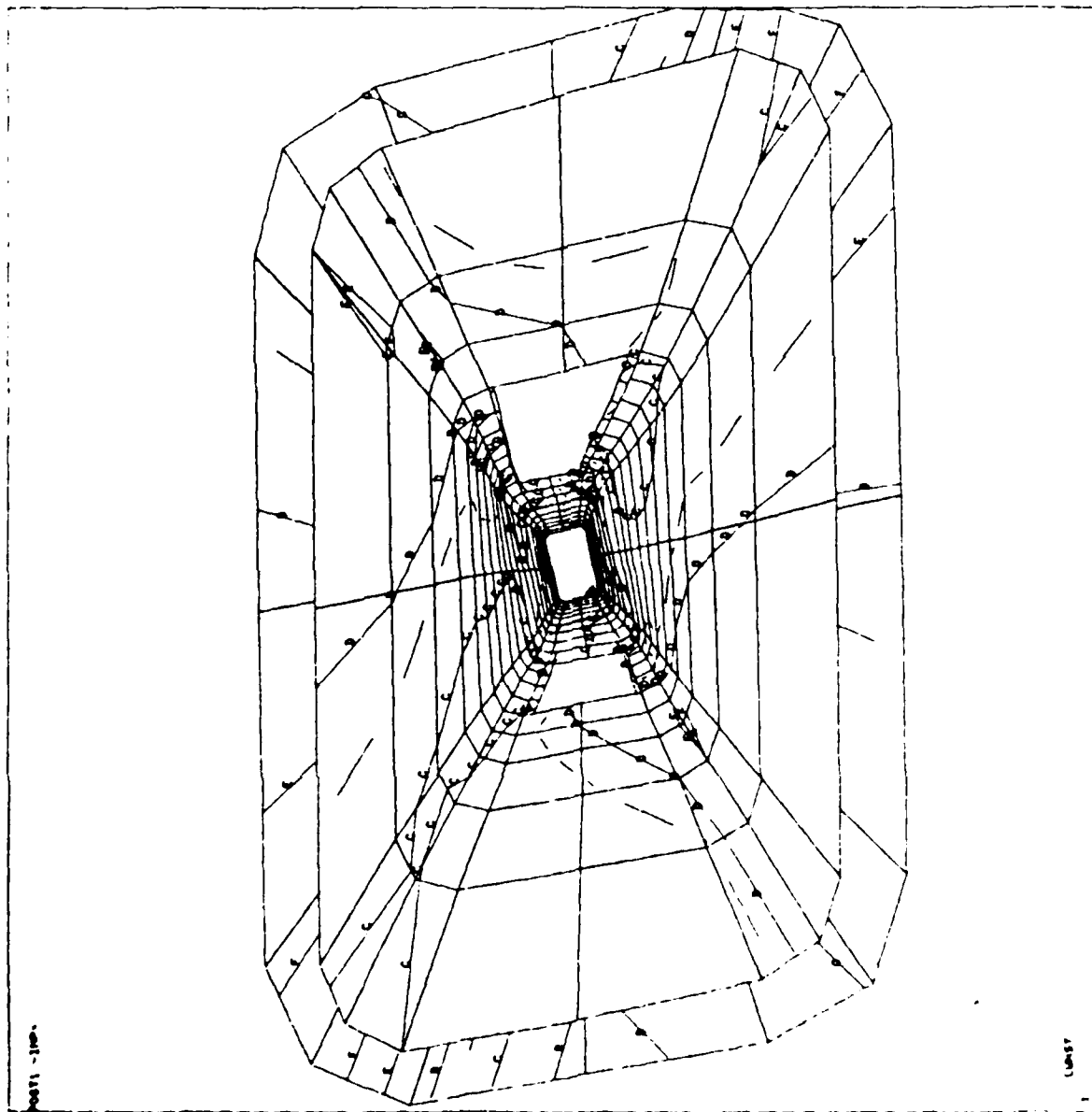
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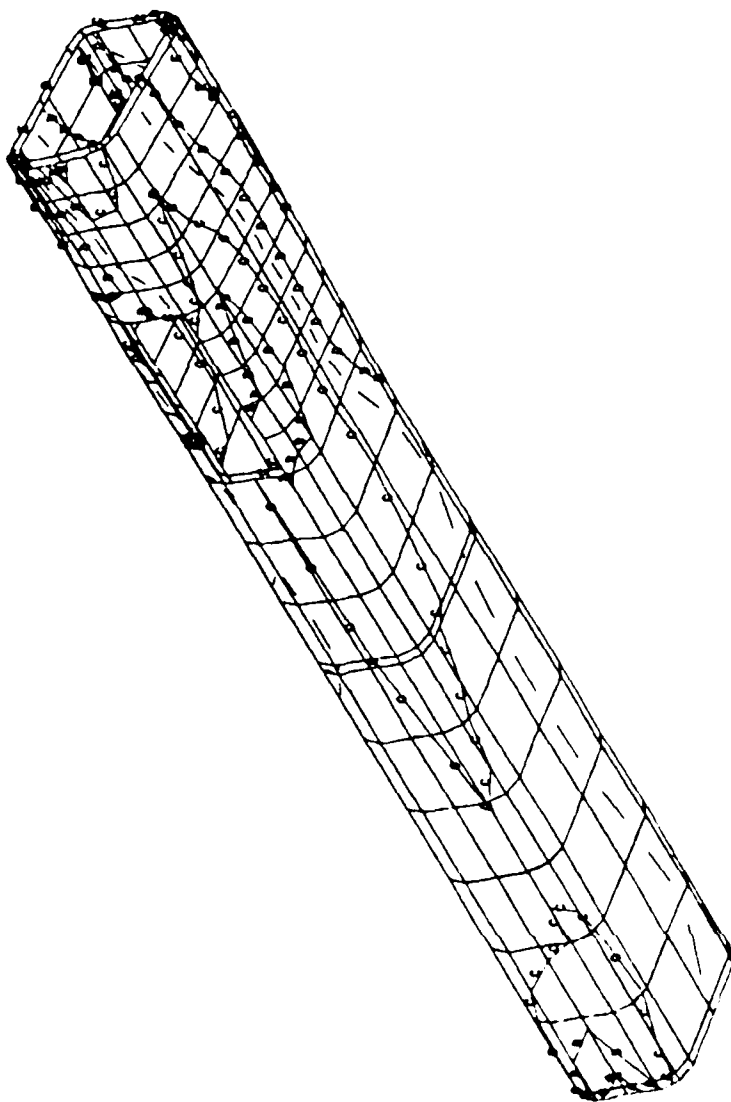
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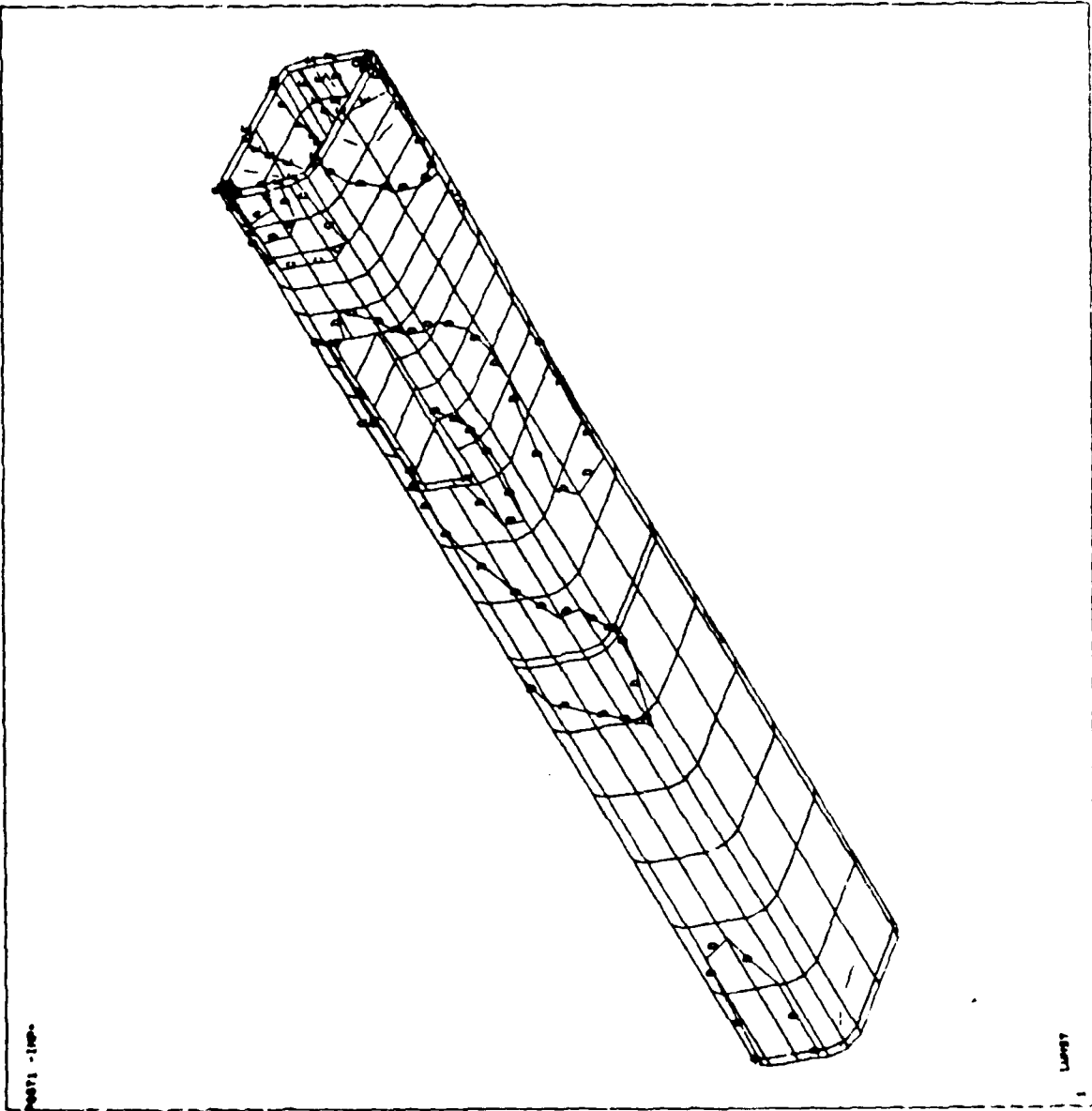
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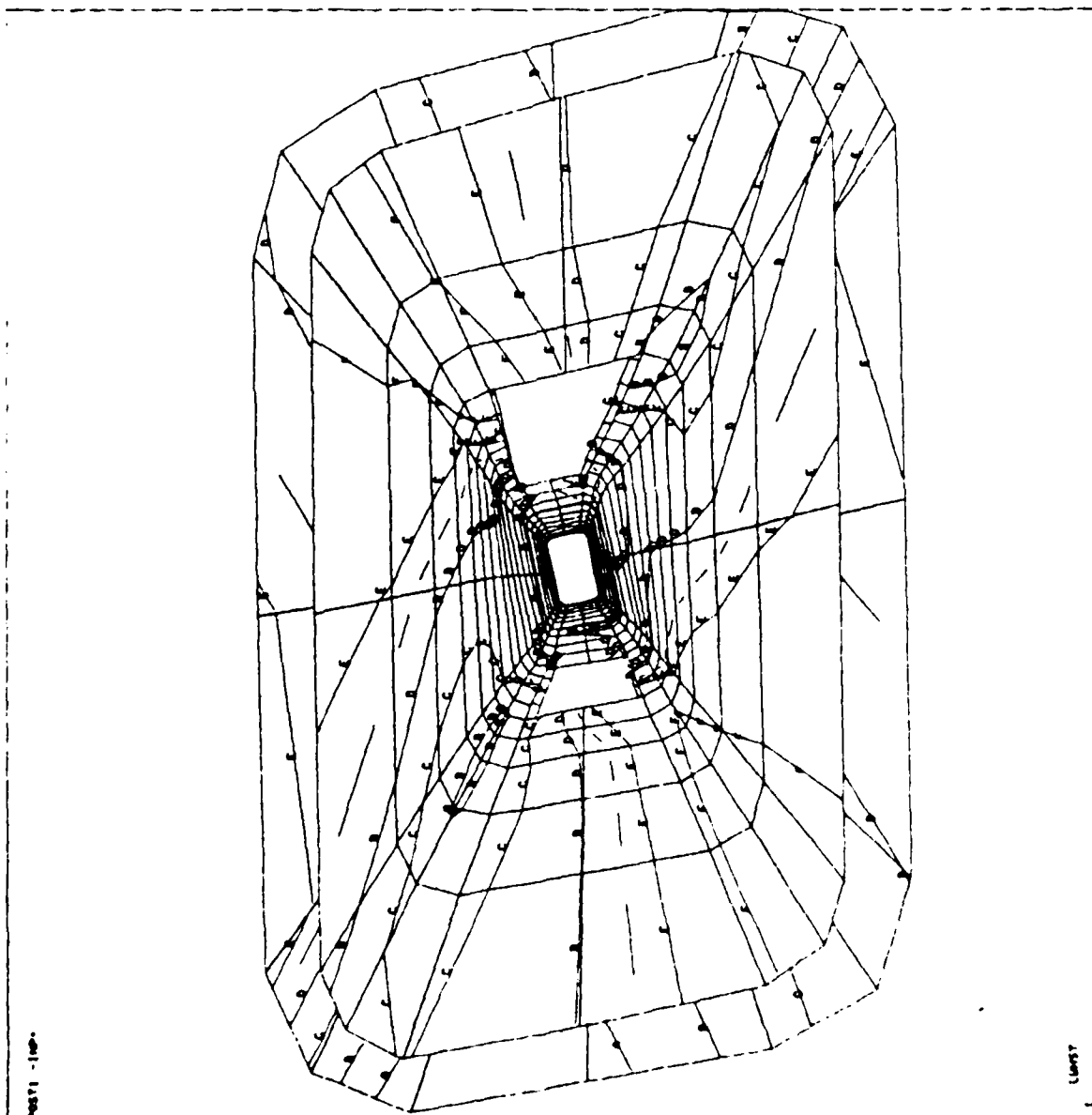
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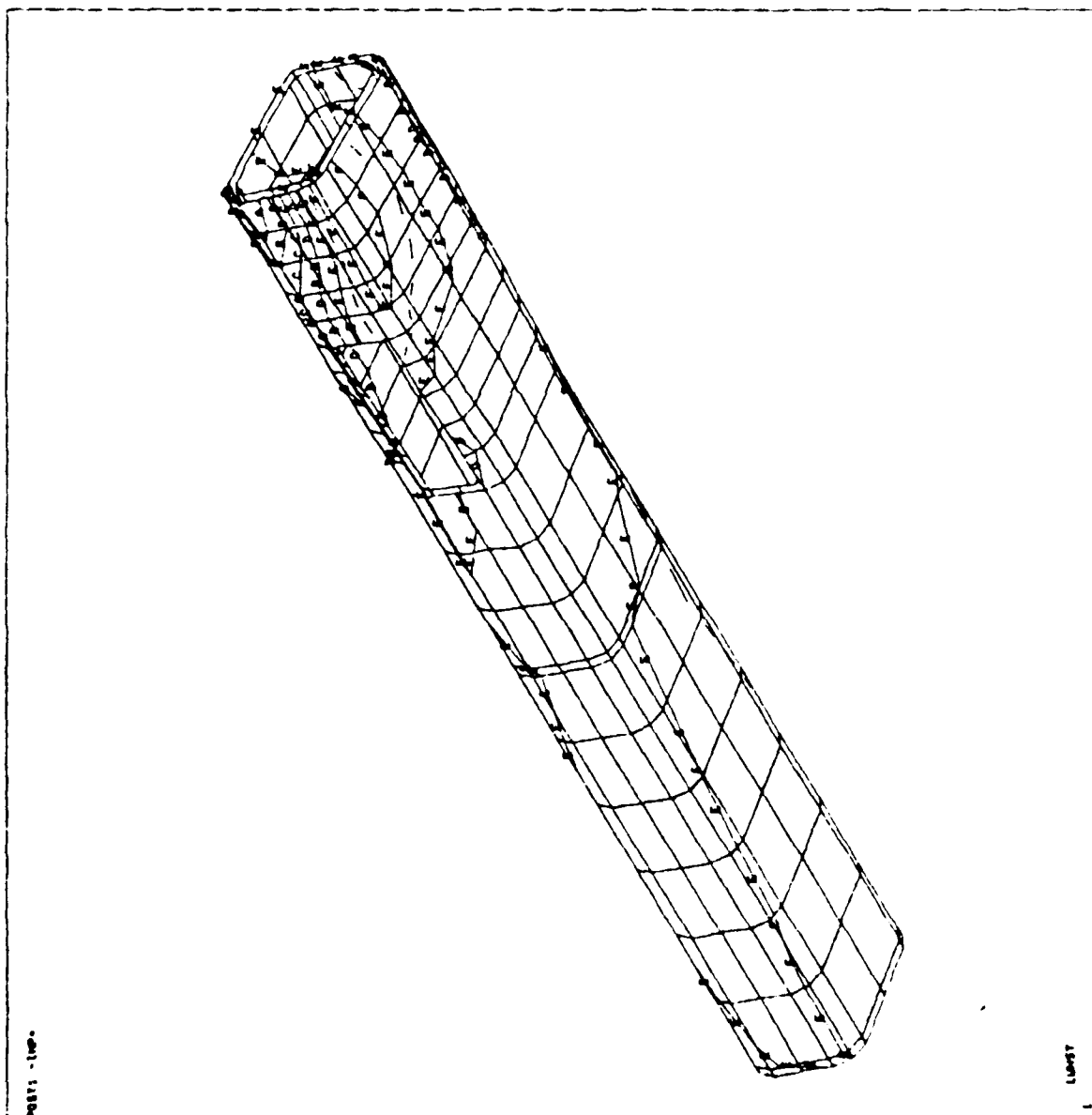
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UD=1  
UE=1  
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WU=1  
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WX=1  
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XG=1  
XH=1  
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XO=1  
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XV=1  
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YB=1  
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YG=1  
YH=1  
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YJ=1  
YK=1  
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YM=1  
YN=1  
YO=1  
YP=1  
YQ=1  
YR=1  
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YT=1  
YU=1  
YV=1  
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ZT=1  
ZU=1  
ZV=1  
ZW=1  
ZX=1  
ZY=1  
ZZ=1



ANALYSIS 0.20  
NOV 25 1966  
B12C-118  
POST1, STRESS  
STEP=1  
ITER=1  
SV4  
ZU=1  
DIST=125  
ZF=116  
CODE=46  
HIDDEN  
R1=2260  
R2=5415  
A1=4226  
B1=2052  
C1=1060  
D1=606  
E=407  
F=1800

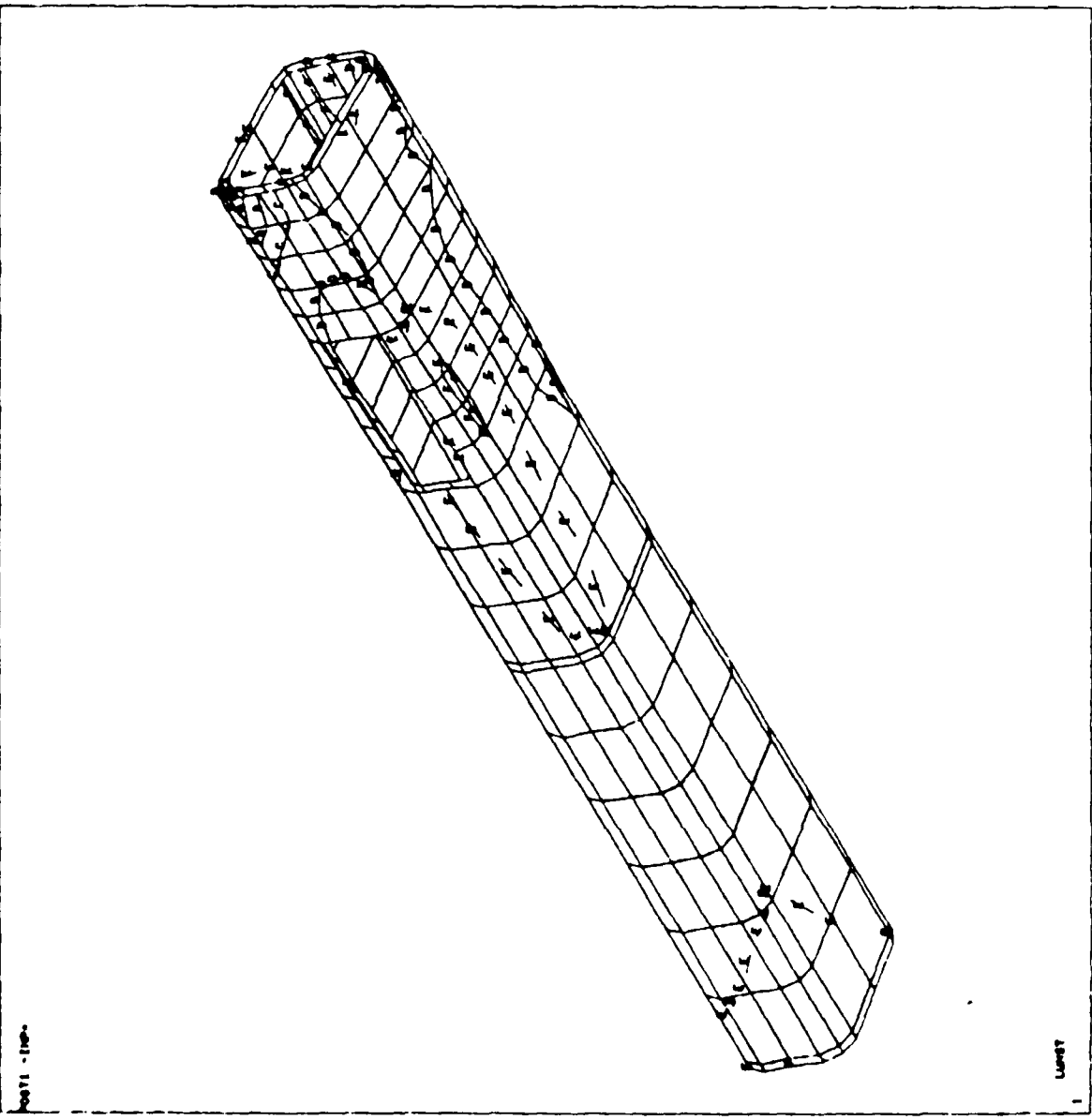


ANALYSIS 4.20  
NOV 25 1966  
S-107110  
POST1 STRESS  
STEP=1  
ITER=1  
S=4  
R=1  
V=1  
Z=1  
D107-104  
Z=116  
M106N  
W=1940  
W=7223  
A=6023  
B=4011  
C=3200  
D=1007  
E=676  
F=637

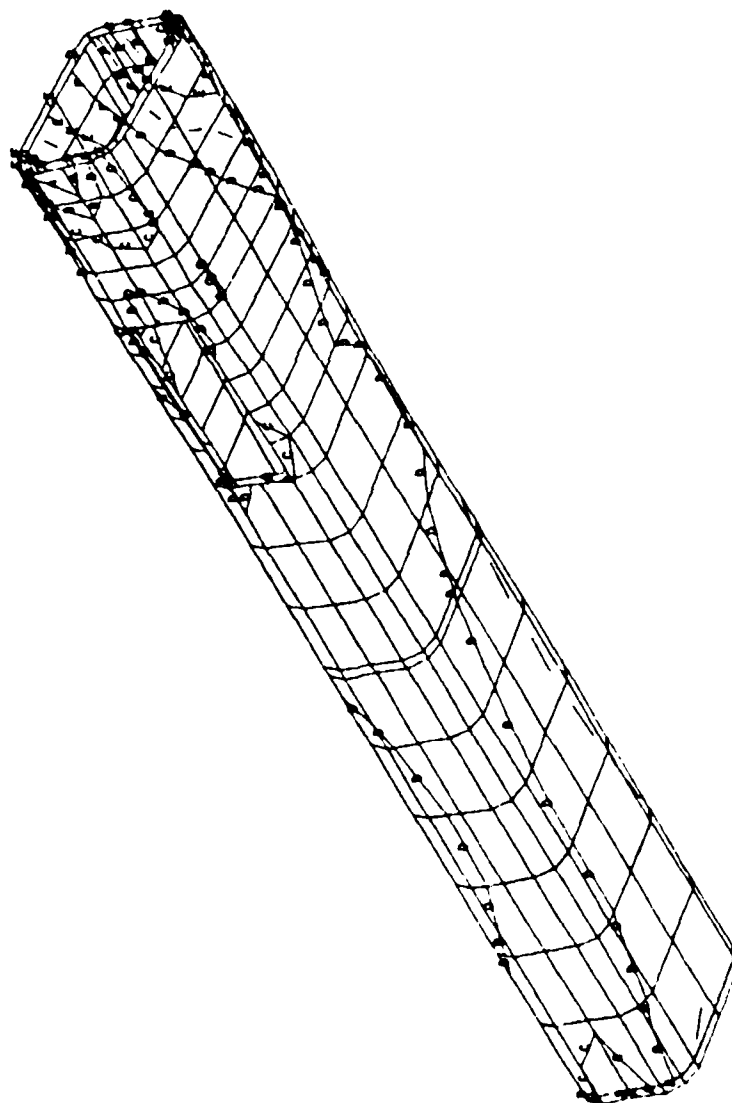




00011 4.20  
 NOV 25 1995  
 8:42:25  
 POS: 1 070655  
 STEP: 1  
 ITER: 1  
 SLS  
 MU: 1  
 VU: 1  
 ZU: 1  
 DIST: 104  
 ZF: 116  
 MID: 604  
 RW: 34732  
 RW: 82236  
 A: 74099  
 B: 98360  
 C: 37821  
 D: 10602  
 E: 1643  
 F: 16596

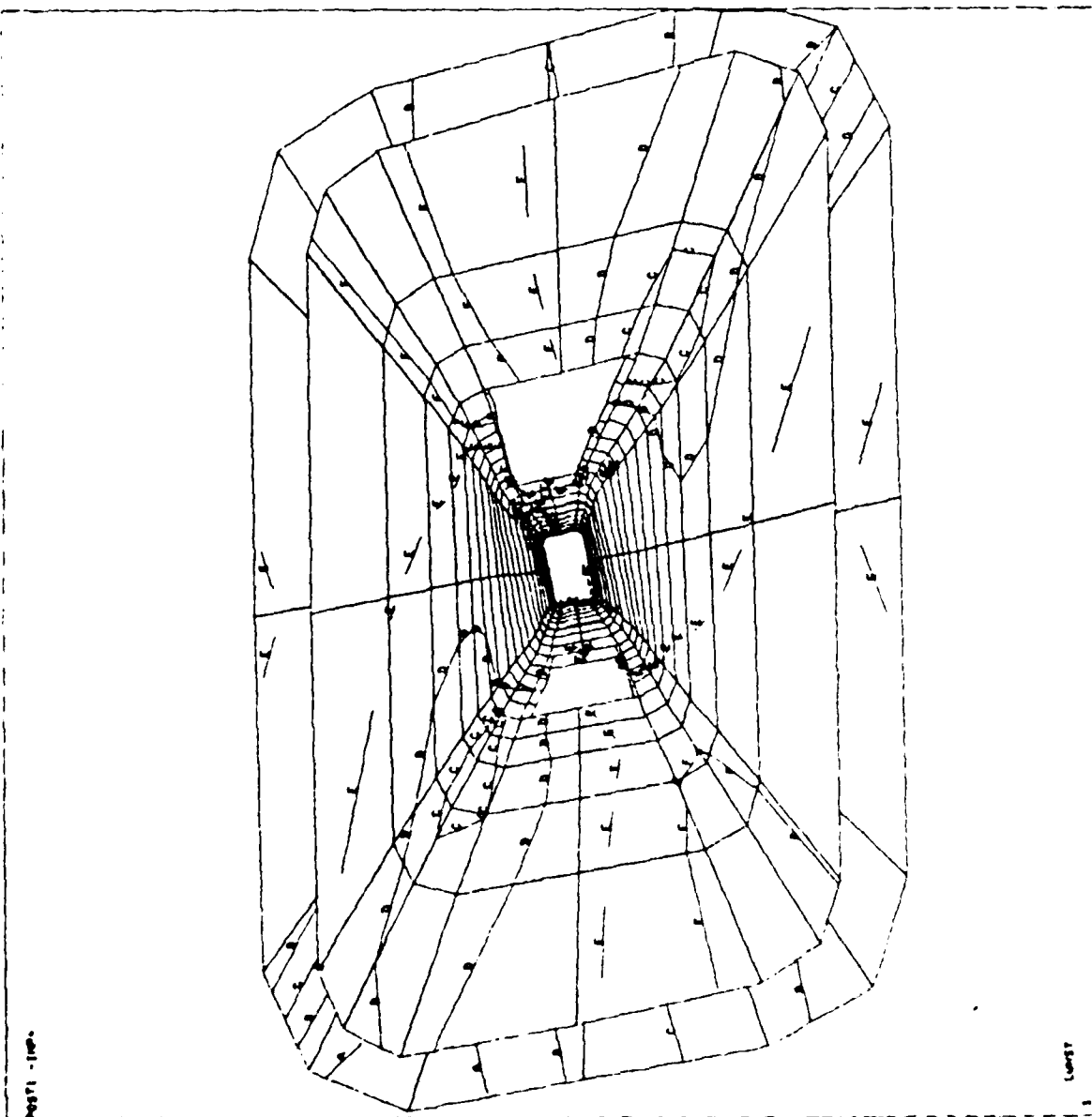


11



11-20-97

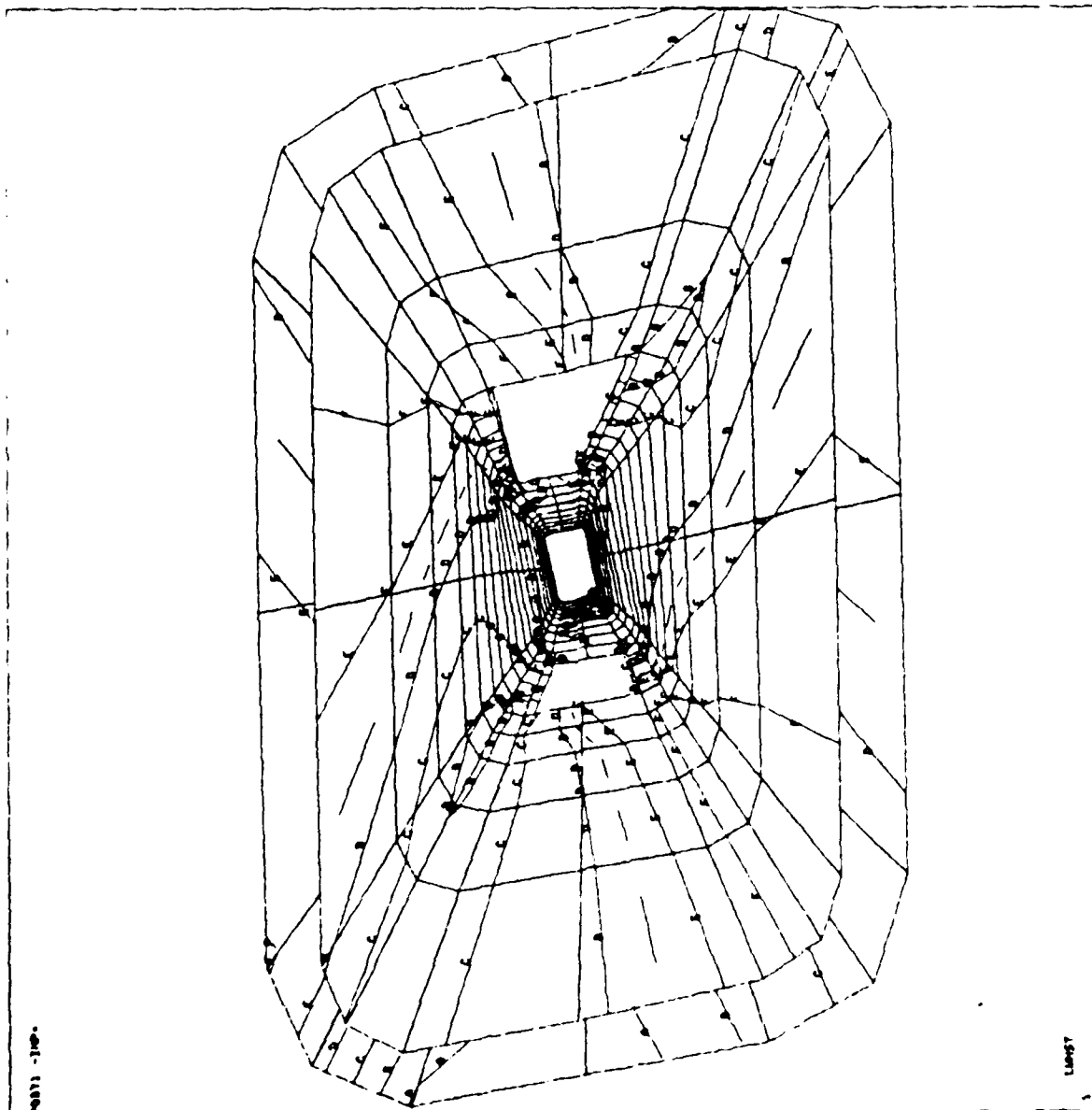
AMYS 4.20  
 NOV 25 1966  
 R-09136  
 POST1: STRESS  
 STEP=1  
 ITER=1  
 SRS  
 ZU=1  
 B1Y=1.36  
 ZY=116  
 CONE=45  
 M1BDEM  
 RU=24732  
 MY=82236  
 R=74099  
 S=55064  
 C=37821  
 D=18682  
 E=1543  
 F=16586



POST1 -100-

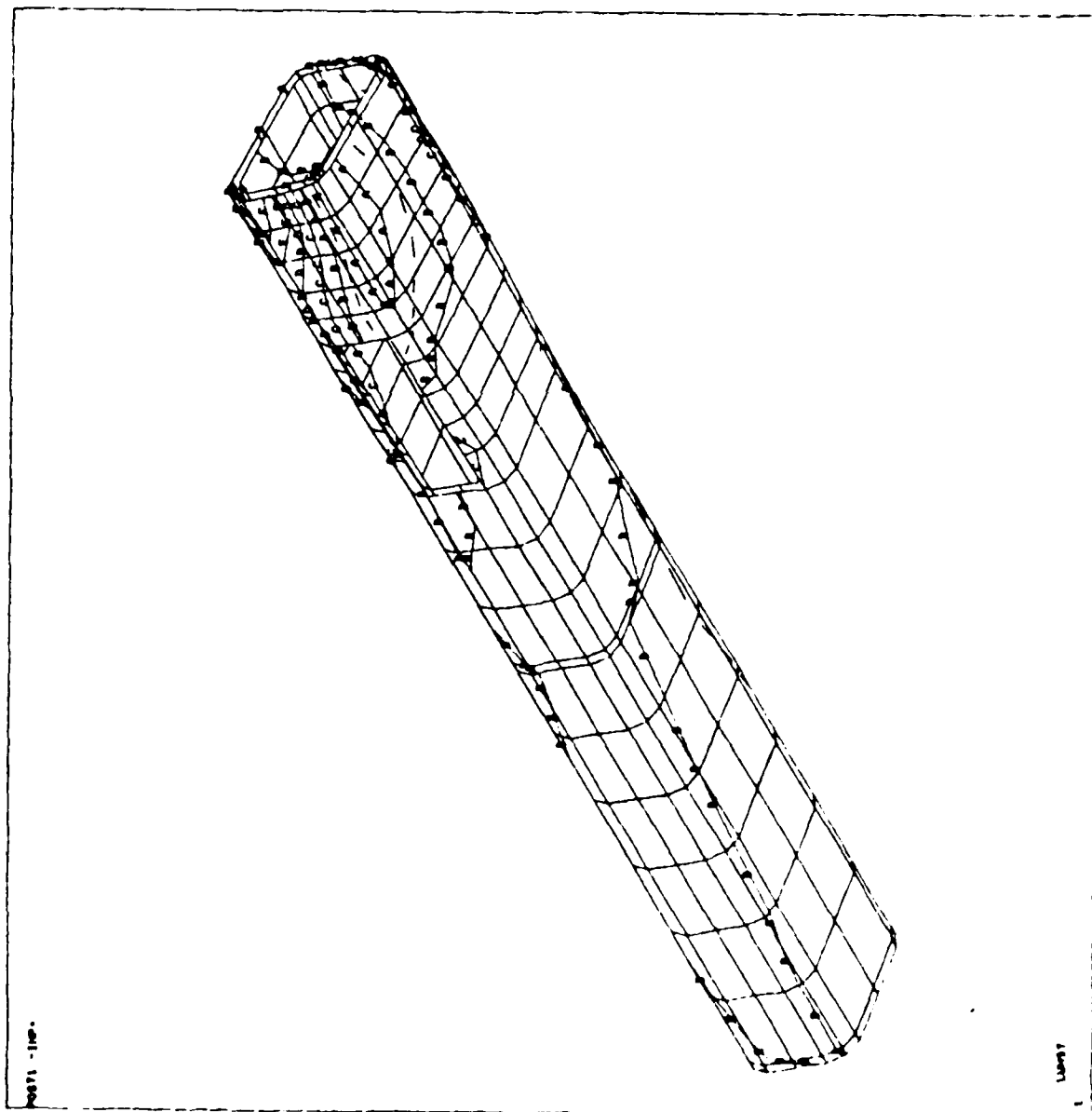
10057

44005 4.20  
 NOV 26 1966  
 9132127  
 POSTI SYMBIOS  
 5750-1  
 1700-1  
 375  
 20-1  
 8157-126  
 27-116  
 CONE-46  
 MIDEA  
 RA-8534  
 RW-4522  
 A-3820  
 B-2508  
 C-1496  
 D-484  
 E-520  
 F-1840



140057

APPV 4.23  
 NOV 25 1985  
 8:10:27  
 POST1 SYM06  
 STEP=1  
 LVEB=1  
 945  
 PU=1  
 VU=1  
 ZU=1  
 2187-104  
 27-110  
 11802N  
 22-2212  
 22-1103  
 A=645  
 B=655  
 C=1075  
 D=3206  
 E=4506  
 F=5005

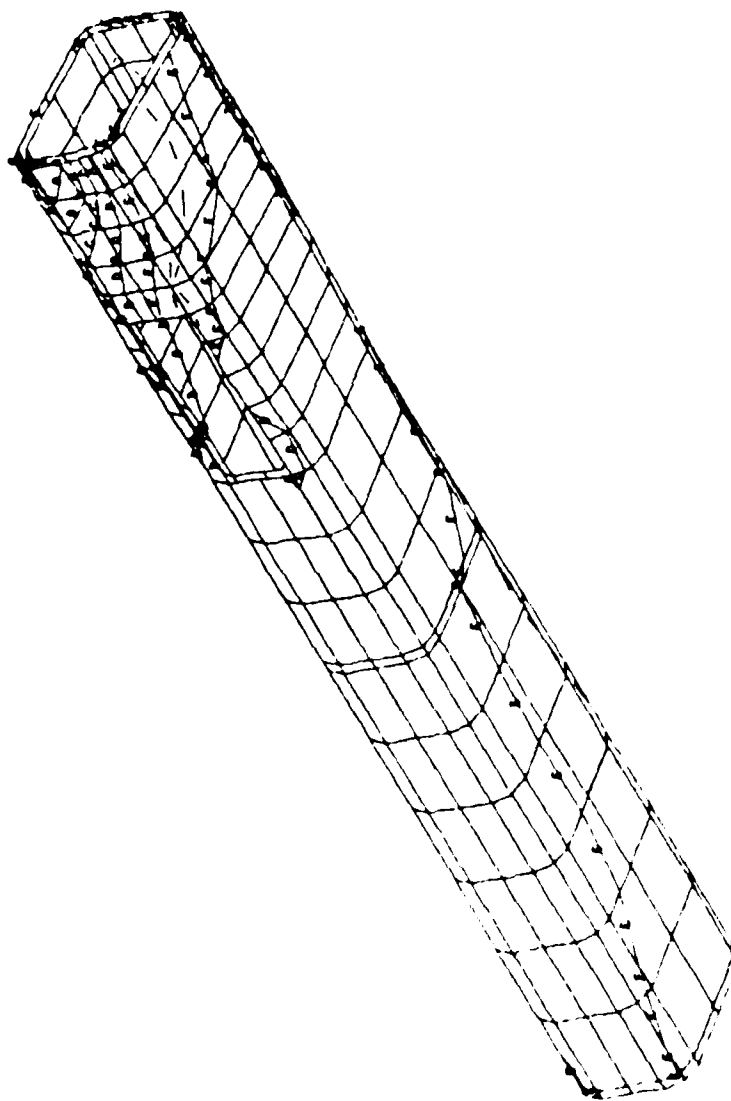


09171 - 100:

iii

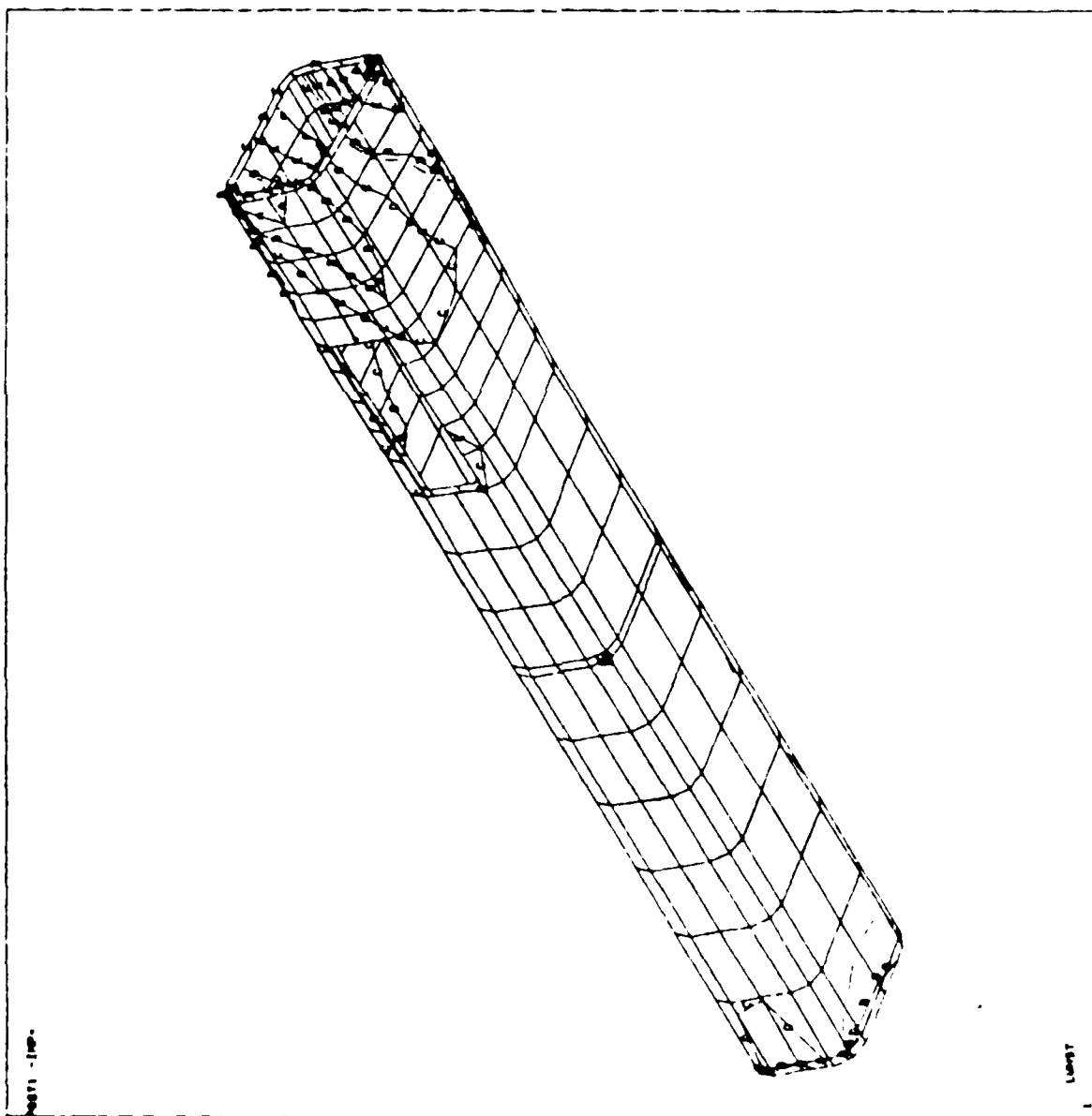
亦

100-110000-1000



120

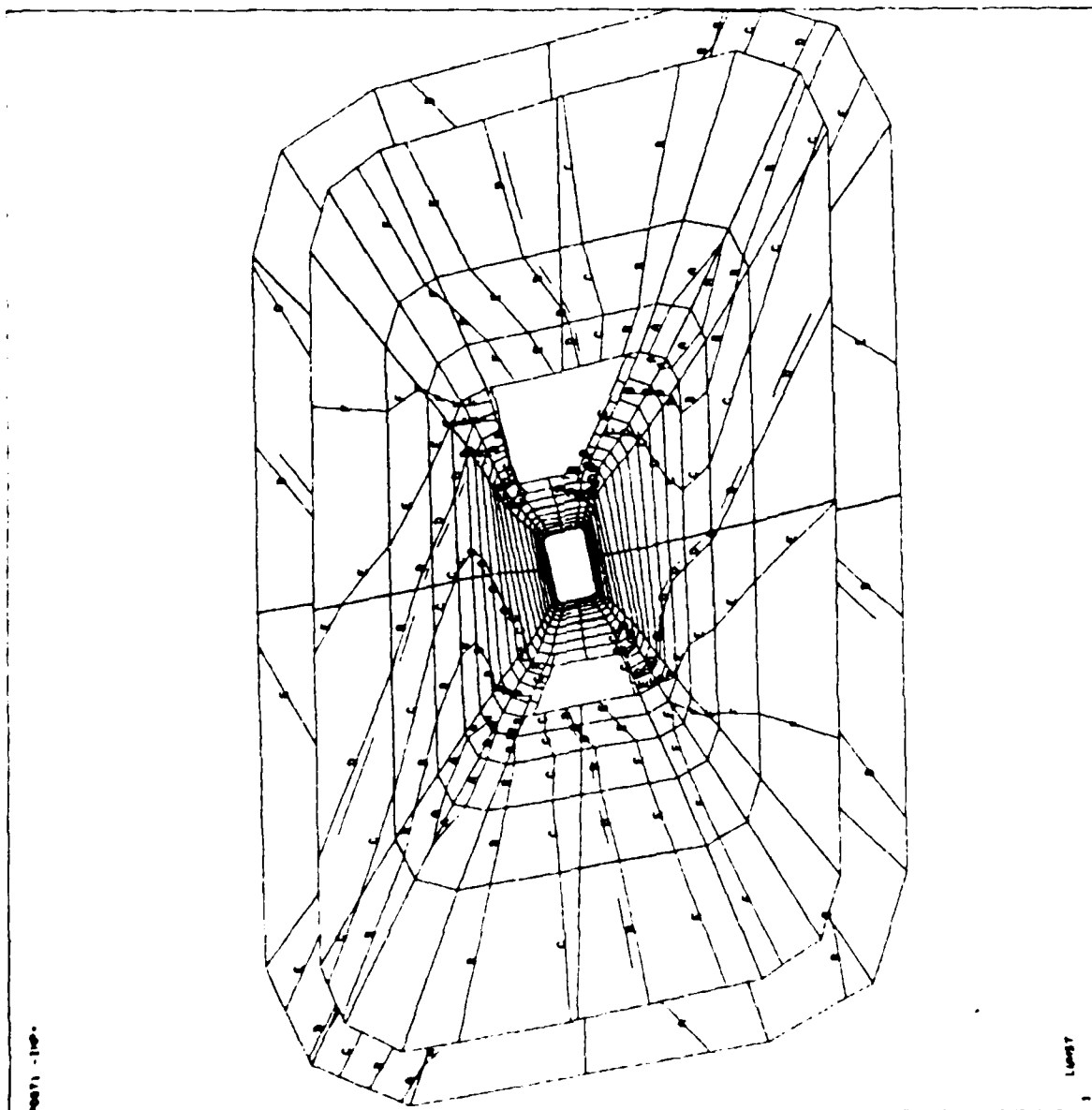
AMB 4.20  
 NOV 25 1966  
 8:03:03  
 POST/STRESS  
 STEP=1  
 ITER=1  
 SVS  
 RV=1  
 VU=1  
 ZU=1  
 DIST=104  
 ZF=110  
 M1002m  
 RU=8700  
 MU=3343  
 A=2400  
 D=1015  
 C=760  
 D=115  
 E=000  
 F=1005



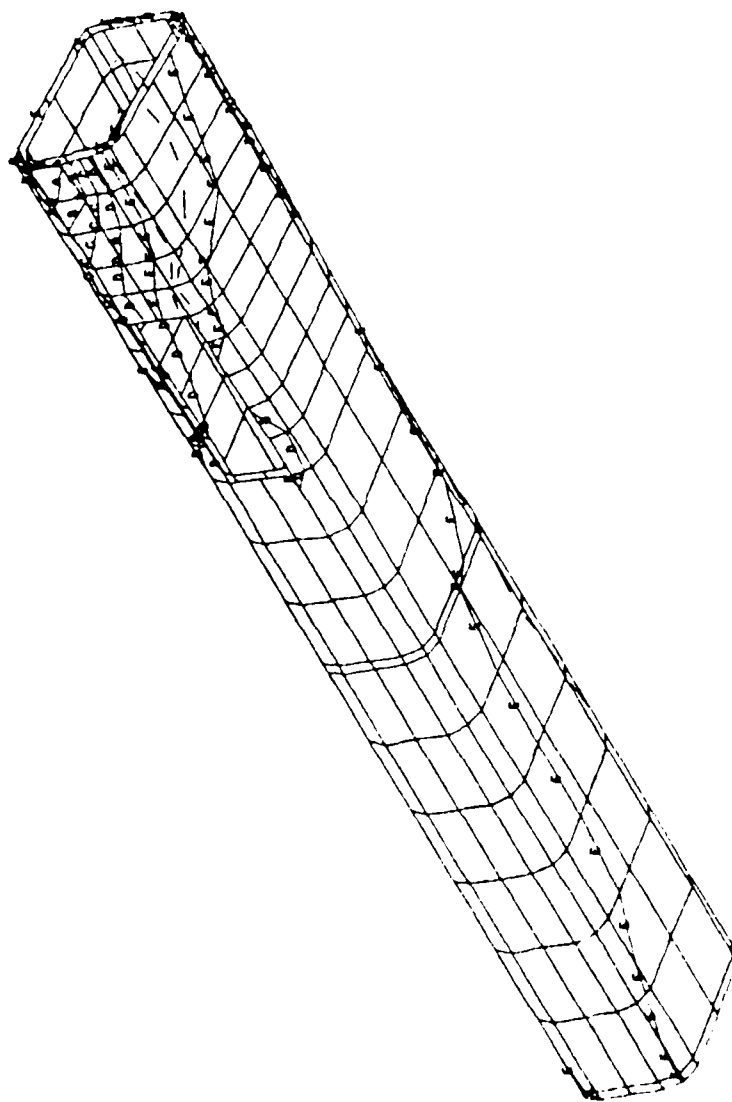




00555 1.25  
 000 05 1000  
 0130143  
 POST1 STRESS  
 STEP=1  
 1720=1  
 3VS  
 20=1  
 0157-175  
 27-110  
 COME-46  
 W100W  
 R=2700  
 R=3343  
 A--8480  
 B--1015  
 C--160  
 D--115  
 E--980  
 F--1045



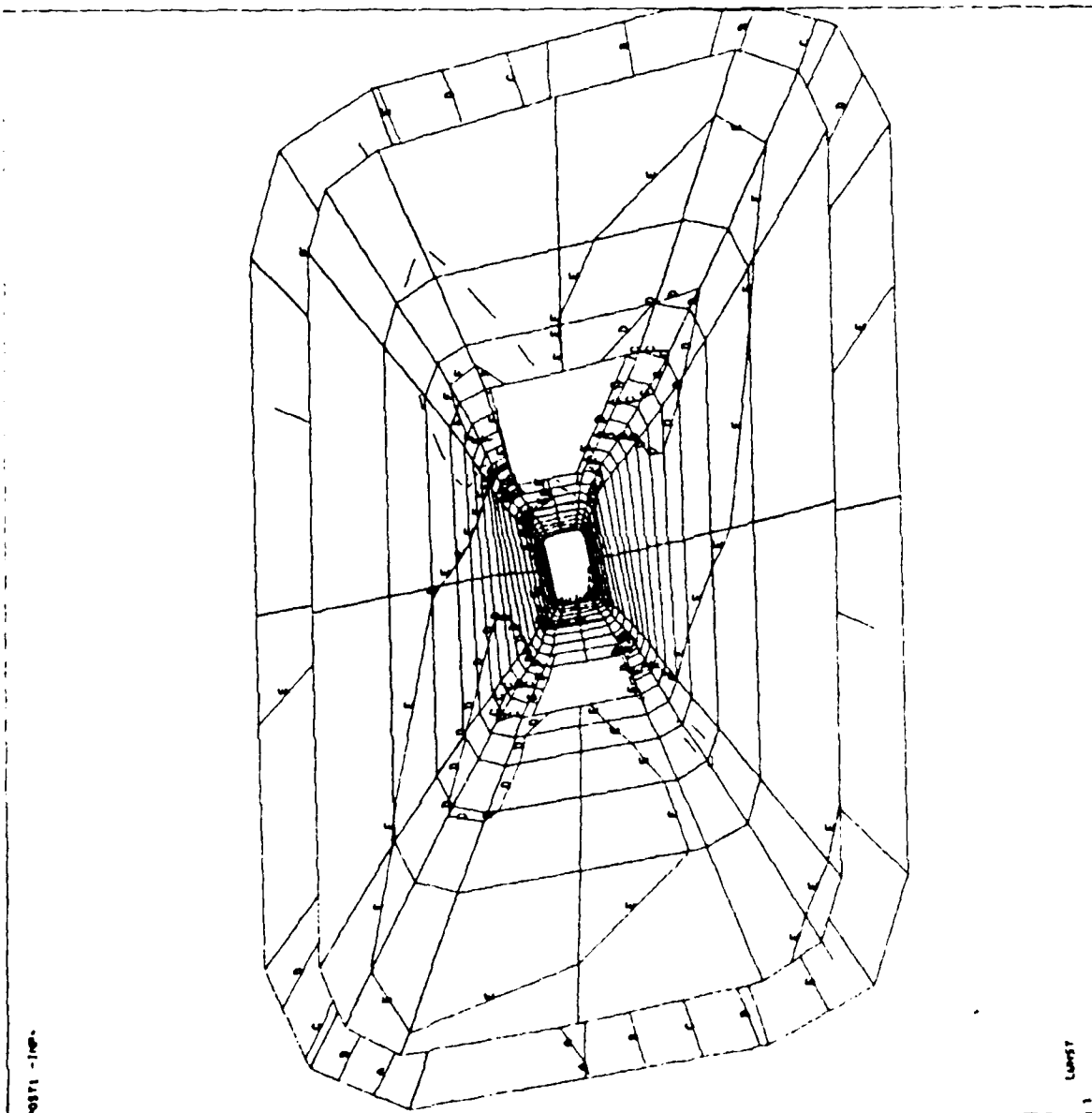
ANALYSIS 4.28  
 NOV 25 1986  
 8117146  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SRT  
 PU=1  
 VU=1  
 ZU=1  
 DIST=104  
 ZF=118  
 MIDDEN  
 NU=64740  
 MU=145845  
 A=118675  
 B=91404  
 C=64173  
 D=26942  
 E=9711  
 F=17620



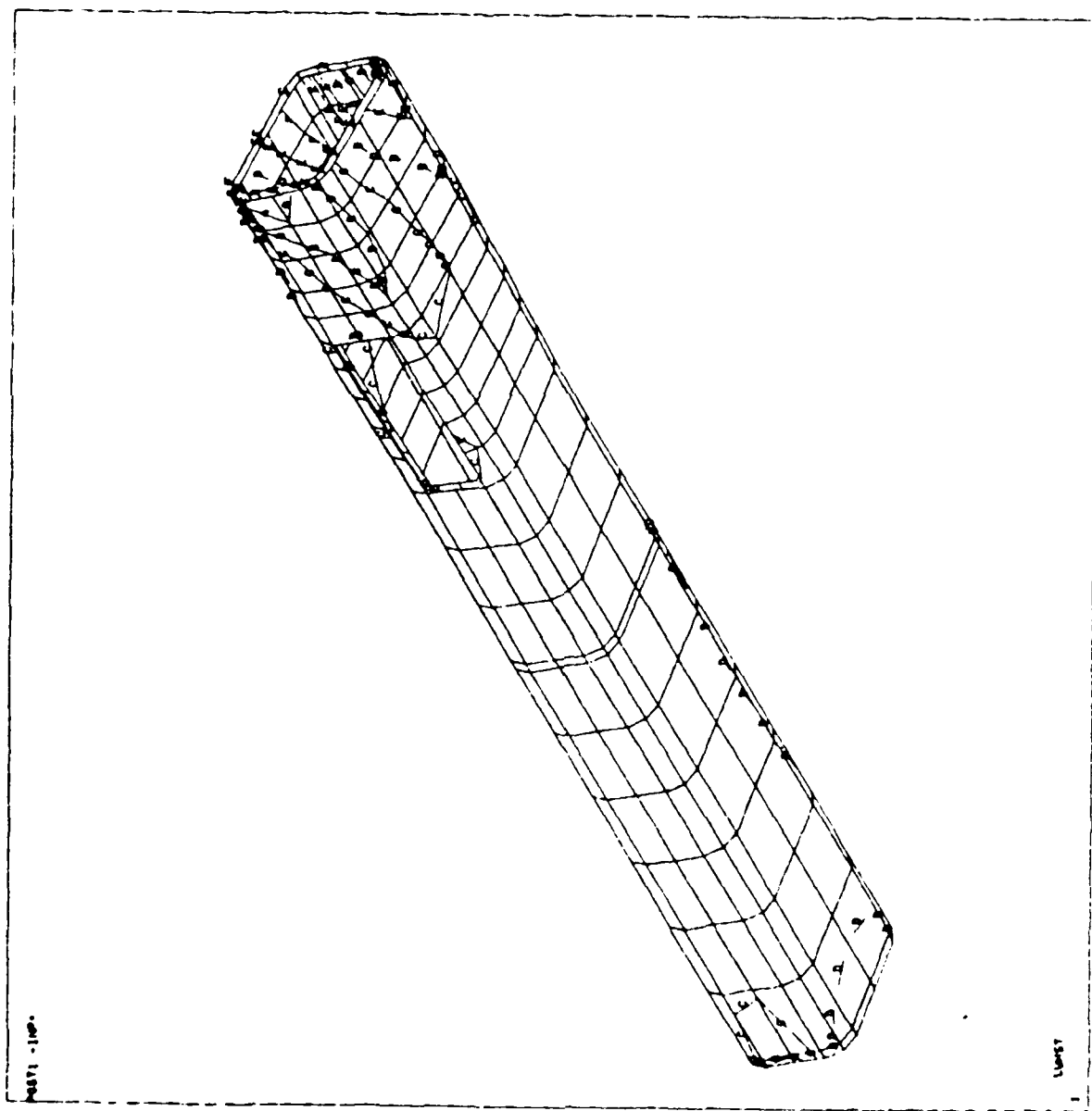
POST1 (PLOT)

11/25/86

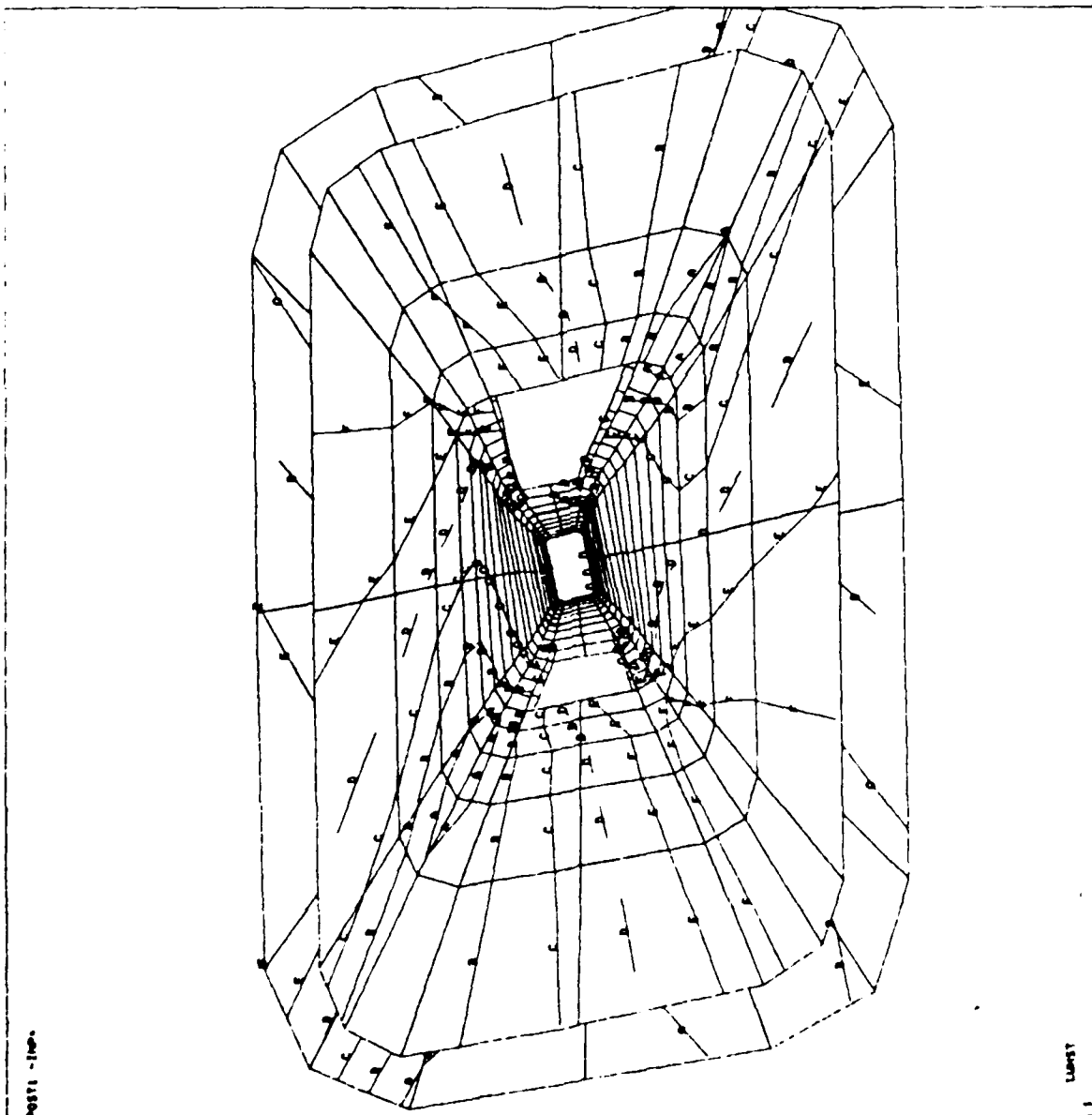
ANSYS 4.20  
 NOV 25 1985  
 91441.00  
 POST1, STRESS  
 STEP=1  
 ITER=1  
 SXT  
 ZOOM  
 DIST=1.25  
 ZF=116  
 CMR=46  
 MIDRCH  
 MS=44749  
 MM=116585  
 A=116635  
 B=91404  
 C=64173  
 D=36942  
 E=9711  
 F=17620



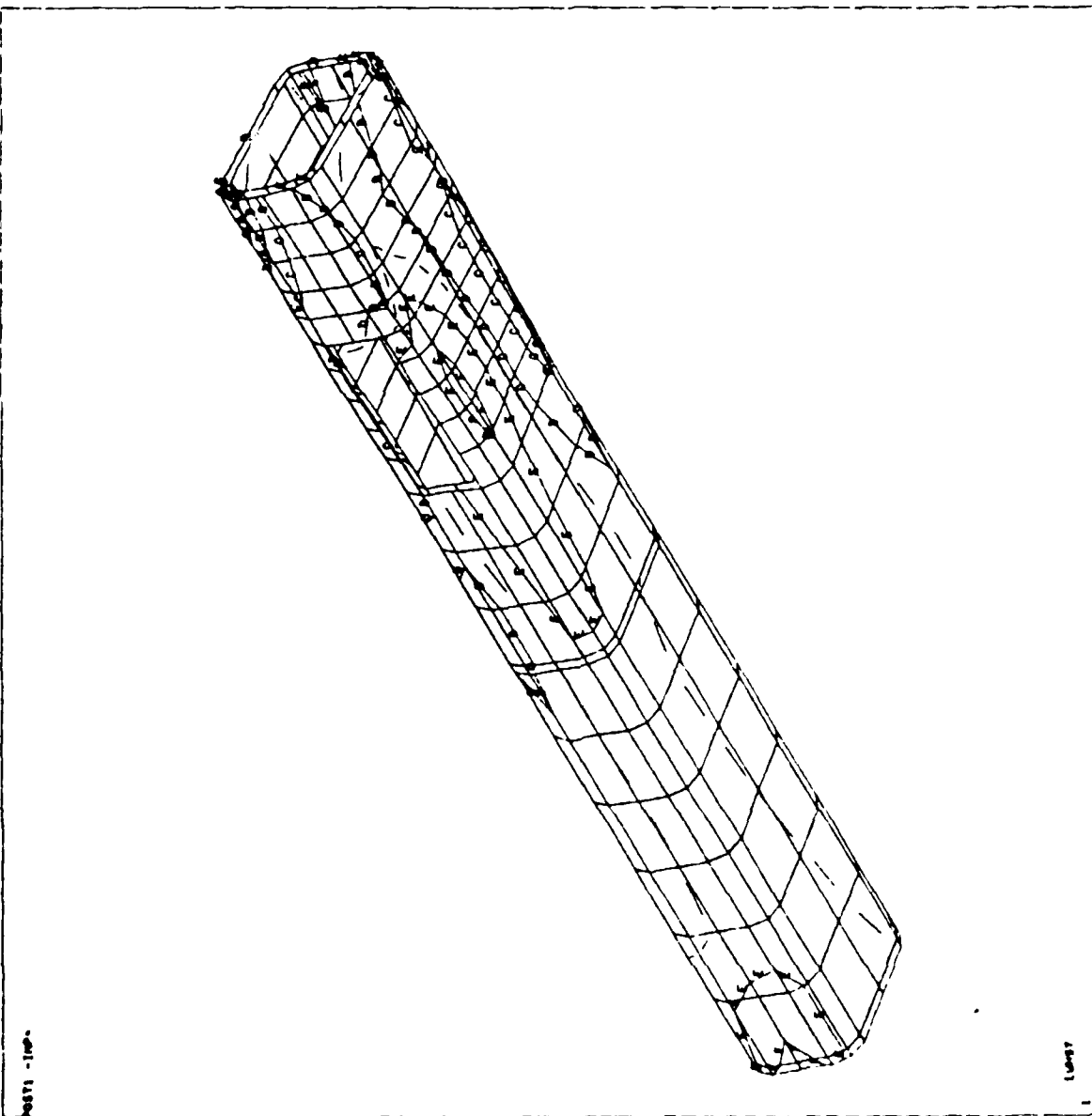
ANALYSIS 6.20  
NOV 85 1000  
10/12/03  
POST1 STRESS  
STEP=1  
ITER=1  
SV7  
DU=1  
VU=1  
ZU=1  
DISP=104  
SP=116  
MIDNEM  
PR=2540  
PR=3368  
A=2524  
B=1600  
C=836  
D=0  
E=844  
F=1630



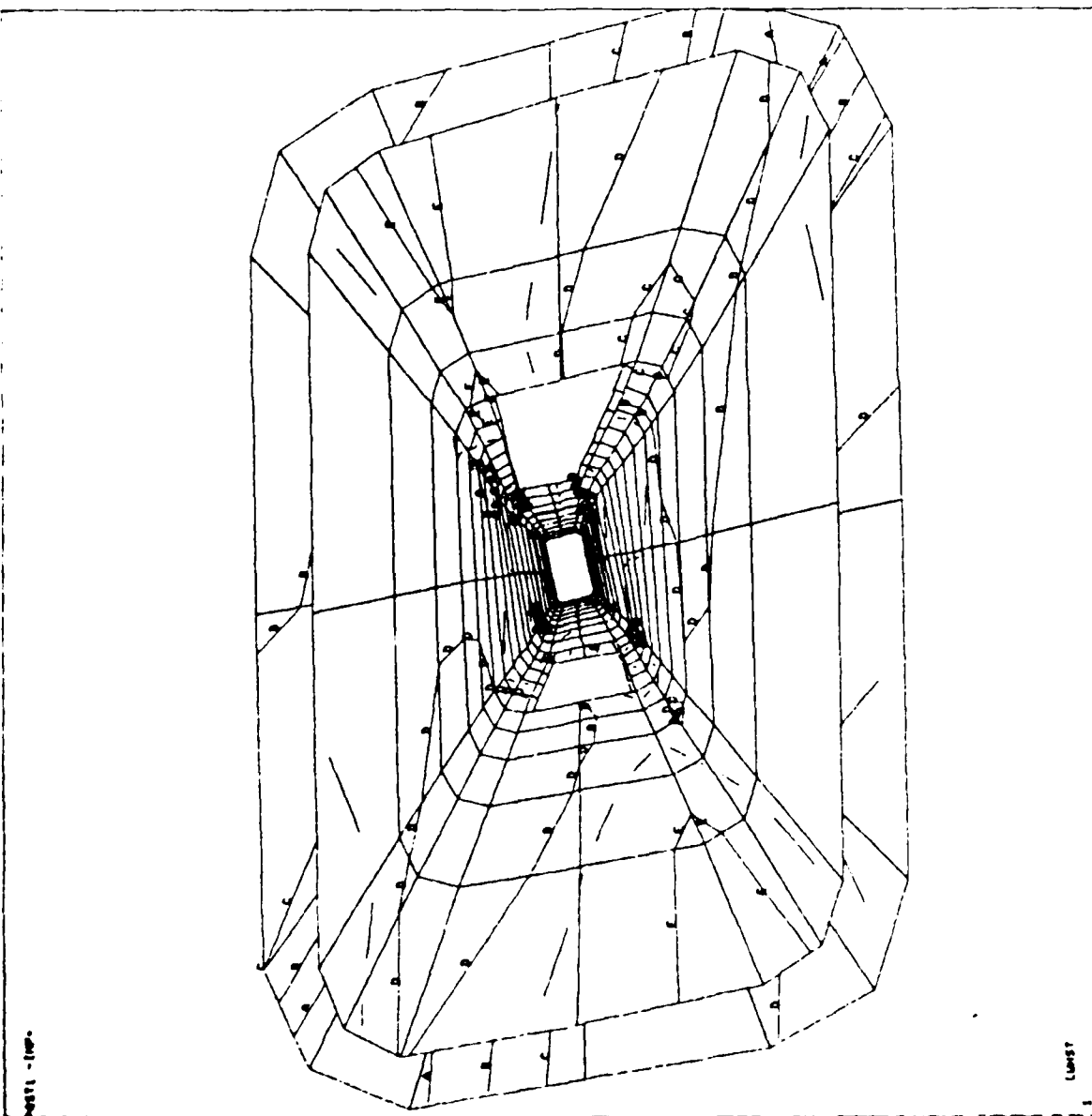
000115 4.20  
 NOV 26 1988  
 10142103  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 0.7  
 20=1  
 0187-134  
 27-116  
 COME-48  
 M1888  
 PA-8848  
 MO-1388  
 A--3324  
 B--1888  
 C--834  
 D=0  
 E-844  
 F-1888



ANALYSIS 4.20  
 NO. 25 1006  
 18/28/22  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 847  
 RU=1  
 VU=1  
 ZU=1  
 BIST=104  
 ZF=110  
 MIDCH  
 RU=2478  
 RU=4164  
 A=3897  
 B=2889  
 C=1311  
 D=383  
 E=585  
 F=1833



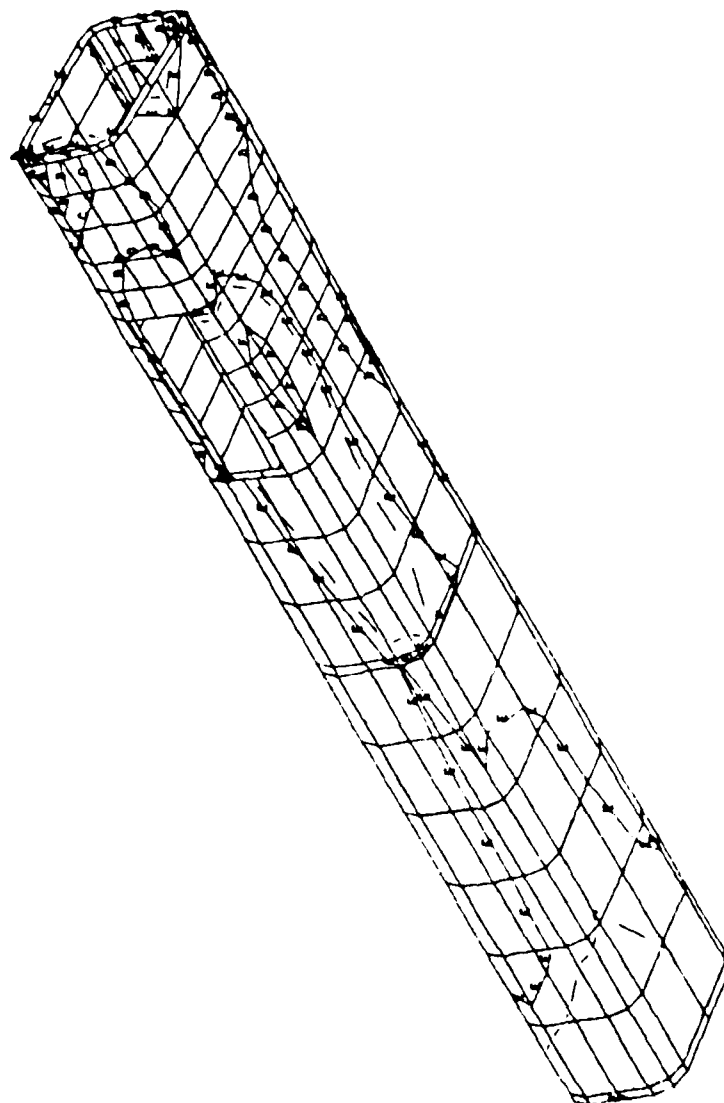
ANALYSIS 4.28  
NOV 25 1966  
10144104  
POST1: STRESS  
STEP=1  
ITER=1  
END  
20=1  
DIST=134  
EP=116  
CONE=48  
MIDCH  
PR=2479  
PR=4154  
A=3207  
B=2259  
C=1211  
D=263  
E=585  
F=1533





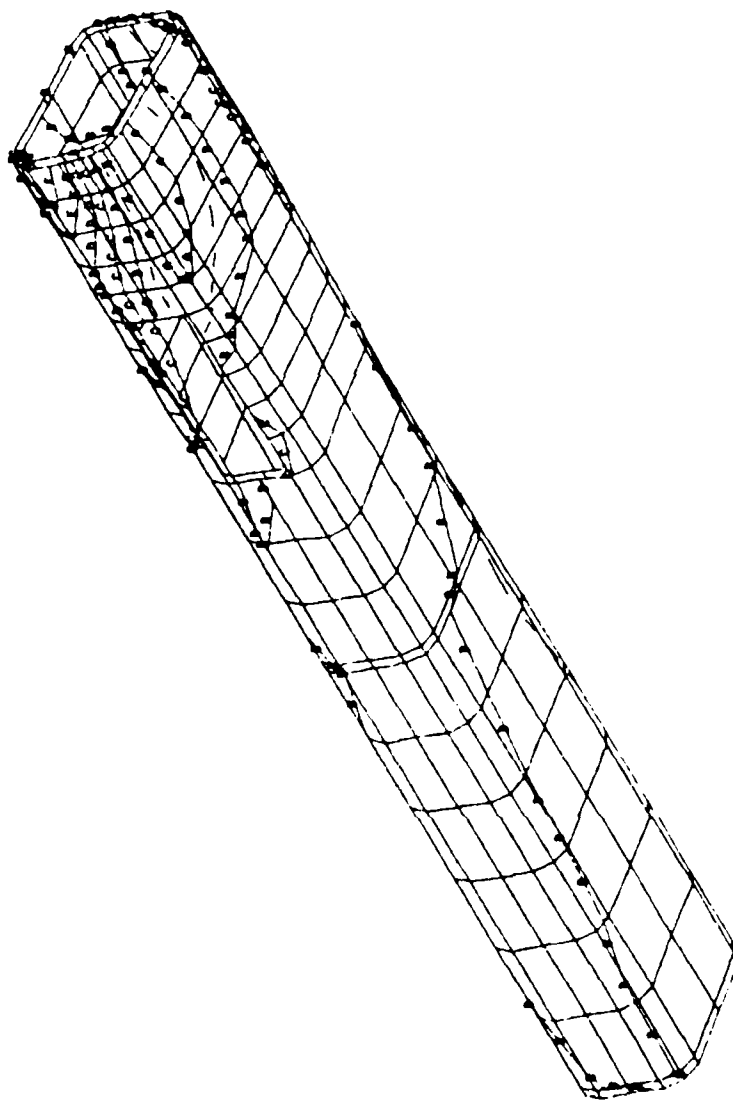
ANALYSIS 4.00  
 NEW 25 1005  
 10110124  
 POST11 5705.05  
 STEP=1  
 IYER=1  
 END

30--1  
 40--1  
 50--1  
 6157-104  
 70--110  
 810024  
 91-22377  
 101-80581  
 11--74795  
 12--58808  
 13--38991  
 14--21004  
 15--31197  
 16--14790

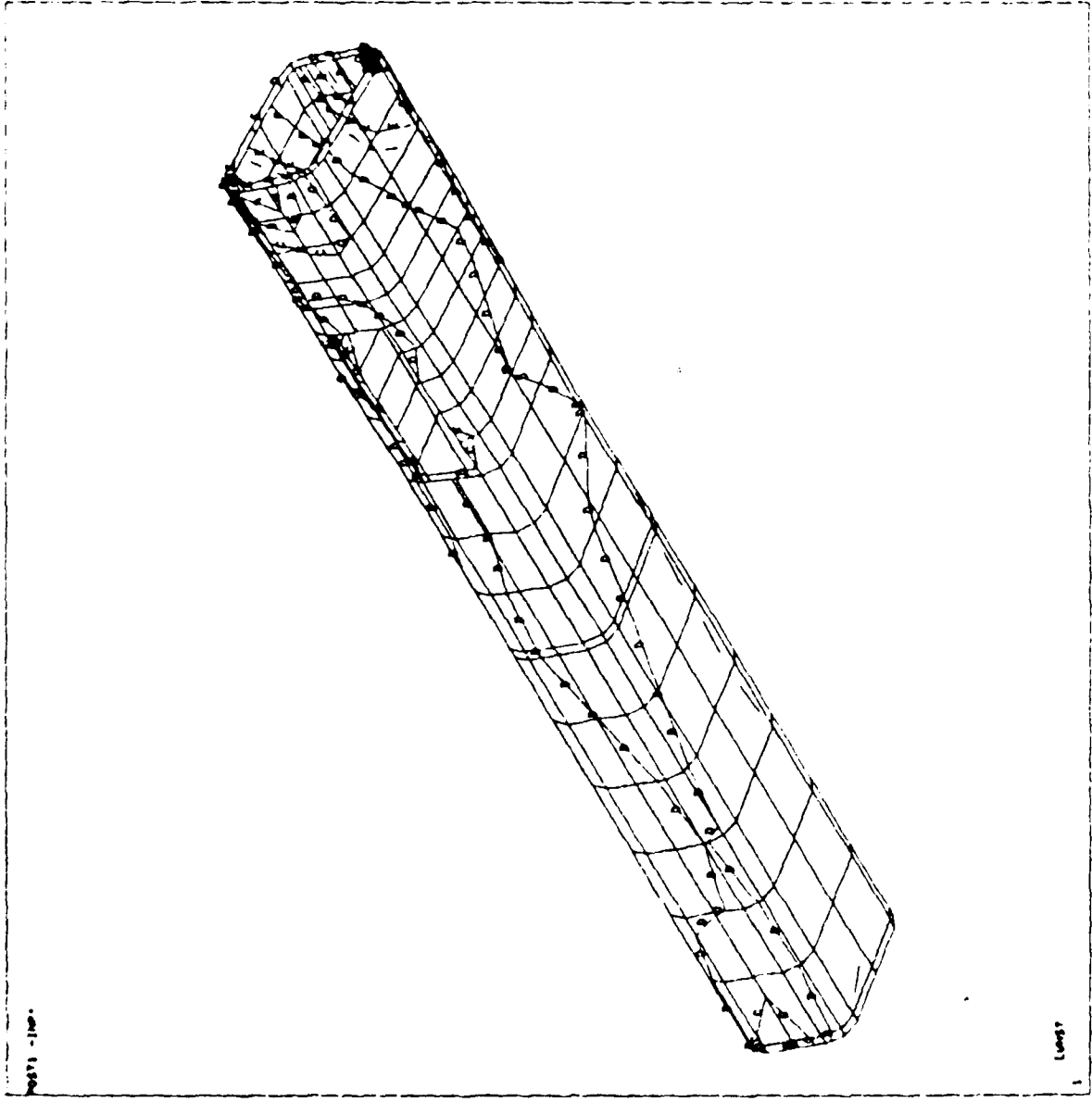


POST11 -100-

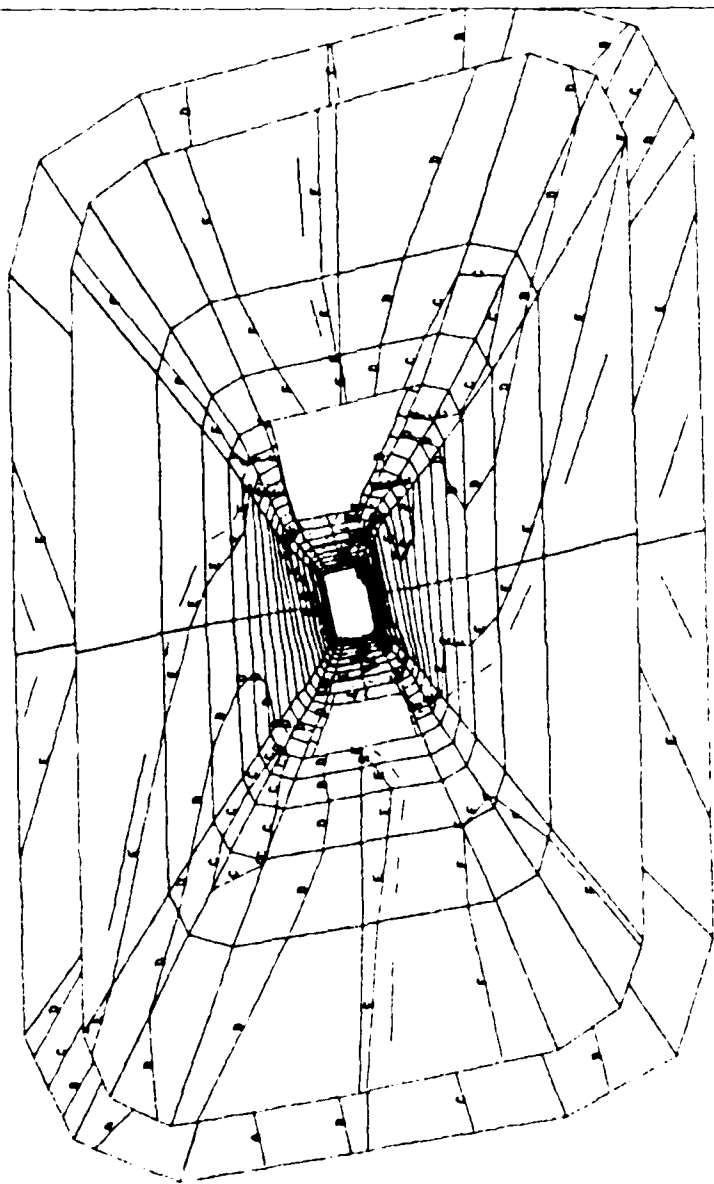
100517

[illegible]

ANSYS 4.20  
NOV 25 1986  
18:09:37  
POST1, STRESS  
STEP=1  
ITER=1  
SVR  
N=1  
M=1  
P=1  
DISP=104  
Z=116  
MIDEL  
PL=2268  
PR=4569  
A=3695  
B=2600  
C=1833  
D=657  
E=310  
F=1205



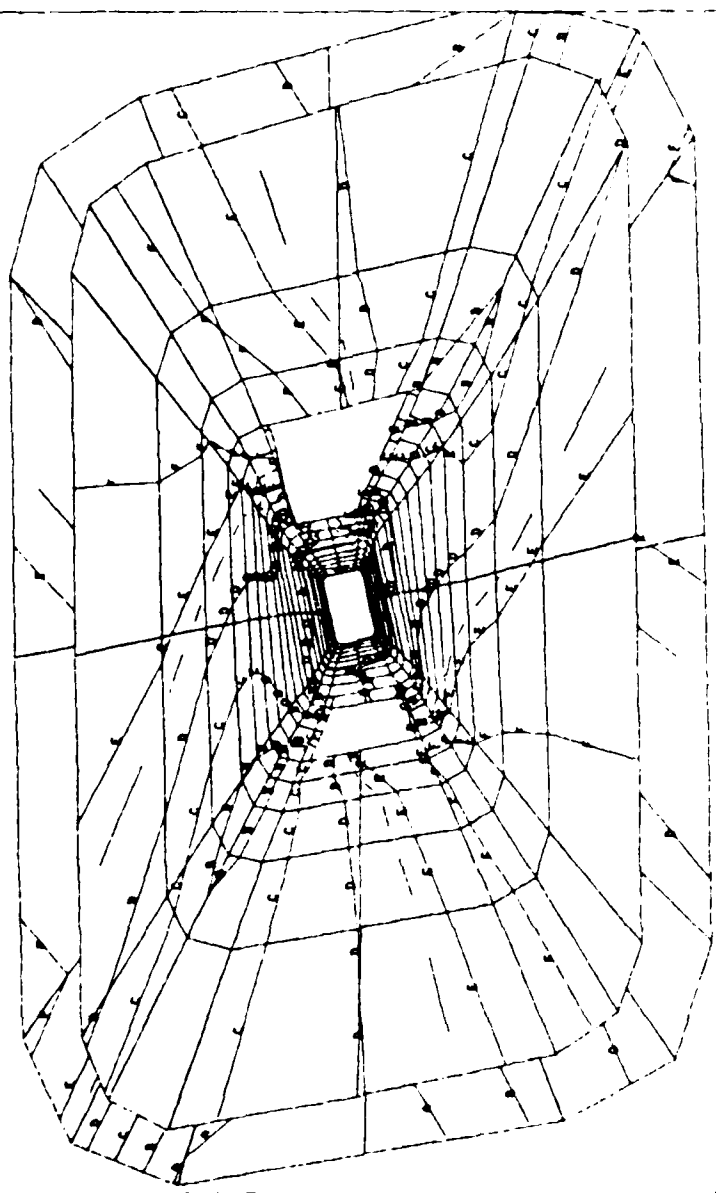
00000 1.20  
 MON 25 1966  
 10:40:16  
 POST1 STAGE  
 STEP=1  
 ITER=1  
 310  
 20=1  
 3187=134  
 27=116  
 COME=48  
 WIDEN  
 PA=12587  
 PH=14441  
 A=7795  
 B=14428  
 C=20901  
 D=21094  
 E=2187  
 F=14700



POST1 -140-

14097

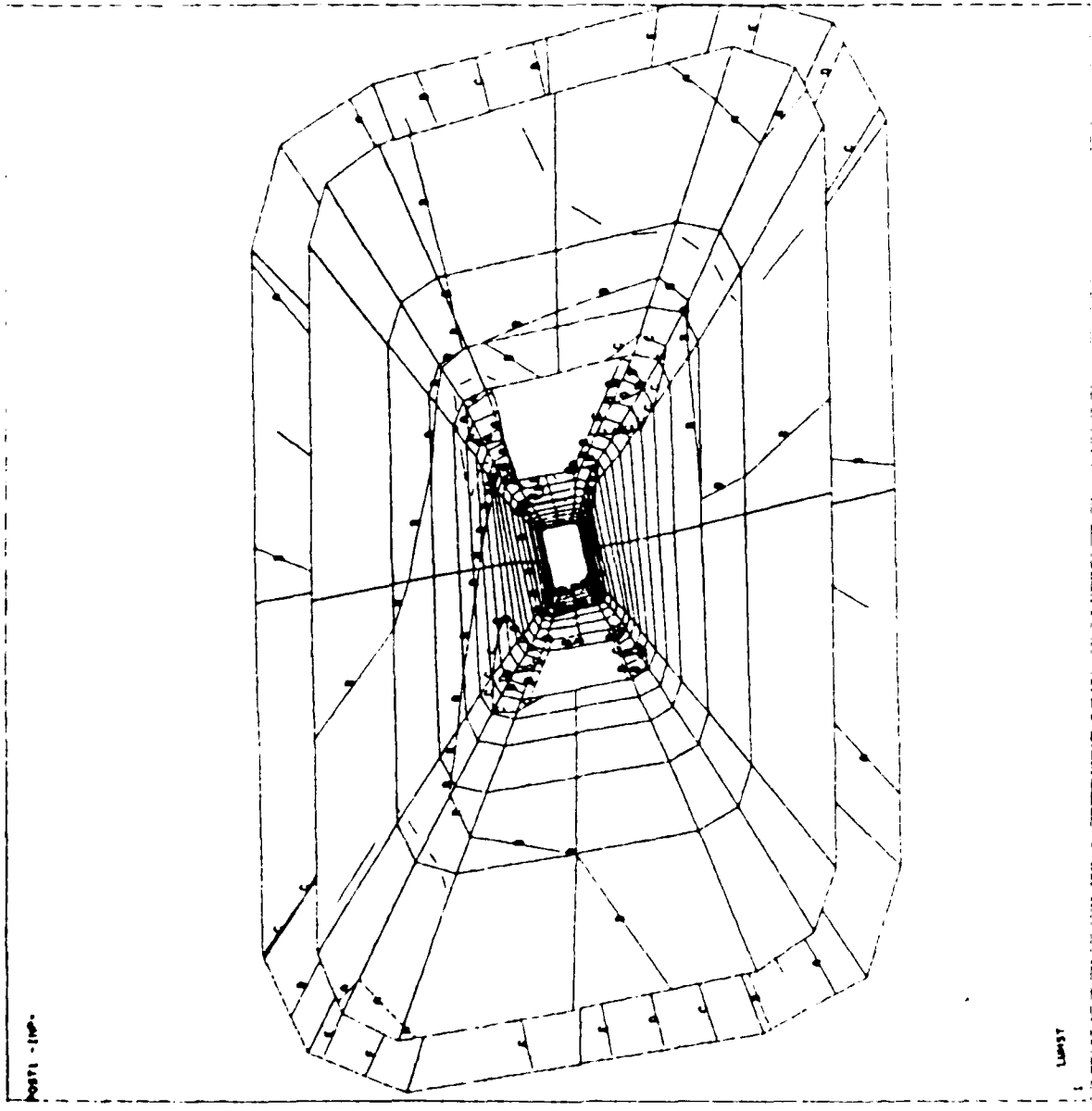
ANALYSIS 4.20  
 NOV 25 1966  
 10:40:40  
 POST11 STRESS  
 STRESS  
 11700.1  
 5VE  
 20-1  
 0151-134  
 27-116  
 COME-40  
 M18M7N  
 RA-2260  
 RA-4559  
 A-3685  
 B-2600  
 C-1633  
 D-657  
 E-310  
 F-1275



POST11 - 1000

11700.1

ANALYSIS 4.25  
NOV 20 1986  
10-12-01  
POST1 5THG10  
STEP=1  
TIME=1  
END  
20=1  
B1C1-134  
Z1-116  
CONC=48  
MIDDM  
R1-7129  
R2-1975  
A1-676  
B1-625  
C1-1826  
D1-2227  
E1-6428  
F1-8229

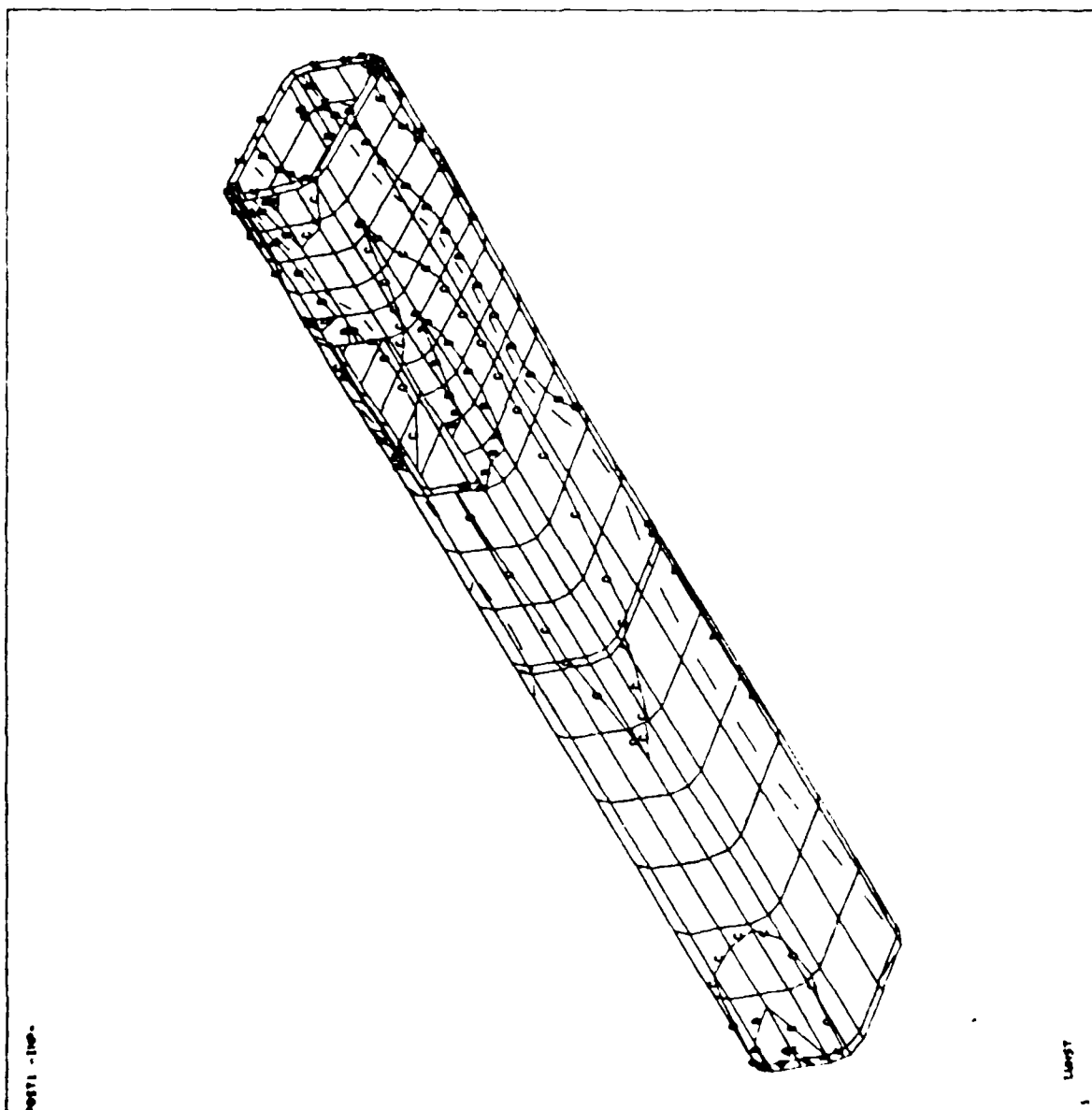


POST1 -100-

100000

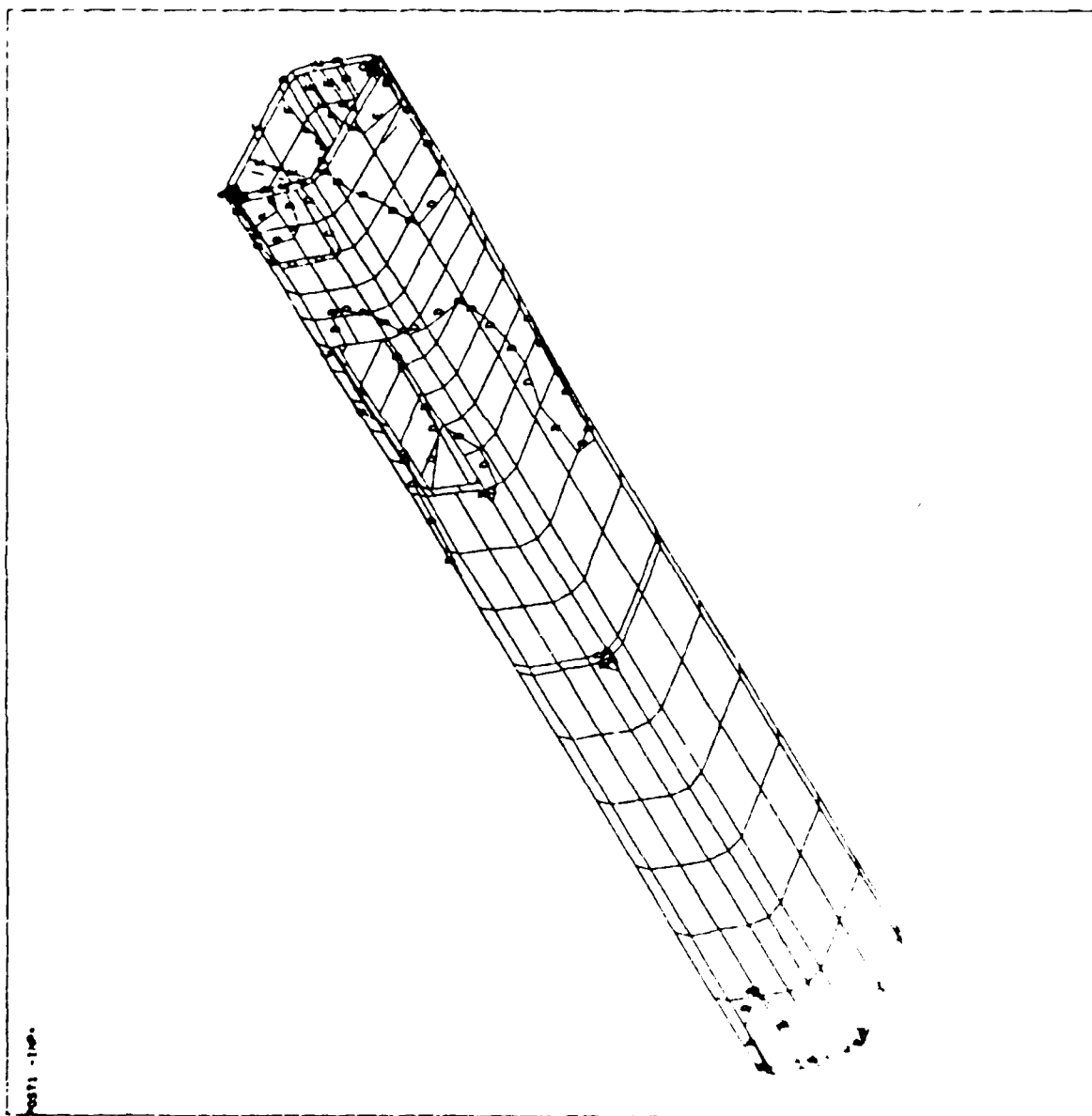
08755 6.20  
MAY 25 1968  
10:22:42  
POSTAL STREET  
STEP-1  
17E=1  
SUN

MU--1  
VU--1  
2V--1  
018F-104  
2P--118  
MI802A  
MU-48782  
MS--45575  
AO--40525  
P--25480  
C--(0431)  
P-4818  
P-19687  
F-34716



0000-9 4.70  
NOV 85 1965  
10:30:35  
POS:1 STAGE 64  
STEP=1  
ITER=1  
SVR

RV=-1  
VV=-1  
ZV=-1  
OBS1=104  
ZT=116  
MIDREQ  
MD=2504  
MS=-1544  
A=-4382  
B=-3220  
C=-2065  
E=-803  
F=260  
P=1423





AD-A183 992

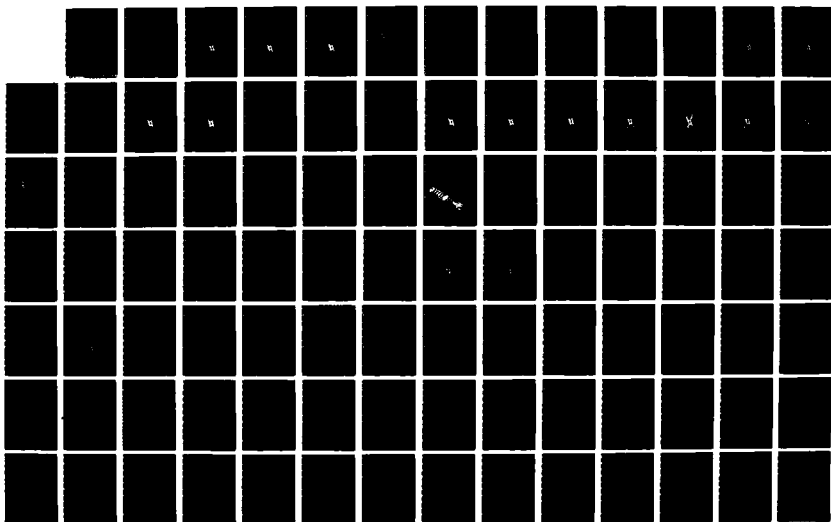
LIGHTWEIGHT TOWED HOWITZER DEMONSTRATOR PHASE 1 AND  
PARTIAL PHASE 2 VOLUM (U) FMC CORP MINNEAPOLIS MINN  
NORTHERN ORDNANCE DIV R RATHE ET AL APR 87  
FMC-E-3041-VOL-D2-PT-4 DAAA21-86-C-0047

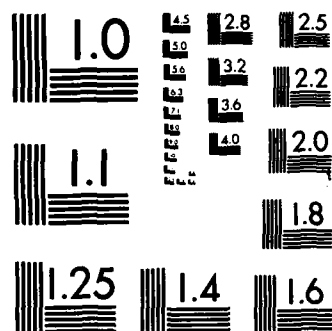
3/4

UNCLASSIFIED

F/G 19/6

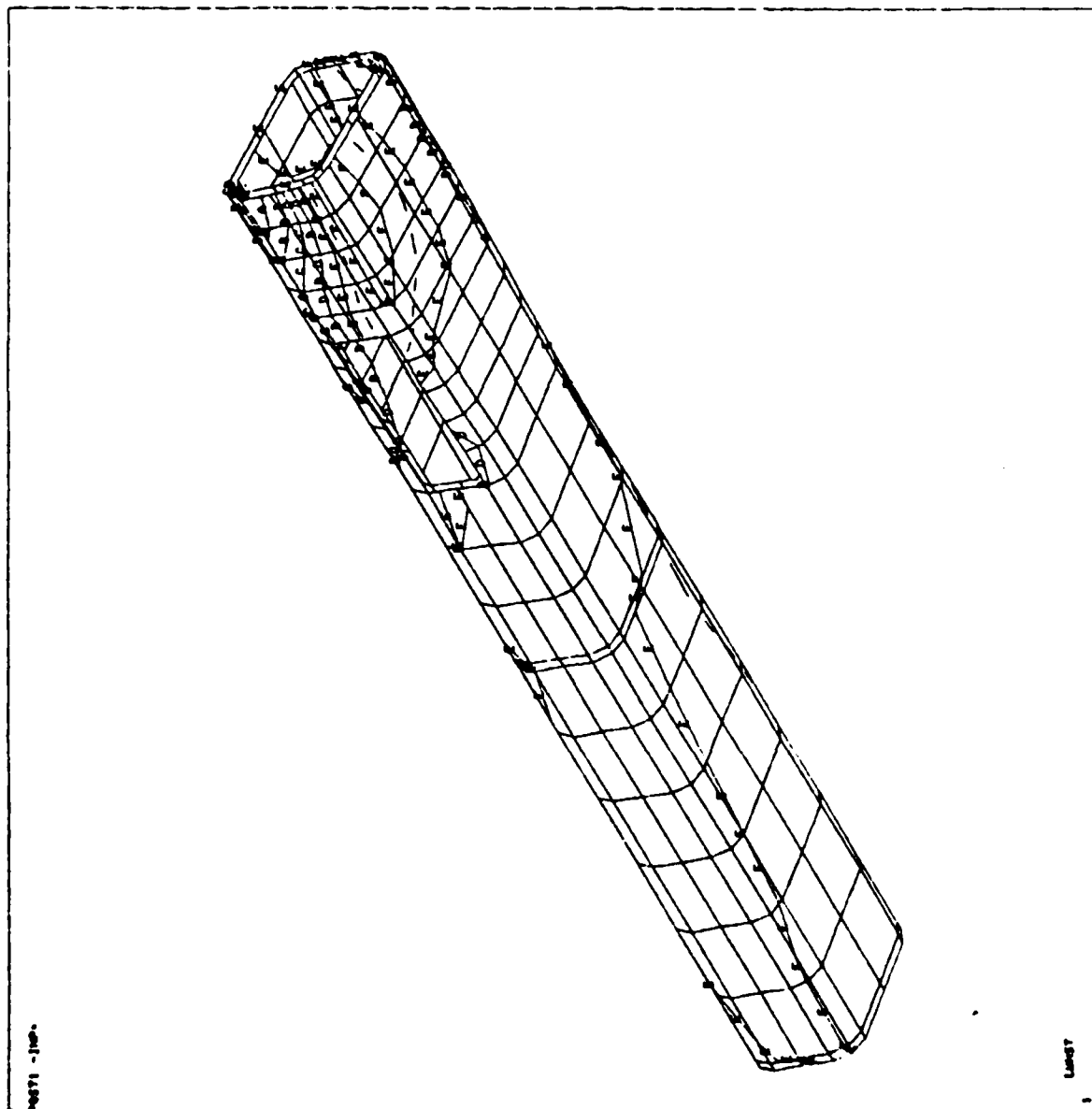
NL



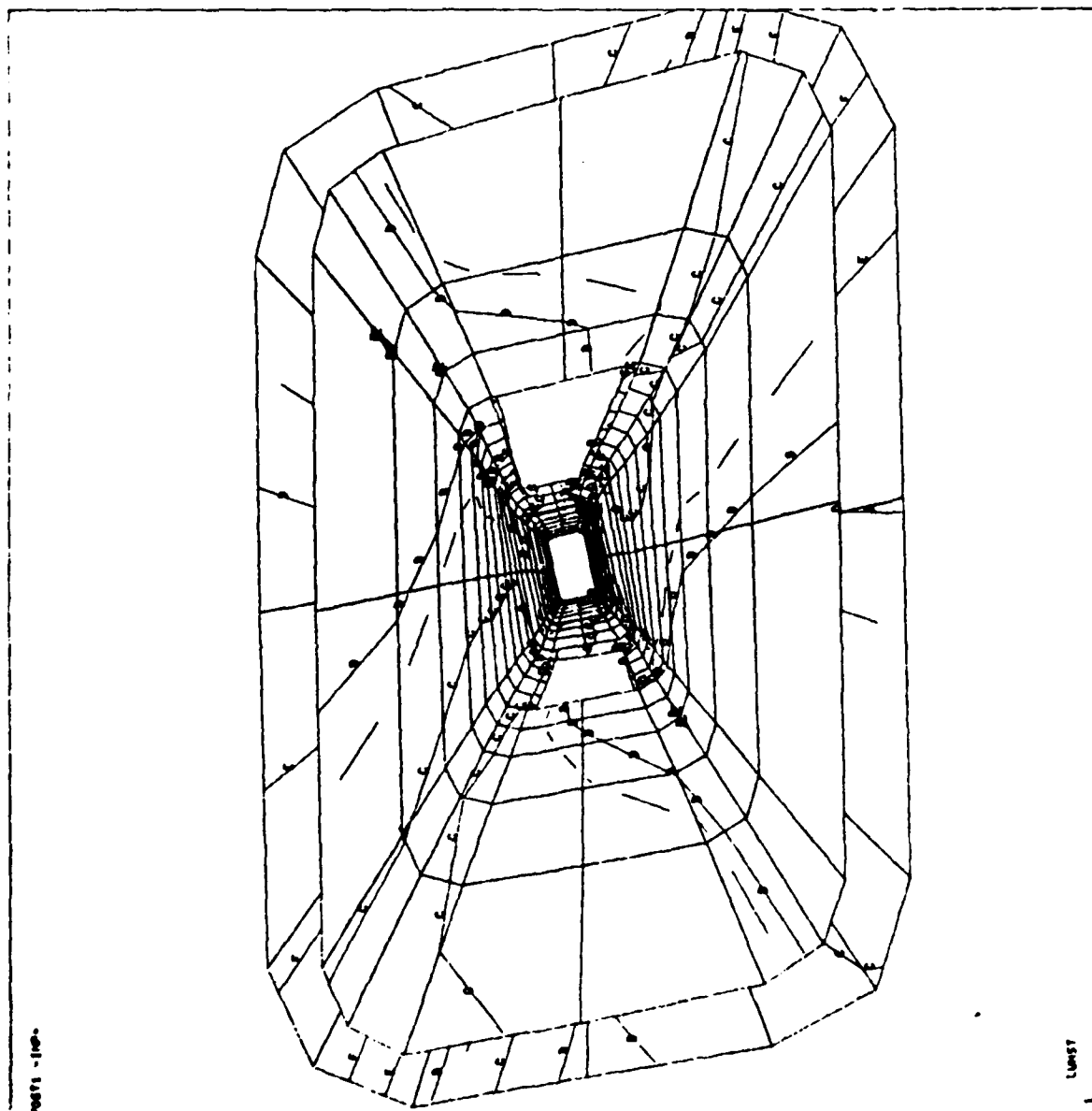


MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

ANALYSIS 4.23  
 NOV 25 1985  
 10:34:16  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 S40  
 NO=1  
 NO=1  
 NO=1  
 3187104  
 27116  
 1186W  
 NO=1801  
 NO=7100  
 A=0811  
 3--0812  
 C--3213  
 D--1914  
 E--615  
 F--084



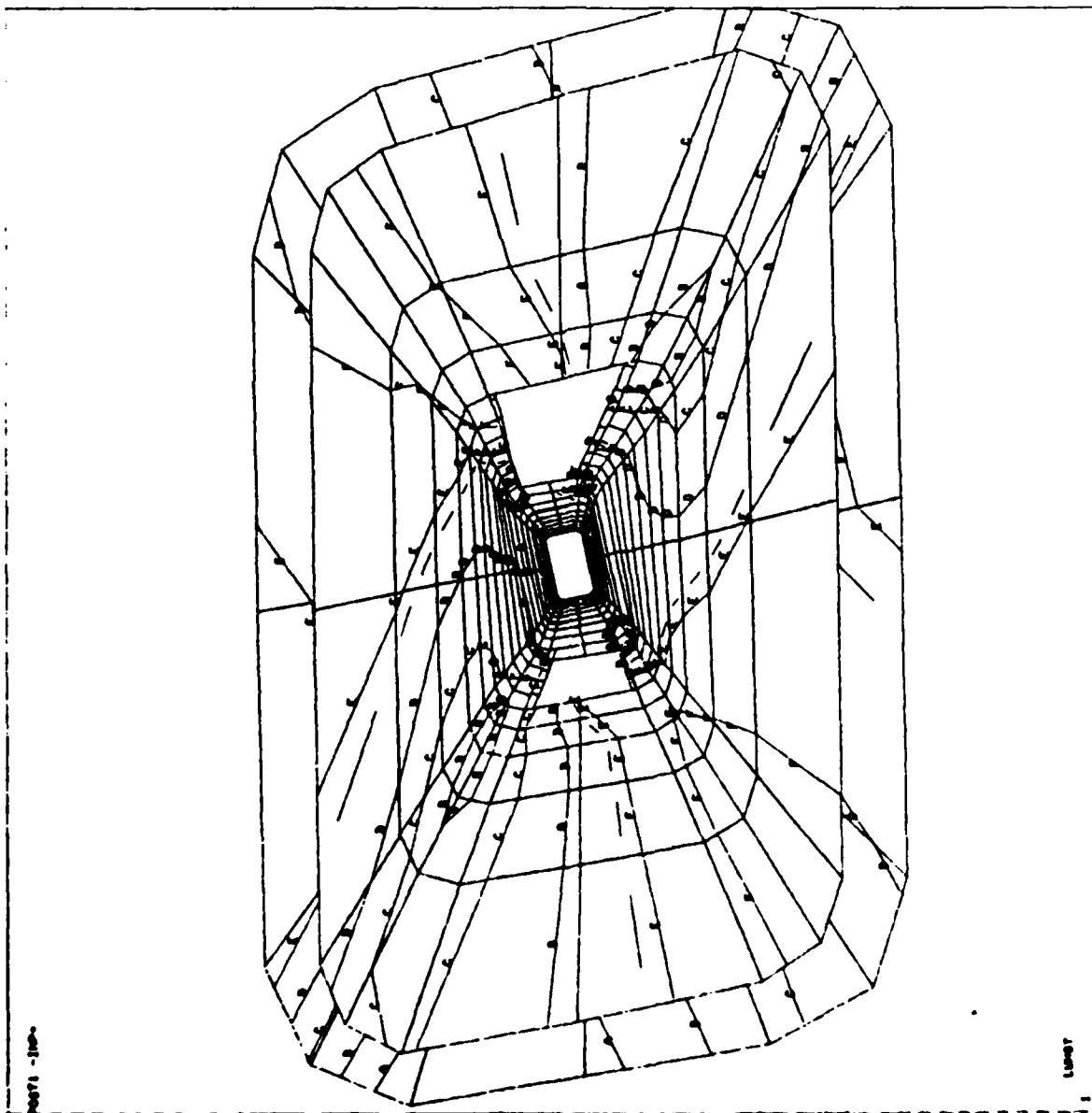
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 CONE=48  
 HIDDEN  
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 C=10431  
 D=618  
 E=18687  
 F=34716



POST1 - 1000

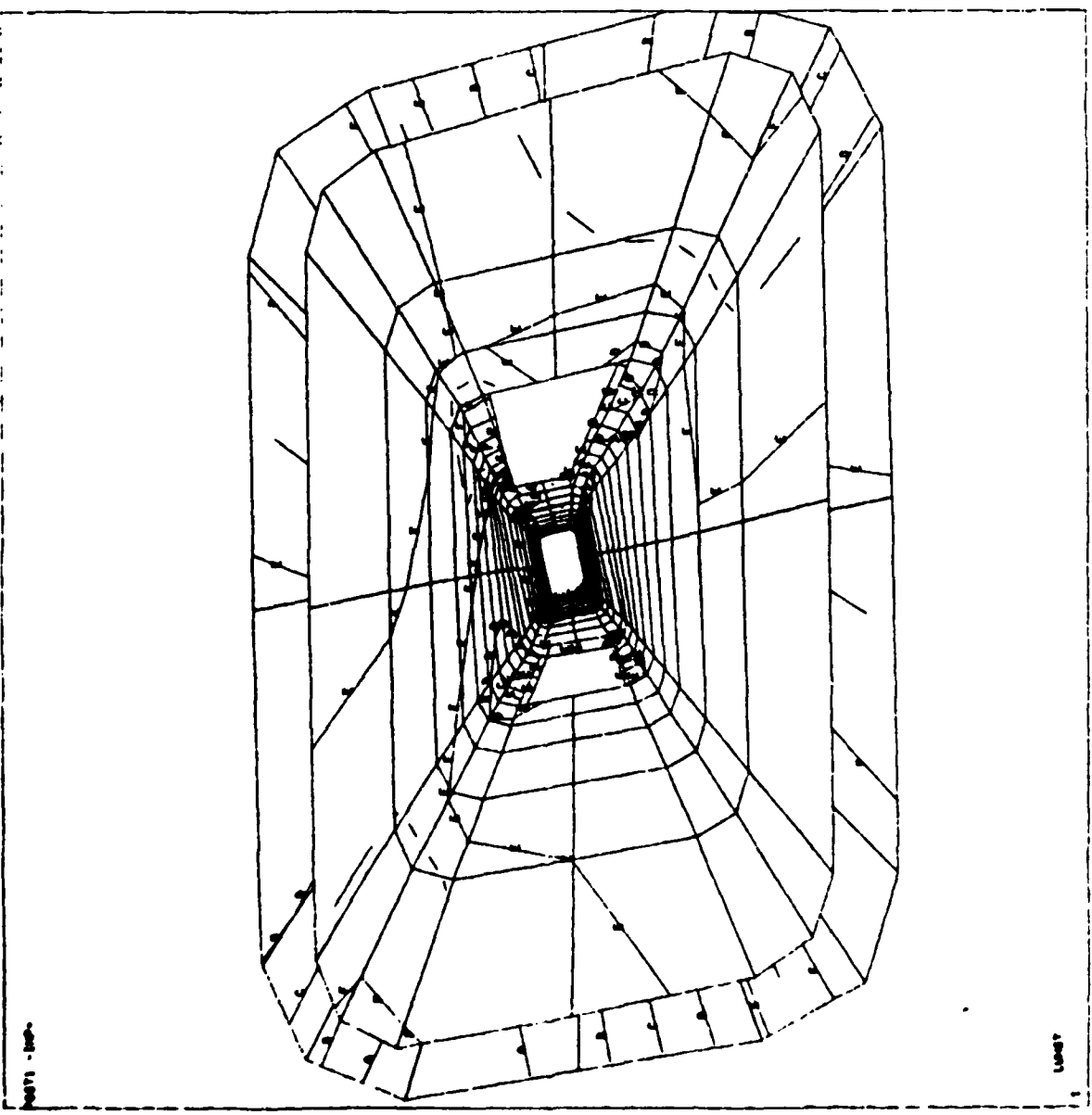
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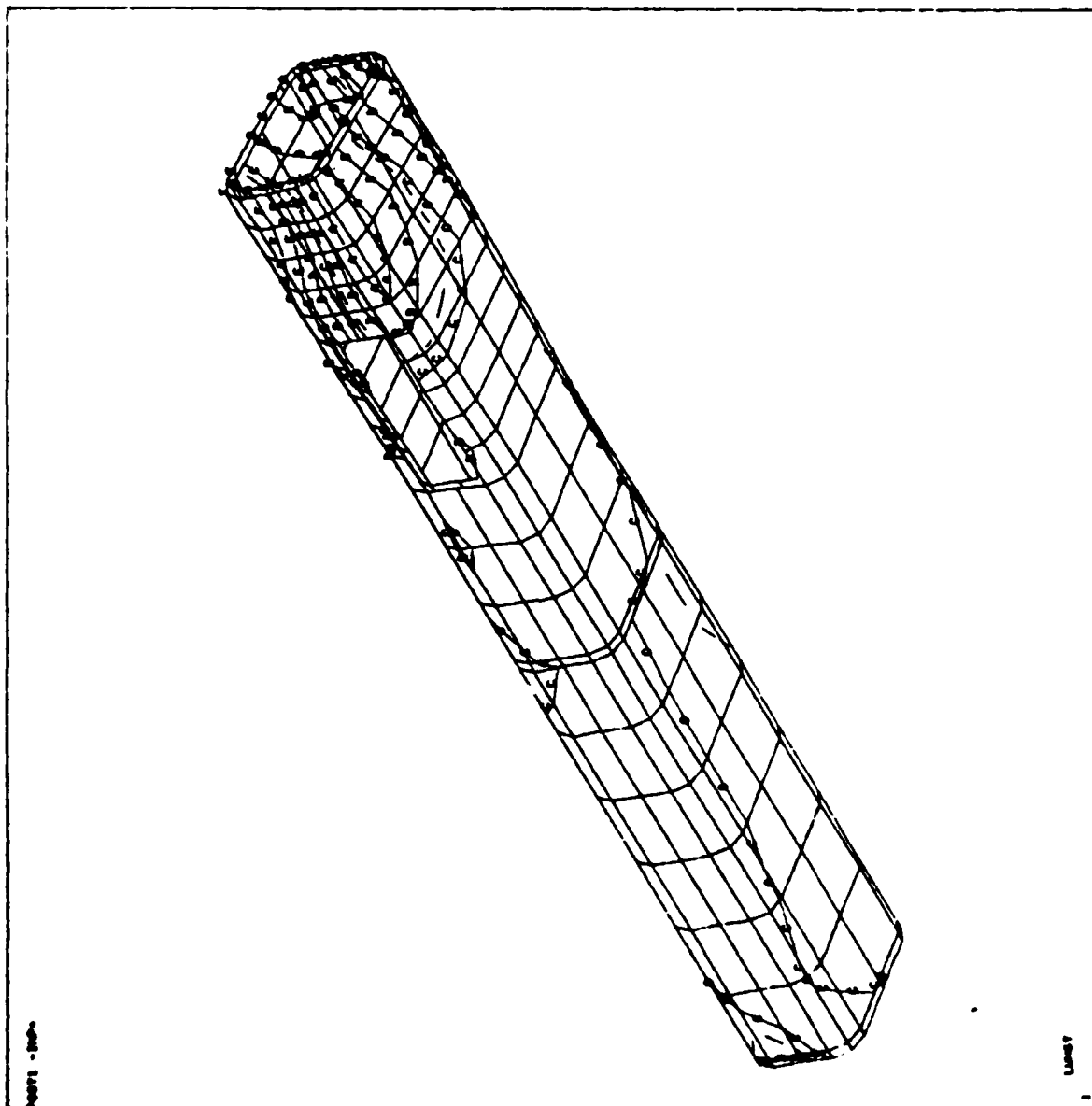


65

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HIBEN  
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RM=-7100  
A=-8811  
B=-4512  
C=-3213  
D=-1014  
E=-615  
F=684



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 10100135  
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 STEP-1  
 ITER-1  
 SIZE  
 000-1  
 000-1  
 20-1  
 0107-100  
 27-116  
 0100010  
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 F-01705



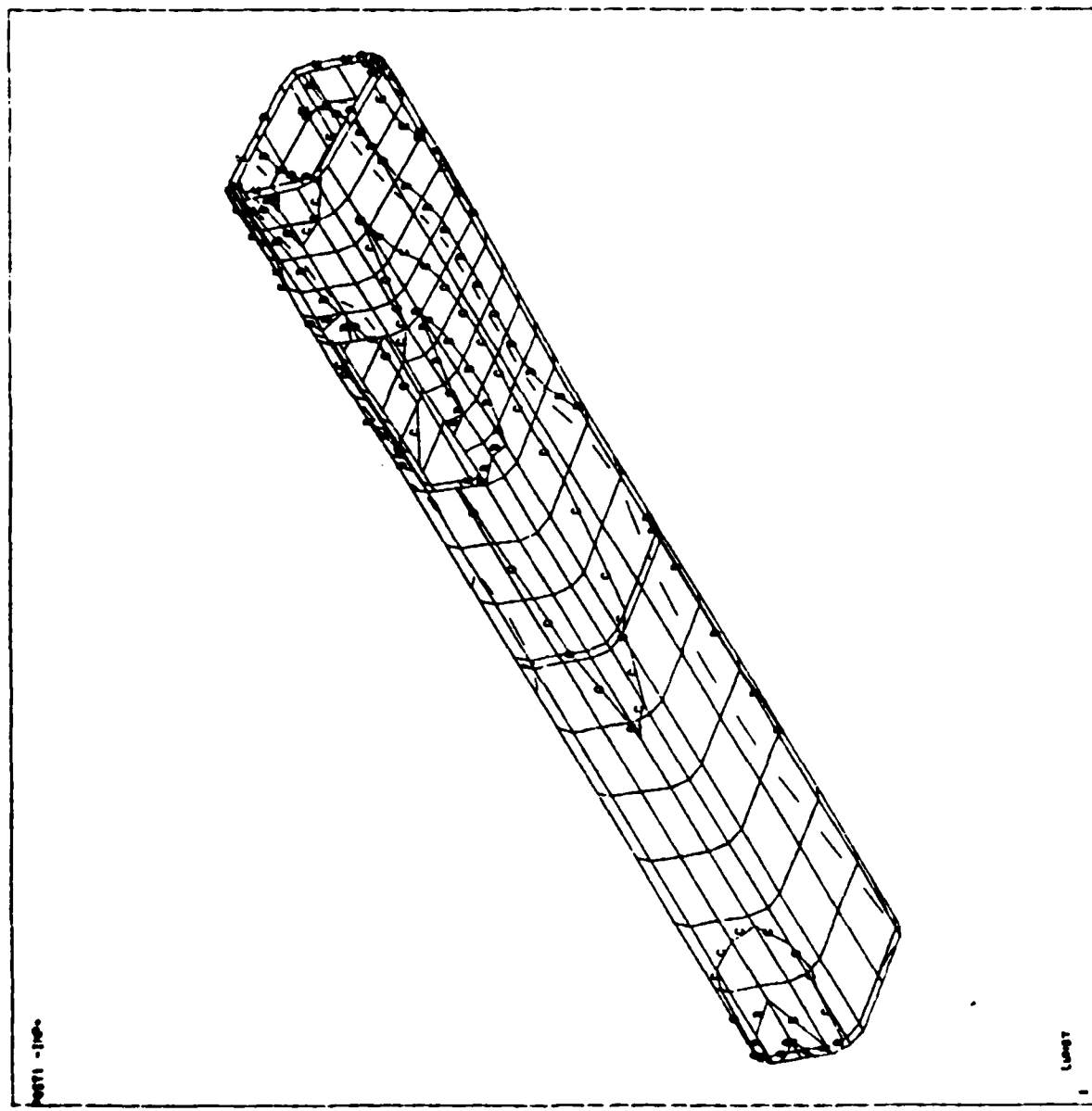




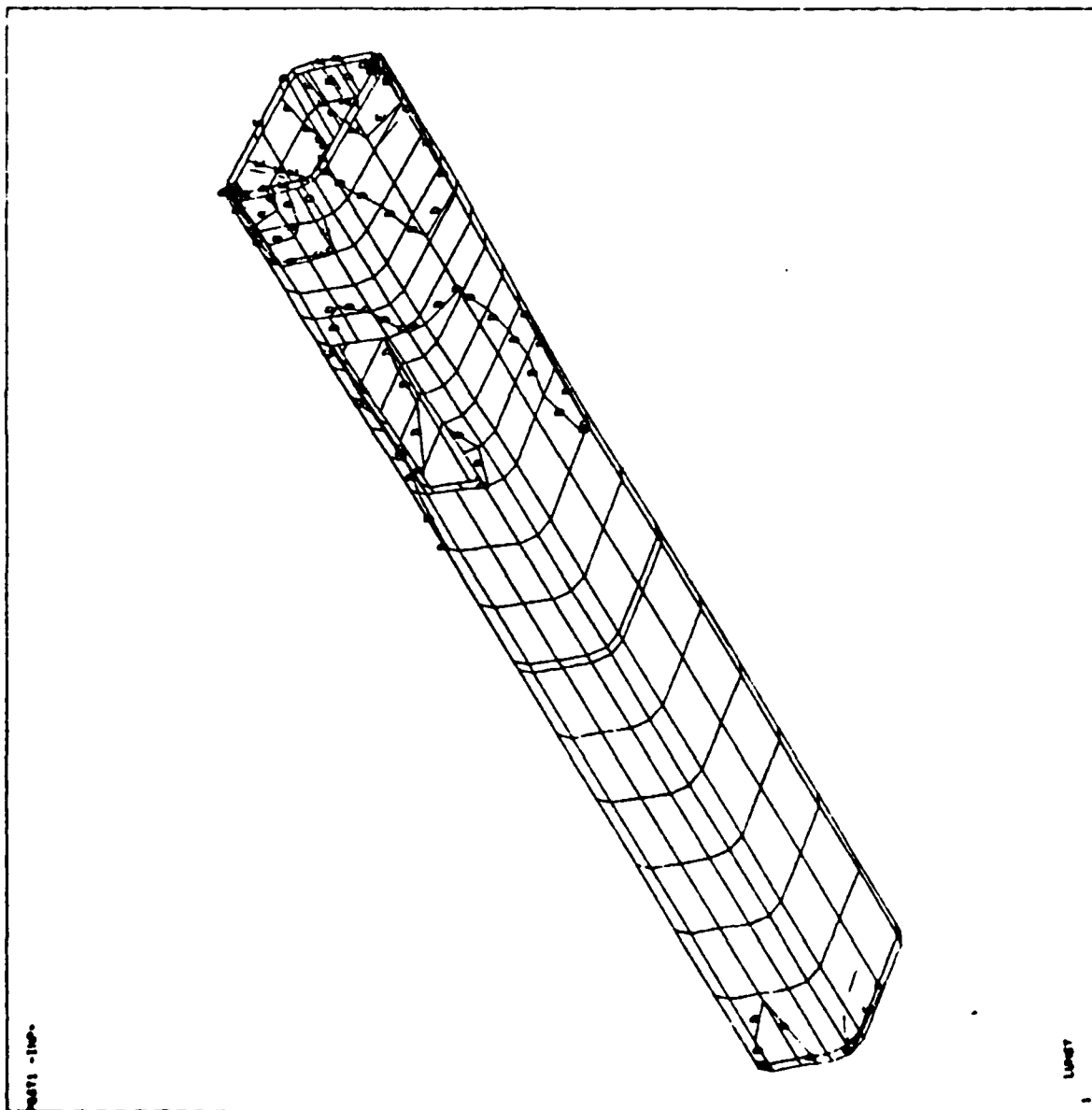
• 2017-18

15057

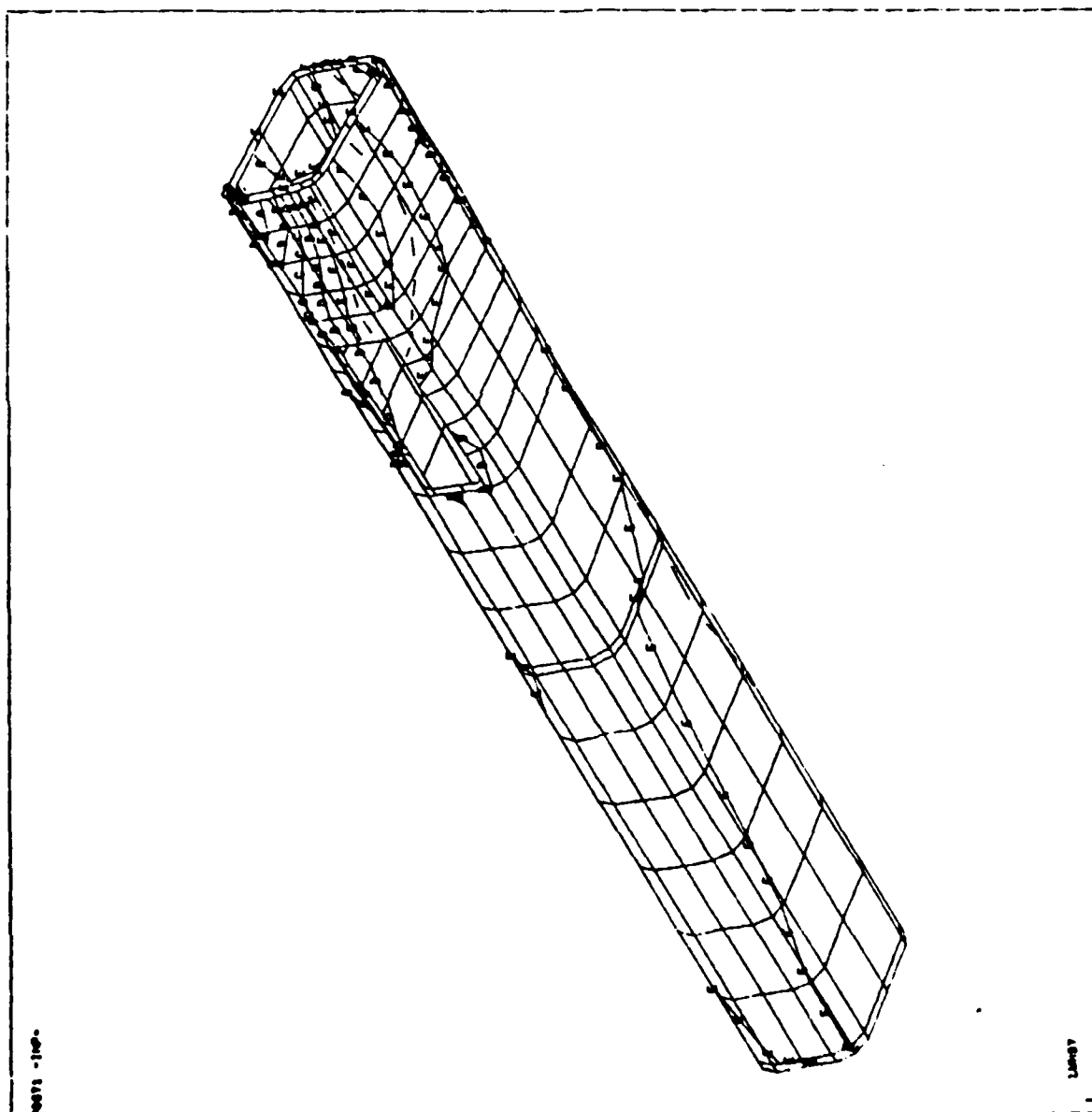
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ZU=1  
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ZP=116  
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C=10125  
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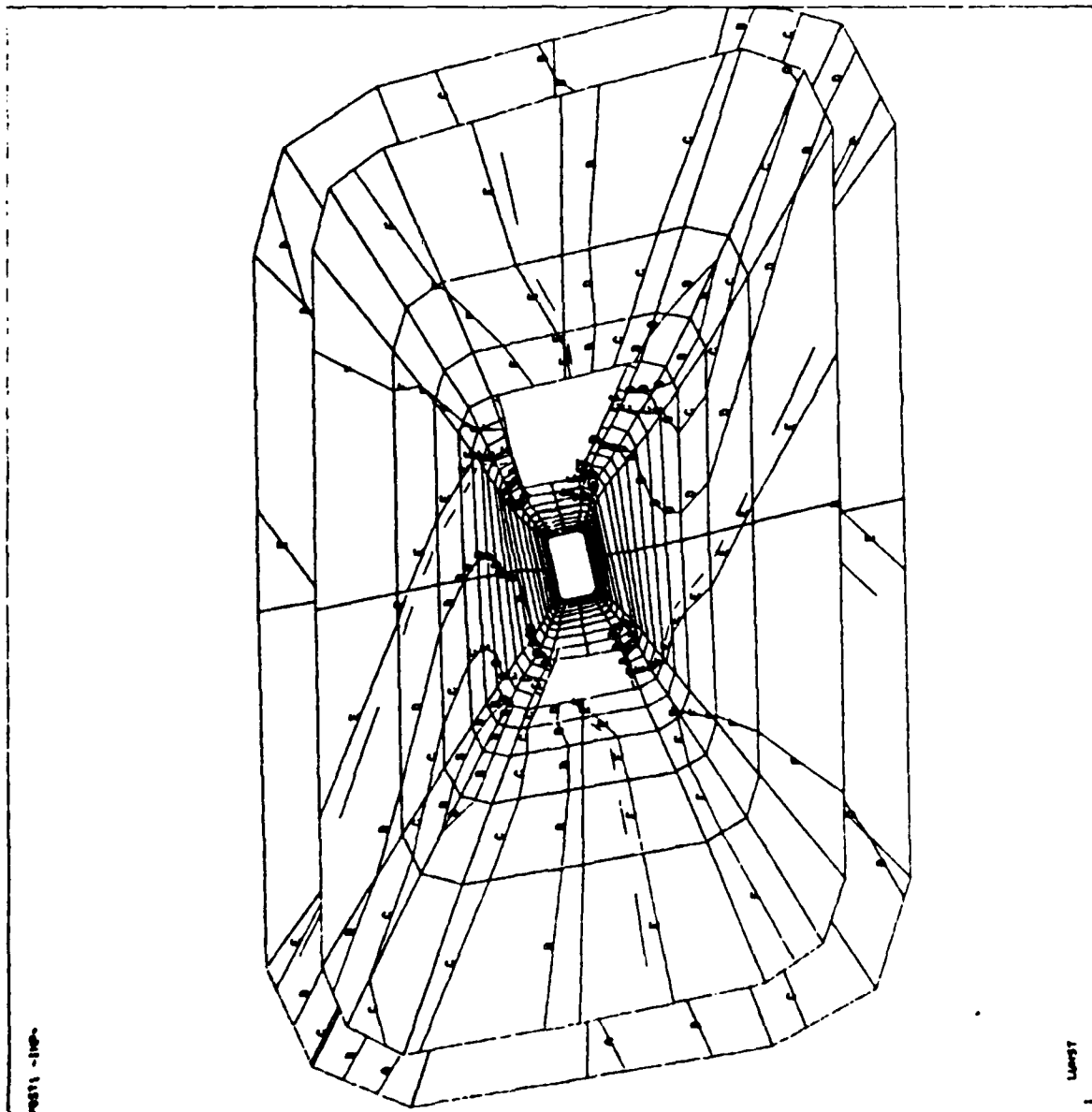
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 000-1  
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 20-1  
 0157-104  
 20-116  
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 00-2132  
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 0-102  
 0-1229



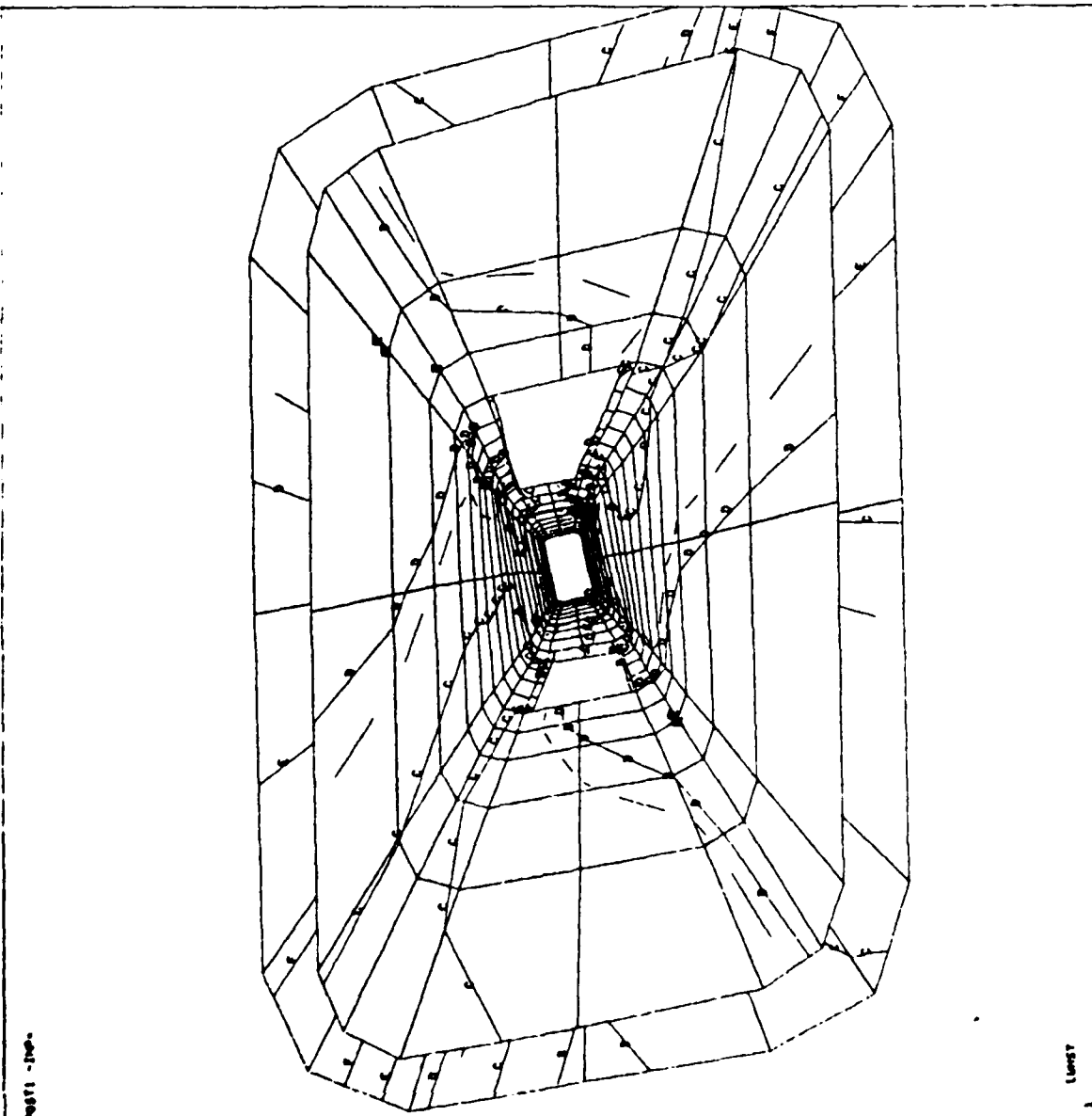
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 ZF=116  
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 F=000



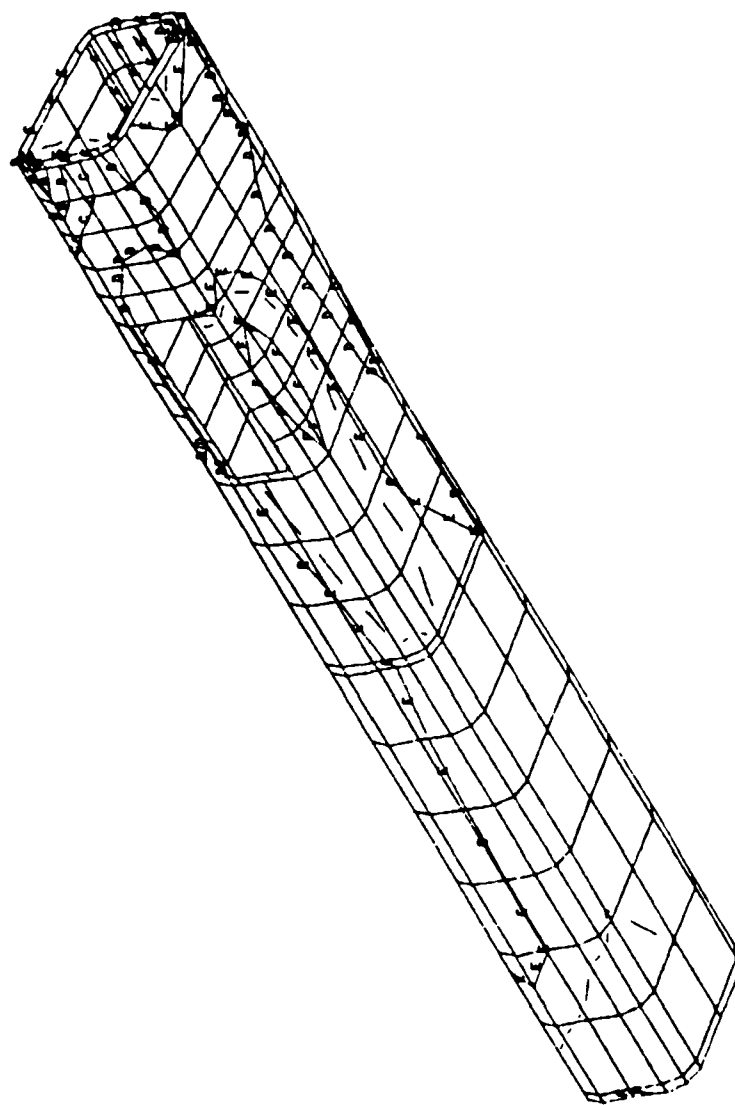
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 CMC=40  
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 F=1370



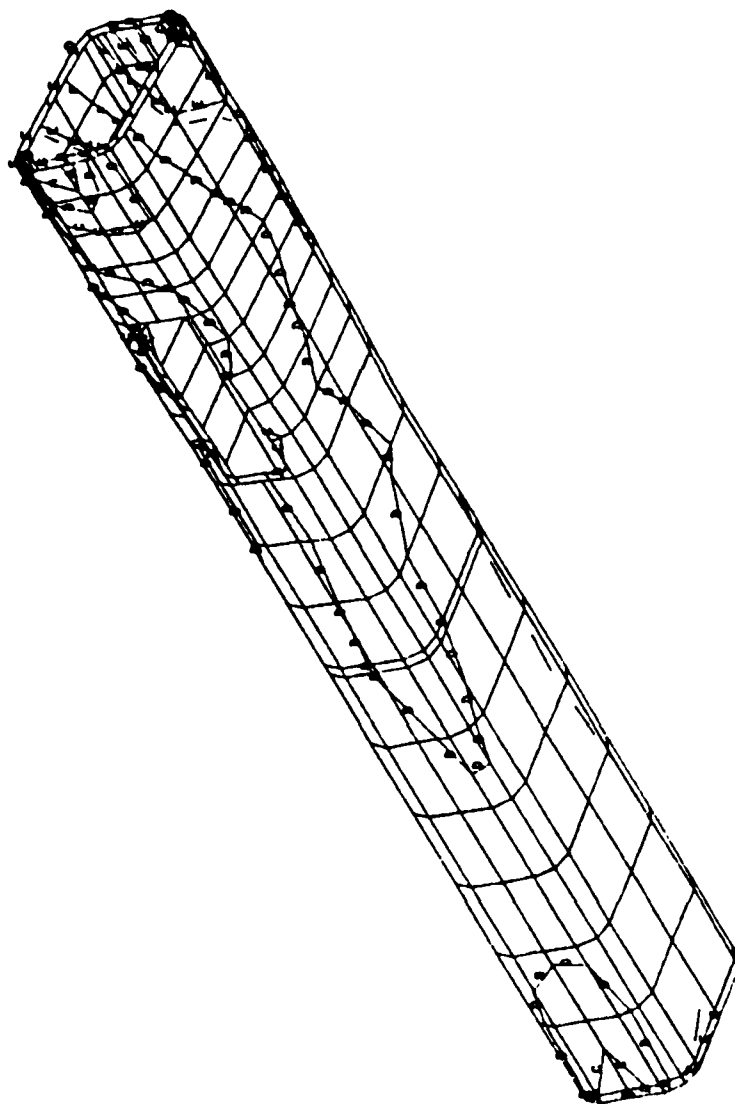
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**REF ID: A68791**



1999

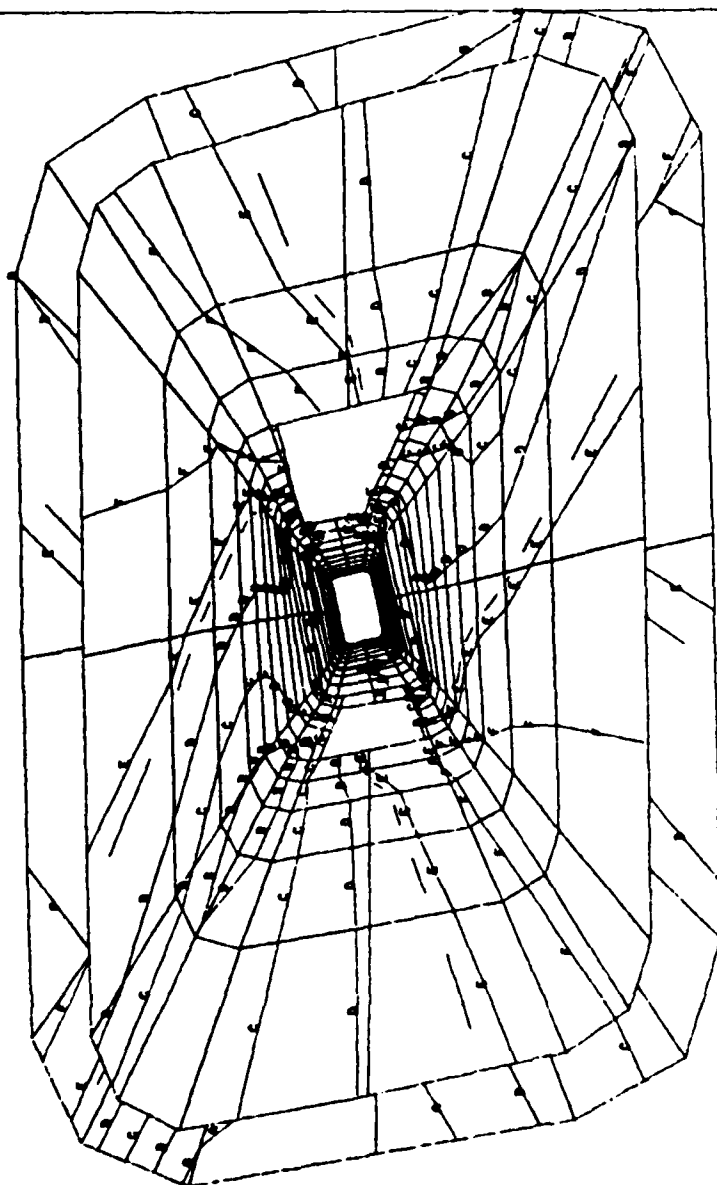
[illegible]

44-38861-1100

**1993**

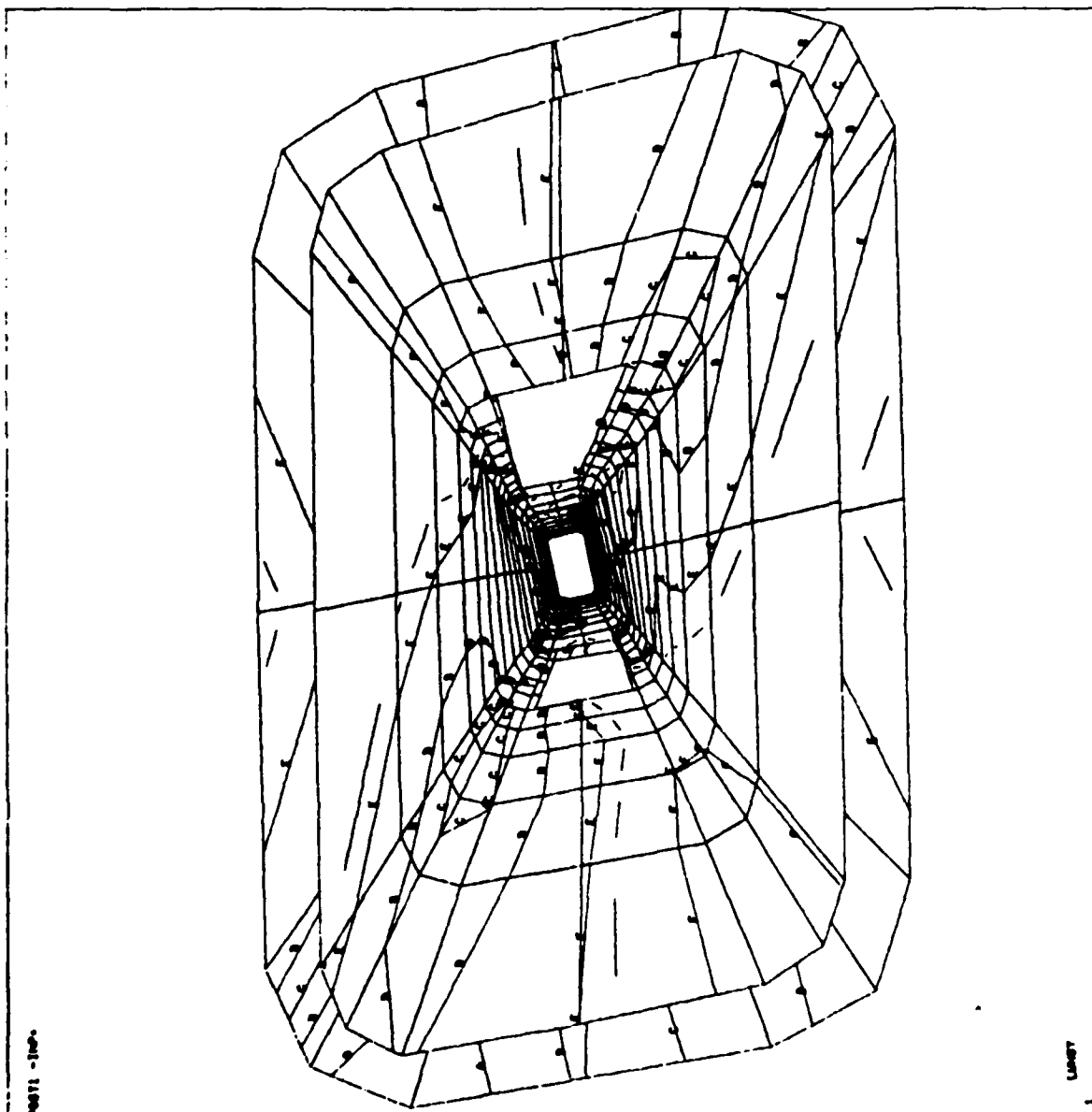


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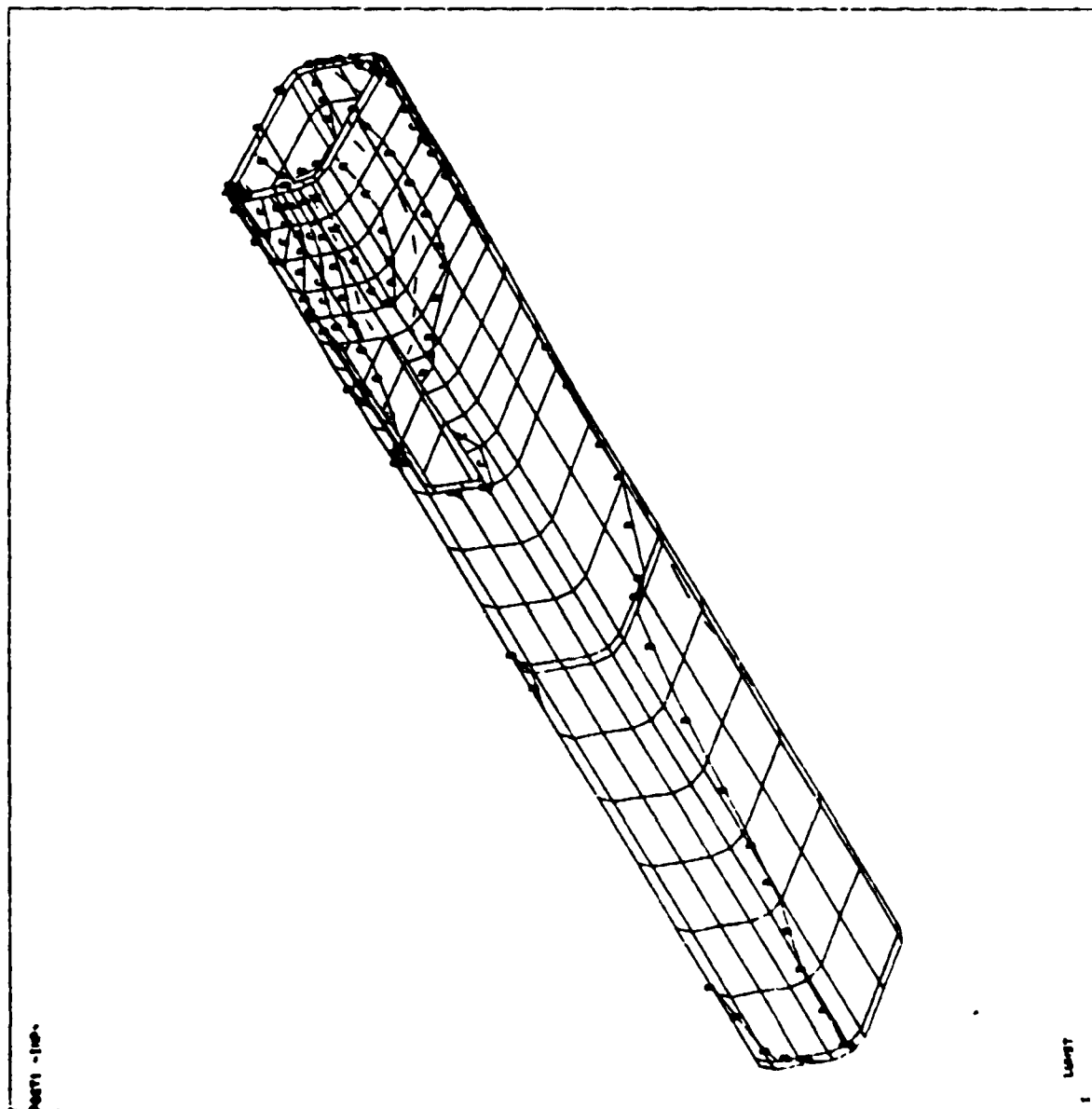


**150437**

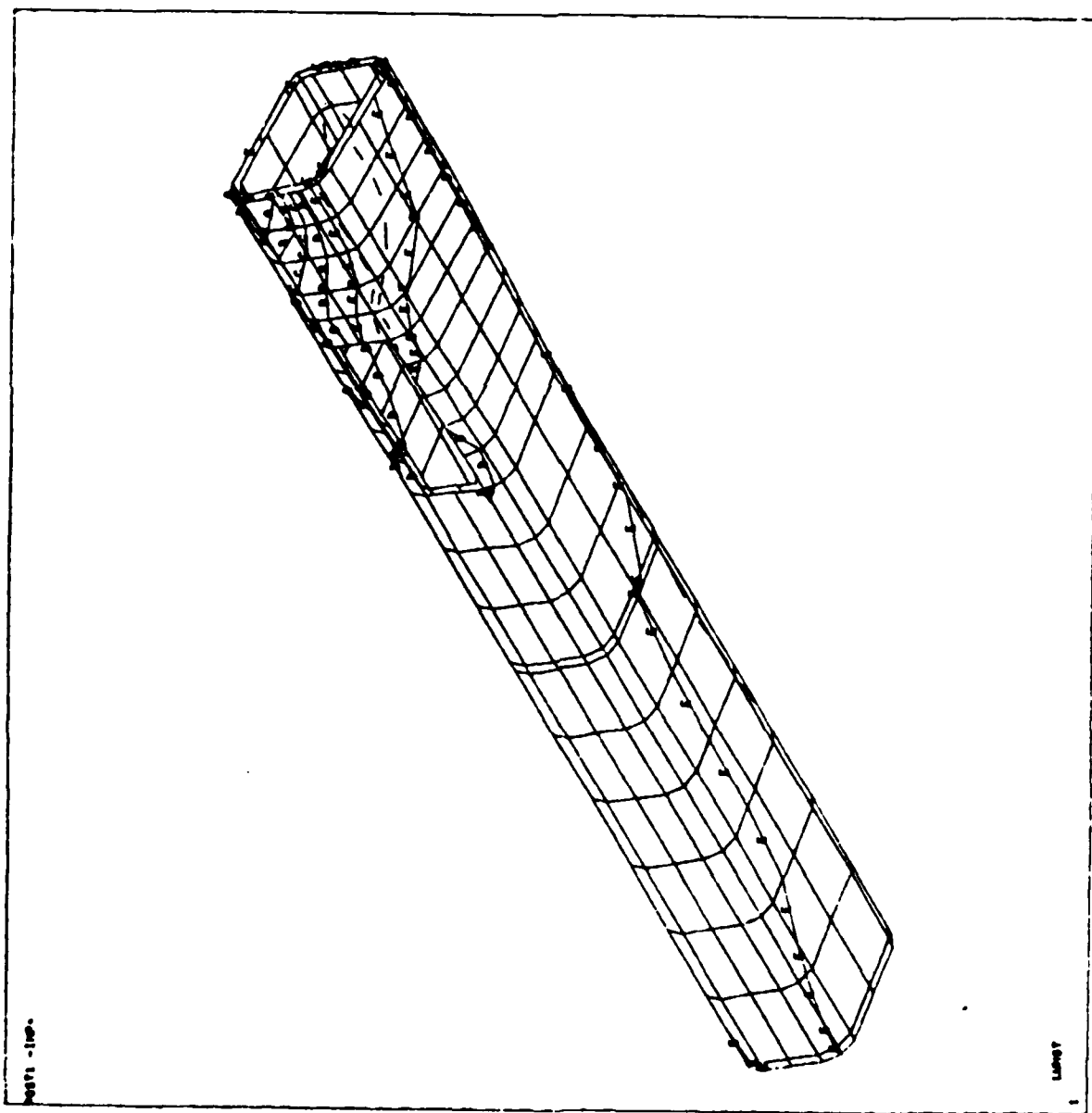
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 STEP-1  
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 SUIZ  
 20-1  
 0157-134  
 2F-116  
 COME-00  
 M105M  
 001-20-005  
 000-07109  
 00-75072  
 00-57912  
 C-00158  
 00-23408  
 00-0020  
 01-10000



ADVIS 4.10  
NOV 25 1966  
10:05:10  
POSTS 674200  
STPD-1  
TYER-1  
0412  
000-1  
000-1  
200-1  
D15T-104  
2P-116  
H10000  
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000-1007  
A-1700  
B-000  
C-1070  
D-3170  
E-0002  
F-0700

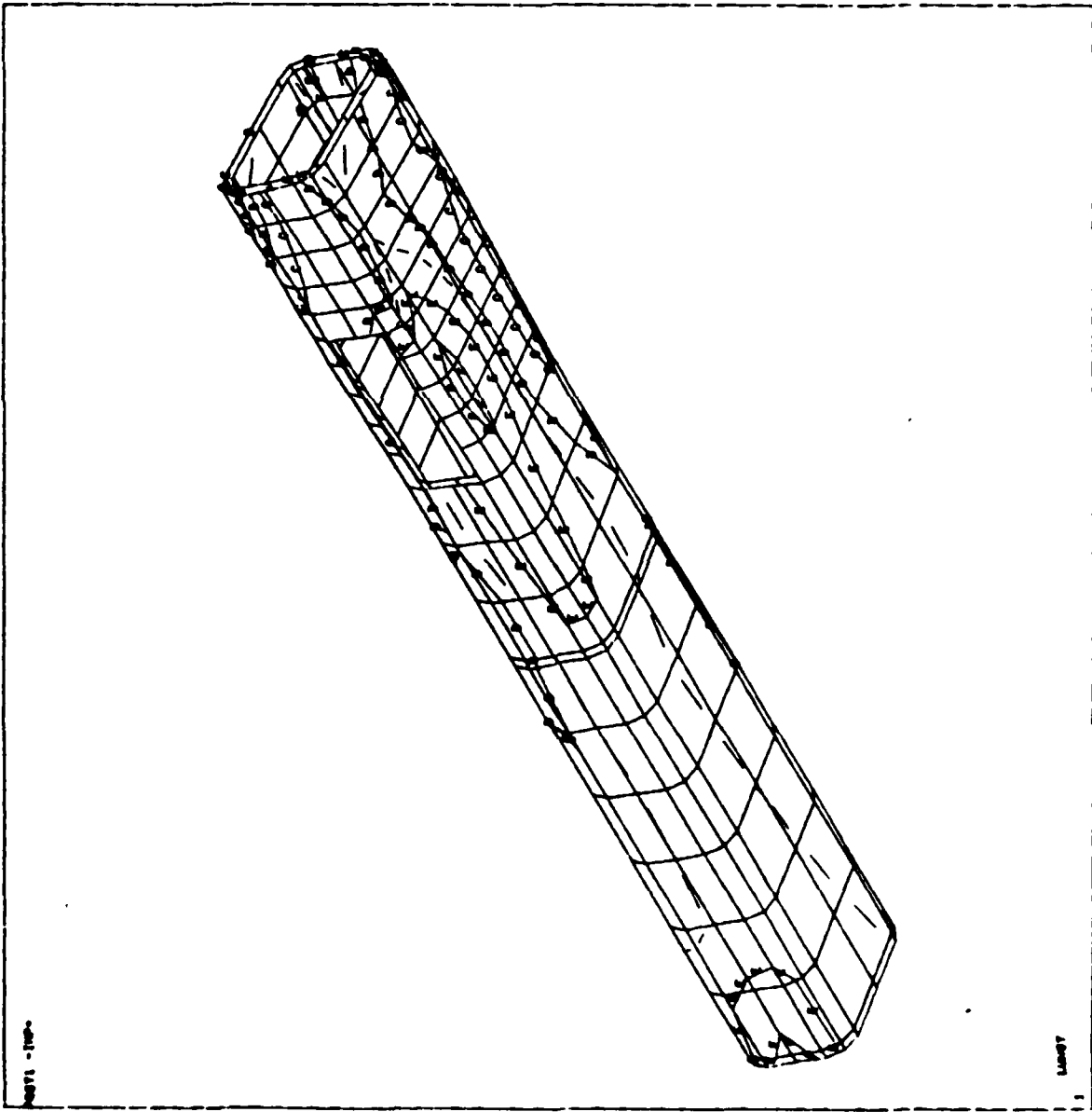


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1700-1  
0013  
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0107-100  
20-110  
010000  
000-00777  
000-10000  
00-110000  
00-01000  
00-00100  
00-27010  
00-0010  
0-17100



714

ADPVS 4.28  
ADU 26 1800  
10.00105  
P0071 STVE10  
STVE-1  
1720-1  
0413  
300--1  
400--1  
200-1  
0101-104  
27-116  
010020  
00-2405  
000-0007  
0-2103  
0-2102  
0-1003  
0-210  
0-017  
F-1002







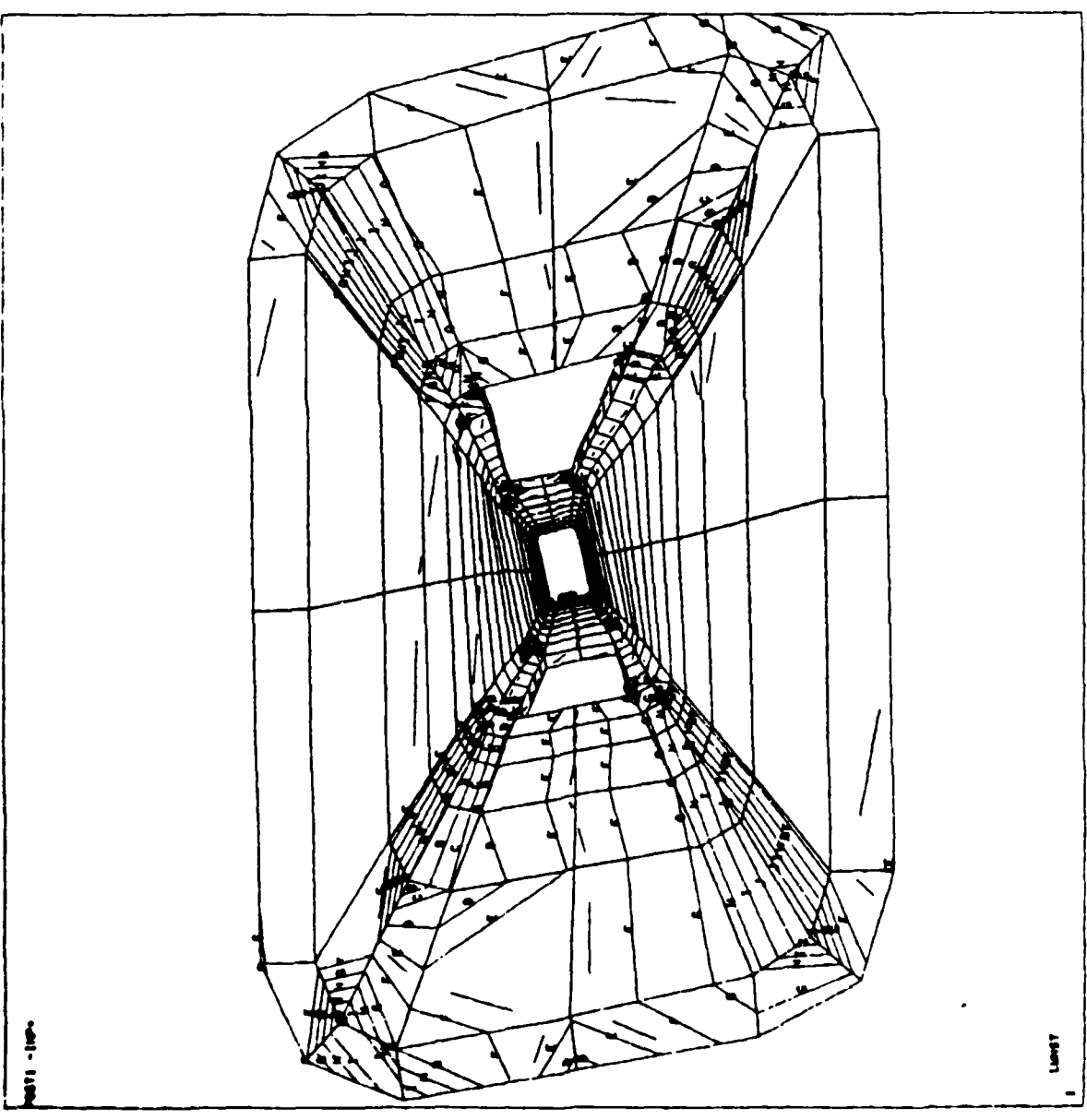
A complex 3D wireframe diagram of a hyperboloid of two sheets, viewed from a perspective looking down the central axis. The structure consists of two separate sheets, one above and one below a central horizontal plane. Each sheet is composed of a grid of lines that converge towards the center, creating a funnel-like shape. Numerous small black dots are placed along the lines of the grid, likely representing discrete points or nodes in a numerical simulation. The overall appearance is that of a technical drawing or a mathematical model of a hyperboloid.

CORE

77



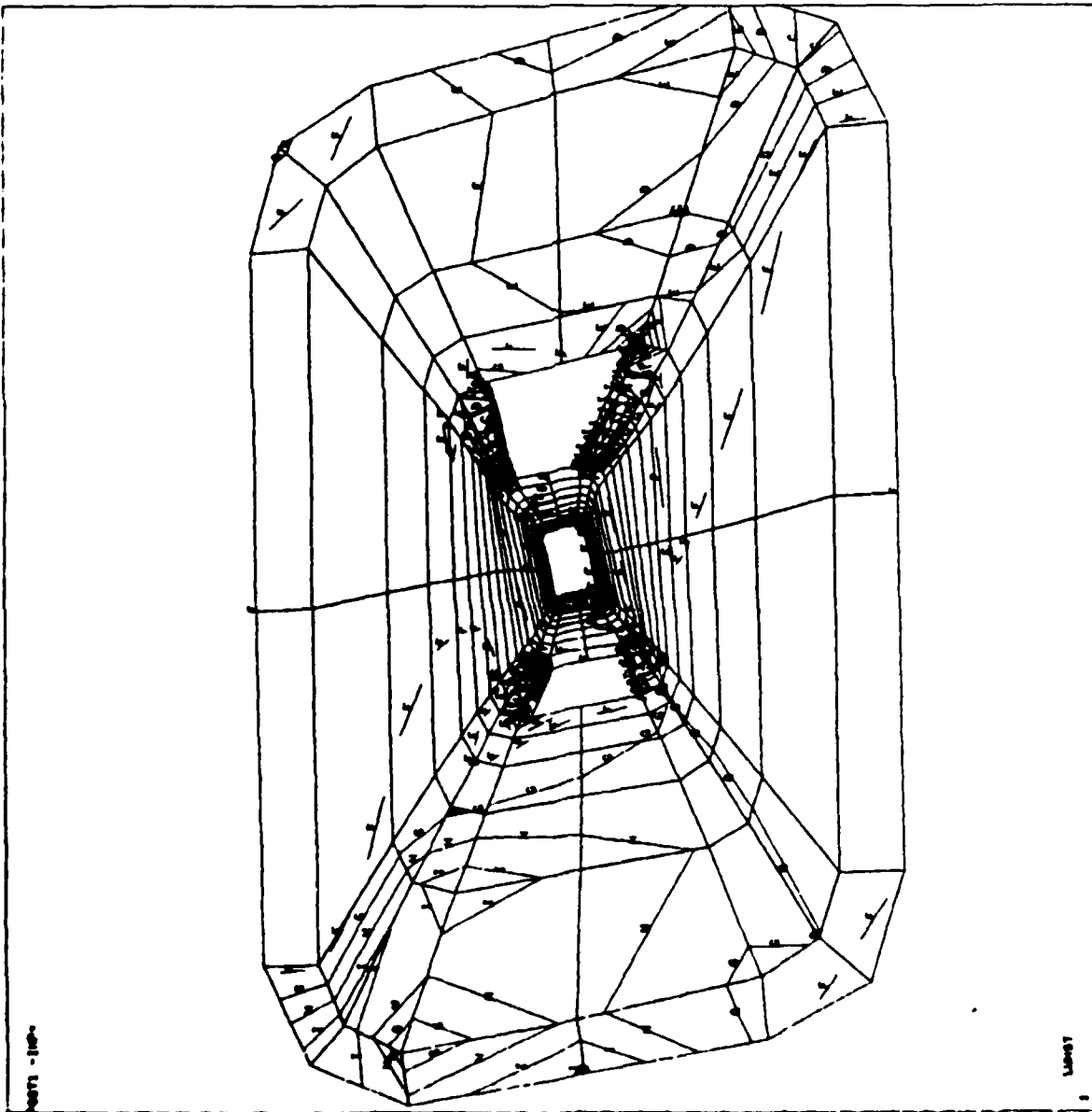
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 BOTTOM  
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 0187-136  
 2F-116  
 C000-45  
 MID000  
 000-334  
 000-318  
 A--002  
 B--004  
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 E--01.7  
 F--00.3  
 G--00.3  
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 J--270



CORE

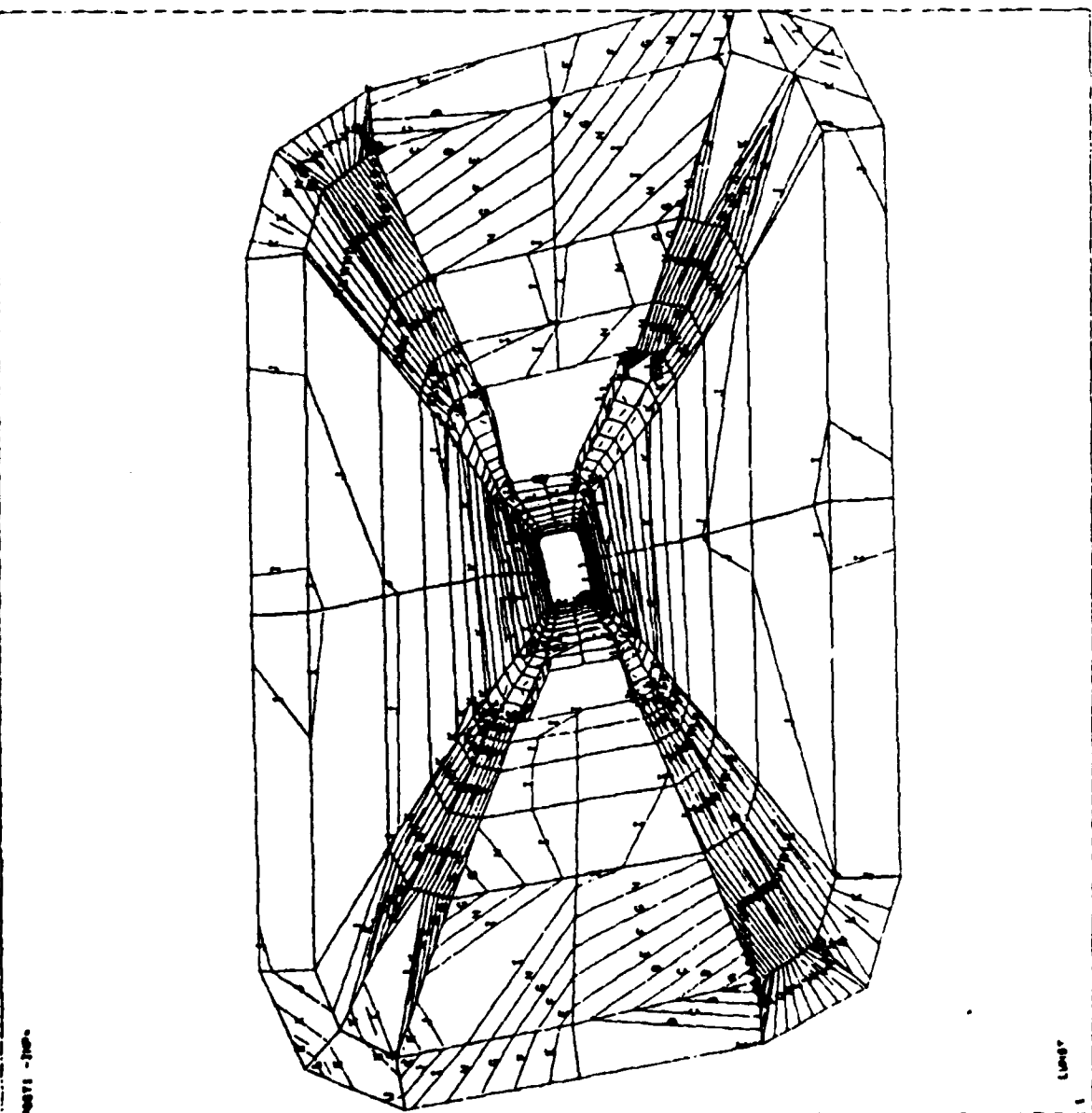
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 SOL1000  
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 0=111  
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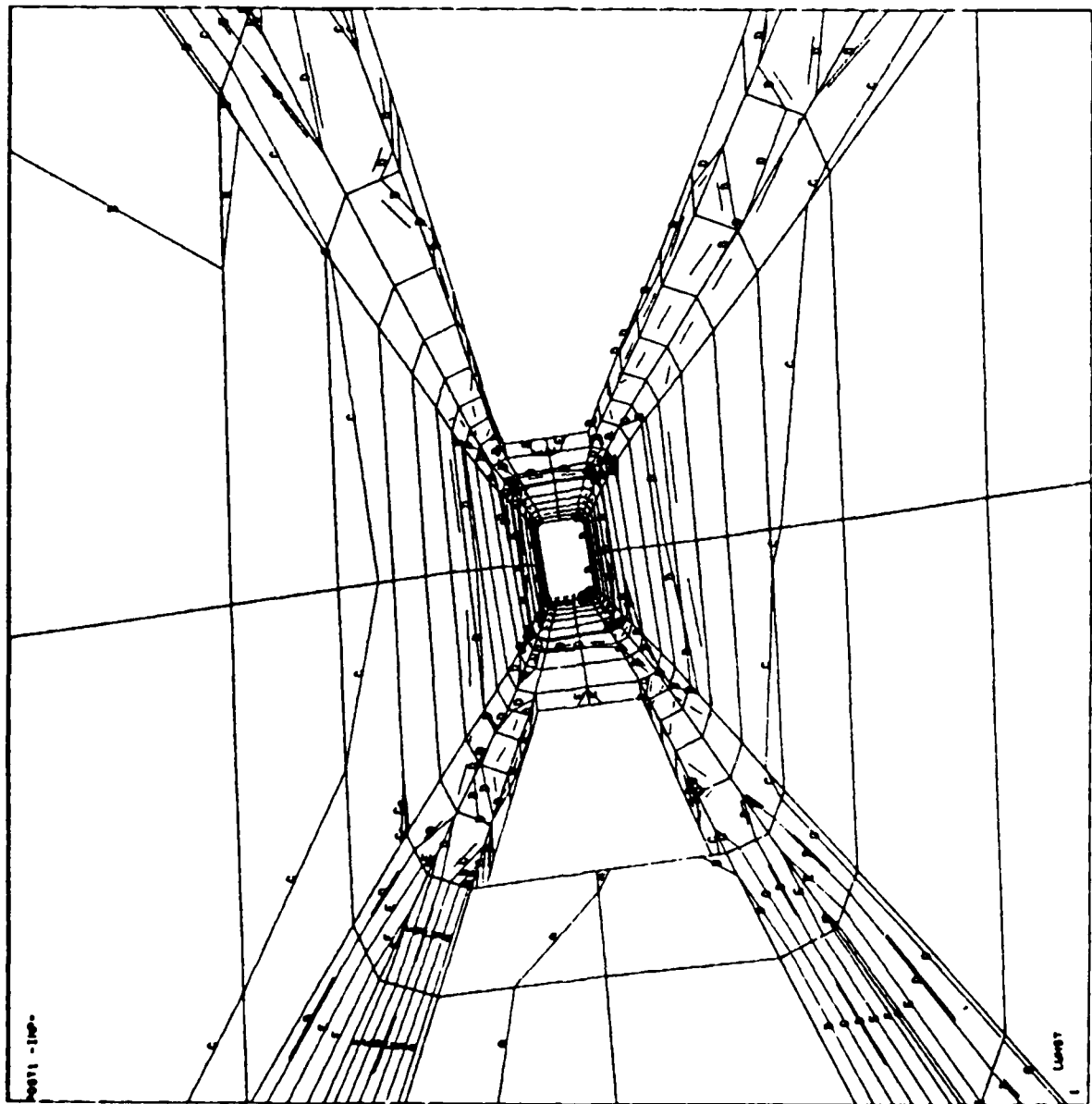
CORE  
 76

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 BOTTOM  
 STRESS ELER C8  
 24-2  
 D157-1.26  
 25-116  
 COME-0.46  
 M1384  
 M1-166  
 M1-437  
 A-406  
 B-267  
 C-289  
 D-291  
 E-263  
 F-215  
 G-177  
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 I-101  
 J-68.6  
 K-24.6  
 L-12.6  
 M-61.6  
 N-89.6  
 O-127



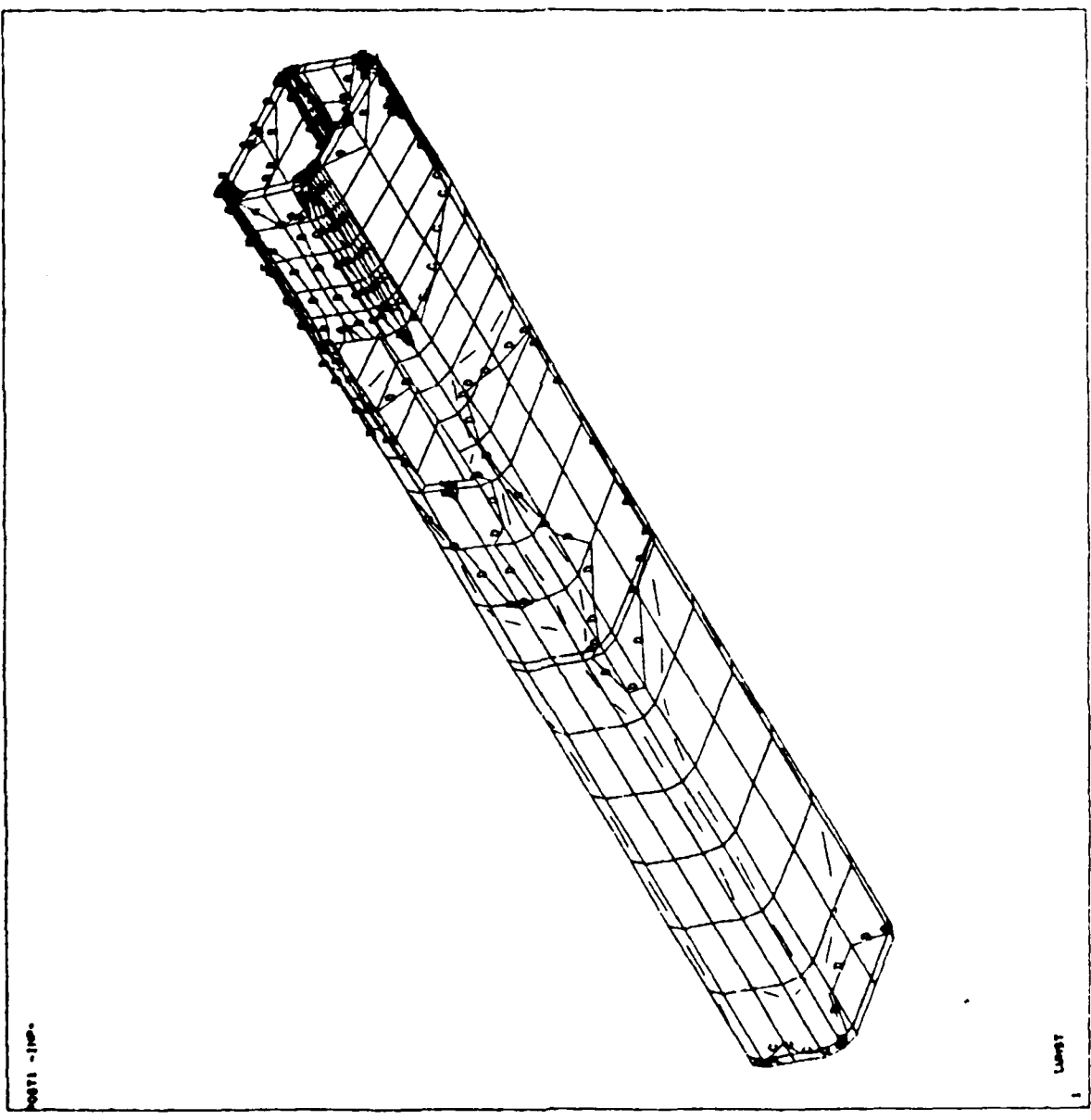
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 77

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 SAV  
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 STRESS ELER C5  
 20=1  
 9101-104  
 27-116  
 CONE-46  
 HIBDEN  
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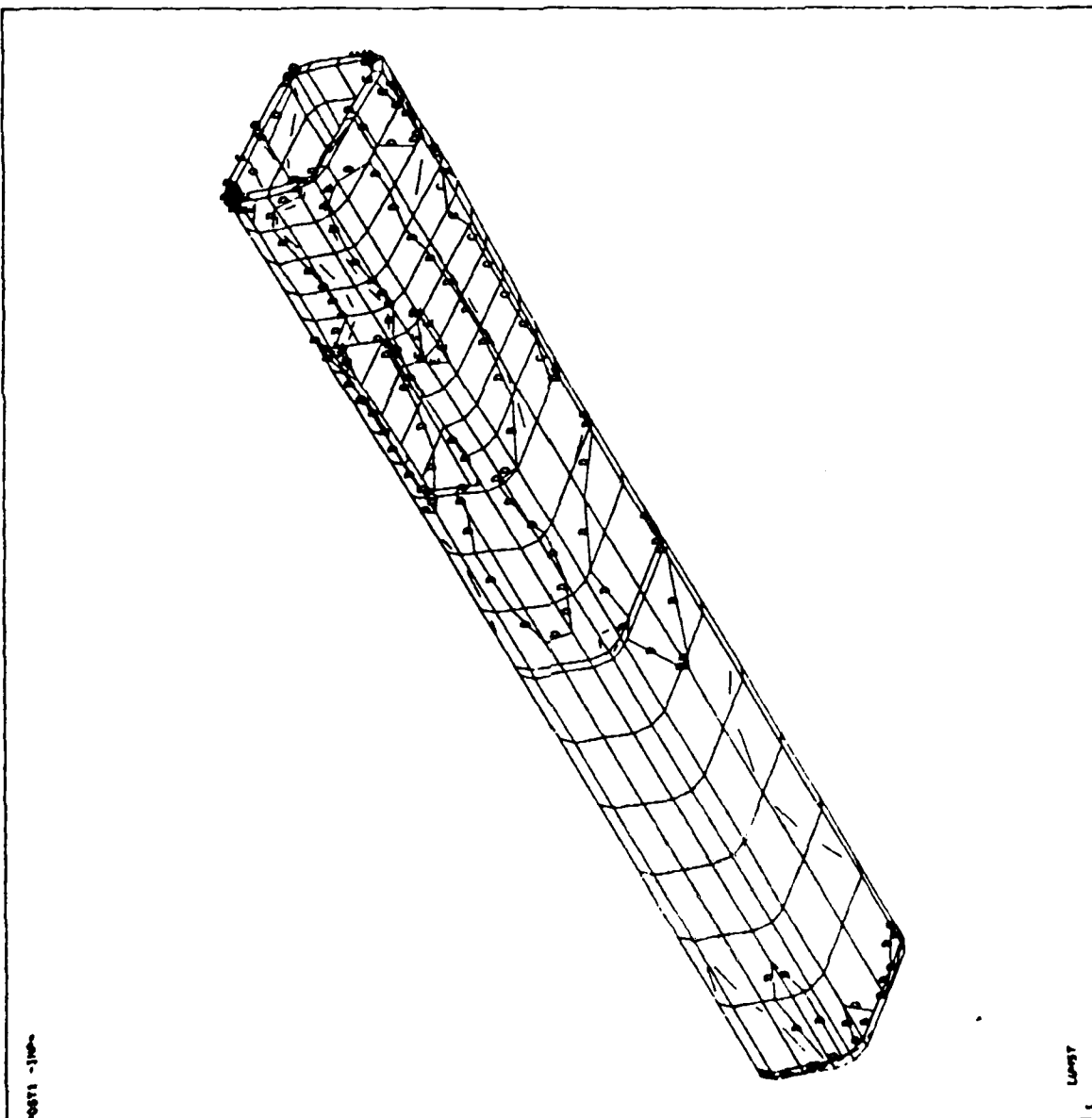
CORE 78

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 BOTTOM  
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 40--1  
 20--1  
 DIST=104  
 27=110  
 MIDDEN  
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 F=75.1



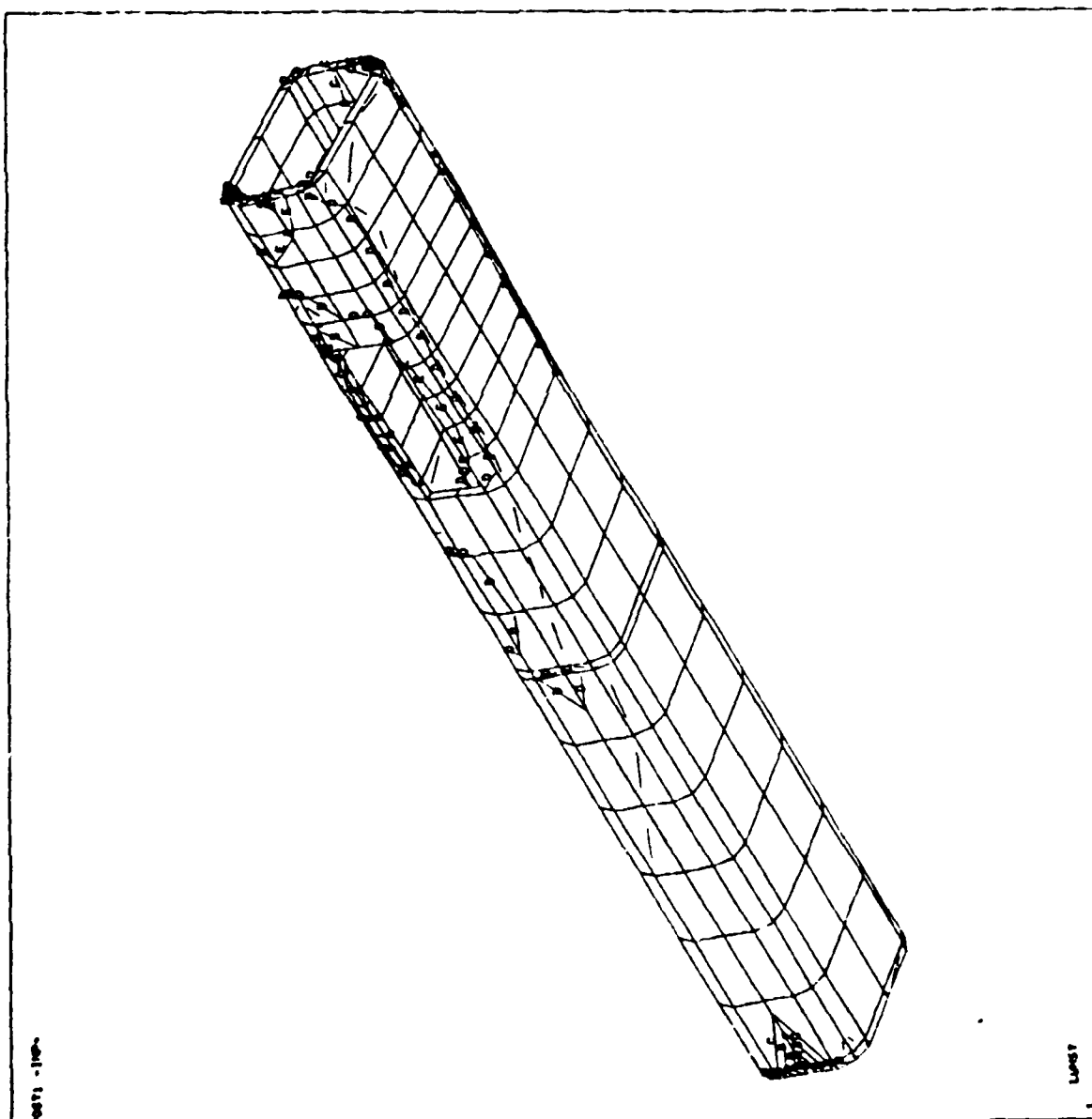
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 BOTTOM  
 STRESS (LEW CS

20--1  
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 20--1  
 DIST=104  
 27-116  
 HIDDEN  
 RH=76.5  
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 C--29.9  
 D=5.05  
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 F=75.1



CORE

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 SIZE  
 BOTTOM  
 STRESS ELER C5  
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 VU=1  
 ZU=1  
 27-110  
 3187-100  
 MIDDER  
 MU=107  
 MU=132  
 A=90.0  
 B=64.0  
 C=20.0  
 D=5.00  
 E=40.1  
 F=75.1



core

D2/370

CEL MEMO: DECEMBER 8, 1986



**FMC** Central Engineering Laboratories  
Santa Clara

Interoffice

To R. Rathe

From C. R. Ortloff

Subject **STATIC ANALYSIS RESULTS FOR THE LVHD  
COMPOSITE CRADLE - PROF LOAD CONDITIONS**

Date Dec. 8, 1986

cc E. Thuse  
L. Liebhardt (NOD)  
J. Ries\* (NOD)  
A. Amberg  
B. Ziervick (NOD)  
E. Alexander (NOD)  
R. Kazares

\*one copy of original 61  
figures only

82-143

Although the cradle design is to be modified again (Memo J. Ries to CRO, 5 Dec 86), it was recommended that the composite design analysis of the old design (drawings delivered, J. Ries to CRO, 14 Nov 86) and subsequent modification 20 Nov 86 be completed. If the latest cradle design shows stresses past allowable values and insufficient time remains to analyze it before it is sent out for prototype bid, then at least one existing prior cradle version has been analyzed with necessary modifications to make it meet design allowables. In this manner, a "back-up" design will exist as a fall-back position if required.

The present static analysis indicates that the 14 Nov 86 cradle design, allowing for a safety factor of 2X (or stress amplification of 2X resulting from the combined effects of moisture absorption, thermal expansion and dynamic amplification loads plus a nominal safety factor allowing for materials defects and manufacturing "built-in" defects) has serious defects in design and should be modified. The attached figure (Figure 1-A) recommends a modified design that should both reduce bending and torsional deflections as well as relieve the existing high stress levels to acceptable levels. If you wish, I can provide calculations to indicate the adequacy of the modified model.

For the new woven roving cradle design (5 Dec 86) it is strongly recommended that a static/dynamic analysis be performed to check the stress levels in each lamina. Use of "averaged equivalent" stresses using CMAP equivalent moduli are in error and local lamina stress allowables may be exceeded (displacements calculated in this manner, however, are reasonably accurate). CEL has wide experience with analysis, test and manufacturing techniques for woven roving materials and would be glad to assist you in your materials selection efforts if requested.

Attached are figures 82-143 showing the static stress state for the composite cradle. This output set updates that contained in the previous memo (CRO to J. Ries 25 Nov 86) as the present set incorporates zero bending stiffness connections between manifolds

3

(Case B). The prior run (Case A - Figures 1-81) contains a rigid connection (the barrel) between manifolds that effectively stiffened the front part of the cradle to bending. Case B results also incorporate the sliding 2nd manifold; additionally, all of the recoil force is on the front manifold. For Case A and B, the firing torque load is distributed equally between 1st and 2nd manifolds. As bending stiffness is less between manifolds for Case B than for Case A, it is expected that vertical deflections will exceed those of Case A and stresses will be higher in the front part of the cradle. A summary of results is given below for Case B:

- o Maximum in-plane lamina shear stress (SHL) for the entire cradle is less than 6,000 psi (layer 1 for example). Allowed stress is 10,000 psi. Allowing for a 2X factor due to thermal expansion effects, moisture swelling induced stress, stress concentrations due to local defects and assuming a dynamic stress amplification factor greater than unity (or a safety factor of 2X for stress), SXY failure may be anticipated in layers 1, 2, 4, 5, 8, 9, 11). This result is similar to the Case A result.
- o Maximum interlaminar shear is less than 100 psi throughout. This result is similar to the Case A result. No failure is anticipated in this mode.
- o Maximum vertical deflection is now about 5 inches (figure 82). This exceeds the Case A deflection (about 4 inches). This is expected as the longitudinal bending stiffness is less for Case B than A. Deflection between manifolds is about 3.5 inches (UY). Results from the dynamic amplification analysis will determine the relative dynamic bending deflections between manifolds. Since the static deflection is already high, some stiffening members may need to be added between manifolds to limit relative deflection to prevent gun to rail binding.
- o Maximum ROTZ rotation is about  $3.5^{\circ}$  (as before for Case A). This is due to the application of similar torque loads to each manifold as before. The Case A beam connection between manifolds (the barrel) does not have torsional stiffness.
- o Maximum fiber stress (SXL) is about 120 ksi in the region near the gimbal attachment zone (figure 118, 121, 139) on the cradle. Allowing for a 2X safety factor, the stress value exceeds the maximum allowed stress of 180 ksi.

not relevant

R. Rathe  
Static Analysis Results for the LWHD  
Composite Cradle - Proof Load conditions

Dec. 8, 1986  
Page 2

- o Epoxy stresses (SYL) are on the order of 4,000-5,000 psi (figures 99, 103, 106, 128, 131, 134). Allowing for a 2X safety factor, the stress exceeds the failure stress of 6 ksi. This is the major cause for concern in the present design as internal resin cracks may be formed serving as failure centers to redistribute loads to the already highly stressed fibers.
- o Foam core normal (figure 142) and shear stress (figure 143) appear to be less than 100 psi in areas away from the gimbal mounting zones. A suitable core material with failure properties above these limits can easily be found.

Although Cases A and B indicate failure of the existing design, this can be remedied by additional layers of Gr/Ep added in a different stacking sequence. This new sequence is shown in Figure 1A and should result in less vertical and rotational deflection as well as lowering stress values to allowable levels. The additional layers are on the rear part of the cradle only and can be easily included in the winding sequence.

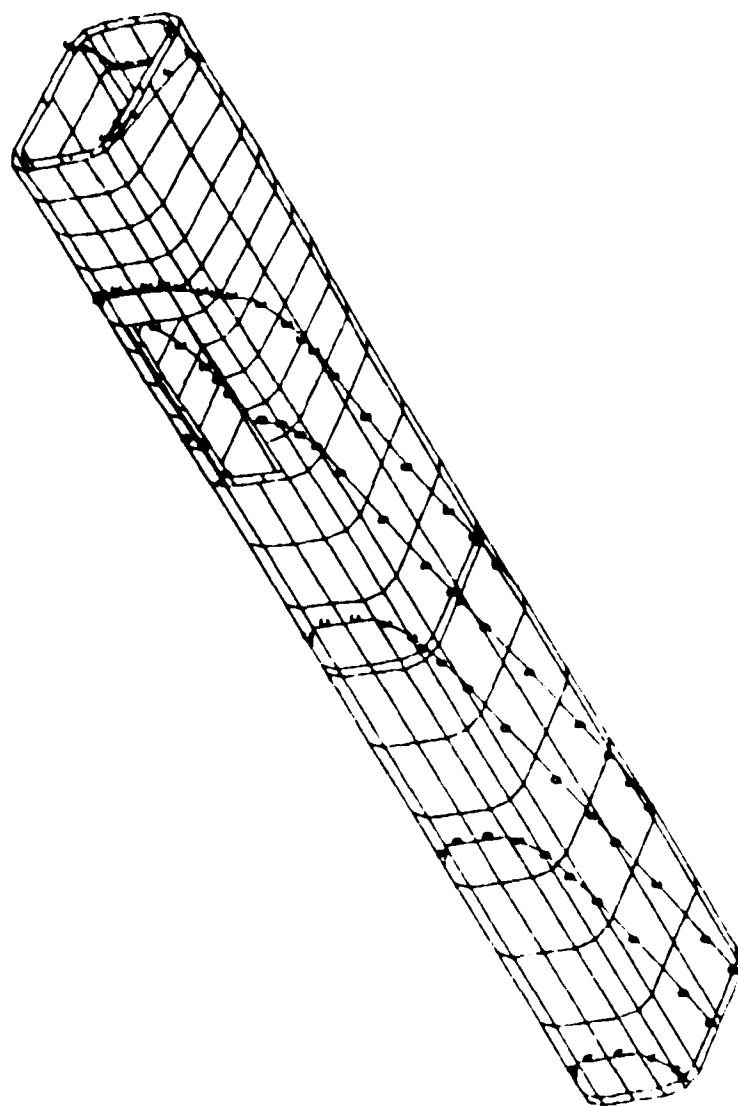
I am forwarding originals of all graphs so you will have the clearest copy. These should be stored in a cool, dark place to preserve them. At some later time when a final stress report is required, I will ask for the return of this material to prepare this report.



C. R. Ortloff

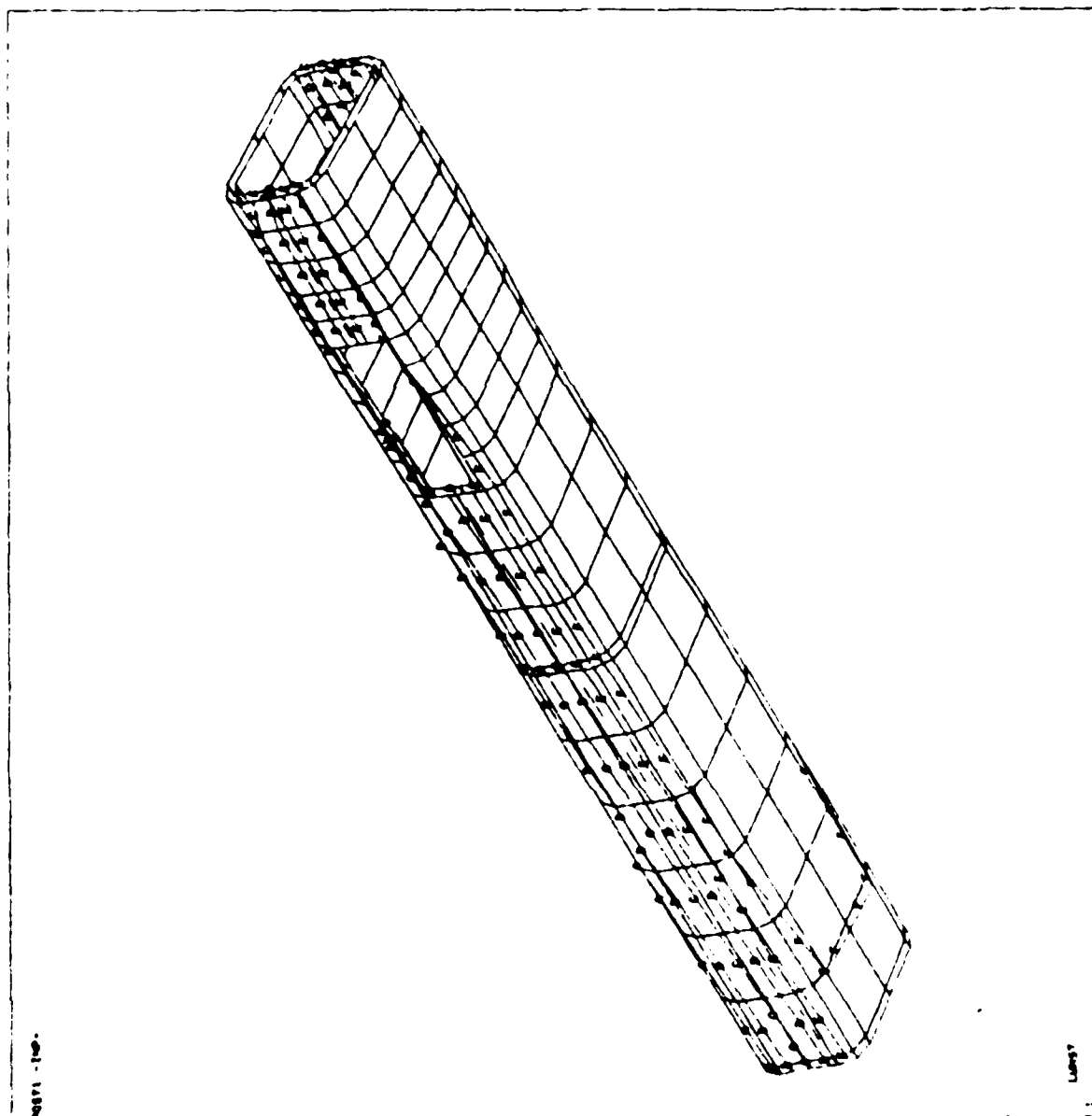


13

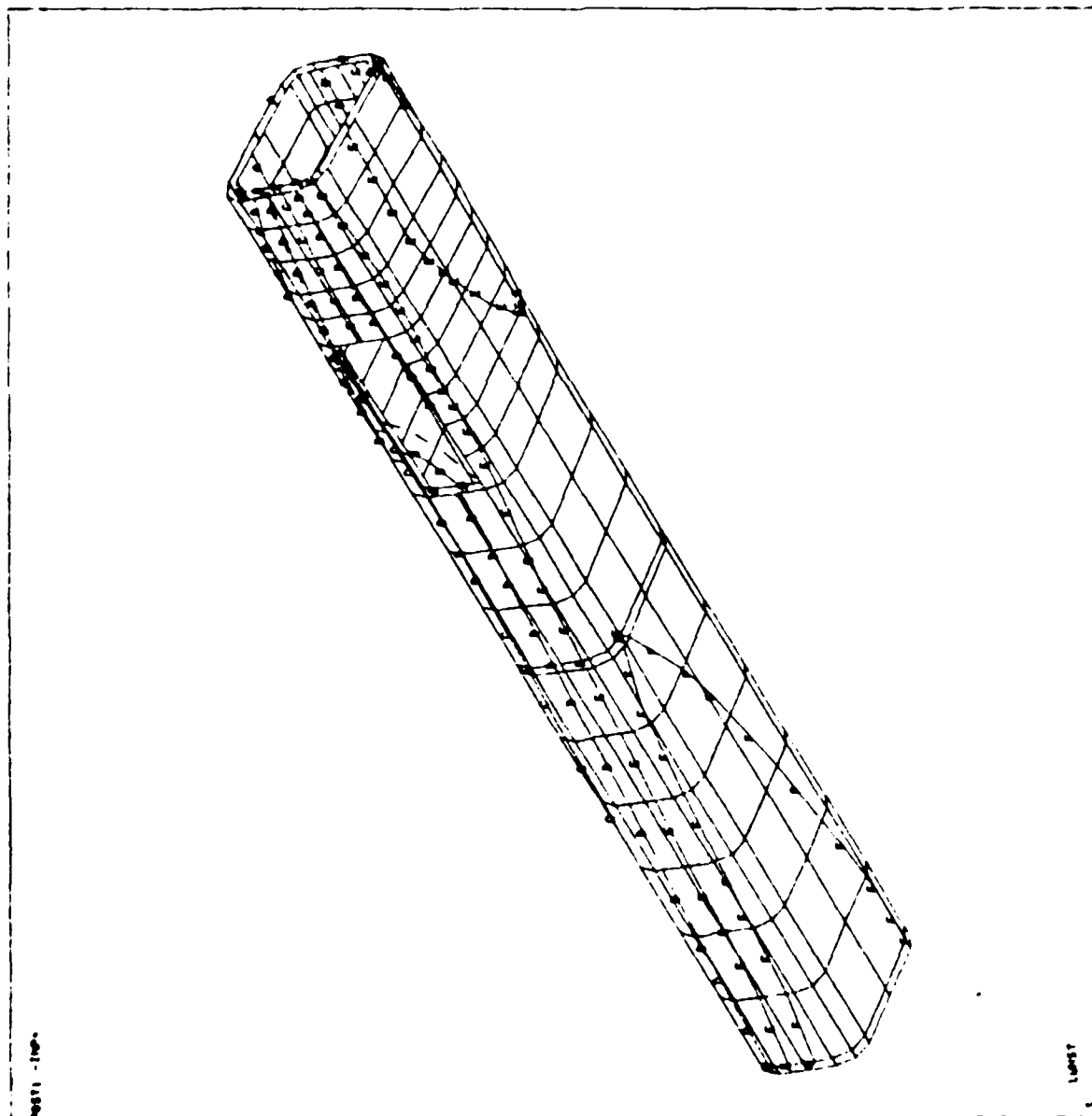


**Answer:**

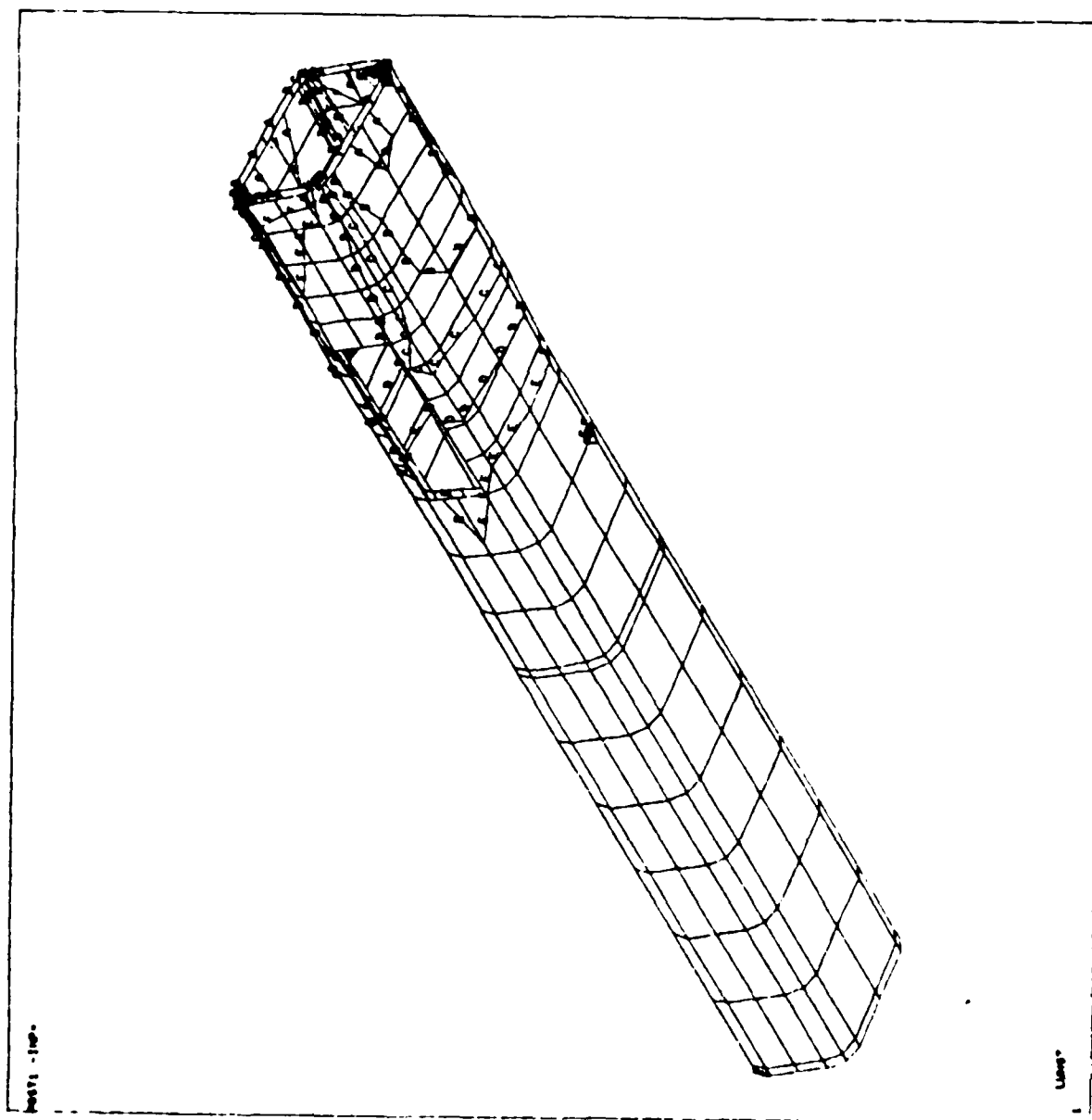
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VU=1  
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DISP=104  
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M1000M  
RM=1.770  
RM=1.132  
RM=1.02  
B=1.72  
C=1.02  
B=1.12  
C=1.10  
F=1.00



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 UZ  
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 DISPL=100  
 ZU=110  
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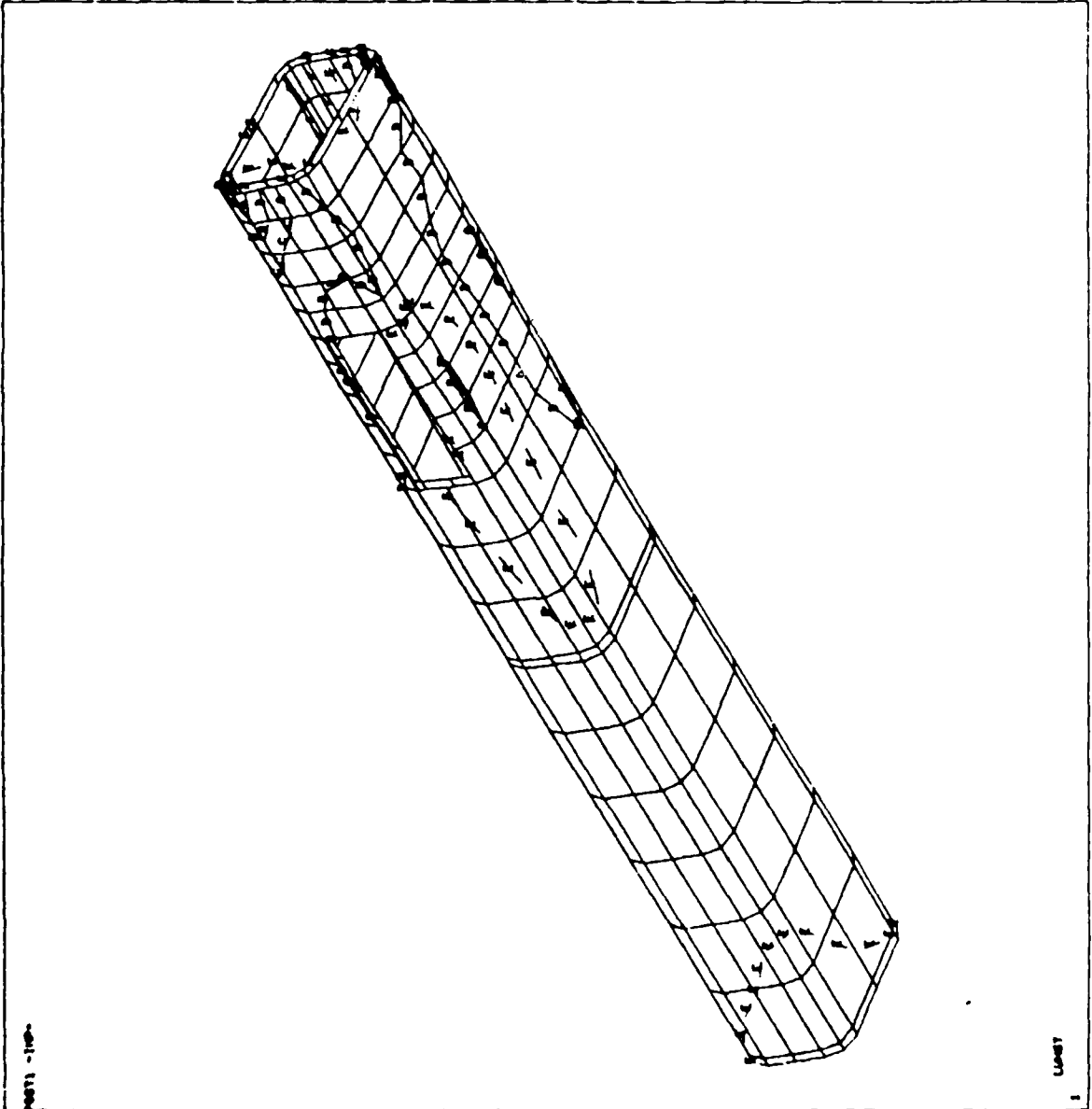
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13741115  
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ITER-1  
NOTE  
DISPL nodal  
NO-1  
VO-1  
ZU-1  
DIST-104  
ZP-116  
HIDEN  
RM-0000  
RM-00261  
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B-0277  
C-0207  
D-0507  
E-0647  
F-0707





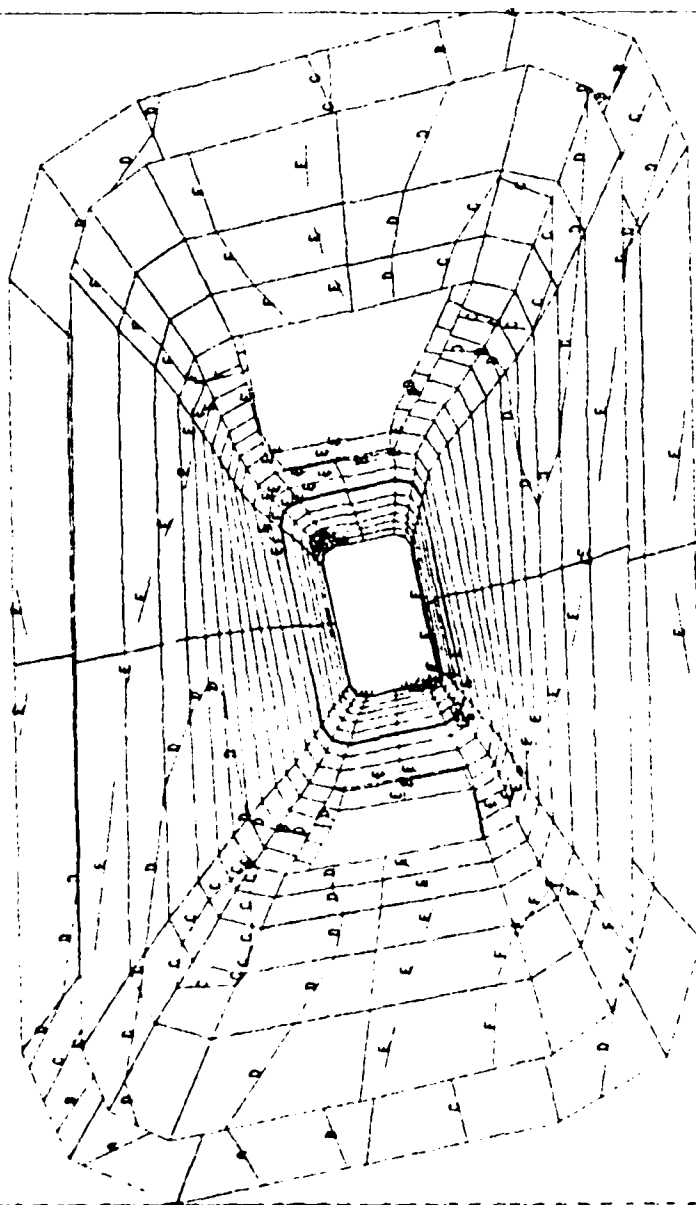


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ZU=1  
0187-104  
2P-110  
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c=-36002  
d=-17000  
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F=10277



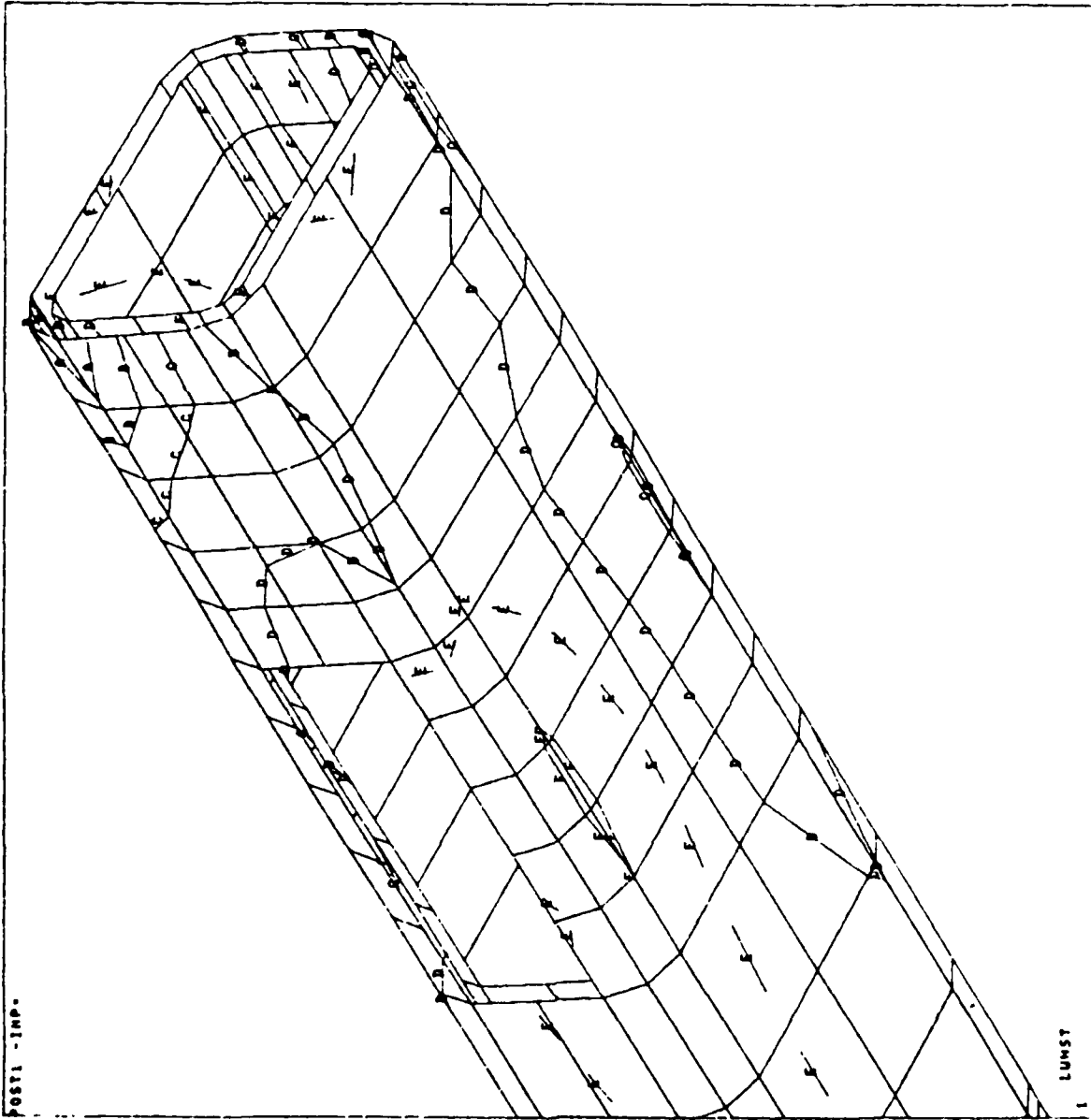
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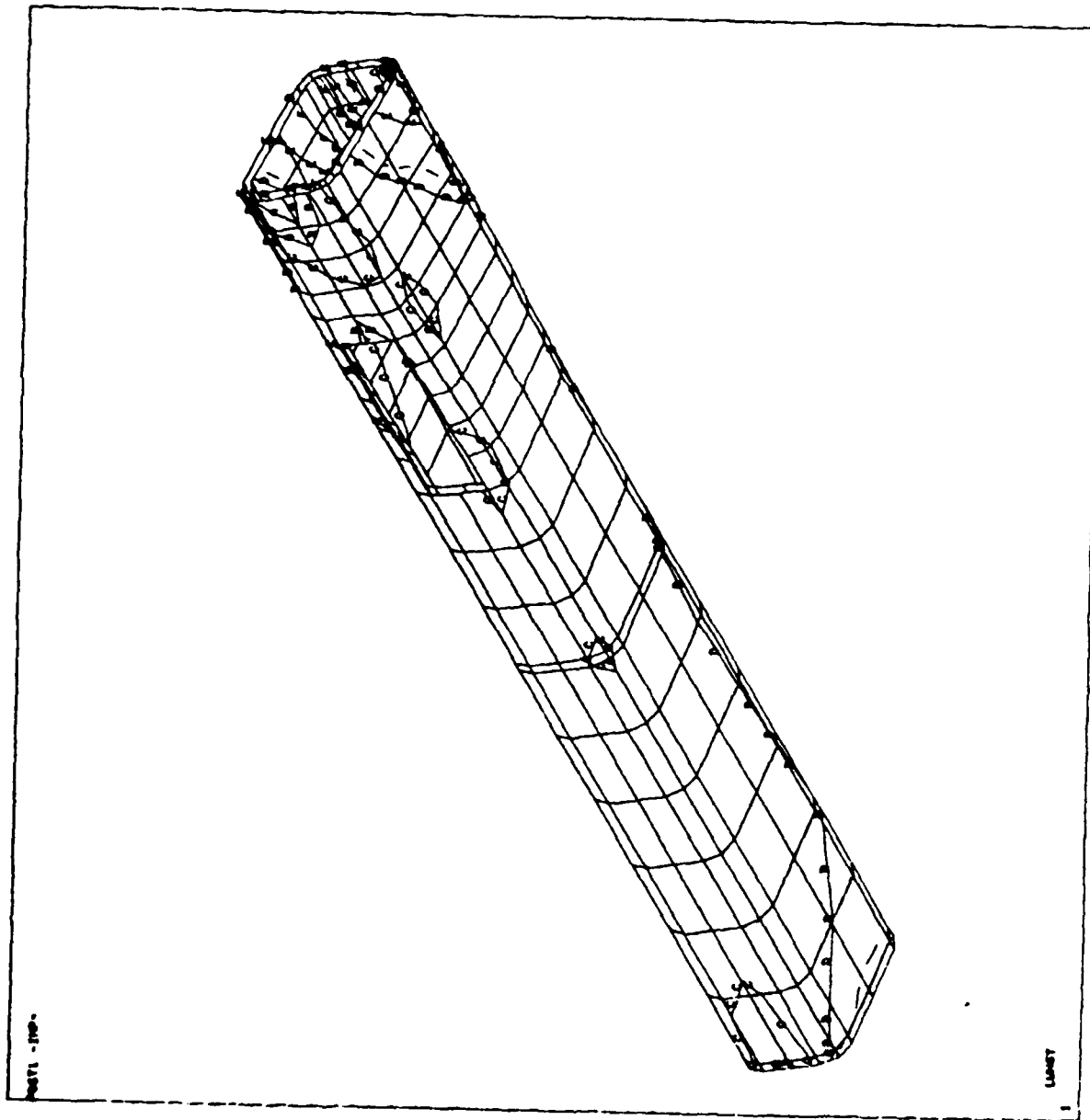
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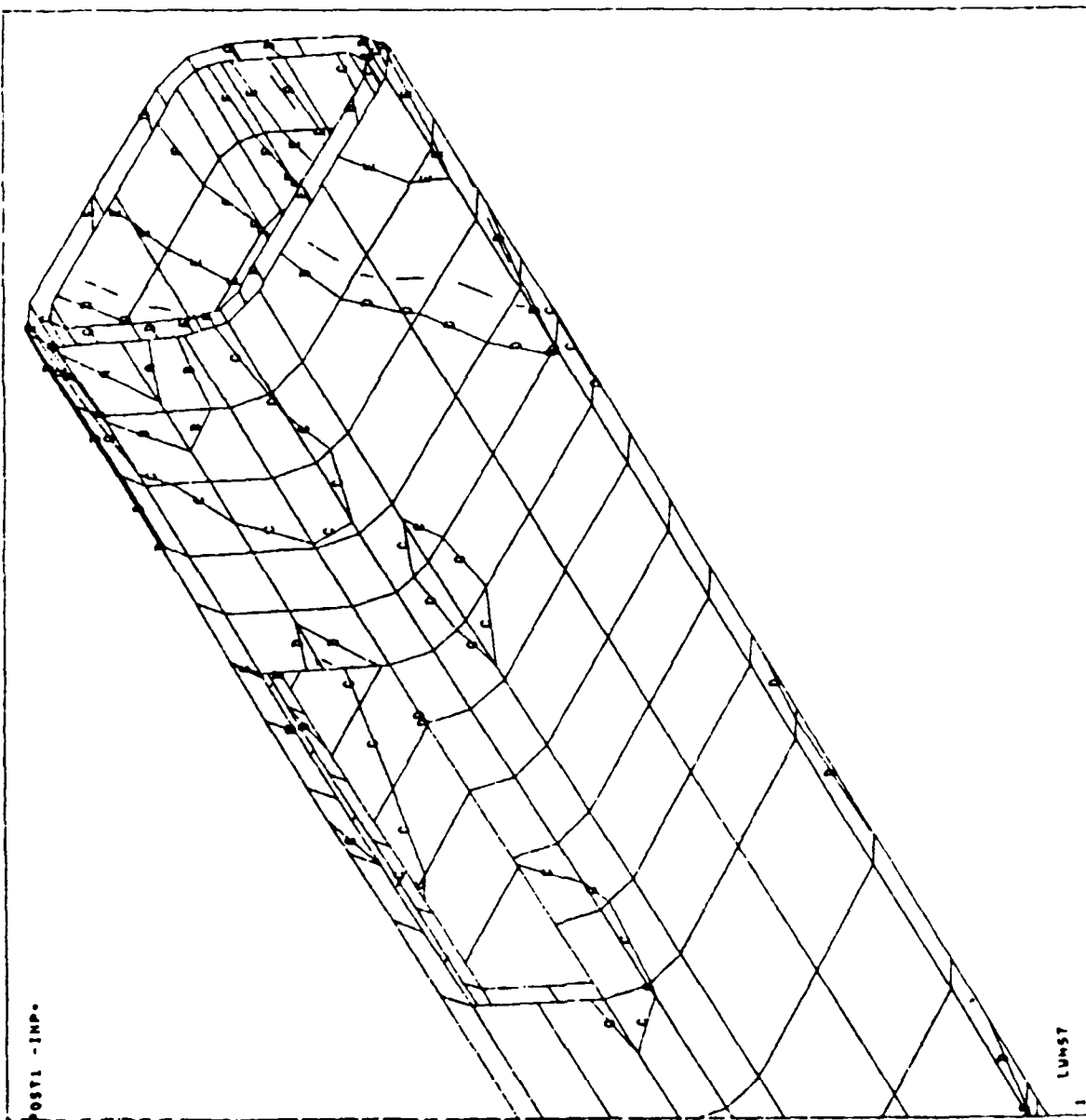
10051

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 11 C=-35992  
 12 D=-17569  
 13 E=854  
 14 F=19277



[illegible]

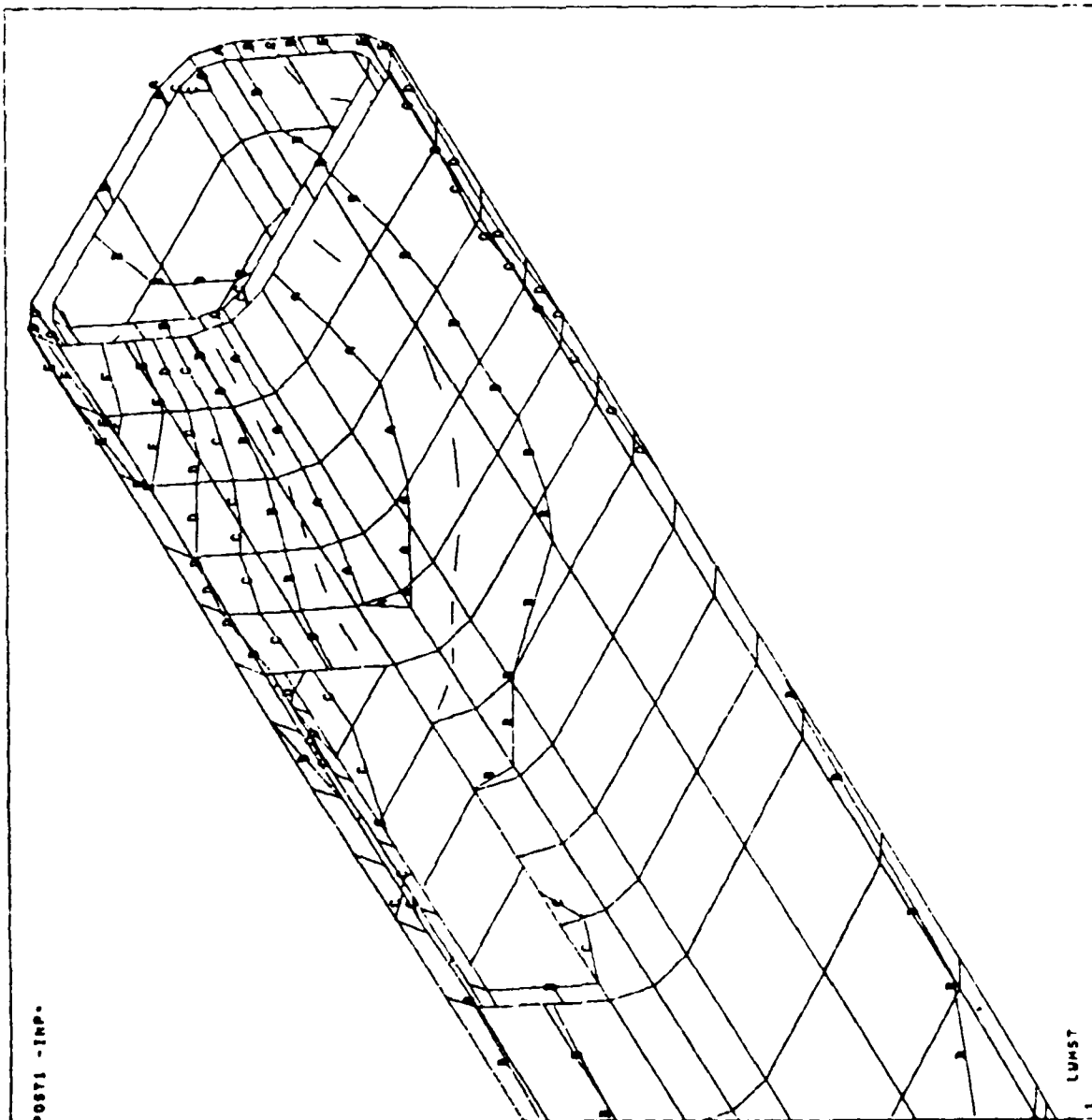
ANSYS 4.20  
 DEC 4 1986  
 14125135  
 POST1 STRESS  
 STEP=1  
 IYER=1  
 SVI  
 ZOOM  
 XU=-1  
 VU=-1  
 ZU=1  
 1 DIST=47  
 2 MF=27.4  
 3 VF=16  
 4 ZF=159  
 VRT0=1.06  
 MIBDEM  
 MK=2885  
 MN=-4430  
 A=-3387  
 B=-2341  
 C=-1295  
 D=-249  
 E=797  
 F=1843



44-38861-100

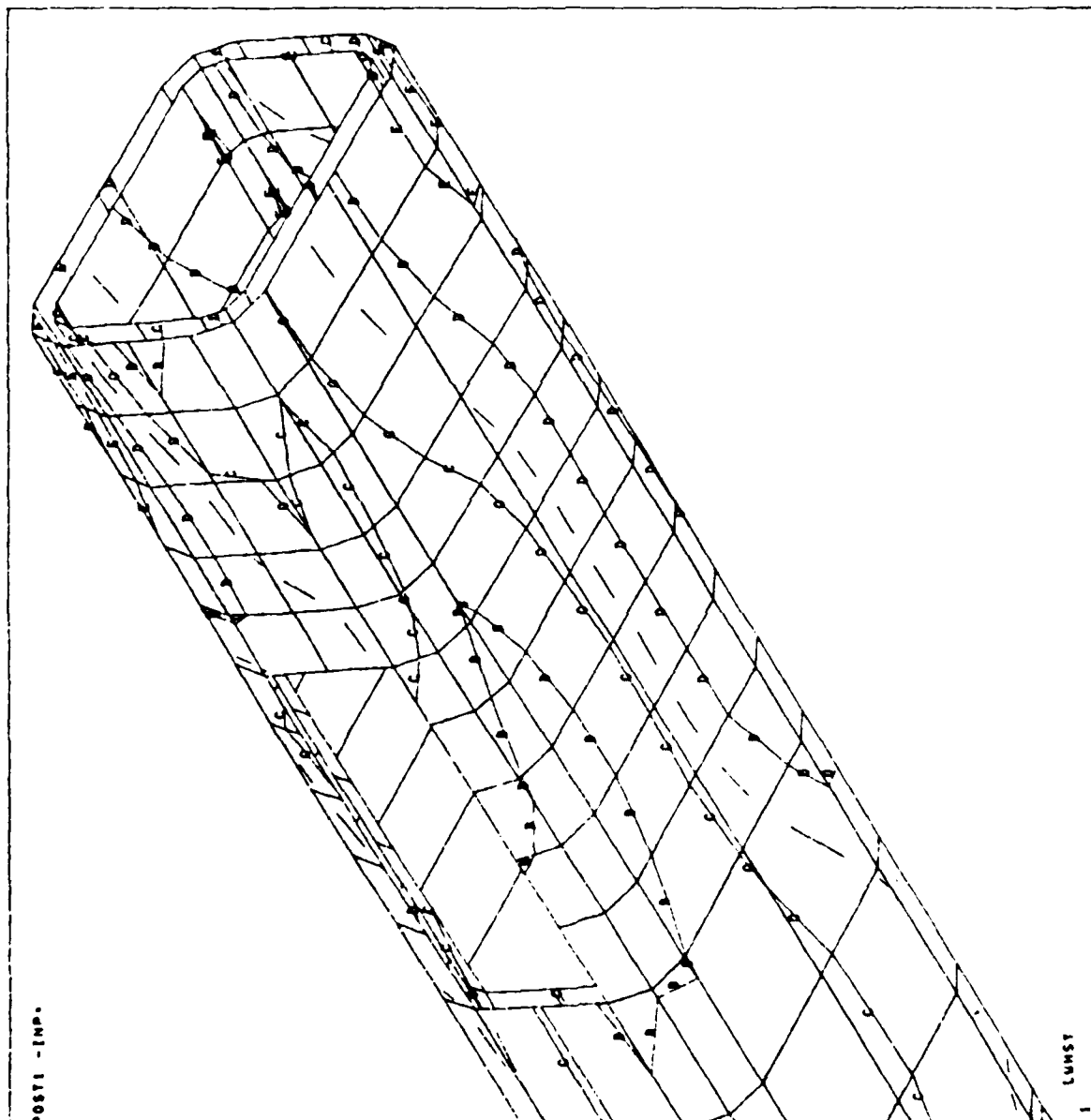
**1**

ANSYS 4.28  
 DEC 4 1986  
 14127.10  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SM1  
 ZOOM  
 KU=1  
 VU=1  
 ZU=1  
 2 DIST=47  
 2 WF=27.4  
 2 VF=16  
 2 ZF=159  
 VRT0=1.06  
 MIDDEN  
 MM=7279  
 MM=1936  
 A=-821  
 B=696  
 C=2013  
 D=3330  
 E=4647  
 F=5964

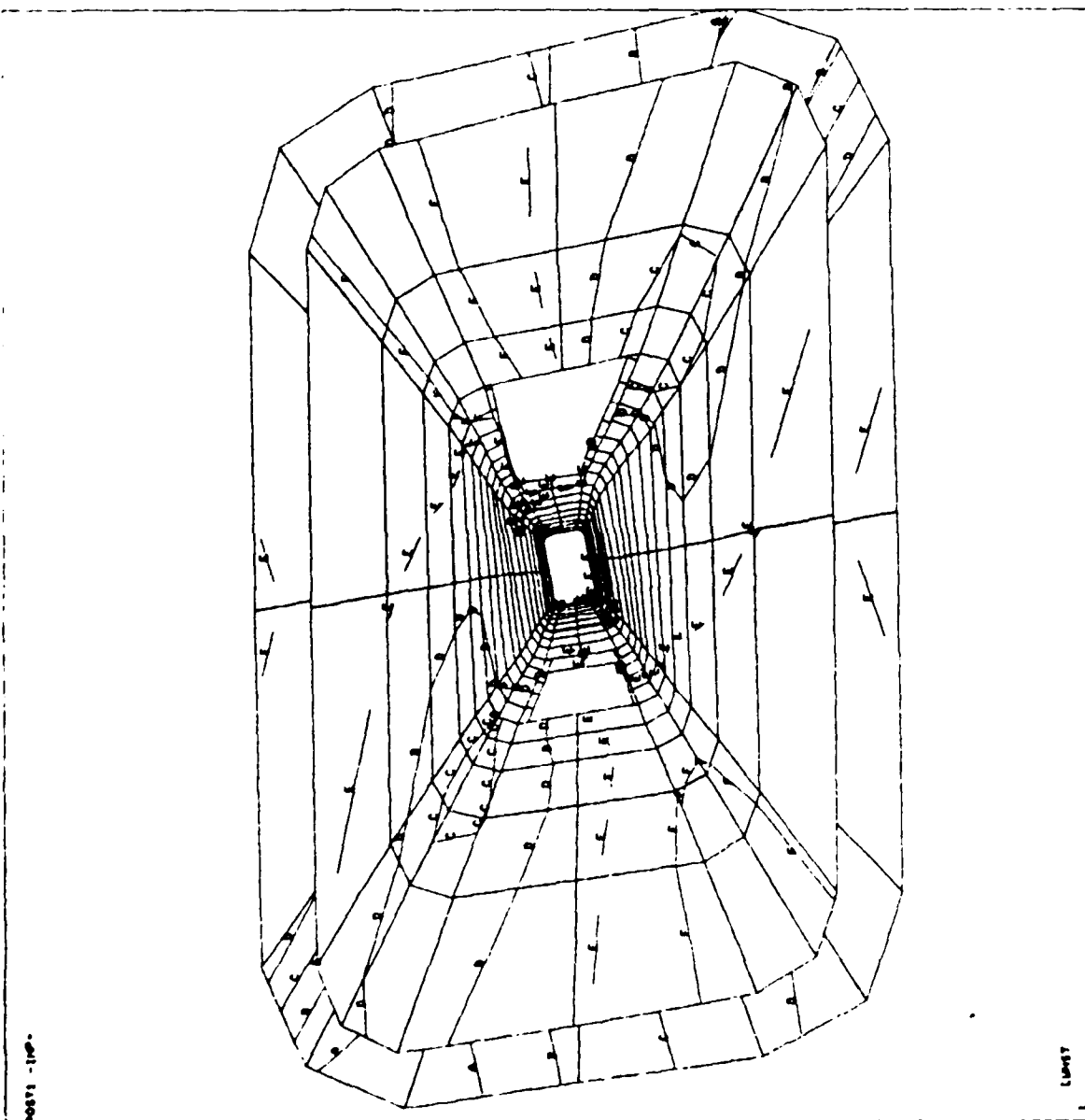




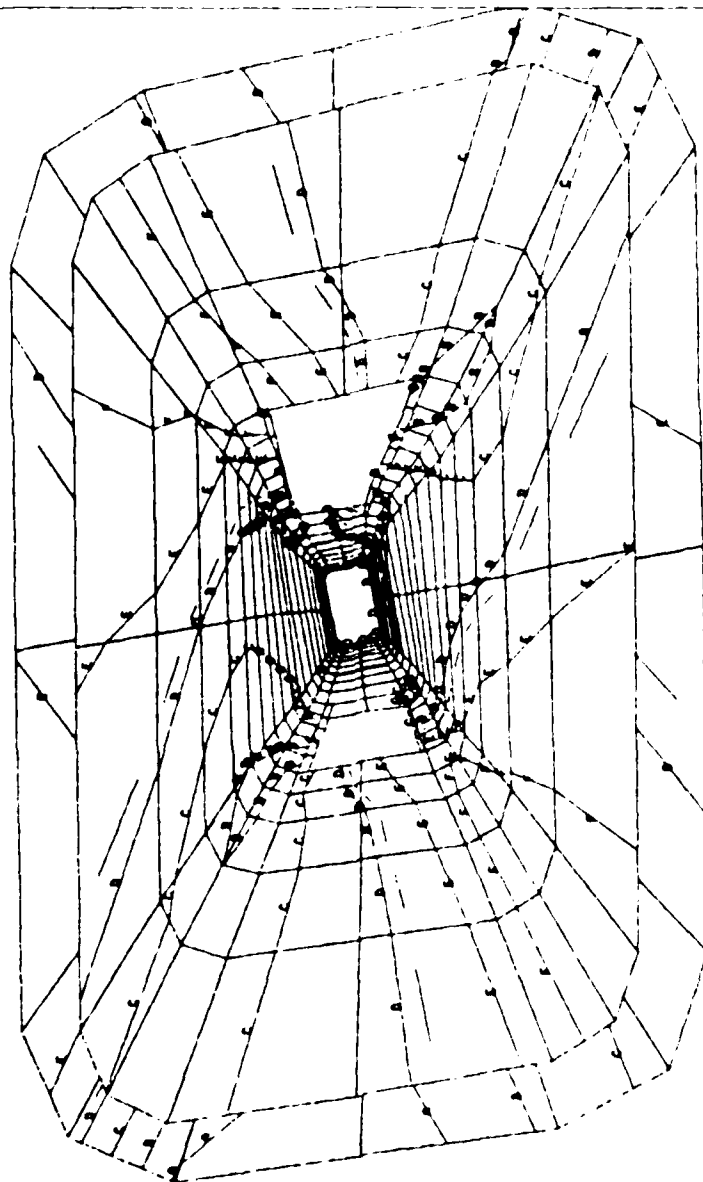
ANSYS 4.28  
 DEC 4 1986  
 14150112  
 POST1 STRESS  
 STEP=1  
 IYER=1  
 SX2  
 ZOOM  
 KU=-1  
 VU=-1  
 ZU=1  
 1 DIST=47  
 1 XF=27.4  
 1 VF=16  
 1 ZF=159  
 VRT0=1.06  
 MIDDEN  
 MX=53861  
 MY=-32281  
 MZ=-22514  
 C=-7219  
 D=8076  
 E=23371  
 F=38666



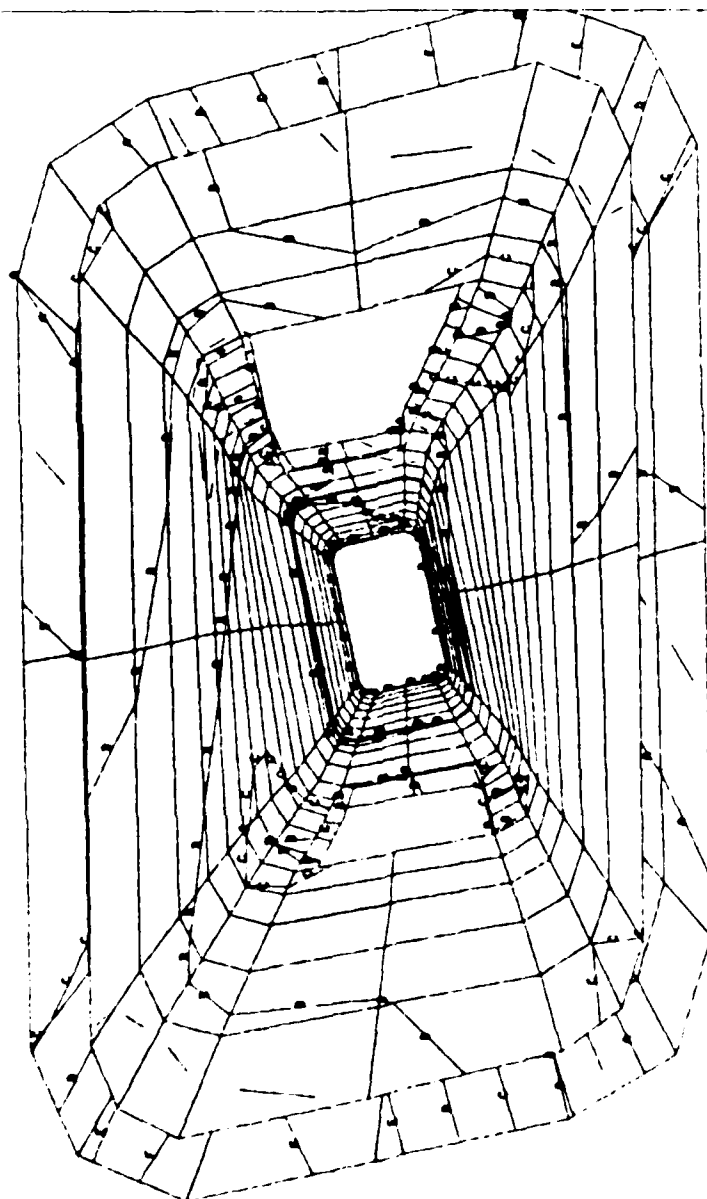
00155 0.20  
 DEC 4 1966  
 13:00:01  
 POST1, STRESS  
 STEP=1  
 ITER=1  
 SOL  
 20=1  
 DIST=136  
 20=110  
 COME=45  
 M180EN  
 RH=27500  
 MM=-01260  
 A=-720.20  
 B=-54415  
 C=-25502  
 D=-17540  
 E=884  
 F=10277



400000 4.28  
 REC 4 10006  
 131500 32  
 POSTI STRESS  
 STEP-1  
 1700-1  
 SV1  
 20-1  
 0157-126  
 2F-110  
 COND-06  
 110000  
 00-0005  
 00-0430  
 0-3207  
 0-2341  
 C-1206  
 0-208  
 E-707  
 0-1043

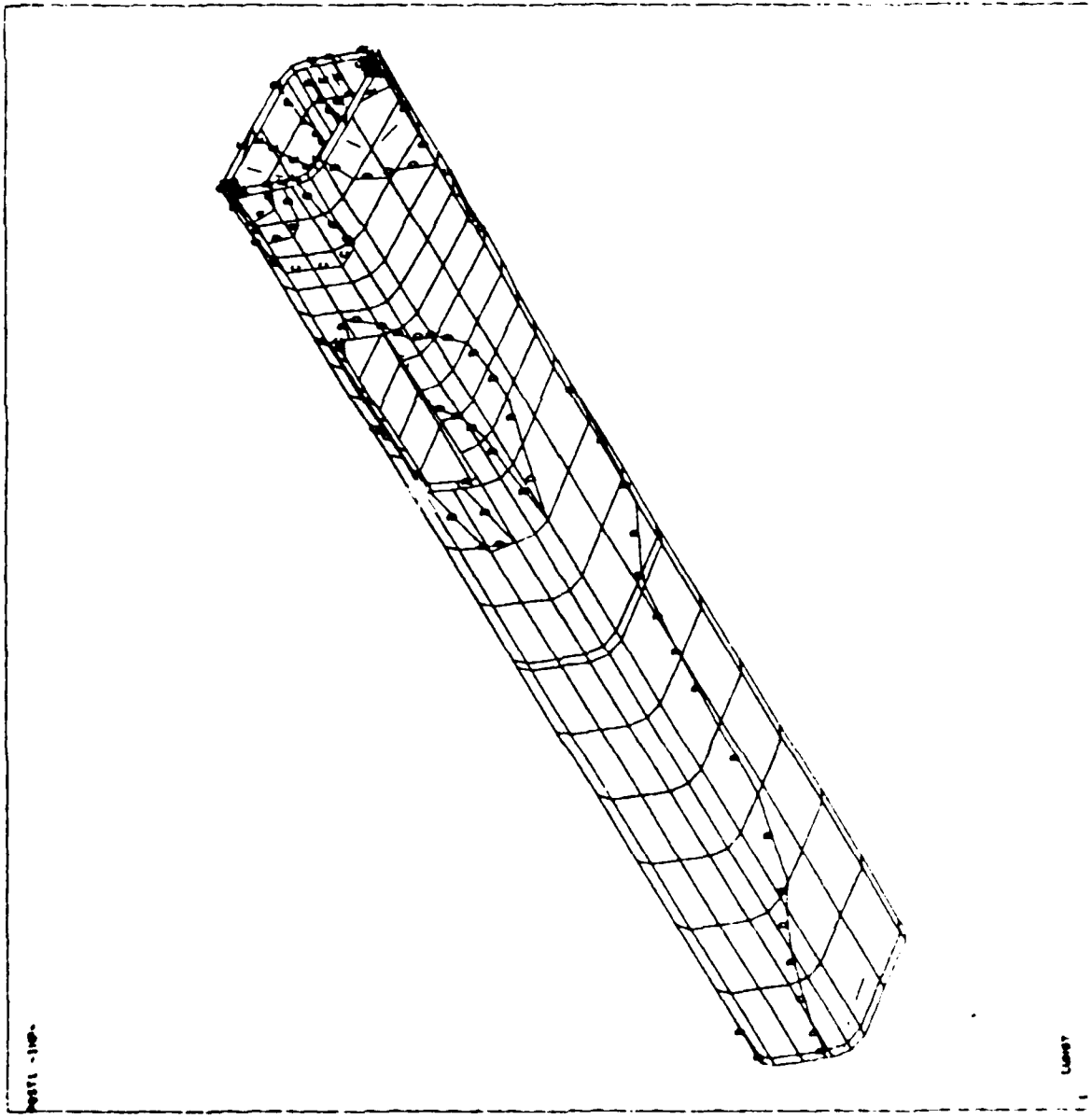


**2.5037**



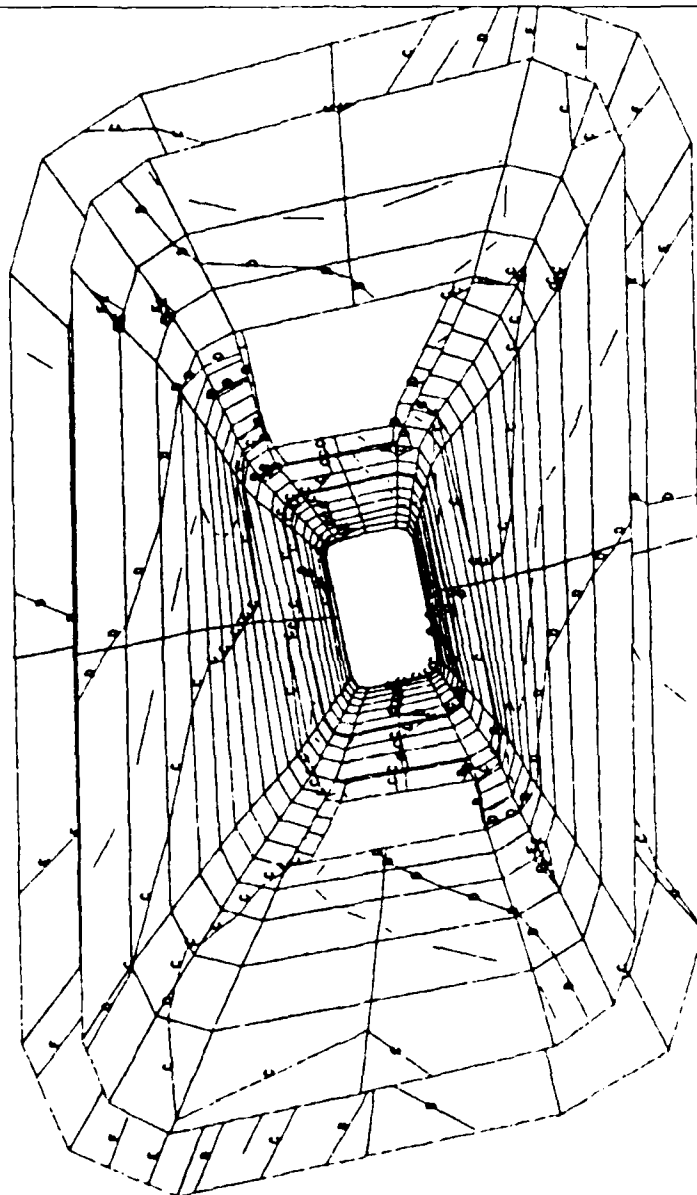


POST1 4.10  
SEC 4.1005  
13.23.12  
POST1 070635  
STEP=1  
ITER=1  
END  
NO=1  
WO=1  
ZO=1  
0187-100  
ZF=110  
WIDEN  
PC=3001  
PM=0310  
A=-0127  
B=-0035  
C=-1703  
D=-551  
E=641  
F=1022





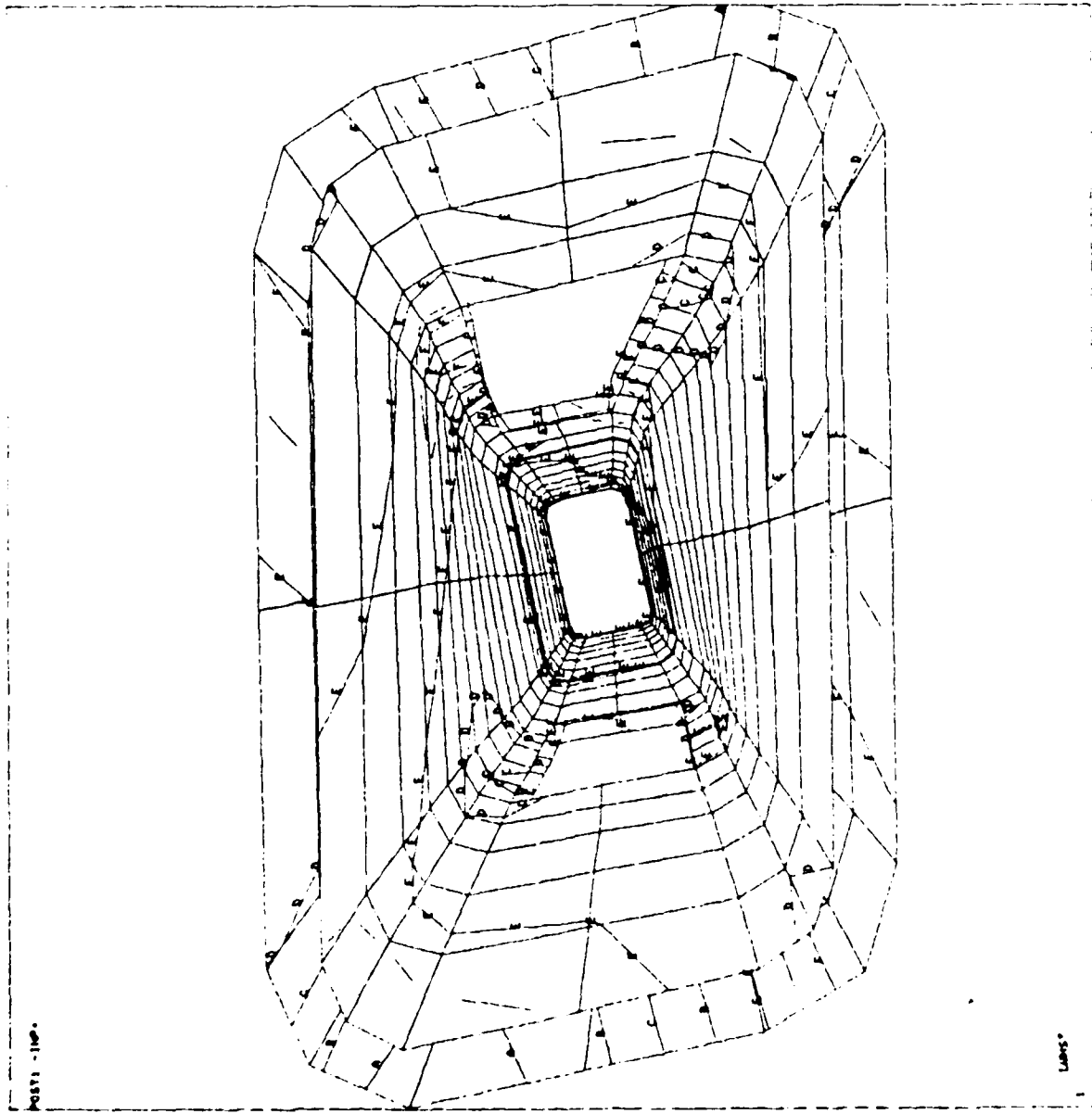
1580 - 1971



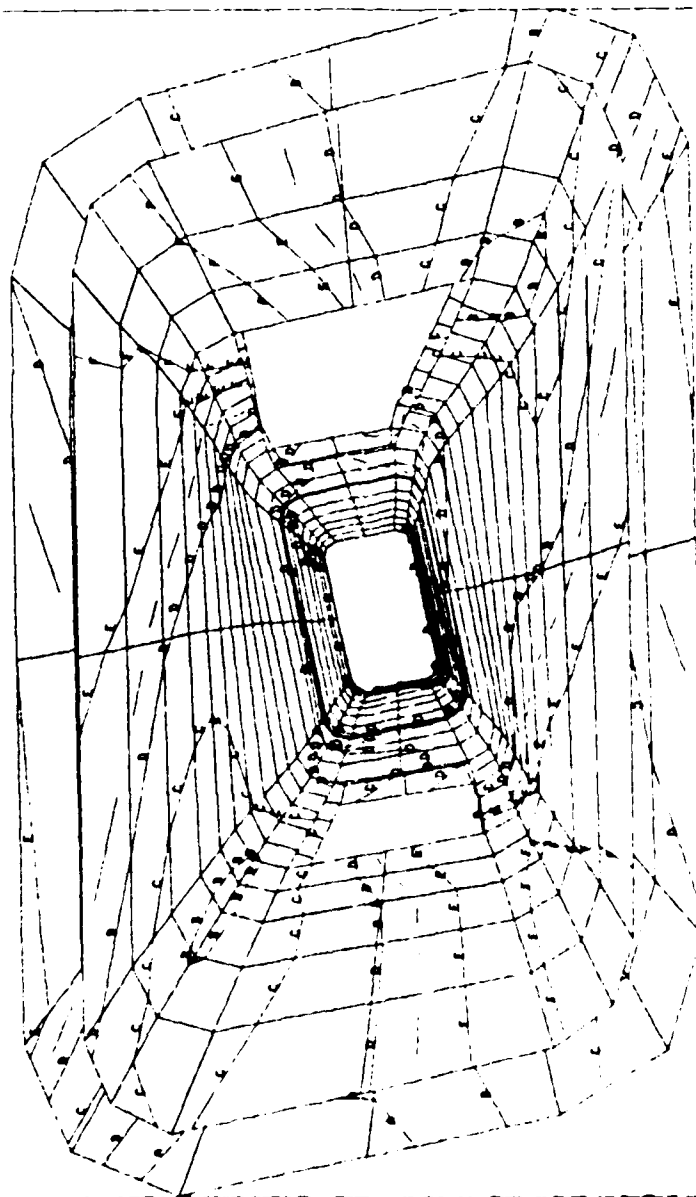
**1. Introduction**



ANALYSIS 1.20  
DEC 4 1986  
13:59:30  
POST1 STRESS  
STEP=1  
ITER=1  
END  
  
Z=1  
DIST=180  
Z=116  
CONC=25  
MIDDEM  
MA=1941  
MM=7288  
A=5946  
B=4631  
C=2316  
D=2001  
E=886  
F=620



ANSYS 4.2P  
 DEC 4 1986  
 14101116  
 POST1, STRESS  
 STEP=1  
 17E8=1  
 5/2  
 20=1  
 DIST=100  
 2F=116  
 CONE=26  
 WIDTH=1  
 MU=3021  
 MU=6310  
 A=4127  
 B=2075  
 C=1743  
 D=551  
 E=641  
 F=1033

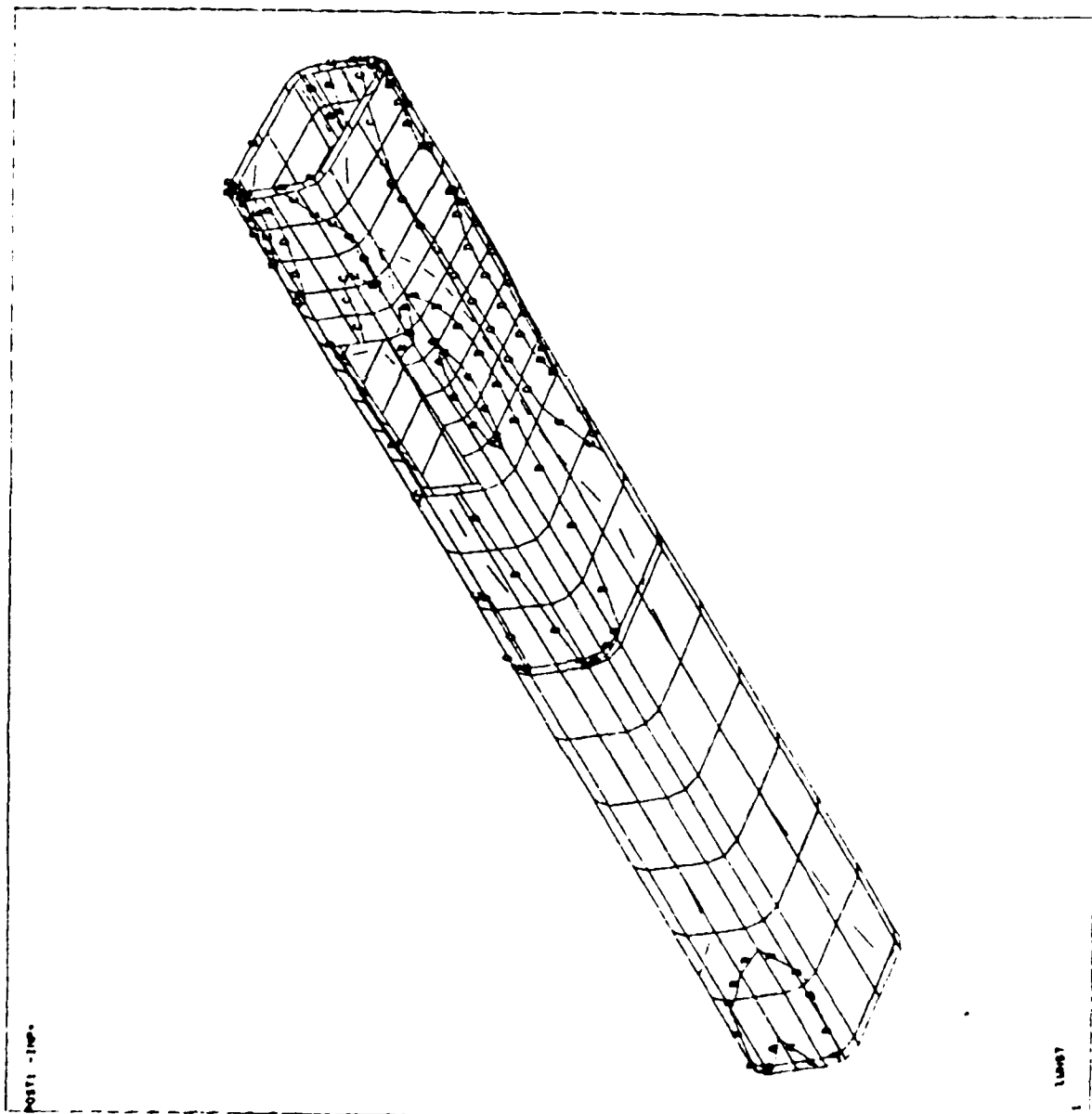


POST1 -1100-

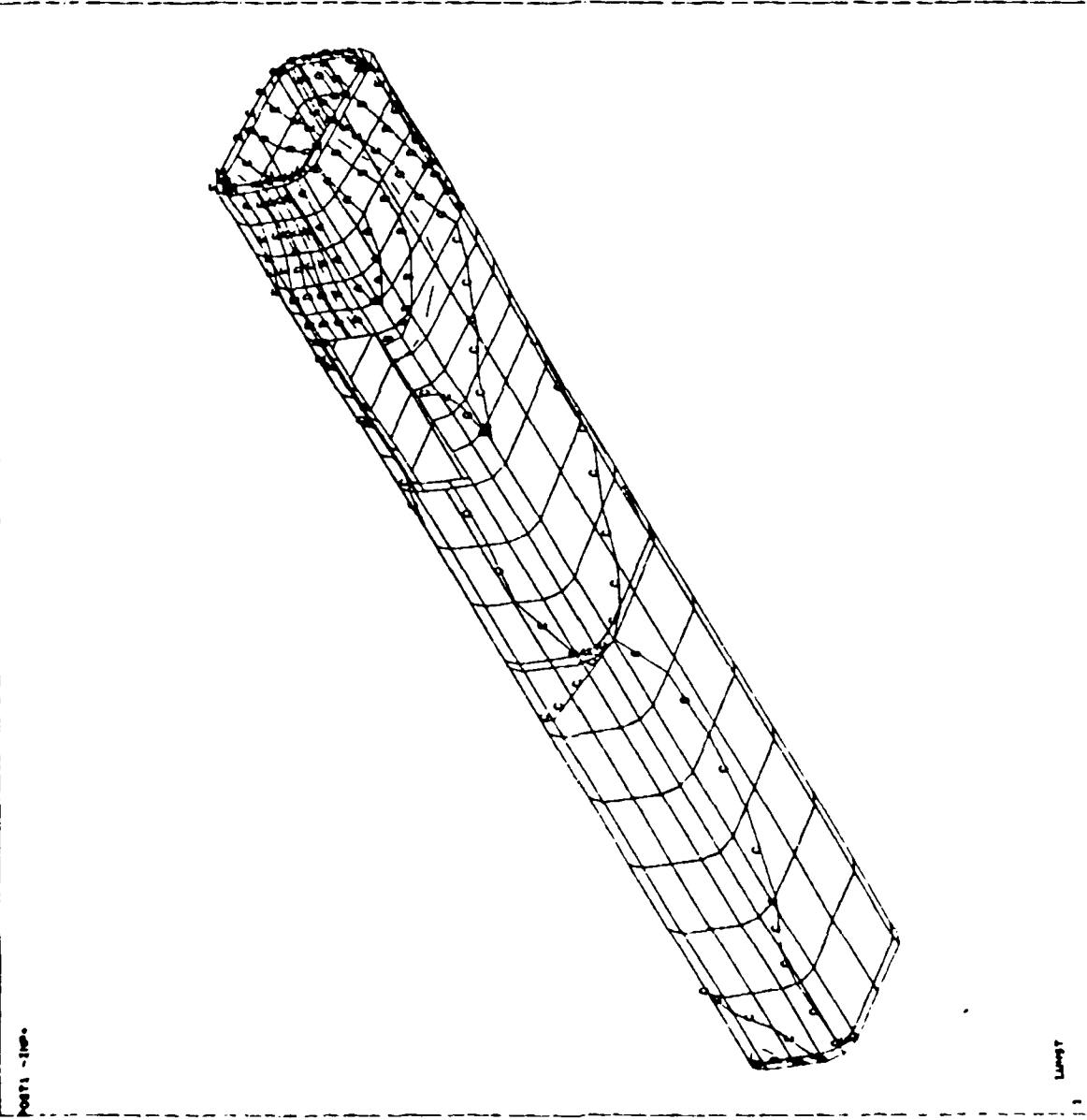
10000

103

ANSYS 4.20  
 DEC 4 1986  
 13:00:50  
 POST1, STRESS  
 STEP=1  
 ITER=1  
 END  
 PU=-1  
 VU=-1  
 ZO=1  
 DIST=100  
 ZF=116  
 HZBDM  
 PO=4240  
 MO=-2357  
 A=-1416  
 B=-473  
 C=478  
 D=1413  
 E=8366  
 F=3200

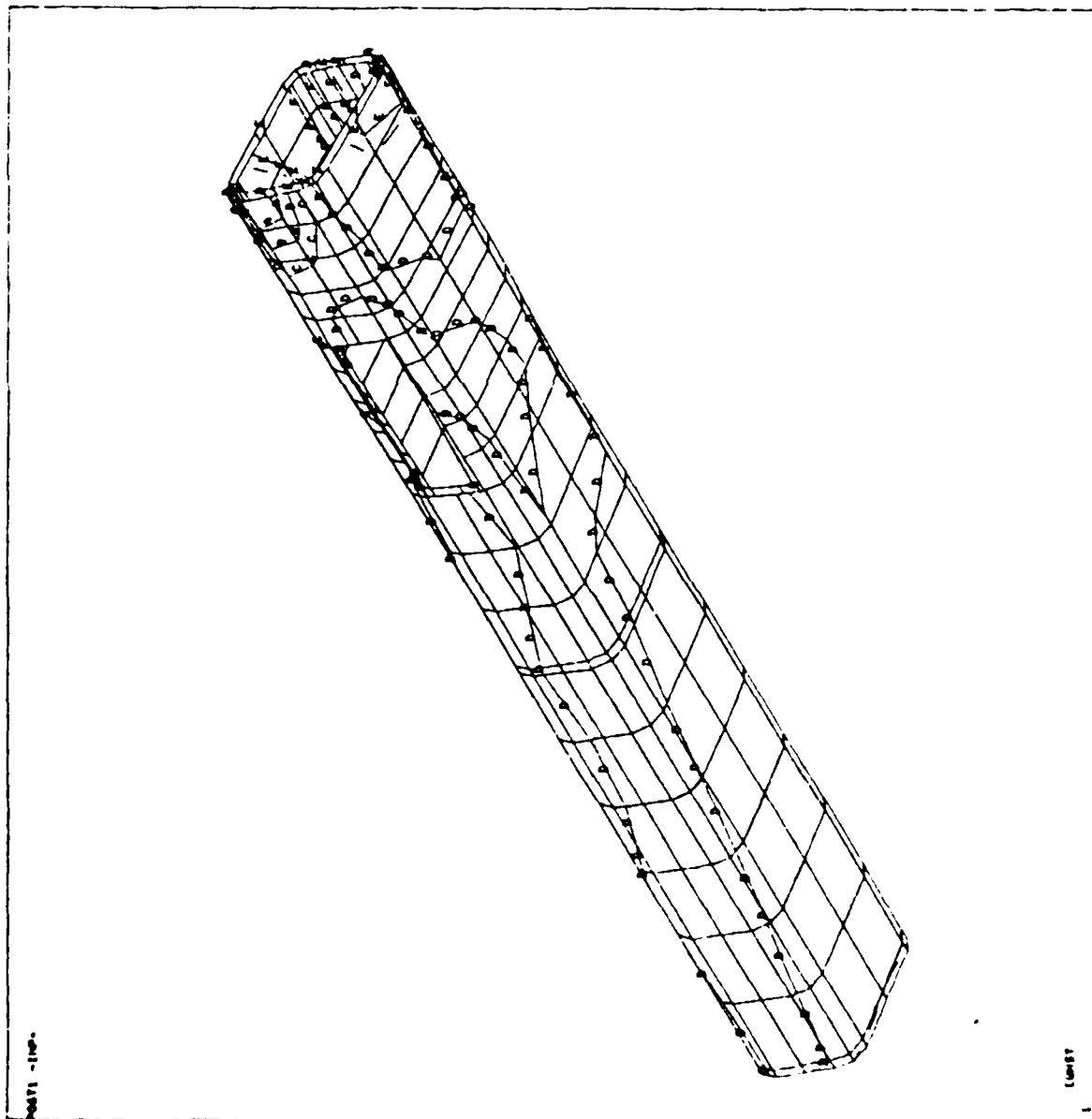


ANALYSIS 4.128  
 DEC 4 1966  
 13:27:13  
 POST11 STRESS  
 STEP=1  
 ITER=1  
 882  
 NU=--1  
 MU=--1  
 ZU=1  
 DIST=104  
 ZF=110  
 MIDEN  
 MU=65723  
 MU=25762  
 A=81257  
 B=6760  
 C=7737  
 D=22234  
 E=26731  
 F=51228



101

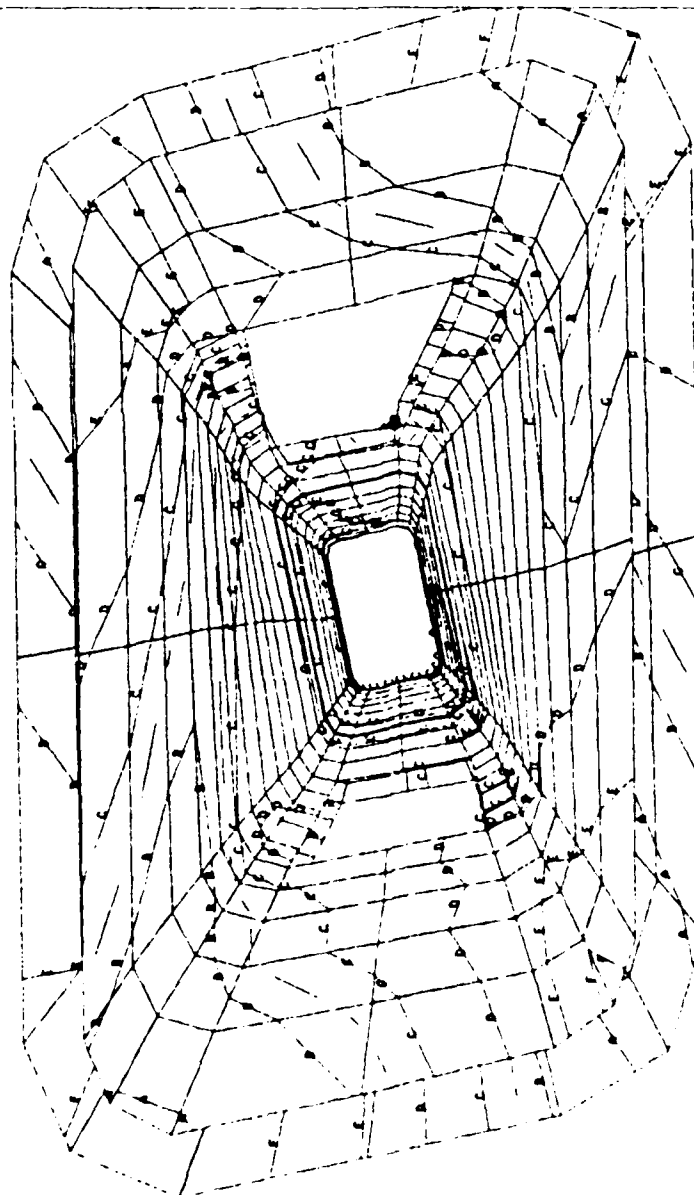
ANALYSIS 4.20  
 DEC 4 1986  
 13:24:57  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 BV3  
 NU=1  
 MU=1  
 ZU=1  
 BIST=100  
 ZF=116  
 M100CM  
 RH=2813  
 RH=6288  
 A=4000  
 B=3680  
 C=2388  
 D=1887  
 E=210  
 F=1516



POST1 -100-

100000

ANSYS 4.20  
 DEC 4 1986  
 14:03:28  
 POST1, STRESS  
 STEP=1  
 ITER=1  
 943  
 20-1  
 DISP=158  
 2F=116  
 COME=25  
 MIDDLEM  
 PM=65723  
 MM=-26752  
 A=-21857  
 B=-6769  
 C=7737  
 D=22234  
 E=38731  
 F=61228

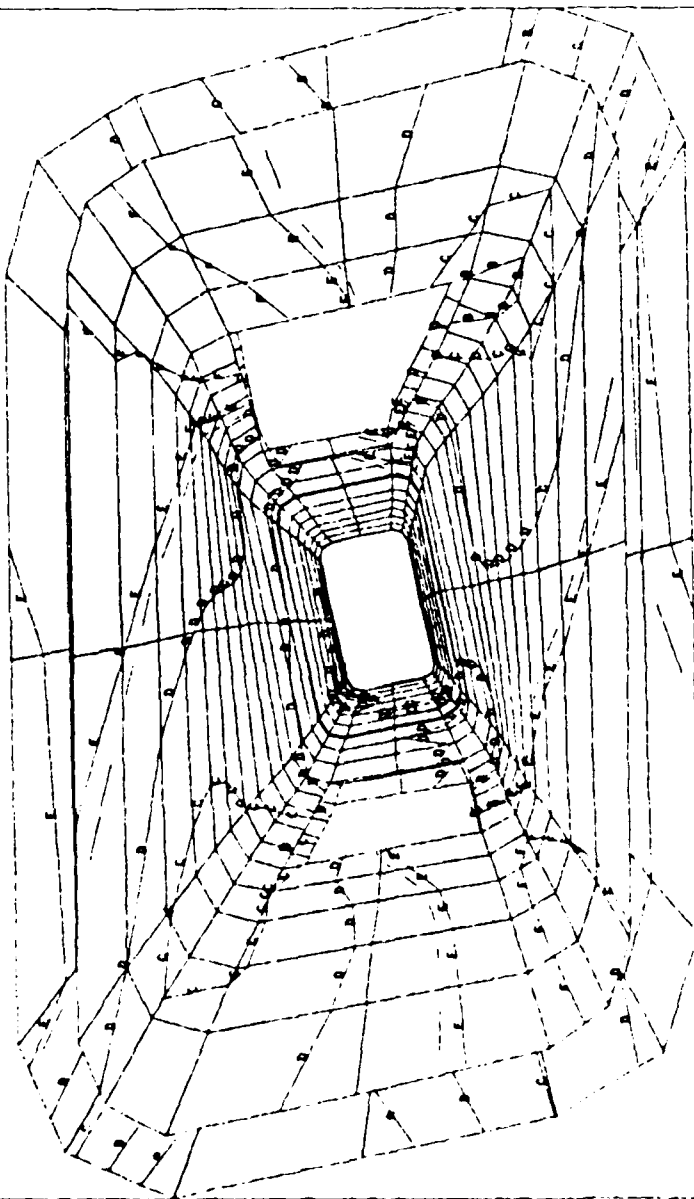


POST1 -100-

LMIST

107

ANSYS 4.20  
 DEC 4 1986  
 14106183  
 POST1, STRESS  
 STEP=1  
 TIME=1  
 SVZ  
 ZN=1  
 DIST=150  
 ZP=116  
 CONE=26  
 MIDDLE  
 PA=2013  
 PM=6288  
 A=4000  
 B=3680  
 C=2300  
 D=1007  
 E=814  
 F=1515



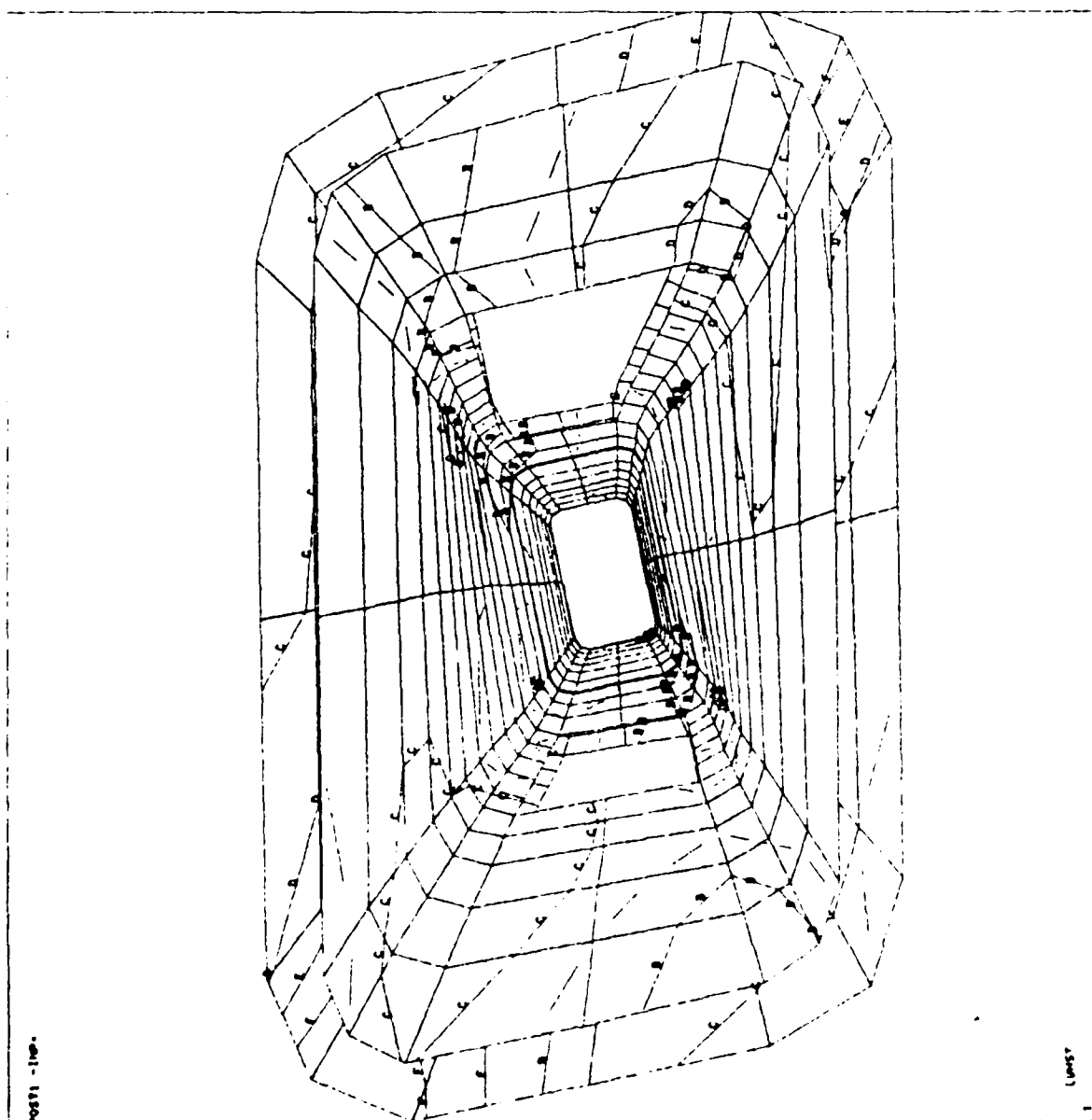
POST1 - 1160

116057

108

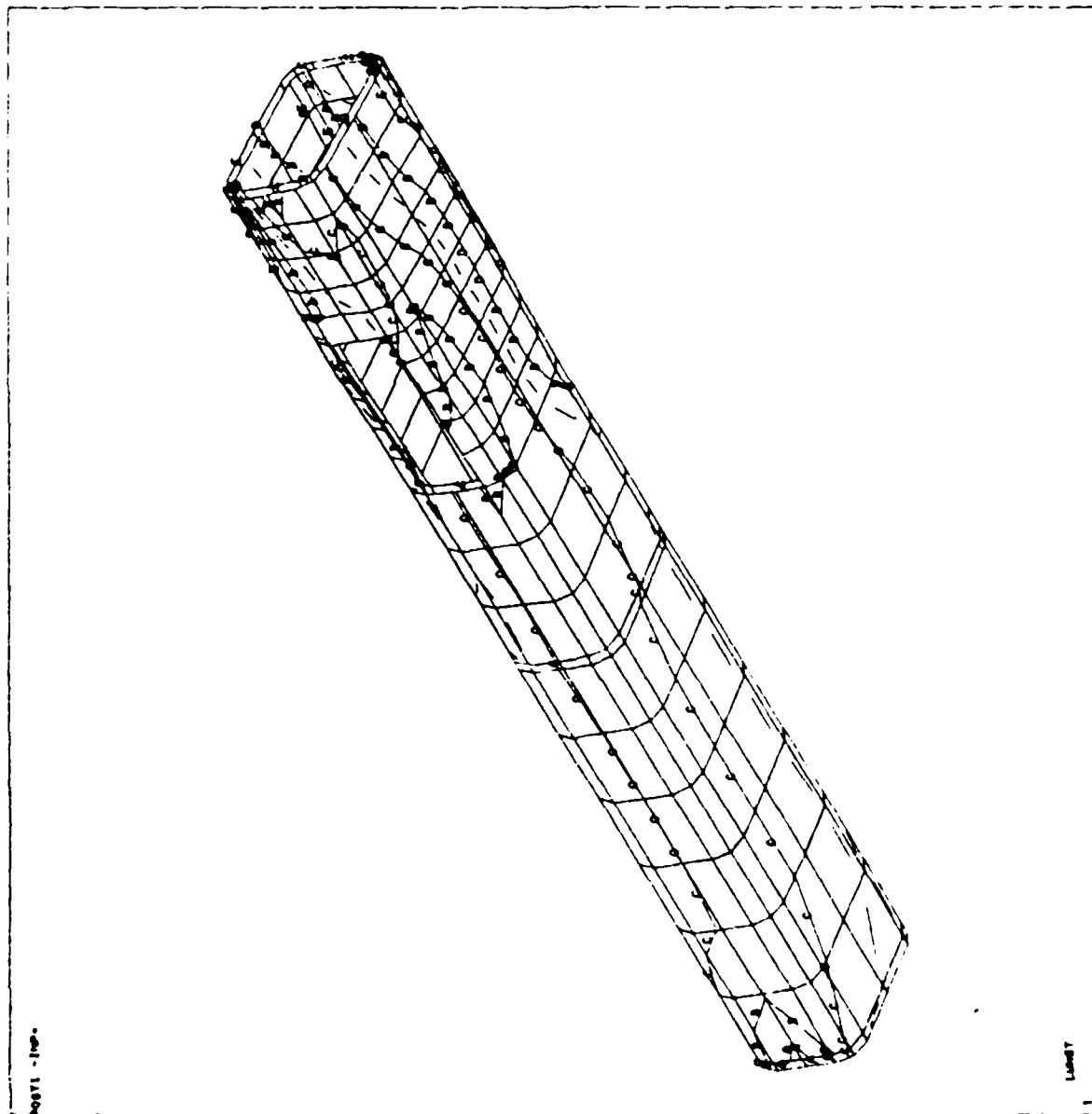
32 105

ANSYS 4.28  
DEC 4 1986  
1410153  
POST1 STRESS  
STEP=1  
ITER=1  
SM3  
20=1  
DISP=154  
ZF=116  
CONE=25  
WIDEN  
RU=4240  
PW=2357  
A=1416  
B=473  
C=470  
D=1413  
E=2356  
F=3299

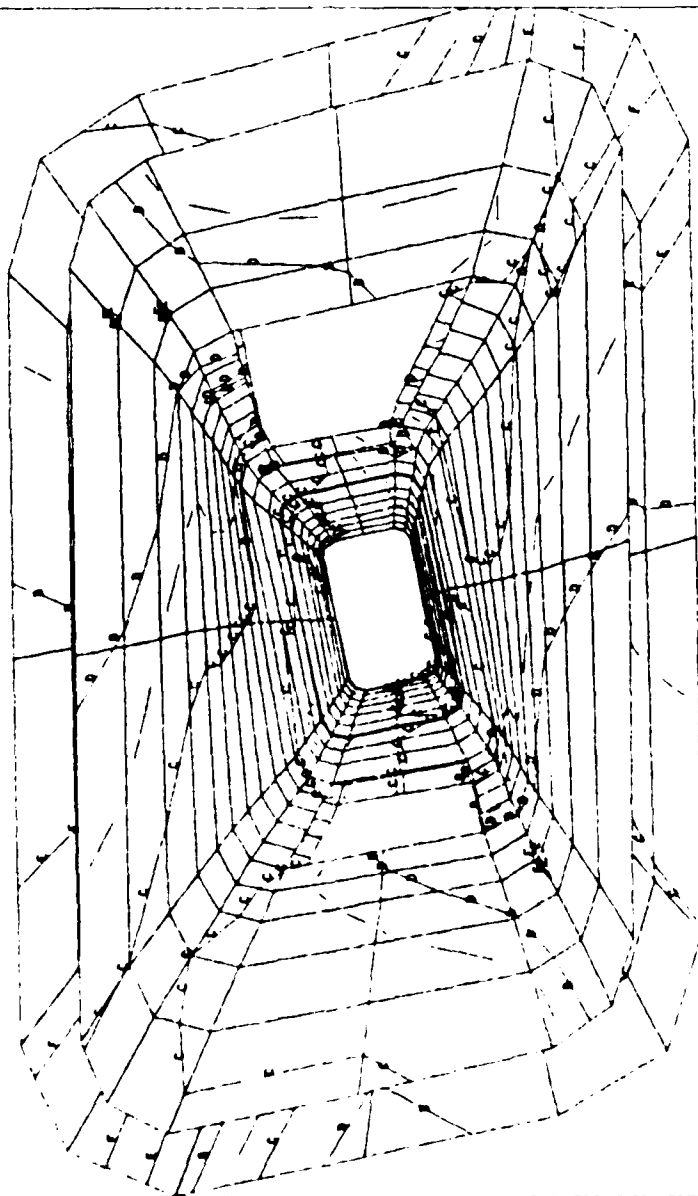




ANALYSIS 4.83  
 DEC 4 1986  
 13:30:00  
 POST1, STRESS  
 STEP=1  
 ITER=1  
 SACS  
 NU=1  
 MU=1  
 ZU=1  
 BIST=104  
 ZF=116  
 MIDCM  
 ME=52004  
 MM=53076  
 A=37923  
 B=22760  
 C=7613  
 D=7642  
 E=22697  
 F=37862



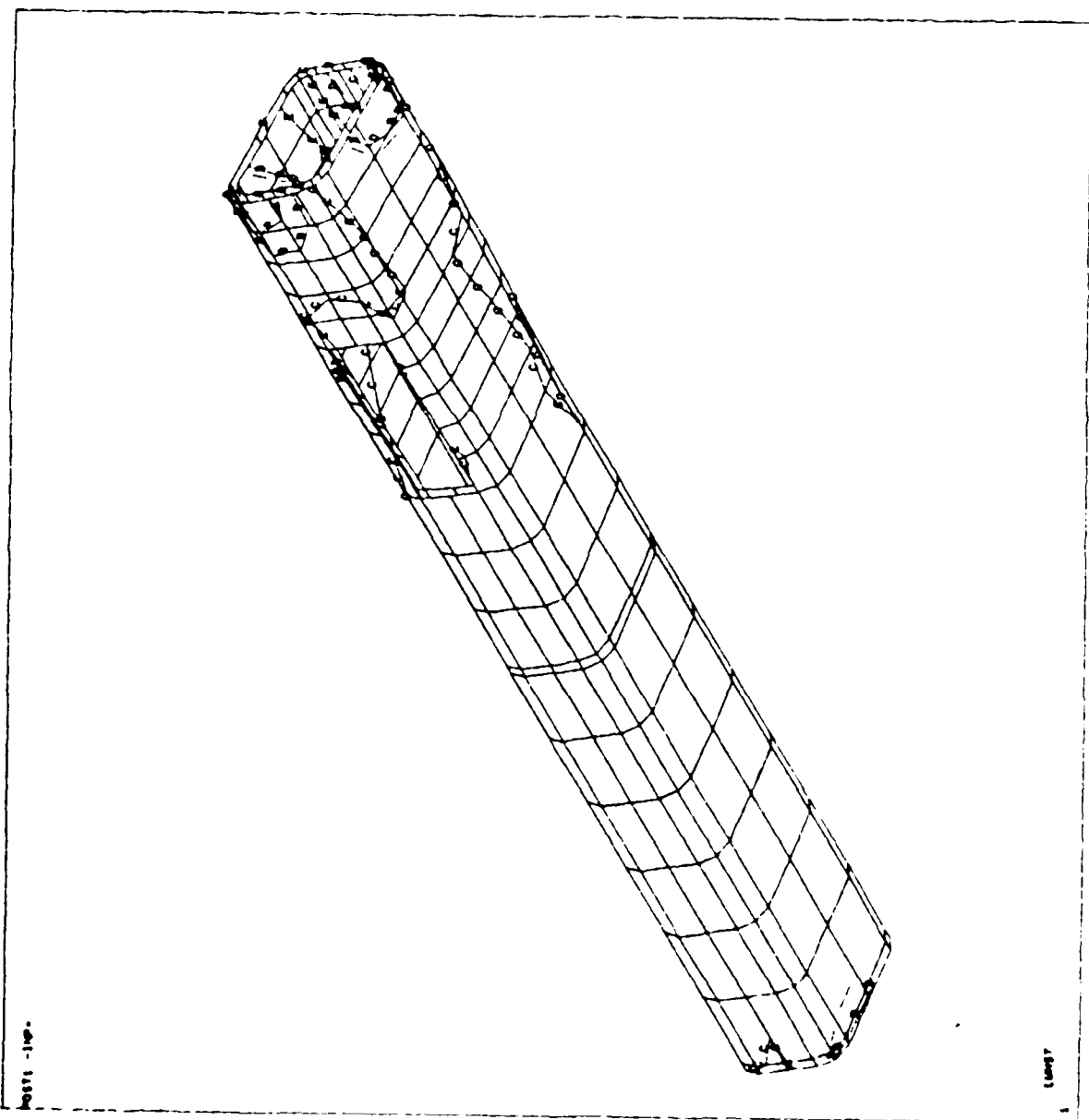
00545 4.20  
 DEC 4 1986  
 1412142  
 POST1, STRESS  
 STEP=1  
 ITER=1  
 SLE  
 20=1  
 DIST=158  
 ZF=118  
 COND=26  
 MISEM  
 PR=53004  
 AN=53076  
 A=37923  
 B=22768  
 C=7613  
 D=7542  
 E=22697  
 F=37952



POST1 -140-

14087

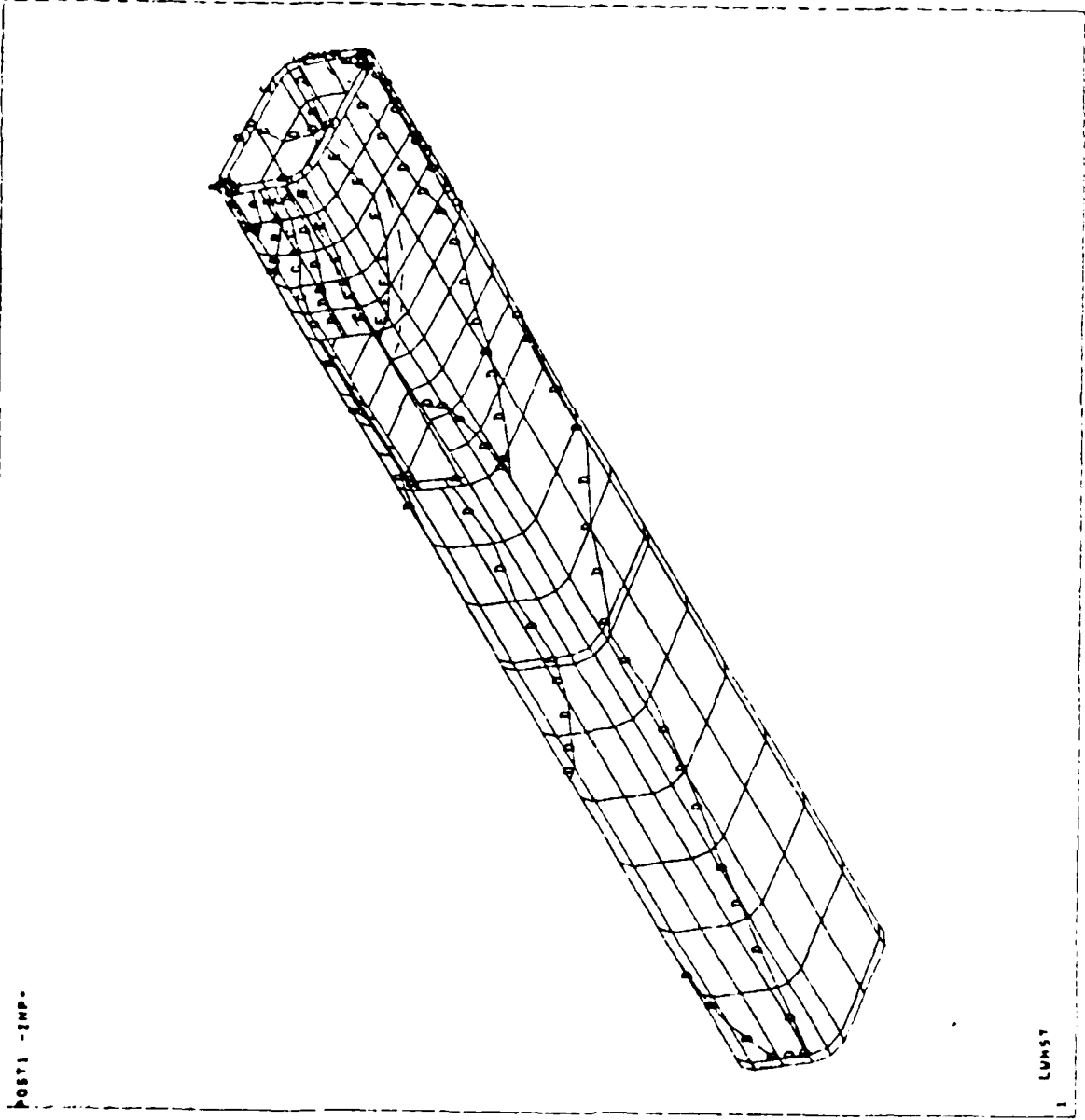
100000 4.20  
 DEC 4 1966  
 15:37:57  
 POST1 STRESS  
 STLP-1  
 STLP-1  
 SVS  
 MU-1  
 MU-1  
 ZU-1  
 ZU-1  
 DIS-100  
 27-116  
 MIDEN  
 70-2026  
 70-2026  
 A-2583  
 A-2583  
 B-0601  
 C-1219  
 B-183  
 E-1545



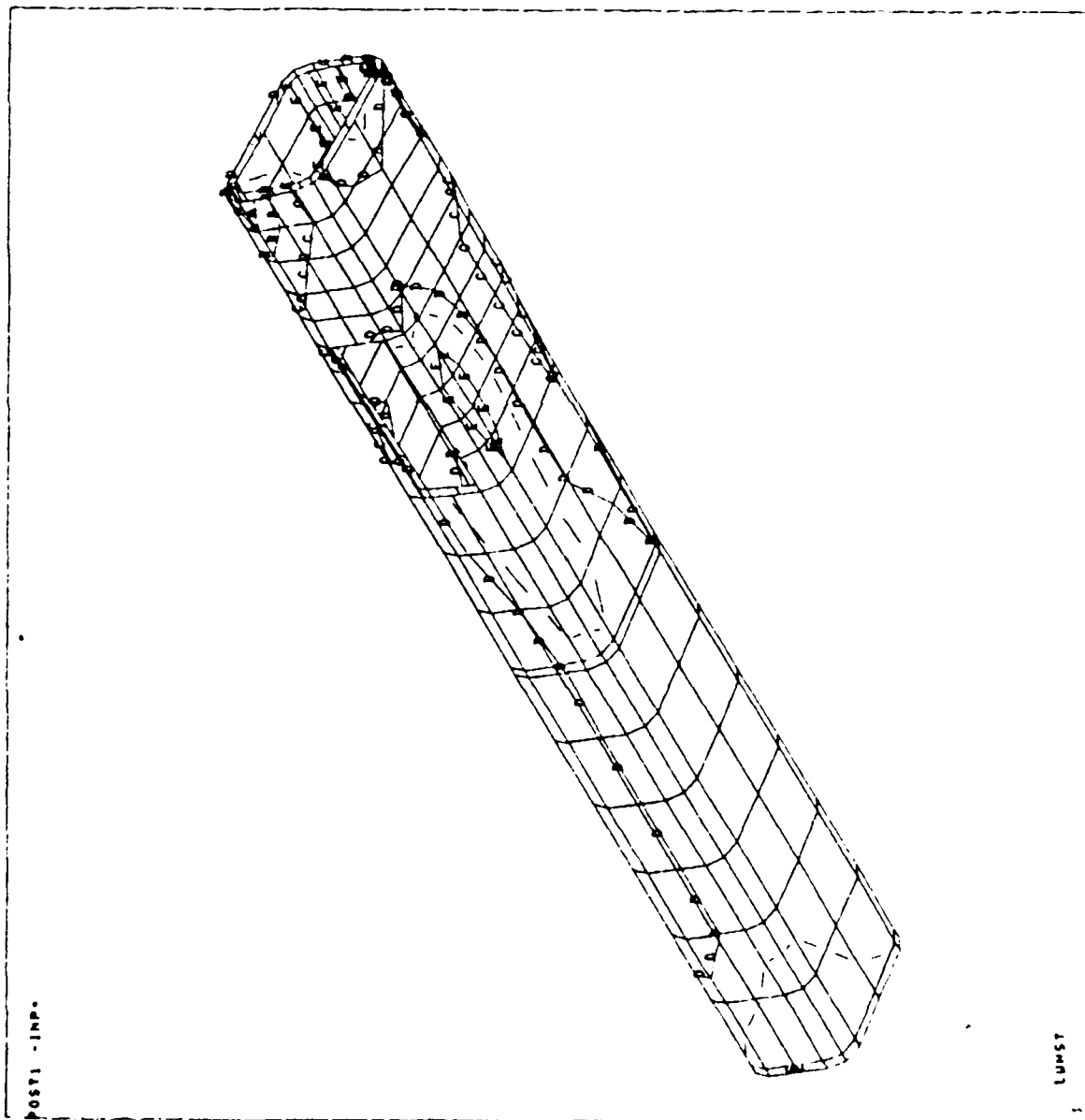
POST1-100

100000

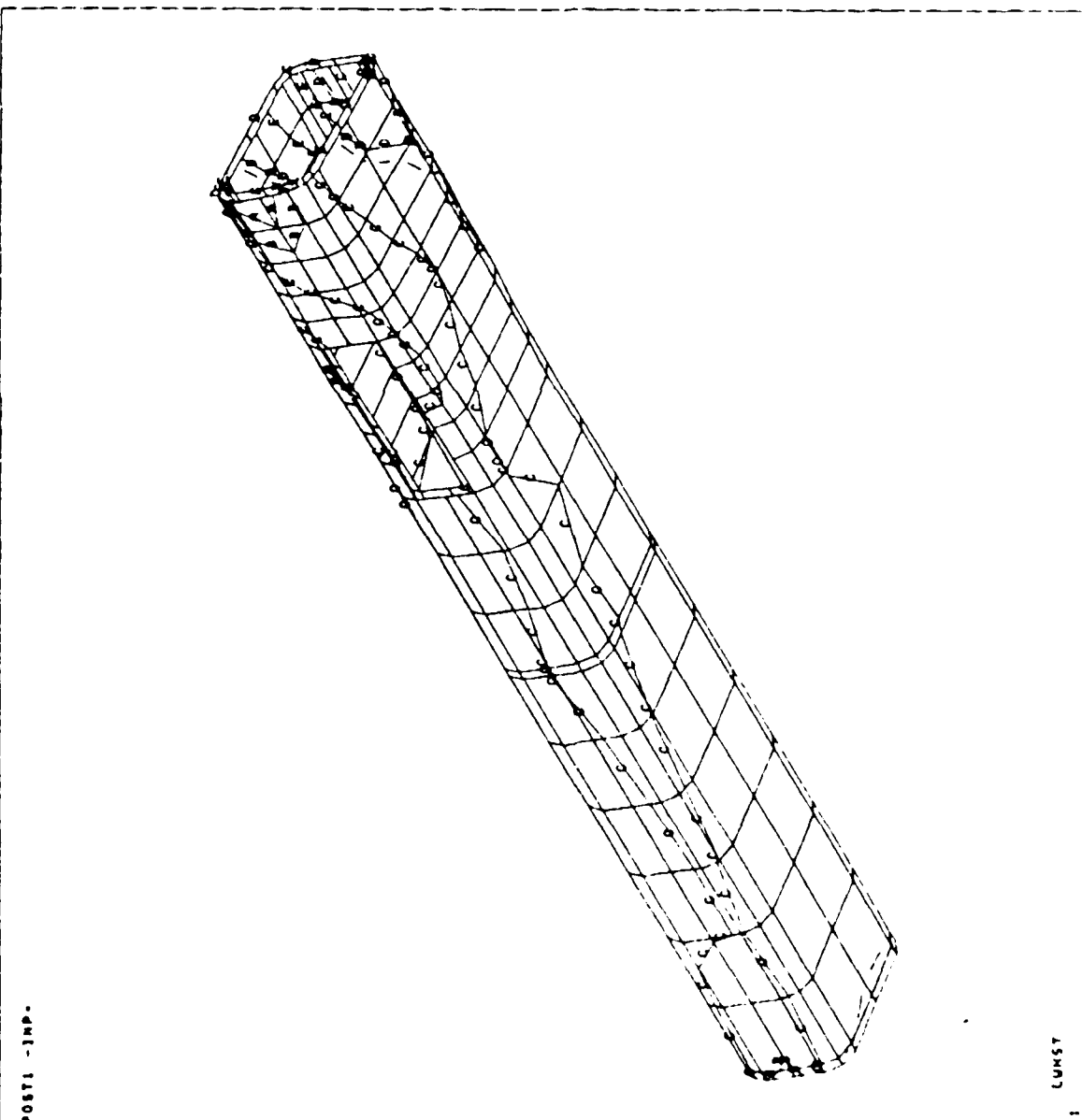
ANSYS 4.20  
 DEC 4 1986  
 15:39:57  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SM4  
 XU=-1  
 VU=-1  
 ZU=-1  
 DIST=104  
 ZF=116  
 MIDDEN  
 RX=1953  
 MY=-7216  
 A=-5690  
 B=-4161  
 C=-2632  
 D=-1103  
 E=426



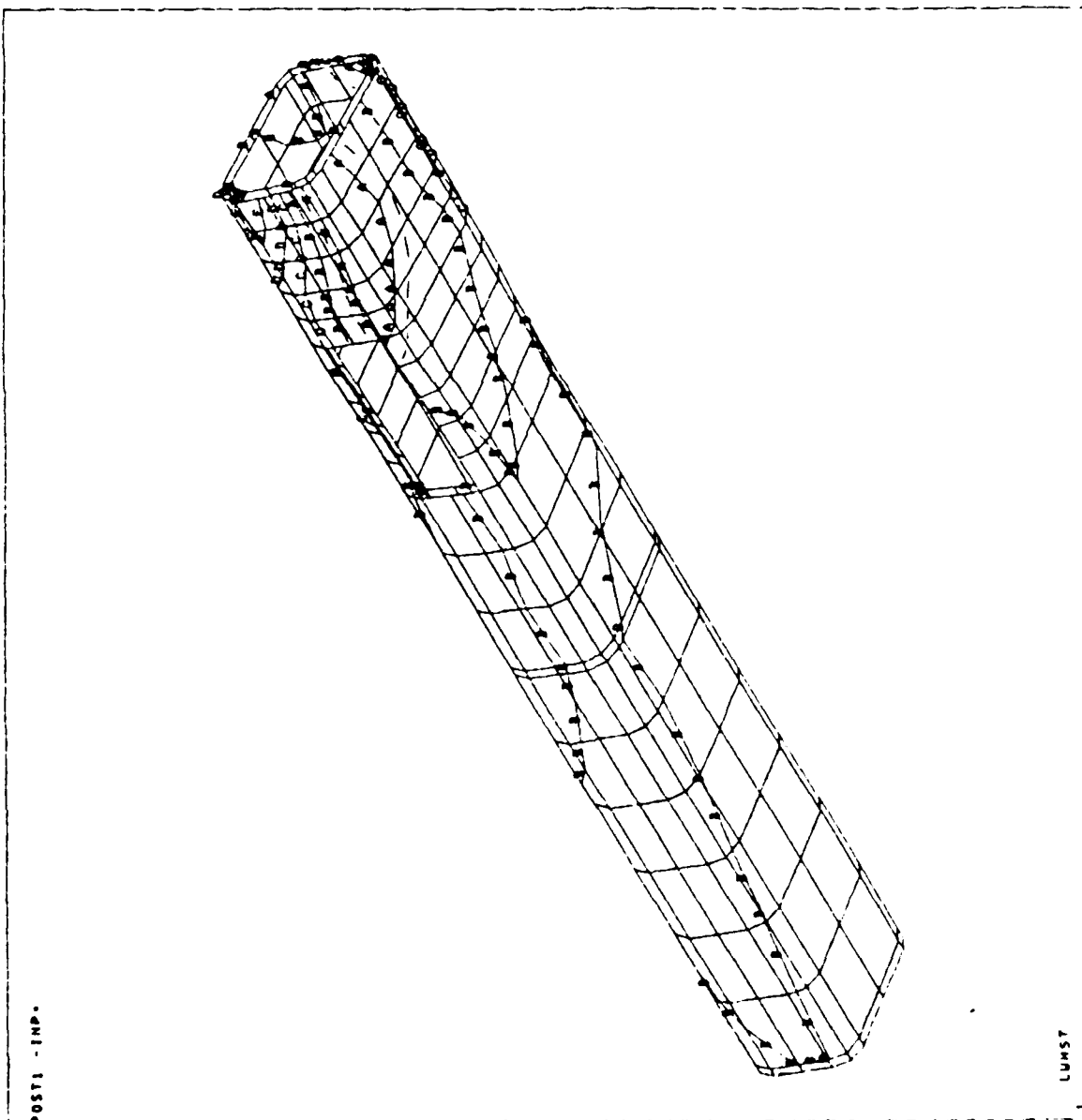
ANSYS 4.28  
 DEC 4 1986  
 15:41:30  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SMS  
 KU=-1  
 VU=-1  
 ZU=-1  
 DIST=104  
 ZF=116  
 MIDDLE  
 MX=35483  
 MY=-91738  
 AZ=70536  
 B=-49332  
 C=-28128  
 D=-6924  
 E=14280



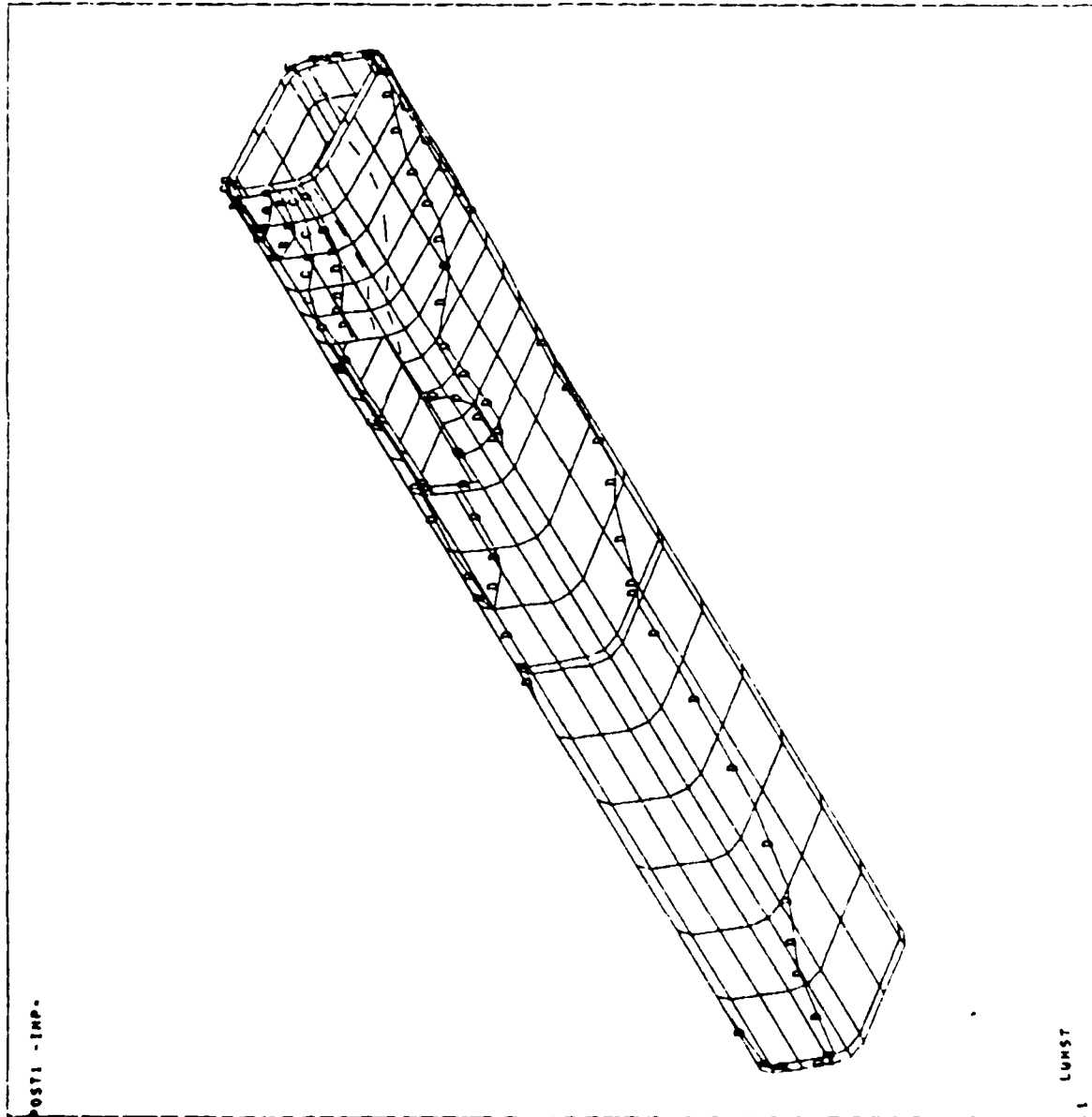
ANSYS 4.20  
 DEC 4 1986  
 15:43:30  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SVS  
 RV=-1  
 VU=-1  
 ZU=1  
 DIST=104  
 ZF=116  
 MIDDEN  
 RX=2592  
 RH=-4457  
 A=-3283  
 B=-2108  
 C=-933  
 D=242  
 E=1417



ANSYS 4.20  
 DEC 4 1986  
 15:45:20  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SMS  
 XU=-1  
 VU=-1  
 ZU=1  
 DIST=104  
 ZF=116  
 MIDDEN  
 RA=7105  
 RM=-1059  
 A=-434  
 B=1092  
 C=2618  
 D=4144  
 E=5670

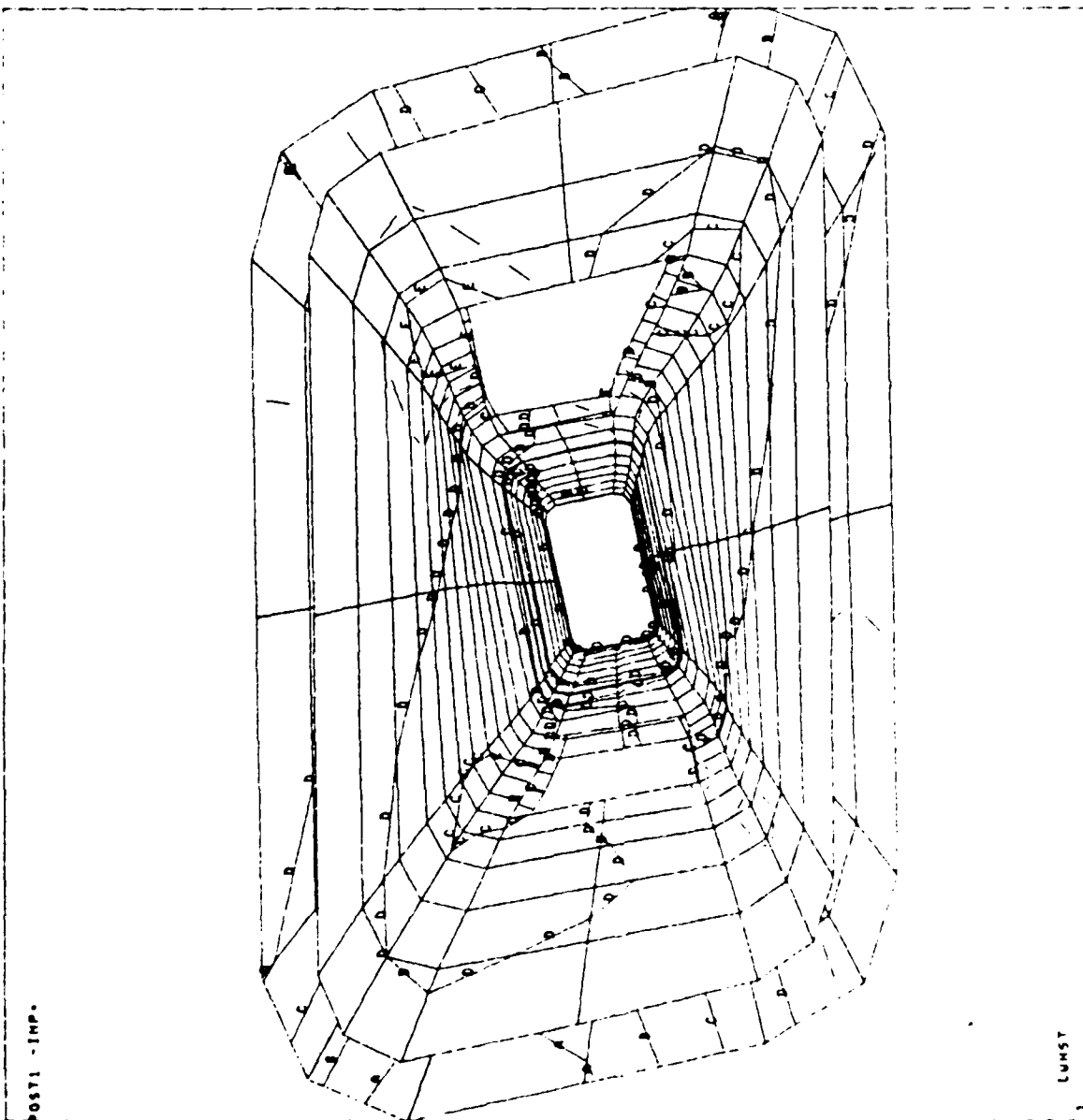


ANSYS 4.20  
 DEC 4 1986  
 15:46:49  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SK6  
 KU=-1  
 YU=-1  
 ZU=-1  
 DIST=104  
 ZF=116  
 HIDDEN  
 MX=45174  
 MN=-145333  
 A=-113583  
 B=-81831  
 C=-50079  
 D=-18327  
 E=13425

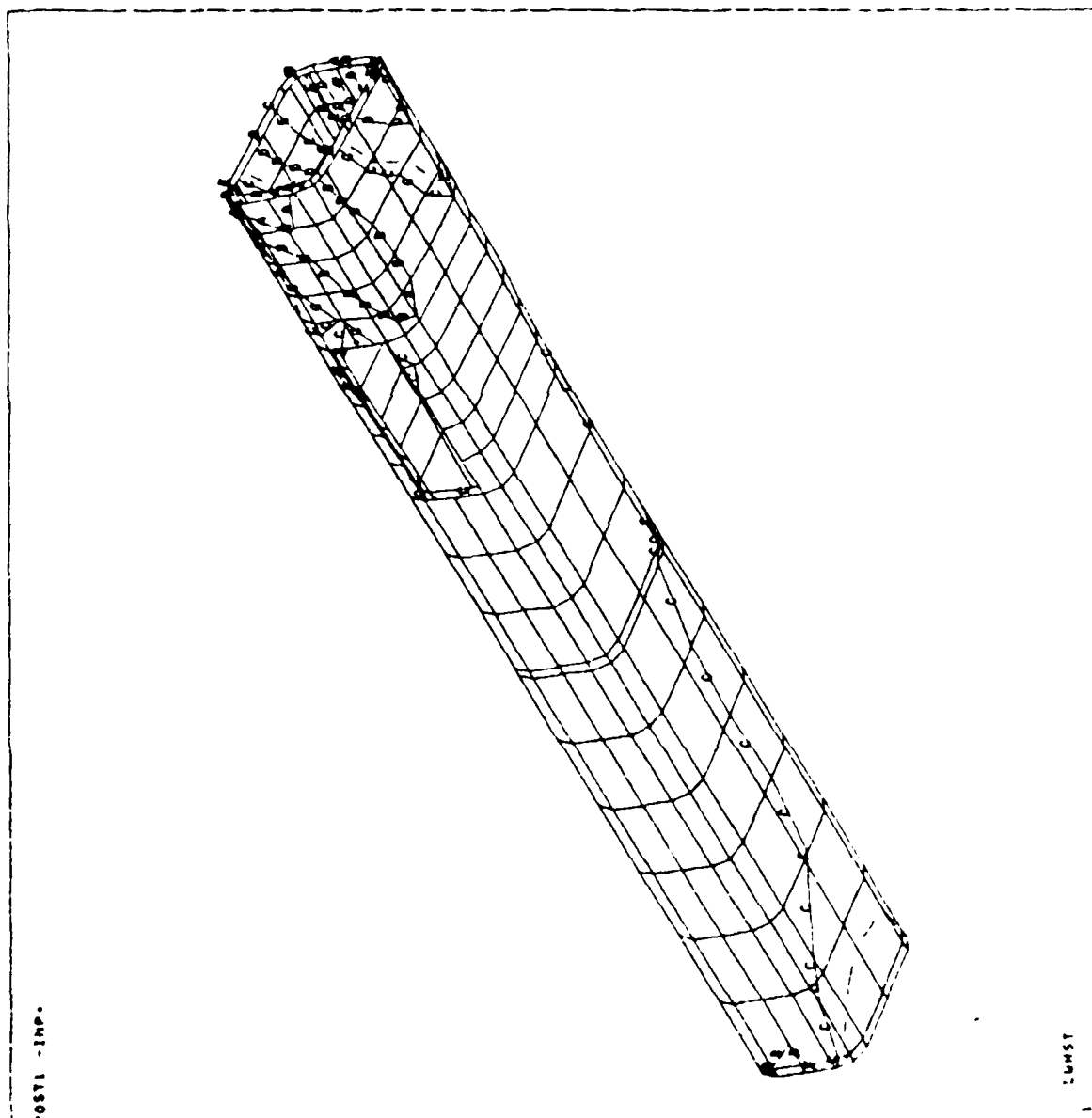




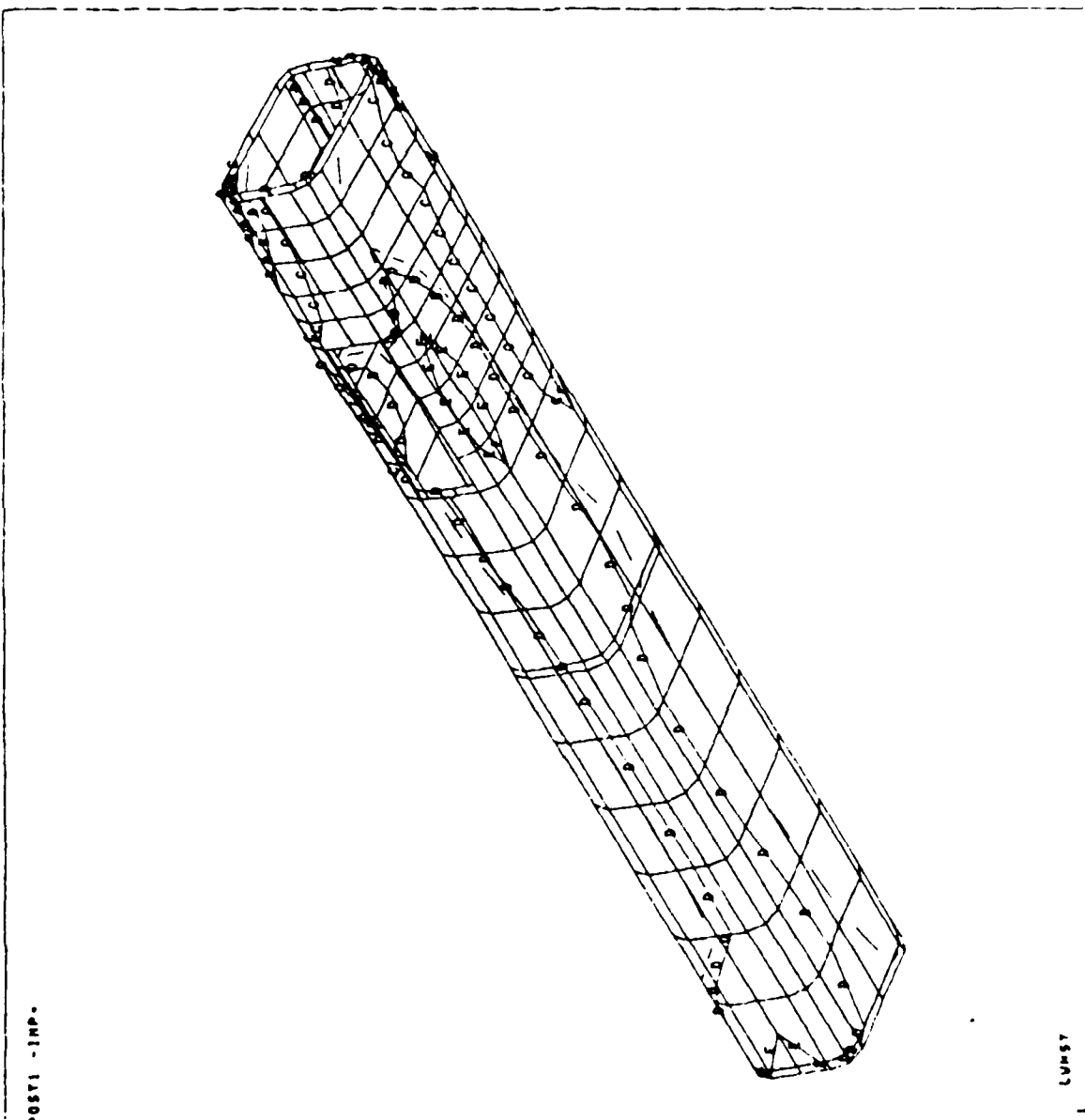
ANSYS 4.2B  
 DEC 4 1986  
 15:55:19  
 POST1 STRESS  
 STEP=1  
 IYER=1  
 SRG  
 ZU=1  
 DIST=160  
 ZF=116  
 CONE=24  
 MIDDEN  
 MX=45174  
 MN=-145233  
 A=-113583  
 B=-81831  
 C=-58879  
 D=-18327  
 E=13425



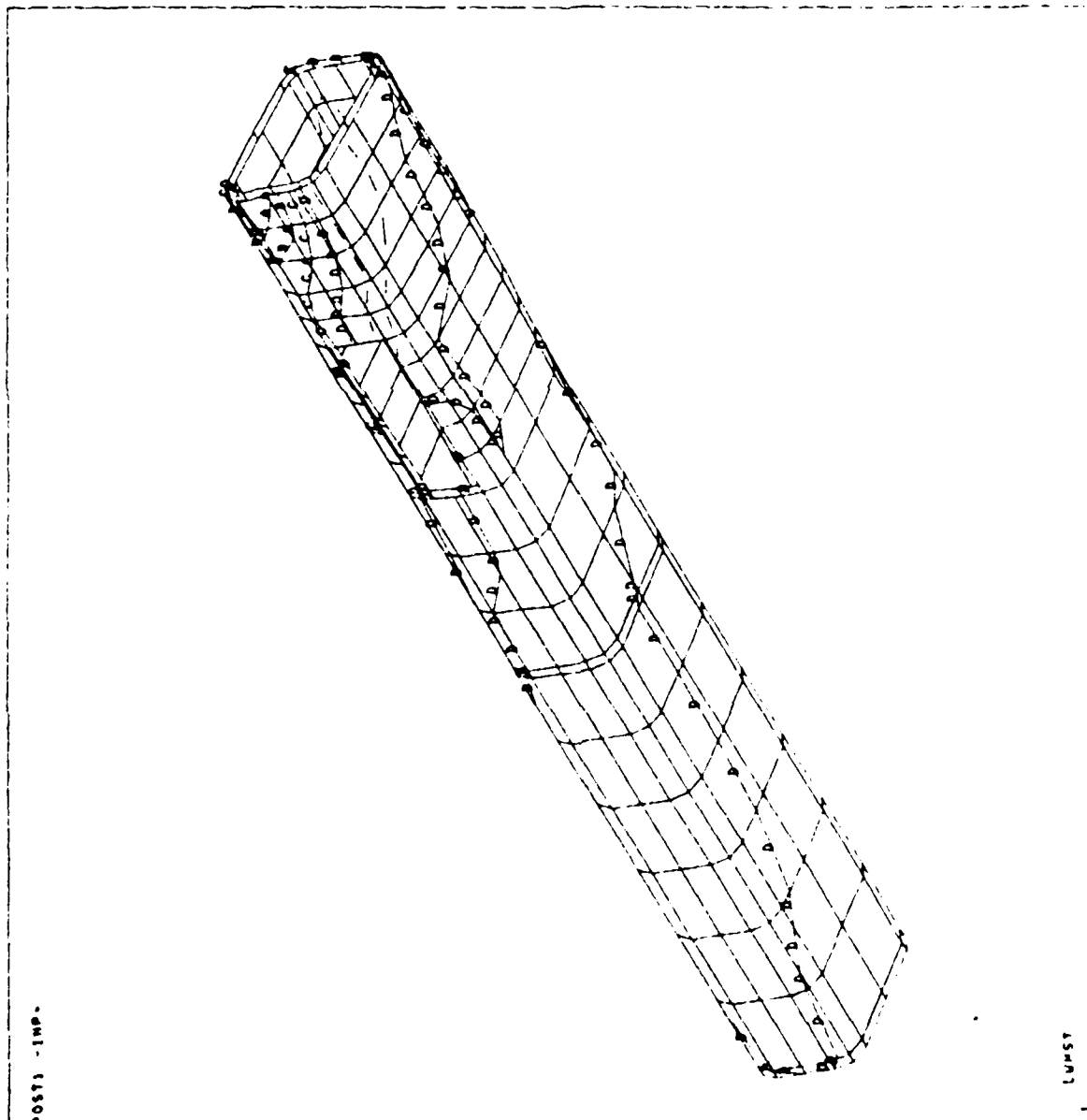
ANSYS 4.20  
 DCC 4 1986  
 15:48:26  
 POST1 STRESS  
 STEP=1  
 LAYER=1  
 SV6  
 KU=-1  
 VU=-1  
 ZU=-1  
 DIST=104  
 ZF=116  
 MIDDEN  
 MX=2758  
 MY=-3289  
 MZ=2281  
 B=-1873  
 C=-265  
 D=743  
 E=1751



ANSYS 4.28  
 DEC 4 1986  
 15:49:55  
 POST1 STRESS  
 STEP=1  
 LAYER=1  
 SHE  
 KU=-1  
 VU=-1  
 ZU=-1  
 DIST=104  
 ZF=116  
 MIDDLEM  
 RH=2359  
 MH=-4192  
 A=-3101  
 B=-2009  
 C=-817  
 D=175  
 E=1267



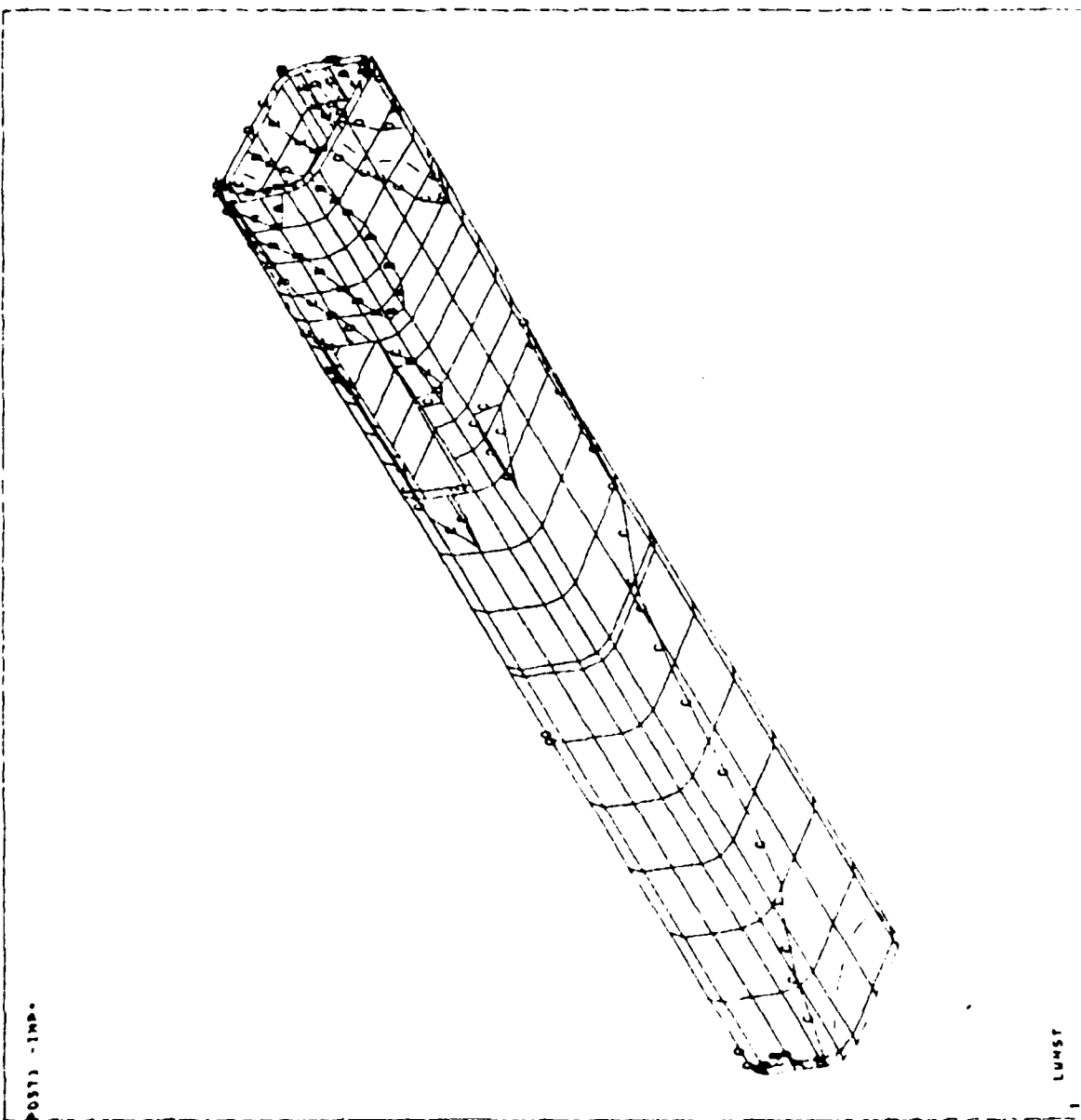
ANSYS 4.20  
 D/C 4 1986  
 IS:51126  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SK7  
 KU=-1  
 VU=-1  
 ZU=-1  
 DIST=104  
 ZF=LLC  
 MIDDLE  
 MX=45010  
 MY=-145109  
 MZ=-113489  
 B=-81789  
 C=-50089  
 D=-10389  
 E=13311



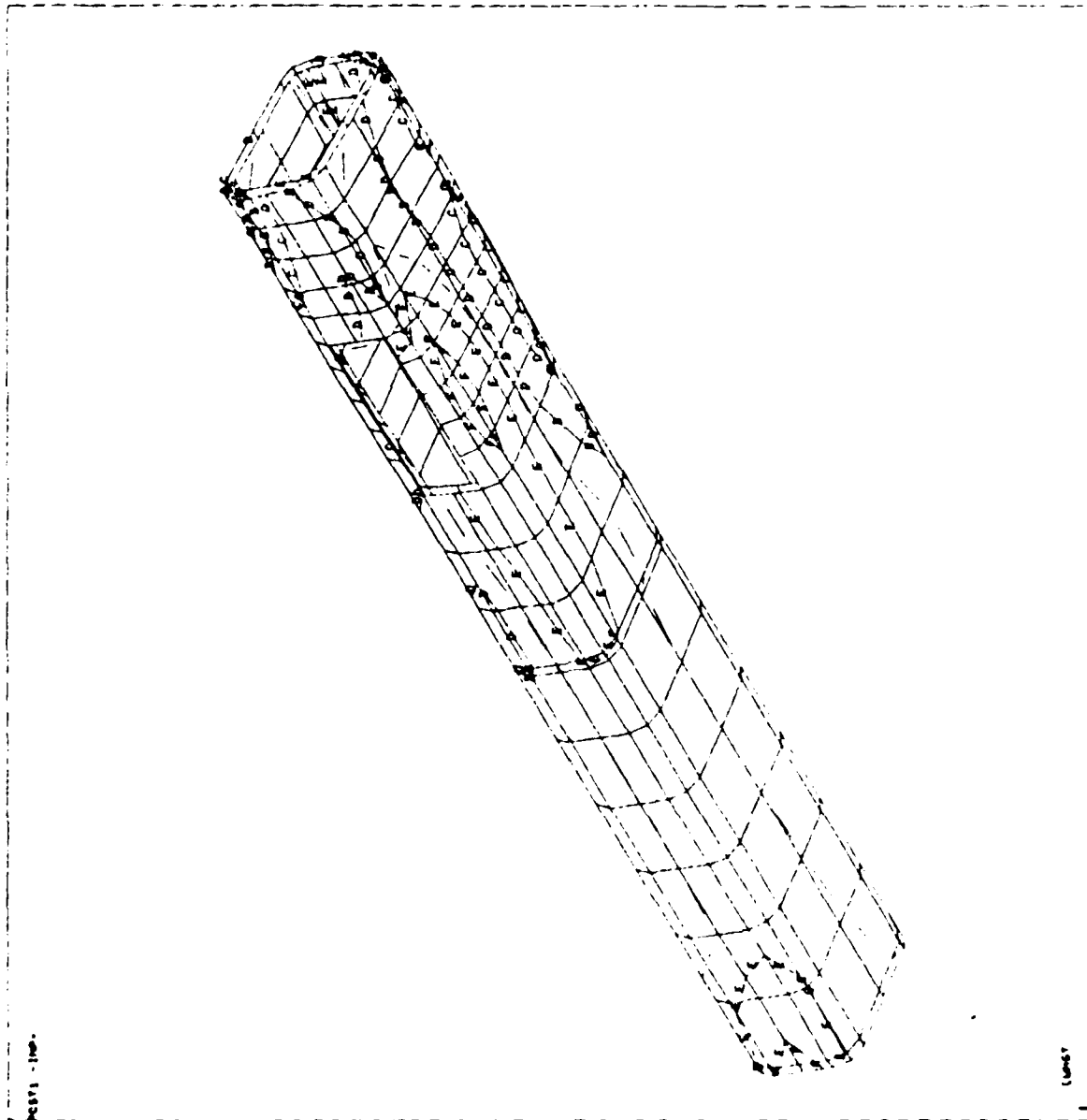
POST1 -IMP-

LUMST

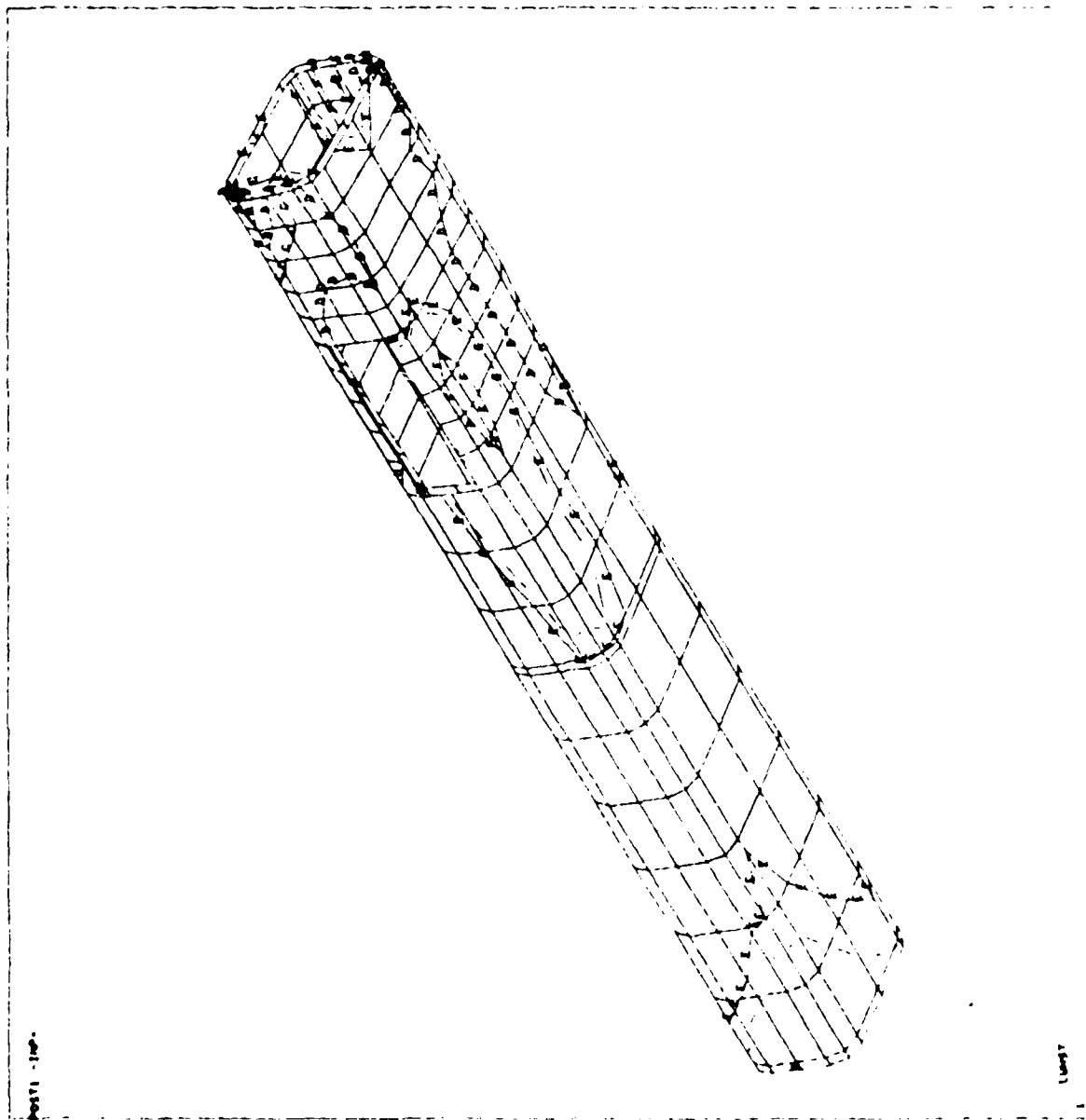
ANSYS 4.20  
 DEC 4 1986  
 151531.03  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SV7  
 MU=-1  
 VU=-1  
 ZU=-1  
 DIST=104  
 ZF=116  
 MIDEM  
 PK=2586  
 PK=-3333  
 A=-2248  
 B=-1261  
 C=-374  
 D=613  
 E=1600



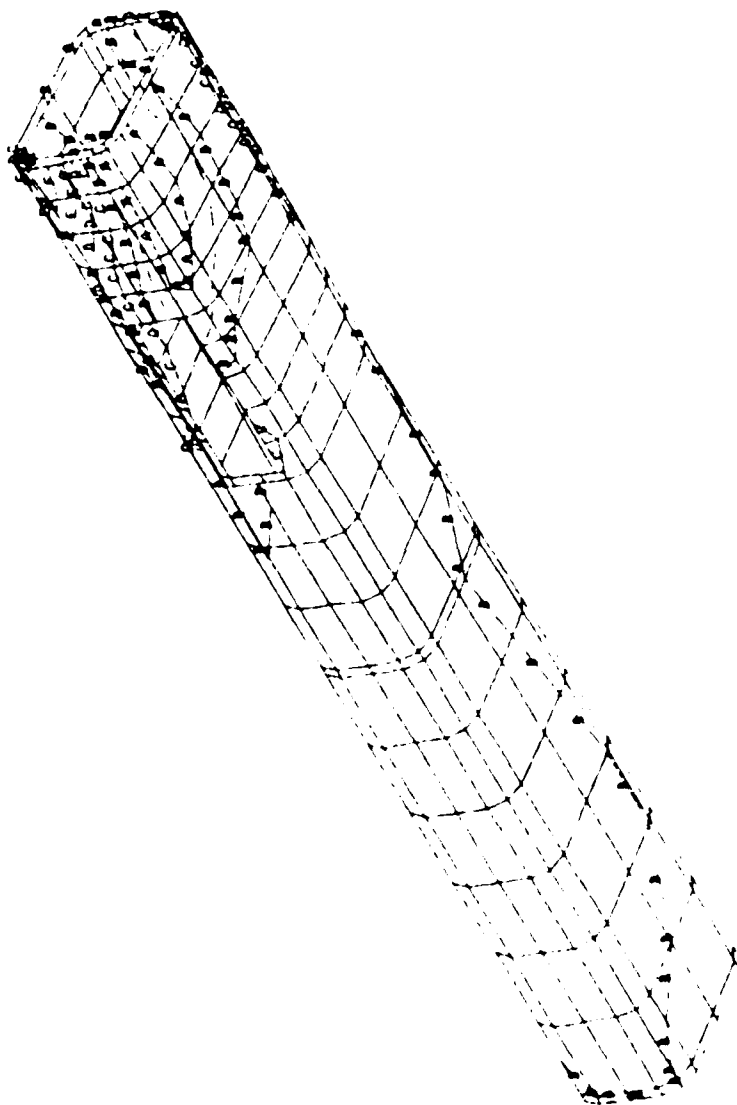
40849 4.25  
 DEC 4 1966  
 16/22/03  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SM7  
 RU=1  
 VU=1  
 ZU=1  
 DIST=106  
 ZF=116  
 MIDDLE  
 MU=2361  
 MU=4160  
 A=3230  
 B=2298  
 C=1365  
 D=434  
 E=498  
 F=1430



ANSYS 4.20  
 MEC 4 1000  
 10/24/11  
 POST1, STRESS  
 STEP=1  
 ITER=1  
 SUB  
 NU=1  
 MU=1  
 ZU=1  
 BIST=100  
 ZF=116  
 MIBCM  
 RU=33202  
 RM=-92220  
 A=-70291  
 B=-56360  
 C=-30429  
 D=-20400  
 E=-8567  
 F=-15360



ANSYS 4.20  
 DEC 4 1986  
 16:28:09  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SHB  
 XU=1  
 YU=1  
 ZU=1  
 C157-104  
 ZF-116  
 MIDDLEM  
 PK=7112  
 PM=1982  
 A=685  
 B=615  
 C=1915  
 D=2215  
 E=4515  
 F=5815

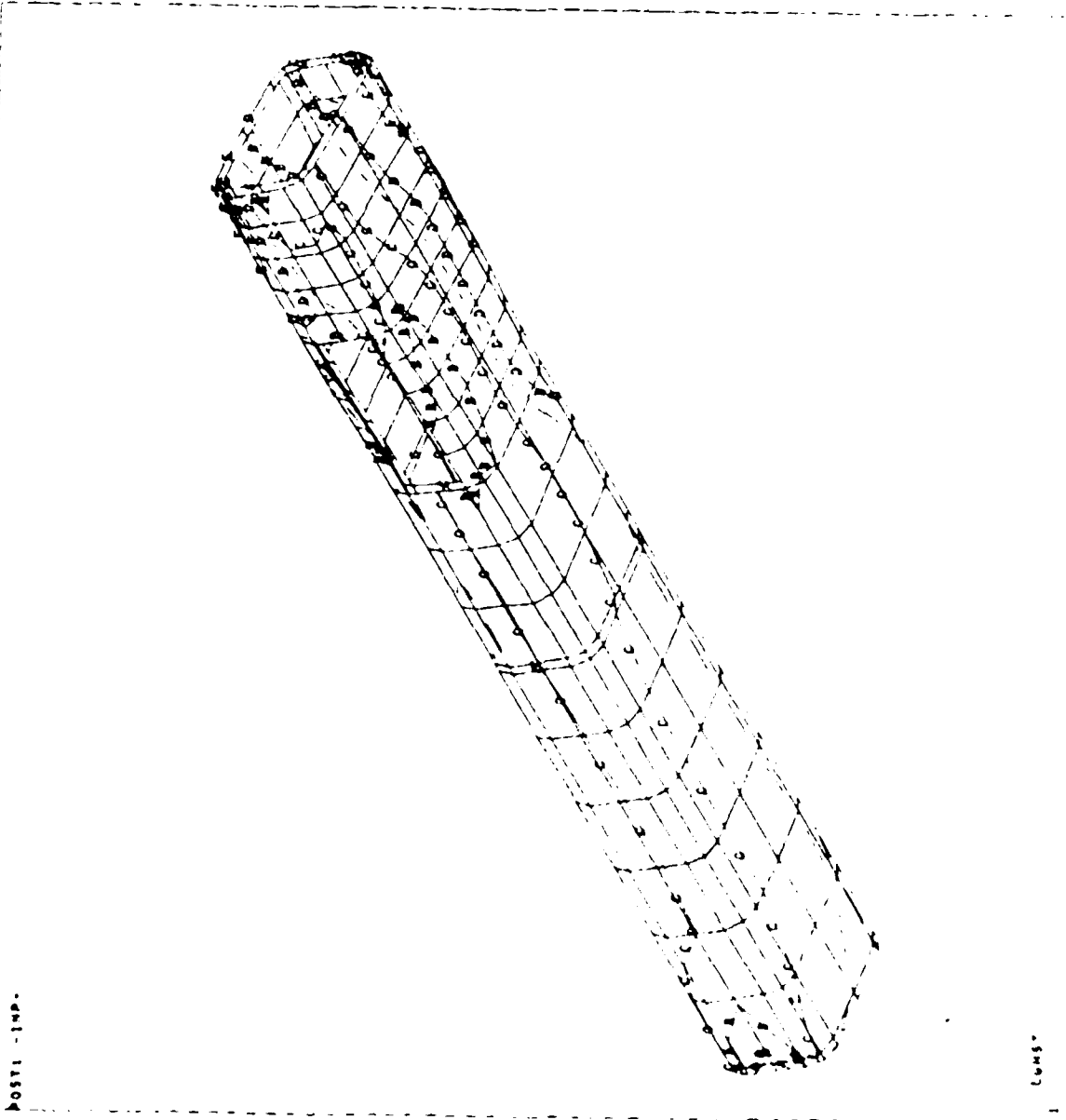


POST1 -IMP-

1

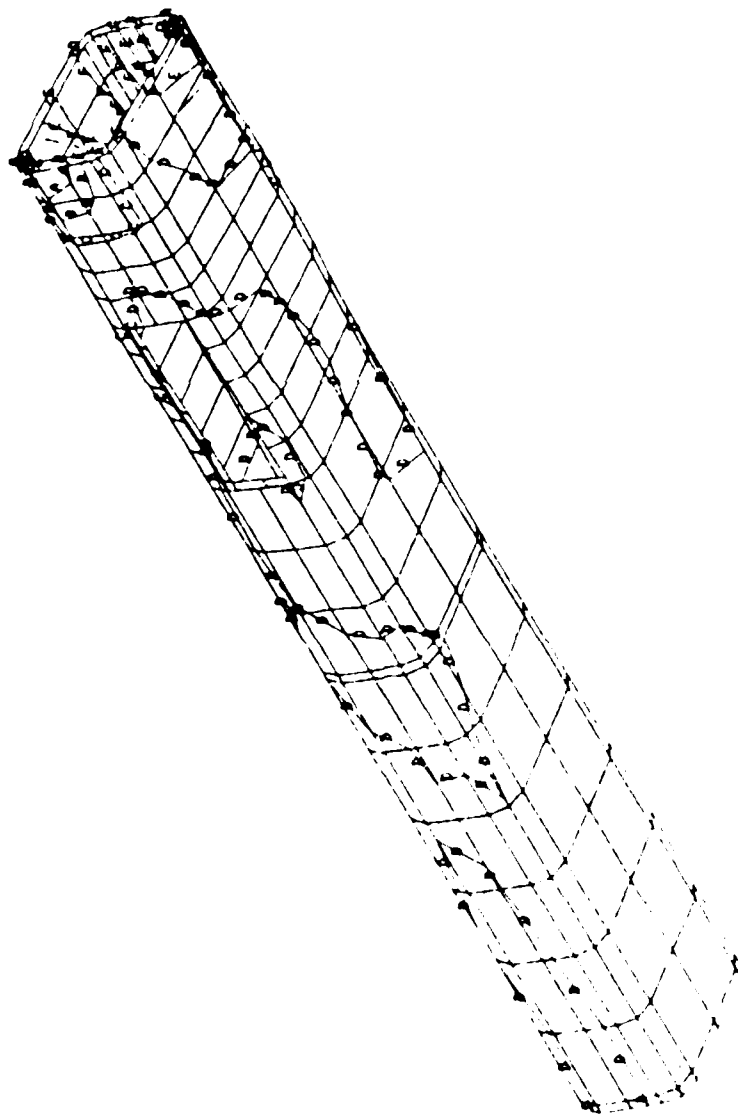


ANSYS 4.20  
 DEC 4 1986  
 16:33:38  
 POST1, STRESS  
 STEP=1  
 TIME=1  
 SDO  
 KU=1  
 VU=1  
 ZU=1  
 DIST=104  
 ZF=116  
 MIDDLE  
 MX=50118  
 MY=52086  
 A=38259  
 B=23529  
 C=8709  
 D=5931  
 E=20661  
 F=35331



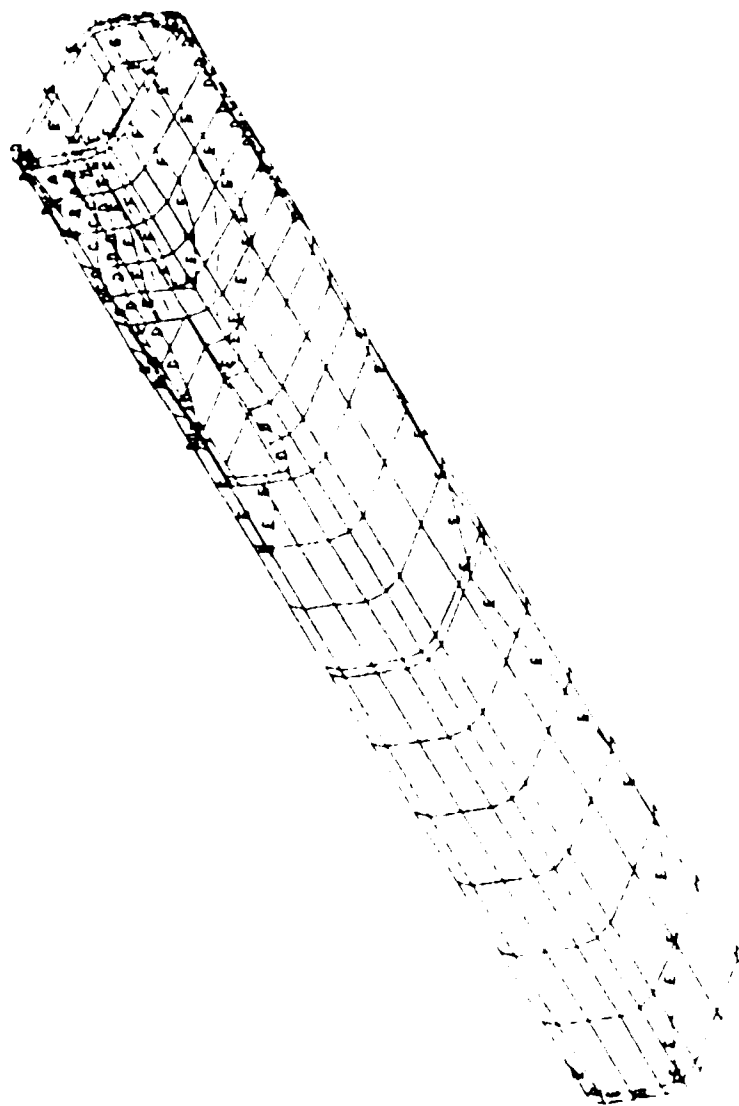
ANSYS 4.20  
 DEC 4 1986  
 16:35:56  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SVD  
 KU=1  
 VU=1  
 ZU=1  
 DIST=104  
 ZF=116  
 MIDDLE  
 MX=2641  
 MN=-5607  
 A=-4345  
 B=-3180  
 C=-2015  
 D=-850  
 E=315  
 F=1480

POST1 -IMP-



LEMS

ANSYS 4.20  
 ELIC 4 1986  
 16-37-46  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SMN  
 KU=-1  
 VU=-1  
 ZU=1  
 DIST=104  
 ZF=116  
 MIDDEN  
 M4=1987  
 MN=-7891  
 A=-5794  
 B=-4497  
 C=-3288  
 D=-1983  
 E=-606  
 F=-691

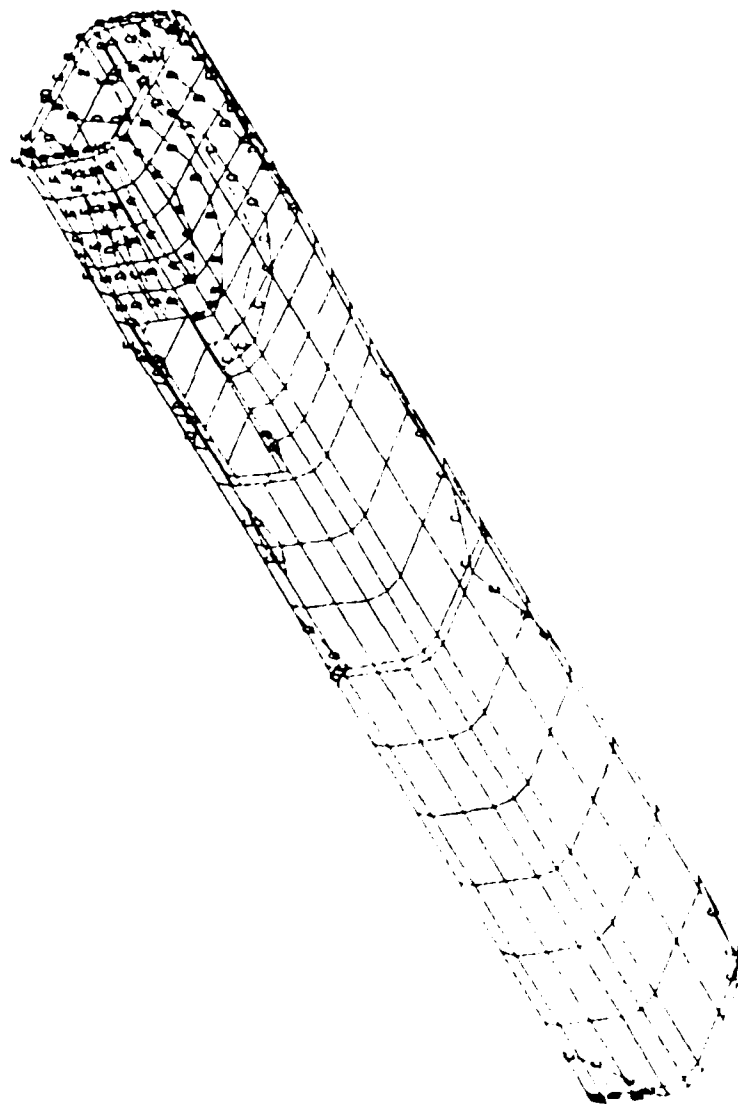


POST1 -IMP-

LUNST

AMVS 4.28  
 ECC 4 1986  
 16:39:36  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SH10  
 KU=-1  
 VU=-1  
 ZU=-1  
 DIST=104  
 ZF=116  
 MIDDEN  
 MM=61867  
 MM=-30202  
 A=-24765  
 B=-10326  
 C=4113  
 D=18552  
 E=32991  
 F=47430

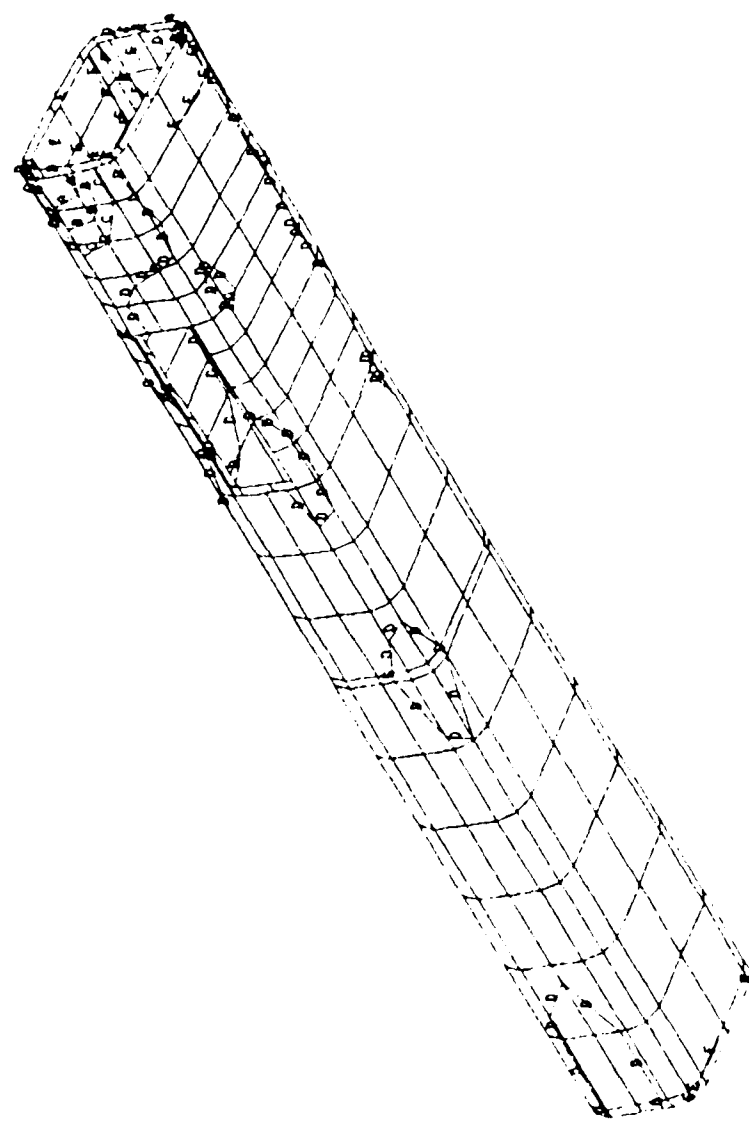
POST1 -IMP-



LMST

ANSYS 4.20  
 DEC 4 1986  
 1614114  
 POST1 STRESS  
 STEP=1  
 ITEM=1  
 SV10  
 KU=-1  
 VU=-1  
 ZU=1  
 DIST=104  
 ZF=116  
 MIDDEN  
 MK=2505  
 MN=6452  
 A=-5174  
 B=-3804  
 C=-2614  
 D=-1334  
 E=-53.6  
 F=1226

POST1 -IMP.

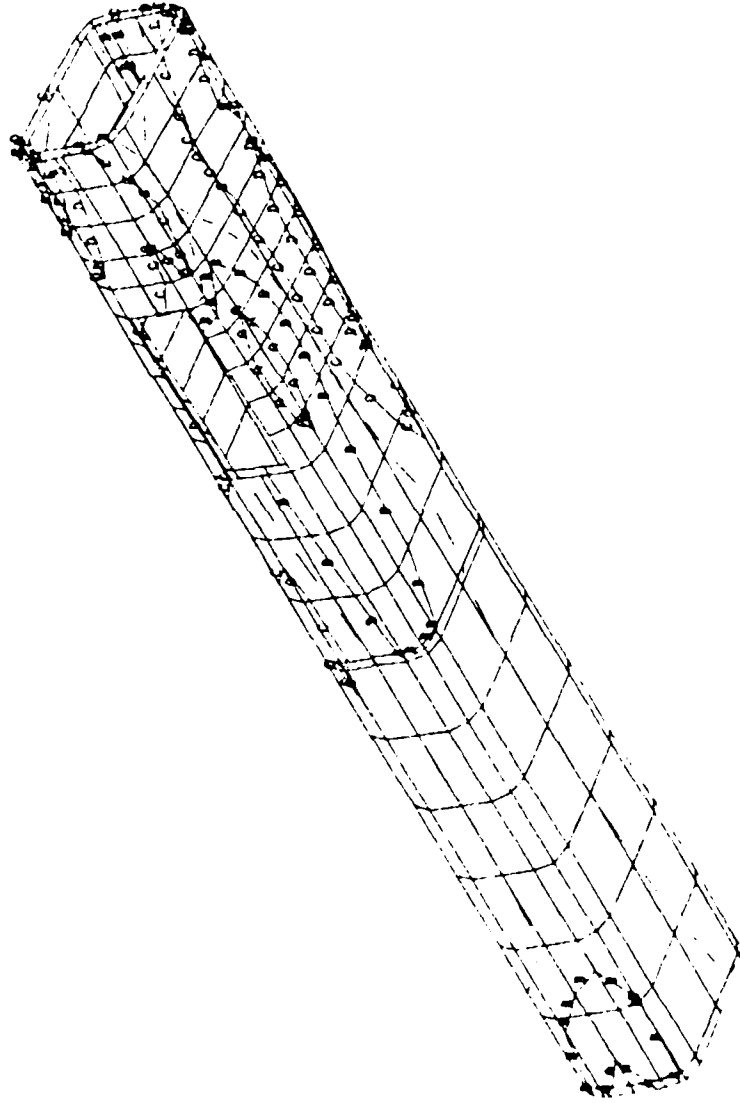


LMST

131

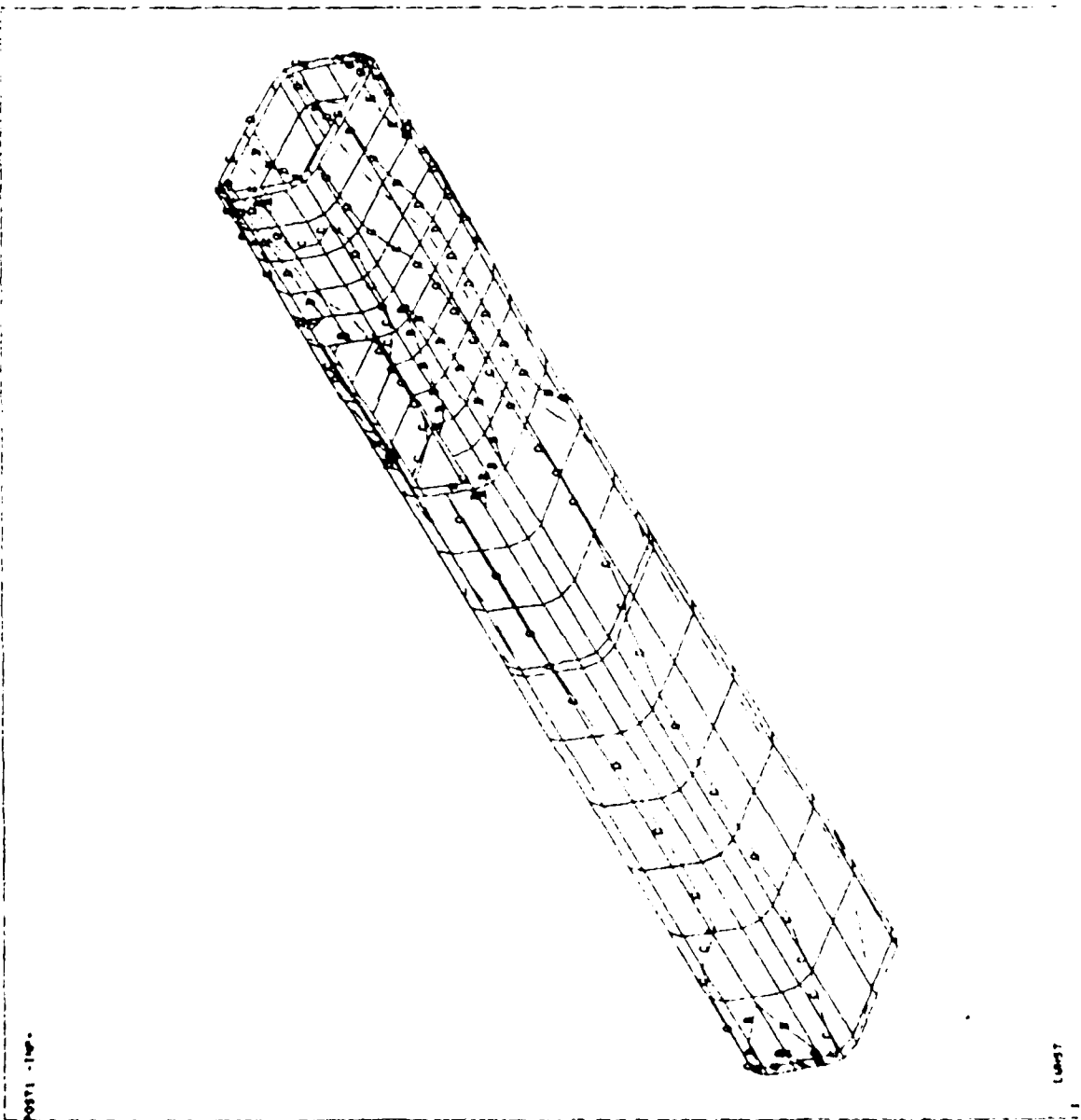
ANSYS 4.20  
 DEC 4 1986  
 16142145  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SM10  
 XU=-1  
 YU=-1  
 ZU=1  
 DIST=104  
 ZF=116  
 MIDDEN  
 MX=4112  
 MY=-2367  
 A=-1438  
 B=-513  
 C=412  
 D=1337  
 E=2262  
 F=3187

POST1 -IMP-



LU457

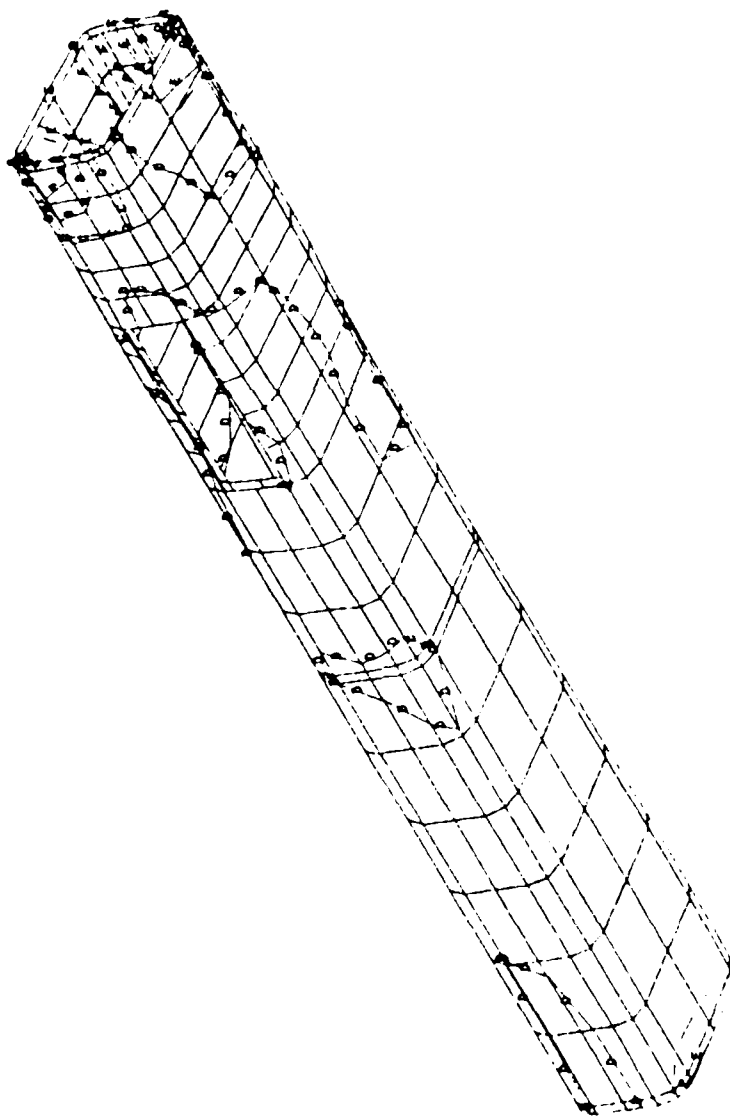
ANALYSIS 4.20  
 DEC 4 1986  
 17:08:16  
 POST1, STRESS  
 STEP=1  
 ITER=1  
 SALL  
 NU=1  
 VU=1  
 ZU=1  
 DIST=100  
 ZF=116  
 MIDDEN  
 RU=49150  
 RW=52067  
 A=30371  
 B=23784  
 C=8107  
 D=5300  
 E=10077  
 F=24564



POST1 -110-

10007

000549 4.20  
DC 4 1006  
7.10-10  
POST-1 STRESS  
STEP-1  
17E(=1)  
SV11  
  
RV=-1  
VU=-1  
ZU=-1  
D167-100  
ZU-116  
M1020M  
M1-2840  
M1-5556  
M1-4700  
B-3241  
C-2003  
D-025  
E-233  
F-1101

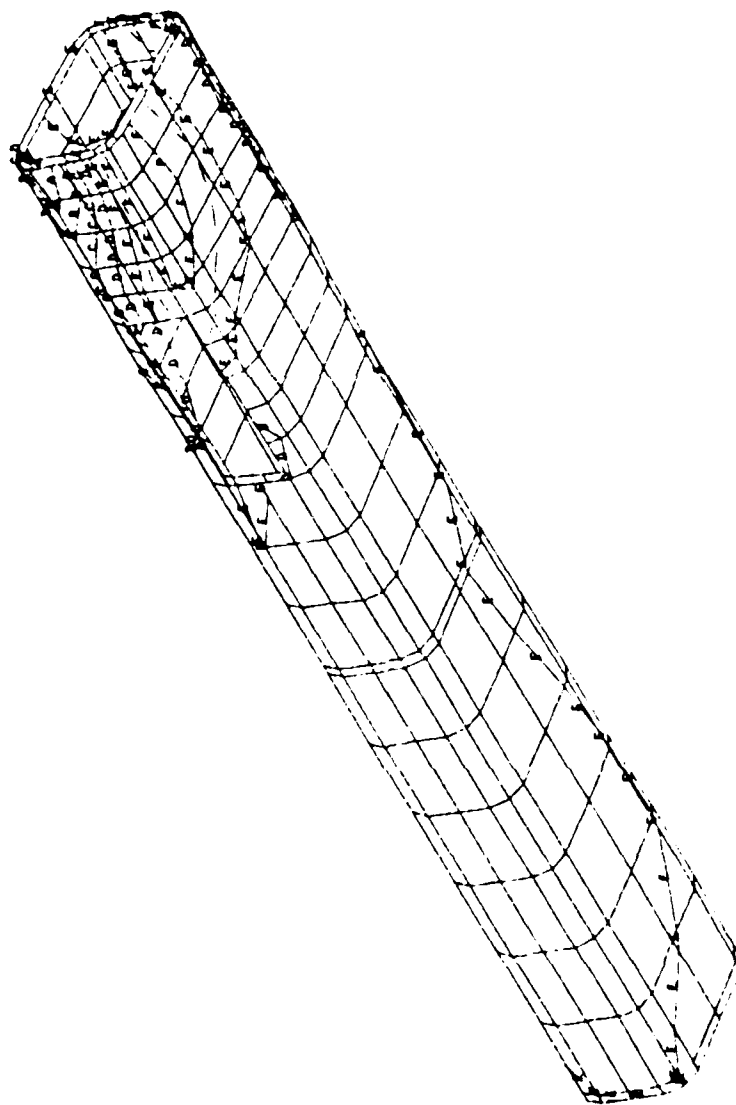


150971 - 3140

14-00000

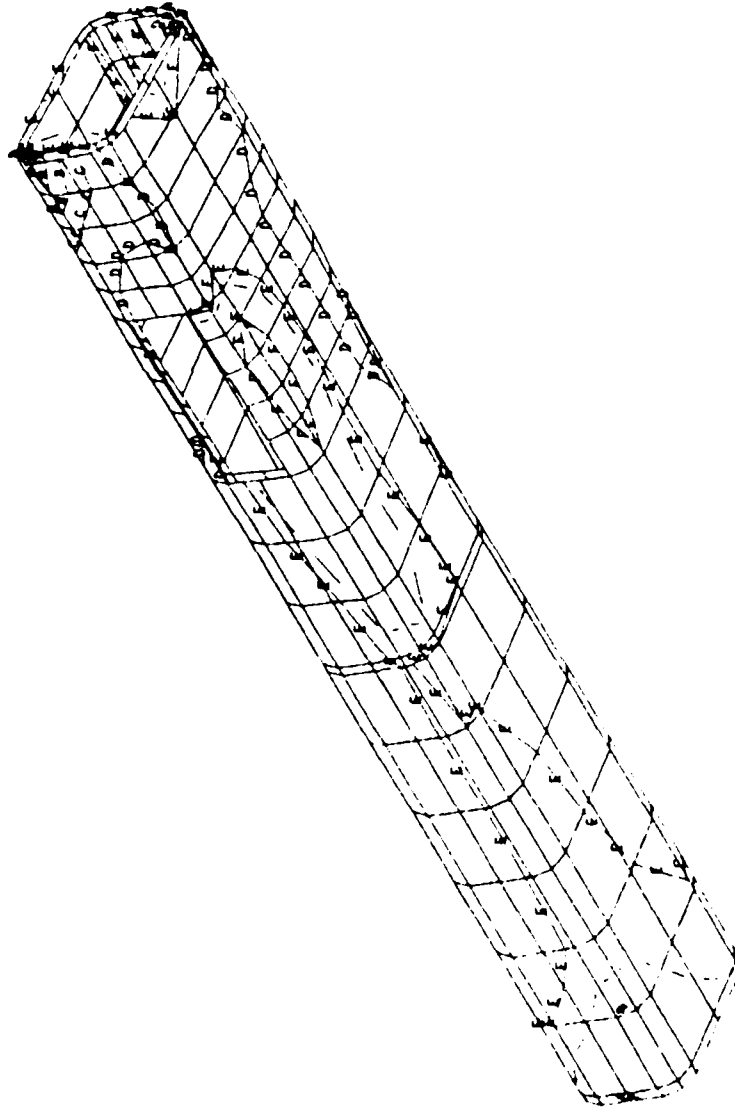


1999



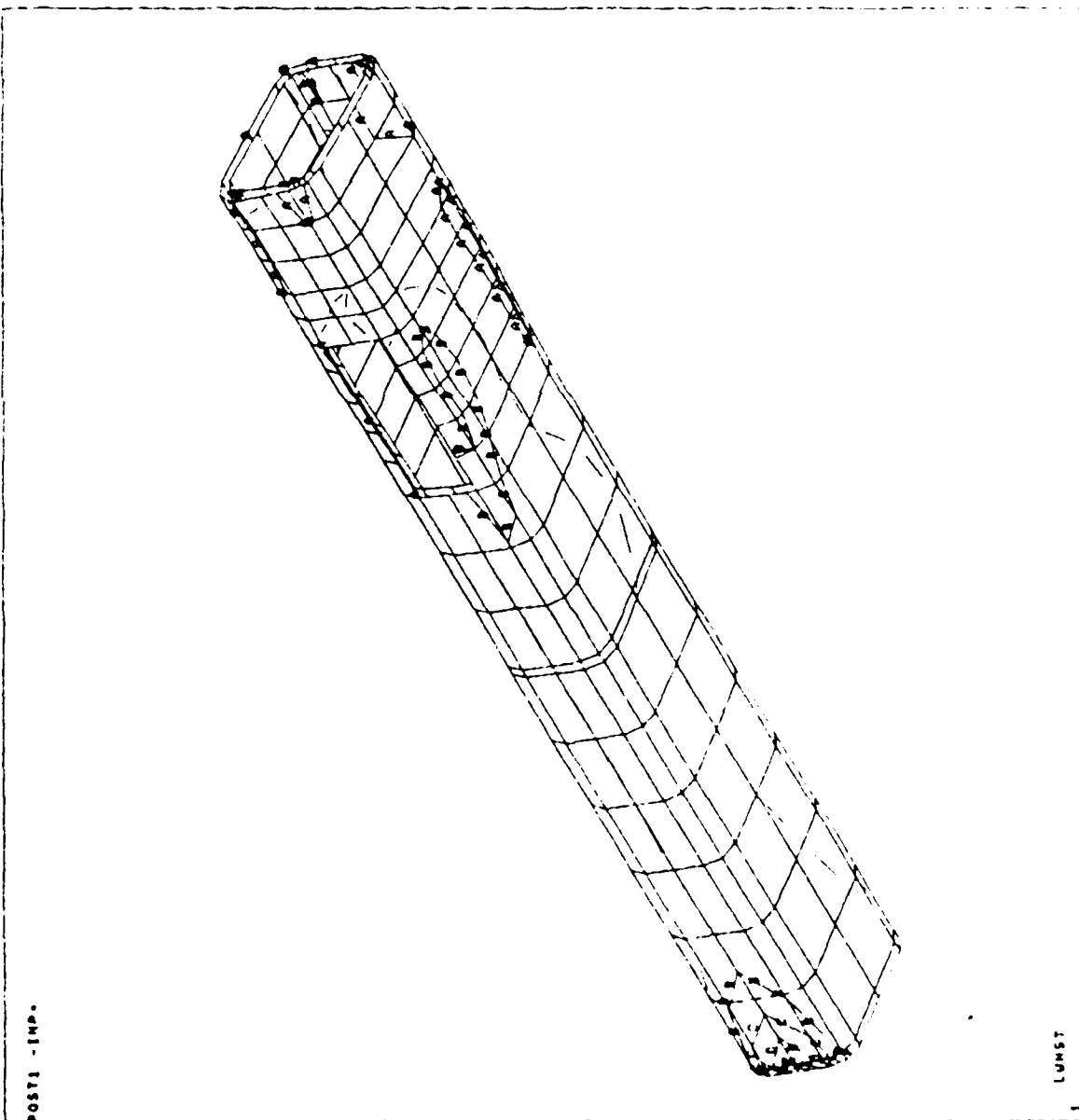
ANSYS 4.2D  
 DEC 4 1986  
 17:14:54  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SK12  
 KU=-1  
 VU=-1  
 ZU=1  
 DIST=104  
 ZF=116  
 MIDDEN  
 PK=31126  
 MN=92784  
 A=-75014  
 B=-57324  
 C=-39634  
 D=-21944  
 E=-4254  
 F=13436

POST1 -IMP-

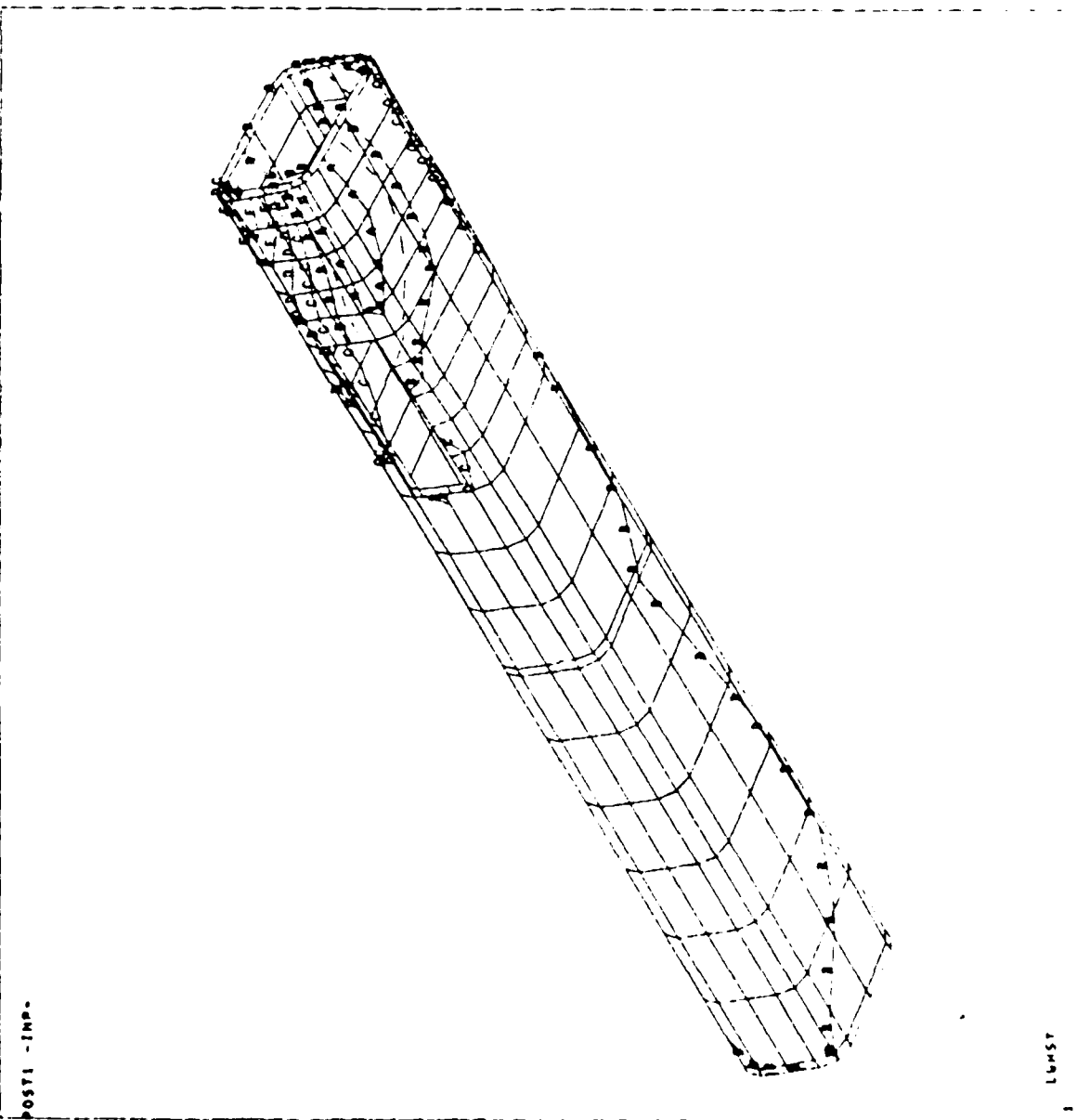


1 LUNST

ANSYS 4.28  
 DEC 4 1986  
 17:16:14  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SVL2  
 KU=-1  
 YU=-1  
 ZU=-1  
 DIST=104  
 ZF=116  
 MIDDEN  
 MA=13981  
 MM=3805  
 A=1352  
 B=1204  
 C=3760  
 D=6316  
 E=8872  
 F=11428

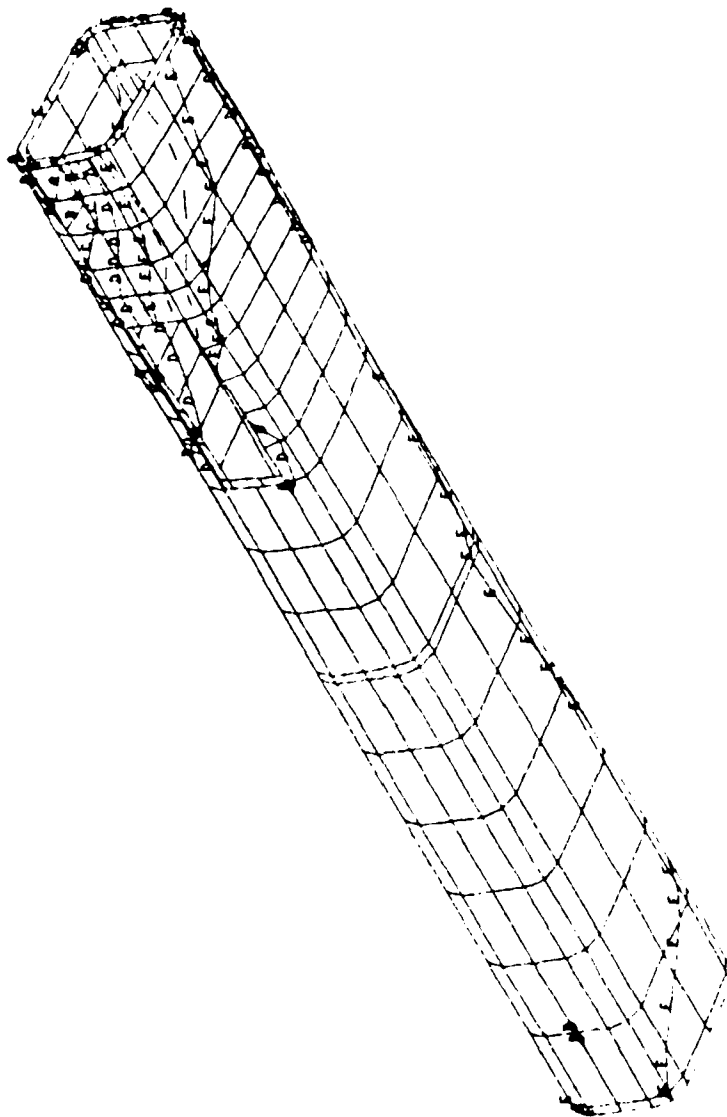


ANSYS 4.20  
 DEC 4 1986  
 17:17:30  
 POST1 STRESS  
 STEP=1  
 LAYER=1  
 SM12  
 KU=-1  
 VU=-1  
 ZU=1  
 DIST=104  
 ZF=116  
 MIDDLE  
 MX=7028  
 MY=-2004  
 A=-716  
 B=575  
 C=1866  
 D=3157  
 E=4448  
 F=5739



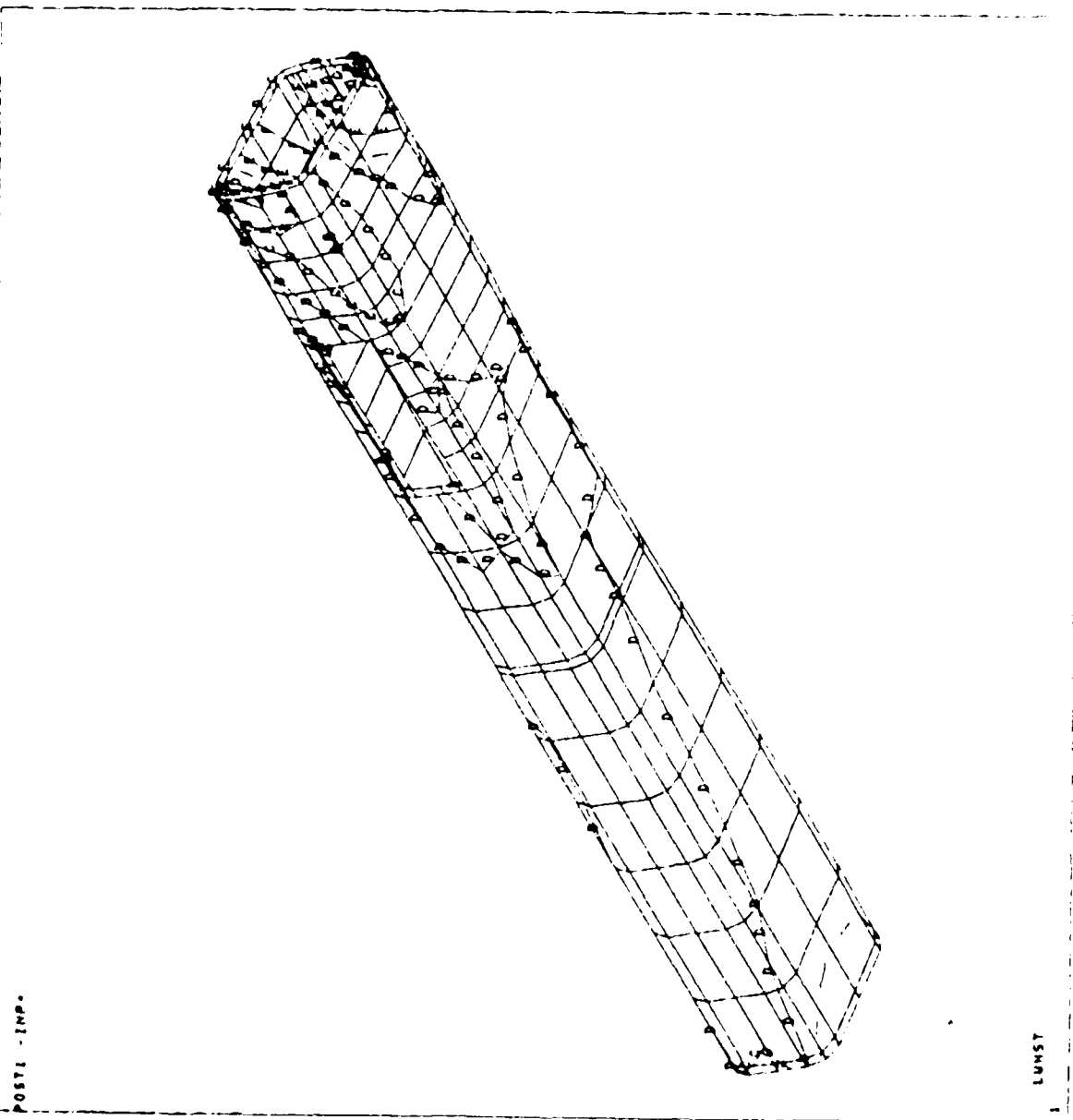
ANSYS 4.20  
 DEC 4 1986  
 17:19:11  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 S413  
 KU=1  
 VU=1  
 ZU=1  
 DIST=104  
 ZF=116  
 MIDDLE  
 RN=44517  
 RM=144755  
 P=117217  
 B=90678  
 C=63039  
 D=36600  
 E=9561  
 F=17478

POST1 -IMP.



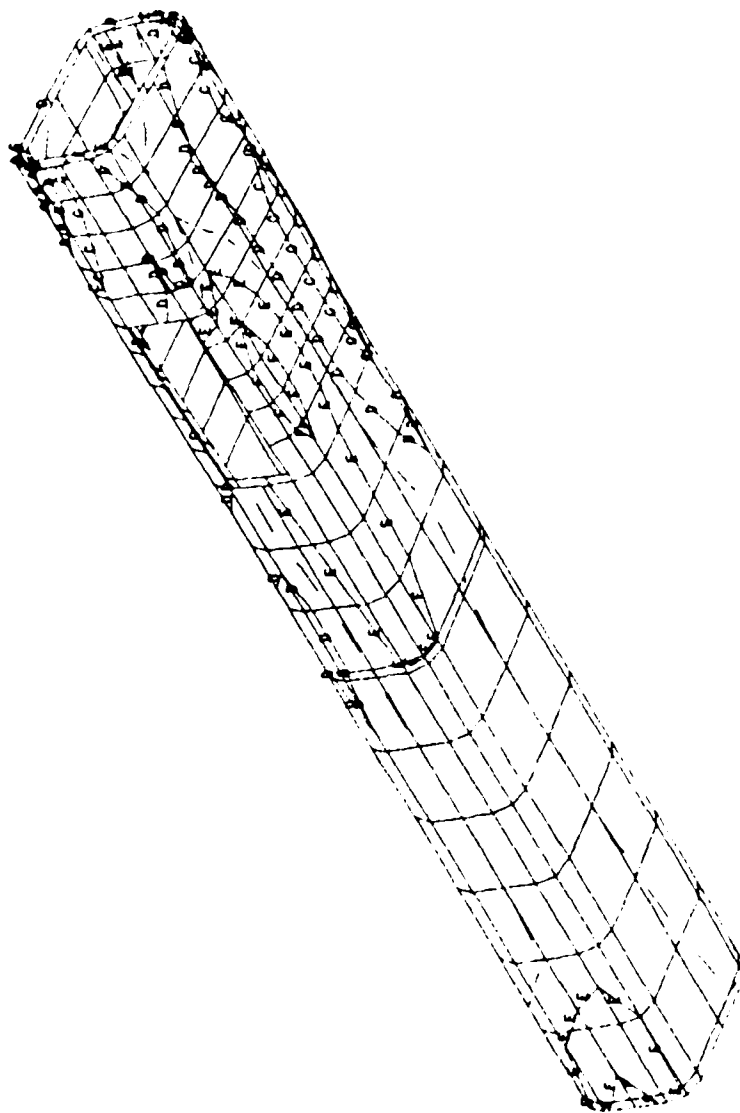
LUNST

ANSYS 4.28  
 DEC 4 1986  
 17:20:37  
 POST1, STRESS  
 STEP=1  
 ITER=1  
 SVL3  
 RV=-1  
 VU=-1  
 ZU=1  
 DIST=104  
 ZF=116  
 MIDDLE  
 MA=2164  
 MN=-3896  
 A=-2031  
 B=-2165  
 C=-1299  
 D=-433  
 E=433  
 F=1299



ANSYS 4.20  
 DEC 4 1986  
 17:22:00  
 POST1, STRESS  
 STEP=1  
 ITER=1  
 SM13  
 KU=-1  
 VU=-1  
 ZU=-1  
 DIST=104  
 ZF=116  
 MIDDLE  
 MX=2365  
 MY=-4064  
 A=-3147  
 B=-2828  
 C=-1309  
 D=-390  
 E=520  
 F=1448

POST1 -IMP-

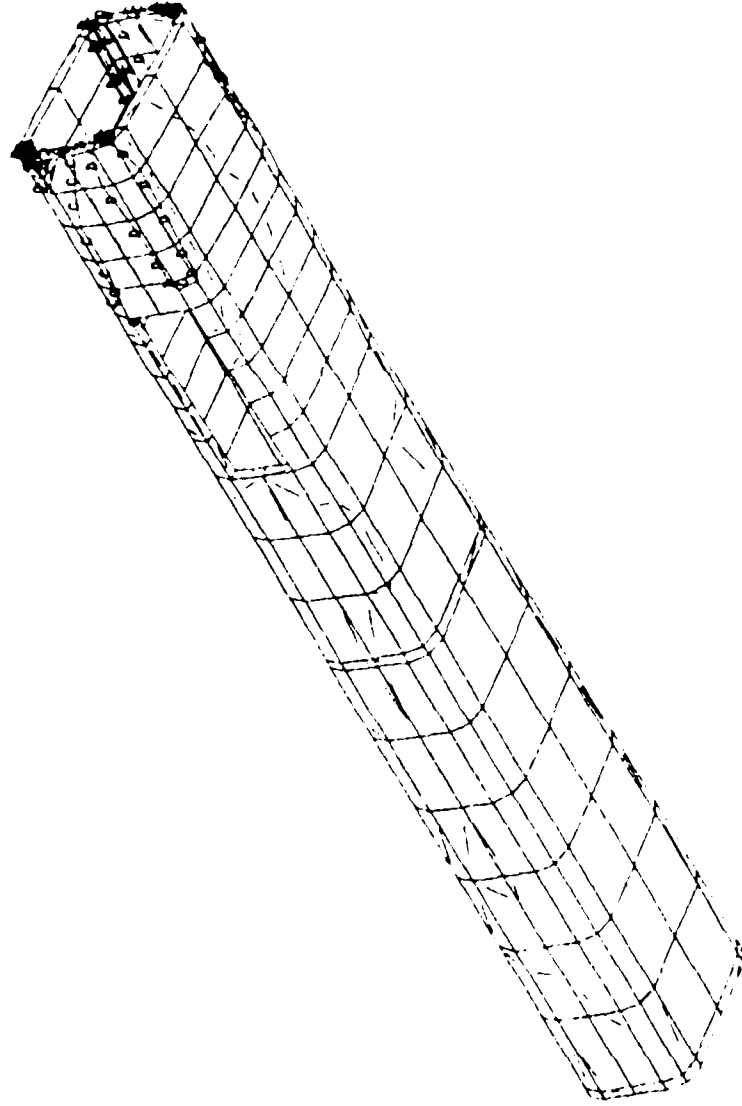


LUMST

ANSYS 4.28  
 DEC 4 1986  
 17:24:34  
 POST1 STRESS  
 STEP=1  
 ITER=1  
 SK  
 BOTTOM  
 STRESS ELEM CS  
 KV=-1  
 VU=-1  
 ZU=1  
 DIST=104  
 ZF=116  
 MIDDLEM  
 RX=342  
 RN=-326  
 A=-232  
 B=-136  
 C=-40  
 D=56  
 E=152  
 F=248

LORE

POST1 -IMP-



LUMST



ANSYS 4.20  
DEC 4 1986  
17128152

POST1 STRESS

STEP=1

ITER=1

SVZ

TOP

STRESS ELEM CS

KU=-1

VU=-1

ZU=-1

DIST=104

ZF=116

MIDLEN

MX=80.2

MY=52.2

A=-58.5

B=-43.5

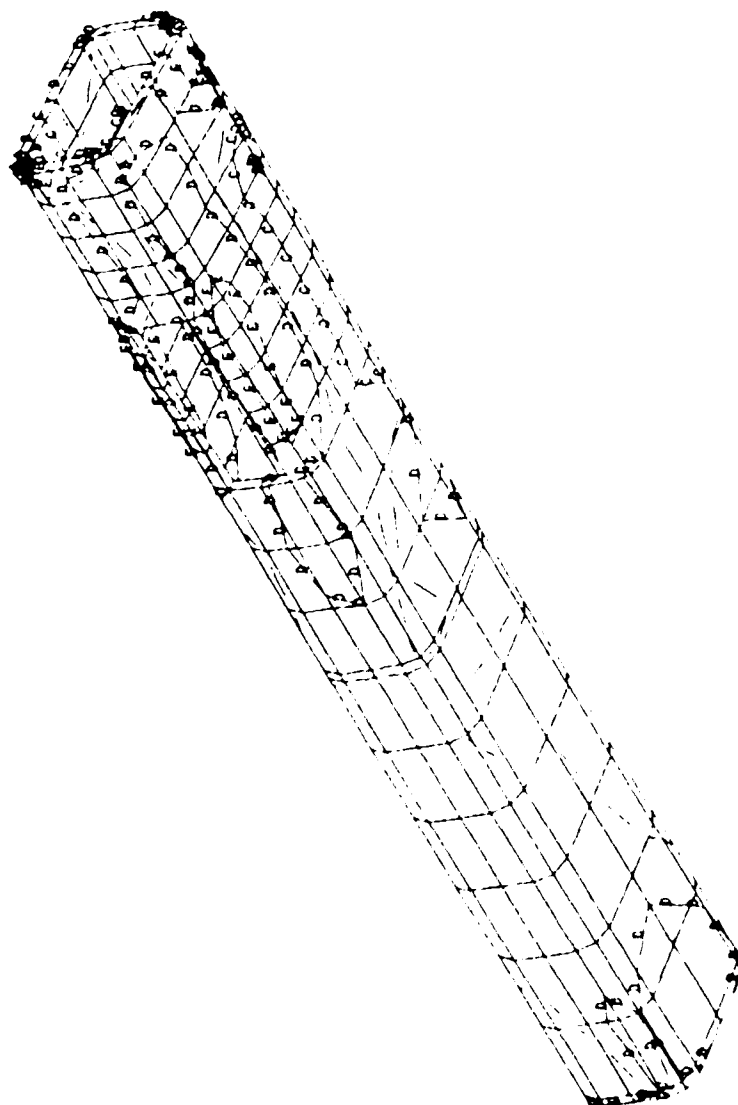
C=-18.5

D=6.52

E=31.5

F=56.5

POST1 -1ND-



LUMST

D2/380

CEL MEMO: DECEMBER 16, 1986

AD-A183 992

LIGHTWEIGHT TOWED HOWITZER DEMONSTRATOR PHASE 1 AND  
PARTIAL PHASE 2 VOLUM (U) FMC CORP MINNEAPOLIS MINN  
NORTHERN ORDNANCE DIV R RATHE ET AL APR 87

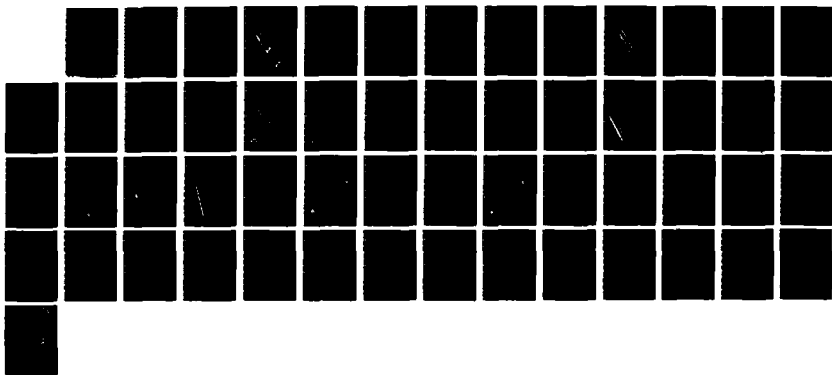
4/4

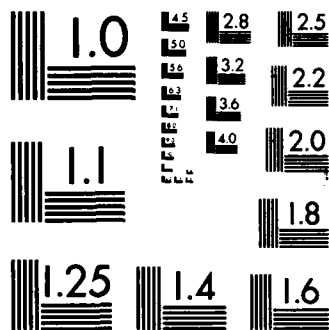
UNCLASSIFIED

FMC-E-3041-VOL-D2-PT-4 DAAA21-86-C-0047

F/G 19/6

NL





MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

**FMC** Central Engineering Laboratories  
Santa Clara

Interoffice

To L. Liebhardt\*

From C. R. Ortloff

Subject ELEMENT AND NODE PRINTOUT FOR THE 14 NOV 86  
VERSION OF THE COMPOSITE CRADLE

Date Dec. 16, 1986

cc E. Thuse  
J. Ries  
A. Amberg  
B. Zierwick  
R. Kazares  
R. Rathe

\*one copy of printout  
and original figures

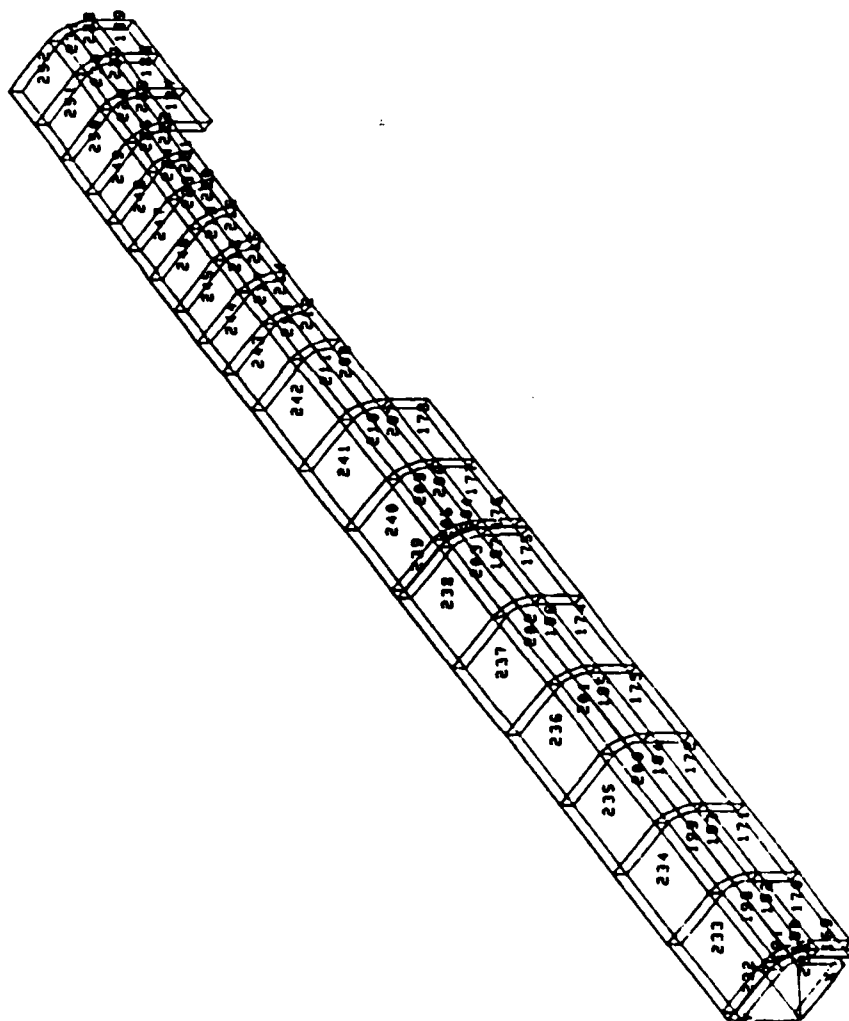
144-192

Attached is the element, node, stress and strain printout for the 14 Nov 86 version of the composite cradle. The attached figures 144-192 are consistent with the stress results reported in the 8 Dec 86 memo (CRO to R. Rathe, figures 82-143). An element printout (figures 179-192) is attached also to aid the location of the elements by nodal position. Zoomed diagrams of both element and node numbers are included also for the 20-node solids and 8-node composite elements. Printout explanation is given in ANSYS manual V.I, II for each stif value; additional explanation of contour plot averaging methods is given in V. II, p. 6.0.5-6.

*CRO*  
C. R. Ortloff

ANSYS 4.2B  
DEC 15 1986  
15158155  
PREP7 ELEMENTS

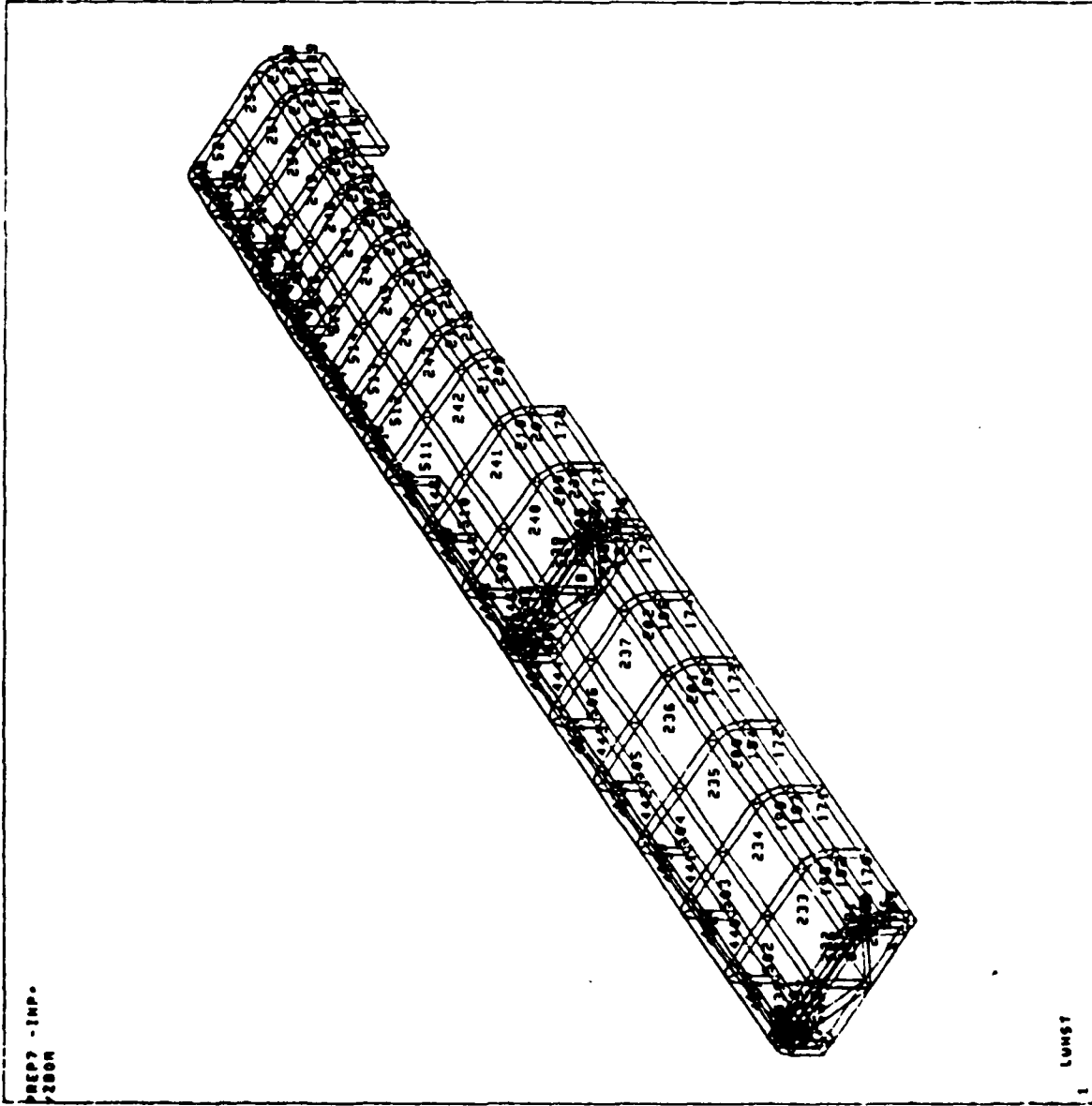
CORE



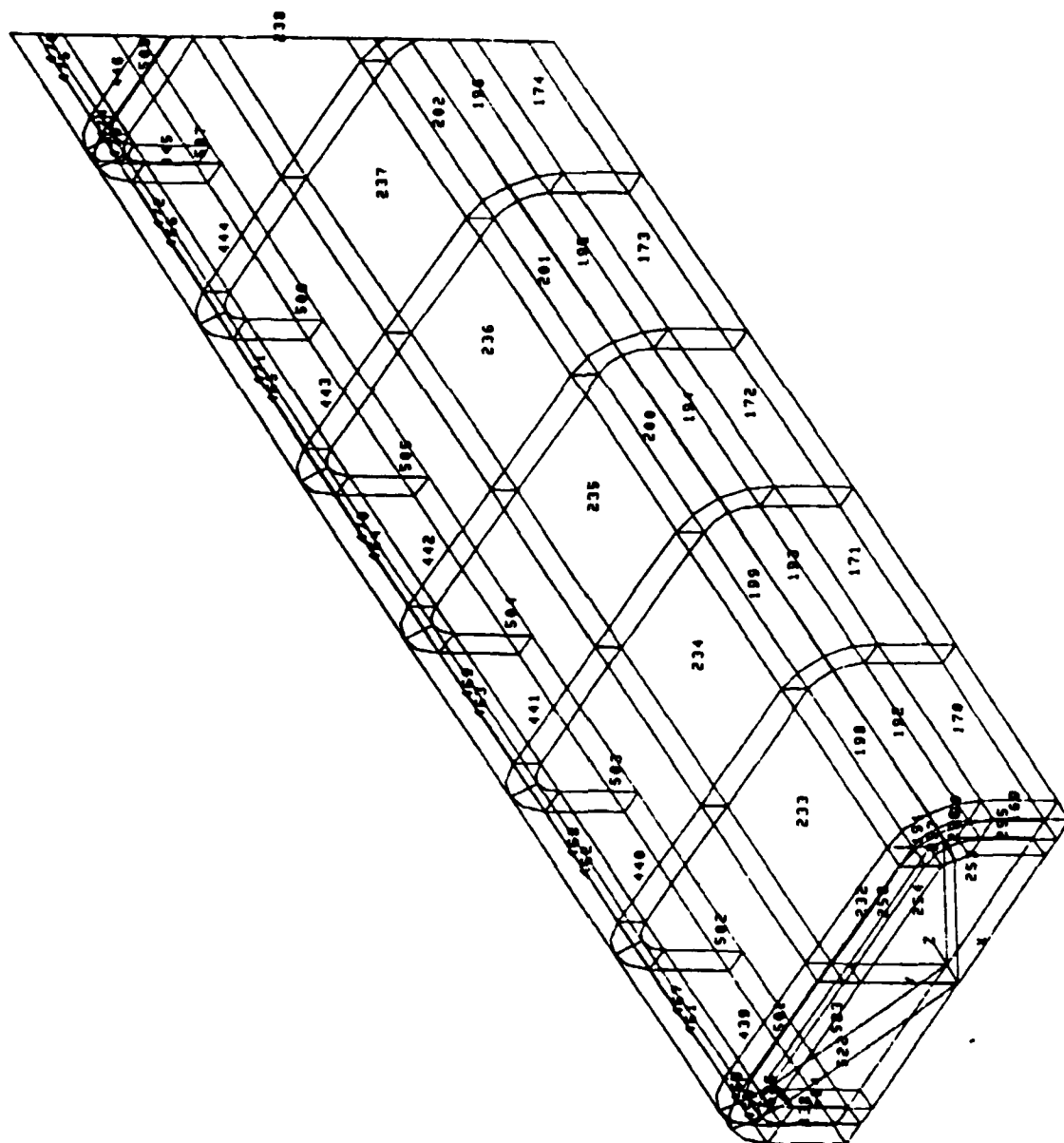
ANSYS 4.20  
DEC 15 1986  
16140150  
PREP7 ELEMENTS  
ENUN-1

ZOOM  
XU--1  
YU--1  
ZU--1  
DIST-104  
XF--1.73  
YF-4.50  
ZF-116  
VETO-1.18

CORE



CORE

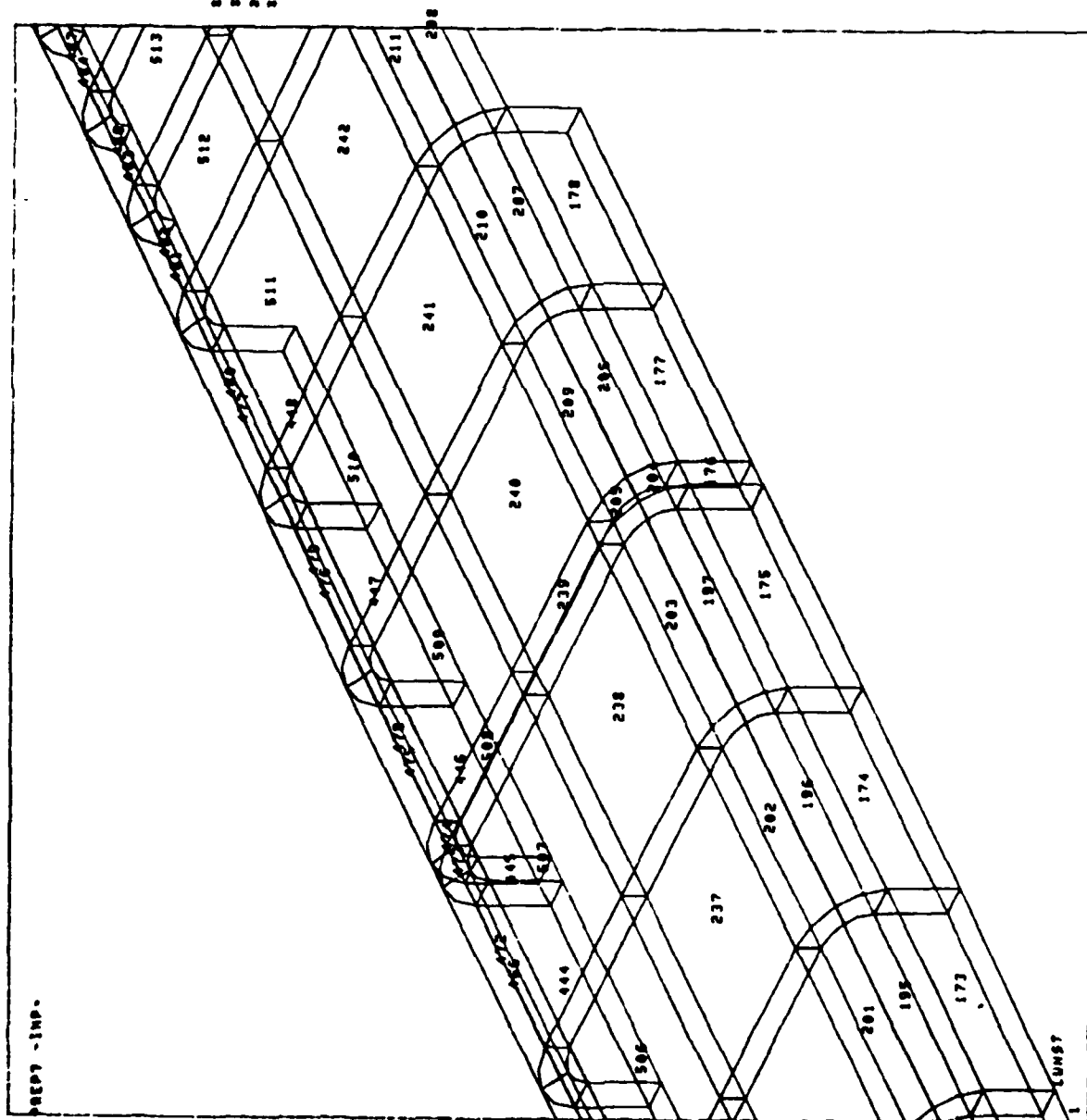




ANSYS 4.20  
 DEC 15 1986  
 16143140  
 PREP7 ELEMENTS  
 (NUM=1)

CORE

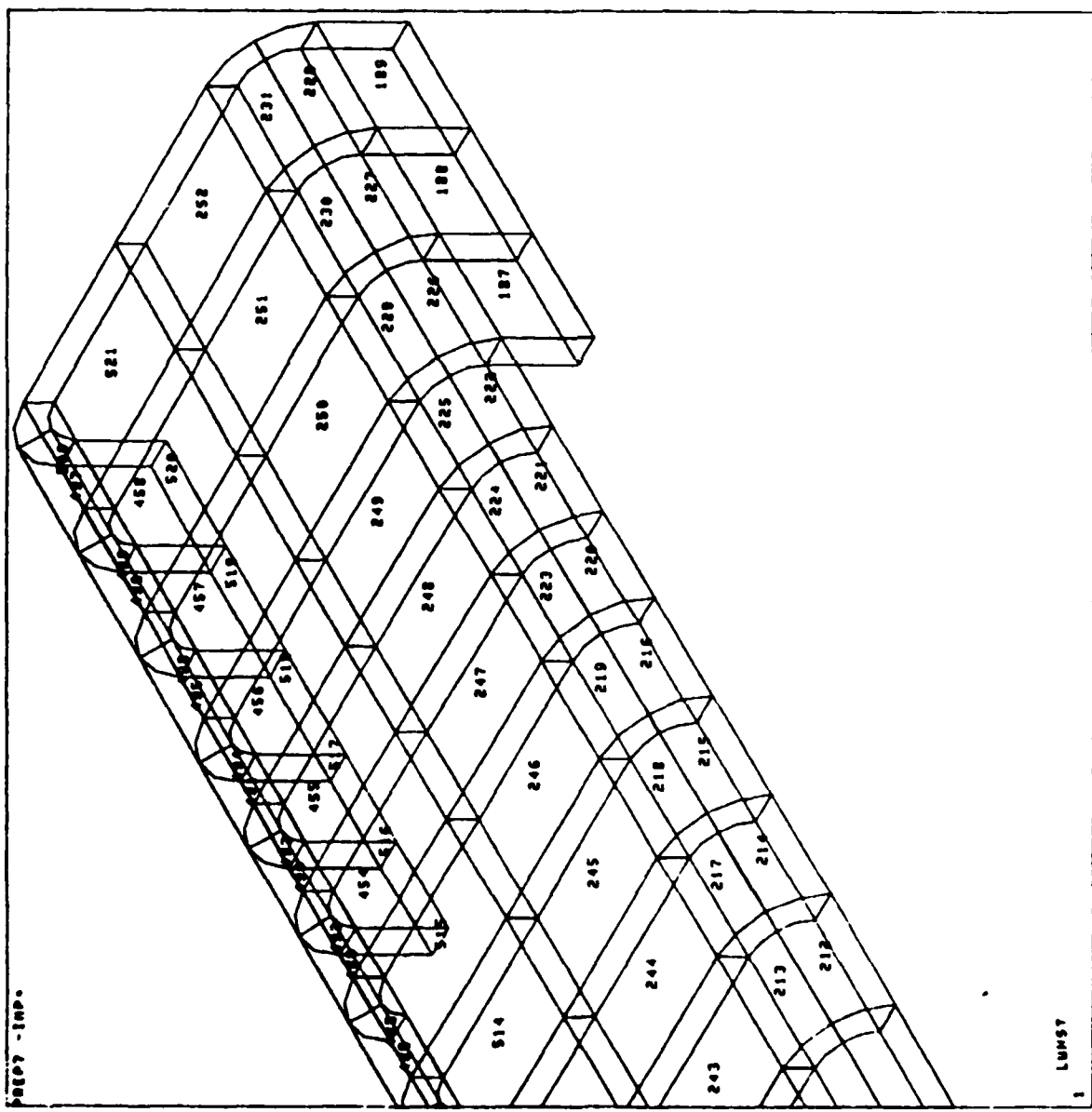
ZOOM  
 KU=-1  
 VU=-1  
 ZU=1  
 2 DIST=45.3  
 2 XF=-.179  
 2 YF=4.02  
 2 ZF=115  
 XRT0=1.38  
 YRT0=1.18



ANSYS 4.20  
 DEC 15 1986  
 18144120  
 PREP7 ELEMENTS  
 EMUN=1

CORE

ZOOR  
 XU=-1  
 YU=-1  
 VU=1  
 1 DIST=43.2  
 2 KF=33.5  
 3 VF=27.5  
 4 ZF=173  
 KATO=1.38  
 VATO=1.41



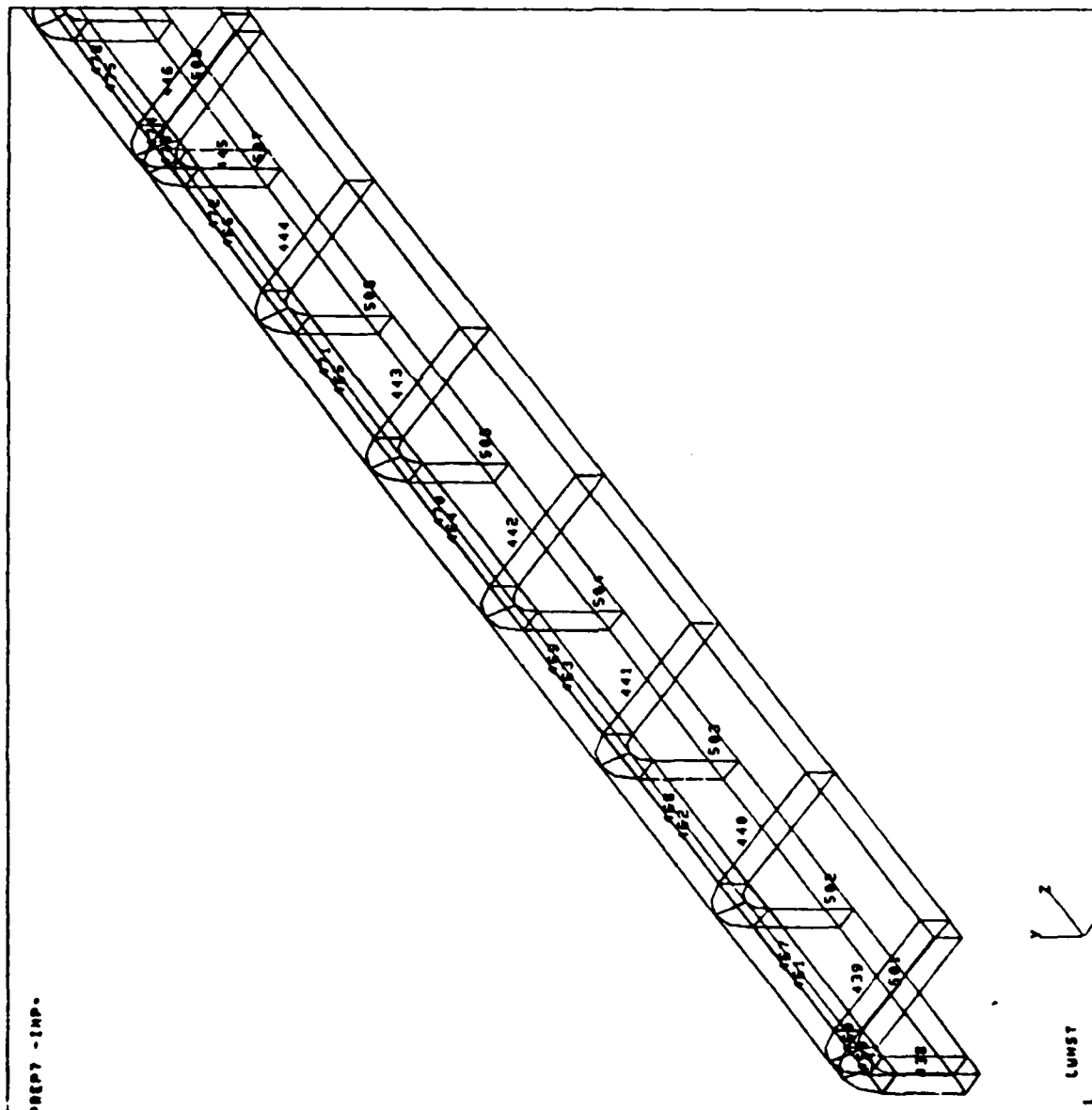
PREP7 -IMP.

LMMS7

ANSYS 4.2B  
 DEC 15 1986  
 15109136  
 PREP7 ELEMENTS  
 ENUR=1

CORE

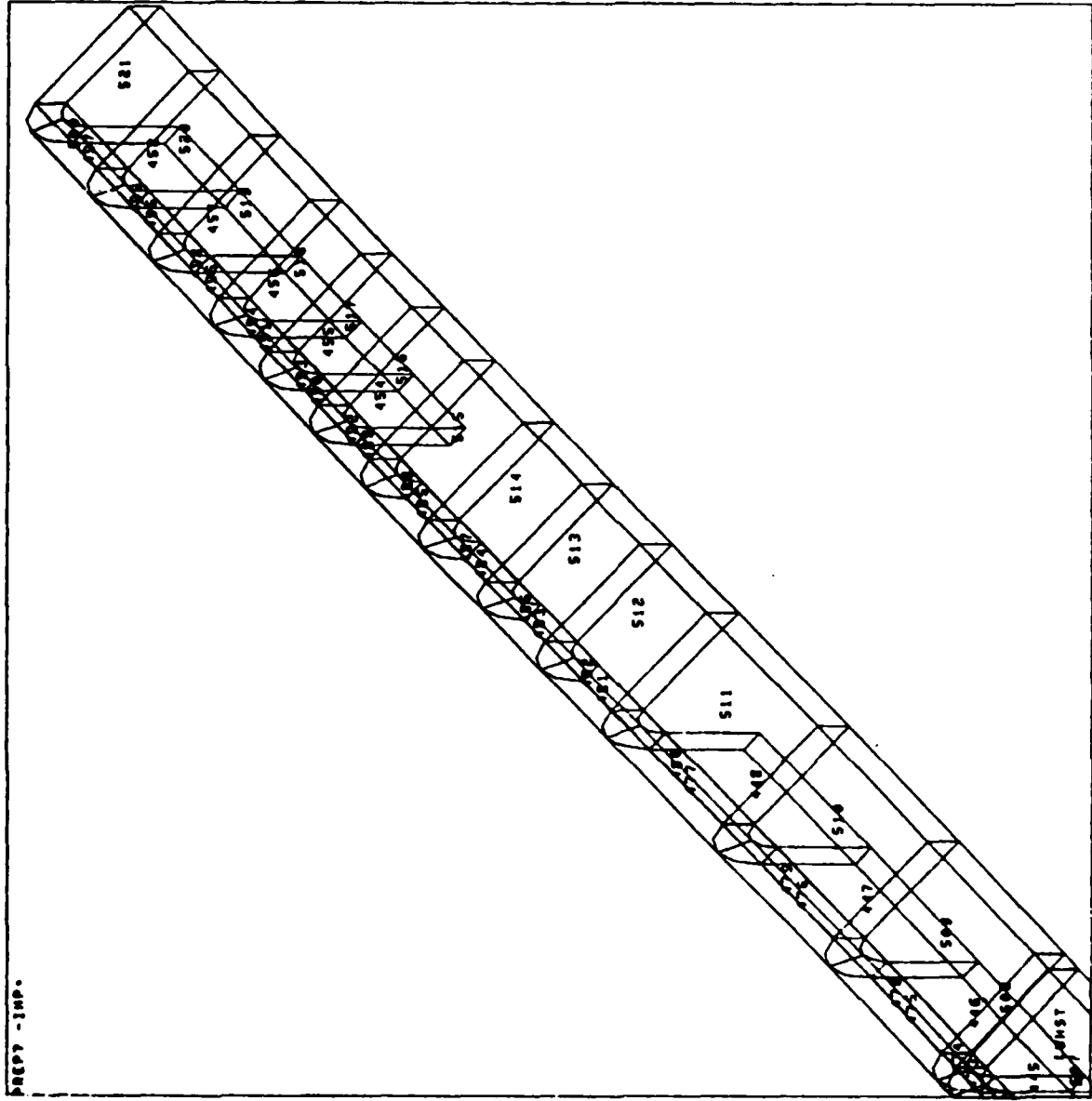
ZOOM  
 XU=-1  
 YU=-1  
 ZU=1  
 DIST=53.4  
 XF=30.2  
 YF=12  
 ZF=73.6  
 KATO=1.18  
 KATO=1.58



CORE

ANSYS 4.80  
DEC 15 1986  
16:10:08  
PREP7 ELEMENTS  
ENUR=1

ZOOM  
XU=-1  
YU=-1  
ZU=1  
SLIST=50.8  
SF=7.84  
VF=25.8  
ZF=182  
MAYO=1.18  
VRTO=1.96

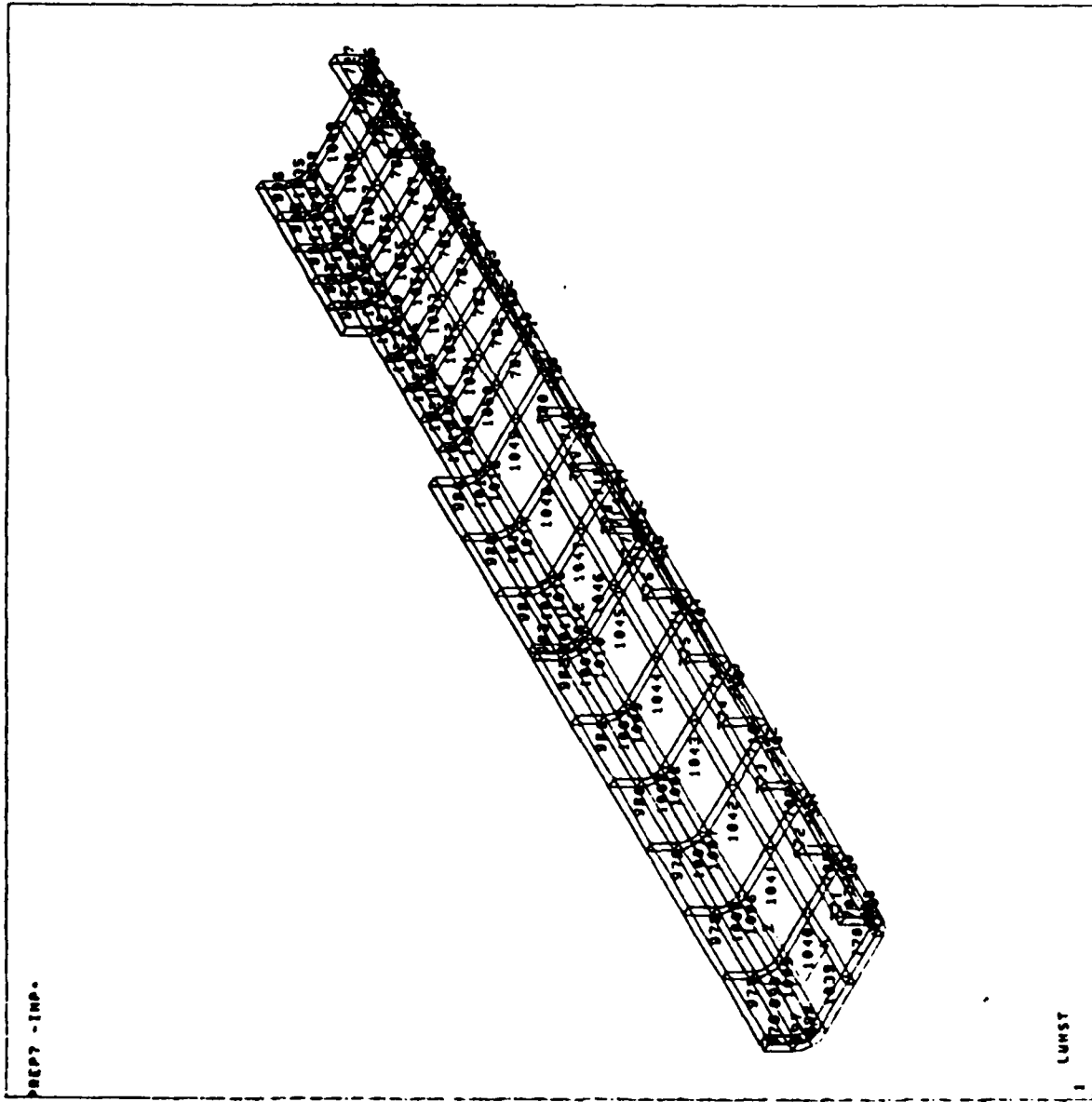


PREP7 -IMP.

ANSYS 4.28  
 DEC 15 1986  
 161531.37  
 PREP7 ELEMENTS  
 EMUR-1

CORE

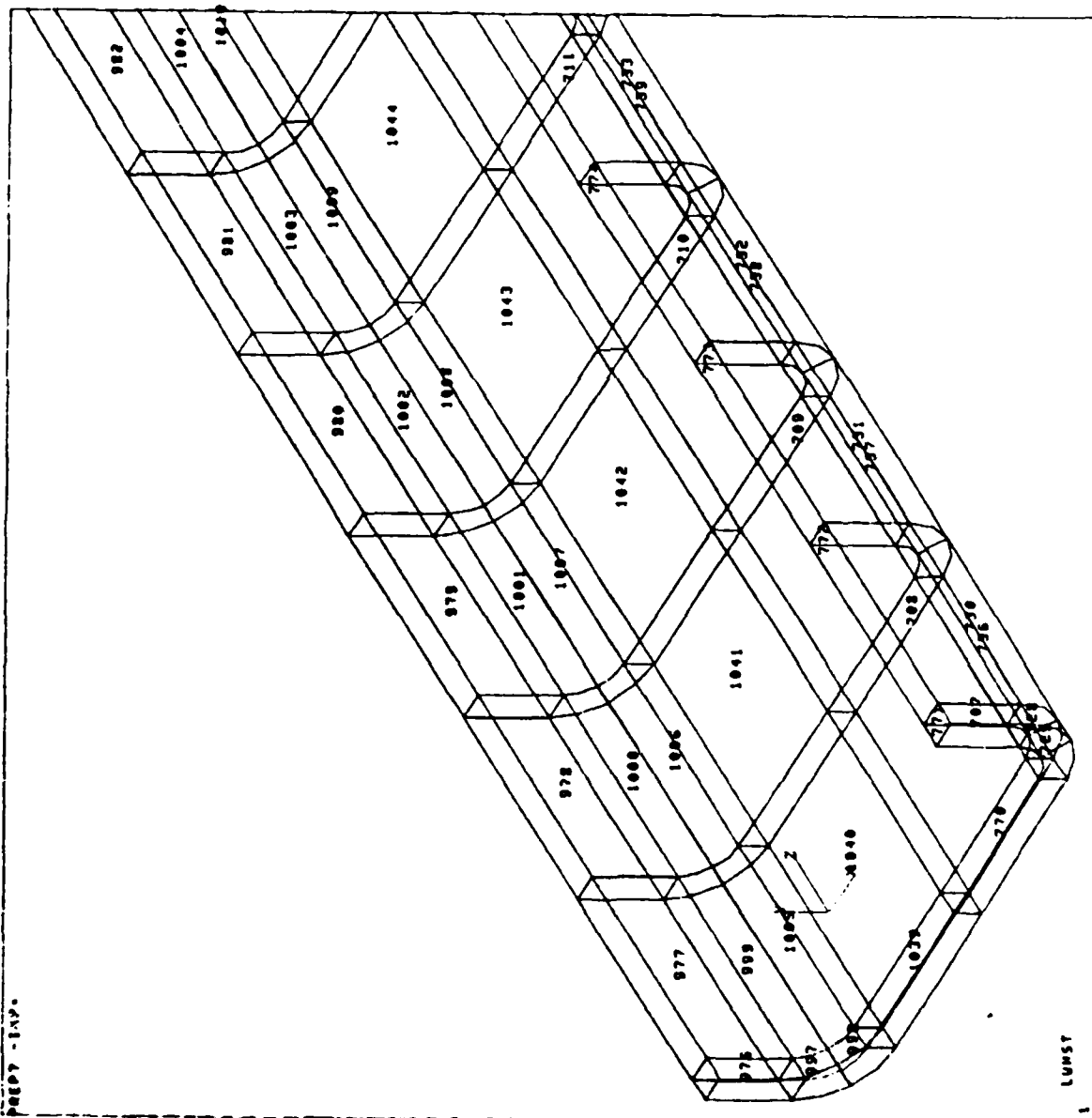
ZOOM  
 KU--1  
 YU--1  
 ZU--1  
 DIST-143  
 2F-116  
 XRT0-1.38  
 YRT0-1.41



041 - 43nd

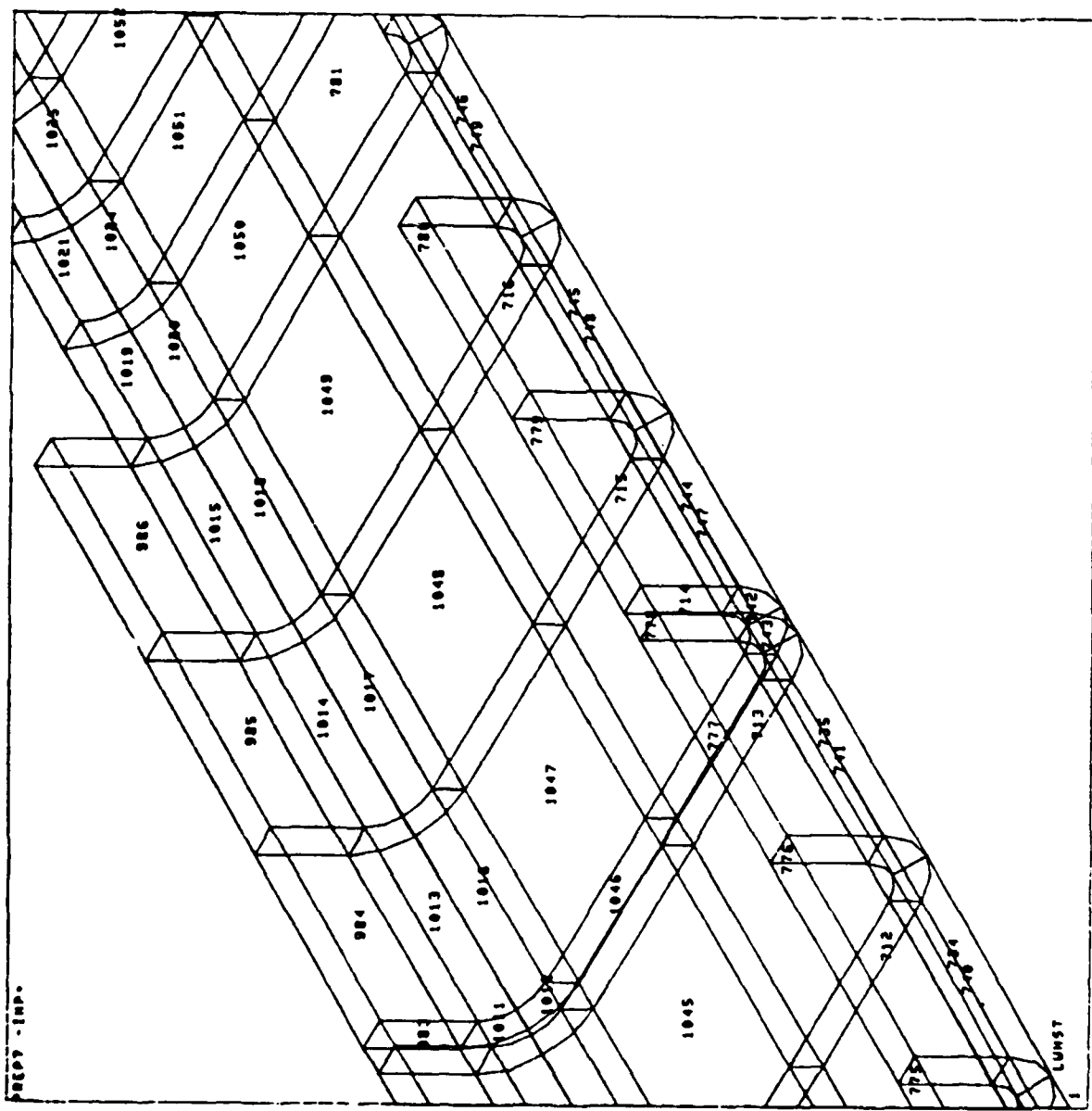
CORE

ZOOH  
XU--1  
YU--1  
ZU-1  
DISY-51.3  
XF--29.1  
YF--24.8  
ZF-61.8  
XATO-1.38  
YATO-1.53



CORE

ANSYS 4.28  
DEC 15 1986  
16155129  
PREP7 ELEMENTS  
ENUR=1  
200H  
XU=-1  
YU=-1  
ZU=1  
1 3157-44.9  
2 11-6.58  
3 11-6.26  
4 21-120  
5 1170-1.5  
6 1170-1.53



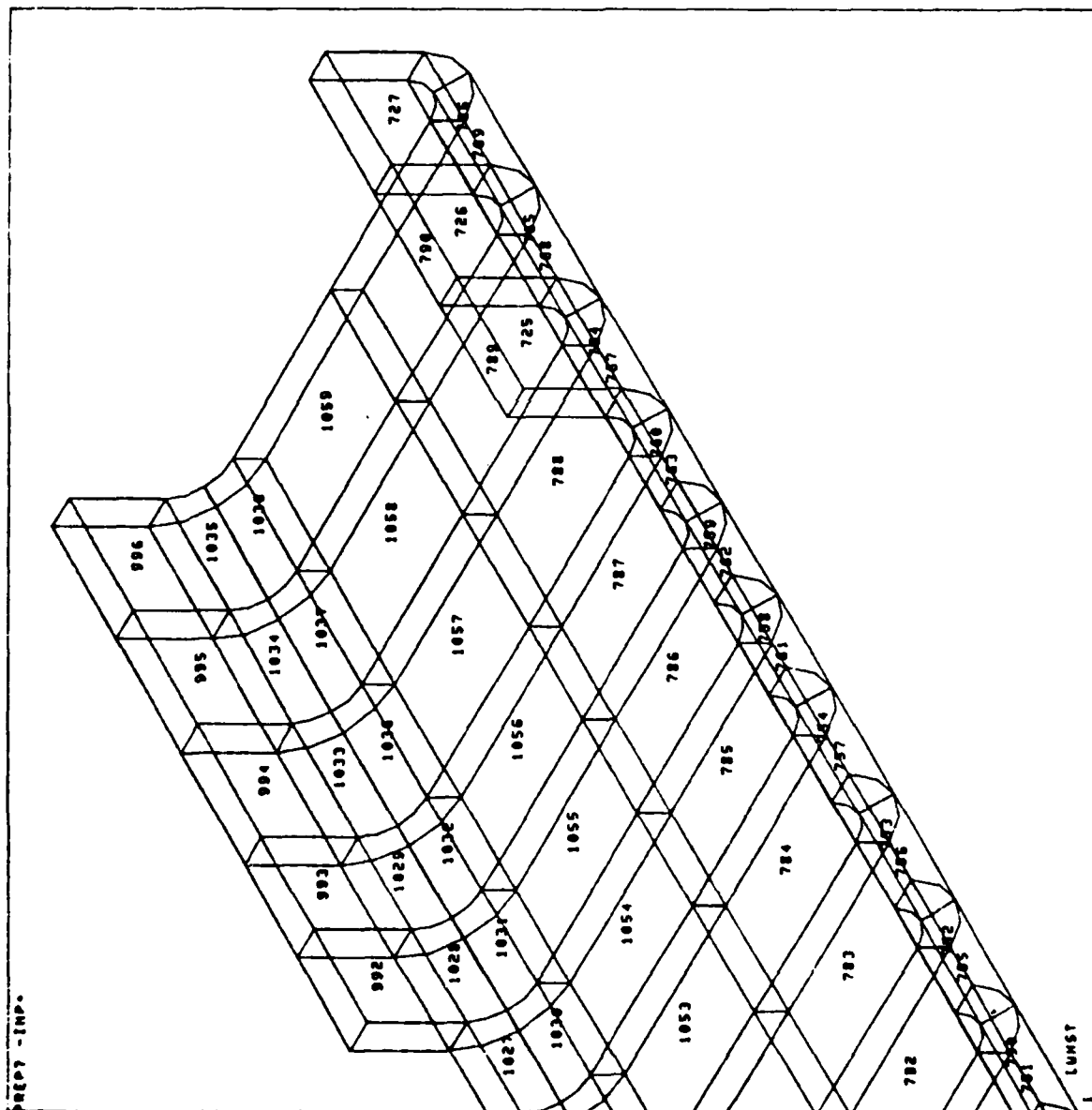
ANSYS 4.2D  
DEC 15 1986  
16156146  
PREP7 ELEMENTS  
[MUN-1

```

ZOOM
XU=-1
YU=-1
ZU=1
DIST=44.3
XF=34.8
YF=21.4
ZF=176
XATO=1.5
YATO=1.53

```

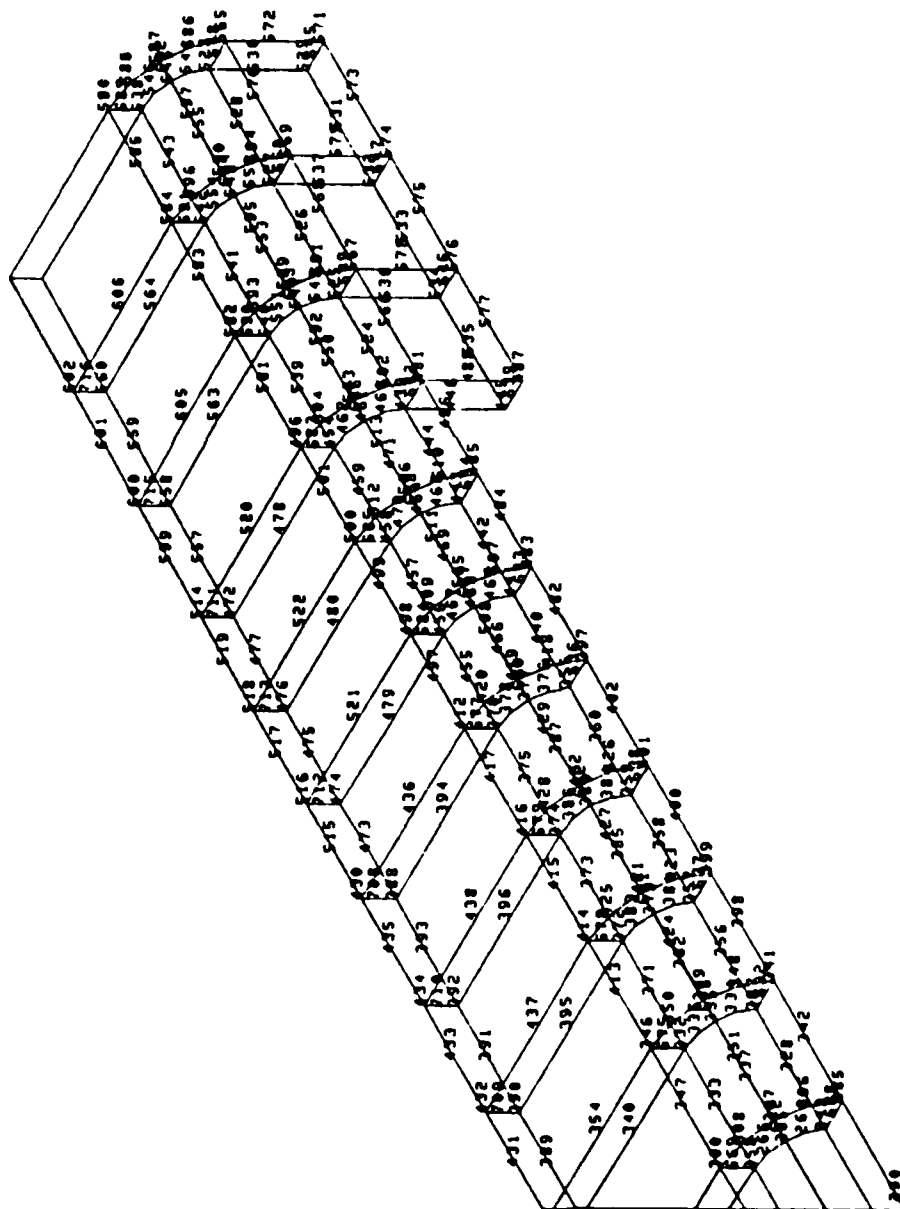
CORE





ANSYS 4.20  
DEC 15 1986  
16147136  
PREP7 ELEMENTS

CORE

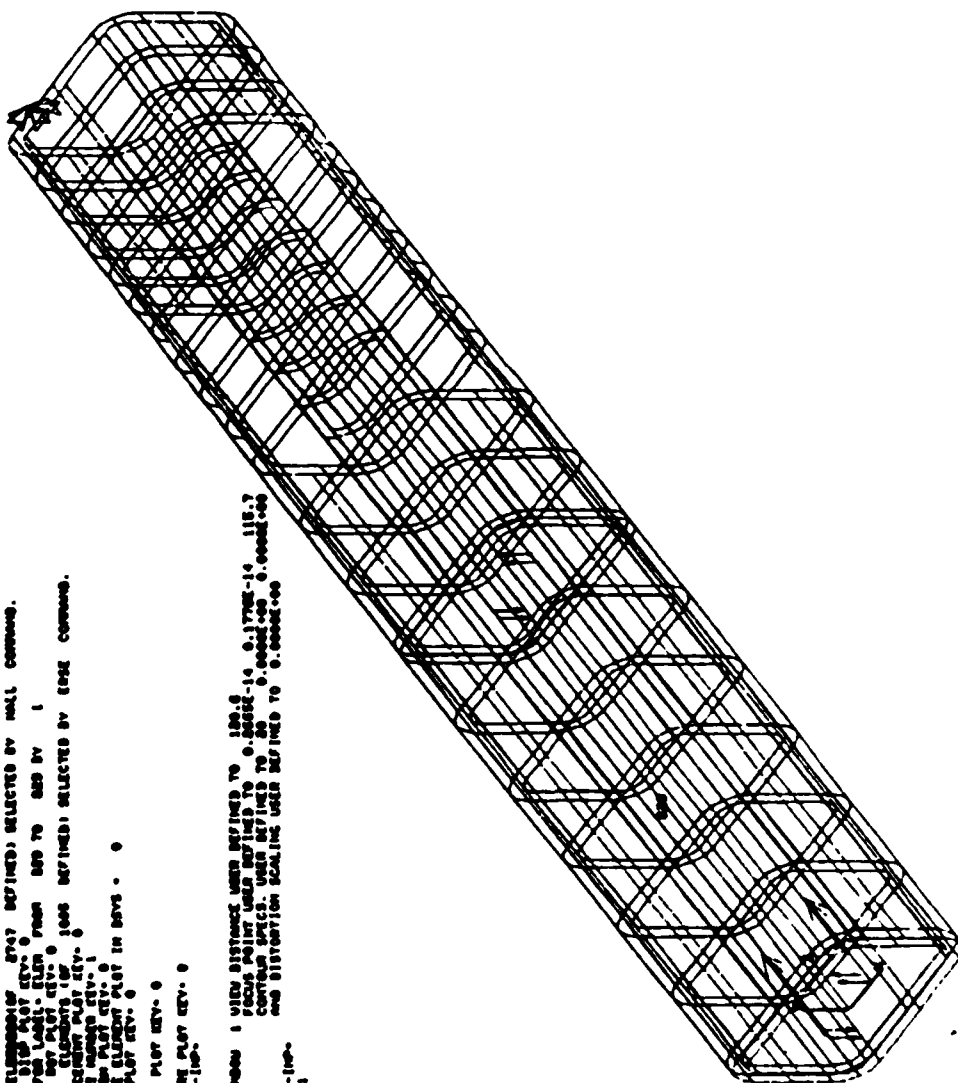








17)

[illegible]

1

ANSYS 4.20  
DEC 15 1986  
15:53:16  
PREP7 ELEMENTS

XU--1  
 VU--1  
 ZU--1  
 8 DIST-121  
 8 ZF-116  
 XATO-1.16  
 VATO-1.58

PROPERTY LAURENCE  
1045-1  
1045-1

1-02  
1-04  
1-06

0 0137-121  
 2 25-116  
 3 2570-1.16  
 4 2570-1.68

SAMPLE  
ELEMENT  
(NODES)

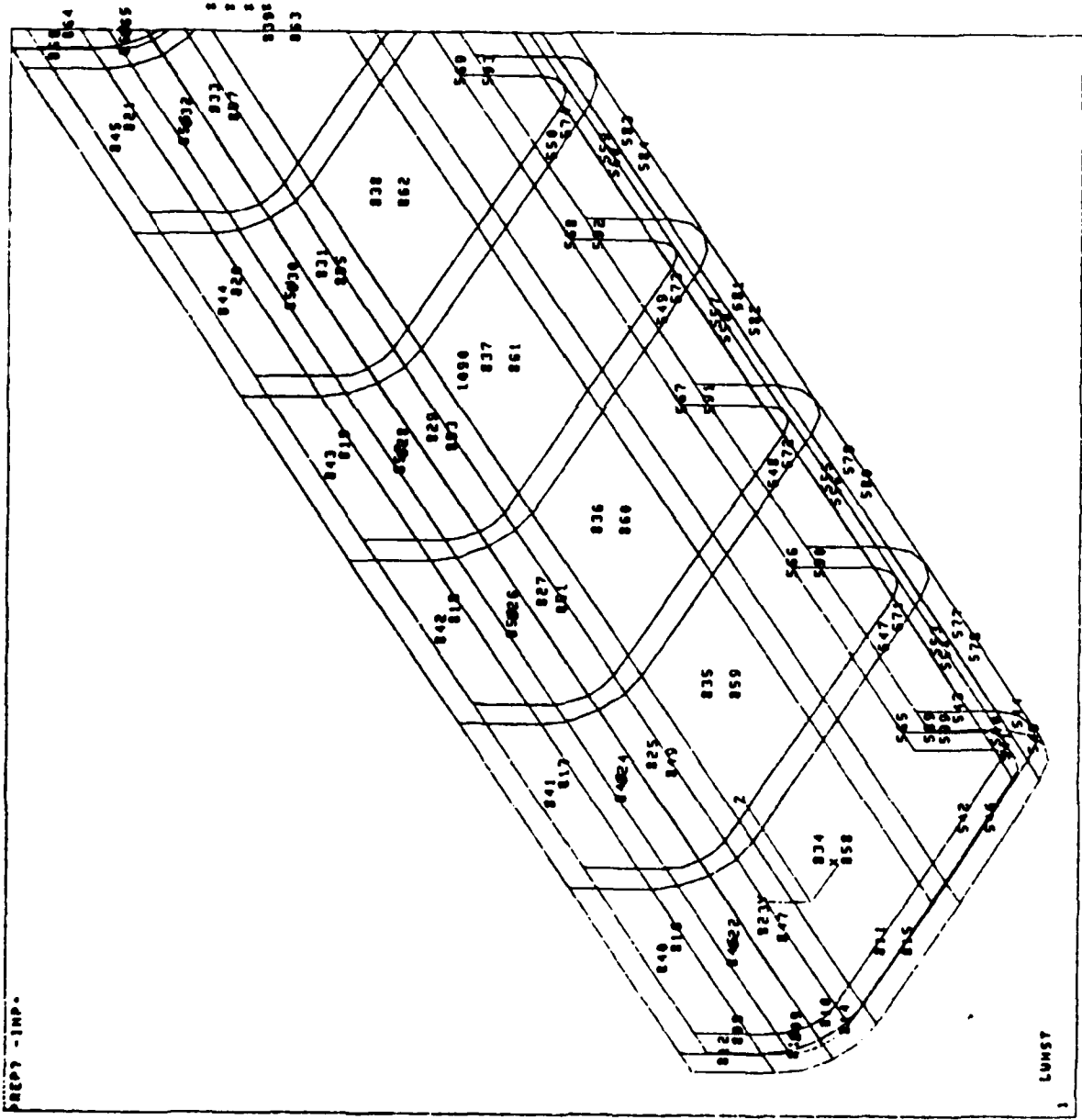
1. ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED  
DATE 01-11-2001 BY 60322 UCBAW/BJS



**1**

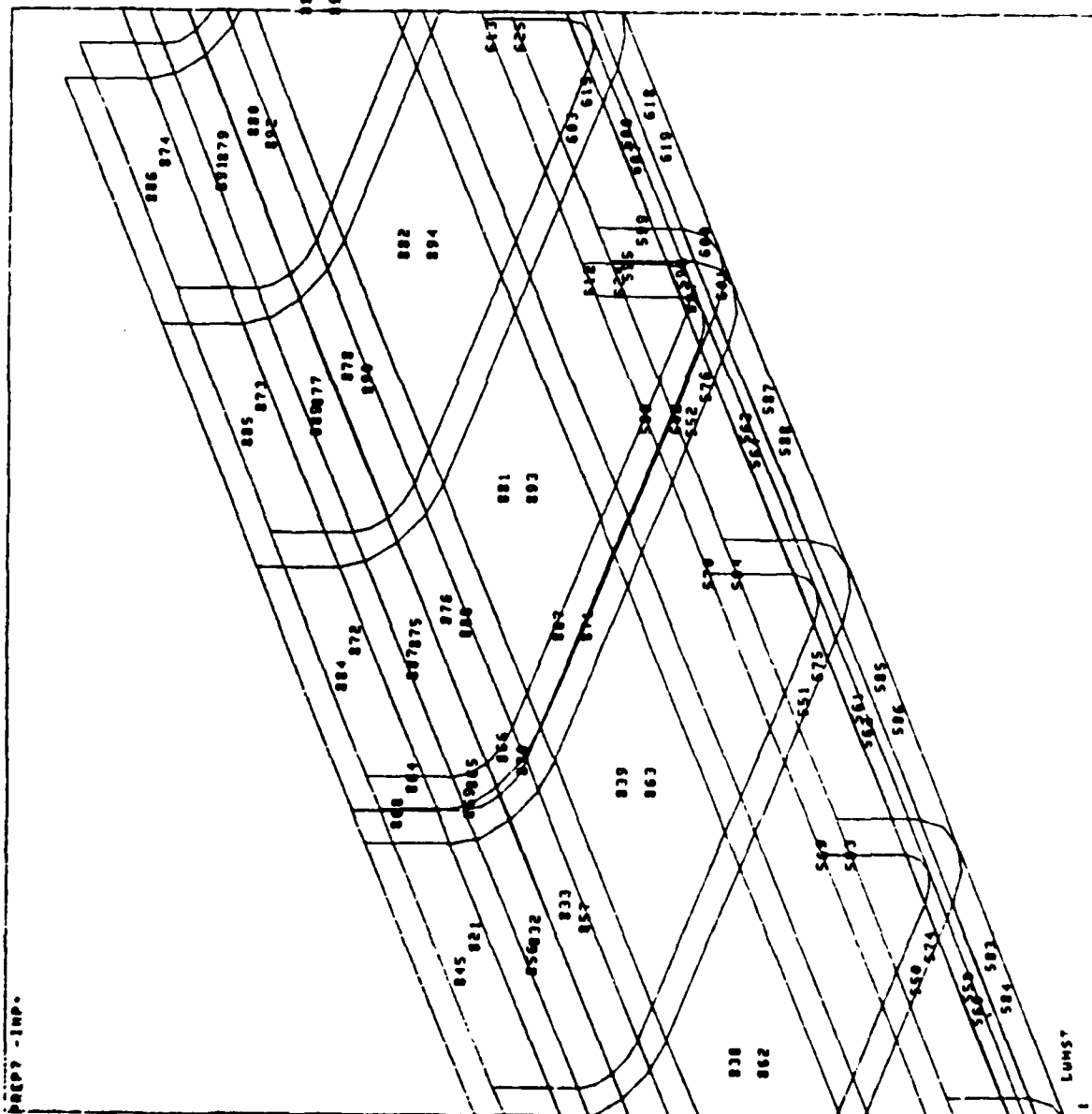
ANSYS 4.88  
 DEC 15 1986  
 17104155  
 PREP7 ELEMENTS  
 EMUR-1  
 ZOOM  
 KU=-1  
 VU=-1  
 20-1  
 1 DIST-103  
 2 KF--20.0  
 3 VF--26.1  
 4 XRT0-2.56  
 5 VRT0-3.02

COMPOSITE  
 ELEMENTS  
 WALLS L,R  
 OUTER  
 INNER  
 WALLS, T,B  
 OUTER



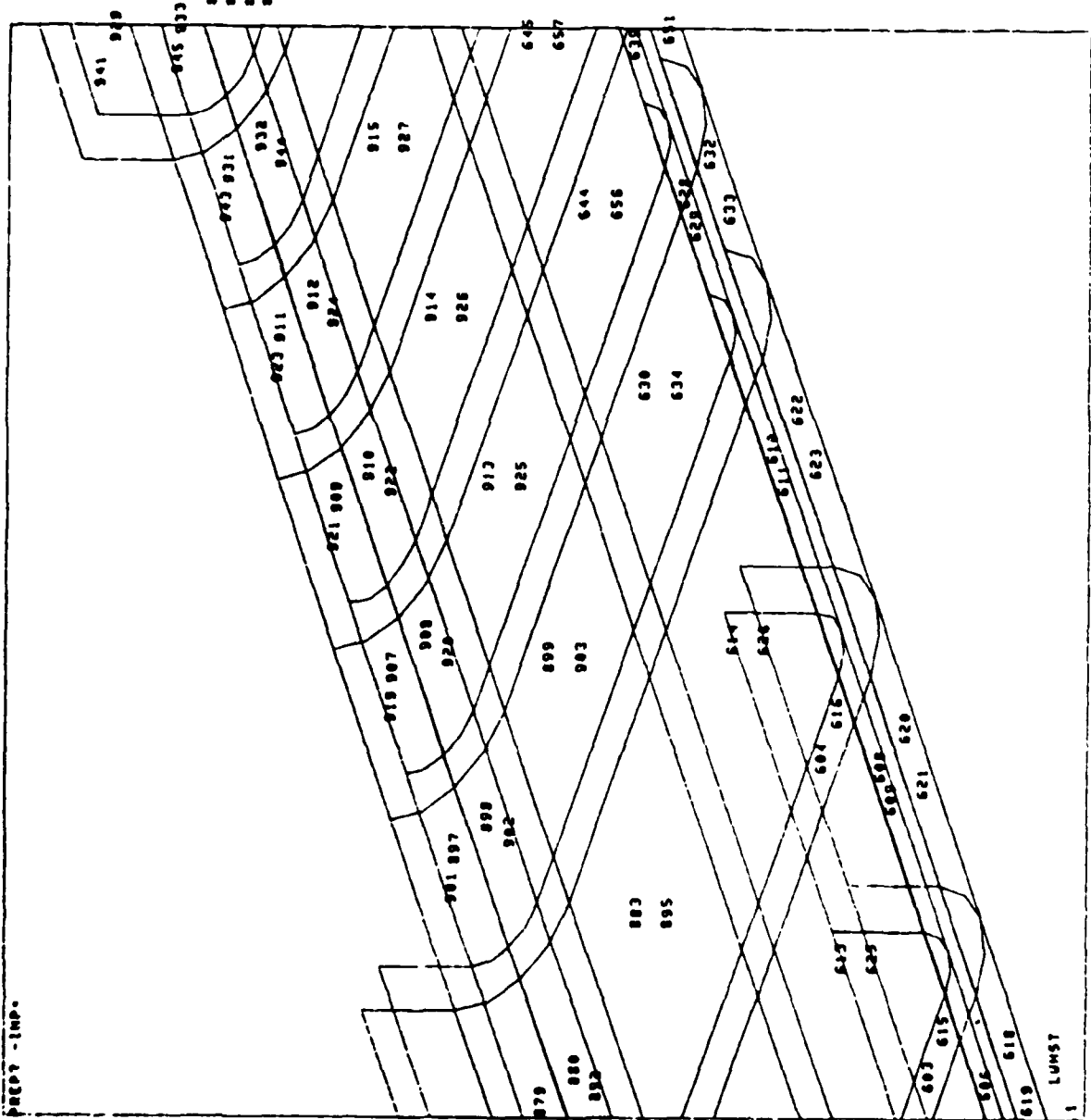
0417-6336

|           |
|-----------|
| ZOOM      |
| XU--1     |
| VU--1     |
| ZU=1      |
| DIST-01.7 |
| SF--3.75  |
| VF--8.25  |
| ZF-108    |
| KOZ-2.56  |
| VRTO-1.82 |



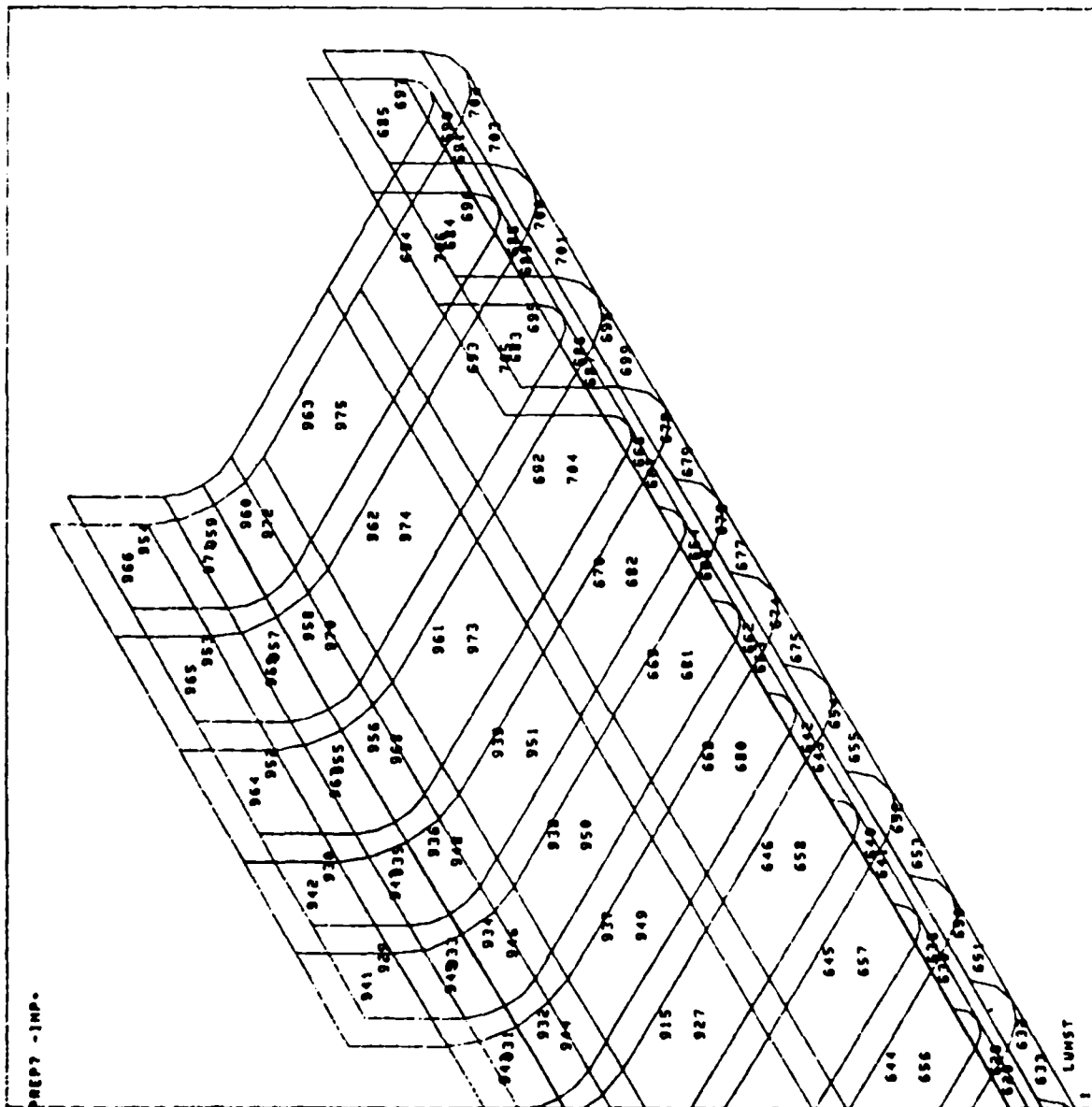


ANSYS 4.20  
DEC 15 1986  
17102130  
PREP7 ELEMENTS  
EMUN=1  
ZOOM  
XU=-1  
VU=-1  
ZU=1  
DIST=46.6  
KF=27.4  
VF=22.8  
ZF=127  
KRYO=2.56  
VRTO=1.53

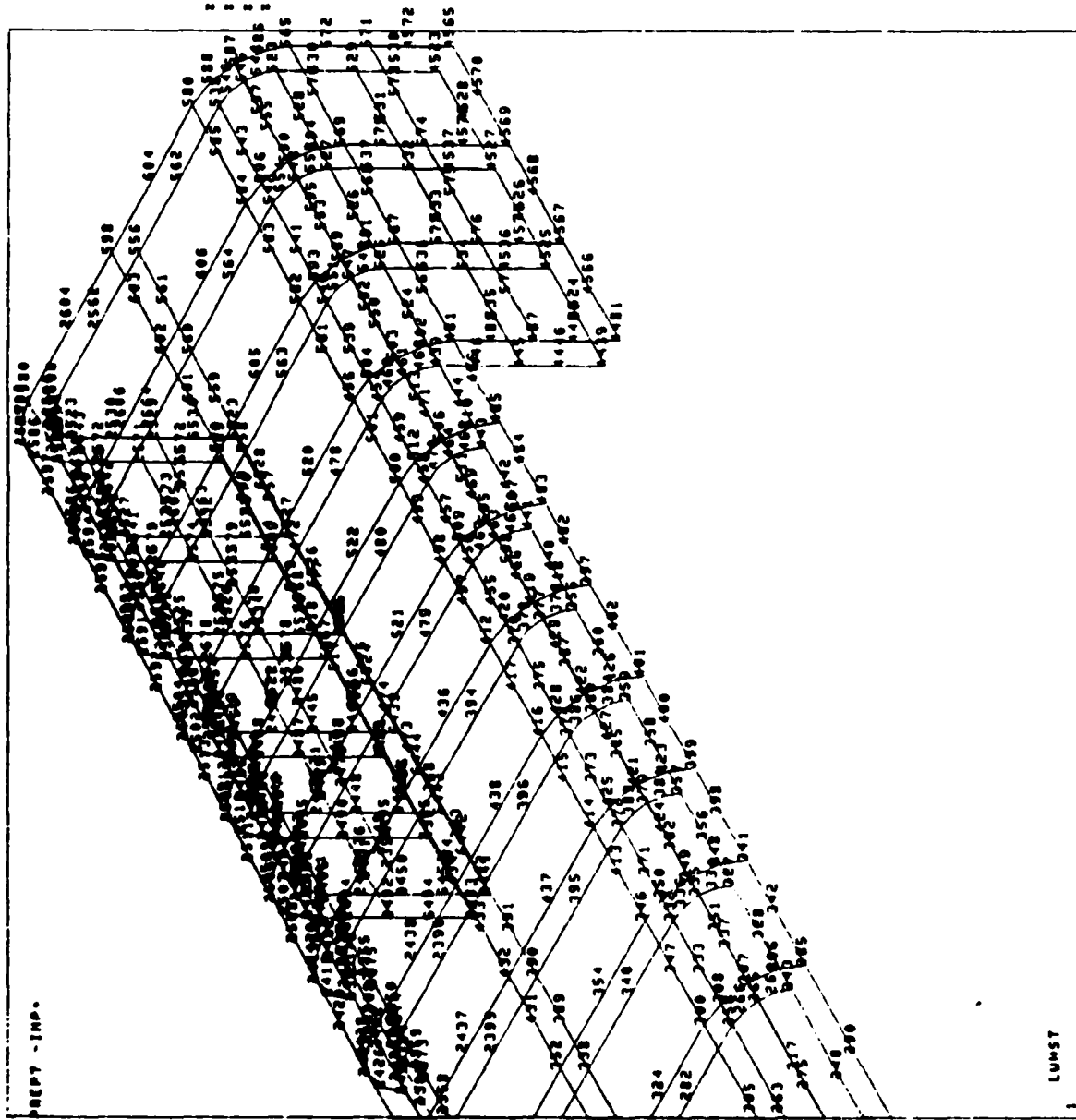


ANSYS 4.20  
 DEC 15 1986  
 17101182  
 PREP7 ELEMENTS  
 ENUR-1

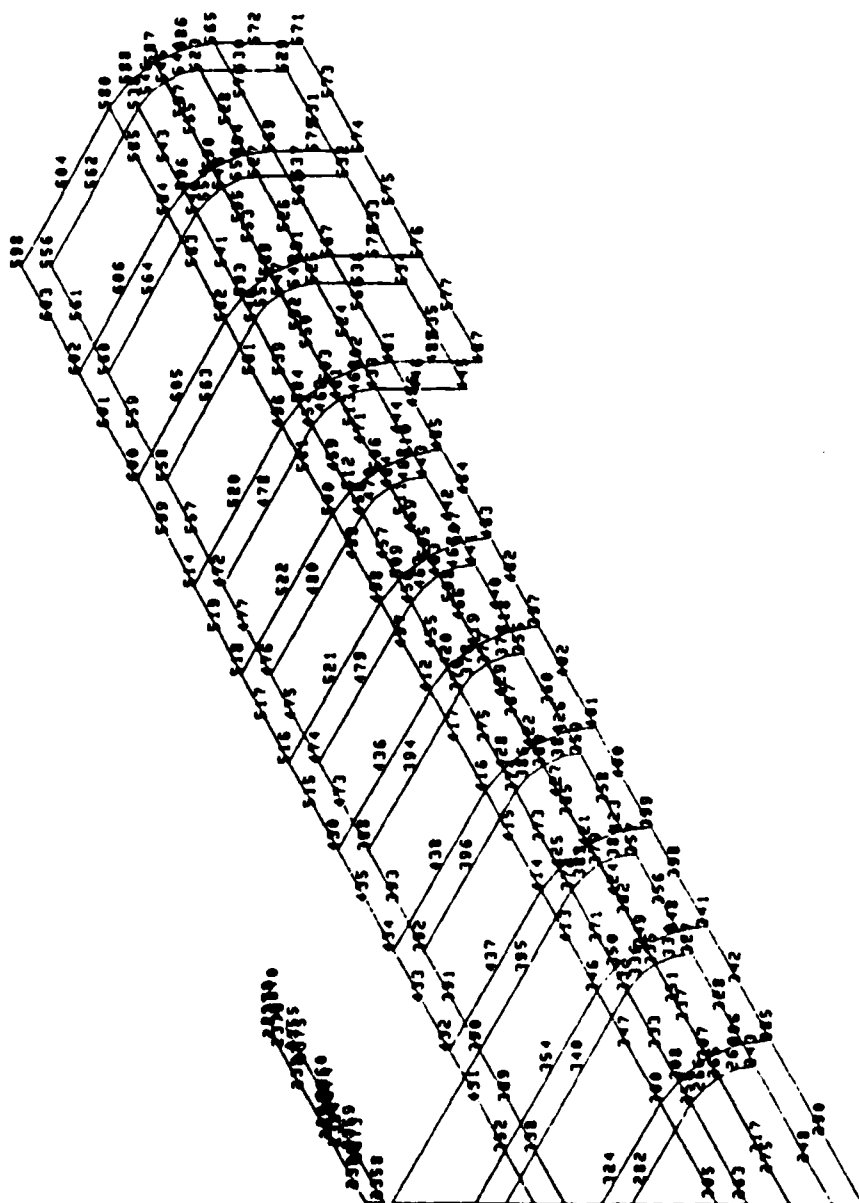
2008  
 XU=-1  
 VU=-1  
 2U=-1  
 8 DIST=44.3  
 8 XF=34.8  
 8 VF=21.4  
 8 ZF=176  
 XRT0=1.5  
 VRT0=1.53



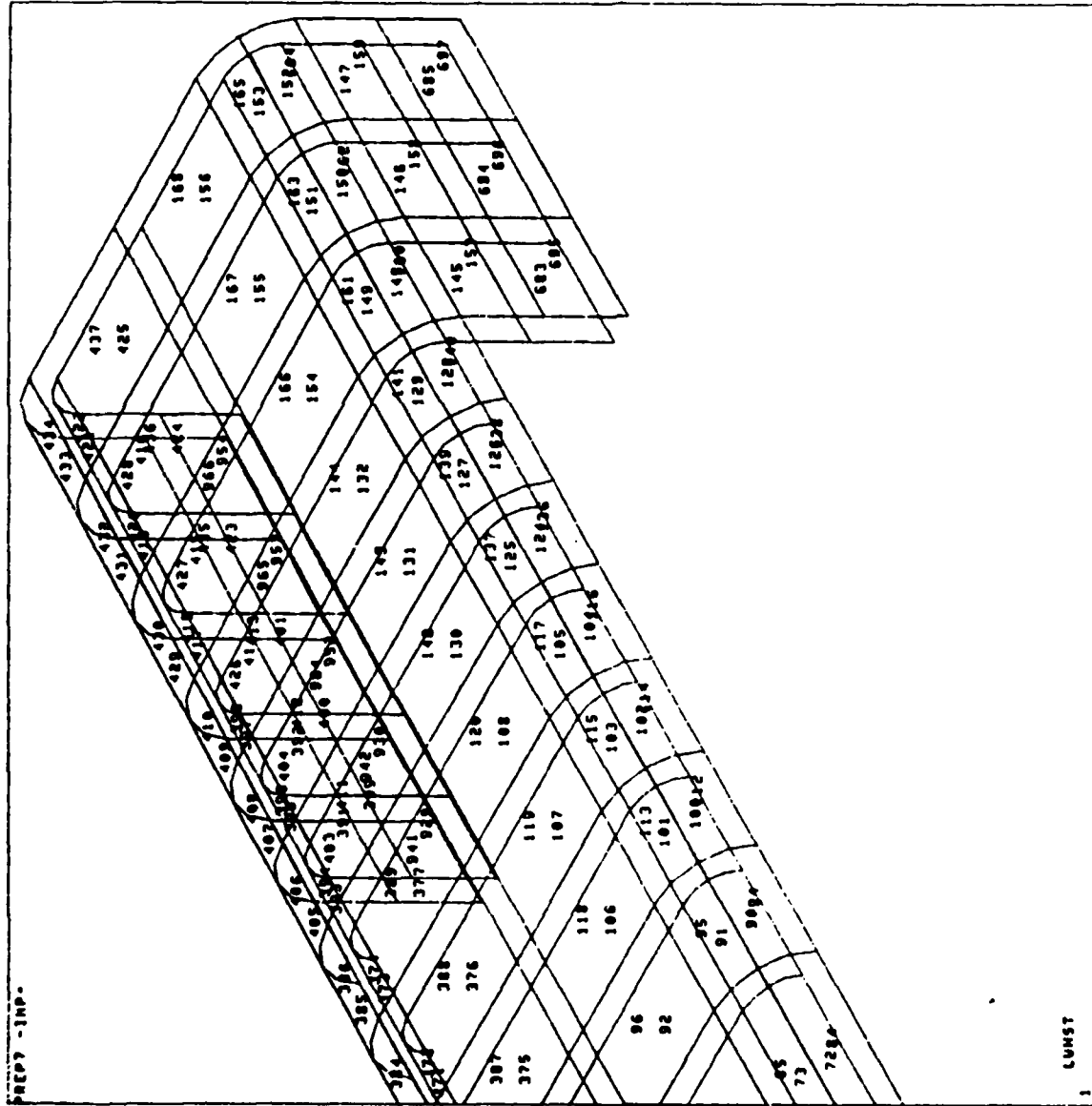
ANSYS 4.23  
 DEC 15 1986  
 17:10:54  
 PREP7 ELEMENTS  
 MMUR-1  
 ZOOM  
 KU--1  
 VU--1  
 ZU--1  
 DIST-141  
 WF-32.5  
 VF-24  
 ZF-171  
 WRT0-4.23  
 WRT0-4.12



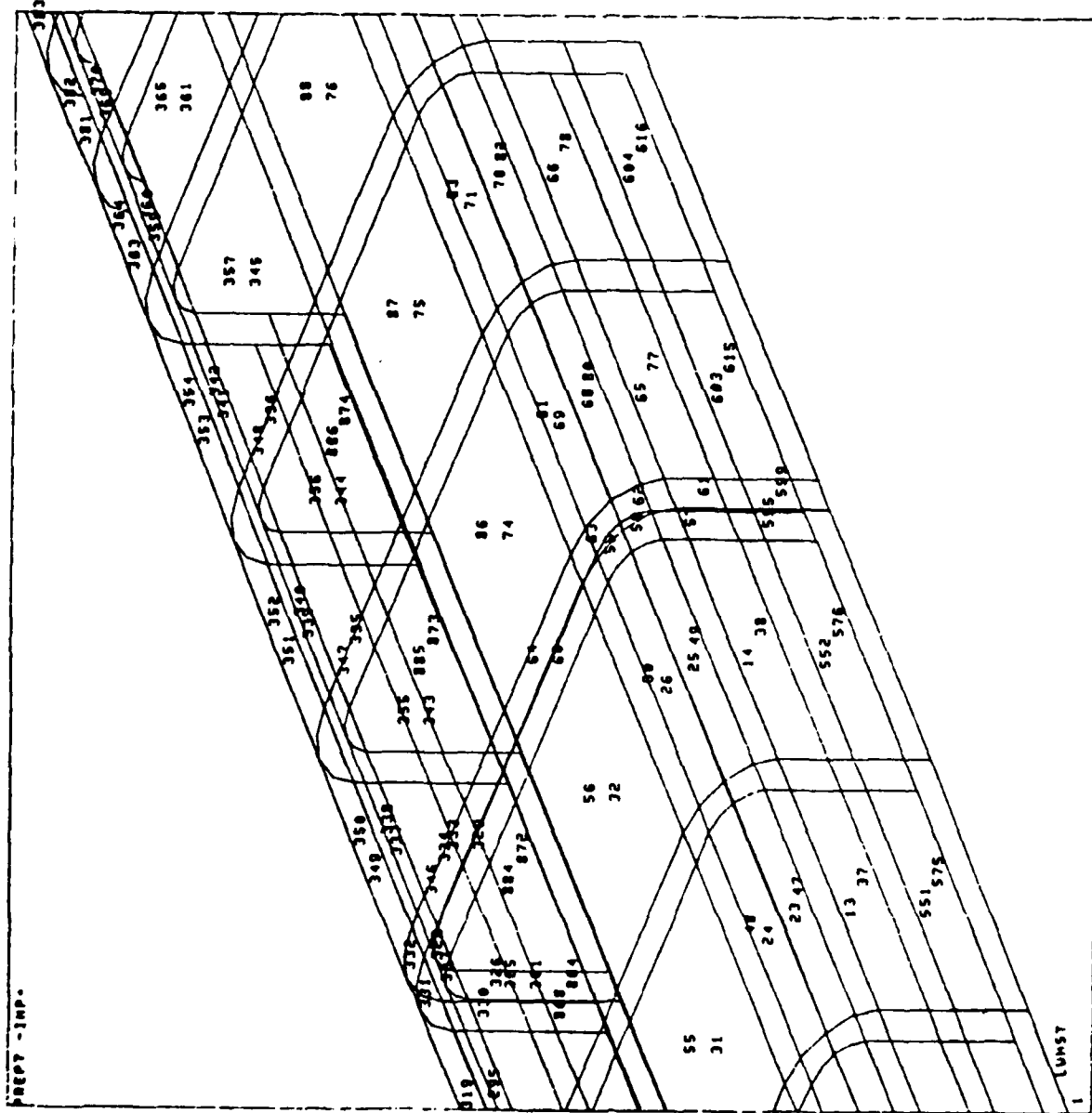
ANSYS 4.20  
 DEC 15 1986  
 1710154  
 PREP7 ELEMENTS



ANSYS 4.20  
 DEC 15 1986  
 17:09:26  
 PREP7 ELEMENTS  
 ENUR-1  
 200H  
 KU--1  
 VU--1  
 2U-1  
 2 D187-141  
 2 KF-32.5  
 2 VF-24  
 2 ZF-171  
 KRTO-4.23  
 VRT0-4.12

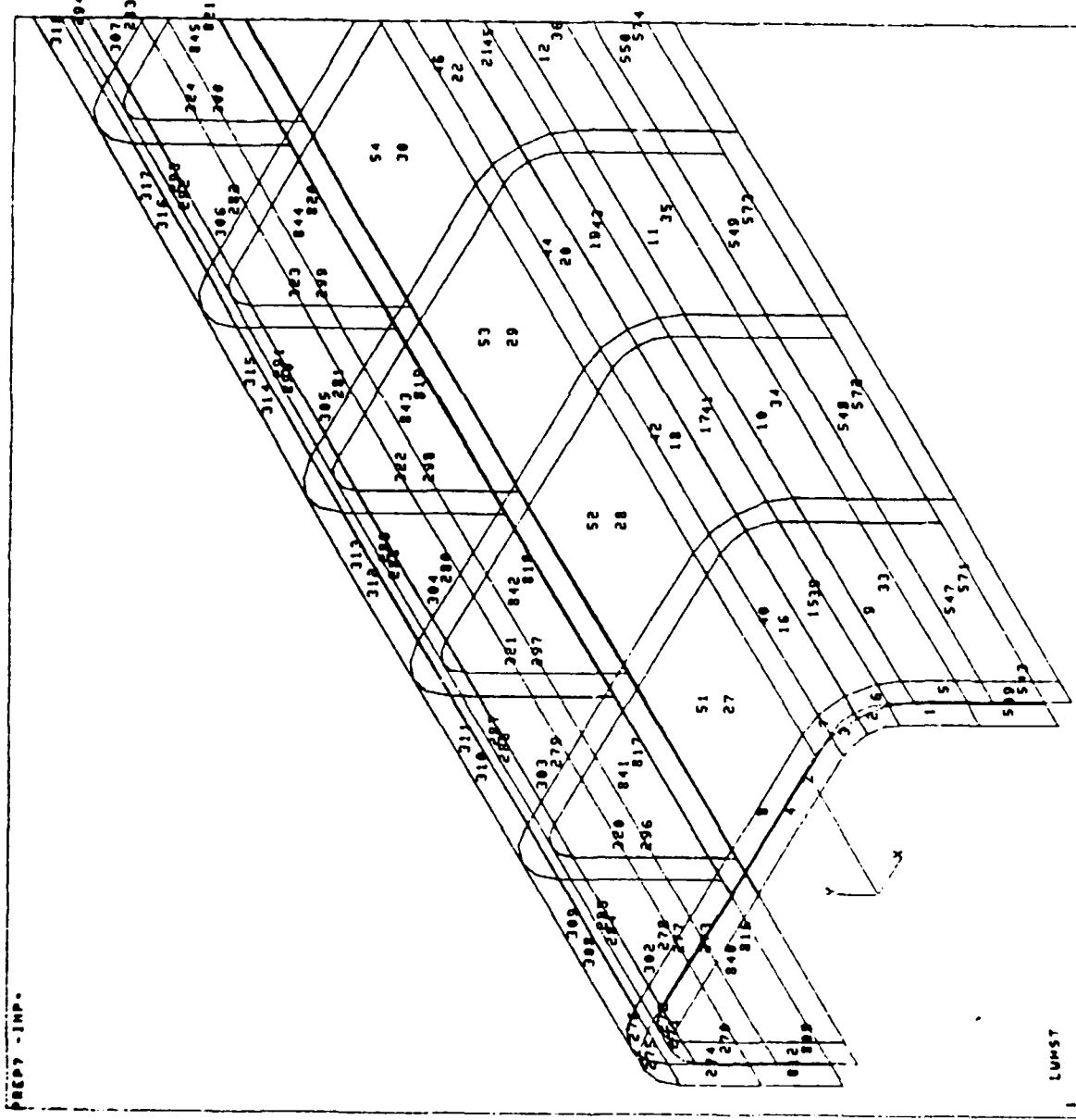


ANSYS 4.20  
 DEC 15 1986  
 17108111  
 PREP7 ELEMENTS  
 ENUR-1  
 ZOOM  
 XU=-1  
 YU=-1  
 ZU=-1  
 2 BIST-113  
 2 XF-1.32  
 2 YF-1.83  
 2 ZF-118  
 KRTQ-4.23  
 VRTQ-3.02



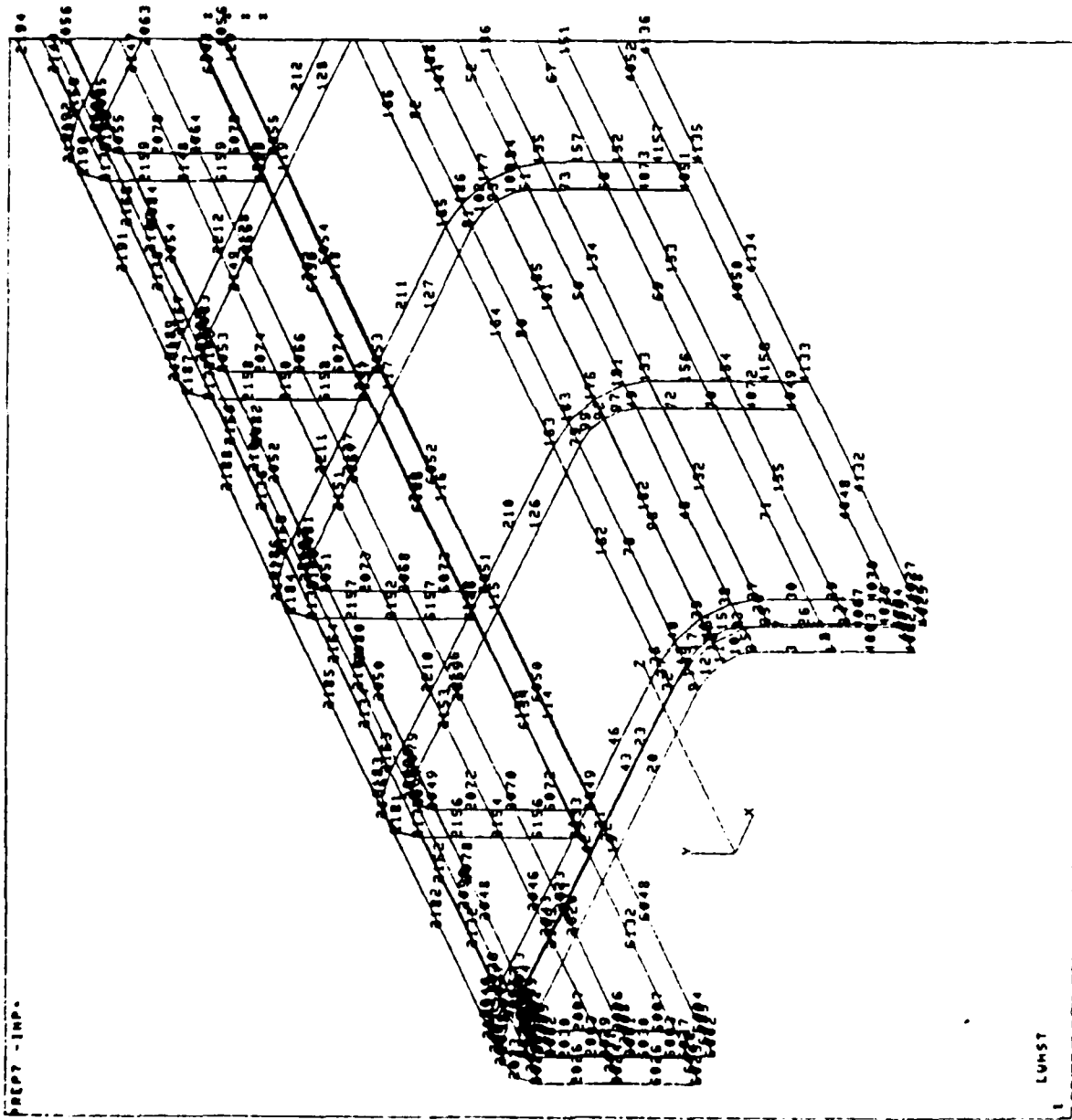
117

ANSYS 4.28  
 DEC 15 1986  
 17106153  
 PREP7 ELEMENTS  
 ENUM=1  
 ZOOM  
 KU=-1  
 VU=-1  
 ZU=1  
 D157-106  
 XF=-31.7  
 VF=-20.9  
 ZF=62.1  
 XRT0-2.92  
 YRT0-3.02

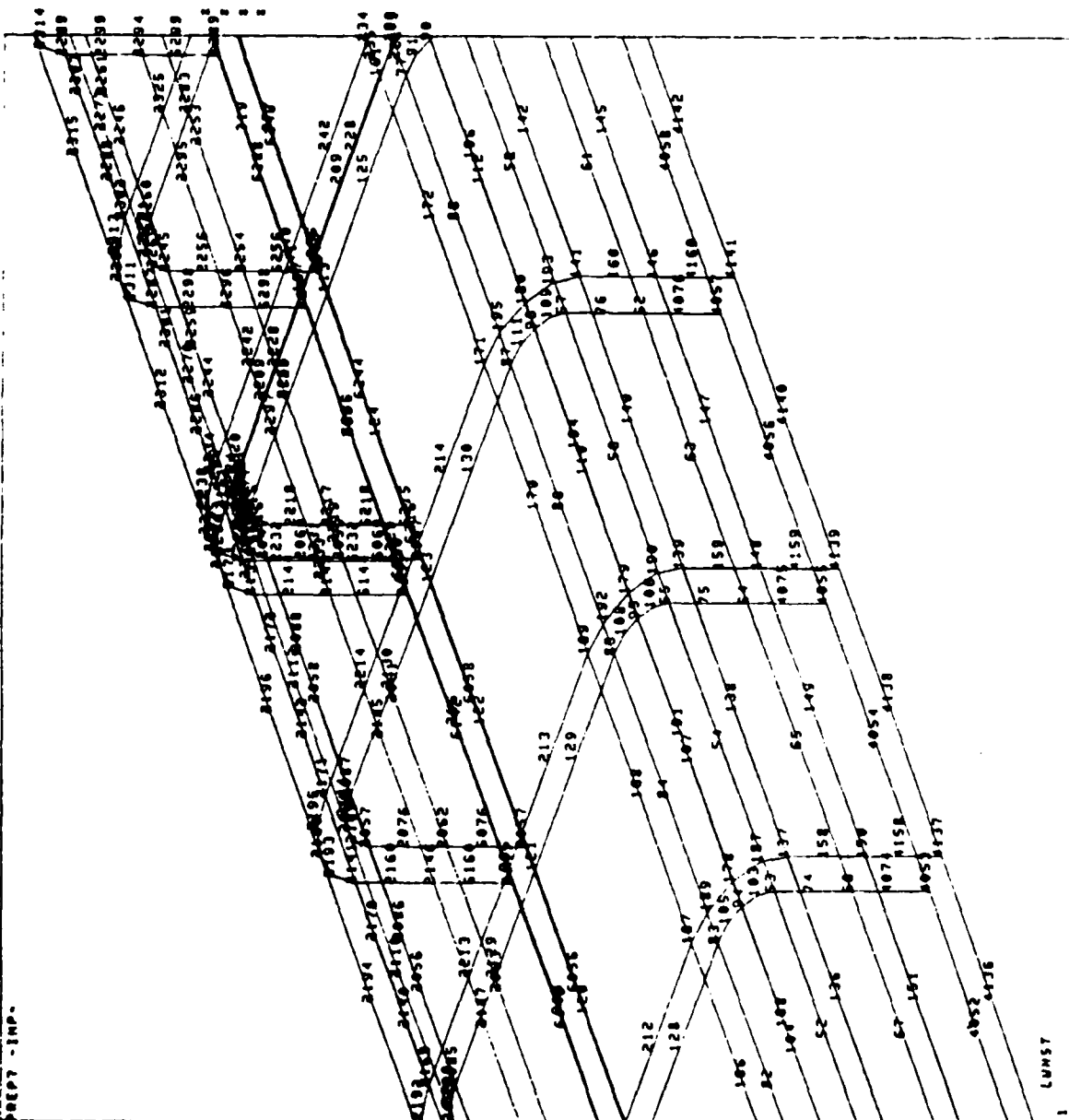


11)

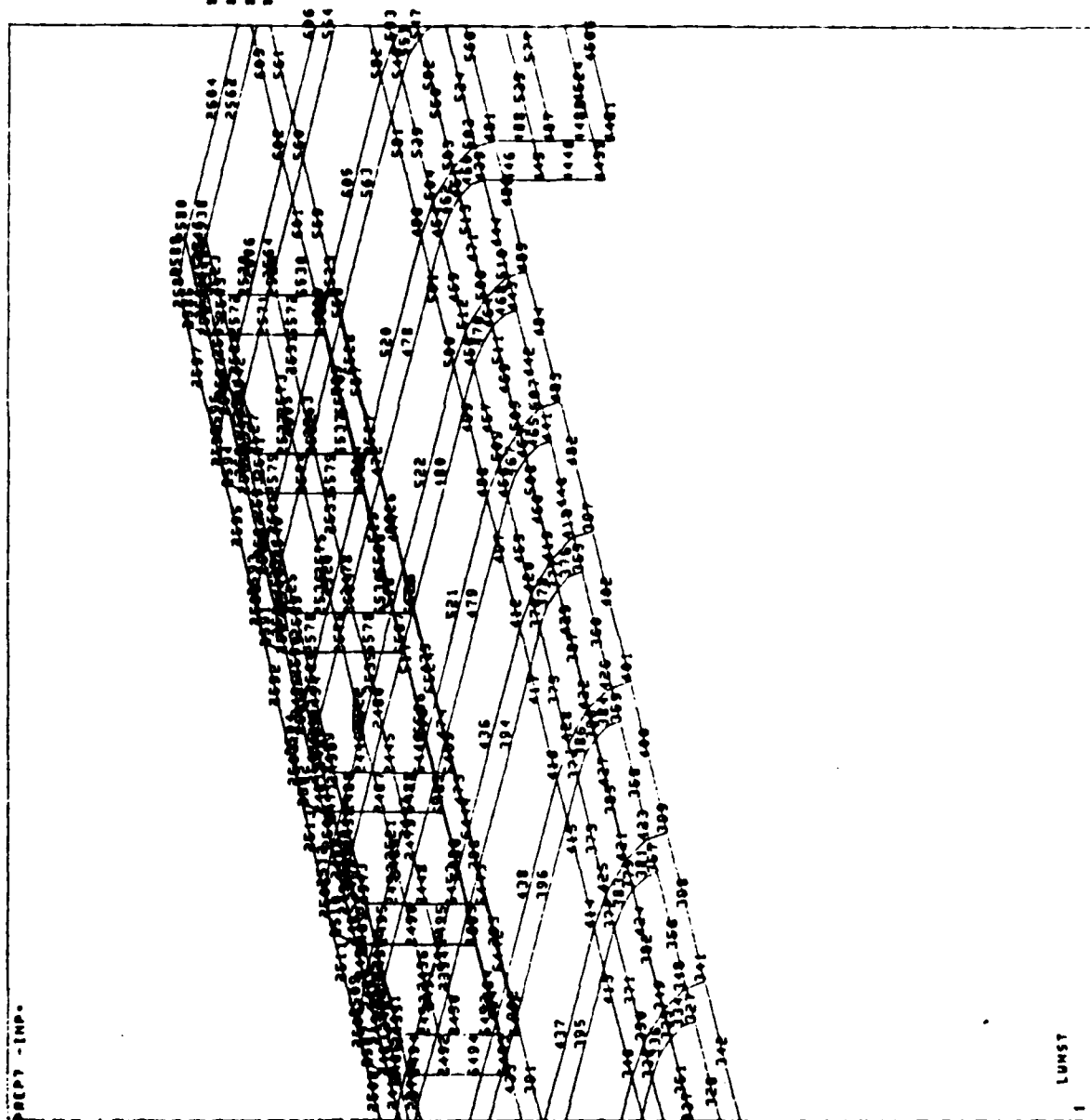
ANSYS 4.2B  
 DEC 16 1986  
 17113114  
 PREP7 ELEMENTS  
 MNUR=1  
 ZOOM  
 XU=-1  
 VU=-1  
 ZU=1  
 DIST=147  
 XFA=-32.7  
 YFA=-27.8  
 ZFA=54.2  
 XRT0=4.91  
 YRT0=4.17





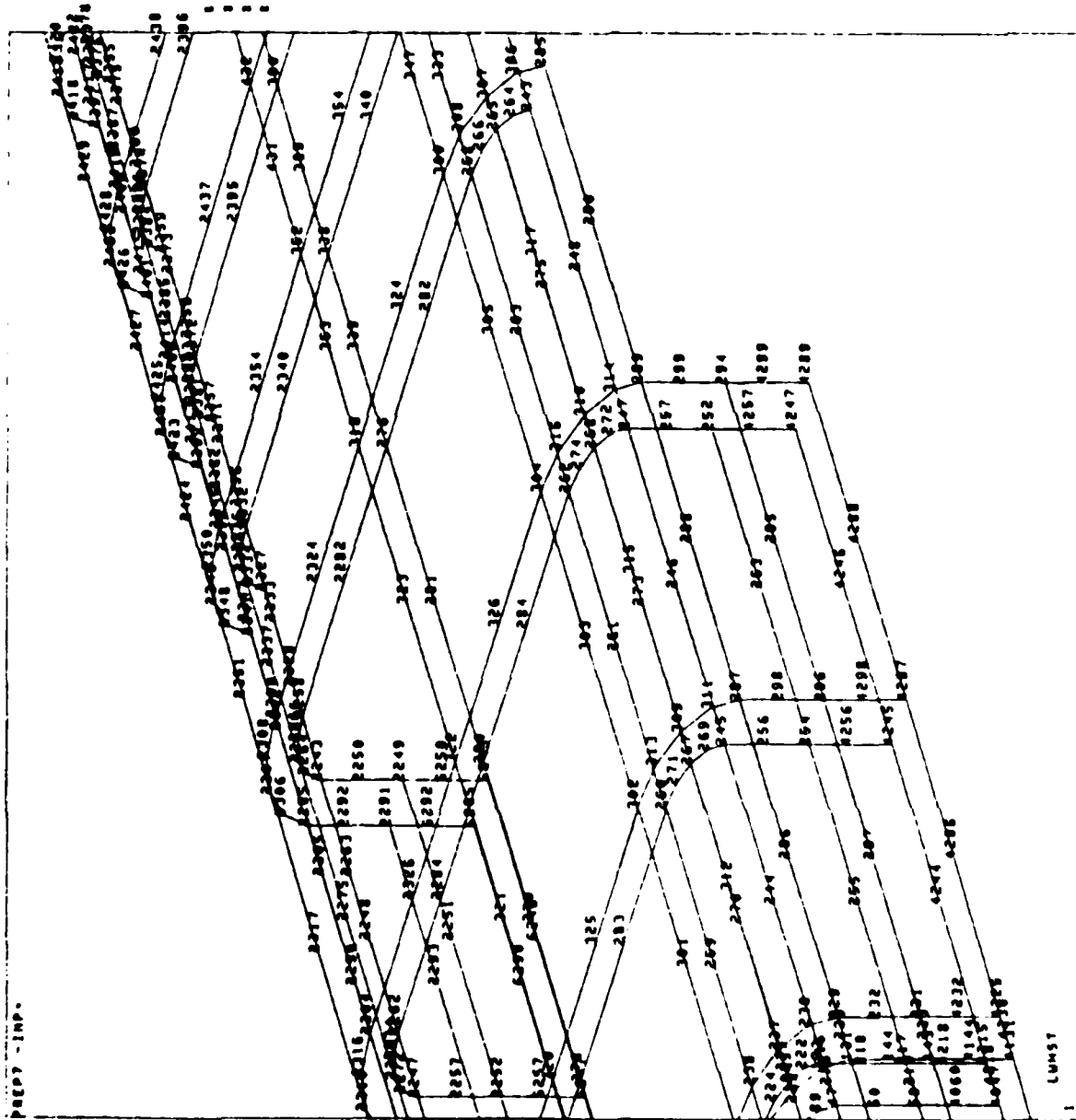


ANSYS 4.23  
 DEC 15 1986  
 17:10:57  
 PREP7 ELEMENTS  
 MMUR-1  
 ZOOM  
 ZU--1  
 ZU--1  
 ZU--1  
 DIST-189  
 AF-30.7  
 VF-24.7  
 ZF-170  
 MOTO-9.62  
 VMT0-4.17



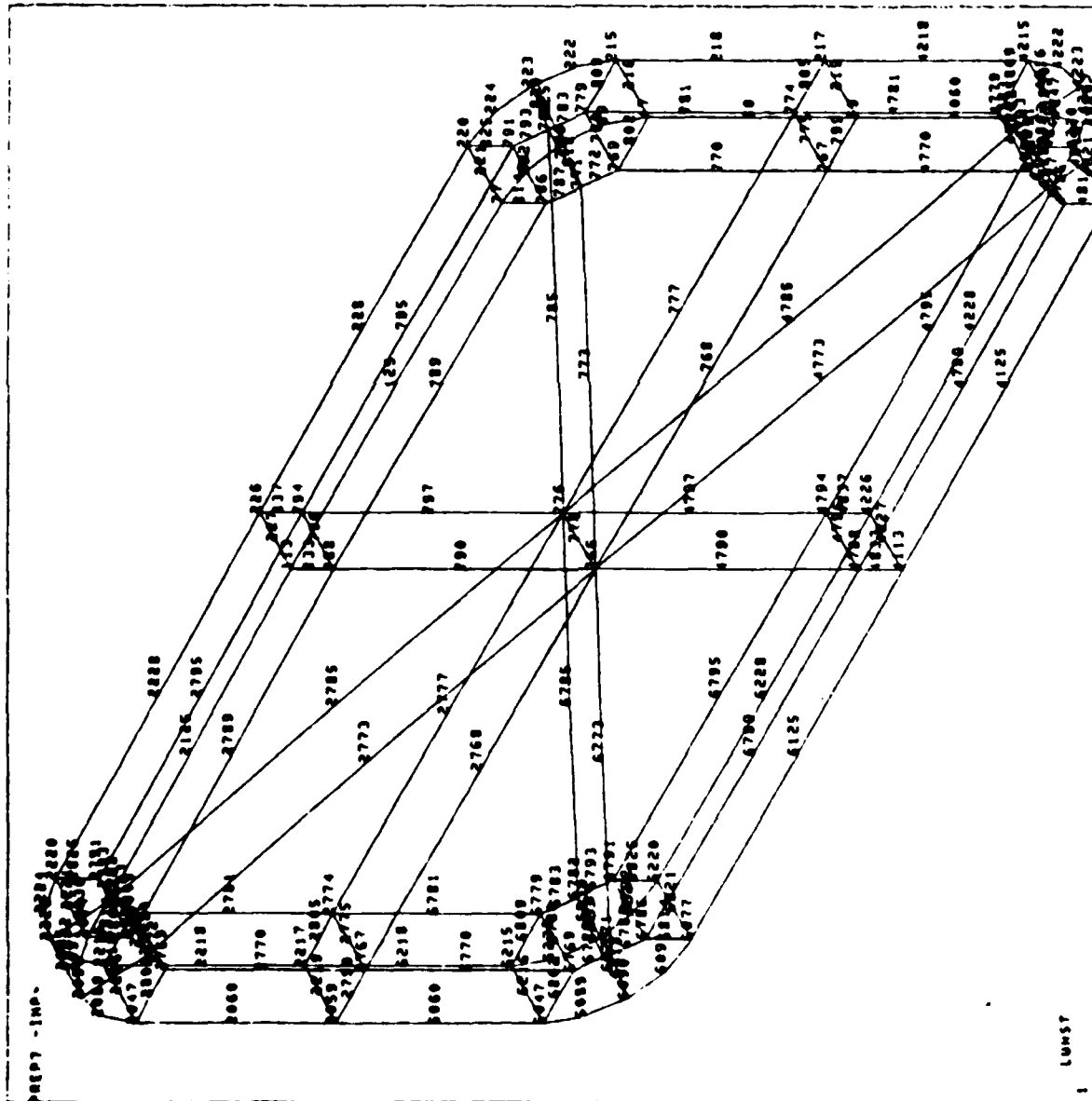
ANSYS 4.2B  
 DEC 15 1986  
 17117127  
 PREPT ELEMENTS  
 MNUR=1

ZOOM  
 KU=-1  
 VU=-1  
 20=1  
 DIST=142  
 XF=10.2  
 YF=10.6  
 ZF=136  
 ARTO=7.81  
 VRT0=4.17



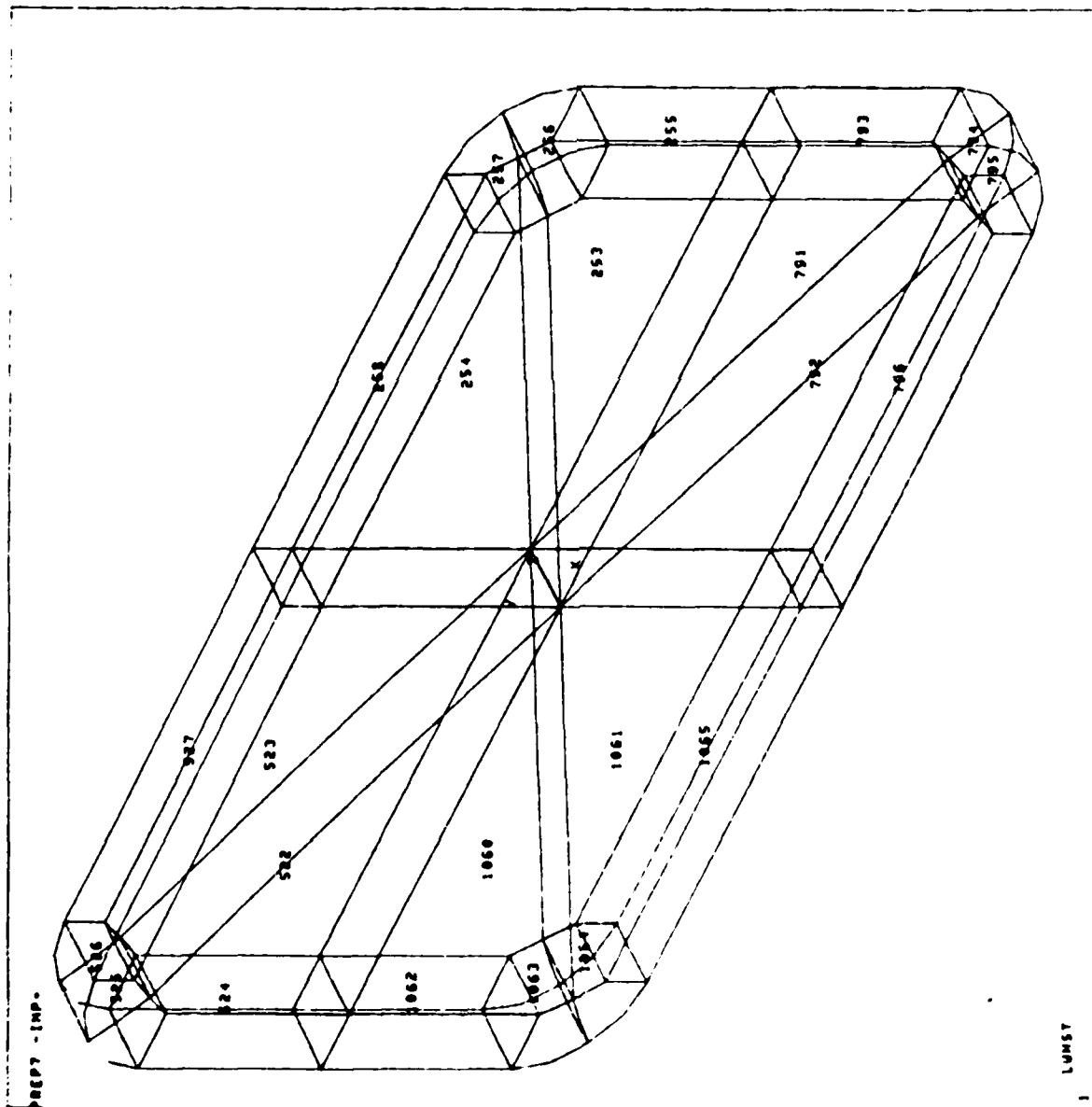
(32)

ANSYS 4.29  
 DEC 15 1986  
 17:26:05  
 PREPT ELEMENTS  
 MMUA-1  
 ZOOM  
 PU--1  
 VU--1  
 ZU-1  
 2 DIST-13.8  
 2 XF-17  
 2 VF-18.1  
 2 2F-88.5  
 2 RTD-1.02

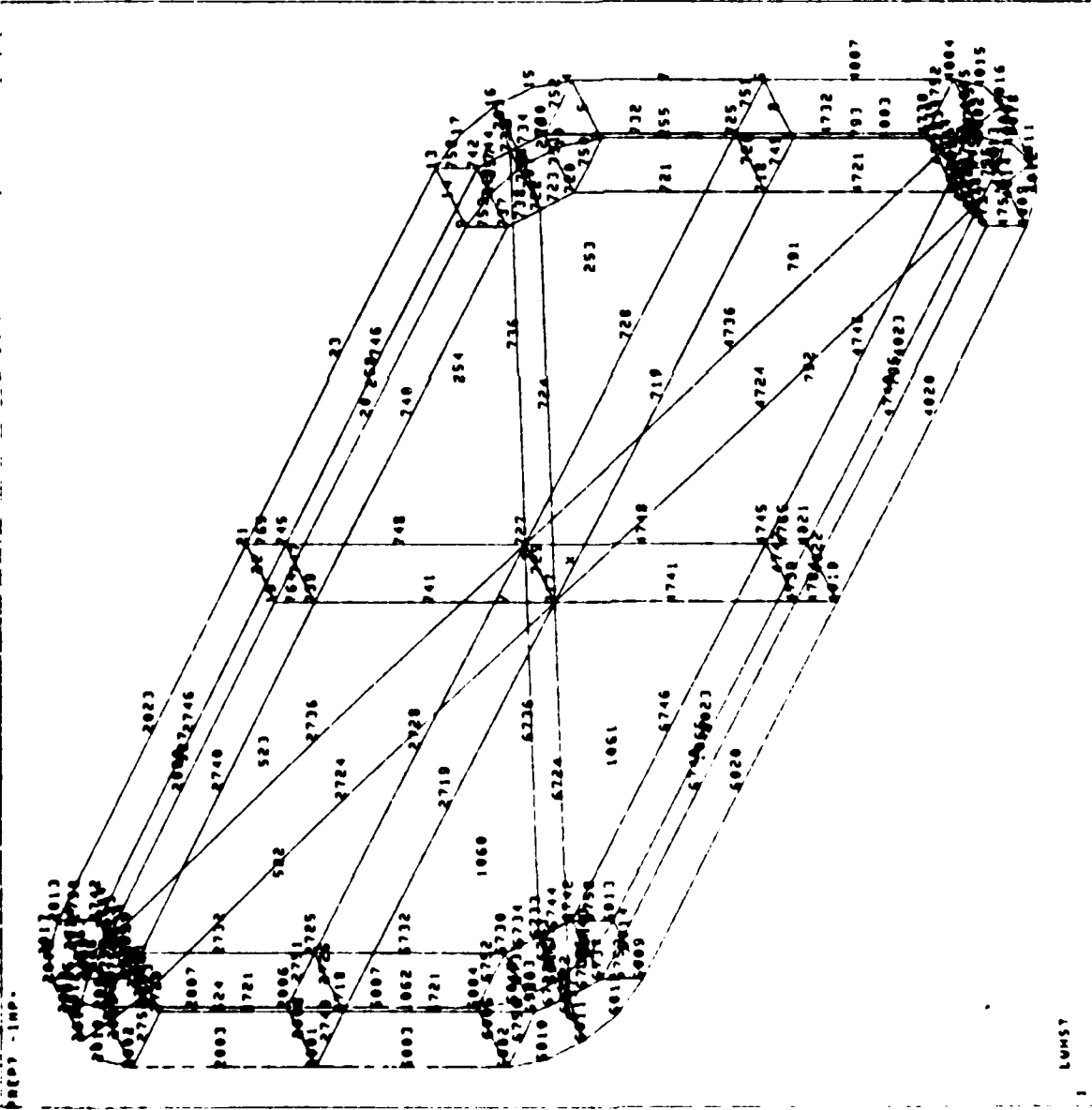




ANSYS 4.28  
 DEC 15 1986  
 17123137  
 PREP7 ELEMENTS  
 CMUR.1  
 2008  
 KU--1  
 VU--1  
 20-1  
 8 DIST-15  
 8 XF--17.1  
 8 VF--17.6  
 8 ZF--18.7  
 8 XRT0-1.12



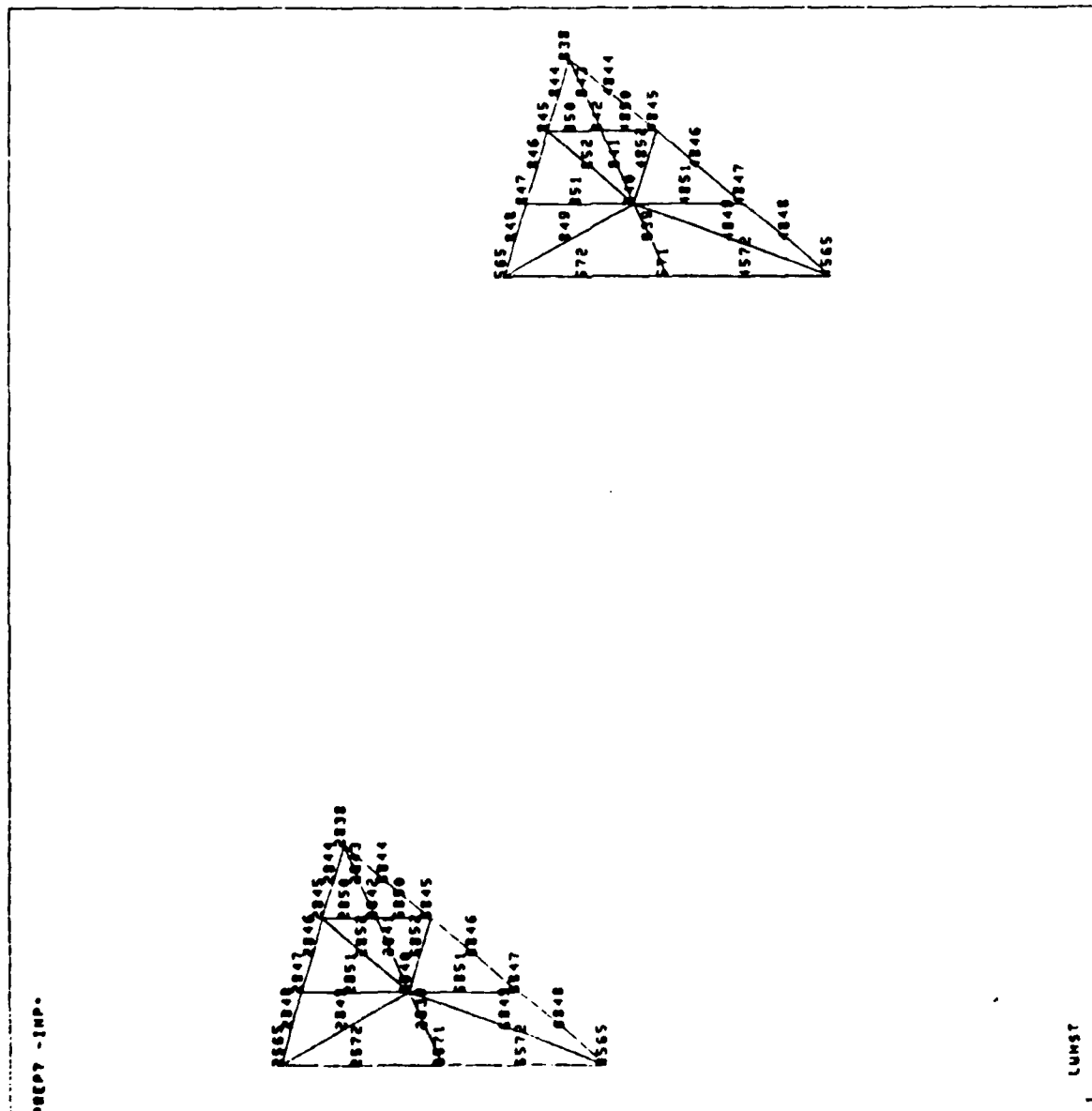
ANSYS 4.20  
 DEC 15 1986  
 17:22:36  
 PREP7 ELEMENTS  
 ENUR=1  
 MMUR=1  
 ZOOM  
 AU=-1  
 VU=-1  
 ZU=1  
 \* DIST=15  
 \* KFE=17.1  
 \* VFE=17.6  
 \* ZFE=18.7  
 \* XRTG=1.12



177



ANSYS 4.20  
 DEC 15 1986  
 17127102  
 PREP7 ELEMENTS  
 MMUR=1  
 ZOOM  
 KU=-.8  
 VU=-.6  
 ZU=-1  
 DIST=20.1  
 XF=1.00  
 YF=-1.23  
 ZF=236  
 KATO=1.02



LIST SELECTED ELEM. IN RANGE 1 TO 1000 BY 1 (LIST NODES)

| ELEM | MAT | TYP | REL | NODES |
|------|-----|-----|-----|-------|
| 1    | 1   | 1   | 1   | 1     |
| 2    | 1   | 1   | 1   | 2     |
| 3    | 1   | 1   | 1   | 3     |
| 4    | 1   | 1   | 1   | 4     |
| 5    | 1   | 1   | 1   | 5     |
| 6    | 1   | 1   | 1   | 6     |
| 7    | 1   | 1   | 1   | 7     |
| 8    | 1   | 1   | 1   | 8     |
| 9    | 1   | 1   | 1   | 9     |
| 10   | 1   | 1   | 1   | 10    |
| 11   | 1   | 1   | 1   | 11    |
| 12   | 1   | 1   | 1   | 12    |
| 13   | 1   | 1   | 1   | 13    |
| 14   | 1   | 1   | 1   | 14    |
| 15   | 1   | 1   | 1   | 15    |
| 16   | 1   | 1   | 1   | 16    |
| 17   | 1   | 1   | 1   | 17    |
| 18   | 1   | 1   | 1   | 18    |
| 19   | 1   | 1   | 1   | 19    |
| 20   | 1   | 1   | 1   | 20    |
| 21   | 1   | 1   | 1   | 21    |
| 22   | 1   | 1   | 1   | 22    |
| 23   | 1   | 1   | 1   | 23    |
| 24   | 1   | 1   | 1   | 24    |
| 25   | 1   | 1   | 1   | 25    |
| 26   | 1   | 1   | 1   | 26    |
| 27   | 1   | 1   | 1   | 27    |
| 28   | 1   | 1   | 1   | 28    |
| 29   | 1   | 1   | 1   | 29    |
| 30   | 1   | 1   | 1   | 30    |
| 31   | 1   | 1   | 1   | 31    |
| 32   | 1   | 1   | 1   | 32    |
| 33   | 1   | 1   | 1   | 33    |
| 34   | 1   | 1   | 1   | 34    |
| 35   | 1   | 1   | 1   | 35    |
| 36   | 1   | 1   | 1   | 36    |
| 37   | 1   | 1   | 1   | 37    |
| 38   | 1   | 1   | 1   | 38    |
| 39   | 1   | 1   | 1   | 39    |
| 40   | 1   | 1   | 1   | 40    |
| 41   | 1   | 1   | 1   | 41    |
| 42   | 1   | 1   | 1   | 42    |
| 43   | 1   | 1   | 1   | 43    |
| 44   | 1   | 1   | 1   | 44    |
| 45   | 1   | 1   | 1   | 45    |
| 46   | 1   | 1   | 1   | 46    |
| 47   | 1   | 1   | 1   | 47    |
| 48   | 1   | 1   | 1   | 48    |
| 49   | 1   | 1   | 1   | 49    |
| 50   | 1   | 1   | 1   | 50    |
| 51   | 1   | 1   | 1   | 51    |
| 52   | 1   | 1   | 1   | 52    |
| 53   | 1   | 1   | 1   | 53    |
| 54   | 1   | 1   | 1   | 54    |
| 55   | 1   | 1   | 1   | 55    |
| 56   | 1   | 1   | 1   | 56    |
| 57   | 1   | 1   | 1   | 57    |
| 58   | 1   | 1   | 1   | 58    |
| 59   | 1   | 1   | 1   | 59    |
| 60   | 1   | 1   | 1   | 60    |
| 61   | 1   | 1   | 1   | 61    |
| 62   | 1   | 1   | 1   | 62    |
| 63   | 1   | 1   | 1   | 63    |
| 64   | 1   | 1   | 1   | 64    |
| 65   | 1   | 1   | 1   | 65    |
| 66   | 1   | 1   | 1   | 66    |
| 67   | 1   | 1   | 1   | 67    |
| 68   | 1   | 1   | 1   | 68    |
| 69   | 1   | 1   | 1   | 69    |
| 70   | 1   | 1   | 1   | 70    |

NODE (YES, NO OR CONTINUOUS) -

| ELEM | MAT | TYP | REL | NODES |
|------|-----|-----|-----|-------|
| 81   | 1   | 1   | 1   | 81    |
| 82   | 1   | 1   | 1   | 82    |
| 83   | 1   | 1   | 1   | 83    |
| 84   | 1   | 1   | 1   | 84    |
| 85   | 1   | 1   | 1   | 85    |
| 86   | 1   | 1   | 1   | 86    |
| 87   | 1   | 1   | 1   | 87    |
| 88   | 1   | 1   | 1   | 88    |
| 89   | 1   | 1   | 1   | 89    |
| 90   | 1   | 1   | 1   | 90    |
| 91   | 1   | 1   | 1   | 91    |
| 92   | 1   | 1   | 1   | 92    |
| 93   | 1   | 1   | 1   | 93    |
| 94   | 1   | 1   | 1   | 94    |
| 95   | 1   | 1   | 1   | 95    |
| 96   | 1   | 1   | 1   | 96    |
| 97   | 1   | 1   | 1   | 97    |
| 98   | 1   | 1   | 1   | 98    |
| 99   | 1   | 1   | 1   | 99    |
| 100  | 1   | 1   | 1   | 100   |
| 101  | 1   | 1   | 1   | 101   |
| 102  | 1   | 1   | 1   | 102   |
| 103  | 1   | 1   | 1   | 103   |
| 104  | 1   | 1   | 1   | 104   |
| 105  | 1   | 1   | 1   | 105   |
| 106  | 1   | 1   | 1   | 106   |
| 107  | 1   | 1   | 1   | 107   |
| 108  | 1   | 1   | 1   | 108   |
| 109  | 1   | 1   | 1   | 109   |
| 110  | 1   | 1   | 1   | 110   |
| 111  | 1   | 1   | 1   | 111   |
| 112  | 1   | 1   | 1   | 112   |
| 113  | 1   | 1   | 1   | 113   |
| 114  | 1   | 1   | 1   | 114   |
| 115  | 1   | 1   | 1   | 115   |
| 116  | 1   | 1   | 1   | 116   |
| 117  | 1   | 1   | 1   | 117   |
| 118  | 1   | 1   | 1   | 118   |
| 119  | 1   | 1   | 1   | 119   |
| 120  | 1   | 1   | 1   | 120   |
| 121  | 1   | 1   | 1   | 121   |
| 122  | 1   | 1   | 1   | 122   |
| 123  | 1   | 1   | 1   | 123   |
| 124  | 1   | 1   | 1   | 124   |
| 125  | 1   | 1   | 1   | 125   |
| 126  | 1   | 1   | 1   | 126   |
| 127  | 1   | 1   | 1   | 127   |
| 128  | 1   | 1   | 1   | 128   |
| 129  | 1   | 1   | 1   | 129   |
| 130  | 1   | 1   | 1   | 130   |
| 131  | 1   | 1   | 1   | 131   |
| 132  | 1   | 1   | 1   | 132   |
| 133  | 1   | 1   | 1   | 133   |
| 134  | 1   | 1   | 1   | 134   |
| 135  | 1   | 1   | 1   | 135   |
| 136  | 1   | 1   | 1   | 136   |
| 137  | 1   | 1   | 1   | 137   |
| 138  | 1   | 1   | 1   | 138   |
| 139  | 1   | 1   | 1   | 139   |
| 140  | 1   | 1   | 1   | 140   |
| 141  | 1   | 1   | 1   | 141   |
| 142  | 1   | 1   | 1   | 142   |
| 143  | 1   | 1   | 1   | 143   |
| 144  | 1   | 1   | 1   | 144   |
| 145  | 1   | 1   | 1   | 145   |
| 146  | 1   | 1   | 1   | 146   |
| 147  | 1   | 1   | 1   | 147   |
| 148  | 1   | 1   | 1   | 148   |
| 149  | 1   | 1   | 1   | 149   |
| 150  | 1   | 1   | 1   | 150   |
| 151  | 1   | 1   | 1   | 151   |
| 152  | 1   | 1   | 1   | 152   |
| 153  | 1   | 1   | 1   | 153   |
| 154  | 1   | 1   | 1   | 154   |
| 155  | 1   | 1   | 1   | 155   |
| 156  | 1   | 1   | 1   | 156   |
| 157  | 1   | 1   | 1   | 157   |
| 158  | 1   | 1   | 1   | 158   |
| 159  | 1   | 1   | 1   | 159   |
| 160  | 1   | 1   | 1   | 160   |
| 161  | 1   | 1   | 1   | 161   |
| 162  | 1   | 1   | 1   | 162   |

| ELEM | MAT | TYP | REL | NODES |
|------|-----|-----|-----|-------|
| 171  | 1   | 1   | 1   | 171   |
| 172  | 1   | 1   | 1   | 172   |
| 173  | 1   | 1   | 1   | 173   |
| 174  | 1   | 1   | 1   | 174   |
| 175  | 1   | 1   | 1   | 175   |
| 176  | 1   | 1   | 1   | 176   |
| 177  | 1   | 1   | 1   | 177   |
| 178  | 1   | 1   | 1   | 178   |
| 179  | 1   | 1   | 1   | 179   |
| 180  | 1   | 1   | 1   | 180   |
| 181  | 1   | 1   | 1   | 181   |
| 182  | 1   | 1   | 1   | 182   |
| 183  | 1   | 1   | 1   | 183   |
| 184  | 1   | 1   | 1   | 184   |
| 185  | 1   | 1   | 1   | 185   |
| 186  | 1   | 1   | 1   | 186   |
| 187  | 1   | 1   | 1   | 187   |
| 188  | 1   | 1   | 1   | 188   |
| 189  | 1   | 1   | 1   | 189   |
| 190  | 1   | 1   | 1   | 190   |
| 191  | 1   | 1   | 1   | 191   |
| 192  | 1   | 1   | 1   | 192   |
| 193  | 1   | 1   | 1   | 193   |
| 194  | 1   | 1   | 1   | 194   |
| 195  | 1   | 1   | 1   | 195   |
| 196  | 1   | 1   | 1   | 196   |
| 197  | 1   | 1   | 1   | 197   |
| 198  | 1   | 1   | 1   | 198   |
| 199  | 1   | 1   | 1   | 199   |
| 200  | 1   | 1   | 1   | 200   |
| 201  | 1   | 1   | 1   | 201   |
| 202  | 1   | 1   | 1   | 202   |
| 203  | 1   | 1   | 1   | 203   |
| 204  | 1   | 1   | 1   | 204   |
| 205  | 1   | 1   | 1   | 205   |
| 206  | 1   | 1   | 1   | 206   |
| 207  | 1   | 1   | 1   | 207   |
| 208  | 1   | 1   | 1   | 208   |
| 209  | 1   | 1   | 1   | 209   |
| 210  | 1   | 1   | 1   | 210   |
| 211  | 1   | 1   | 1   | 211   |
| 212  | 1   | 1   | 1   | 212   |
| 213  | 1   | 1   | 1   | 213   |
| 214  | 1   | 1   | 1   | 214   |
| 215  | 1   | 1   | 1   | 215   |
| 216  | 1   | 1   | 1   | 216   |
| 217  | 1   | 1   | 1   | 217   |
| 218  | 1   | 1   | 1   | 218   |
| 219  | 1   | 1   | 1   | 219   |
| 220  | 1   | 1   | 1   | 220   |
| 221  | 1   | 1   | 1   | 221   |
| 222  | 1   | 1   | 1   | 222   |
| 223  | 1   | 1   | 1   | 223   |
| 224  | 1   | 1   | 1   | 224   |
| 225  | 1   | 1   | 1   | 225   |
| 226  | 1   | 1   | 1   | 226   |
| 227  | 1   | 1   | 1   | 227   |
| 228  | 1   | 1   | 1   | 228   |
| 229  | 1   | 1   | 1   | 229   |
| 230  | 1   | 1   | 1   | 230   |
| 231  | 1   | 1   | 1   | 231   |
| 232  | 1   | 1   | 1   | 232   |
| 233  | 1   | 1   | 1   | 233   |
| 234  | 1   | 1   | 1   | 234   |
| 235  | 1   | 1   | 1   | 235   |
| 236  | 1   | 1   | 1   | 236   |
| 237  | 1   | 1   | 1   | 237   |
| 238  | 1   | 1   | 1   | 238   |
| 239  | 1   | 1   | 1   | 239   |
| 240  | 1   | 1   | 1   | 240   |
| 241  | 1   | 1   | 1   | 241   |
| 242  | 1   | 1   | 1   | 242   |
| 243  | 1   | 1   | 1   | 243   |
| 244  | 1   | 1   | 1   | 244   |
| 245  | 1   | 1   | 1   | 245   |
| 246  | 1   | 1   | 1   | 246   |
| 247  | 1   | 1   | 1   | 247   |
| 248  | 1   | 1   | 1   | 248   |
| 249  | 1   | 1   | 1   | 249   |
| 250  | 1   | 1   | 1   | 250   |
| 251  | 1   | 1   | 1   | 251   |
| 252  | 1   | 1   | 1   | 252   |
| 253  | 1   | 1   | 1   | 253   |
| 254  | 1   | 1   | 1   | 254   |
| 255  | 1   | 1   | 1   | 255   |
| 256  | 1   | 1   | 1   | 256   |
| 257  | 1   | 1   | 1   | 257   |
| 258  | 1   | 1   | 1   | 258   |
| 259  | 1   | 1   | 1   | 259   |
| 260  | 1   | 1   | 1   | 260   |
| 261  | 1   | 1   | 1   | 261   |
| 262  | 1   | 1   | 1   | 262   |
| 263  | 1   | 1   | 1   | 263   |
| 264  | 1   | 1   | 1   | 264   |
| 265  | 1   | 1   | 1   | 265   |
| 266  | 1   | 1   | 1   | 266   |
| 267  | 1   | 1   | 1   | 267   |
| 268  | 1   | 1   | 1   | 268   |
| 269  | 1   | 1   | 1   | 269   |
| 270  | 1   | 1   | 1   | 270   |

| ELEM | MAT | TYP | REL | NODES |
|------|-----|-----|-----|-------|
| 271  | 1   | 1   | 1   | 271   |
| 272  | 1   | 1   | 1   | 272   |
| 273  | 1   | 1   | 1   | 273   |
| 274  | 1   | 1   | 1   | 274   |
| 275  | 1   | 1   | 1   | 275   |
| 276  | 1   | 1   | 1   | 276   |
| 277  | 1   | 1   | 1   | 277   |
| 278  | 1   | 1   | 1   | 278   |
| 279  | 1   | 1   | 1   | 279   |
| 280  | 1   | 1   | 1   | 280   |
| 281  | 1   | 1   | 1   | 281   |
| 282  | 1   | 1   | 1   | 282   |
| 283  | 1   | 1   | 1   | 283   |
| 284  | 1   | 1   | 1   | 284   |
| 285  | 1   | 1   | 1   | 285   |
| 286  | 1   | 1   | 1   | 286   |
| 287  | 1   | 1   | 1   | 287   |
| 288  | 1   | 1   | 1   | 288   |
| 289  | 1   | 1   | 1   | 289   |
| 290  | 1   | 1   | 1   | 290   |
| 291  | 1   | 1   | 1   | 291   |
| 292  | 1   | 1   | 1   | 292   |
| 293  | 1   | 1   | 1   | 293   |
| 294  | 1   | 1   | 1   | 294   |
| 295  | 1   | 1   | 1   | 295   |
| 296  | 1   | 1   | 1   | 296   |
| 297  | 1   | 1   | 1   | 297   |
| 298  | 1   | 1   | 1   | 298   |
| 299  | 1   | 1   | 1   | 299   |
| 300  | 1   | 1   | 1   | 300   |
| 301  | 1   | 1   | 1   | 301   |
| 302  | 1   | 1   | 1   | 302   |
| 303  | 1   | 1   | 1   | 303   |
| 304  | 1   | 1   | 1   | 304   |
| 305  | 1   | 1   | 1   | 305   |
| 306  | 1   | 1   | 1   | 306   |
| 307  | 1   | 1   | 1   | 307   |
| 308  | 1   | 1   | 1   | 308   |
| 309  | 1   | 1   | 1   | 309   |
| 310  | 1   | 1   | 1   | 310   |
| 311  | 1   | 1   | 1   | 311   |
| 312  | 1   | 1   | 1   | 312   |
| 313  | 1   | 1   | 1   | 313   |
| 314  | 1   | 1   | 1   | 314   |
| 315  | 1   | 1   | 1   | 315   |
| 316  | 1   | 1   | 1   | 316   |
| 317  | 1   | 1   | 1   | 317   |
| 318  | 1   | 1   | 1   | 318   |
| 319  | 1   | 1   | 1   | 319   |
| 320  | 1   | 1   | 1   | 320   |
| 321  | 1   | 1   | 1   | 321   |
| 322  | 1   | 1   | 1   | 322   |
| 323  | 1   | 1   | 1   | 323   |
| 324  | 1   | 1   | 1   | 324   |
| 325  | 1   | 1   | 1   | 325   |
| 326  | 1   | 1   | 1   | 326   |
| 327  | 1   | 1   | 1   | 327   |
| 328  | 1   | 1   | 1   | 328   |
| 329  | 1   | 1   | 1   | 329   |
| 330  | 1   | 1   | 1   | 330   |
| 331  | 1   | 1   | 1   | 331   |
| 332  | 1   | 1   | 1   | 332   |
| 333  | 1   | 1   | 1   | 333   |
| 334  | 1   | 1   | 1   | 334   |
| 335  | 1   | 1   | 1   | 335   |
| 336  | 1   | 1   | 1   | 336   |
| 337  | 1   | 1   | 1   | 337   |
| 338  | 1   | 1   | 1   | 338   |
| 339  | 1   | 1   | 1   | 339   |
| 340  | 1   | 1   | 1   | 340   |





ELIST.073.207.1

LIST SELECTED ELEMS. IN RANGE 073 TO 307 BY 1 (LIST NAMES)

| ELN | MT | TP | REL | NOES |
|-----|----|----|-----|------|
| 073 | 1  | 1  | 1   | 2000 |
| 074 | 1  | 1  | 1   | 2001 |
| 075 | 1  | 1  | 1   | 2002 |
| 076 | 1  | 1  | 1   | 2003 |
| 077 | 1  | 1  | 1   | 2004 |
| 078 | 1  | 1  | 1   | 2005 |
| 079 | 1  | 1  | 1   | 2006 |
| 080 | 1  | 1  | 1   | 2007 |
| 081 | 1  | 1  | 1   | 2008 |
| 082 | 1  | 1  | 1   | 2009 |
| 083 | 1  | 1  | 1   | 2010 |
| 084 | 1  | 1  | 1   | 2011 |
| 085 | 1  | 1  | 1   | 2012 |
| 086 | 1  | 1  | 1   | 2013 |
| 087 | 1  | 1  | 1   | 2014 |
| 088 | 1  | 1  | 1   | 2015 |
| 089 | 1  | 1  | 1   | 2016 |
| 090 | 1  | 1  | 1   | 2017 |
| 091 | 1  | 1  | 1   | 2018 |
| 092 | 1  | 1  | 1   | 2019 |
| 093 | 1  | 1  | 1   | 2020 |
| 094 | 1  | 1  | 1   | 2021 |
| 095 | 1  | 1  | 1   | 2022 |
| 096 | 1  | 1  | 1   | 2023 |
| 097 | 1  | 1  | 1   | 2024 |
| 098 | 1  | 1  | 1   | 2025 |
| 099 | 1  | 1  | 1   | 2026 |
| 100 | 1  | 1  | 1   | 2027 |
| 101 | 1  | 1  | 1   | 2028 |
| 102 | 1  | 1  | 1   | 2029 |
| 103 | 1  | 1  | 1   | 2030 |
| 104 | 1  | 1  | 1   | 2031 |
| 105 | 1  | 1  | 1   | 2032 |
| 106 | 1  | 1  | 1   | 2033 |
| 107 | 1  | 1  | 1   | 2034 |
| 108 | 1  | 1  | 1   | 2035 |
| 109 | 1  | 1  | 1   | 2036 |
| 110 | 1  | 1  | 1   | 2037 |
| 111 | 1  | 1  | 1   | 2038 |
| 112 | 1  | 1  | 1   | 2039 |
| 113 | 1  | 1  | 1   | 2040 |
| 114 | 1  | 1  | 1   | 2041 |
| 115 | 1  | 1  | 1   | 2042 |
| 116 | 1  | 1  | 1   | 2043 |
| 117 | 1  | 1  | 1   | 2044 |
| 118 | 1  | 1  | 1   | 2045 |
| 119 | 1  | 1  | 1   | 2046 |
| 120 | 1  | 1  | 1   | 2047 |
| 121 | 1  | 1  | 1   | 2048 |
| 122 | 1  | 1  | 1   | 2049 |
| 123 | 1  | 1  | 1   | 2050 |
| 124 | 1  | 1  | 1   | 2051 |
| 125 | 1  | 1  | 1   | 2052 |
| 126 | 1  | 1  | 1   | 2053 |
| 127 | 1  | 1  | 1   | 2054 |
| 128 | 1  | 1  | 1   | 2055 |
| 129 | 1  | 1  | 1   | 2056 |
| 130 | 1  | 1  | 1   | 2057 |
| 131 | 1  | 1  | 1   | 2058 |
| 132 | 1  | 1  | 1   | 2059 |
| 133 | 1  | 1  | 1   | 2060 |
| 134 | 1  | 1  | 1   | 2061 |
| 135 | 1  | 1  | 1   | 2062 |
| 136 | 1  | 1  | 1   | 2063 |
| 137 | 1  | 1  | 1   | 2064 |
| 138 | 1  | 1  | 1   | 2065 |
| 139 | 1  | 1  | 1   | 2066 |
| 140 | 1  | 1  | 1   | 2067 |
| 141 | 1  | 1  | 1   | 2068 |
| 142 | 1  | 1  | 1   | 2069 |
| 143 | 1  | 1  | 1   | 2070 |
| 144 | 1  | 1  | 1   | 2071 |
| 145 | 1  | 1  | 1   | 2072 |
| 146 | 1  | 1  | 1   | 2073 |
| 147 | 1  | 1  | 1   | 2074 |
| 148 | 1  | 1  | 1   | 2075 |
| 149 | 1  | 1  | 1   | 2076 |
| 150 | 1  | 1  | 1   | 2077 |
| 151 | 1  | 1  | 1   | 2078 |
| 152 | 1  | 1  | 1   | 2079 |
| 153 | 1  | 1  | 1   | 2080 |
| 154 | 1  | 1  | 1   | 2081 |
| 155 | 1  | 1  | 1   | 2082 |
| 156 | 1  | 1  | 1   | 2083 |
| 157 | 1  | 1  | 1   | 2084 |
| 158 | 1  | 1  | 1   | 2085 |
| 159 | 1  | 1  | 1   | 2086 |
| 160 | 1  | 1  | 1   | 2087 |
| 161 | 1  | 1  | 1   | 2088 |
| 162 | 1  | 1  | 1   | 2089 |
| 163 | 1  | 1  | 1   | 2090 |
| 164 | 1  | 1  | 1   | 2091 |
| 165 | 1  | 1  | 1   | 2092 |
| 166 | 1  | 1  | 1   | 2093 |
| 167 | 1  | 1  | 1   | 2094 |
| 168 | 1  | 1  | 1   | 2095 |
| 169 | 1  | 1  | 1   | 2096 |
| 170 | 1  | 1  | 1   | 2097 |
| 171 | 1  | 1  | 1   | 2098 |
| 172 | 1  | 1  | 1   | 2099 |
| 173 | 1  | 1  | 1   | 2100 |
| 174 | 1  | 1  | 1   | 2101 |
| 175 | 1  | 1  | 1   | 2102 |
| 176 | 1  | 1  | 1   | 2103 |
| 177 | 1  | 1  | 1   | 2104 |
| 178 | 1  | 1  | 1   | 2105 |
| 179 | 1  | 1  | 1   | 2106 |
| 180 | 1  | 1  | 1   | 2107 |
| 181 | 1  | 1  | 1   | 2108 |
| 182 | 1  | 1  | 1   | 2109 |
| 183 | 1  | 1  | 1   | 2110 |
| 184 | 1  | 1  | 1   | 2111 |
| 185 | 1  | 1  | 1   | 2112 |
| 186 | 1  | 1  | 1   | 2113 |
| 187 | 1  | 1  | 1   | 2114 |
| 188 | 1  | 1  | 1   | 2115 |
| 189 | 1  | 1  | 1   | 2116 |
| 190 | 1  | 1  | 1   | 2117 |
| 191 | 1  | 1  | 1   | 2118 |
| 192 | 1  | 1  | 1   | 2119 |
| 193 | 1  | 1  | 1   | 2120 |
| 194 | 1  | 1  | 1   | 2121 |
| 195 | 1  | 1  | 1   | 2122 |
| 196 | 1  | 1  | 1   | 2123 |
| 197 | 1  | 1  | 1   | 2124 |
| 198 | 1  | 1  | 1   | 2125 |
| 199 | 1  | 1  | 1   | 2126 |
| 200 | 1  | 1  | 1   | 2127 |
| 201 | 1  | 1  | 1   | 2128 |
| 202 | 1  | 1  | 1   | 2129 |
| 203 | 1  | 1  | 1   | 2130 |
| 204 | 1  | 1  | 1   | 2131 |
| 205 | 1  | 1  | 1   | 2132 |
| 206 | 1  | 1  | 1   | 2133 |
| 207 | 1  | 1  | 1   | 2134 |
| 208 | 1  | 1  | 1   | 2135 |
| 209 | 1  | 1  | 1   | 2136 |
| 210 | 1  | 1  | 1   | 2137 |
| 211 | 1  | 1  | 1   | 2138 |
| 212 | 1  | 1  | 1   | 2139 |
| 213 | 1  | 1  | 1   | 2140 |
| 214 | 1  | 1  | 1   | 2141 |
| 215 | 1  | 1  | 1   | 2142 |
| 216 | 1  | 1  | 1   | 2143 |
| 217 | 1  | 1  | 1   | 2144 |
| 218 | 1  | 1  | 1   | 2145 |
| 219 | 1  | 1  | 1   | 2146 |
| 220 | 1  | 1  | 1   | 2147 |
| 221 | 1  | 1  | 1   | 2148 |
| 222 | 1  | 1  | 1   | 2149 |
| 223 | 1  | 1  | 1   | 2150 |
| 224 | 1  | 1  | 1   | 2151 |
| 225 | 1  | 1  | 1   | 2152 |
| 226 | 1  | 1  | 1   | 2153 |
| 227 | 1  | 1  | 1   | 2154 |
| 228 | 1  | 1  | 1   | 2155 |
| 229 | 1  | 1  | 1   | 2156 |
| 230 | 1  | 1  | 1   | 2157 |
| 231 | 1  | 1  | 1   | 2158 |
| 232 | 1  | 1  | 1   | 2159 |
| 233 | 1  | 1  | 1   | 2160 |
| 234 | 1  | 1  | 1   | 2161 |
| 235 | 1  | 1  | 1   | 2162 |
| 236 | 1  | 1  | 1   | 2163 |
| 237 | 1  | 1  | 1   | 2164 |
| 238 | 1  | 1  | 1   | 2165 |
| 239 | 1  | 1  | 1   | 2166 |
| 240 | 1  | 1  | 1   | 2167 |
| 241 | 1  | 1  | 1   | 2168 |
| 242 | 1  | 1  | 1   | 2169 |
| 243 | 1  | 1  | 1   | 2170 |
| 244 | 1  | 1  | 1   | 2171 |
| 245 | 1  | 1  | 1   | 2172 |
| 246 | 1  | 1  | 1   | 2173 |
| 247 | 1  | 1  | 1   | 2174 |
| 248 | 1  | 1  | 1   | 2175 |
| 249 | 1  | 1  | 1   | 2176 |
| 250 | 1  | 1  | 1   | 2177 |
| 251 | 1  | 1  | 1   | 2178 |
| 252 | 1  | 1  | 1   | 2179 |
| 253 | 1  | 1  | 1   | 2180 |
| 254 | 1  | 1  | 1   | 2181 |
| 255 | 1  | 1  | 1   | 2182 |
| 256 | 1  | 1  | 1   | 2183 |
| 257 | 1  | 1  | 1   | 2184 |
| 258 | 1  | 1  | 1   | 2185 |
| 259 | 1  | 1  | 1   | 2186 |
| 260 | 1  | 1  | 1   | 2187 |
| 261 | 1  | 1  | 1   | 2188 |
| 262 | 1  | 1  | 1   | 2189 |
| 263 | 1  | 1  | 1   | 2190 |
| 264 | 1  | 1  | 1   | 2191 |
| 265 | 1  | 1  | 1   | 2192 |
| 266 | 1  | 1  | 1   | 2193 |
| 267 | 1  | 1  | 1   | 2194 |
| 268 | 1  | 1  | 1   | 2195 |
| 269 | 1  | 1  | 1   | 2196 |
| 270 | 1  | 1  | 1   | 2197 |
| 271 | 1  | 1  | 1   | 2198 |
| 272 | 1  | 1  | 1   | 2199 |
| 273 | 1  | 1  | 1   | 2200 |
| 274 | 1  | 1  | 1   | 2201 |
| 275 | 1  | 1  | 1   | 2202 |
| 276 | 1  | 1  | 1   | 2203 |
| 277 | 1  | 1  | 1   | 2204 |
| 278 | 1  | 1  | 1   | 2205 |
| 279 | 1  | 1  | 1   | 2206 |
| 280 | 1  | 1  | 1   | 2207 |
| 281 | 1  | 1  | 1   | 2208 |
| 282 | 1  | 1  | 1   | 2209 |
| 283 | 1  | 1  | 1   | 2210 |
| 284 | 1  | 1  | 1   | 2211 |
| 285 | 1  | 1  | 1   | 2212 |
| 286 | 1  | 1  | 1   | 2213 |
| 287 | 1  | 1  | 1   | 2214 |
| 288 | 1  | 1  | 1   | 2215 |
| 289 | 1  | 1  | 1   | 2216 |
| 290 | 1  | 1  | 1   | 2217 |
| 291 | 1  | 1  | 1   | 2218 |
| 292 | 1  | 1  | 1   | 2219 |
| 293 | 1  | 1  | 1   | 2220 |
| 294 | 1  | 1  | 1   | 2221 |
| 295 | 1  | 1  | 1   | 2222 |
| 296 | 1  | 1  | 1   | 2223 |
| 297 | 1  | 1  | 1   | 2224 |
| 298 | 1  | 1  | 1   | 2225 |
| 299 | 1  | 1  | 1   | 2226 |
| 300 | 1  | 1  | 1   | 2227 |
| 301 | 1  | 1  | 1   | 2228 |
| 302 | 1  | 1  | 1   | 2229 |
| 303 | 1  | 1  | 1   | 2230 |
| 304 | 1  | 1  | 1   | 2231 |
| 305 | 1  | 1  | 1   | 2232 |
| 306 | 1  | 1  | 1   | 2233 |
| 307 | 1  | 1  | 1   | 2234 |

NOTE: (YES, NO OR CONTINUOUS)

| ELN | MT | TP | REL | NOES |
|-----|----|----|-----|------|
| 308 | 1  | 1  | 1   | 2005 |
| 309 | 1  | 1  | 1   | 2006 |
| 310 | 1  | 1  | 1   | 2007 |
| 311 | 1  | 1  | 1   | 2008 |
| 312 | 1  | 1  | 1   | 2009 |
| 313 | 1  | 1  | 1   | 2010 |
| 314 | 1  | 1  | 1   | 2011 |
| 315 | 1  | 1  | 1   | 2012 |
| 316 | 1  | 1  | 1   | 2013 |
| 317 | 1  | 1  | 1   | 2014 |
| 318 | 1  | 1  | 1   | 2015 |
| 319 | 1  | 1  | 1   | 2016 |
| 320 | 1  | 1  | 1   | 2017 |
| 321 | 1  | 1  | 1   | 2018 |
| 322 | 1  | 1  | 1   | 2019 |
| 323 | 1  | 1  | 1   | 2020 |
| 324 | 1  | 1  | 1   | 2021 |
| 325 | 1  | 1  | 1   | 2022 |
| 326 | 1  | 1  | 1   | 2023 |
| 327 | 1  | 1  | 1   | 2024 |
| 328 | 1  | 1  | 1   | 2025 |
| 329 | 1  | 1  | 1   | 2026 |
| 330 | 1  | 1  | 1   | 2027 |
| 331 | 1  | 1  | 1   | 2028 |
| 332 | 1  | 1  | 1   | 2029 |
| 333 | 1  | 1  | 1   | 2030 |
| 334 | 1  | 1  | 1   | 2031 |
| 335 | 1  | 1  | 1   | 2032 |
| 336 | 1  | 1  | 1   | 2033 |
| 337 | 1  | 1  | 1   | 2034 |
| 338 | 1  | 1  | 1   | 2035 |
| 339 | 1  | 1  | 1   | 2036 |
| 340 | 1  | 1  | 1   | 2037 |
| 341 | 1  | 1  | 1   | 2038 |
| 342 | 1  | 1  | 1   | 2039 |
| 343 | 1  | 1  | 1   | 2040 |
| 344 | 1  | 1  | 1   | 2041 |
| 345 | 1  | 1  | 1   | 2042 |
| 346 | 1  | 1  | 1   | 2043 |
| 347 | 1  | 1  | 1   | 2044 |
| 348 | 1  | 1  | 1   | 2045 |
| 349 | 1  | 1  | 1   | 2046 |
| 350 | 1  | 1  | 1   | 2047 |
| 351 | 1  | 1  | 1   | 2048 |
| 352 | 1  | 1  | 1   | 2049 |
| 353 | 1  | 1  | 1   | 2050 |
| 354 | 1  | 1  | 1   | 2051 |
| 355 | 1  | 1  | 1   | 2052 |
| 356 | 1  | 1  | 1   | 2053 |
| 357 | 1  | 1  | 1   | 2054 |
| 358 | 1  | 1  | 1   | 2055 |
| 359 | 1  | 1  | 1   | 2056 |
| 360 | 1  | 1  | 1   | 2057 |
| 361 | 1  | 1  | 1   | 2058 |
| 362 | 1  | 1  | 1   | 2059 |
| 363 | 1  | 1  | 1   | 2060 |
| 364 | 1  | 1  | 1   | 2061 |
| 365 | 1  | 1  | 1   | 2062 |
| 366 | 1  | 1  | 1   | 2063 |
| 367 | 1  | 1  | 1   | 2064 |
| 368 | 1  | 1  | 1   | 2065 |
| 369 | 1  | 1  | 1   | 2066 |
| 370 | 1  | 1  | 1   | 2067 |
| 371 | 1  | 1  | 1   | 2068 |
| 372 | 1  | 1  | 1   | 2069 |
| 373 | 1  | 1  | 1   | 2070 |
| 374 | 1  | 1  | 1   | 2071 |
| 375 | 1  | 1  | 1   | 2072 |
| 376 | 1  | 1  | 1   | 2073 |
| 377 | 1  | 1  | 1   | 2074 |
| 378 | 1  | 1  | 1   | 2075 |
| 379 | 1  | 1  | 1   | 2076 |
| 380 | 1  | 1  | 1   | 2077 |
| 381 | 1  | 1  | 1   | 2078 |
| 382 | 1  | 1  | 1   | 2079 |
| 383 | 1  | 1  | 1   | 2080 |
| 384 | 1  | 1  | 1   | 2081 |
| 385 | 1  | 1  | 1   | 2082 |
| 386 | 1  | 1  | 1   | 2083 |
| 387 | 1  | 1  | 1   | 2084 |
| 388 | 1  | 1  | 1   | 2085 |
| 389 | 1  | 1  | 1   | 2086 |
| 390 | 1  | 1  | 1   | 2087 |
| 391 | 1  | 1  | 1   | 2088 |
| 392 | 1  | 1  | 1   | 2089 |
| 393 | 1  | 1  | 1   | 2090 |
| 394 | 1  | 1  | 1   | 2091 |
| 395 | 1  | 1  | 1   | 2092 |
| 396 | 1  | 1  | 1   | 2093 |
| 397 | 1  | 1  | 1   | 2094 |
| 398 | 1  | 1  | 1   | 2095 |
| 399 | 1  | 1  | 1   | 2096 |
| 400 | 1  | 1  | 1   | 2097 |
| 401 | 1  | 1  | 1   | 2098 |
| 402 | 1  | 1  | 1   | 2099 |
| 403 | 1  | 1  | 1   | 2100 |
| 404 | 1  | 1  | 1   | 2101 |
| 405 | 1  | 1  | 1   | 2102 |
| 406 | 1  | 1  | 1   | 2103 |
| 407 | 1  | 1  | 1   | 2104 |
| 408 | 1  | 1  | 1   | 2105 |
| 409 | 1  | 1  | 1   | 2106 |
| 410 | 1  | 1  | 1   | 2107 |
| 411 | 1  | 1  | 1   | 2108 |
| 412 | 1  | 1  | 1   | 2109 |
| 413 | 1  | 1  | 1   | 2110 |
| 414 | 1  | 1  | 1   | 2111 |
| 415 | 1  | 1  | 1   | 2112 |
| 416 | 1  | 1  | 1   | 2113 |
| 417 | 1  | 1  | 1   | 2114 |
| 418 | 1  | 1  | 1   | 2115 |
| 419 | 1  | 1  | 1   | 2116 |
| 420 | 1  | 1  | 1   | 2117 |
| 421 | 1  | 1  | 1   | 2118 |
| 422 | 1  | 1  | 1   | 2119 |
| 423 | 1  | 1  | 1   | 2120 |
| 424 | 1  | 1  | 1   | 2121 |
| 425 | 1  | 1  | 1   | 2122 |
| 426 | 1  | 1  | 1   | 2123 |
| 427 | 1  | 1  | 1   | 2124 |
| 428 | 1  | 1  | 1   | 2125 |
| 429 | 1  | 1  | 1   | 2126 |
| 430 | 1  | 1  | 1   | 2127 |
| 431 | 1  | 1  | 1   | 2128 |
| 432 | 1  | 1  | 1   | 2129 |
| 433 | 1  | 1  | 1   | 2130 |
| 434 | 1  | 1  | 1   | 2131 |
| 435 | 1  | 1  | 1   | 2132 |
| 436 | 1  | 1  | 1   | 2133 |
| 437 | 1  | 1  | 1   | 2134 |
| 438 | 1  | 1  | 1   | 2135 |
| 439 | 1  | 1  | 1   | 2136 |
| 440 | 1  | 1  | 1   | 2137 |
| 441 | 1  | 1  | 1   | 2138 |
| 442 | 1  | 1  | 1   | 2139 |
| 443 | 1  | 1  | 1   | 2140 |
| 444 | 1  | 1  | 1   | 2141 |
| 445 | 1  | 1  | 1   | 2142 |
| 446 | 1  | 1  | 1   | 2143 |
| 447 | 1  | 1  | 1   | 2144 |
| 448 | 1  | 1  | 1   | 2145 |
| 449 | 1  | 1  | 1   | 2146 |
| 450 | 1  | 1  | 1   | 2147 |
| 451 | 1  | 1  | 1   | 2148 |
| 452 | 1  | 1  | 1   | 2149 |
| 453 | 1  | 1  | 1   | 2150 |
| 454 | 1  | 1  | 1   | 2151 |
| 455 | 1  | 1  | 1   | 2152 |
| 456 | 1  | 1  | 1   | 2153 |
| 457 | 1  | 1  | 1   | 2154 |
| 458 | 1  | 1  | 1   | 2155 |
| 459 | 1  | 1  | 1   | 2156 |
| 460 | 1  | 1  | 1   | 2157 |
| 461 | 1  | 1  | 1   | 2158 |
| 462 | 1  | 1  | 1   | 2159 |
| 463 | 1  | 1  | 1   | 2160 |
| 464 | 1  | 1  | 1   | 2161 |
| 465 | 1  | 1  | 1   | 2162 |
| 466 | 1  | 1  | 1   | 2163 |
| 467 | 1  | 1  | 1   | 2164 |
| 468 | 1  | 1  | 1   | 2165 |
| 469 | 1  | 1  | 1   | 2166 |
| 470 | 1  | 1  | 1   | 2167 |
| 471 | 1  | 1  | 1   | 2168 |
| 472 | 1  | 1  | 1   | 2169 |
| 473 | 1  | 1  | 1   | 2170 |
| 474 | 1  | 1  | 1   | 2171 |
| 475 | 1  | 1  | 1   | 2172 |
| 476 | 1  | 1  | 1   | 2173 |
| 477 | 1  | 1  | 1   | 2174 |
| 478 | 1  | 1  | 1   | 2175 |
| 479 | 1  | 1  | 1   | 2176 |
| 480 | 1  | 1  | 1   | 2177 |
| 481 | 1  | 1  | 1   | 2178 |
| 482 | 1  | 1  | 1   | 2179 |
| 483 | 1  | 1  | 1   | 2180 |
| 484 | 1  | 1  | 1   | 2181 |
| 485 | 1  | 1  | 1   | 2182 |
| 486 | 1  | 1  | 1   | 2183 |
| 487 | 1  | 1  | 1   | 2184 |
| 488 | 1  | 1  | 1   | 2185 |
| 489 | 1  | 1  | 1   | 2186 |
| 490 | 1  | 1  | 1   | 2187 |
| 491 | 1  | 1  | 1   | 2188 |
| 492 | 1  | 1  | 1   | 2189 |
| 493 | 1  | 1  | 1   | 2190 |
| 494 | 1  | 1  | 1   | 2191 |
| 495 | 1  | 1  | 1   | 2192 |
| 496 | 1  | 1  | 1   | 2193 |
| 497 | 1  | 1  | 1   | 2194 |
| 498 | 1  | 1  | 1   | 2195 |
| 499 | 1  | 1  | 1   | 2196 |
| 500 | 1  | 1  | 1   | 2197 |
| 501 | 1  | 1  | 1   | 2198 |
| 502 | 1  | 1  | 1   | 2199 |
| 503 | 1  | 1  | 1   | 2200 |
| 504 | 1  | 1  | 1   | 2201 |
| 505 | 1  | 1  | 1   | 2202 |
| 506 | 1  | 1  | 1   | 2203 |
| 507 | 1  | 1  | 1   | 2204 |
| 508 | 1  | 1  | 1   | 2205 |
| 509 | 1  | 1  | 1   | 2206 |
| 510 | 1  | 1  | 1   | 2207 |
| 511 | 1  | 1  | 1   | 2208 |
| 512 | 1  | 1  | 1   | 2209 |
| 513 | 1  | 1  | 1   | 2210 |
| 514 | 1  | 1  | 1   | 2211 |
| 515 | 1  | 1  | 1   | 2212 |
| 516 | 1  | 1  | 1   | 2213 |
| 517 | 1  | 1  | 1   | 2214 |
| 518 | 1  | 1  | 1   | 2215 |
| 519 | 1  | 1  | 1   | 2216 |
| 520 | 1  | 1  | 1   | 2217 |
| 521 | 1  | 1  | 1   | 2218 |
| 522 | 1  | 1  | 1   | 2219 |
| 523 | 1  | 1  | 1   | 2220 |
| 524 | 1  | 1  | 1   | 2221 |
| 525 | 1  | 1  | 1   | 2222 |
| 526 | 1  | 1  | 1   | 2223 |
| 527 | 1  | 1  | 1   | 2224 |
| 528 | 1  | 1  | 1   | 2225 |
| 529 | 1  | 1  | 1   | 2226 |
| 530 | 1  | 1  | 1   | 2227 |
| 531 | 1  | 1  | 1   | 2228 |
| 532 | 1  | 1  | 1   | 2229 |
| 533 | 1  | 1  | 1   | 2230 |
| 534 | 1  | 1  | 1   | 2231 |
| 535 | 1  | 1  | 1   | 2232 |
| 536 | 1  | 1  | 1   | 2233 |
| 537 | 1  | 1  | 1   | 2234 |
| 538 | 1  | 1  | 1   | 2235 |
| 539 | 1  | 1  | 1   | 2236 |
| 540 | 1  | 1  | 1   | 2237 |
| 541 | 1  | 1  | 1   | 2238 |
| 542 | 1  | 1  | 1   | 2239 |
| 543 | 1  | 1  | 1   | 2240 |
| 544 | 1  | 1  | 1   | 2241 |
| 545 | 1  | 1  | 1   | 2242 |
| 546 | 1  | 1  | 1   | 2243 |
| 547 | 1  | 1  | 1   | 2244 |
| 548 | 1  | 1  | 1   | 2245 |
| 549 | 1  | 1  | 1   | 2246 |
| 550 | 1  | 1  | 1   | 2247 |
| 551 | 1  | 1  | 1   | 2248 |
| 552 | 1  | 1  | 1   | 2249 |
| 553 | 1  | 1  | 1   | 2250 |
| 554 | 1  | 1  | 1   | 2251 |
| 555 | 1  | 1  | 1   | 2252 |
| 556 | 1  | 1  | 1   | 2253 |
| 557 | 1  | 1  | 1   | 2254 |
| 558 | 1  | 1  | 1   | 2255 |
| 559 | 1  | 1  | 1   | 2256 |
| 560 | 1  | 1  | 1   | 2257 |
| 561 | 1  | 1  | 1   | 2258 |
| 562 | 1  | 1  | 1   | 2259 |
| 563 | 1  | 1  | 1   | 2260 |
| 564 | 1  | 1  | 1   | 2261 |
| 565 | 1  | 1  | 1   | 2262 |
| 566 | 1  | 1  | 1   | 2263 |
| 567 | 1  | 1  | 1   | 2264 |
| 568 | 1  | 1  | 1   | 2265 |
| 569 | 1  | 1  | 1   | 2266 |
| 570 | 1  | 1  | 1   | 2267 |
| 571 | 1  | 1  | 1   | 2268 |
| 572 | 1  | 1  | 1   | 2269 |
| 573 | 1  | 1  | 1   | 2270 |
| 574 | 1  | 1  | 1   | 2271 |
| 575 | 1  | 1  | 1   | 2272 |
| 576 | 1  | 1  | 1   | 2273 |
| 577 | 1  | 1  | 1   | 2274 |
| 578 | 1  | 1  | 1   | 2275 |
| 579 | 1  | 1  | 1   | 2276 |
| 580 | 1  | 1  | 1   | 2277 |
| 581 | 1  | 1  | 1   | 2278 |
| 582 | 1  | 1  | 1   | 2279 |
| 583 | 1  | 1  | 1   | 2280 |
| 584 | 1  | 1  | 1   | 2281 |
| 585 | 1  | 1  | 1   | 2282 |
| 586 | 1  | 1  | 1   | 2283 |
| 587 | 1  | 1  | 1   | 2284 |
| 588 | 1  | 1  | 1   | 2285 |
| 589 | 1  | 1  | 1   | 2286 |
| 590 | 1  | 1  | 1   | 2287 |
| 591 | 1  | 1  | 1   | 2288 |
| 592 | 1  | 1  | 1   | 2289 |
| 593 | 1  | 1  | 1   | 2290 |
| 594 | 1  | 1  | 1   | 2291 |
| 595 | 1  | 1  | 1   | 2292 |
| 596 | 1  | 1  | 1   | 2293 |
| 597 | 1  | 1  | 1   | 2294 |
| 598 | 1  | 1  | 1   | 2295 |
| 599 | 1  | 1  | 1   | 2296 |
| 600 | 1  | 1  | 1   | 2297 |
| 601 | 1  | 1  | 1   | 2298 |
| 602 | 1  | 1  | 1   | 2299 |
| 603 | 1  | 1  | 1   | 2300 |
| 604 | 1  | 1  | 1   | 2301 |
| 605 | 1  | 1  | 1   | 2302 |
| 606 | 1  | 1  | 1   | 2303 |
| 607 | 1  | 1  | 1   | 2304 |
| 608 | 1  | 1  | 1   | 2305 |
| 609 | 1  | 1  | 1   | 2306 |
| 610 | 1  | 1  | 1   | 2307 |
| 611 | 1  | 1  | 1   | 2308 |
| 612 | 1  | 1  | 1   | 2309 |
| 613 | 1  | 1  | 1   | 2310 |
| 614 | 1  | 1  | 1   | 2311 |
| 615 | 1  | 1  | 1   | 2312 |
| 616 | 1  | 1  | 1   | 2313 |
| 617 | 1  | 1  | 1   | 2314 |
| 618 | 1  | 1  | 1   | 2315 |
| 619 | 1  | 1  | 1   | 2316 |
| 620 | 1  | 1  | 1   | 2317 |
| 621 | 1  | 1  | 1   | 2318 |
| 622 | 1  | 1  | 1   | 2319 |
| 623 | 1  | 1  | 1   | 2320 |
| 624 | 1  | 1  |     |      |















| LIST SELECTED ELEMENTS IN RANGE 770 TO 800 BY 1 (LIST NODES) |     |     |     |     |     |     |     |     |     |
|--------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| ELN                                                          | INT | TPP | REL |     |     |     |     |     |     |
| 770                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 771                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 772                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 773                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 774                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 775                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 776                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 777                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 778                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 779                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 780                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 781                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 782                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 783                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 784                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 785                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 786                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 787                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 788                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 789                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 790                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 791                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 792                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 793                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 794                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 795                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 796                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 797                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 798                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 799                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |
| 800                                                          | 3   | 0   | 0   | 110 | 000 | 000 | 000 | 000 | 000 |

(19)  
551







D2/390

TORQUE PROGRAM



AAAAAAAAAA  
 AAAAAAAAAA  
 AAAAAAAAAA

|            |        |          |          |          |      |    |
|------------|--------|----------|----------|----------|------|----|
| FFFFFFFFFF | 000000 | RRRRRRRR | ;;;;     | 77777777 |      |    |
| FFFFFFFFFF | 000000 | RRRRRRRR | ;;;;     | 77777777 |      |    |
| FF         | 00     | 00       | RR       | RR       | ;;;; | 77 |
| FF         | 00     | 00       | RR       | RR       | ;;;; | 77 |
| FF         | 00     | 00       | RR       | RR       |      | 77 |
| FF         | 00     | 00       | RR       | RR       |      | 77 |
| FFFFFFFF   | 00     | 00       | RRRRRRRR | ;;;;     |      | 77 |
| FFFFFFFF   | 00     | 00       | RRRRRRRR | ;;;;     |      | 77 |
| FF         | 00     | 00       | RR       | RR       | ;;;; | 77 |
| FF         | 00     | 00       | RR       | RR       | ;;;; | 77 |
| FF         | 00     | 00       | RR       | RR       | ;;   | 77 |
| FF         | 00     | 00       | RR       | RR       | ;;   | 77 |
| FF         | 000000 | RR       | RR       | ;;       |      | 77 |
| FF         | 000000 | RR       | RR       | ;;       |      | 77 |

File HSC000\$DUA9:[M20.IRELAND\_JV.VMS]TORQUE.FOR;7 (2544,15,1), last revised on 6-FEB-1987 15:14, is a 2 block sequential file owned by UIC [M20,IRELAND\_JV]. The records are variable length with implied (CR) carriage control. The longest record is 51 bytes.

```

Job AODAT (375) queued to LN on 24-APR-1987 11:31 by user M20E20, UIC
M20,IRELAND_JV], under account M22 at priority 100, started on printer
VENUS$TXA6: on 24-APR-1987 11:37 from queue TXA6.

```

AAAAAA  
AAAAAA  
AAAAAA

```
TMAX=42500.
PROJOI=.10816
VM=2978.
UM=16.675
TWIST=.613
SIGDDM=TMAX/PROJOI
BQ=2.*UM-27.*SIGDDM*UM*UM/(4.*TWIST*VM*VM)
CQ=UM*UM
B=(-BQ-SQRT(BQ*BQ-4.*CQ))/2.
A=VM*(1.+B/UM)
TM=2.*UM/VM
UO=EXP(LOG(UM)-2.-UM/B)
WRITE (*,'(3X,F8.3,4X,3(F9.7,4X))') A,B,UO,TM
T=0.
TORK=0.
U=0.
PRINT 300,T,TORK,U
U=UO
DT=.0005
DELT=DT/2.
200 VP=A*U/(B+U)
BB=B+U-(VP+A)*DELT
CC=-((VP+A)*U+VP*B)*DELT
DELU=(-BB+SQRT(BB*BB-4.*CC))/2.
DELT2=(B*LOG(1.+DELU/U)+DELU)/A
U=U+DELU+(DT-DELT2)*A*(U+DELU)/(B+U+DELU)
TORK=PROJOI*A*A*B*TWIST*U/(B+U)**3.
T=T+DT
PRINT 300,T,TORK,U
300 FORMAT(3X,F5.4,4X,F7.0,4X,F7.4)
IF(T.LT.TM) GO TO 200
STOP
END
```

END

10-87

DTIC