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TRACKING SYSTEMS TO SUPPORT

THE

COMMON LUNAR LANDER

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William X. Culpepper/EE6/x31479

Tracking and Communications Division

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MISSION PHASES REQUIRING TRACKING INSTRUMENTATION

- IN TRANSIT TRACKING FOR STATE INFORMATION (DSN AND/OR TDRSS)
  - ACCOMPLISHED IN THE COMMUNICATIONS EQUIPMENT
- SURFACE RELATIVE TRACKING TO SUPPORT LANDING
  - TOPIC OF THIS PRESENTATION

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MAJOR DRIVERS FOR TRACKING SYSTEM DEFINITION

- TRACKING SUBSYSTEM FLIGHT HARDWARE DUE OCTOBER, 1993
- PERFORMANCE REQUIREMENTS/COMPLEXITY EQUIVALENT TO SURVEYOR
  - MAXIMUM RANGE: 16 Km
  - VELOCITY ACCURACY: 30 cm/sec + 2% of TOTAL VELOCITY (V< 200 m/s)
    30 cm/sec + 3% of TOTAL VELOCITY (V>200 m/s)
  - RANGE ACCURACY: 9 m + 5% RANGE (R>300 m)
    1.3 m + 5% RANGE (R<300 m)

RESULTS OF VENDOR SURVEY

- NO LANDING SYSTEM EXISTS OFF-THE-SHELF
- NEW TECHNOLOGIES, SPECIFICALLY DOD, ARE PROMISING
  - NOT DEVELOPED FOR DE-ORBIT TO LANDING
  - NOT DEVELOPED FOR SPACE
  - EXCITING FOR THE NEXT GENERATION INSTRUMENTATION
- SURVEYOR/APOLLO/VIKING APPROACHES AVAILABLE
  - KNOWLEDGE/EXPERTISE STILL AVAILABLE
  - UPGRADE TO TODAY'S TECHNOLOGY REASONABLE AND FEASIBLE
  - HISTORICALLY PROVEN

SELECTED BASELINE

THE RECOMMENDED SYSTEM APPROACH FOR THE INITIAL BASELINE FOLLOWS THE VIKING HARDWARE DESIGN UPGRADED TO TODAY'S TECHNOLOGY.

BASIC DESCRIPTION

- ALTIMETER: PULSE SYSTEM
- FOUR BEAM VELOCITY SENSING RADAR

BASELINE SYSTEM PROPERTIES

- LANDING RADAR
  - SIZE: 76.2 cm X 76.2 cm X 8.26 cm
  - WEIGHT: 22.1 Kg; POWER: 68 W
  - ANTENNA: INCORPORATED ON 76.2X76.2 SURFACE
- ALTIMETER
  - SIZE: 23.4 cm X 14.7 cm X 20.1 cm
  - WEIGHT: 5.1 Kg; POWER: 28.5 W
- ALTIMETER ANTENNA (CONICAL HORN)
  - WEIGHT: 0.7 Kg; DIAMETER: 15.25 cm; LENGTH: 15.25 cm

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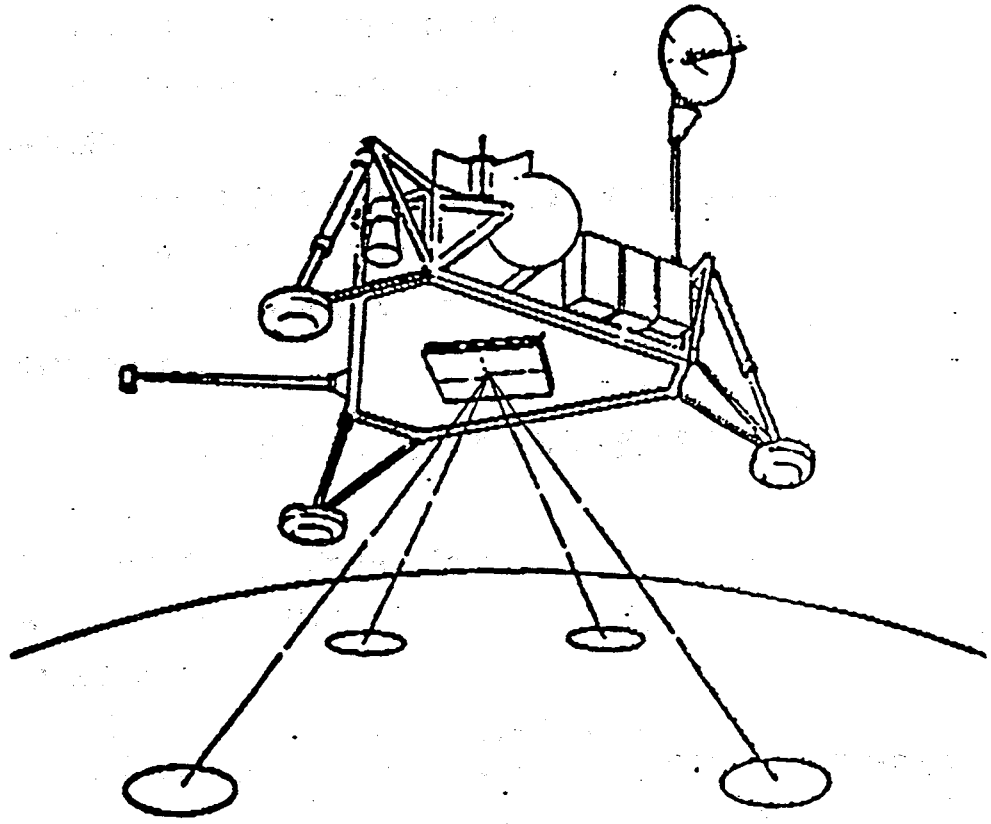
LANDING INSTRUMENTATION CONCEPT



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PROGRAMMATIC CONSIDERATIONS

- SCHEDULE (ASSUMING JANUARY 1992 START)
  - FLIGHT HARDWARE DELIVERY JUNE 1, 1994
- COSTING
  - ALTIMETER $875K/COPY
  - RADAR $675K/COPY
  - NON-RECURRING COSTS: ALTIMETER - $2.2M; RADAR - $1.8M
  - PRICING ESTIMATED FROM VIKING BUT IN TODAY'S DOLLARS
- CAVEATS
  - PARTS TO BE SPACE QUALIFIED WHERE AVAILABLE, MIL SPEC OTHERWISE
  - MATERIAL SELECTION AND HANDLING TO BE MIL STANDARD AT TELEDYNE RYAN
  - MANUFACTURING, FAB AND PROCESSING TO BE MIL STANDARD AT TELEDYNE RYAN
  - DOCUMENTATION TO MIL STANDARDS
  - WORK DONE TO VIKING CLEAN ROOM STANDARDS
  - ENVIRONMENTAL QUALIFICATION TO NASA STANDARDS