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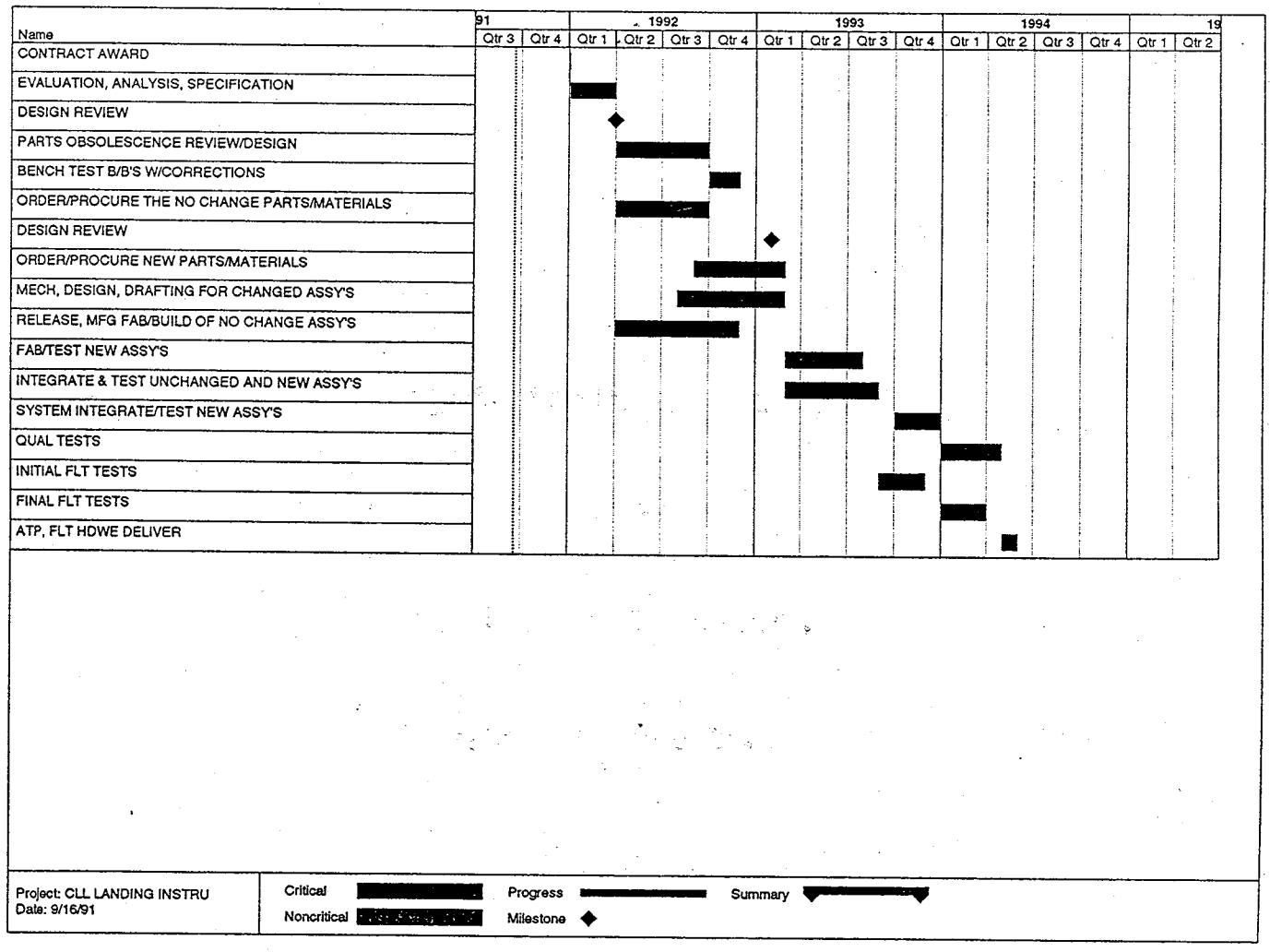
INITIAL HARDWARE DEVELOPMENT SCHEDULE



William X. Culpepper/EE6/x31479

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TRACKING SYSTEMS

BACKGROUND MATERIAL

FOR THE

COMMON LUNAR LANDER

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HISTORICAL PERSPECTIVE

- THREE SPACE PROGRAMS HAVE ACCOMPLISHED PLANETARY LANDINGS
  - SURVEYOR
  - APOLLO
  - VIKING
- ALL THREE USED THE SAME BASIC TECHNIQUE
  - ALTIMETER FOR RANGE TO THE SURFACE
  - VELOCITY SENSING RADAR FOR MAJOR AXES VELOCITY MEASUREMENTS

ALL THREE SYSTEMS WERE SUCCESSFUL

SOLUTION OPTIONS

- OFF THE SHELF HARDWARE
  - SOME EXISTING ALTIMETERS MAY BE CLOSE
  - NO RADARS ARE KNOWN TO EXIST

- VENDOR SURVEY
  - WHAT APPROACH AND TECHNOLOGY THEY RECOMMEND
  - SYSTEMS THEY MIGHT HAVE THAT ARE APPLICABLE
  - ESTIMATES OF SIZE, WEIGHT, POWER, AND SCHEDULE

INDUSTRY CONTACTS

- INITIAL INDUSTRY CONTACTS
  - TELEDYNE RYAN
  - GENERAL DYNAMICS
  - HUGHES AIRCRAFT COMPANY
  - LORAL DEFENSE SYSTEMS
  - MOTOROLA
  - McDONNELL DOUGLAS
  - MARTIN MARIETTA

A PACKET OF INFO WAS MAILED TO SIX OF THE SEVEN COMPANIES.
TWO COMPANIES CHOSE NOT TO RESPOND.

- RESPONDING COMPANIES WERE
  - TELEDYNE RYAN
  - GENERAL DYNAMICS
  - HUGHES AIRCRAFT COMPANY
  - LORAL DEFENSE SYSTEMS

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RESPONSE CONTENT

TWO COMPANIES RESPONDED WITH DESIGNS BASED ON EXPERIENCE WITH SURVEYOR AND VIKING

- HUGHES AIRCRAFT WITH AN UPDATE OF THE SURVEYOR SYSTEM
  - DESIGN UPGRADED WITH TODAY'S MIMIC TECHNOLOGY
  - CHALLENGES ARE ANTENNA AND COMPRESSED SCHEDULE
  - SCHEDULE ESTIMATE IS 2 YEARS AND 9 MONTHS FOR FIRST FLIGHT UNIT
  - NO COSTING
- TELEDYNE RYAN PREFERS THE BASIC VIKING APPROACH
  - RADAR WAS FOUR BEAM WHICH YIELDS REDUNDANCY
  - RADAR RECEIVER UPGRADE FROM 14 dB NF TO 5 dB NF WILL COVER 15Km REQUIREMENT
  - ASSUMING JANUARY 1992 START, DELIVERY IS JUNE 1, 1994
  - COST ESTIMATE IS $1.5M/COPY FOR BOTH ALTIMETER AND RADAR
  - NON-RECURRING COST IS $4M TOTAL FOR BOTH ALTIMETER AND RADAR
  - COST ESTIMATE BASED ON VIKING COSTS IN TODAY'S DOLLARS

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RESPONSE CONTENT (CONTINUED)

TWO COMPANIES RESPONDED WITH DIFFERENT APPROACHES FROM SURVEYOR/VIKING

- GENERAL DYNAMICS RESPONDED WITH TECHNOLOGY FROM DOD APPLICATIONS
  - DATA IS PROPRIETARY
  - APPROACH INCLUDES SOME PIECES THAT EXIST TODAY AND SOME TO BE DEVELOPED
  - NONE WERE DEVELOPED FOR THIS APPLICATION
  - NONE HAVE BEEN SEASONED IN THE WORLD OF SPACE
- LORAL DEFENSE SYSTEMS RESPONDED WITH TECHNOLOGY BEING DEVELOPED BY THE ARMY
  - CONCEPT, THOUGH PROMISING, IS IMMATURE
  - DATA IS PROPRIETARY

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PERSPECTIVE ON THE RESPONSES

- WHAT THE RESPONSES ARE NOT
  - REPRESENTATIVE OF A COMPLETE COMMERCIAL SURVEY
  - A STUDY EFFORT
  - A SYSTEM DESIGN
- WHAT THE RESPONSES ARE
  - A CURSORY LOOK REQUESTED ON 8/2 AND COMPLETED BY 8/12
  - BEST GUESSES
  - A COURTESY PARTICIPATION
- WHAT THE RESPONSES COST
  - ZERO

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RATIONALE FOR SELECTION

- SHORT TIME SCHEDULE REQUIRES USE OF PROVEN TECHNIQUES
- THE SURVEYOR/VIKING/APOLLO APPROACHES WORKED
- NEW APPROACHES REQUIRE TECHNOLOGY INCORPORATION AND DEVELOPMENT TEST
- HISTORICAL DATA PROVIDE REALISM IN ESTIMATES FOR SIZE, WEIGHT, POWER, DELIVERY AND COST
- THE VIKING RADAR HAS A FOURTH SENSING BEAM WHICH OFFERS REDUNDANCY SINCE ONLY THREE ARE NEEDED