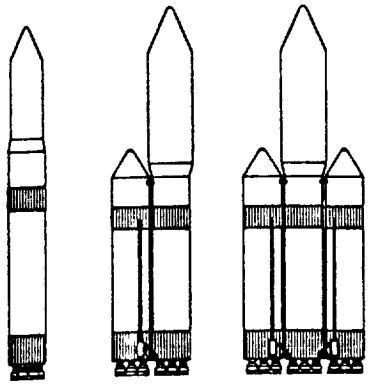
N91-28208

ADVANCED LAUNCH SYSTEM



SPACE TRANSPORTATION PROPULSION TECHNOLOGY SYMPOSIUM PENNSYLVANIA STATE UNIVERSITY

JAN C. MONK
GEORGE C. MARSHALL SPACE FLIGHT CENTER

June 27, 1990

U.S. SPACE TRANSPORTATION

COST

- $3,600 per POUND (AND UP)
- OVER $4B/YR

RELIABILITY

- OVER 5% FAILURES
- DOWNTIMES: UP TO 30+ MONTHS
- FAILURE COSTS ABOUT HALF LAUNCH COSTS

CAPABILITY

- SINGLE THREAD FOR CRITICAL PAYLOADS
- LITTLE OR NO MARGINS
- CONSTRAINTS INCREASE PAYLOAD COST
- BLOCKS FUTURE EXPANSION

ADVANCED LAUNCH SYSTEM

U.S. SPACE TRANSPORTATION (cont.)

INVESTMENT REQUIRED

- INFRASTRUCTURE OLD/MANPOWER INTENSIVE
- ELVs USE OLD DESIGNS/TECHNOLOGY

INFRASTRUCTURE NEEDS TO BE CHANGED

- OPERABILITY AND PERFORMANCE INADEQUATE FOR FUTURE NEEDS
- P3I HAS GOOD INTENTIONS AND POTENTAIL PAYOFFS, BUT THE INFRASTRUCTURE NEEDS TO BE CHANGED

"...BOOSTERS ARE REALLY TRUCKS...WE DON'T NEED A CADILLAC, MERCEDES, OR CORVETTE TO DELIVER OUR PACKAGES TO SPACE. WE NEED A VERY RELIABLE, MAINTAINABLE FLEET OF TRUCKS THAT CAN HAUL A VARIETY OF PACKAGES-QUICKLY AND CHEAPLY."

29 JULY 1988 E.A. ALDRIDGE, SEC AF

ADVANCED LAUNCH SYSTEM

WHAT IS ALS?

- A NEW WAY OF DOING BUSINESS
- A SYSTEM CONCEPT FOCUSED ON HIGH OPERABILITY AND LOW COST
- DEVELOPMENT, INTEGRATION AND TRANSFER OF NEW TECHNOLOGIES
- EFFECTIVE DEVELOPMENT AND USE OF INFORMATION SYSTEMS MANAGEMENT
- SUCCESSFUL APPLICATION OF TOTAL QUALITY MANAGEMENT (TQM)

Total Quality Management: THE OFFICIAL DOD DEFINITION

"Total Quality Management in the DOD is Strategy for continuously improving performance at every level, and in all areas of responsibility. It combines fundamental management techniques, existing improvement efforts, and specialized technical tools under a disciplined structure focused on continuously improving all processes. Improved performance is directed at satisfying such broad goals as cost, quality, schedule, and mission need and suitability. Increasing user satisfaction is the overriding objective." DOD 5000.51-G (DRAFT)

SIMPLY, TQM IS A MOVEMENT TO CURE THE TRADITIONAL MANAGEMENT PARADOX:

↑ *QUALITY*
↑ *PRODUCTIVITY*
↓ *COSTS*
→
↑ *PROFIT*

1. Improve quality
2. Costs decrease because of less rework, fewer mistakes, fewer delays, snags; better use of machine time and material
3. Productivity improves
4. Capture the market with better quality and lower price
5. Stay in business
6. Provide jobs and more jobs

-Dr. W. Edwards Deming

ADVANCED LAUNCH SYSTEM

DEFINITION OF QUALITY

- MEETING LAUNCH NEEDS AT THE LOWEST COST TO THE TAXPAYER
- ALS PROGRAM IS SYNONOMOUS WITH THE TQM GOALS
  - RELIABILITY
  - LOW COST
  - ROBUST

IF TQM DIDN'T EXIST -- WE'D INVENT IT

TQM IS ESSENTIAL TO THE SUCCESS OF ALS

THE GOAL IS TO DEVELOP A ROBUST DESIGN

ALS QUALITY APPROACH

DESIGN IT RIGHT

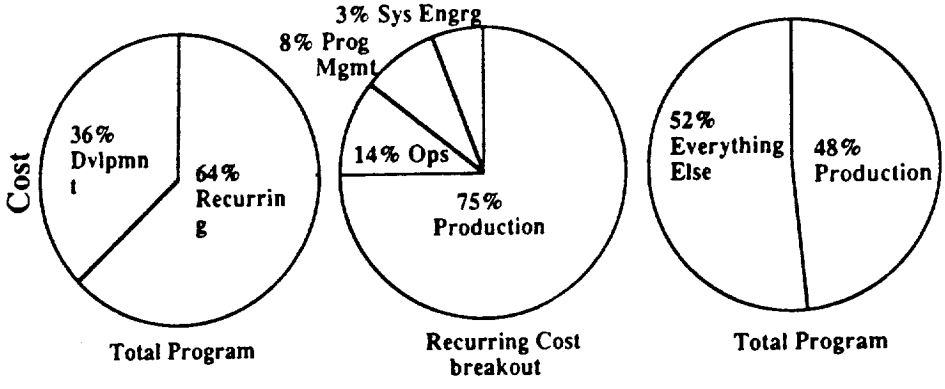
CONCURRENT ENGINEERING
VARIABILITY REDUCTION
QUALITY FUNCTION DEPLOYMENT
QUALITY ENGINEERING

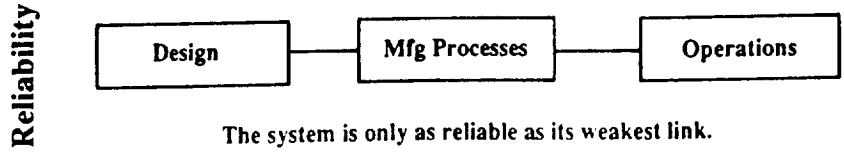
BUILD IT RIGHT

IN-PROCESS MONITORING
STATISTICAL PROCESS CONTROL
CONTINOUS PROCESS IMPROVEMENT

ALS Goals are Improved Reliability and Reduced Cost

Process Knowledge is a key to both areas.

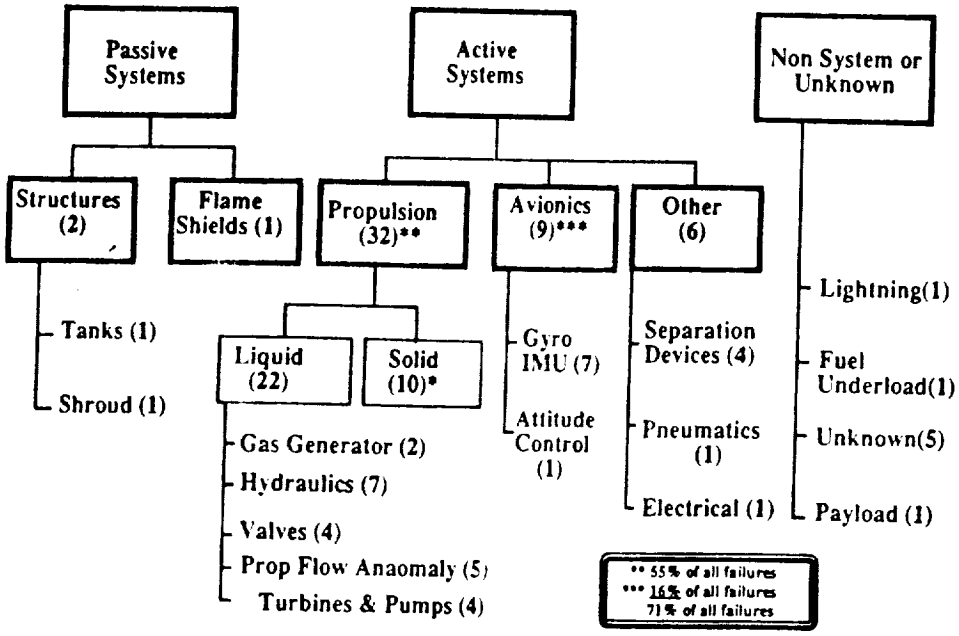




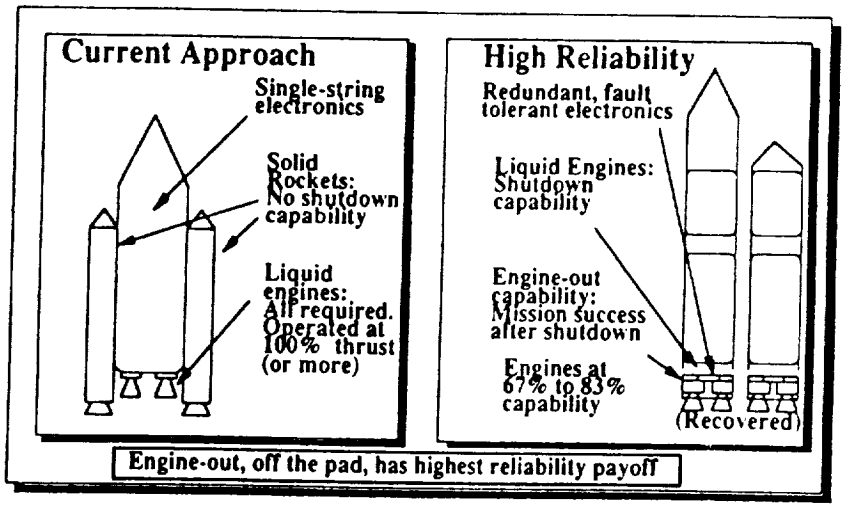
The system is only as reliable as its weakest link.

SUB SYSTEM SOURCES OF FAILURE

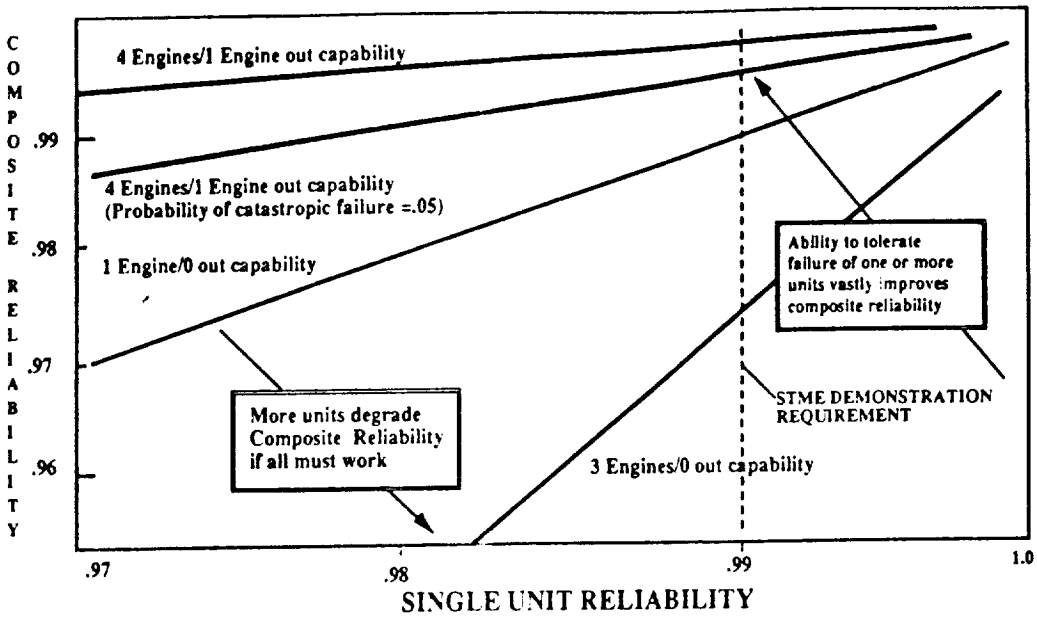
1966-1987



DESIGN FOR RELIABILITY



Vehicle Engine Out Capability Provides A Significant Improvement In System Reliability



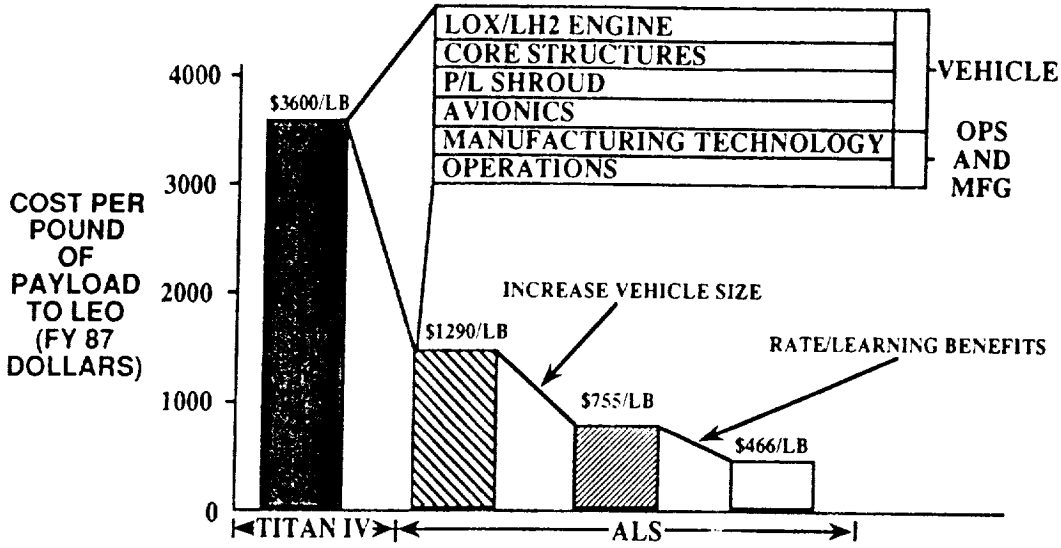
ADVANCED LAUNCH SYSTEM

FULL ENGINE-OUT CAPABILITY WITH HOLD DOWN FOR PRE-RELEASE ENGINE VERIFICATION SIGNIFICANTLY INCREASES FLIGHT RELIABILITY

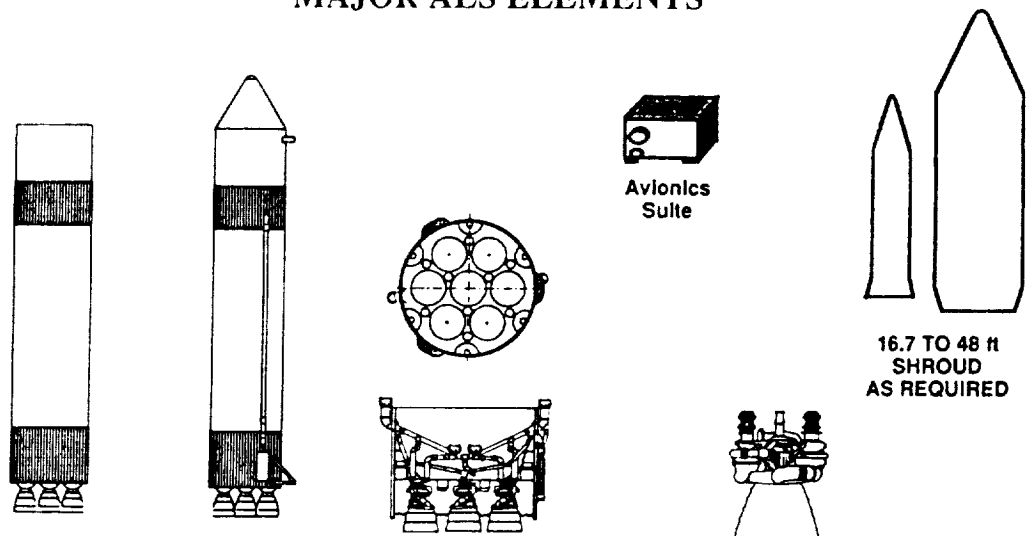
- VEHICLE ENGINE OUT CAPABILITY REDUCES THE ENGINE RELIABILITY REQUIREMENT TO AN ACHIEVABLE VALUE
- ADDITIONAL RELIABILITY CAN BE ACHIEVED BY IMPLEMENTATION OF HOLD-DOWN
  - HISTORY INDICATES THAT 35-50 PERCENT OF ENGINE FAILURES OCCUR DURING START

PATH TO REDUCED OPERATIONS COSTS

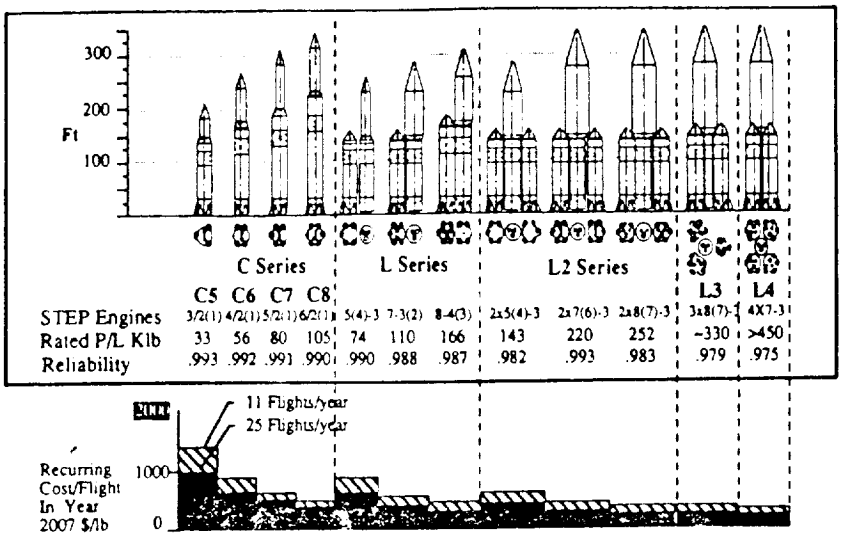
TECHNOLOGY BENEFITS



MAJOR ALS ELEMENTS



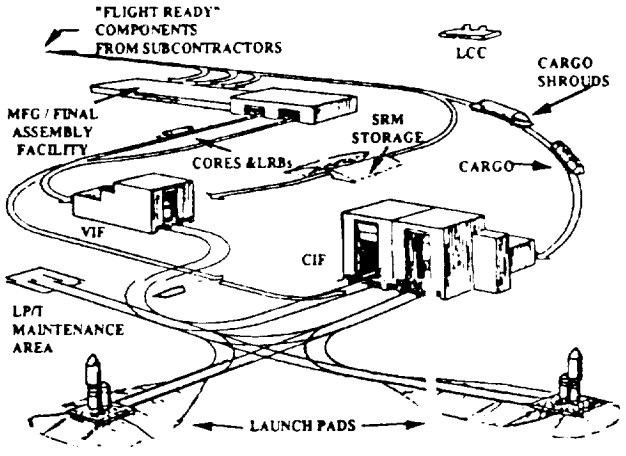
CANDIDATE ALS FAMILY MEMBERS



Select Only the Version Appropriate to Mission Needs

ADVANCED LAUNCH SYSTEM

KEY ALS FACILITIES



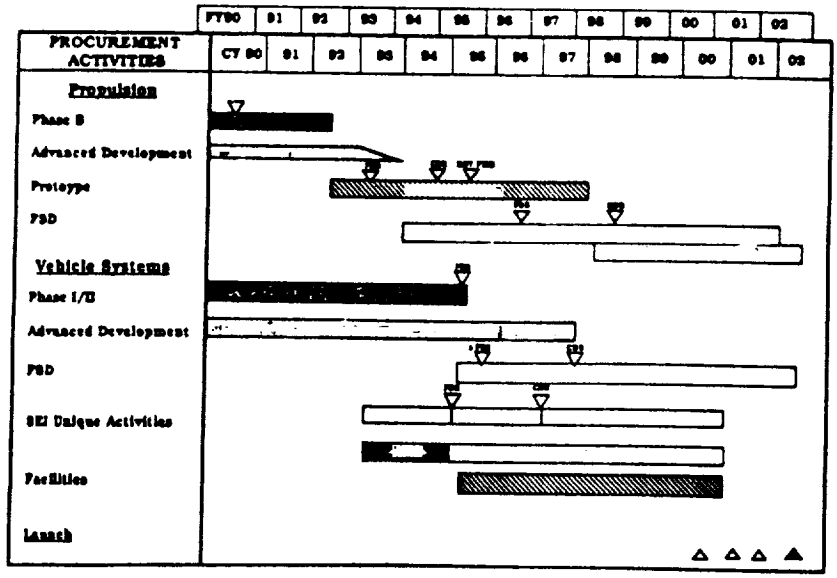
ALS Baseline Facilities Will Accommodate the Family

BALANCED ALS PROGRAM

- NEW PROPULSION SYSTEM (LONG LEAD)
  - BUILT WITH RELIABILITY, PERFORMANCE MARGIN, AND MAINTAINABILITY DESIGNED INTO THE SYSTEM
  - CONTINUE FIRST NEW INVESTMENT IN PROPULSION TECHNOLOGY IN MORE THAN A DECADE (AF AND NASA)
- NON-PROPULSION TECHNOLOGIES
  - SUPPORT FUTURE LAUNCH VEHICLE
    - SUPPORT FUTURE LAUNCH VEHICLE
    - COST / OPERABILITY
  - IMPROVE EXISTING LAUNCH VEHICLES
    - COST / OPERABILITY
    - PERFORMANCE

ADVANCED LAUNCH SYSTEM

ADVANCED LAUNCH DEVELOPMENT
PROGRAM SCHEDULE
(2000 ILC)



ALS CAN SATISFY THE NATION'S LAUNCH REQUIREMENTS BY PROVIDING A LOW COST, RELIABLE, ROBUST LAUNCH SYSTEM

"...BOOSTERS ARE REALLY TRUCKS...WE DON'T NEED A CADILLAC, MERCEDES, OR CORVETTE TO DELIVER OUR PACKAGES TO SPACE. WE NEED A VERY RELIABLE, MAINTAINABLE FLEET OF TRUCKS THAT CAN HAUL A VARIETY OF PACKAGES-QUICKLY AND CHEAPLY."

29 JULY 1988 E.A. ALDRIDGE, SEC AF

PRESENTATION 1.3.5

AIR FORCE SPACE SYSTEMS PROPULSION