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## Paper Session II-A - Delta III Reaches Out to the Commercial Market

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## **“Delta III Reaches Out to the Commercial Market”**

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The dramatic growth in demand for world-wide communication has driven the requirement for lower cost, higher reliability launch services to drastically increase over the past decade. This need has developed due to the advent of commercial communication satellites and cellular communications. This loss created a void in launch services that has been filled since 1987 by the introduction of commercial launches on Atlas, Delta, Long March, H-1 and H-2, Titan, Proton, and Zenit.

The introduction of numerous launch vehicles has created an extremely competitive marketplace, and the explosion of the commercial market places ever increasing demand on the launch vehicle manufacturers to continually increase vehicle capability while maintaining or decreasing the cost of payloads to orbit. To satisfy this requirement, McDonnell Douglas has built on the reliability and cost effectiveness started in the 1950's on Thor and the enhanced and improved performance of Delta and Delta II to develop the new Delta III system. Delta III offers increased performance and affordability, more efficient operations, and a true responsiveness to the requirements expressed by commercial launch customers.

The McDonnell Douglas Aerospace (MDA) commitment to providing improved capability launch services is demonstrated by the history of the Delta vehicle family. (Figure 1) The Delta II has led the way and with 104 successes in our last 107 launches our performance stands at better than a 97% success rate. The Delta III will build on this heritage and its capabilities and benefits are as follows:

- 8,500 lbs (3,863 kgs) to GTO (This capability is greater than the Atlas IIAS and double the capability of the Delta II)
- Operational efficiency equal to or better than the Delta II
- Reliability equal to or greater than the Delta II
- Competitive commercial prices

The current National Space Policy states that it is in the best interest of the United States security, civil and commercial sectors to stimulate and sustain growth of space activity at the earliest possible time. In pursuit of this strategy, MDA launched the Delta III and with it provides the world a highly reliable internationally competitive launch system. In conjunction with the Delta II, MDA provides affordable access to space for over 80% of the world's payloads projected through 2010. (Figure 2)

MDA's approach to the Delta III is the result of a developing strategy created with the help of our commercial customer base and our existing government users. The capabilities and requirements being built into the new system have been developed by continually meeting with our customers and understanding their requirements and expectations. Internal trade studies are performed to evaluate the affordability of all changes and the ones that support both our customers requirements and our affordability expectations are being implemented in the Delta III launch system.

Utilizing an evolutionary approach from our Delta II to our Delta III provides reduced cost and assured reliability in the new system. This evolution dates back to the 1960's and will continue well into the 21st century. Our heritage has been as MDA has developed new launch systems,

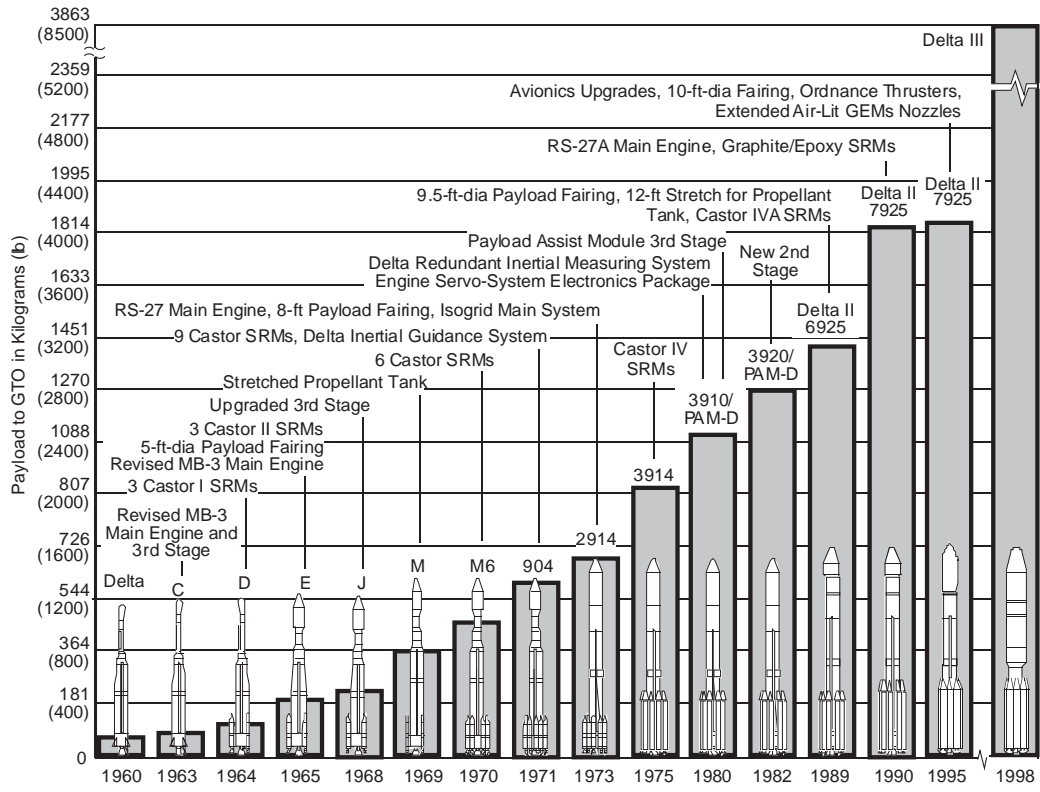


Figure 1. Delta Modification and Growth

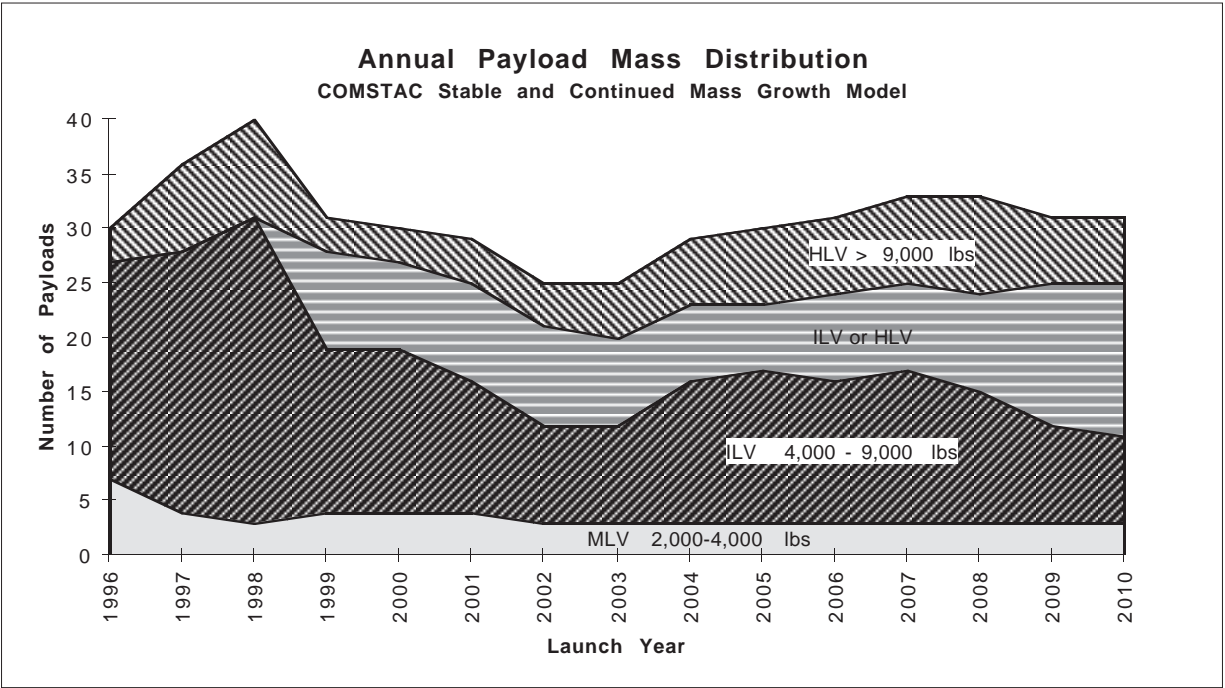


Figure 2. COMSTAC Mission Model 1996 Update (June 24, 1996)

our reliability has been maintained or improved and our systems have continued to become more affordable. The side-by-side comparison of the Delta II and Delta III vehicle shown in Figure 3 demonstrate how we maximize the use of existing flight-proven hardware to reduce development risk.

# DELTA III EVOLVED TO MINIMIZE RISK

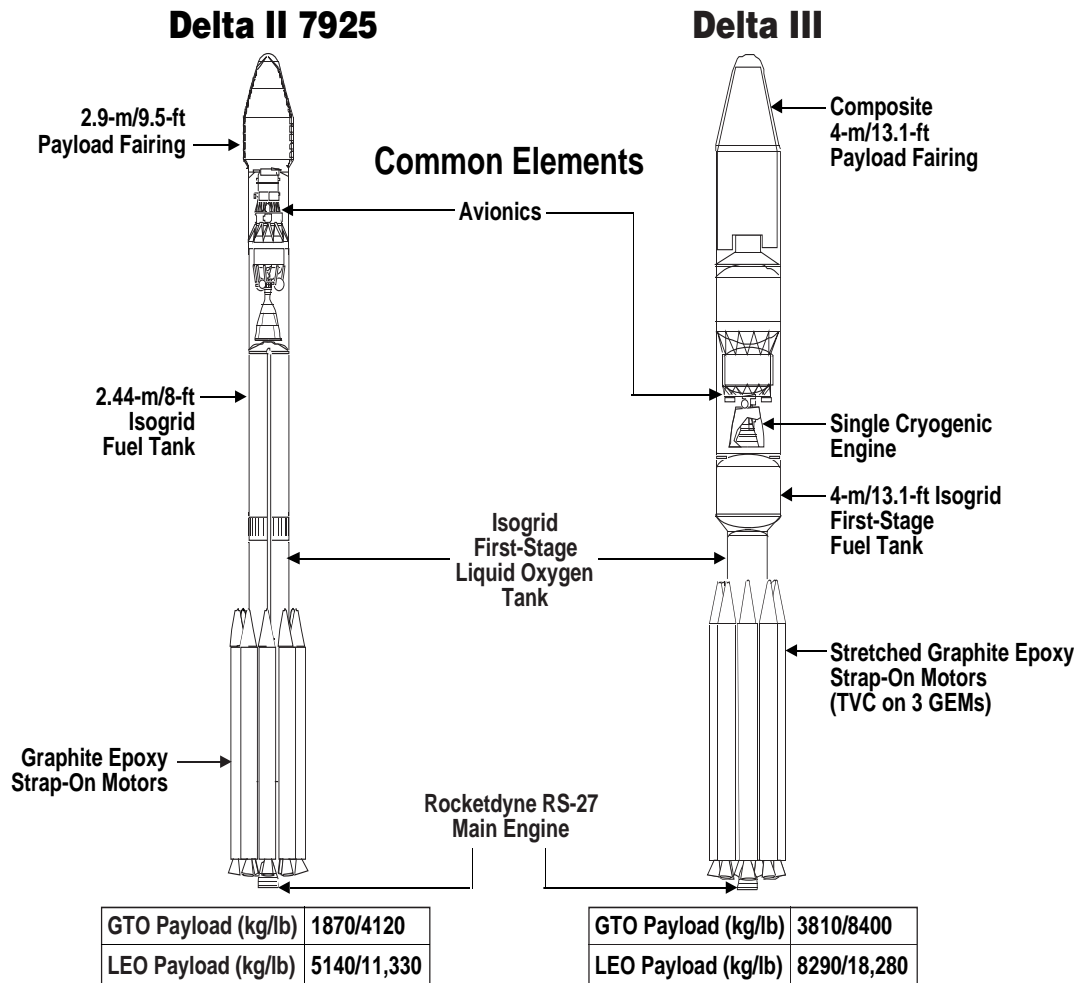


Figure 3

The second step in assuring the success of the Delta III program is the approach to development and qualification testing as risk mitigation actions. The success of all tests to date provides even more confidence that MDA is going to successfully complete this development cycle and begin launching Delta III's in 1998.

Each critical hardware and software element of the Delta III system was analyzed to determine whether the Delta III should be qualified for flight by similarity, demonstration, analysis or test. Significant development testing was conducted for aerodynamics, environmental level validation, manufacturing process improvements and thermal insulation characterization. A full structural qualification test, payload fairing separation, tank cycle and burst tests, liquid rocket engine and solid rocket motor qualification tests, stage demonstration, and launch base pathfinder operations are planned to demonstrate our readiness for first flight. Examples of the successful test program include the vehicle wind tunnel test, the burst test of the solid rocket motor, RL-10 engine chill down, SRM static firing, and acoustic tests on the first stage equipment shelf and the payload fairing.

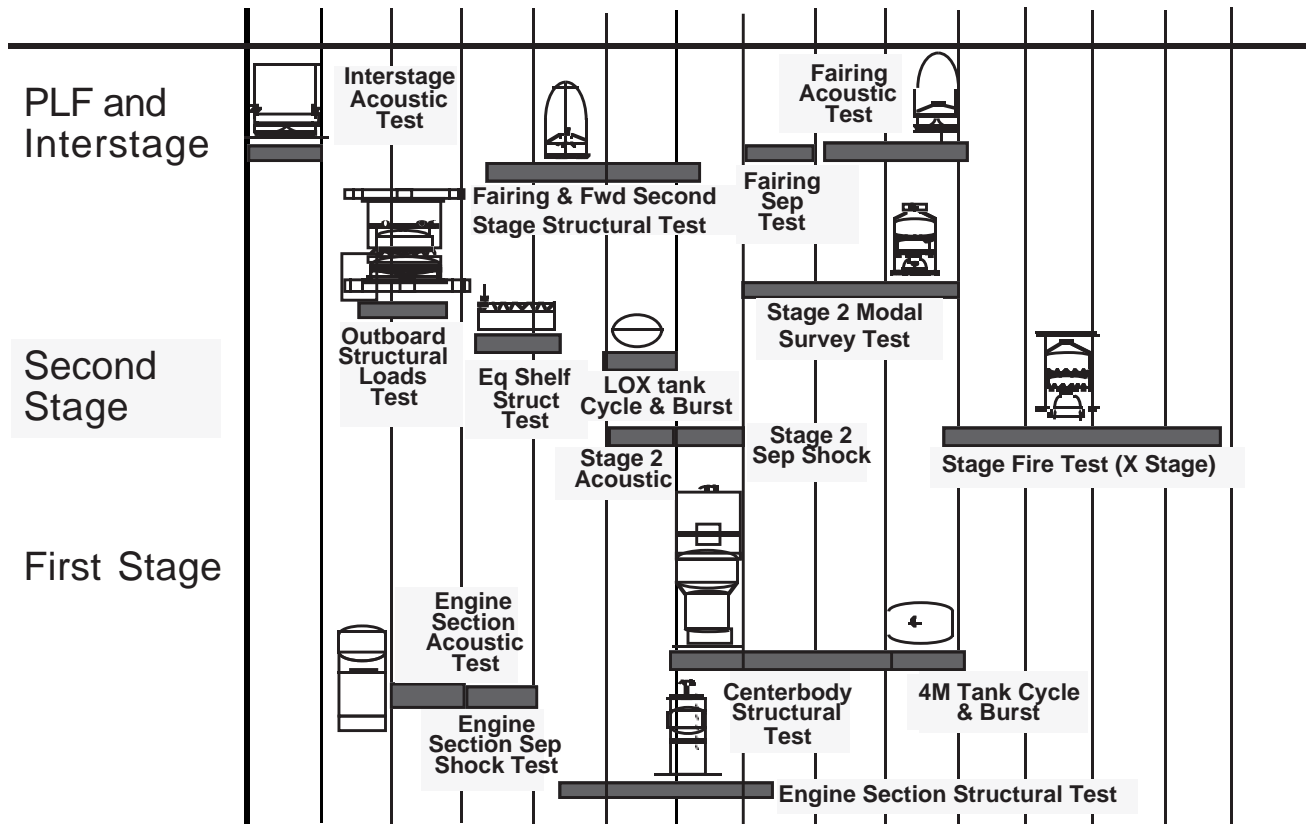


Figure 4. Comprehensive test plan in place

In addition to these development tests, we have demonstrated through program performance that we have the capability to meet both schedule and cost goals in development programs. An example of this point is the Delta III upper stage development and the SSRT program which have many similar characteristics as demonstrated in Table 1. Both programs attempted to utilize existing hardware, modify existing RL-10 engines, and develop several new components. One of the differences between the two programs is the production requirement of the Delta III. At the end of the program, Delta III must be capable of being repetitively built within required quality levels and cost targets.

Table 1. Previous Stage Development Programs Support Delta III Objectives

Task / Approach	Delta III Upper Stage	SSRT
Use of Existing Available Hardware	Yes	Yes
Development of Cryogenic Tankage	Yes	Yes
Modification of RL-10 Engines	Yes	Yes
Development of a new Boattail	1 Engine	4 engines
Development of a composite aeroshell	Fairing	Yes
Production processes and qualification testing	Yes	No
Development period	30 months	18 months

Another example of a development program that has similar objectives to the Delta III is the Air Force Medium Launch Vehicle I (MLV I) program. These objectives, Table 2, are to develop a launch vehicle that is more operable and has greater performance than the existing systems. The modifications necessary include improved engine performance and reliability, increase in first-stage tankage size, and the development of a new fairing. The similarity in the requirements for these equivalent activities provides MDA with a high degree of confidence in its development of the Delta III system on schedule.

Table 2. System Evolution supported by previous programs

Task / Approach	Delta III Upper Stage	MLV I	Delta 6925 & 7925
Engine Modification	RL-10B-2 New Nozzle		RS-27A New Nozzle
Increase in 1st stage tankage	Yes	Yes	
Add new SRMs	Yes	Yes	
New Fairing	Yes	Yes	
Development period	30 Months	24 Months	

The over 35 years of launch vehicle experience that MDA has provides the confidence for meeting the government and commercial customer requirements into the 21st century. Having increased the capability of the Delta from a 400 lb to LEO capability with an on-pad time in excess of 40 days to the existing Delta II system with a 11,000 lb to LEO capability and 24 days on-pad time, MDA continues to demonstrate a commitment to our customers needs and the execution of our program plans.

Finally, involvement of our commercial customers in our process and keeping them informed on program progress through the mission integration program for their satellite has yielded customer satisfaction time and again. Figure 5 shows our process which provides, via a MDA mission manager, a single point of contact for the customer on all spacecraft integration activity.

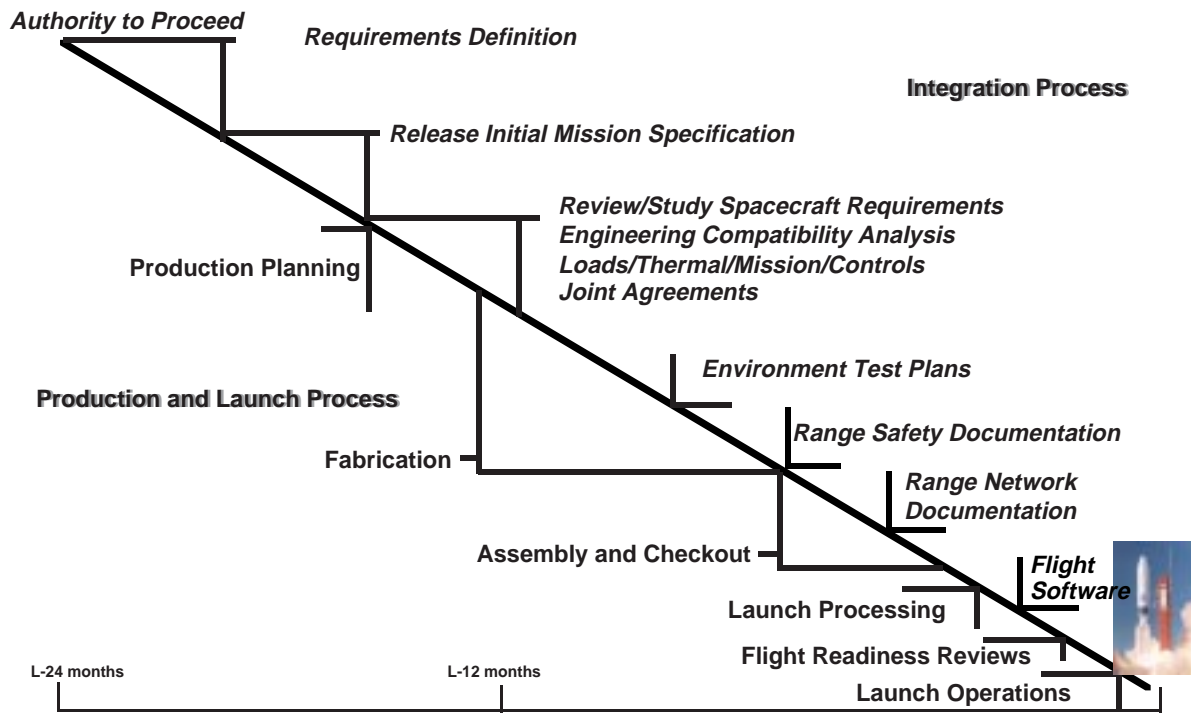


Figure 5. Proven mission integration process

As is evidenced above, the Delta III launch system is well into production. The 4 meter hardware has been demonstrated on production tooling. The remainder of 1997 provides the test bed for mitigating risk and by year end, all the major component tests will be completed. Additionally, the pad modifications necessary for Delta III are proceeding and are on schedule to support a second quarter 1998 first launch. The Delta III is on plan to be a highly competitive launch system that will maintain the Delta heritage of mission success.