

## Historian's Corner

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We are making some minor changes to the Historian's writings for each addition of the STAR. Ray Ziehm has volunteered to take the lead in coordinating our quarterly write ups. He will be the only one listed under the officers for Historians. The individual contributors are well appreciated and are needed every year. We have in the past missed some Historian write ups, so having a lead coordinator should eliminate that. The individual writers will continue to be identified with their writings. Those of you that would like to write an article in the STAR for an item of historical interest should contact Ray at 303-784-1413.

Thanks, Bob Snodgress

Ed Bock

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### **Atlas/Centaur Sale and Transition to Martin Marietta**

This Atlas Program history was originally presented at the Centaur 50th Anniversary celebration in San Diego by Ed Bock. It has been expanded with input from Tony Christensen to include the Centaur for Titan Program Transition.

To appreciate this sale and transition, it's necessary to understand the environment at General Dynamics Space Systems (GDSS) Division in the early 1990's.

The Commercial Atlas Program was inaugurated with the launch of AC-69, the first Atlas I, in July 1990. Atlas II was in development, and its first launch occurred in December 1991. GDSS was in the process of evaluating a Russian rocket engine (the RD-180) for its evolved Atlas. From mid 1990 to late 1993 there were 14 Atlas/Centaur launches, including three Atlas I failures. The Centaur upper stage for Titan IV was in development via a GDSS subcontract to Martin Marietta (MM). During this period, General Dynamics (GD) was trying to divest many of its Divisions, although Space Systems was identified by the Corporation as a "core business that was not for sale". Because of the three Atlas I failures and investment in a new building at GDSS Kearny Mesa Plant, our division General Manager was replaced and there were across-the-board salary cuts. Heavy investment in the Atlas II family development, combined with the loss of revenue associated with the three Atlas I failures, resulted in the Atlas Program being approximately \$800M in the red. In December 1993, Martin Marietta announced the acquisition of GD's Space Systems Division for \$208.5M.

There was much apprehension and anguish throughout GD Space Systems about the MM buyout and transition. Common assumptions by many GD employees were that Martin had purchased Space Systems primarily to acquire the Centaur upper stage for Titan, and that the Atlas Program was just included as part of the deal. Martin had tried to market Titan III as a commercial launch vehicle and had been unsuccessful. Martin's Titan IV Program was managed by the US Air Force and was bureaucratic and very expensive, with lots of government oversight. Many of the GD program and business people working on Titan/Centaur had developed an adversarial relationship with their MM counterparts and were not looking forward to becoming Martin employees. Prior to the sale, some GD engineers were afraid that MM was trying to acquire Centaur knowledge so they could develop their own cryogenic upper stage. We perceived MM as competitors, not really as business partners. Atlas folks were afraid that the commercial Atlas Program would be "Titanized" once we moved to Denver, rendering Atlas non-competitive. Also, it was commonly assumed that once the Atlas program transferred to Denver, it would likely be directly managed by heritage Martin employees. Many were concerned that the disruption caused by the transition to Denver would lead to launch failures. None of these assumptions (with the

exception that MM included had been looking at developing their own cryogenic upper stage) turned out to be correct.

From mid to late 1994, approximately 800 Space Systems employees and their families relocated to Denver. This included the entire, very experienced, Atlas program and technical staff. Atlas and Centaur final assembly moved the next year. The physical relocation of people and manufacturing from San Diego to Denver was a textbook case of how to do it right. Former GD and MM teams of senders and receivers seamlessly managed this process. Atlas and Centaur production continued in San Diego in parallel with factory start-up in Denver. There was concern that these soon to be laid off GD workers would let quality slide. Not so! Their pride in producing these launch vehicles resulted in some of the best defect-free Atlas and Centaurs ever produced.

While this transition was ongoing, launches continued: Five Atlas/Centaur and three Titan/Centaur missions in 1994, 11 Atlas/Centaur and three T/C missions in 1995 - twice as many as the previous record of seven Centaur launches in 1978. All these launches were successful, starting a string of over 100 Atlas/Centaur mission successes from July 1993 to the present.

Once in Denver, the former GD folks were welcomed as equals. Instead of the Atlas program being managed by heritage MM employees, current members of the Atlas team were assigned major management positions within MM. Mike Wynne became senior VP of launch vehicles other than Titan (Atlas recurring, Atlas III & V development, Athena), John Karas VP of Atlas III & V development, and Ed Bock VP of Atlas recurring. At MM's Space Systems Division level, Bob DiNal became VP of Technical Operations and Division Chief Engineer, and Ed Squires VP of Manufacturing. Many former GD employees became Directors and Managers of MM functional departments and programs. Several heritage MM employees, including Tom Knapp, joined the Atlas Program as members of the management team and were instrumental in helping the program adapt to and thrive within the Martin culture.

The GD Titan/Centaur technical team integration went fairly smoothly, including incorporating GD middle management since MM had no real experience with any of the Centaur systems. Business team member integration was more traumatic and took longer to mesh with the MM systems. All of the GD Titan Centaur team members worked under MM upper level management existing in the Titan program at the time of the transition.

The Atlas Program was compartmentalized (and purposely isolated) from Titan and continued to use its heritage GD systems and processes. There were efforts to standardize processes to those used in the rest of MM (and later Lockheed Martin (LM)), but these were adopted very slowly, at a pace agreed to and controlled by the Atlas Program. If Atlas had suffered a failure during those initial years, things might have gone differently. Some interesting highlights:

Atlas institutionalized its philosophy of continuous improvement (CI). As a commercial program, Atlas did not need permission from any government entity to make changes. In fact, no two vehicles flown between 1995 and 2000 were identical. At first, MM and LM Division management didn't fully understand what Atlas was doing. Improvements were internally developed by the Program and implemented when ready without customer or MM Division level approval. Finally, a vehicle with several dozen CI changes caught upper management's attention, and they initiated an investigation. The Atlas rigorous Systems Engineering process was approved and our CI process was cleared. Many improvements for Atlas III were initially incorporated and flight proven as CI changes on Atlas II vehicles.

While still in San Diego, Atlas had recurring manufacturing parts shortage problems. The Program Office held thrice weekly meetings with manufacturing to try and solve these shortages, right up until the transition to Denver. Most vehicles were shipped with missing parts, requiring extra out-of-sequence work at the launch site. After the program had been in Denver for about six months, Tom Knapp was

asked how the shortage meetings were going. His answer - there weren't any meetings because there was no factory shortage problem. Somehow, the move to Denver solved this issue.

Atlas provided commercial launch services to both industry and government customers. During the 1990's, we were competitive with Ariane and captured a reasonable market share. Atlas was also quite profitable, and repaid its acquisition price many times over.

The first Atlas III, with a Russian manufactured RD-180 engine, flew successfully in May 2000. This Atlas configuration still used pressure stabilized stainless steel propellant tanks and was an evolutionary step toward Atlas V. There never was an Atlas IV - LM marketeers decided that we needed an Atlas V to compete with Ariane V.

The last Titan/Centaur upper stage, TC-23, was launched in 2003 on a Titan-IVB. After many years of service to the USA, the Titan program was completed in 2005 and closed out by the USAF. After MM acquired Centaur for Titan, there were 15 TC missions including two failures. One was caused by a Centaur anomalous orbit. In the second Titan failure, the Centaur and its payload failed to reach orbit as a result of an electrical short circuit in the Titan booster and loss of the entire launch vehicle. The final Titan IV launch occurred in October 2005. Atlas continued as LM's space launch vehicle until the formation of United Launch Alliance in late 2006.