Dynetics, Incorporated

Senate Appropriations Committee Hearing: Driving Innovation through Federal Investments

24 April 2014

Founded in 1974, Dynetics is a 1,400-employee, mid-tier aerospace and defense company headquartered in Huntsville, AL. As we celebrate our 40th anniversary this year, and our 25th anniversary as an employee-owned company, we reflect back on the significant role that federal investments have made throughout our corporate history.

Our leadership emerged from the highly dynamic culture of Bell Telephone Labs missile defense programs in the 1960s and established a company founded on a "Culture of Innovation." Beginning with missile defense and intelligence customers in the Huntsville market, we grew to support increasingly complex missile and radar analysis and technology programs. Through the late 1980s and 1990s, we benefited from federal investments in small businesses (less than 500 employees), such as the Small Business Innovation Research (SBIR) program.

As we grew beyond the 500-employee threshold, we continued to benefit from federal small business set-asides for increasingly complex and challenging projects. Throughout this period of steady growth, we invested in our personnel, facilities, and hardware resources to position ourselves to solve some of the most pressing national needs through rapid prototyping and rapid acquisition. As a mid-tier federal contractor, our investments in our Huntsville campus have resulted in over a half million square feet of state-of-the-art design, analysis, laboratory, and hardware prototyping and production facilities that enable us to continue to innovate and solve our customers' most challenging problems. For much of our work, we benefit from the trust we have established and strive daily to maintain with our customers who require innovative solutions within classified programs.

Our testimony focuses on the advantages of Dynetics and other mid-tier federal contractors for supporting the increasing demands for innovation our nation faces. These advantages include rapid innovation, affordability, agility and responsiveness.

Hitting the Target: Large, Precision-Guided Munitions Technologies

The core of our large, precision-guided munitions innovations have centered around the use of lattice fins for flight control. Dynetics engineers were first introduced to the aerodynamic properties of lattice fins while analyzing performance of select foreign missiles in the 1990s. The same engineers then participated in designing and building lattice fin controls for the Small Smart Bomb Range Extension Program, controlling a 250-pound munition in test flights in 2000 and 2001.

Figure 1: MOAB

In April 2002, the Air Force Research Laboratory Munitions Directorate (AFRL/MN) came to Dynetics with $35,000 to develop a concept for a 21,000-pound weapon system called the Massive Ordnance Air Blast (MOAB). We quickly applied the lattice fin designs to control the massive weapon using GPS and control fin actuators that were being manufactured for a 2,000-pound bomb at the time as is illustrated in Figure 1.

In partnership with AFRL/MN, HR Textron, and ASEI, the team received the go-ahead in January 2003 for full-scale testing of three units in fewer than 90 days from the start. We successfully flight-tested two inert test units, and the final full-up munition was tested on March 11, 2003. The team subsequently produced more than 10 weapons and delivered them between April and May. The Air Force repeatedly commended our agility in procuring parts and integrating the units under our ISO 9001 quality system in such a short time.

Our success with MOAB readied us to participate as a subcontractor to Boeing on another large operational munition, the 30,000-pound Massive Ordnance Penetrator (MOP). We have provided lattice fins and selected actuation subsystems for that system up to the current day. One small investment by the government in this innovative approach has multiplied many times over in supporting our National defense.

Enabling Small, Affordable, and Responsive Satellites: FASTSAT

The Fast, Affordable, Science and Technology SATellite (FASTSAT-HSV01), shown in Figure 2, launched on Nov. 19, 2010, carrying six experiment payloads to low Earth orbit on the STP-S26 mission. Our public-private partnership satellite provided valuable scientific data through successful mission operations. FASTSAT-HSV01 was developed as a multi-million dollar investment by Dynetics employee-owners and built in a strong partnership with NASA's Marshall Space Flight Center (MSFC) in collaboration with the Von Braun Center for Science and Innovation (VCSI) in Huntsville, AL, for the Department of Defense Space Test Program (DoD STP).

Figure 2: FASTSAT-HSV01

FASTSAT-HSV01 was developed, integrated, tested, and ready to ship in 16 months using an innovative business model, tailored processes, and a co-located and experienced team – a radically short timeframe to develop a new spacecraft. A Dynetics engineer whose background included 10 years of supporting commercial automotive customers led the effort. Our leader successfully brought that lean business model to a multi-faceted project with a very short suspense date. FASTSAT was designed from the ground up to meet short schedules with modular components at a lower cost. Satellite integration was completed within 10 months and included the use of a rigorous systems engineering and test approach from NASA and DoD to achieve flight readiness certification. Under MSFC leadership, the verification and validation program was executed involving significant NASA capabilities including an electromagnetic interference/electromagnetic compatibility test facility and a thermal vacuum test facility.

FASTSAT-HSV01 provided access to space for six payloads, raising their Technology Readiness Level (TRL) and providing scientific data over a two-year period. The plan for payload operations included the ejection of NanoSail-D right after commissioning and then a sequential payload operations phase for the five remaining experiments. There were several key accomplishments for the payload operations, starting with the payload hardware checkout on Day 10 and the initial power-up and communications to each instrument.

When we ejected the NanoSail-D CubeSat, FASTSAT became the first ESPA spacecraft to launch a CubeSat on-orbit. The P-POD door opened Day 16, and the NanoSail-D was released 43 days later. Due to the Nano-Sail ejection, the FASTSAT entered 3-degree spin – we were able to recover in three orbits. We raised the TRL of NanoSails from 6 to 9.

Other payloads demonstrated on FASTSAT included the NASA Miniature Imager for Neutral Ionospheric Atoms and Magnetospheric Electrons (MINI-ME), the NASA Thermospheric Temperature

Imager (TTI), the NASA Plasma Impedance Spectrum Analyzer (PISA), the Light Detection System, and the AFRL Miniature Star Tracker.

The MINI-ME clocked 3,424 hours on-orbit and provided 167 MB of data, meeting threshold and objective goals and raising the TRL from 2 to 9. TTI clocked 1,224 hours on-orbit and provided 250 MB of data, meeting threshold science goals and raising the TRL from 2 to 9. PISA contributed 3,717 orbital hours and provided 914 MB of data, meeting threshold and objective goals and raising the TRL from 2 to 9. The Light Detection System functioned 591 hours and produced 262 MB of data, raising the TRL to 7. The AFRL Miniature Star Tracker clocked 4,577 orbital hours and provided 774 MB of data, meeting threshold goals and raising the TRL from 6 to 8.

Several key lessons were gleaned from the rapid development and testing of a Class D spacecraft in 16 months, including: a co-located, flat team model greatly improved efficiency; leveraging the best of NASA and industry capabilities can result in groundbreaking capabilities; "faster and cheaper" from "ground up" was easier than optimizing "slow and expensive"; getting Class-D risk buy-in from leadership up-front avoided scope creep; streamlining approval processes eliminated waiting on signatures; modern collaboration tools facilitated rapid spacecraft and payload layout; multiple avionics test beds were needed to accelerate hardware and software testing; early "testing as you fly" – including long duration runs – avoided system test problems.

The Next Step in Additive Manufacturing: Growing Materials and Structures from Atoms

In July 2012, Dynetics embarked on a strategic thrust to enter the materials field by hiring a team of four experienced scientists and researchers and a technician to establish a nano-materials laboratory in Huntsville. With some seed funding from NASA and the Department of Energy and several million dollars of Dynetics employee-owner investment, we have established a laboratory to grow nano-fibers for numerous applications ranging from producing more effective heat sinks for semiconductors to fabricating extremely lightweight lattice structures. Dynetics has pioneered a rapid prototyping method that will revolutionize the aerospace industry by providing a new way to make strong, lightweight structures. This technology is directly applicable for areas such as aviation, deep space missions, in-space manufacturing of parts and radiation shielding. Our team has pioneered the application of Hyperbaric Laser Chemical Vapor Deposition (HP-LCVD), which can inherently create the strongest materials in the world using a virtually limitless combination of elements from the periodic table**.**

Our Culture of Innovation

Dynetics' "Culture of Innovation" means lifetime learning is nurtured and expected. We embody this goal through our internal Dynetics University, our Dynetics Technical Journal, monthly scientific and technical colloquia, an inherent enthusiasm for innovation in new hires, investments in tools needed to innovate, and leaders who are technically minded including our Founder (a PhD who currently serves as Senior Advisor), Chief Executive Officer (PhD), Chief Technology Officer (MS), Chief Scientist (PhD), Chief Engineer (PhD), Chief Technologist (PhD), and Chief Research Scientist (PhD).

Summary

In summary, Dynetics has benefited from federal research and development investments to move from a small business to a 1,400-employee, mid-tier company – able to apply agility and innovation to important projects of increasing scale. This growth has also benefited from our corporate investments in ground–breaking research, our people, state-of-the-art facilities, and tools. Dynetics believes that increased federal investment in research and development will pay large dividends as our nation deals with challenging issues and limited budgets.