PROGRAM MANAGEMENT FOR 2001 INSTRUMENTATION

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ABSTRACT

The Hardened Subminiature Telemetry and Sensor System (HSTSS) is a model program; executing Department of Defense (DoD) initiatives, such as Acquisition Reform, Industry Partnering, and the use of Integrated Product Teams (IPT). HSTSS is using partnering because the expertise is spread across the industry, and integration is required to fabricate an instrumentation system that would meet tri-service test requirements. This paper will describe the programmatic and technical approaches being used to mitigate risk. In this paper key management strategies will be addressed. I will discuss the affect that the IPT process has had on HSTSS to make the program so successful. This paper will essentially discuss the acquisition strategy as it has evolved to mitigate obsolescence. The strategy has been influenced by acquisition streamlining , commercial technology and the limited production requirements. In this paper I will address how partnering and the use of commercial technology will reduce the program costs as well as the unit cost. The importance of working together within the services and sharing funds and technology to accomplish more with less will be addressed in this paper. This paper will address how we intend to deliver a low cost, microminiature, high g (100,000 g), modular instrumentation system. This instrumentation is to be used for indirect fire and direct fire projectiles and small missiles. Data is to be collected from launch to impact. The modules being developed will include but not be limited to batteries, transmitter, data acquisition chipset and a variety of sensors (pressure, spin rate, GPS, etc.).

KEY WORDS

Commercial Technology, Partnering, Building Blocks, Integrated Product Teams

INTRODUCTION

We are developing instrumentation systems that will allow the Government to test weapons systems that are being delivered to the field. Quantities to be tested are usually limited in number because of the unit cost per test sample and the test budget, so the Government market is not sufficient for industry to commit their limited resources. This results in expensive and non-reusable instrumentation systems. In order to reduce the cost and the risk the focus has been shifted to commercial technology and leveraging. The HSTSS Program has made effective use of the IPT process and partnering. The IPT has selected the Building Block method for developing the instrumentation to satisfy the tri-service needs of HSTSS. This also reduces the long term affects of obsolescence and allows ready insertion of advanced technology. HSTSS has led the way in acquisition streamlining in many areas which will be discussed throughout this paper. It is important for us in the Government to realize that because of the limited resources available, different activities and services must team together rather than trying to maintain individual programs duplicating efforts. Duplication hurts programs more than anything. HSTSS has been successful in leveraging other programs and working with other programs to help them meet their requirements.

BACKGROUND

The HSTSS project was started in 1992. This project started off as an Office of the Secretary of Defense (OSD) sponsored Test Technology Development and Demonstration (TTD&D) program. It has successfully transitioned into an OSD Joint Improvement (JIM) program. HSTSS is required to be a low cost, microminiature, high g (100,000 g's), modular instrumentation system. HSTSS instrumentation will be used on projectiles and small missiles which will allow measurements to be made on board during flight testing. Data will be collected from launch to impact. The limiting factors in the design of HSTSS instrumentation are the package size and the high-g environment. Because the size and shape of the space available for instrumentation varies, the tri-service users wanted a modular/component design so that each user could repackage the system to meet their particular needs, especially the volume constraints. During flight, accurate data can not be collected with present systems. Present systems are too large. During the early phase of HSTSS, it was determined that the hardest components to shrink would be the battery. After much market research, it was decided that most battery manufacturers were not interested in taking on a development project because in test instrumentation there was a limited market. One company was willing to work with U S Army Research Laboratories (ARL), Weapons and Materials Research Directorate and through this effort, we now have a battery that withstands 100,000 g's and can be configured to the subminiature package (less than a cubic inch) without taking up all the space. From the experience of the Integrated Product Team (IPT) on other instrumentation development programs, it was decided that HSTSS should be developed as a modular/component system. The modular/component design is a building block design so systems can be configured to fit the different space requirements. This way we could develop individual technology and allow HSTSS to be geometrically flexible and be easily adaptable to future advanced technology. The modular/component design makes HSTSS more adaptable to meet the different configurations needed by the three services.

ACQUISITION STRATEGY

The acquisition strategy for HSTSS is to have contractors developing the individual technologies or building blocks. After the delivery of these building blocks the Government would prototype instrumentation systems to meet a number of different requirements. The prototypes would be limited to quantities no greater than twenty. When test quantities grew large enough it would require a contract award of an integration/production contract to be able to meet the large quantity requirements. The development of the individual technology is what we refer to as the HSTSS "building blocks". It is expected that the technology is commercially available and could be fabricated with very little development. The system environment for a high g and microminiature size are the restricting parameters which have to be satisfied. Present contracts are for the development of a transmitter and a Data Acquisition Chipset (DAC). Other future solicitations will be for a pressure transducer and GPS/IMU. HSTSS has led the way using acquisition reform and streamlining in our acquisition process. The IPT has been innovative and works hard to reduce the award time and to utilize the electronic media.. Program management and acquisition reform in the 90's has been very rewarding and exciting.

PROGRAM MANAGEMENT

With the ever increasing sophistication of munitions and small missiles, flight tests are necessary to reduce development costs. However, in the case of small or relatively inexpensive systems, flight tests are often not made due to anticipated or presumed high cost of measurement systems. Usually the instrumentation is expensive and in most cases expendable. Although, special high-g telemetry systems exist (a telemetry system is defined as the complete measuring, transmitting and receiving apparatus for indicating or recording at a distance the value of a quantity), their usage is not as common as in larger, more expensive, non-high-g systems. Additionally, the role and impact of simulation requires accurate and realistic flight measurements as input. The HSTSS program has been jointly sponsored by the Department of Defense and the Army to develop and demonstrate a new generation of high-g telemetry technologies and to make these products available to the test community (Ref 1). The acquisition strategy is obviously driven by the need for inexpensive, microminiature and high-g instrumentation modules/components. If instrumentation is to be inexpensive it needs to come from commercial technology. If program costs are to be reduced we need to leverage other programs and work the three services as a super integrated product team. Managing programs to develop test and evaluation instrumentation is a challenge today because the Government does not buy sufficient quantities to control the market. This is an important reason the Government can not duplicate effort and why the three services have to work together so we leverage the quantities and combine them into one market. This still does not create a market as large as the commercial market, but it will help. We still need to utilize commercial technology. A company will not invest resources in a program that does not have a future market place to make them sufficient profits. It is the commercial technology that controls the market place and is highly profitable because of the quantities required. Automobiles, cell phones and computers are a few examples where the volume purchases are high and the profits are also high. There are two paths we can take to be able to work with industry and make it profitable for them. First, we can take existing commercial technology and adapt it to our needs or we can develop something to meet our needs and show industry that there can be a commercial market for that technology. In our case the Transmitter manufacturer is adapting his cell phone technology to meet our needs because he feels when our product is developed he can use this same technology for other commercial applications. HSTSS can only be a success if commercial technology is considered in the modules/components being developed under this program. The critical aspect of HSTSS is that the instrumentation is not recoverable and therefore the cost must be kept at a minimum. The following are examples of how leveraging and commercial technology has helped advance the HSTSS program.

The key management tools I have used successfully are the IPT, leveraging technology being developed by other activities and searching out and using commercial technology. Sharing development between projects is saving money and time. This is what is making HSTSS successful.

COMMERCIAL TECHNOLOGY

HSTSS developed a power source that would exist in the harsh launch environment using the commercial technology that was available. Solid polymer electrolyte, lithium-ion power cells from Ultralife Batteries (UK) were evaluated (Ref 2). The solid-state polymer batteries (nominal 4 V) are rechargeable, lightweight, physically configurable, and environmentally friendly. Cells can be made to almost any user shape or configuration. They can be layered together and connected in parallel and/or series to provide a complete battery system. Ultralife is under contract to modify its commercial cells for the gun-launched environment. Single-cell configurations have survived shock accelerations of more than 110,000 g’s and centrifugal tests at 300 rev/sec, yielding radial accelerations of 24,000 g’s. HSTSS is currently funding the development to increase the energy density and temperature performance of the cells. Primary power cells, available from Ultralife Batteries (US), offer similar form factor characteristics with even higher energy density and are currently being evaluated for high-g applications (Ref 3).

The portable communications industry is rapidly developing new devices and products. Wireless communication systems, local area networks, cellular phones and mobile links are common at frequencies not permitted on test ranges. However, existing commercial communication technologies have promise for application at L and S-band frequencies (approximately 1.5 and 2.2 GHz). Preliminary evaluations indicate these technologies can be made compatible with the standards of frequency allocation, stability and bandwidth. Link budgets and analyses have been completed in this preliminary survey. HSTSS has awarded a contract to provide the community with a new family of miniature, high-g, low cost transmitter components and modules.

INTEGRATED PRODUCT TEAM

The major factor contributing to the success of the HSTSS program is the Integrated Product Team (IPT). When I took over as the Project Director for HSTSS, it was obvious that this program would not go any where unless we had a cohesive team. It is hard enough to get a team to work together when you are from the same service, but HSTSS IPT is tri-service. After a few meetings the team seemed to realize that we all had the same goal. HSTSS is such a large program for that it was decided to have more than just a single IPT. I utilize the IPT process to help manage my program. I have six active contracts totaling almost $10 M. I have two universities doing studies for HSTSS. There is one IPT for acquisition and is cross fertilized by members on the technical working group IPT. There is the tri-service international IPT. The IPT process is a valuable asset to HSTSS. The team is constantly considering the cost and the affects on cost of any change in requirement and yet they strive for a superior product that can be used by the majority of the participants. Teams are formed as additional projects are added to cover individual applications. It is very rewarding to see the cooperation and unity the HSTSS program has between services, various activities, industry and other governments.

The IPT is effective because it brings together a great variety of talent and experience. It also by nature produces a greater networking capability than can be done alone. This process has been responsible for the progress the HSTSS project has made over the past two years. The IPT has been able to make technical decisions and still keep cost and schedule well under control. Everyone is focused on the end requirements and the team works hard to keep requirements from creeping.

CONCLUSION

HSTSS is a low cost flexible instrumentation system. This is happening because we have a good acquisition strategy, a great IPT, we are leveraging other programs and making full use of commercial technology. The battery technology that was developed for HSTSS is now being used in lap top computers. This allows the manufacturer to expand the market which eventually reduces the unit cost and gives the manufacturer a reason to keep the battery line producing. On the other side, HSTSS has looked at the automobile industry to find an air bag sensor which is a commercial accelerometer. This accelerometer has been tested up to 30,000 g’s. The cost is less than $50. In order to be able to find this technology we must be looking. It has been a total team effort and it has required leveraging other programs and sharing with programs working the same or similar issues. The way to have a successful instrumentation development in today's arena requires leveraging, Integrated product teams, partnering and commercial technology.

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