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Improved cost monitoring and control through the Earned Value Management System

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ABSTRACT

As economic pressure and competition for budget among federal agencies has increased, there has been an increasing need for more granular data and robust management information systems. This is especially true for the execution of major civilian space programs. This need has resulted in new program management requirements being implemented in an attempt to limit cost and schedule growth. In particular, NASA Procedural Requirements (NPR) 7120.5D requires the implementation of an Earned Value Management System (EVMS) compliant with the requirements of American National Standards Institute (ANSI)/Electronic Industries Alliance Standard 748-B. The Radiation Belt Storm Probes (RBSP) program management team at The Johns Hopkins University Applied Physics Laboratory (JHU/APL) made a decision to implement an EVMS on RBSP during Phase B—a year earlier than specified in the contractual Phase C reporting requirement as defined in the NPR. This decision was made so that the project would have the benefit of 12 months of training and hands-on implementation during Phase B. Although there were a number of technical and process hurdles encountered during Phase B and into Phase C, the system was working well when the Integrated Baseline Review (IBR) was held in August 2009. The IBR was a success because it met the review requirements. It was also clear to all IBR participants that the EVMS was providing value to the project management team. Although the IBR pointed out some areas of concern regarding process and ANSI compliance, the system had markedly improved the project's ability to monitor cost and schedule. This, in turn, allowed the project team to foresee problems in advance, formulate corrective actions, and implement course corrections without causing significant adverse impact to the project. Opponents of EVMS systems often communicate the unfavorable opinion that EVMS systems create unnecessary cost and administration. Although it is undeniable that EVMS implementation does not occur without cost, the cost is minimal in comparison to the benefits of successful implementation. This paper will focus on the implementation of EVMS on the RBSP project, explain EV processes and the implementation's cost, and analyze the benefits of EVMS to provide insight into cost/benefit considerations for other projects considering EVMS implementation. This paper will do this by focusing on the following points: (1) RBSP is the first full-up implementation of earned value management (EVM) at JHU/APL; (2) RBSP EVM started in Phase B; (3) RBSP EVM implementation has been working well in Phase C/D; (4) RBSP EVM implementation has been recognized by Goddard Space Flight Center and NASA Headquarters as successful;

Abbreviations: ANSI, American National Standards Institute; CAM, Control account manager; EV, Earned value; EVM, Earned value management; EVMS, Earned Value Management System; IBR, Integrated Baseline Review; IMS, Integrated Master Schedule; JHU/APL, The Johns Hopkins University Applied Physics Laboratory; NPR, NASA Procedural Requirements; PM, Program manager; PMB, Performance Measurement Baseline; RBSP, Radiation Belt Storm Probes; SD, Space Department; SMD, Science Mission Directorate; VAR, Variance Analysis Report

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and (5) an assessment of the benefits of EVMS to the project management team and sponsor shows that the system's benefits outweigh the cost of implementation.

1. Intent of the Johns Hopkins University Applied Physics Laboratory (JHU/APL) Earned Value Management System (EVMS)

The goal of the JHU/APL EVMS is to provide Space Department (SD) management with a consistent, standard framework for assessing project performance. The basic tenets of earned value management (EVM) have been introduced and used within the JHU/APL SD on the Radiation Belt Storm Probes (RBSP) project. The EVMS currently interfaces with the systems that comprise the accounting system and scheduling tool and incorporates data from both to produce the output necessary for earned value (EV) data production. These data are comprised of an Integrated Master Schedule (IMS), Contract Performance Reports, a Variance Analysis Report (VAR), and monthly schedule reports. This output has allowed the SD project management team to make timely decisions regarding the project, provided a sound basis for project cost estimates and funding requirements, and assisted in meeting the project reporting requirements for the contract cost/schedule performance measurement data.

2. Beginning the implementation

Before the start of the implementation, there was concern stated by the control account managers (CAMs) who were going to use the EVMS. Our CAMs were concerned about the potential impact of the requirements that would be levied on them. The principal CAM concerns included the possibility of the EVMS taking up too much of their time or the system not supplying any added value to them.

With that said, there were factors that precipitated an EVM implementation at JHU/APL. In the period from 1979 to 1996, JHU/APL was singularly successful in arriving at program costs that were within a few percentage points of planned costs. Eight spacecraft bus programs were within $\pm 8\%$ of the initial cost estimate at Phase C/D start.

Recently, though, missions and instruments have experienced cost growth. Along with this, requirements were levied by the sponsor [NASA Procedural Requirements (NPR) 7120.5D] regarding cost and schedule requirements in an EVMS environment. To combat future cost/schedule growth and meet the reporting requirements, JHU/APL began implementing several new processes and systems, one of which is the current EVMS.

The EVMS implementation started to become a reality after several key factors came together. JHU/APL management took a series of steps to support the implementation. Senior management promoted a cultural shift—among senior department managers through project managers to the CAMs—with the use of an EVMS to manage a project. This buy-in from senior management expedited the change process.

The implementation team used this momentum and built on it by demonstrating to users that there was value in the EVMS. The EVM team used a gradual approach for the implementation by first using the EVMS on smaller departmental projects. This approach demonstrated to the project manager (PM) and CAMs that the EVMS was beneficial in the management of the project. It also allowed the EVM team to leverage the project to bring on different aspects of the EVMS and refine them. Other factors in this approach included maintaining open communication among the project team and senior management, introducing different aspects of the system, and allowing the users time to digest how to use the system and to garner CAM support.

This approach was critical for instituting EVMS on RBSP. The lessons learned from the smaller projects were used and additional key factors were identified to keep the implementation on track. One factor was showing "value" to the user. The EVMS team demonstrated the value of an IMS to the CAMs. This was done by working with the CAMs through workshops. These workshops built on the relationship between the EVMS team and CAMs to break down the cultural barriers of change through the analysis of the IMS and its data products. This helped ensure that the CAMs would have a better understanding of the IMS and its products. It allowed the CAMs to identify key variances, what causal effect was behind each variance, and what could possibly be done to mitigate the variance.

The EVMS used a "one system approach". This meant the entire project team at JHU/APL collaborated on the efforts of the implementation with the sponsor and instrument teams. The EVMS at JHU/APL used MS Project file updates and cost data from partnering institutions as input. The project did not force individual EVM systems on each partnering institution. Our partners were mostly universities that did not have this capability. By using this approach, we were able to maintain a one system approach.

The EVMS team fostered open communication via continuous discussions with the CAMs, project team, and sponsor organizations regarding the implementation and what it meant to them. Frequent feedback to the team on data quality, results, and areas for improvement facilitated continual improvement of the system throughout implementation.

Having using this graduated approach and demonstrating initial success, the implementation was poised to move onto its next phase: the use of EVMS in a reporting phase on a SD mission.

3. EVMS in Phase B

Key components of the EVMS were developed in Phase B on RBSP. The baseline was developed for both schedule and cost. An Integrated Master Plan and IMS were put in