Management and Measurement

Analyzing What Makes Systems Development Programs Successful in the Engineering and Manufacturing Phase

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A popular saying about managing the acquisition process is that "You can't manage what you can't measure." With this in mind, the Office of the Director of Operational Test and Evaluation (DOT&E), Department of Defense, asked three faculty members of our Test and Evaluation Department at the Defense Systems Management College (DSMC) to analyze what makes systems development programs successful in the Engineering and Manufacturing Development (EMD) phase. As a result, we published DSMC Technical Report TR-2-95.[1] This report commented on several program parameters during EMD, including cost and schedule success, but not performance success.

Since then, we have completed two more research phases. The first phase evaluated the performance success of the original 24 programs. Detailed results appeared in the Proceedings of the 1997 Acquisition Research Symposium.[2] The second follow-on phase applied the original research methodology for evaluating performance success to 20 more recent programs, and is the focus of this article.

Creating a Tool to Measure Success

Beginning in 1993, the original research helped develop criteria for cost, schedule, and performance success during EMD. To measure performance success, we devised a success scale of 1 (not successful) to 5 (very successful). For cost and schedule, we measured the degree of overrun experienced in EMD using standard DoD decrements of 15 percent in cost and six months in schedule, which we then converted to success ratings of 1 to 5.

Using descriptive criteria, which discriminated among the five possible ratings, we subjectively applied performance success ratings. These descriptive criteria indicated what the content of the Initial Operational Test and Evaluation (IOTE) or Operational Evaluation (OPEVAL) report would be like in each of the five rating gradations. For each program, the IOTE/OPEVAL reports and associated DOT&E Beyond Low Rate Initial Production (BLRIP) report were rated. We also reviewed the performance criteria prior to, and immediately after reading each report, and then assigned a performance success rating.

As standard procedure, IOTE/OPEVAL reports comment on operational effectiveness and operational suitability. A simplified definition of operational effectiveness is the degree of mission accomplishment of a system when used by representative personnel in the expected environment. Operational suitability can be defined as the degree to which a system can be placed satisfactorily in field use with consideration given to several operational features, including those generally referred to as the "ilities."

Improving Overall Performance

Figure 1 compares the average results of the original 24 programs with the follow-on 20 programs. The original programs went before the Defense Acquisition Board at Milestone III for Full Rate

FIGURE 1. **Comparison of Original Programs (24) With Follow-on Programs (20)**

Research Phase	IOTE/OPEVAL Report (OTAs)◆			BLRIP Report (DOT&E)		
	Effectiveness	Suitability	Overall	Effectiveness	Suitability	Overall
Original 24 Programs (1980–1992)	3.6	3.1	3.4	3.5	3.1	3.5
Follow-on 20 Programs (1993–1997)	4.5	4.1	4.4	4.0	4.1	4.2

◆ Service Independent Operational Test Activity

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Production (FRP) approval, between 1980 and 1992. The median date for these programs was mid-1988, and the average duration of the EMD phase was 7.4 years. The follow-on programs had their Milestone III FRP decision, or equivalent, between 1993 and 1997. The median date for these programs was early 1995.

Figure 1 also shows that during the period 1980-1992, the average overall performance success rating for OTA test and evaluation reports was 3.4 (out of a possible 5.0); it was 3.5 for DOT&E reports. During the period 1993-1997, the average overall performance success rating climbed to 4.4 for OTA test and evaluation reports and improved to 4.2 for DOT&E reports.

One of our responsibilities in the DSMC Research Division is information dissemination. Consequently, we make all research data immediately available for use in new and unique analytical ways. An example of this is the summary data for overall OTA and DOT&E performance ratings on a year-by-year basis (Figure 2).

Accounting for Improved Performance Ratings

An unanswered question caused this significant improvement. Current research data do not provide the answer, but several possibilities suggest further research may. Possible reasons for this improvement include:

Reason 1

The improvement is due to the effects of acquisition reform initiatives. Possibly, but the first practical date one can ascribe Acquisition Reform results actually being implemented in the field is probably beyond the time when actions could have affected these particular 20 systems. The earlier research showed the average duration of EMD to be 7.4 years; any action taken after a program is more than halfway through EMD would have little effect.

Reason 2

The 24 programs developed under an earlier version of the 5000 Series required important user requirements like the Operational Requirements Document and Initial Operational Capability to be stated at Milestone I. In this time period, it was generally understood that these requirements were firm and not subject to change.

The commanders of the Service OTAs realized (Possibly also in the 1991 time frame) that they no longer could operate in the mode of being the independent director of the "final exam" — the IOTE/OPEVAL — just prior to Milestone III.

In February 1991, a revised 5000 Series stated that these and other requirements were subject to review at each milestone. This allowed for a more reasoned approach to changing requirements as more data were developed, and allowed the program manager to suggest changes in a more receptive environment.

Reason 3

The commanders of the Service OTAs realized (possibly also in the 1991 time frame) that they no longer could operate in the mode of being the independent director of the "final exam" — the IOTE/OPEVAL — just prior to Milestone III. Rather, they initiated an earlier consultative role with the Developing Activity, and by means of Early Operational Assessments, worked with the program managers to clarify what would be expected at the IOTE/OPEVAL. This change in modus operandi occurred before the acquisition reform initiative of Integrated Product Teams.

Our opinion is that the most probable cause for the improvement in the success of systems in operational testing is a combination of Reasons 2 and 3. If this is true, then the unsung heroes of the pre-acquisition reform efforts to improve the DoD acquisition system are the Office of the Secretary of Defense managers and staffs who issued the February 1991 revision to the 5000-Series documents, and the commanders and test directors of the OTAs who, on their own initiative, modified operational test procedures to include an early consultative phase.

References

1. Gailey, C.K., R.W. Reig, W. Weber, and L.R. George (1995). A Study of the Relationship Between Initial Production Test Articles used in a System Development Program and the Success of that Program. (The DSMC Press, TR2-95). Fort Belvoir, Va.

2 Reig, R.W., "Cost, Schedule and Performance Metrics," Proceedings, June 1997 Acquisition Research Symposium, Defense Systems Management College, et al.

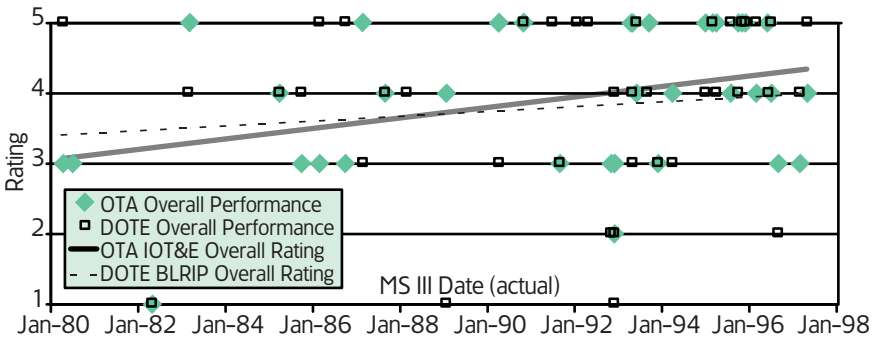

FIGURE 2. **EMD Performance Trends (All Programs)**