ASSESSING GROUND-BASED MIDCOURSE DEFENSE PRODUCTION READINESS

Steve Austin, Brandy Simmons,
Lucinda Stiene, and Heidi Wheeler

Background

The Ground-Based Midcourse Defense (GMD) Program, (formerly National Missile Defense) now includes a new process for assessing production readiness activities. The new process is called Production Readiness Assessment (PRA) and replaces the previous traditional formal review known as a Production Readiness Review (PRR). The PRA process was developed to provide periodic objective production readiness assessments and early risk identification. The PRA process was designed to be less intrusive, time-consuming, and costly than the PRR process. It also provides the structure to implement the integrated product team (IPT) concept to address transition to production

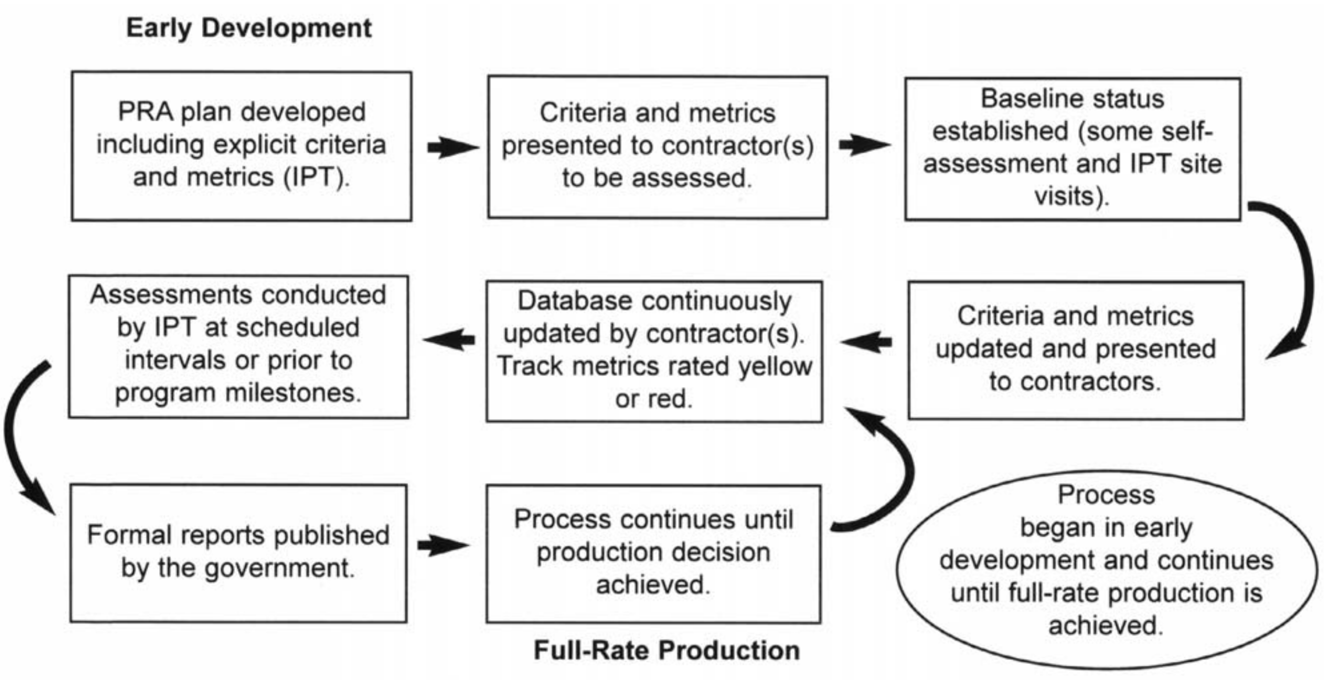

Figure 1.
PRA process flow

PRODUCTION READINESS ASSESSMENT

		$TIME_1 = 0$	$TIME_2$ = 6 MONTHS	$TIME_3$ = I YEAR	$TIME_4$ = 2 YEARS	$TIME_5$ =3 YEARS
CRITERIA	METRIC	0.1	0.3	0.5	0.7	0.9
Mfg. infrastructure	Capacity/ facilities planning	Initial planning not complete; production/ product flow not fully defined.	Production flow, sequence defined. Critical path has been determined.	Production flow analysis complete. Capacity projections established.	Facility layout plans approved. Rate projections refined and estimated capacities meet production requirements.	Production facilities in place and capacity meets production rate requirements.
Mfg. infrastructure	Schedule compatibility	Initial planning not complete; production/ product flow not fully defined.	Production flow, sequence defined. Critical path has been determined.	All major schedule activities defined. Coordinated schedule containing tool/fixture, process equipment, environmental stress screening, test, and government-furnished equipment activities defined.	Detailed production schedule established, refinement in process.	Firm production schedule in place based on completed transition to production effort.

Figure 2.
Portion of a PRA matrix

planning activities as an ongoing process. This approach is preferred to one that is a periodic event that only takes a snapshot of accomplishments that may not allow adequate time to cost-effectively mitigate risks.

A PRR was composed of a team of independent subject matter experts from functional areas such as design, production planning, and quality assurance. The team typically spent 2-3 days in the prime contractor and major subcontractor facilities reviewing accomplishments and planning for production. Findings and risks were documented in a formal report that was used in support of major program milestone decisions.

The PRA process used by the GMD staff was developed by the GMD Production and Quality Directorate composed of a team from the Production Engineering Division (PED) of the Aviation and Missile Research, Development and Engineering Center (AMRDEC) at the U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, AL. It is an iterative process using predetermined criteria to assess the progress of a contractor in achieving a stable design, proven manufacturing processes, and available/programmed production facilities and equipment resulting in a viable production capability with limited risk.

GMD consists of four major components: Ground-Based Interceptor (GBI); X-Band Radar; Upgraded Early Warning Radar; and Battle Management Command, Control, and Communications (BMC3). In 1999, a plan was developed that tailored the PRA structure to meet the needs of GBI, which was in the early stages of production planning. The PRA plan reflected a rating scheme that followed expected progress in relation to key program events. An initial assessment was conducted in January 2000 to exercise the plan, resolve any unforeseen bugs, and establish a baseline. A second assessment was conducted in April 2000, with a formal report submitted to the deployment readiness review panel. Based on the success of this early application, a decision was made to apply the process against all GMD components.

New Beginning

In October 2000, GMD organized a production engineering working group (PEWG) to manage production planning activities. Led jointly by the prime contractor's (Boeing) production operations and the GMD Production and Quality Directorate, the PEWG met weekly with representatives from each GMD component. The PEWG adopted the PRA process to consolidate the management of production activities throughout the program into a logical integrated process that would yield ongoing, real-time status of progress toward production readiness. Figure 1 illustrates the PRA process flow.

The AMRDEC PED staff provided training and promoted buy-in of all personnel involved in making the PRA process successful. The GMD components and system teams are composed of both government and contractor personnel. Each team developed a PRA plan that described its own tailored approach and included a matrix displaying the component's metrics and measures associated with standard criteria. The standard criteria that were evaluated included design, production planning, manufacturing infrastructure, manufacturing processes, subcontractor management, and quality assurance.

A matrix was laid out to include a predefined scale of 0.1, 0.3, 0.5, 0.7, and 0.9, which was tied to the program time line. The points in the scale represent uniform rating periods and specific dates. The metrics were assessed using measures that represent increasing progress toward production readiness. These measures depict the minimum expected progress for that metric in relation to the program time line. All progress measures for that given point in time should be in line with the predefined score for that rating period. This allows scoring to be done against a common point in time denoted by a set number on the overall scale. Figure 2 shows an example of a portion of a PRA matrix.

For each assessment period, a target score is established for each component to be measured against. The target score is agreed on jointly by the government and prime contractor after considering input from subcontractors. The highest score attainable during an assessment is the target score. Performance achieved beyond the target score is noted, but higher scores are not used because the consolidated score for each component is an average of the criterion scores, which in turn are an average of the metric scores. Because the objective of the assessment is to identify any risks upfront, restricting higher scores reduced the potential problem caused from mathematical skewing during scoring roll-up.

The success of the PRA process is very dependent on the relationships developed and exercised among government and contractor personnel. The PRA process must be supported by all involved to ensure accurate and credible results.

A color scheme is associated with each metric. If the metric score attained is equal to the target score for that period, the metric receives a green rating. If the score attained is less than the target rating by 0.2, the metric is rated yellow. If the score attained is more than 0.2 below the target rating, the metric is rated red. This color scheme is also used to rate criteria, based on the average score of each metric, and to rate the component's progress toward production readiness, which is an average of the criteria scores. By tying the color scheme directly to the scoring system, color ratings remain objective and consistent from one assessment period to the next.

To gather data, a series of self-assessment files were submitted for completion by subcontractors being assessed. The Technical Risk Identification and Mitigation System database from Best Manufacturing Practices Center of Excellence acted as a shell to input the GMD components' metrics and measures matrix and as the self-assessment file submitted to the subcontractor. Subcontractors assessed themselves based on the progress measure that they had achieved. For each metric, rationale and evidence for the self-rating was required. After completion of the self-assessment, the completed files were forwarded to PEWG points of contact.

Each assessment is based on the subcontractor's progress to achieve its target measure. Subcontractors are scored jointly by the government and prime contractor, based on information provided in the self-assessment and evaluation of their documentation and performance. Site visits were performed as needed, based on areas of concern in the self-assessments. Metrics rated yellow or red were noted as action items or candidate risks to be tracked and closed out.

A formal report was published by the government documenting results for the rating period in September 2001. A report will be completed annually and used to support program decisions and milestones. The publication of the formal report completes an iteration of the process and documents the progress made for a particular assessment period. GMD will continue to assess progress made toward the upcoming target score in the next iteration of the PRA process and work to resolve action items noted during the last assessment period.

The Production Readiness Assessment process depicts the progression made toward production readiness, which allows early identification and mitigation of potential risks to the production program.

Lessons Learned

The success of the PRA process is very dependent on the relationships developed and exercised among government and contractor personnel. The PRA process must be supported by all involved to ensure accurate and credible results. Representatives from each of the GMD Program components were involved in establishing the guidelines for conducting the PRA. These guidelines manifested themselves in the criterion, metrics, target scores, and measures established for each component. Subcontractors were involved in the process and provided input into how best to identify progress along individual schedule paths. Because each component in the development stages operates somewhat autonomously and tracks against its own detailed schedule, the target score can vary among components. For this reason, it was important to include some individually tailored measures to receive the maximum benefit from the assessments.

Component metrics and measures may require updates to remain compatible with the latest program structure. To provide greater insight into the subcontractor's progress, additional supporting questions for measures were developed. Also, future iterations should use common metrics and measures to the maximum extent possible across all components assessed.

Conclusion

The PRA methodology provides an objective evaluation of production readiness. The PRA process depicts the progression made toward production readiness, which allows early identification and mitigation of potential risks to the production program. It promotes a teaming environment, requiring both the government and prime contractor to work together to track progression and handle action items. This process is flexible and can be tailored to fit various program requirements.

The PRA process provided GMD with real-time information that can be used to manage the program, as opposed to PRRs that are conducted prior to a major milestone, not permitting adequate time for risk mitigation.

Self-assessments obtained throughout the PRA process yield problem identification without numerous costly investigative trips conducted by the government. The GMD Program results demonstrated that the PRA process provides a tool to track production readiness progress in an objective and cost-effective manner.

STEVE AUSTIN is a Technical Team Leader in AMRDEC's PED. He holds a B.S.I.E. and an M.B.A. from Tennessee Technological University in Cookeville, TN, and is a graduate of the Senior Service College Fellowship Program at the University of Texas.

BRANDY SIMMONS is a General Engineer in AMRDEC's PED. She holds a B.S.E. and an M.S.E. from the University of Alabama in Huntsville.

LUCINDA STIENE is a General Engineer in AMRDEC's PED. She holds a B.S.I.E. from the University of Alabama.

HEIDI WHEELER is a General Engineer in the GMD Production and Quality Directorate. She holds a B.S.E.E. from the University of Pittsburgh and an M.S.I.E. from Texas A&M.
