This lesson introduces key concepts of Earned Value Management (EVM), including the basic EVM process, key elements of EVM, reports, and risk management.

The terminal learning objective for this lesson is to recognize key concepts about EVM as a program management tool that integrates cost, schedule, and technical performance.

This lesson includes two topics:

- **Topic 1:** What is EVM?
- **Topic 2:** EVM and Other Functional Disciplines
This lesson introduces key concepts of Earned Value Management (EVM), including the basic EVM process, key elements of EVM, reports, and risk management.

The terminal learning objective is to recognize the value of EVM program management in cost, schedule, and performance disciplines.

This lesson includes:

- **Topic 1:** Introduction to EVM
- **Topic 2:** EVM Discipline

### Long Description

A graph depicts project EVM data in terms of dollars in millions and time. The y-axis reflects dollars in millions. A bar at the top of the graph indicates a management reserve. Time is indicated on the x-axis Contract Start to Contract End. A vertical line labeled Time Now identifies the current point in time. Three curves are shown. A curve labeled BCWS begins in the lower left corner at Contract Start and slopes upward, crosses the Time Now line, and terminates in the upper right corner at Contract End, at the bottom of the Management Reserve bar. The end point of the BCWS line is labeled BAC. A second curve, labeled BCWP, is shown beneath the BCWS curve and ends at the Time Now line. A third curve, labeled ACWP, runs between the BCWP and BCWS curves, crosses the Time Now line, and continues as a dashed curve to cross above the BCWS and Management Reserve bar, and past the Contract End point. Where the ACWP curve terminates, it is labeled EAC. A bracket labeled CV encompasses the span between where the ACWP and BCWS lines intersect with the Time Now line. A bracket labeled SV encompasses the span between where the BCWS and BCWP lines intersect the Time Now line.
In this topic, you will:

- Recognize that Earned Value Management (EVM) is a management tool that program managers use for insight into cost, schedule and performance of Department of Defense (DoD) acquisition programs and that supports proactive decision-making.

- Define the terms for key EVM elements: budgeted cost for work scheduled (BCWS), budgeted cost for work performed (BCWP), actual cost of work performed (ACWP), budget at completion (BAC), and estimate at completion (EAC).

- Recognize a favorable and unfavorable cost and schedule variance, given a graphic depiction of a time-phased performance measurement baseline (PMB), cumulative BCWS, BCWP, and ACWP (BCWScum, BCWPcum, ACWPcum).
EVM in the Acquisition Life Cycle

EVM is an integrated program management tool that the program manager (PM) uses to track specific contract cost, schedule and performance objectives, in support of the Acquisition Program Baseline (APB) goals.

EVM is primarily used in development and integration contracts with measurable and discrete work scope, to measure cost and schedule performance and manage risk. These contracts are usually in the Engineering and Manufacturing Development (EMD) phase and early production phases of the acquisition life cycle, as illustrated in the graphic below.
EVM in the Acquisition Life Cycle

EVM is an integrated program management tool that the program manager (PM) uses to track specific contract cost, schedule and performance objectives, in support of the Acquisition Program Baseline (APB) goals.

EVM is primarily used to measure the Acquisition Program Baseline (APB), which is an agreement between the program manager (PM) and the Milestone Decision Authority (MDA) that reflects the approved program and contains schedule, performance, and cost parameters that are the basis for satisfying an identified mission need. The first APB is approved by the MDA prior to a program entering Engineering and Manufacturing Development, or at program initiation, whichever occurs later. As a minimum, the APB contains the objective and threshold values for major milestones and significant schedule events, key performance parameters from the approved requirements document, and the life-cycle cost estimate approved for the program.

Acquisition Program Baseline

An agreement between the program manager (PM) and the Milestone Decision Authority (MDA) that reflects the approved program and contains schedule, performance, and cost parameters that are the basis for satisfying an identified mission need. The first APB is approved by the MDA prior to a program entering Engineering and Manufacturing Development, or at program initiation, whichever occurs later. As a minimum, the APB contains the objective and threshold values for major milestones and significant schedule events, key performance parameters from the approved requirements document, and the life-cycle cost estimate approved for the program.

Where are we now?
Where are we going?
What can be done to get us there?
EVM in the Acquisition Life Cycle

EVM is an integrated program management tool that the program manager (PM) uses to track specific contract cost, schedule and performance objectives, in support of the Acquisition Program Baseline (APB) goals.

EVM is primarily used to measure the performance of a project. The traditional project life cycle is further divided into five sequential phases: 1. Materiel Solution Analysis, 2. Technology Maturation and Risk Reduction, 3. Engineering and Manufacturing Development, 4. Production and Deployment, and 5. Operations and Support. Performance, cost, and schedule requirements are determined in the Materiel Solution Analysis phase. Earned Value Management (EVM) occurs across the acquisition life cycle phases and it tracks contract cost, schedule, and performance. EVM answers these questions: Where are we now? Where are we going? What can be done to get us there?

Long Description

The acquisition life cycle displays with five sequential phases: 1. Materiel Solution Analysis, 2. Technology Maturation and Risk Reduction, 3. Engineering and Manufacturing Development, 4. Production and Deployment, and 5. Operations and Support. Performance, cost, and schedule requirements are determined in the Materiel Solution Analysis phase. Earned Value Management (EVM) occurs across the acquisition life cycle phases and it tracks contract cost, schedule, and performance. EVM answers these questions: Where are we now? Where are we going? What can be done to get us there?
EVM in Relation to the APB

The APB is an agreement between the Milestone Decision Authority (MDA) and the PM. It is established at program initiation and revised throughout the program’s life cycle.

The APB contains the **objective** and **threshold** values for major milestones and significant schedule events, **key performance parameters** (KPP), and the approved program life-cycle cost estimate.

These include:

- **Technical Performance** – What technical characteristics are needed and to what level?
- **Schedule** – When is it needed?
- **Cost** – What is the cost constraint for the program?

EVM is applied at the contract level, with contract cost, schedule, and technical performance objectives that support the APB parameters.

Take a look at some of the Lightweight, Assault and Reconnaissance (LAR) Vehicle program APB Parameters for the EMD phase, and the supporting LAR EMD contract objectives. Note that the contract was awarded on June 1, 2013.
EVM in Relation to the APB

The APB is an agreement between the Milestone Decision Authority (MDA) and the PM. It is established at program initiation and revised throughout the program’s life cycle.

<table>
<thead>
<tr>
<th>Sample of Government APB Key Performance Parameters (KPPs)</th>
<th>EMD Contract</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>KPP</strong></td>
<td><strong>Objective</strong></td>
</tr>
<tr>
<td>Survivability Rate</td>
<td>0.95</td>
</tr>
<tr>
<td>Grade</td>
<td>50 degrees</td>
</tr>
<tr>
<td>Turning Radius</td>
<td>20 feet</td>
</tr>
<tr>
<td>Range</td>
<td>400 miles</td>
</tr>
<tr>
<td>Mean Time to Repair (MTTR)</td>
<td>1 hour</td>
</tr>
</tbody>
</table>
EVM in Relation to the APB

The APB is an agreement between the Milestone Decision Authority (MDA) and the PM. It is established at program initiation and revised throughout the program’s life cycle.

<table>
<thead>
<tr>
<th>Key Event</th>
<th>Objective</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS B Decision</td>
<td>Mar-13</td>
<td>Mar-13</td>
</tr>
<tr>
<td>EMD Contract Award</td>
<td>Mar-13</td>
<td>Jun-13</td>
</tr>
<tr>
<td>Critical Design Review (CDR)</td>
<td>Sep-14</td>
<td>Dec-14</td>
</tr>
<tr>
<td>Production Prototype Delivery</td>
<td>Jul-15</td>
<td>Dec-15</td>
</tr>
<tr>
<td>Dev Test/Op Test (DT/OT) Complete</td>
<td>Jan-16</td>
<td>Apr-16</td>
</tr>
<tr>
<td>EMD Contract Schedule Requirements</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

You must select each LAR document to move on.
EVM in Relation to the APB

The APB is an agreement between the Milestone Decision Authority (MDA) and the PM. It is established at program initiation and revised throughout the program’s life cycle.

The APB contains the objective and threshold values for major milestones and significant schedule events, key performance parameters (KPP), and the approved program life-cycle cost estimate.

<table>
<thead>
<tr>
<th>Government APB Cost Parameters</th>
<th>EMD Negotiated Contract Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost $ in Millions (SM)</strong></td>
<td><strong>Objective</strong></td>
</tr>
<tr>
<td>Research, Development, Test &amp; Evaluation (RDT&amp;E)</td>
<td>$100M</td>
</tr>
<tr>
<td></td>
<td><strong>Threshold</strong></td>
</tr>
<tr>
<td></td>
<td>$110M</td>
</tr>
<tr>
<td></td>
<td>Target Price: $72.4M</td>
</tr>
<tr>
<td></td>
<td>Target Cost: $65M</td>
</tr>
</tbody>
</table>

The APB will include affordability caps for unit production and sustainment costs. Affordability caps are established as fixed cost requirements equivalent to key performance parameters (KPPs). The contract cost is not the only item that must be accounted for in the APB cost parameters. The APB cost will also include funding required for testing, program office support, and possibly other elements.
EVM in Relation to the APB

The APB is an agreement between the Milestone Decision Authority (MDA) and the PM. It is established at program initiation and revised throughout the program’s life cycle.

The APB contains the objective and threshold events, key performance parameters (KPP).

These include:

- **Technical Performance** - What technical performance should be achieved?
- **Schedule** - When is it needed?
- **Cost** - What is the cost constraint for the program?

EVM is applied at the contract level, with contract cost, schedule, and technical performance objectives that support the APB parameters.

Take a look at some of the Lightweight, Assault and Reconnaissance (LAR) Vehicle program APB Parameters for the EMD phase, and the supporting LAR EMD contract objectives. Note that the contract was awarded on June 1, 2013.
EVM in Relation to the APB

The APB is an agreement between the Milestone Decision Authority (MDA) and the PM. It is established at program initiation and revised throughout the program’s life cycle.

The APB contains the objective and threshold values for major milestones and significant schedule events, key performance parameters (KPP), and the approved program life cycle cost estimate.

These include:

- **Technical Performance** - What is the desired operational goal that is achievable and to what level?
- **Schedule** - When is the operational goal expected to be delivered at an affordable life-cycle cost? The schedule threshold does not signify additional expense.
- **Cost** - What is the desired operational goal that is achievable but at a higher risk in life-cycle cost, schedule, and technology. Performance above the threshold does not signify additional expense.

Take a look at some of the Lightweight, Assault and Reconnaissance (LAR) Vehicle program APB Parameters for the EMD phase, and the supporting LAR EMD contract objectives. Note that the contract was awarded on June 1, 2013.
EVM in Relation to the APB

The APB is an agreement between the Milestone Decision Authority (MDA) and the PM. It is established at program initiation and revised throughout the program's life cycle.

The APB contains the objective and threshold values for major milestones and significant schedule events, key performance parameters (KPP), and the approved program life-cycle cost estimate.

These include:

- **Technical Performance** - What is required to achieve the required operational effect, while being achievable through the current state of technology at an affordable life-cycle cost.
- **Schedule** - When is it needed?
- **Cost** - What is the cost constraining schedule objectives?

EVM is applied at the contract level, with performance measures that support the APB parameters.

Performance below the threshold value is not operationally effective or suitable or may not provide an improvement over current capabilities.

Take a look at some of the Lightweight, Assault and Reconnaissance (LAR) Vehicle program APB Parameters for the EMD phase, and the supporting LAR EMD contract objectives. Note that the contract was awarded on June 1, 2013.
EVM in Relation to the APB

The APB is an agreement between the Milestone Decision Authority (MDA) and the PM. It is established at program initiation and revised throughout the program’s life cycle.

The APB contains the objective and threshold values for major milestones and significant schedule events, key performance parameters (KPP), and the approved program life-cycle cost estimate.

These include key performance parameters:

- **Technical**: Performance attribute of a system considered critical or essential to the development of an effective military capability. KPPs are contained in the Capability Development Document (CDD) and the Capability Production Document (CPD).
- **Schedule**: The approved schedule, and technical performance objectives that support Program Baseline (APB).

Take a look at some of the Lightweight, Assault and Reconnaissance (LAR) Vehicle program APB Parameters for the EMD phase, and the supporting LAR EMD contract objectives. Note that the contract was awarded on June 1, 2013.
EVM in Relation to the APB

The APB is an agreement between the Milestone Decision Authority (MDA) and the PM. It is established at program initiation and revised throughout the program’s life cycle.

Long Description

Three data tables display: Sample of Government APB Key Performance Parameters (KPPs) for the EMD contract, Government APB Schedule Parameters with the EMD Contract Schedule Requirements for Key Events, and Government APB Cost Parameters with the EMD Negotiated Contract Cost. The data for the sample of Government APB Key Performance Parameters (KPPs) follows: Survivability objective is 0.95, threshold is 0.95, and contract specification is 0.95. Grade objective is 50 degrees, threshold is 40 degrees, and contract specification is 40 degrees. Turning radius objective is 20 feet, threshold is 25 feet, and contract specification is 25 feet. Range objective is 400 miles, threshold is 350 miles, and contract specification is 385 miles. Mean Time to Repair (MTTR) objective is 1 hour, threshold is 1.5 hours, and contract specification is 1.4 hours. Schedule parameters are: MS B Decision objective date is March 2013, threshold date is March 2013, and no contract schedule requirement date. EMD Contract award objective date is March 2013, threshold date is June 2013, and contact schedule schedule date is June 2013. Critical design review (CDR) objective date is September 2014, threshold date is December 2014, and contract schedule date is September 2014. Production prototype delivery objective date is July 2015, threshold date is December 2015, and contract schedule date is November 2015. Dev Test/Op Test (DT/OT) Complete objective date is June 2016, threshold date is April 2016, and contact schedule date is May 2016. APB cost data displays in millions of dollars for Research, Development, Test, & Evaluation (RDT&E). The APB Objective is $100 million, the APB threshold is $110 million. The EMD negotiated contract costs are a target price of $72.4 million and target cost of $65 million. The APB will include affordability caps for unit production and sustainment costs. Affordability caps are established as fixed cost requirements equivalent to KPPs.
The APB and Risk

All programs involve risk to technical performance, schedule, and cost. Moreover, these risks are interrelated.

For example, consider risks to the LAR EMD program:

- **Technical Performance Risk**: High technical risk is associated with the inclusion of state-of-the-art technologies for a quiet running high performance diesel engine, and requirement that vehicle temperature remains at or appears to remain at a constant with the operating environment temperature in order to avoid detection.

- **Schedule Risk**: Moderate risk based on aggressive production delivery schedule and tight technical requirements mitigated by the integration of proven technology in vehicle development.

- **Cost Risk**: Moderate based on an already aggressive initial production delivery schedule and tight technical specifications which may drive higher costs than are reflected in the cost estimates.
The APB and Risk

All programs involve risk to technical performance, schedule, and cost. Moreover, these risks are associated with program performance goals and objectives within defined cost, schedule, and performance constraints.

For example, consider

- **Technical Performance Risk**: Moderate risk associated with technologies for a quiet running high performance diesel engine, and requirement that vehicle temperature remains at or appears to remain at a constant with the operating environment temperature in order to avoid detection.

- **Schedule Risk**: Moderate risk based on aggressive production delivery schedule and tight technical requirements mitigated by the integration of proven technology in vehicle development.

- **Cost Risk**: Moderate based on an already aggressive initial production delivery schedule and tight technical specifications which may drive higher costs than are reflected in the cost estimates.

---

**risk**

A measure of future uncertainties in achieving program performance goals and objectives within defined cost, schedule, and performance constraints.
The APB and Risk

All programs involve risk to technical performance, schedule, and cost. Moreover, these risks are interrelated.

For example, consider risks to the LAR EMD program:

- **Technical Performance Risk**: High technical risk is associated with the technologies for a specific engine, and requirements mitigated by the integration of proven technology in vehicle development.

- **Schedule Risk**: Moderate based on an already aggressive initial production delivery schedule and tight technical specifications which may drive higher costs than are reflected in the cost estimates.

- **Cost Risk**: Moderate based on an already aggressive initial production delivery schedule and tight technical specifications which may drive higher costs than are reflected in the cost estimates.
The APB and Risk

All programs involve risk to technical performance, schedule, and cost. Moreover, these risks are interrelated.

For example, consider risks to the LAR EMD program:

- **Technical Performance Risk**: High technical risk is associated with the inclusion of state-of-the-art technologies for a quiet running high performance diesel engine, and requirement that vehicle temperature remains at or appears to remain at a constant with the operating environment temperature in order to avoid detection.

- **Schedule Risk**: Moderate risk based on aggressive production delivery requirements.

- **Cost Risk**: Modest risk based on production delivery specifications; may drive higher costs than are reflected in the cost estimates.

---

**Schedule Risk**

The risk that a program will not meet its acquisition strategy schedule objectives or major milestones established by the acquisition authority.
The APB and Risk

All programs involve risk to technical performance, schedule, and cost. Moreover, these risks are interrelated.

For example, consider risks to the LAR EMD program:

- **Technical Performance Risk**: High technical risk is associated with the inclusion of state-of-the-art technologies for a quiet running high performance diesel engine, and requirement that vehicle temperature remains at or appears to remain at a constant with the operating environment temperature in order to avoid detection.

- **Schedule Risk**: Moderate risk based on aggressive production delivery schedule and tight technical requirements mitigated by the integration of proven technology in vehicle development.

- **Cost Risk**: Moderate based on an already aggressive initial

**Cost Risk**

The risk that a program will not meet its acquisition strategy cost objectives that were developed using Cost as an Independent Variable (CAIV) or cost objectives established by the acquisition authority.
The APB and Risk

All programs involve risk to technical performance, schedule, and cost. Moreover, these risks are interrelated.

For example, consider risks to the LAR EMD program:

- **Technical Performance Risk**: High technical risk is associated with new technologies in the engine, and related to technologies appearing at or appearing at or appears in the environment that appear.

- **Schedule Risk**: Moderate risk based on aggressive production delivery schedule and tight technical requirements mitigated by the integration of proven technology in vehicle development.

- **Cost Risk**: Moderate based on an already aggressive initial production delivery schedule and tight technical specifications which may drive higher costs than are reflected in the cost estimates.
EVM - A Program Management Approach

PMs have a wide range of supporting data and processes to help them manage risk, including EVM. EVM is unique in that it integrates contract cost, schedule, and technical performance objectives into a performance measurement baseline (PMB):

- **Schedule**: EVM baseline includes a time-phased integrated schedule of contract events
- **Cost**: EVM baseline includes a time-phased budget baseline that captures contract cost objectives in dollars
- **Technical Performance**: EVM baseline includes a product-oriented work breakdown structure that relates technical requirements to ongoing work

Contractors may incorporate risk mitigation strategies in the EVM PMB. As the contract is executed, contractors submit EVM reports that include metrics that measure cost and schedule performance against this baseline.

Program managers can analyze this EVM information for identification of emerging risk items or worsening performance trends for known risk items. They can also use EVM data to assess the realism of contractor *estimates at completion* and adequacy of contractor corrective action plans.
EVM - A Program Management Approach

PMs have a wide range of supporting data and processes to help them manage risk, including EVM. EVM is unique in that it integrates contract cost, schedule, and technical performance objectives into a performance measurement baseline (PMB):

- **Schedule**: EVM baseline includes a time-phased integrated schedule of contract events
- **Cost**: EVM baseline includes a time-phased budget baseline that captures contract cost objectives in dollars
- **Technical Performance**: EVM baseline includes a product-oriented work breakdown structure that relates technical requirements to ongoing work

Contractors may incorporate risk mitigation strategies in the EVM PMB. As the contract is executed, contractors submit EVM reports that include metrics that measure cost and schedule performance against this baseline.

Program managers can analyze this EVM information for identification of emerging risk items or worsening performance trends for known risk items. They can also use EVM data to assess the realism of contractor estimates at completion and adequacy of contractor corrective action plans.

**Estimates at Completion (EAC)**

- The estimated total cost for authorized work
- Actual costs plus the estimate of costs for authorized work remaining
- Term can apply at any WBS level
EVM - A Program Management Approach

PMs have a wide range of supporting data and processes to help them manage risk, including EVM. EVM is unique in that it integrates contract cost, schedule, and technical performance objectives into a performance measurement baseline (PMB):

- **Schedule**: EVM integrates the schedule into the baseline.
- **Cost**: EVM baseline that captures the cost of the contract.
- **Technical Performance**: product-oriented work breakdown structure that relates technical requirements to ongoing work.

Contractors may incorporate risk mitigation strategies in the EVM PMB. As the contract is executed, contractors submit EVM reports that include metrics that measure cost and schedule performance against this baseline.

Program managers can analyze this EVM information for identification of emerging risk items or worsening performance trends for known risk items. They can also use EVM data to assess the realism of contractor estimates at completion and adequacy of contractor corrective action plans.
EVM as a Contract Management Tool

EVM is a method of managing projects that integrates the technical performance, schedule, and cost parameters of a contract.

As you learned, the APB documents the technical performance, schedule, and cost parameters of a program.

When EVM is required as a management tool, the requirement applies to a specific contract rather than the entire program. The EVM PMB supports the attainment of the contract cost, schedule, and technical performance objectives, which can differ from the APB parameters, particularly if a program includes multiple contracts.

The PMB is the time-phased budget plan for accomplishing the contract objectives, against which contract performance is measured.
EVM as a Contract Management Tool

EVM is a method of managing projects that integrates the technical performance, schedule, and cost parameters of a contract.

As you learned, the APB contract risk diagram illustrating the relationship between the contract and risks related to technical performance, schedule, and cost.

When EVM is required as a program requirement applies to a specific contract rather than the entire program. The EVM PMB supports the attainment of the contract cost, schedule, and technical performance objectives, which can differ from the APB parameters, particularly if a program includes multiple contracts.

The PMB is the time-phased budget plan for accomplishing the contract objectives, against which contract performance is measured.
The Performance Measurement Baseline

During the acquisition planning phase, the Government outlines the cost, schedule, and technical performance parameters that the contractor will use to build the PMB after the contract is awarded.

The PMB integrates the technical objectives, schedule, and cost of the contract by:

1. **Technical Performance**: The [Work Breakdown Structure (WBS)](#) breaks down the work required to meet technical requirements resulting from the systems engineering process.

2. **Schedule**: Time-phasing the tasks to meet contract milestones.

3. **Cost**: Time-phasing the contract budget in accordance with the schedule.

The PMB must reflect the major contract events (such as captured in an Integrated Master Plan (IMP)), and the Integrated Master Schedule (IMS), which indicates when those milestones will be met.

Once the PMB is created, it is reviewed to ensure a mutual understanding by both the contractor and Government PMs throughout the project life cycle during [Integrated Baseline Reviews (IBRs)](#).
The Performance Measurement Baseline

During the acquisition planning phase, the Government outlines the cost, schedule, and technical performance parameters that the contractor will use to build the PMB after the contract is awarded.

The PMB integrates the technical objectives, schedule, and cost of the contract by:

1. Technical Performance: The Work Breakdown Structure (WBS) breaks down the work required to meet technical requirements resulting in a product. It is a product-oriented family tree composed of hardware, software, services, data, and facilities.

2. Schedule: The Integrated Master Schedule (IMS) indicates when milestones will be met.


Tasks are time phased from contract start to contract end.

Work to be accomplished is represented in dollars.

Once the PMB is created, it is reviewed to ensure a mutual understanding by both the contractor and Government PMs throughout the project life cycle during Integrated Baseline Reviews (IBRs).
The Performance Measurement Baseline

During the acquisition planning phase, the Government outlines the cost, schedule, and technical performance parameters that the contractor will use to build the PMB after the contract is awarded.

The PMB integrates the technical objectives, schedule, and cost of the contract by:

1. **Technical Performance:** The [Work Breakdown Structure (WBS)](#) breaks down the work required to meet technical requirements resulting from the systems engineering process.

2. **Schedule:** Time-phasing the tasks to meet contract milestones.

3. **Cost:** Time-phasing the contract budget in accordance with the schedule.

The PMB must reflect the major contract events, as captured in an Integrated Master Plan (IMP) or the Integrated Master Schedule (IMS), which indicate when those milestones will be met.

Once the PMB is created, it is reviewed to ensure mutual understanding by both the contractor and the Government PMs throughout the project life cycle during Integrated Baseline Reviews (IBRs).

**Integrated Baseline Reviews**

Review of a contractor's performance measurement baseline (PMB). It is conducted by program managers (PMs) and their technical staffs, or Integrated Product Teams (IPTs), on contracts requiring compliance with DoD Earned Value Management System (EVMS) criteria requirements within 6 months after contract award.
The Performance Measurement Baseline

During the acquisition planning phase, the Government outlines the cost, schedule, and technical performance parameters that the contractor will use to build the PMB after the contract is awarded.

The PMB integrates the technical objectives, schedule, and cost of the contract.

1. **Technical Performance:** The work breakdown structure (WBS) and the work required to achieve the technical objectives. The WBS is the 'PMF'.
2. **Schedule:** Time-phasing of tasks with contract milestones.
3. **Cost:** Cost phased in accordance with the contract schedule.

The PMB must reflect the technical objectives as captured in an Integrated Master Plan (IMP), and the Integrated Master Schedule (IMS), which indicates when those milestones will be met.

Once the PMB is created, it is reviewed to ensure a mutual understanding by both the contractor and Government PMs throughout the project life cycle during Integrated Baseline Reviews (IBRs).

**Long Description**

An EVM graph depicts the PMB. The y-axis depicts dollars in millions, up to the total contract cost, and the x-axis depicts units of time from contract start to contract end. A line labeled Performance Measurement Baseline displays beginning in the lower left corner at Contract Start and terminating in the upper right corner at Contract End. Work to be accomplished is represented in dollars. Tasks are time phased from contract start to contract end. The performance measurement baseline (PMB) integrates cost, schedule, and technical objectives.
The LAR EVM PMB

For example, look at how the LAR EVM PMB reflects contract cost, schedule, and performance objectives:

**Cost Objectives**

Cost Objectives: $65M Management Reserve ($2M) = LAR Negotiated Contract Cost

**Performance Objectives**

The PMB reflects the work that is required to meet the technical requirements resulting from the systems engineering process.

**Schedule Objectives**

Contract Start: June 2013
CDR: Sep 14
Prod Proto: Sep 15
Contract End: April 2016
The LAR EVM PMB

For example, look at how the LAR EVM PMB reflects contract cost, schedule, and performance objectives:

**Cost Objectives**

$65M = LAR Negotiated Contract Cost. Cost objectives include the management reserve and negotiated contract cost.

**Schedule Objectives**

- Contract Start: June 2013
- CDR: Sep 14
- Prod Proto: Sep 15
- Contract End: April 2016

**Performance Objectives:** The PMB reflects the work that is required to meet the technical requirements resulting from the systems engineering process.
The LAR EVM PMB: Cost Objectives

The LAR contract was negotiated at a target price of $72.4 million, with a target cost of $65 million. The PMB will measure progress toward that cost objective.

Cost Objectives

- **Management Reserve ($2M)**
- **Performance Measurement Baseline**
- **$65M = LAR Negotiated Contract Cost**

Performance Objectives

The PMB reflects the work that is required to meet the technical requirements resulting from the systems engineering process.

Schedule Objectives

- **Contract Start: June 2013**
- **CDR: Sep 14**
- **Prod Proto: Sep 15**
- **Contract End: April 2016**

Government APB EMD

<table>
<thead>
<tr>
<th>Cost Parameters</th>
<th>Objective</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost $ in Millions (SM)</td>
<td>$100M</td>
<td>$110M</td>
</tr>
<tr>
<td>RDT&amp;E</td>
<td>Target Price: $72.4M</td>
<td>Target Cost: $65M</td>
</tr>
</tbody>
</table>

EMD Negotiated Contract Cost
The LAR EVM PMB: Cost Objectives

The LAR contract was negotiated at a target price of $72.4 million, with a target cost of $65 million. The PMB will measure progress toward that cost objective.

Cost Objectives

Government APB EMD Cost Parameters ($ in millions) and EMD Negotiated Cost, as depicted in the LAR PMB graph.

The APB cost parameters for RDT&E are: objective is $100 million, threshold is $110 million, and for negotiated contract cost, the target price is $72.4 million and the target cost is $65 million.

Performance Objectives

The PMB reflects the work that is required to meet the technical requirements resulting from the systems engineering process.

Schedule Objectives

Contract Start: June 2013

CDR: Sep 14

Time

Prod Proto: Sep 15

Contract End: April 2016

Long Description

Government APB EMD Cost Parameters ($ in millions) and EMD Negotiated Cost, as depicted in the LAR PMB graph.

The APB cost parameters for RDT&E are: objective is $100 million, threshold is $110 million, and for negotiated contract cost, the target price is $72.4 million and the target cost is $65 million.
The LAR EVM PMB: Schedule Objectives

The contract schedule parameters are captured in the LAR EVM PMB milestone and review dates.

Cost Objectives
- Management Reserve ($2M)

Performance Objectives
- The PMB reflects the work that is required to meet the technical requirements resulting from the systems engineering process.

Schedule Objectives
- Contract Start: June 2013
- CDR: Sep 14
- Time
- Prod Proto: Sep 15
- Contract End: April 2016

Government APB Schedule Parameters

<table>
<thead>
<tr>
<th>Key Event</th>
<th>Objective</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS B Decision</td>
<td>Mar-13</td>
<td>Mar-13</td>
</tr>
<tr>
<td>EMD Contract Award</td>
<td>Mar-13</td>
<td>Jun-13</td>
</tr>
<tr>
<td>Subsystem Critical Design Review</td>
<td>Jan-14</td>
<td>May-14</td>
</tr>
<tr>
<td>Critical Design Review (CDR)</td>
<td>Sep-14</td>
<td>Dec-14</td>
</tr>
<tr>
<td>Production Prototype Delivery</td>
<td>Jul-15</td>
<td>Dec-15</td>
</tr>
<tr>
<td>Draft LRIP/Prod RFP Release</td>
<td>Jan-16</td>
<td>Apr-16</td>
</tr>
<tr>
<td>DT OT Complete</td>
<td>Jan-16</td>
<td>Apr-16</td>
</tr>
<tr>
<td>LRIP Proposal Received</td>
<td>Jun-16</td>
<td>Sep-16</td>
</tr>
</tbody>
</table>

EMD Contract Schedule Requirements

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>
The contract schedule parameters are captured in the LAR EVM PMB milestone and review dates.

### Cost Objectives

### Government APB Schedule Parameters

<table>
<thead>
<tr>
<th>Key Event</th>
<th>Objective</th>
<th>Threshold</th>
<th>Schedule Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSB Decision</td>
<td>March 2013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMD Contract Award</td>
<td>March 2013, June 2013</td>
<td>June 2013</td>
<td></td>
</tr>
<tr>
<td>LRIP/Prod RFP Release</td>
<td>January 2016, April 2016</td>
<td>April 2016</td>
<td></td>
</tr>
<tr>
<td>DT OT Complete</td>
<td>June 2016, April 2016</td>
<td>April 2016</td>
<td>May 2016</td>
</tr>
<tr>
<td>LRIP Proposal Received</td>
<td>June 2016, September 2016</td>
<td>September 2016</td>
<td></td>
</tr>
</tbody>
</table>

### Long Description

Government APB Schedule Parameters and EMD Contract Schedule Requirements as depicted in LAR PMB Graph. Under the APB schedule parameters there are eight key events, each with an associated objective and threshold, and contract schedule requirement. MSB Decision has an objective and threshold of March 2013 and no associated contract schedule requirement. EMD Contract Award has an objective of March 2013, a threshold of June 2013, and a contract schedule requirement of June 2013. Subsystem Critical Design Review has an objective of January 2014, a threshold of May 2014, and a contract schedule requirement of February 2014. Critical Design Review (CDR) has an objective of September 2014, a threshold of December 2014, and a contract schedule requirement of September 2014. Production Prototype Delivery has an objective of July 2015, a threshold of December 2015, and a contract schedule requirement of November 2015. Draft LRIP/Prod RFP Release has an objective of January 2016, a threshold of April 2016, and no contract schedule requirement. DT OT Complete has an objective of June 2016, a threshold of April 2016, and a contract schedule requirement of May 2016. LRIP Proposal Received has an objective of June 2016, a threshold of September 2016, and no contract schedule requirement.
The LAR EVM PMB: Performance Objectives

The contract performance specifications are captured in the LAR EVM PMB tasks and technical events in the IMS.

**Cost Objectives**

- Survivability: 0.95
- Grade: 50 degrees
- Turning Radius: 20 feet
- Range: 400 miles
- MTTR: 1 hour

**Performance Objectives**

The PMB reflects the work that is required to meet the technical requirements resulting from the systems engineering process.

**Schedule Objectives**

- Contract Start: June 2013
- CDR: Sep 14
- Prod Proto: Sep 15
- Contract End: April 2016

**EMD Contract Specifications**

- Survivability: 0.95
- Grade: 40 degrees
- Turning Radius: 25 feet
- Range: 385 miles
- MTTR: 1.4 hours
The LAR EVM PMB: Performance Objectives

The contract performance specifications are captured in the LAR EVM PMB tasks and technical events in the IMS.

IMS

An integrated and networked multi-layered schedule of program tasks required to complete the work effort captured in a related IMP.

Sample of Government APB Key Performance Parameters (KPPs)

<table>
<thead>
<tr>
<th>KPP</th>
<th>Objective</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survivability Rate</td>
<td>0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>Grade</td>
<td>50 degrees</td>
<td>40 degrees</td>
</tr>
<tr>
<td>Turning Radius</td>
<td>20 feet</td>
<td>25 feet</td>
</tr>
<tr>
<td>Range</td>
<td>400 miles</td>
<td>350 miles</td>
</tr>
<tr>
<td>MTTR</td>
<td>1 hour</td>
<td>1.5 hours</td>
</tr>
</tbody>
</table>

EMD Contract

- Specifications: 0.95
- 40 degrees
- 25 feet
- 385 miles
- 1.4 hours

Performance Objectives

The PMB reflects the work that is required to meet the technical requirements resulting from the systems engineering process.

Schedule Objectives

- Contract Start: June 2013
- CDR: Sep 14
- Prod Proto: Sep 15
- Contract End: April 2016
The LAR EVM PMB: Performance Objectives

The contract performance specifications are captured in the LAR EVM PMB tasks and technical events in the IMS.

Sample of Government APB Key Performance Parameters (KPPs)

<table>
<thead>
<tr>
<th>EMD Contract</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>40 degrees</td>
</tr>
<tr>
<td></td>
<td>25 feet</td>
</tr>
<tr>
<td></td>
<td>385 miles</td>
</tr>
<tr>
<td></td>
<td>1.4 hours</td>
</tr>
</tbody>
</table>

Government APB Key Performance Parameters (KPPs) and EMD Contract Specifications as depicted in LAR PMB Graph. Under the APB key performance parameters, KPPs are listed with their associated objective, threshold, and EMD contract specification. Survivability has an objective and threshold of 0.95 and a contract specification of 0.95. Grade has an objective of 50 degrees, a threshold of 40 degrees, and a contract specification of 40. Turning Radius has an objective of 20 feet, a threshold of 25 feet, and a contract specification of 25 feet. Range has an objective of 400 miles, a threshold of 350 miles, and a contract specification of 385 miles. MTTR has an objective of 1 hour, a threshold of 1.5 hours, and a contract specification of 1.4 hours.
Developing the PMB

How do I establish my project baseline?

Rob
Government
Program Manager
Developing the PMB

Long Description

Bob, the Government Program Manager, displays. Question displays: How do I establish my project baseline? A Hardware item icon displays. Calendar displays labeled five months. Joe, the contractor, displays. Contract price of $6,000 displays. $500 fee and remaining $5,500 contract amount display. $500 management reserve and remaining $5,000 contract amount display. Five components display next to the hardware item. Text displays for each component: 1 month, $1,000, and BCWS equals $1,000. PMB diagram displays with five components, plotted out over five months, at one component per month for a total cost of $5,000.
Let’s take a closer look at the development of the PMB.

Consider a simple example: Bob is a Government program manager. He needs one hardware item built in 5 months. Bob hires Joe to do the work, and they agree on a cost plus incentive fee contract price of $6,000 that includes a $500 fee as an incentive for Joe to perform efficiently. That fee is not part of Joe’s performance measurement baseline because it is Joe’s incentive to perform well.

From that $6,000 price, Joe has $5,500 with which to perform the scope of the contract. Joe decides to set $500 aside as a management reserve. This management reserve is an amount contractors withhold for management control purposes, rather than for the accomplishment of a specific task. Joe knows there are risks on any project and having a management reserve is part of his risk management planning. This leaves $5,000 for labor and supplies, and other costs necessary to complete the work.

Joe will build five components for the hardware item. He can only build them one at a time, so he plans to take one month to build each component, and estimates each component will cost $1,000 in labor and supplies to complete. This is also known as the budgeted cost for work scheduled, or BCWS, for each component.

So Joe plans out the performance measurement baseline. He plans to build 1 component per month over the course of the 5-month-long project. Plotting the planned value of all components against the project schedule yields the PMB. The planned value is the BCWS. Now, as work is accomplished, it can be compared to this baseline plan to determine if the project is on schedule and on budget.

Let’s see how that works.
How do I measure performance?
Measuring Performance - Month 1

Long Description

Bob, the Government Program Manager, displays. Question displays: How do I measure performance? Five components display. Calendar displays with label: 5 months. Joe, the contractor displays. Contract displays with contract amounts: $5,500 plus $500 fee. $500 management reserve displays. $5,000 displays with text: labor, supplies, and other costs. PMB diagram displays with Budgeted Cost for Work Scheduled, or BCWS, plotted out over five months with a Budget at Completion, or BAC, of $5,000. Table displays showing number of Components produced for months one through five, including one planned component per month, each with a BCWS of $1,000, for a total of five components with a BCWS of $5,000. Time now displays at month one. Two completed components are added to the table at month one, and the total displays two completed. Budgeted Cost for Work Performed, or BCWP, of $2,000 displays at month one. Text displays: Ahead of schedule. Actual Cost of Work Performed, or ACWP, of $1,500 displays at month one. Text displays: Under budget. Question displays: Why are the costs so low? Question displays: Will it continue?
Once the PMB is in place, PMs use EVM to measure performance.

Consider Bob’s project. Remember, he needs one hardware item composed of five components in five months. He negotiated with Joe, the contractor, to develop the components at a contract cost of $5,500. As you know, Joe allocated $500 of the contract cost to management reserve and the remaining $5,000 for labor, supplies, and other costs to build the components. Joe built the PMB for the entire project scope of work based on this $5,000, which represents the budget at completion, or BAC.

Let’s look at how Bob and the contractor, Joe, use EVM to measure project progress with respect to the PMB. Recall that Joe planned to build one component per month, at a cost of $1,000 for each component. This is the budgeted cost for work scheduled, or BCWS. In the first month, Joe planned to complete one component, so the BCWS is $1000 for month one. At the end of the month, Joe actually has completed two components.

Since, according to the plan, each component represents $1,000 worth of work, Joe has earned $2,000 of value or, said another way, has an earned value of $2,000. This 'earned value' measurement is also called the budgeted cost for work performed, or BCWP. By comparing the BCWP to the BCWS, Joe realizes that he is ahead of schedule. His BCWP is $2,000, which reflects the completion of two components, but his BCWS is only $1,000 for month one – he only planned to complete one component in the first month. So Joe has completed more work than planned.

But how much did it actually cost Joe to build those components? It turns out, it only cost Joe $1,500 in labor and materials to build two components. This is the actual cost of work performed, or ACWP. It represents what Joe actually spent on labor and materials on the first two components. These costs are recorded in Joe’s books of account, and are costs he must actually pay. By comparing the ACWP to the BCWP, Joe sees he is doing well—he has made $2,000 worth of components for only $1,500.

Note that in order to anticipate future performance, Joe needs a clear understanding of why he is doing so well. Did it take less labor? Were supplies cheaper than planned? And, importantly, does he expect it to continue? Bob will also want to understand this performance.
So, what happens next?
Measuring Performance - Month 2

- Ahead of schedule
- Over budget

Bob's Estimate at Completion (EAC) = much higher!

Joe's Estimate at Completion (EAC) = $6,500

<table>
<thead>
<tr>
<th># of Components Produced</th>
<th>Month</th>
<th>Planned</th>
<th>BCWS</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>$1,000</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>$1,000</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>$1,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1</td>
<td>$1,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1</td>
<td>$1,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>5</td>
<td>$5,000</td>
<td>3</td>
</tr>
</tbody>
</table>

Bob
Government Program Manager

Joe
Contractor
Measuring Performance - Month 2

- Ahead of schedule
- Over budget

Bob’s Estimate at Completion (EAC) =

Long Description

Bob, the Government Program Manager, and Joe, the contractor, display. Reprised PMB diagram displays with Budgeted Cost for Work Scheduled, or BCWS, plotted out over five months with a Budget at Completion, or BAC, of $5,000; Budgeted Cost for Work Performed, or BCWP, of $2,000; and Actual Cost of Work Performed, or ACWP, of $1,500 displays at month one. Reprised number of components produced displays for months one through five, including one planned component per month, each with a BCWS of $1,000, and two completed in month one, for a total of five components with a BCWS of $5,000 with two completed. Text displays: Ahead of schedule; and Under budget. Time Now displays at two months. Text displays: supply problems. Question displays: How does this impact the project? One completed component is added to the table at month two, and the total displays three completed. BCWP of $3,000 displays at Time Now. ACWP of $4,500 displays at Time Now. Text displays: Ahead of schedule; and Over budget. Text displays: I think I’ve resolved the supply issues. Projected ACWP of $6,500 displays. Text displays: Joe’s Estimate at Completion, or EAC, equals $6,500. Questions display: Are the supply issues really resolved? What does the EVM trend information tell me? Second projected ACWP of $7,500 displays. Text displays: Bob’s Estimate at Completion, or EAC, equals much higher.
Joe and Bob’s project has been performing very well.

In the second month, however, Joe runs into supply problems. He had to find a new supplier, labor was standing by in the meantime, and the new supplier charged a much higher price. So what was the impact on the project in month two?

Joe does manage to build one more component, for a total of three components completed by month two. At $1,000 BCWS per component, the total BCWP for completing the three components is $3,000. However, looking at the ACWP, Joe sees that he spent a lot more on that third component than he planned, due to the supply issues. Building that third component actually cost Joe $3,000 in labor and materials instead of the $1,000 he had planned. The total ACWP is now up to $4,500 for the project. By comparing the BCWS to the BCWP, Joe sees that he is still ahead of schedule, but by comparing the BCWP to the ACWP, Joes realizes that he is now over budget by $1,500.

By the end of month two, Joe thinks the problems with his new supplier may be behind him and that he is close to having his production back on track. Joe thinks he will make the remaining two components for $2,000, as planned, so he adds $2,000 to the $4,500 of ACWP, and estimates it will cost him $6,500 to complete all components. This is Joe’s estimate at completion, or EAC. Joe’s EAC is a detailed estimate based on Joe’s intimate knowledge of the costs of labor and materials for each component.

Bob, on the other hand, is not so sure the supply problems are fixed, and is less optimistic. As a Government PM, Bob can use the EVM trend information for potential early warning of cost or schedule performance problems. By seeing the early warning information, Bob can potentially help identify ways of resolving issues before they become major problems. In this case, Bob extrapolates from the trends and thinks costs could go much higher. He talks to Joe about mitigation plans and alerts his management to likely funding pressure.

Let’s find out what happens next.
Measuring Performance - Month 3

<table>
<thead>
<tr>
<th>Month</th>
<th>Planned</th>
<th>BCWS</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>$1,000</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>$1,000</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>$1,000</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>$1,000</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>$1,000</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>5</td>
<td>$5,000</td>
<td>3</td>
</tr>
</tbody>
</table>

# of Components Produced

- ACWP: Ahead of schedule
- BCWP: Over budget
- BCWS: Budget at completion

Bob
Government Program Manager

Joe
Contractor
Measuring Performance - Month 3

Long Description

Bob, the Government Program Manager, and Joe, the contractor, display. Reprised PMB diagram displays with BCWS plotted out over five months with a BAC of $5,000; BCWP of $3,000 and ACWP of $4,500 display at month 2. Reprised number of components produced displays for months one through five, including one planned component per month, each with a BCWS of $1,000, and two completed in month one, and one completed in month two, for a total of five components with a BCWS of $5,000 with three completed. Text displays: Ahead of schedule; and Over budget. Time Now displays at three months. BCWS of $3,000 and BCWP of $4,000 display at Time Now. One completed component is added to the table at month three, and the total displays four completed. ACWP of $5,500 displays at Time Now. Questions display. What are our assumptions?: What can we learn from the latest data? Projected ACWP of $6,500 displays at month four. Text displays: EAC equals $6,500. Text displays at difference between BCWP and BCWS: Ahead of schedule. Text displays at difference between ACWP and BCWP: Over budget. Projected BCWP and BCWS of $5,000 display at month five.
In month two, Joe ran into supply problems, and this impacted the project. Well, in month three, Joe makes one more component and spends $1,000 on labor and materials.

At this point, Joe has completed four components, so his total BCWP is $4,000. Joe spent $5,500 to build those four components, so his total ACWP is $5,500. While Joe is over budget, it looks like he was right, and the supply issues are behind him, since he built the 4th component for $1,000. The ACWP trend line is flattening out as a result. Joe and Bob will both revisit their assumptions about the supply and labor costs and update their estimates based on this latest data.

There is one more component left to build. Since Joe thinks his production is back on track, and the supply issues do appear to be under control, he estimates that the remaining component will cost $1,000 to build and that it will take one month, as usual. His EAC for all five components is therefore still $6,500, and he will finish ahead of schedule. However, Joe’s final costs will be $1,500 more than the original budget of $5,000.

It looks like Bob will need to get more funding or cut out some scope if he wants to pay Joe to complete the fifth component. At month five, if Joe completes all five components, the BCWP line will equal the BCWS line, since all the work is complete. At that point, Joe and Bob will know what the actual completion costs.
Key Definitions

Take a moment to review the definitions of each of these key elements of EVM by selecting the callouts.

- **Budgeted Cost for Work Scheduled (BCWS)**
- **Budgeted Cost for Work Performed (BCWP)**
- **Actual Cost of Work Performed (ACWP)**
- **Estimate at Completion (EAC)**
- **Budget at Completion (BAC)**

You must select each highlighted EVM element to move on.
Key Definitions

Take a moment to review the definitions of each of these key elements of EVM by selecting the callouts.

Estimate at Completion (EAC)
- The estimated total cost for authorized work
- Actual costs plus the estimate of costs for authorized work remaining
- Term can apply at any WBS level
Key Definitions

Take a moment to review the definitions of each of these key elements of EVM by selecting the callouts.

**Budget at Completion (BAC)**
- The sum of all EVM performance budgets for a given effort
- Equal to the total cumulative BCWS value for the work planned
- Term can apply at any WBS level
Key Definitions

Take a moment to review the definitions of each of these key elements of EVM by selecting the callouts.

- **Budgeted Cost for Work Performed (BCWP)**: Also called earned value (EV)
  - The value of completed work expressed as the value of the BCWS assigned to that work
  - May be expressed as a value for a specific period, or cumulative to date
  - Term can apply at any WBS level

- **Budget at Completion (BAC)**
- **Estimate at Completion (EAC)**
- **Actual Cost of Work Performed (ACWP)**
Key Definitions

Take a moment to review the definitions of each of these key elements of EVM by selecting the callouts.

**Budgeted Cost for Work Scheduled (BCWS)**
The sum of the performance budgets for all work scheduled to be accomplished

- May be expressed as a value for a specific period, or cumulative to date
- Term can apply at any WBS level

---

**Budgeted Cost for Work Performed (BCWP)**

**Actual Cost of Work Performed (ACWP)**

**Budget at Completion (BAC)**

**Estimate at Completion (EAC)**
Key Definitions

Take a moment to review the definitions of each of these key elements of EVM by selecting the callouts.

- **Budgeted Cost for Work Performed (BCWP)**
- **Budgeted Cost for Work Scheduled (BCWS)**
- **Actual Cost of Work Performed (ACWP)**
- **Estimate at Completion (EAC)**
- **Budget at Completion (BAC)**

**Actual Cost of Work Performed (ACWP)**
- The costs actually incurred and recorded in accomplishing the work performed within a given time period.
- May be expressed as a value for a specific period or cumulative to date.
- Term can apply at any WBS level.

You must select each highlighted EVM element to move on.
Key Definitions

Take a moment to review the definitions of each of these key elements of EVM by selecting the callouts.

Long Description

A simplified EVM graph is shown. The y-axis depicts dollars up to $8,000. The x-axis depicts months up to month five. "Time Now" is indicated at month three. The Budgeted Cost for Work Scheduled (BCWS) curve begins in the lower left corner at Contract Start and slopes upward, crosses the time now line, and terminates at the intersection of month five and $5,000. The end of this curve is labeled Budget at Completion (BAC). The Budgeted Cost for Work Performed (BCWP) curve begins in the lower left corner and ends at the intersection of month three and $4,000. The Actual Cost of Work Performed (ACWP) curve begins in the lower left corner, crosses the Time Now line at $5,500 and continues as a dashed line to terminate at the intersection of month five and $6,500. The end of this curve is labeled Estimate at Completion (EAC).
Analyzing Performance

Once the work performed to date (the cumulative BCWP, or BCWPcum) and the actual costs (the cumulative ACWP, or ACWPcum) have been measured and recorded, PMs can use that information to determine cost and schedule variances from the original plan.

In Bob’s simple project, the contractor, Joe, compared BCWPcum to cumulative BCWS (BCWScum) to determine if the project was on schedule, and he compared BCWPcum to ACWPcum to see if the project was on budget. In more complex situations, the comparison of BCWPcum to BCWScum will indicate the value of the work scheduled and the value of the work completed but to determine how that affects schedule, an analysis of the IMS must be undertaken.

This comparison is captured with two metrics: schedule variance (SV) and cost variance (CV).
Analyzing Performance

Once the work performed to date (the cumulative BCWP, or BCWPCum) and the actual costs (the cumulative ACWP, or ACWPCum) have been measured and recorded, PMs can use that information to determine cost and schedule variances from the original plan.

In Bob’s simple project, the contractor, Joe, compared BCWPCum to cumulative BCWS (BCWSCum) to determine if the project was on schedule, and he compared BCWPCum to ACWPCum to see if the project was on budget.

Comparing BCWP to ACWP determines Cost Variance (CV). Comparing BCWP to BCWS determines Schedule Variance (SV). A simplified EVM graph depicts three curves plotted in dollars up to $8,000 over five months. The three curves are: budgeted cost for work scheduled (BCWS), actual cost of work performed (ACWP), and budgeted cost for work performed (BCWP). Time Now is indicated at month three. The difference between the ACWP and BCWP curves at Time Now shows Cost Variance. The difference between the BCWP and BCWS curves at Time Now shows Schedule Variance.

Schedule Variance
Analyzing Performance - Schedule Variance

SV: the value of the work actually **accomplished** compared to the value of the work originally planned

- \( SV = BCWP - BCWS \)

- A negative SV is **unfavorable**; a positive SV is **favorable**

- The SV does not show the number of days ahead or behind schedule. This requires looking at the Integrated Master Schedule (IMS)

Recall that Joe planned to build 3 widgets by month 3, but he actually built 4 widgets in that timeframe.

At month 3:

- \( BCWS = $3,000 \)
- \( BCWP = $4,000 \)
- \( SV = BCWP - BCWS = $4,000 - $3,000 = $1,000 \)

The **positive** SV is favorable. Joe has completed more work than planned.
Analyzing Performance - Schedule Variance

SV: the value of the work actually **accomplished** compared to the value of the work originally planned

- **SV = BCWP - BCWS**
- A negative SV is **unfavorable**; a positive SV is **favorable**
- The SV does not indicate whether the project is ahead or behind the schedule. This requires looking at the **Integrated Master Schedule**.

If the BCWP is less than the BCWS, this is an unfavorable schedule variance.

Joe planned to build 3 widgets by month 3, but he actually built 4 widgets in that timeframe.

At month 3:

- **BCWS = $3,000**
- **BCWP = $4,000**
- **SV = BCWP - BCWS**
  \[ SV = 4,000 - 3,000 = 1,000 \]

The **positive** SV is favorable. Joe has completed more work than planned.
Analyzing Performance - Schedule Variance

SV: the value of the work actually **accomplished** compared to the value of the work originally planned

- **SV = BCWP - BCWS**
- A negative SV is **unfavorable**; a positive SV is **favorable**
- The SV does not show the number of days ahead or behind the Integrated Master Schedule (IMS)

**favorable**

If the BCWP is greater than the BCWS, this is a favorable schedule variance.

Joe budgeted by month 3, but he actually built 4 widgets in that timeframe.

At month 3:

- **BCWS = $3,000**
- **BCWP = $4,000**
- **SV = BCWP - BCWS**
  \[
  = $4,000 - $3,000 \\
  = $1,000
  \]

The **positive** SV is favorable. Joe has completed more work than planned.
Analyzing Performance - Schedule Variance

SV: the value of the work actually **accomplished** compared to the value of the work originally planned

- SV = BCWP - BCWS

- A negative SV is **unfavorable**; a positive SV is **favorable**

- The SV does not show the number of days ahead or behind schedule. This requires looking at the Integrated Master Schedule.

---

**Long Description**

A simplified EVM graph depicts three curves plotted in dollars up to $8,000 over five months. The three curves are: budgeted cost for work scheduled (BCWS), actual cost of work performed (ACWP), and budgeted cost for work performed (BCWP). Time Now is indicated at month three. At Time Now the BCWP is $4,000 and the BCWS is $3,000. The difference between the BCWP and BCWS curves at Time Now shows Schedule Variance.

- BCWP = $4,000
- SV = BCWP - BCWS
  = $4,000 - $3,000
  = $1,000

The positive SV is favorable. Joe has completed more work than planned.
Analyzing Performance - Cost Variance

CV: the work accomplished compared to the actual costs to accomplish that work

- \( CV = BCWP - ACWP \)

- A negative CV is unfavorable; a positive CV is favorable

Recall that Joe built 4 widgets by month 3, and actually spent $5,500 to build them.

At month 3:

- \( BCWP = 4,000 \)
- \( ACWP = 5,500 \)
- \( CV = BCWP - ACWP = 4,000 - 5,500 = -1,500 \)

The negative CV is unfavorable. Joe is over budget.
Analyzing Performance - Cost Variance

CV: the work accomplished compared to the actual costs to accomplish that work

- CV = BCWP - ACWP
- A negative CV is unfavorable; a positive CV is favorable

At month 3:
- BCWP = $4,000
- ACWP = $5,500
- CV = BCWP - ACWP
  = $4,000 - $5,500
  = -$1,500

The negative CV is unfavorable. Joe is over budget.

You must select unfavorable and favorable to move on.
Analyzing Performance - Cost Variance

CV: the work accomplished compared to the actual costs to accomplish that work

- CV = BCWP - ACWP
- A negative CV is unfavorable; a positive CV is favorable

At month 3:

- BCWP = $4,000
- ACWP = $5,500
- CV = BCWP - ACWP
  = $4,000 - $5,500
  = -$1,500

The negative CV is unfavorable. Joe is over budget.
Analyzing Performance - Cost Variance

CV: the work accomplished compared to the actual costs to accomplish that work

- CV = BCWP - ACWP
- A negative CV is unfavorable; a positive CV is favorable

Long Description

A simplified EVM graph depicts three curves plotted in dollars up to $8,000 over five months. The three curves are: budgeted cost for work scheduled (BCWS), actual cost of work performed (ACWP), and budgeted cost for work performed (BCWP). Time Now is indicated at month three. At Time Now, the ACWP is $5,500 and the BCWP $4,000. The difference between the ACWP and BCWP curves at Time Now shows Cost Variance.

- CV = BCWP - ACWP
  = $4,000 - $5,500
  = -$1,500

The **negative** CV is unfavorable. Joe is over budget.
Knowledge Review

The performance measurement baseline (PMB), or cumulative budgeted cost for work scheduled (BCWScum), developed for the LAR EMD contract is shown below. What is the budget at completion (BAC) of the PMB indicated in the graph?

- $34.7M
- $54.7M
- $62.7M
- $101.5M

The budget at completion (BAC) for the LAR EMD is $62.7M, which is equal to the total cumulative BCWS (BCWScum) for the work planned.
Knowledge Review

The performance measurement baseline (PMB), or cumulative budgeted cost for work scheduled (BCWScum), developed for the LAR EMD contract is shown below. What is the budget at completion (BAC) of the PMB indicated in the graph?

- $34.7M
- $54.7M
- $62.7M
- $101.5M

Long Description

A simplified EVM graph with three curves is shown. The y-axis is labeled Dollars in Millions and the x-axis is labeled Time through Completion Date. Time Now is indicated approximately two-thirds of the way along the x-axis. The curve labeled BCWS begins in the lower left corner of the graph and slopes upward, crosses the Time Now line at $54.7 million, and terminates at the Completion Date line at $62.7 million. The curve labeled BCWP begins in the lower left corner of the graph and terminates at the Time Now line at $34.7 million. The curve labeled ACWP begins in the lower left corner of the graph up to the Time Now at $44.7 million. After the Time Now line, it continues as a dashed line that terminates after the Completion Date line at $101.5 million.

Check Answer

The budget at completion (BAC) for the LAR EMD is **$62.7M**, which is equal to the total cumulative BCWS (BCWScum) for the work planned.
Knowledge Review

Bob has a contract with a negotiated price of $10,000 which includes a negotiated fee of $1,000. Bob sets aside $1,000 for management reserve (MR). Given just this information, what is the budget at completion (BAC) available to build the performance measurement baseline (PMB)?

- [x] $8,000
- [ ] $12,000
- [ ] $10,000
- [ ] $11,000

The PMB cost objective Bob will use to measure performance using EVM is $8,000. This is the negotiated price less the fee and MR values ($10,000 - $1,000 - $1,000 = $8,000).
Knowledge Review

The actual cost of work performed (ACWP) is shown below. Which of these metrics can you determine by comparing the budgeted cost for work performed (BCWP) and the ACWP?

- Cost variance (CV)
- Schedule variance (SV)
- Variance at completion (VAC)
- Management reserve (MR)

Cost variance (CV) can be determined:

\[ CV = BCWP - ACWP \]
Knowledge Review

The actual cost of work performed (ACWP) is shown below. Which of these metrics can you determine by comparing the budgeted cost for work performed (BCWP) and the ACWP?

Cost variance (CV) can be determined:  
CV = BCWP - ACWP
The chart below shows the budgeted cost for work scheduled (BCWS), actual cost of work performed (ACWP), and budgeted cost for work performed (BCWP) at the current time. Given the data in the chart, which of the following statements is true? Remember: Schedule variance (SV) = BCWP - BCWS and cost variance (CV) = BCWP - ACWP.

- CV and SV are both favorable
- CV and SV are both unfavorable
- CV is favorable and SV is unfavorable
- CV is unfavorable and SV is favorable

The CV and SV are both unfavorable.

CV = BCWP - ACWP = 34.7 - 44.7 = -10
SV = BCWP - BCWS = 34.7 - 54.7 = -20
The chart below shows the budgeted cost for work scheduled (BCWS), actual cost of work performed (ACWP), and budgeted cost for work performed (BCWP) at the current time. Given the data in the chart, which of the following statements is true? Remember: Schedule variance (SV) = BCWP - BCWS and cost variance (CV) = BCWP - ACWP

CV and SV are both favorable

The CV and SV are both unfavorable.

CV = BCWP - ACWP = 34.7 - 44.7 = -10

SV = BCWP - BCWS = 34.7 - 54.7 = -20
Integrated Program Management

EVM is a powerful integrated program management tool that is fundamentally interrelated with other program management disciplines, such as:

- Logistics
- Systems engineering
- Contracting
- Cost estimating
- Risk management
- Quality management
- Financial management

In order to use EVM effectively, PMs must ensure that EVM is considered in the context of all of these key disciplines.
EVM is a powerful integrated program management tool that is fundamentally interrelated with other program management disciplines, such as:

- Logistics
- Systems engineering
- Contracting
- Cost estimating
- Risk management
- Quality management
- Financial management

In order to use EVM effectively, PMs must ensure that EVM is considered in the context of all of these key disciplines.

Diagram depicts EVM as being interrelated to the following disciplines: Logistics, Systems Engineering, Contracting, Cost Estimating, Risk Management, Quality Management, and Financial Management.
Knowledge Review

Earned value management (EVM) is a powerful tool that can be used instead of cost estimating and risk management.

- False

This is a false statement. In a successful program PMs must ensure that EVM is considered in the context of all of these key disciplines.
In this topic, you will:

- Given typical Earned Value Management (EVM) data and notional Government budget value, recognize that EVM provides information useful for updating budget and funding projections.
- Compare EVM and Technical Performance Measurement.
- Given a graphical depiction of the Department of Defense (DoD) risk management process, identify typical EVM processes related to each step in the risk management process.
EVM and Budgeting

In addition to providing vital early-warning cost and schedule variance information to Program Management teams, EVM is useful specifically for the Government financial manager (FM) in preparing budget requests and tracking expenditures via the Planning, Programming, Budgeting, and Execution (PPBE) process.

The Government PM and FM face a number of challenges in the development of budget requests and tracking of funding for contracts:

- Government PMs budget to the most likely price of a contract, but most likely estimates change over time (contract negotiations, cost reimbursable and incentive contract cost growth), so budget requests must be updated.

- Government PMs must also come up with a reasonable breakdown of the most likely contract estimate by fiscal year so as to have appropriated funds available at the right time to pay for contract costs.

EVM provides useful information to help with financial management:

- EVM provides updated contractor EACs based on cost and schedule performance to support updated budget requests.

- EVM provides cost and schedule performance metrics that help the Government PM develop an updated EAC.

- Contract EVM and EVM-related reports provide information on the time-phasing of the contract costs.

The Government PM and FM must work closely together in order to comply with DoD financial management policy and fiscal law.
EVM and Budgeting

In addition to providing vital early-warning cost and schedule variance information to Program Management teams, EVM is useful specifically for the Government financial manager (FM) in preparing budget requests and tracking expenditures via the Planning, Programming, Budgeting, and Execution (PPBE) process.

The Government PM and FM face annual Planning, Programming, Budgeting, and Execution (PPBE) challenges in the development of budget requests and tracking of funding for the military departments and defense agencies.

- Government PMs budget to the price of a contract, but most incentive contract cost growth, so budget requests must be updated.
- Contract EVM and EVM-related reports provide information on the time-phasing of the contract costs.

The Government PM and FM must work closely together in order to comply with DoD financial management policy and fiscal law.
EVM and Financial Management

EVM budgets are **goals for work performance**. The EVM budgets must be sufficient to represent a realistic plan to capture all scope on contract. In EVM, the term Total Allocated Budget (TAB) is used to represent the sum of all budgets allocated to the performance of the contractual effort, including management reserve. It will differ from PPBE budgets and from contract funding because it does not include profit and/or fee. Additionally, for cost reimbursable contracts the PPBE budgets must be updated to reflect the contractor’s latest estimate at completion, but the EVM PMB does not change.

If the contract has only incremental funding appropriated that does not cover the entire contract price, the EVM PMB still reflects a realistic plan for the **entire** scope of work. FMs and PMs must monitor contract performance to ensure funding is available at the right time to pay for necessary costs or take other contractual action.

One report that can help with this task is the Contractor Funds Status Report (CFSR). The CFSR provides the contractor’s updated estimates for the price (including profit/fee), since the funding must cover all costs, profits, and fees.
EVM and Financial Management

EVM budgets are **goals for work performance**. The EVM budgets must be sufficient to represent a realistic plan to capture all scope on contract. In EVM, the term Total Allocated Budget (TAB) is used to represent the sum of all budgets allocated to the performance of the contractual effort, including management reserve. It will differ from PPBE budgets and from contract funding because it does not include profit and/or fee. Additionally, for cost reimbursable contracts the contractor’s latest estimate at completion is updated to reflect all authorized, contractually agreed to effort.

If the contract has only incremental funding appropriated that does not cover the entire contract price, the EVM PMB still reflects a realistic plan for the **entire** scope of work. FMs and PMs must monitor contract performance to ensure funding is available at the right time to pay for necessary costs or take other contractual action.

One report that can help with this task is the Contractor Funds Status Report (CFSR). The CFSR provides the contractor’s updated estimates for the price (including profit/fee), since the funding must cover all costs, profits, and fees.

Congress grants funding for federal agencies via appropriations, using the agency budgets as inputs to monitor how funds are spent.
EVM budgets are goals for work performance. The EVM budgets must be sufficient to represent a realistic plan to capture all scope on contract. In EVM, the term Total Allocated Budget (TAB) is used to represent the sum of all budgets allocated to the performance of the contractual effort, including management reserve. It will differ from PPBE budgets and from contract funding because it does not include profit and/or fee. Additionally, for cost reimbursable contracts the PPBE budgets must be updated to reflect the contractor’s latest estimate at completion, but the EVM PMB does not change.

If the contract has only incremental funding appropriated that does not cover the entire contract price, the EVM PMB still reflects a realistic plan for the entire scope. PMs must manage performance, including profit/fee available at the right time to pay for necessary costs or take other contractual action.

One report that can help with this task is the Contractor Funds Status Report (CFSR). The CFSR provides the contractor’s updated estimates for the price (including profit/fee), since the funding must cover all costs, profits, and fees.
EVM and Financial Management

EVM budgets are **goals for work performance**. The EVM budgets must be sufficient to represent a realistic plan to capture all scope on contract. In EVM, the term Total Allocated Budget (TAB) is used to represent the sum of all budgets allocated to the performance of the contractual effort, including management reserve. It will differ from PPBE budgets and from contract funding because it does not include profit and/or fee. Additionally, for cost reimbursable contracts the PPBE budgets must be updated to reflect the contractor's latest estimate at completion, but the EVM PMB does not change.

If the contract is cost reimbursable, incremental funding is provided that does not reflect the entire management reserve. The EVM graph displays the BCWS, BCWP, and ACWP in dollars plotted over time through Contract End. BCWS displays through the contract end. BCWP and ACWP terminate at Time Now, and the ACWP is projected through the contract end. The contract has a $2 million management reserve. The TAB is indicated at the top of the management reserve. Three steps of incremental funding display from contract start until past Time Now, but not through contract end. The EAC is updated to reflect the contractor's latest estimates. The available EVM PMB is planned to reflect all authorized, contractually agreed to effort.

One report that can help with this task is the Contractor Funds Status Report (CFSR). The CFSR provides the contractor's updated estimates for the price (including profit/fee), since the funding must cover all costs, profits, and fees.
The Contract Funds Status Report (CFSR)

The CFSR is an important financial management report, prepared by defense contractors for Government PMs. Contractors report the accrued expenditures to date, the forecast expenditures to the end of the project, and the estimated forecasts of billings to the Government.

PMs use CFSR data to gain insight into contractor funding requirements from the current reporting period to the end of the project. The CFSR is used by Government FMs to help assess budget and funding needs for a contract. It can be used on contracts that don't require EVM. When the contractor has developed a range of estimates at completion such as those reported in the Integrated Program Management Report (IPMR), the most likely estimate is used to develop the projected data in the CFSR. The CFSR, however, shows the estimates "at price", meaning it includes contractor fee and/or profit, while the IPMR reports estimates "at cost", meaning it does not include contractor fee and/or profit. The CFSR is reported at price because Government funding must be provided to cover the entire contract price, including profit and/or fee.

The CFSR:

- Contains data that updates and forecasts contract funding requirements by appropriation
- Includes planning and decision-making data for funding changes to contracts
- Develops funding requirements and budget estimates in support of approved programs
- Determines funds that are in excess of contract needs and available for de-obligation
- Contains rough estimates of termination costs
The Contract Funds Status Report (CFSR)

The CFSR is an important financial management report, prepared by defense contractors for Government PMs. Contractors report the accrued expenditures to date, the forecast expenditures to the end of the project, and the estimated forecasts of billings to the Government.

PMs use CFSR data to gain insight into contractor funding requirements from the current reporting period to the end of the project. The CFSR is used by Government FMs to help assess budget and funding needs for a contract. It can be used on contracts that don't require EVM. When the contractor has developed a range of estimates at completion such as those reported in the Integrated Program Management Report (IPMR), the most likely estimate is used to develop the estimates "at price", meaning it includes all "at cost", meaning it does not include contractor estimates.

Government funding must be provided to meet program needs. The IPMR is the primary means of communicating program cost and schedule performance measurement information between the contractor and the Government. It is carefully tailored to meet program needs.

- Contains data that updates and forecasts contract funding requirements by appropriation
- Includes planning and decision-making data for funding changes to contracts
- Develops funding requirements and budget estimates in support of approved programs
- Determines funds that are in excess of contract needs and available for de-obligation
- Contains rough estimates of termination costs
EVM and Cost Estimating

EVM and cost estimating are also inextricably linked. Cost estimating begins early in a program’s life cycle, with a comprehensive life-cycle cost estimate that includes a cost-risk analysis that quantifies the program’s cost, schedule, and technical impacts.

Cost estimators use EVM analysis data for ongoing cost estimation.

As a best practice, cost estimators and EVM analysts should:

- Use each other’s data to update program costs and examine differences between estimated and actual costs
- Compare program status to historical data to understand variances
EVM and Cost Estimating

EVM and cost estimating are also inextricably linked. Cost estimating begins early in a program’s life cycle, with a comprehensive life-cycle cost estimate that includes a cost-risk analysis that quantifies the program’s cost, schedule, and technical impacts.

Cost estimators use EVM analysis data for ongoing cost estimation.

As a best practice, cost estimators and EVM analysts should:

- Use each other’s data
- Compare program status
- Reconcile estimated and actual costs

**Long Description**

The cost estimator uses EVM analysis for ongoing cost estimation and the EVM analyst uses cost estimation to develop the EVM EAC.

Cost Estimator

Uses EVM analysis for ongoing cost estimation

EVM Analyst

Uses cost estimation to develop the EVM EAC
A LAR Example

In this example, you can see typical differences, in dollar values, due to timing between the cost estimating, financial management, and EVM processes.

In the LAR program, the FM submitted a budget request for $81M in the pre-contract award time period, based on the most likely cost estimate available at the time. The contract was negotiated at a lower price of $72.4M, resulting in a target cost of $64.7M, which becomes the total allocated budget (TAB) for EVM. So at the next budget update, the FM might consider updating the budget request to reflect that amount, unless, for example, the EVM data indicates a higher most likely target price.

The contract is incrementally funded at $37 million. In spite of this, the contractor develops the EVM PMB to reflect a realistic plan for the ENTIRE contract scope using the contract TAB, which is equal to the Negotiated Contract Cost (Target Price - Target Fee) in the LAR example.
A LAR Example

In this example, you can see typical differences, in dollar values, due to timing between the cost estimating, financial management, and EVM processes.

In the LAR program, the FM submitted a budget request for $81M. Budget based on most likely estimate pre-contract. Post Contract Award, Contract Cost is $64.7M, Contract Target Fee is $7.7M, and Contract Target Price is $72.4M. Contract Target Price was negotiated lower than estimated. Contract Funding Allocated is $37M. 2 years of RDT&E incremental funding.

A simplified EVM graph depicting the PMB is shown. The y-axis is labeled $ in Millions up to $65M. The x-axis is labeled Time from Contract Start of June 2013 through Contract End at April 2016. LAR negotiated contract cost equals $65M. There is a management reserve of 2 million dollars. A performance measurement baseline curves begins at Contract Start and $0 and terminates at Contract End just below the management reserve. Two events display along the x-axis. CDR at September 2014 and Prod Proto at September 2015.

In spite of this, the contractor develops the EVM PMB to reflect a realistic plan for the ENTIRE contract scope using the contract TAB, which is equal to the Negotiated Contract Cost (Target Price - Target Fee) in the LAR example.
Knowledge Review

What credible management information can you determine from EVM data such as that presented in the graph shown below?

Select all that apply.

- [x] Whether more or less work than planned has been accomplished as of time now
- [x] Whether work is accomplished at planned cost
- [x] Estimated costs at completion
- [ ] Detailed technical specifications

EVM data will indicate to management whether work is being accomplished as planned as of time now and at planned cost, and will provide estimated costs at completion.
Knowledge Review

What credible management information can you determine from EVM data such as that presented in the graph shown below?

Select all that apply.

- Whether more or less work than planned has been accomplished.
- Whether more or less cost than planned has been incurred.
- EVM data will indicate to management whether work is being accomplished as planned as of time now and at planned cost, and will provide estimated costs at completion.

EVM data will indicate to management whether work is being accomplished as planned as of time now and at planned cost, and will provide estimated costs at completion.
Knowledge Review

A contract has a target cost of $80M, incremental funding of $45M, and a Government budget of $90M. What is the total allocated budget (TAB) for EVM?

- $45M
- $90M
- $80M
- There is not enough information to answer this question

The TAB for EVM is $80M.
EVM Measures of Progress (BCWP)

Clearly, the BCWP is of paramount importance in EVM. The cost and schedule variances are meaningful only in so far as the BCWP measure reflects real performance accomplishments.

EVM requires the identification of physical products, milestones, technical performance goals, or other indicators that will be used to measure progress. In our simple hardware item case, those requirements are reflected in the contract specification that defines the hardware item component, a physical product.

We could also define Technical Performance Measures (TPMs) to help us measure progress toward performance specifications. TPMs are a subset of metrics and measures that evaluate technical progress. For instance, we might want to measure the strength or weight of our components to help us determine if we are making progress toward our technical specifications. We could use TPMs directly to determine earned value (BCWP) or we may evaluate the TPMs alongside the EVM cost and schedule variances to assess the status of our project.

TPMs provide:

- An early warning of technical problems, in order to support assessments of their risk impacts
- A crosscheck on the validity of BCWP claimed by a contractor
EVM Measures of Progress (BCWP)

Clearly, the BCWP is of paramount importance in EVM. The cost and schedule variances are meaningful only in so far as the BCWP measure reflects real performance accomplishments.

EVM requires the identification of physical products, milestones, technical performance goals, or other indicators that will be used to measure progress. In our simple hardware item case, those requirements are reflected in the contract specification that defines the hardware item component, a physical product.

We could also define technical performance specifications that will help us determine if we are making progress toward technical performance objectives. For instance, we might define a technical performance baseline (APB) risk diagram illustrating the relationship between the APB and risks related to technical performance, schedule, and cost. Technical performance is emphasized.

Long Description

APB risk diagram illustrating the relationship between the APB and risks related to technical performance, schedule, and cost. Technical performance is emphasized.

TPMs provide:

- An early warning of technical problems, in order to support assessments of their risk impacts
- A crosscheck on the validity of BCWP claimed by a contractor
Technical Performance Measurement and EVM

Technical managers (such as systems engineers and logisticians) integrate a variety of technical assessment tools and metrics to measure progress in meeting stakeholder and technical requirements. Key tools used in technical assessment include testing, technical reviews, EVM, and technical performance measurement. Technical performance measurement and EVM are both performance measurement processes that:

- Verify actual versus anticipated achievement
- Confirm progress
- Identify variances that might jeopardize meeting a higher-level end product requirement
- Assess values that fall outside established tolerances
- Indicate the need for management attention and corrective action
- Provide early warning of problems
- Provide regular reports as contract deliverables

Recall that TPMs can be used as criteria by contractors to determine if work is complete and BCWP can be earned. Even if not used directly to determine work completion, TPM data should be considered as part of an integrated performance analysis along with EVM data. TPM analysis can give early warning of issues that might impact cost and schedule performance. Early insight into developing problems allows earlier management action.

EVM performance should reflect the status and progress of TPMs even though a one-to-one mapping of TPMs to EVM control accounts is not required.
TPMs - A LAR Example

TPMs:

- Are defined to align with key performance parameters
- Specify progress of selected technical parameters in terms of expected performance at specific points and with specific measurements
- Record actual performance observed during the program
- Compare actual vs. planned profile performance

As an example, the LAR program chose to have a TPM report on Infrared (IR) Signature. This TPM report was selected to help manage technical risk on the LAR program towards meeting the Survivability Key Performance Parameter (KPP), which was identified as a high risk area for the program.
TPMs - A LAR Example

TPMs:

- Are defined to align with key performance parameters
- Specify progress of selected technical parameters in terms of expected performance at specific points and with specific measurements

**Long Description**

A graph titled "IR Signature Dec 11 TPM" is shown with y-axis labeled Degrees (C) and x-axis labeled with project dates from J-11 through D-14. The graph shows 5 lines. The line labeled Threshold spans the graph from J-11 to D-14 at 55 degrees. The line labeled Upper Tolerance starts at the intersection of J-11 and 220 degrees, slopes downward to the intersection of S-13 and 60 degrees, and then spans the remainder of the graph horizontally at 60 degrees. The line labeled Lower Tolerance starts at the intersection of J-11 and 180 degrees, drops to the intersection of S-13 and 50 degrees, spans the remainder of the graph horizontally at 50 degrees. The dashed line labeled Plan spans the graph from J-11 to D-14 staying consistently between the Upper and Lower Tolerance lines. Finally, the line labeled Actual depicts progress for the first three time points, J-11 to D-11, that closely follows the Upper Tolerance line. Text associated with the Actual line displays: "IR signature is coming in at the upper tolerance in early tests, indicating possible technical problems."

As an example report on selected program towards meeting the Survivability Key Performance Parameter (KPP), which was identified as a high risk area for the program.
Risk and EVM

Effective qualitative and quantitative risk, issue, and opportunity management are critical to a program’s success. EVM brings important information to the table that can help in the management of risk.

As you know, EVM provides critical management information regarding technical performance, schedule, and cost.

To understand how this EVM data helps managers mitigate performance, schedule, and cost risks, let’s take a closer look at what risk is, how the DoD manages risk, and the role that EVM plays in the risk management process.
What is Risk?

Proactively addressing not only risks, but also issues and opportunities, can help programs achieve cost, schedule, and performance objectives at every stage of the life cycle.

**Risks** are future uncertainties relating to achieving program technical performance goals within defined cost and schedule constraints.

**Issues** are current problems (realized risks) that should be addressed with action plans, resourced and resolved.

**Opportunities** are events that may or may not occur that have the potential for improving the program in terms of cost, schedule, and performance.

EVM data can provide important cost and schedule performance data helpful to the risk management process.
The DoD Risk Management Process Model

The DoD manages risk using the DoD risk management process, which is shown here as a 4 step model. Risk management is not a stand-alone program office task but should be integrated with other Processes, including EVM.

EVM contributes important information useful in the risk management process. By integrating the technical, cost, and schedule parameters of a contract into an integrated baseline, EVM allows the measurement of work performance against this baseline in terms of cost and schedule variances. If EVM data starts to show cost and schedule variances, the program team can then use EVM to analyze the data and isolate causes of the variances and identify any risks that may be associated with the variance. This data helps the program manager identify significant risk drivers, forecast future cost and schedule performance, and implement corrective action plans to get back on track.

EVM is effective in helping a program monitor WBS elements that are experiencing issues. The strength of EVM lies in its rigorous examination of what has already occurred on the project, using quantitative metrics to evaluate project past performance. The program can then analyze what actions are necessary to establish or modify a risk mitigation approach.
The DoD Risk Management Process Model

The DoD manages risk using the DoD risk management process, which is shown here as a 4 step model. Risk management is not a stand-alone program office task but should be integrated with other Processes, including EVM.

EVM contributes important information useful in the risk management process. The DoD contracts can be decomposed into an integrated contract into an integrated baseline for the measurement of work. EVM converts this baseline in terms of technical, cost, and schedule variances. If EVM data shows technical, schedule variances, the project team can use EVM to analyze the drivers of the variances and identify what can be associated with the variances. The program manager identifies risk drivers, forecast future cost and schedule performance, and implement corrective action plans to get back on track.

EVM is effective in helping a program monitor WBS elements that are experiencing issues. The strength of EVM lies in its rigorous examination of what has already occurred on the project, using quantitative metrics to evaluate project past performance. The program can then analyze what actions are necessary to establish or modify a risk mitigation approach.

Four-step risk management cycle is shown. The steps are:
1. Risk Identification - What can go wrong?
2. Risk Analysis - What is the likelihood and consequence of the risk?
3. Risk Mitigation - Should the risk be accepted, avoided, transferred, or controlled?
4. Risk Monitoring - How has the risk changed? Communication and Feedback occur throughout the cycle.
EVM in Key DoD Reports

Another use of EVM information is for required reporting to higher headquarters and Congress.

Key reports include:

- Defense Acquisition Executive Summary (DAES)
- Selected Acquisition Report (SAR)
- Unit Cost Report (UCR)
EVM in Key DoD Reports

Another use of EVM information is to inform key DoD reports. Key reports include:

- Defense Acquisition Executive Summary (DAES)
- Selected Acquisition Reports (SARs)
- Unit Cost Report (UCR)

**Defense Acquisition Executive Summary (DAES)**

The goal of the DAES process is to facilitate communication between, and provide feedback to, key stakeholders in OSD, the Joint Staff, the Components, and Program Offices. DAES is not just a report. It is a process that includes:

- A DAES report is provided by PMs of Major Defense Acquisition Programs (MDAPs), Acquisition Category (ACAT) I, and Major Automated Information Systems (MAIS), ACAT IA programs, to the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) each calendar quarter.
- Independent assessments by the OSD and Joint Staff stakeholders.
- DAES meetings.

The Defense Contract Management Agency (DCMA) and the Performance Assessment and Root Cause Analyses (PARCA) office are the assessing organizations for DAES Contract Performance Assessment (CPA), which contains predominantly EVM information.

Information is submitted in the online Defense Acquisition Management Information Retrieval (DAMIR) system.

IPMR data is updated in DAMIR monthly.
EVM in Key DoD Reports

Another use of EVM information is for reporting in key reports. Key reports include:

- Defense Acquisition Executive Summary (DAES)
- Selected Acquisition Report (SAR)
- Unit Cost Report (UCR)

**Selected Acquisition Report (SAR)**

The SAR is a report to Congress for all Major Defense Acquisition Programs (MDAPs). It includes:

- Annual status of total program cost, schedule, and performance (the EAC)
- Quarterly program unit cost and unit cost breach information for a specific program
- A full life-cycle cost analysis

EVM information includes EACs and the reasons for any cost or schedule variances.
EVM in Key DoD Reports

Another use of EVM information is for required reporting on key DoD reports.

Key reports include:

- Defense Acquisition Executive Summary (DAES)
- Selected Acquisition Report (SAR)
- Unit Cost Report (UCR)

**Unit Cost Report (UCR)**

UCRs are quarterly reports to the Component Acquisition Executive (CAE).

EVM information included in the UCR report includes:

- EVM cost and schedule variances, for each of the major contracts
- Anticipated or known changes from baseline program schedule milestones

You must select each report to move on.
EVM in Key DoD Reports

Another use of EVM information is for required reporting to higher headquarters and Congress.

Key reports include:

- Defense Acquisition Executive Summary (DAES)
- Selected Acquisition Report (SAR)
- Unit Cost Report (UCR)

Long Description

The Program Manager submits information to Congress and the Department of Defense in the Defense Acquisition Executive Summary (DAES), Selected Acquisition Report (SAR), and Unit Cost Report (UCR).

You must select each report to move on.
Knowledge Review

Which of the following is a report to Congress that contains EVM information?

- [ ] Integrated Program Management Report (IPMR)
- [ ] Contract Funds Status Report (CFSR)
- [ ] Cost and Software Data Reporting (CSDR) plan
- [x] Selected Acquisition Report (SAR)

The **Selected Acquisition Report (SAR)** is a report to Congress that contains EVM information.
Knowledge Review

Routine EVM analysis can help track known risks, but it will not help PMs identify new risks.

☐ True

☑ False

This is a **false** statement. Routine EVM analysis can help PMs track known risks **AND** identify new risks.
Lesson Summary

Congratulations! You have completed the lesson Key Concepts of Earned Value Management. You should now know the following key points:

- There are many tools available to manage risk, but EVM is unique because it integrates contract cost, schedule, and technical performance objectives into a PMB.
- Early in a project the contractor develops the PMB. The PMB is the baseline against which all EVM data will be measured.

Select EAC, BAC, ACWP, SV, CV, BCWS, and BCWP to review a description of each.
Lesson Summary

Congratulations! You have completed the lesson **Key Concepts of Earned Value Management**. You should now know the following key points:

- There are many tools available to manage risk, but EVM is unique because it integrates contract **cost**, **schedule**, and **technical performance** objectives into a PMB.
- Early in a project the contractor develops the PMB. The PMB is the basis of the contract data that will be measured.

Select EAC, BAC, ACWP, SV, CV, BCWS, and BCWP to review a description of each.
Lesson Summary

Congratulations! You have completed the lesson *Key Concepts of Earned Value Management*. You should now know the following key points:

- There are many tools available to manage risk, but EVM is unique because it integrates contract cost, schedule, and technical performance objectives into a PMB.

- **schedule**
  
  The PMB includes a time-phased integrated schedule of contract events.

Select EAC, BAC, ACWP, SV, CV, BCWS, and BCWP to review a description of each.
Lesson Summary

Congratulations! You have completed the lesson **Key Concepts of Earned Value Management**. You should now know the following key points:

- There are many tools available to manage risk, but EVM is unique because it integrates contract **cost**, **schedule**, and **technical performance** objectives into a PMB.
- Early in a project, **technical performance** data will be minimal. A baseline of the project is established, and the baseline BAC is the baseline against which all EVM data will be measured.

The PMB includes a product-oriented work breakdown structure that relates technical requirements to ongoing work.

Select EAC, BAC, ACWP, SV, CV, BCWS, and BCWP to review a description of each.
Lesson Summary

Congratulations! You have completed the lesson **Key Concepts of Earned Value Management**. You should now know the following key points:

- There are many tools available to manage risk, but EVM is unique because it integrates contract **cost**, **schedule**, and **technical performance** objectives into a PMB.
- Early in a project the contractor develops the PMB. The PMB is the baseline against which all EVM data will be measured.

**PMB**

The PMB integrates the technical objectives, schedule, and cost of the contract by:

1. Technical Performance: The WBS breaks down the work required to meet technical requirements resulting from the systems engineering process
2. Schedule: Time-phasing the tasks to meet contract milestones
3. Cost: Time-phasing the contract budget in accordance with the schedule

Select EAC, BAC, ACWP, SV, CV, BCWS, and BCWP to review a description of each.
Lesson Summary

Congratulations! You have completed the lesson Key Concepts of Earned Value Management. You should now know the following key points:

- There are many tools available to manage risk, but EVM is unique because it integrates contract cost, schedule, and technical performance objectives into a PMB.

- Early in a project the contractor develops the PMB. The PMB is the baseline against which all EVM data will be measured.

*EAC*

- The estimated total cost for Management Reserve authorized work
- Equal to the sum of actual costs to date (including all allocable indirect costs), plus the estimated costs to completion
- Term can apply at any WBS level, from control account through total contract

Select EAC, BAC, ACWP, SV, CV, BCWS, and BCWP to review a description of each.
Lesson Summary

Congratulations! You have completed the lesson **Key Concepts of Earned Value Management**. You should now know the following key points:

- There are many tools available to manage risk, but EVM is unique because it integrates contract **cost**, **schedule**, and **technical performance** objectives into a PMB.

- Early in a project the contractor develops the **PMB**. The PMB is the baseline against which all EVM data will be measured.

Select **EAC**, **BAC**, **ACWP**, **SV**, **CV**, **BCWS**, and **BCWP** to review a description of each.
Congratulations! You have completed the lesson **Key Concepts of Earned Value Management**. You should now know the following key points:

- There are many tools available to manage risk, but EVM is unique because it integrates contract **cost**, **schedule**, and **technical performance** objectives into a PMB.

- Early in a project the contractor develops the **PMB**. The PMB is the baseline against which all EVM data will be measured.

Select **EAC**, **BAC**, **ACWP**, **SV**, **CV**, **BCWS**, and **BCWP** to review a description of each.
Lesson Summary

Congratulations! You have completed the lesson Key Concepts of Earned Value Management. You should now know the following key points:

- There are many tools available to manage risk, but EVM is unique because it integrates contract cost, schedule, and technical performance objectives into a PMB.
- Early in a project the contractor develops the PMB. The PMB is the baseline against which all EVM data will be measured.

Schedule Variance (SV) = BCWP - BCWS

This metric depicts the work actually accomplished compared to the work originally planned. A negative SV, which results when the BCWP is less than the BCWS, is unfavorable. A positive SV, which results when the BCWP is greater than the BCWS, is favorable.

Select EAC, BAC, ACWP, SV, CV, BCWS, and BCWP to review a description of each.
Lesson Summary

Congratulations! You have completed the lesson Key Concepts of Earned Value Management. You should now know the following key points:

- There are many tools available to manage risk, but EVM is unique because it integrates contract cost, schedule, and technical performance objectives into a PMB.
- Early in a project the contractor develops the PMB. The PMB is the baseline against which all EVM data will be measured.

Cost variance (CV) = BCWP - ACWP

This metric depicts the work accomplished compared to the actual costs to accomplish that work. A negative CV, which results when the BCWP is less than the ACWP, is unfavorable. A positive CV, which results when the BCWP is greater than the ACWP, is favorable.

Select EAC, BAC, ACWP, SV, CV, BCWS, and BCWP to review a description of each.
Lesson Summary

Congratulations! You have completed the lesson **Key Concepts of Earned Value Management**. You should now know the following key points:

- There are many tools available to manage risk, but EVM is unique because it integrates contract **cost**, **schedule**, and **technical performance** objectives into a PMB.
- Early in a project the contractor develops the PMB. The PMB is the baseline against which all EVM data will be measured.

**BCWS**

*Also called the PMB*

- The sum of the performance budgets for all work scheduled to be accomplished
- May be expressed as a value for a specific period, or cumulative to date
- Term can apply at any WBS level, from control account through total contract

Select EAC, BAC, ACWP, SV, CV, BCWS, and BCWP to review a description of each.
Lesson Summary

Congratulations! You have completed the lesson **Key Concepts of Earned Value Management**. You should now know the following key points:

- There are many tools available to manage risk, but EVM is unique because it integrates contract **cost**, **schedule**, and **technical performance** objectives into a PMB.
- Early in a project the contractor develops the **PMB**. The PMB is the baseline against which all EVM data will be measured.

**BCWP**

*Also called earned value (EV)*

- The value of completed work expressed as the value of the BCWS assigned to that work
- May be expressed as a value for a specific period, or cumulative to date
- Term can apply at any WBS level, from control account through total contract

Select EAC, BAC, ACWP, SV, CV, BCWS, and BCWP to review a description of each.
Lesson Summary

Congratulations! You have completed the lesson **Key Concepts of Earned Value Management**. You should now know the following key points:

- There are many tools available to manage risk, but EVM is unique because it integrates contract cost, schedule, and technical performance objectives into a PMB.

Long Description

A graph depicts project EVM data in terms of dollars in millions and time. The y-axis reflects dollars in millions. A bar at the top of the graph indicates a management reserve. Time is indicated on the x-axis Contract Start to Contract End. A vertical line labeled Time Now identifies the current point in time. Three curves are shown. A curve labeled BCWS begins in the lower left corner at Contract Start and slopes upward, crosses the Time Now line, and terminates in the upper right corner at Contract End, at the bottom of the Management Reserve bar. The end point of the BCWS line is labeled BAC. A second curve, labeled BCWP, is shown beneath the BCWS curve and ends at the Time Now line. A third curve, labeled ACWP, runs between the BCWP and BCWS curves, crosses the Time Now line, and continues as a dashed curve to cross above the BCWS and Management Reserve bar, and past the Contract End point. Where the ACWP curve terminates, it is labeled EAC. A bracket labeled CV encompasses the span between where the ACWP and BCWP lines intersect with the Time Now line. A bracket labeled SV encompasses the span between where the BCWS and BCWP lines intersect the Time Now line.

Select EAC, BAC, ACWP, SV, CV, BCWS, and BCWP to review a description of each.
Lesson Summary, Cont.

- EVM provides management with **key information**.
- The IPMR is the primary means of communicating program cost and schedule performance measurement information between the contractor and the Government. It is carefully tailored to meet program needs.
- Financial managers use EVM data to prepare budgets and track funding. The CFSR provides insight into funding requirements.
- Cost Estimators and EVM Analysts use each other's data to update program costs.
- EVM provides PMs with many benefits including insight into program performance, accountability, and an early warning of potential issues.
- EVM also provides information that can be used in reports to higher headquarters and Congress.
- EVM assists in risk mitigation throughout the DoD risk management process.
- Technical performance can impact cost and schedule performance, so it is important to consider both EVM and TPM data as part of an integrated performance assessment.
Lesson Summary, Cont.

- EVM provides management with *key information*.

**key information**

Using EVM information, managers can determine whether work is accomplished at planned cost and on schedule, estimate costs and schedules at completion, and understand the root causes of key variances from the plan.

- The key information is carefully tailored to meet the needs of the Government. Using EVM information, managers can determine whether work is accomplished at planned cost and on schedule, estimate costs and schedules at completion, and understand the root causes of key variances from the plan.

- Financial insight and track funding. The CFSR provides data to update program costs.

- EVM provides PMs with many benefits including insight into program performance, accountability, and an early warning of potential issues.

- EVM also provides information that can be used in reports to higher headquarters and Congress.

- EVM assists in risk mitigation throughout the DoD risk management process.

- Technical performance can impact cost and schedule performance, so it is important to consider both EVM and TPM data as part of an integrated performance assessment.
Lesson Summary, Cont.

- EVM provides management with key information.
- The IPMR is the primary means of communicating program cost and schedule performance measurement information between the contractor and the Government. It is carefully tailored to meet program needs.
- Financial report provides insight into the contractor's financial performance and accountability, and an early forecast of billings to the Government.
- EVM also provides information that can be used in reports to higher headquarters and Congress.
- EVM assists in risk mitigation throughout the DoD risk management process.
- Technical performance can impact cost and schedule performance, so it is important to consider both EVM and TPM data as part of an integrated performance assessment.

**CFSR**

The CFSR is a financial management report prepared by defense contractors for Government project managers. Contractors report the accrued expenditures to date, the forecast expenditures to the end of the project, and the estimated forecasts of billings to the Government.
Lesson Summary, Cont.

- EVM provides management with key information.

reports to higher headquarters and Congress

In addition to regular reports from the contractor to the PM, EVM also requires regular reporting to higher headquarters and Congress, including:

- Defense Acquisition Executive Summary (DAES)
- Selected Acquisition Report (SAR)
- Unit Cost Report (UCR)

- EVM assists in risk mitigation throughout the DoD risk management process.
- Technical performance can impact cost and schedule performance, so it is important to consider both EVM and TPM data as part of an integrated performance assessment.
DoD risk management process

The DoD manages risk using the DoD risk management process. This model consists of four steps:

- Risk identification
- Risk analysis
- Risk mitigation
- Risk monitoring

The program cost and schedule performance process provides data to update program costs. The CFSR provides insights and track funding. The CFSR provides data to update program costs.

EVM also provides information that can be used in reports to higher headquarters and Congress.

EVM assists in risk mitigation throughout the DoD risk management process.

Technical performance can impact cost and schedule performance, so it is important to consider both EVM and TPM data as part of an integrated performance assessment.
Lesson Completion

You have completed the content for this lesson.

To continue, select another lesson from the Table of Contents on the left.

If you have closed or hidden the Table of Contents, click the Show TOC button in the Atlas navigation bar at the top of the screen.