The Acquisition Program Baseline

1. Background. The term "baseline" is defined in the Defense Acquisition University Glossary as a "…quantity or quality used as a starting point for subsequent efforts and progress measurement…" Within that definition there are several types of baselines. For example, there are Earned Value Performance Measurement Baselines, Configuration Management Baselines, and Acquisition Program Baselines. These baselines are important and complementary tools in controlling an acquisition program.

 a. The Performance Measurement Baseline is the time-phased budget plan against which contract performance is measured.

 b. The Configuration Management Baseline is either the functional, allocated, or product baseline that establishes the specifications for designing, developing, and manufacturing.

 c. This paper addresses the <u>Acquisition Program Baseline</u>, or "APB," which is a baseline that documents the cost, schedule, and performance "goals" for a program. Program goals are defined as thresholds and objectives.

2. When Required? Beginning at program initiation (normally Milestone B), every acquisition program (all acquisition categories (ACATs))[1] must establish an APB. This first APB is called the "original" APB. The original APB serves as the "current" APB until a revised APB is prepared for a subsequent milestone or the full-rate production decision.

3. APB Thresholds and Objectives - Where do they come from? The Joint Capabilities Integration and Development System (JCIDS) process produces the Capability Development Document (CDD) approved at Milestone B, and the Capability Production Document (CPD)[2] approved at Milestone C. The CDD and CPD are the sources for performance threshold and objective values. These values reflect the required performance for the fielded system. The CDD and CPD also provide cost objectives and thresholds related to the affordability of the system. In some cases, operational capability schedules may be derived from the CDD or CPD. Although the CDD and CPD are the responsibility of the sponsor (the requirements manager (RM) sometimes called the user or user representative), the program office must be involved in the review and staffing process to ensure realistic expectations for cost, schedule and performance attributes. Selected sustainment metrics in the CDD/CPD are the responsibility of the Program Manager (PM) and will be discussed later.

 a. Thresholds. Performance thresholds are the <u>minimum</u> acceptable values considered achievable within available cost, schedule and technology at low-to-moderate risk. Performance below the threshold value is considered not operationally effective or suitable. By contrast, schedule and cost thresholds are <u>maximum</u> allowable values. If thresholds are not achieved, program performance is seriously degraded, or may be too costly, or no longer be timely.

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[1] ACAT I are major defense acquisition programs (MDAP). ACAT ID are reviewed by the Defense Acquisition Board (DAB); ACAT IC are reviewed by the Component. ACAT IA are major automated information system (MAIS) acquisition programs. ACAT IAM are reviewed by the Information Technology Acquisition Board (ITAB); ACAT IAC are reviewed by the Component. ACAT II programs are major systems (nonmajor defense acquisition programs) reviewed by the Component. ACAT III and IV programs are nonmajor defense acquisition programs reviewed at Component level.

[2] See CJCSI 3170.01, *Joint Capabilities Integration and Development System.* JCIDS implements the requirements process for DoD.

b. Objectives. Performance objectives represent what the user desires and expects. The objective value for a performance attribute is the desired operational goal achievable but at higher risk in cost, schedule and technology. Objective values for performance represent operationally-meaningful, time-critical, and cost-effective improvements in capability above the threshold for each performance parameter. The PM manages the program to obtain optimum performance between threshold and objective values. If an objective value is not otherwise specified, the objective value for performance is the same as the threshold value. Although performance beyond the objective value may be possible, it does not justify additional costs. Cost objectives should represent the most likely cost of the system based on the life-cycle cost estimate. Schedule objectives represent the estimated dates of key scheduled events.

4. Key Performance Parameters (KPPs) and Key System Attributes (KSAs). KPPs are those attributes considered critical or essential for an effective military capability and make a significant contribution to the characteristics of the future joint force. KSAs are those system attributes considered crucial or essential for an effective military capability, but not selected as KPPs. A KPP will normally be a rollup of a number of supporting attributes or KSAs that may be traded off to deliver the overall required performance. KPPs, KSAs and other performance attributes are listed in the CDD and CPD in threshold and objective format. All performance attributes must be measurable and testable.

5. KPPs Required by the Joint Requirements Oversight Council (JROC):

> (1) A Net Ready KPP for programs having information exchange requirements.[3]

> (2) Survivability KPPs for attributes that contribute to the survivability of a manned system.

> (3) Force Protection KPPs for attributes that contribute to the protection of personnel. May be the same as survivability but emphasis is on protection of the system operator(s) or other personnel rather than the system itself.

> (4) Sustainment KPPs: Sustainment consists of four metrics: Materiel Availability (Am), Operational Availability (Ao)) and two mandatory supporting KSAs, Materiel Reliability and Ownership Cost.

> (5) Selectively Applied KPPs. The JROC has defined two KPPs to be selectively applied to programs based on the sponsor's analysis: System Training and Energy Efficiency.

> (6). Nuclear Survivability KPPs. Mandatory KPPs for nuclear survivability (including EMP hardening) are required for some systems. See DoDI 3150.09.

5. APB Performance Parameters. Not all performance parameters listed in the CDD and CPD are included in the APB. However, all KPP thresholds and objectives are extracted from the CDD and CPD and included verbatim in the APB. KSA's that support the mandated Sustainment KPP are also inserted verbatim into the APB. Failure to meet a CDD/CPD KPP

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[3]A Net-Ready KPP will be developed for all Information Technology and National Security Systems used to enter, process, store, display or transmit DoD information regardless of classification or sensitivity. Exceptions include those that do not communicate with external systems. The Net Ready KPP does not have any supporting KSAs. See CJCSI 6212,01E for information on developing and assessing the Net Ready KPP.

threshold may result in a reevaluation or reassessment or the program, or modification of the content of production increments. Threshold and objective values may change between the CDD and CPD based on experience gained during EMDD, and trade-off decisions made to optimize performance.   Sometimes KPPs do not completely define operational effectiveness and suitability; therefore the MDA may add other performance parameters to the APB as necessary.

6. APB Schedule & Cost Parameters.

       a. Schedule. Schedule parameters include program initiation, major milestone decision points, initial operational capability, and other critical events. If a schedule threshold is not specified, the Defense Acquisition Guidebook (DAG)[4] indicates that the schedule threshold be the objective date plus 6 months.

       c. Cost.   The CDD and CPD should include an affordability determination identified as life cycle cost, or if available, total ownership cost (TOC), in threshold and objective format. Also included are total quantity, Average Procurement Unit Cost (AUPC)[5], Program Acquisition Unit Cost (PAUC)[6], and any other cost objectives designated by the MDA.

7. Trade Space.   The range between the objective and the threshold ("trade space") provides room for the PM and System Engineers, after coordination with the user, to make cost, schedule, and performance trade-offs without MDA approval. Trade-offs outside the trade space may not be made without the approval of the MDA and CDD/CPD validation authority. KPPs validated by the JROC may not be traded off outside the trade space without JROC approval.

8. Evolutionary Acquisition. For programs using an evolutionary acquisition strategy, the APB must be consistent with the CDD and/or CPD. If the CDD defines multiple increments of capability, the APB will contain multiple sets of parameter values, each set defining an increment.   In an evolutionary strategy achievement of full capability may not occur with the first deployed increment, so selected performance parameters, to include KPPs, and may be delayed until subsequent increments.

9. Current Estimate. During each phase of development the PM maintains a "current estimate" of cost, schedule and performance parameters as the program is being executed. This estimate of each baseline parameter is reported periodically to the MDA. For ACAT I and IA programs, this reporting is done quarterly in the DAES.

10. Program Deviations. A program deviation (also called a "baseline breach") occurs when the PM has reason to believe that the current estimate of a performance, schedule, or cost parameter does not meet the threshold value for that parameter. If the PM's current estimate indicates a baseline breach, the MDA must be notified immediately. For ACAT I/IA programs, the DAES exception report is used.

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[4] See Defense Acquisition Guidebook, Chapter 2, Defense Acquisition Program Goals and Strategy, at https://akss.dau.mil/dag

[5] APUC is calculated by dividing total procurement cost by the number of articles to be procured. Congress uses the term "Procurement Unit Cost (PUC)". PUC is the same as APUC.

[6] PAUC is calculated by dividing the Program Acquisition Cost (RDT&E + Procurement + Construction) by the number of articles to be procured.

11. An Example. Examples of performance, schedule, and cost baselines for selected parameters of a hypothetical cruise missile are depicted in Figure 1 for MS B, updated for cost and schedule deviations and for MS C. (Note: This example is not complete, but rather illustrates a few examples of performance, schedule, and cost parameters).

Figure 1. Acquisition Program Baseline
### (Example for Cruise Missile)

	Original Development APB MS B, 8/10/00 (Obj/Thrshld)	Current Development APB Pgm Review, 5/1/02 (Obj/Thrshld)	Production APB MS C, 8/1/04 (Obj/Thrshld)
Performance			
Survivability	.85/.80	.85/.80	.85/.80
• Speed(mach)	1.3/1.0	1.3/1.0	1.3/1.0
• Radar Cross Section (sq meter)	.10/.25	.10/.25	.10/.25
Schedule			
IOT&E Start	May 04/Nov04	Dec 04/Jun 05	Dec 04/Jun 05
IOT&E Complete	Nov 05/Apr 05	May 06/Nov 06	May 06/Nov 06
IOC	Jun 07/Dec 07	Jan 08/Jul 08	Jan 08/Jul 08
Cost			
Base Year $ (FY97)			
Total RDT&E	$350M/$385M	$405M/$445M	$405M/$445M
Total Procurement	$1200M/1320M	$1400M/$1540M	$1400M/$1540M

12. Other Related Concepts. The APB also complements the related concepts of maturity/growth curve, exit criteria, event based contracting, event driven acquisition strategy and technical performance measurement. To understand how these concepts are complementary, consider Figure 2:

       a. Thresholds, Objectives, Specifications. In this example - a KPP, survivability, is the baselined parameter. Other KPPs would be similarly depicted. KPPs are generally higher order measures of performance (MOP), such as survivability, lethality, etc. The baseline is represented by a threshold and an objective. In our example of the performance parameter - survivability - a trade space of .05 exists between the threshold and objective (from .80 to .85). For Integrated System Design and the System Capability and Manufacturing Process Demonstration efforts, respectively, of the Engineering and Manufacturing Development and Demonstration phase, the contract specification for survivability could be expressed in terms of this range of values; alternatively, the specification could be some value on the growth curve that is attainable during the phase. For LRIP, the contract specification could again be expressed as the threshold/objective range of values or as a discrete value within the range, e.g., the objective. Note in Figure 2 that more specific KPPs (speed and radar cross section) considered essential to achieving the required survivability are also included in the APB.

       b. Maturity/Growth Curve. Developmental testing (DT) tests to values along the maturity or growth curve. In Engineering and Manufacturing Development, DT is oriented to measuring the attainment of the contract specification values. During LRIP, initial operational test and evaluation (IOT&E) is structured to demonstrate that the system will attain the threshold value; i.e., the minimum capability (or better). In the case of the parameter "survivability", a higher value is considered better; some performance parameters - such as weight or specific fuel consumption - are just the reverse, that is, a higher value is considered less desirable.

Figure 2. Acquisition Program Baseline (Performance)
(Illustrative)
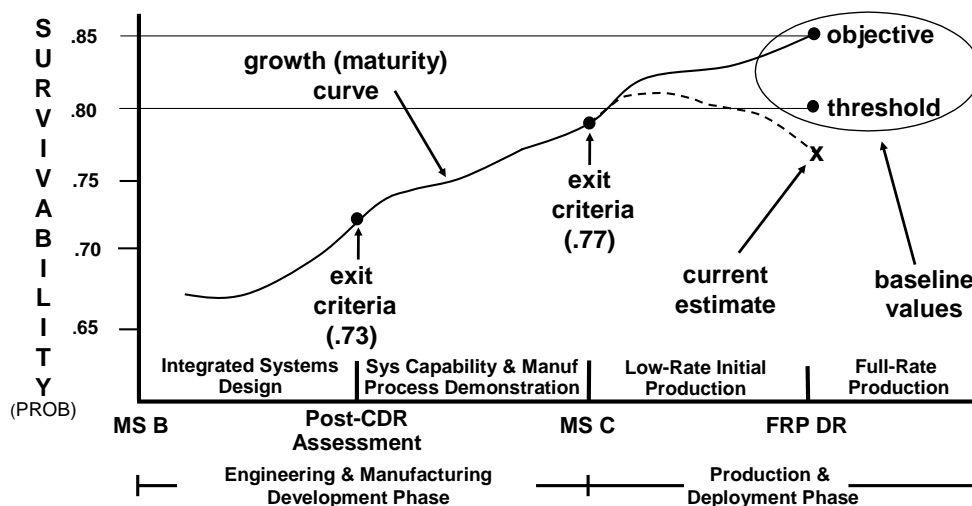
c. Exit Criteria. Exit criteria will normally be selected to track important technical, schedule, or management risk areas. Exit criteria must be specific and <u>demonstrable</u> during the applicable phase/effort, and normally consist of no more than three or four major data points or events.

(1) In Figure 2 the MDA has decided that to achieve a probability of survivability objective of .85 prior to the Full-Rate Production Decision Review, the system must demonstrate, prior to the Post-Critical Design Review Assessment (P-CDRA), achievement of "exit criteria" of .73 probability of survivability during Integrated Systems Design. Figure 3 also indicates that probability of survivability continues to be of concern as a risk area for Engineering and Manufacturing Development, with the requirement that .77 probability of survivability be demonstrated prior to Milestone C. Exit criteria are program specific "gates" within and at the end of each acquisition phase. They could represent a point on the maturity path towards the threshold and objective (baseline) parameter values, or may be phase specific events tied to the schedule. While progress toward achievement of KPPs may be identified as exit criteria, other types of exit criteria might be the successful completion of certain activities or events, such as: selected testing, demonstration of a new manufacturing process, completion of a contract line item at its estimated cost, first flight, or final assembly.

(2) At the end of a phase/effort, exit criteria are program-specific accomplishments required in addition to the minimum required accomplishments for the phase/ effort and any other ADM direction. They are metrics of progress aimed at increasing confidence and reducing risk. Whether within or at the end of a phase/effort, they allow the program office to expand its activities or commitments, e.g., long-lead procurement, low-rate initial production, or full production.

d. Technical Performance Measurement (TPM). To track performance parameters, TPM techniques are used to support projections. In the final analysis, the maturity or growth curve for performance parameters must reach or exceed the threshold value at or near the Full-Rate Production Decision Review. If that doesn't occur, the anticipated breach could prevent the program from moving forward into full-rate production.

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