



FAA Acquisition Program Baseline Stability:

**Comparison between growth rates for programs conducted
prior to acquisition reform and those conducted under
acquisition reform**

NAS Configuration Management and Evaluation Staff
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I. Introduction

Background, Objective, Scope, and Methodology

Since the Federal Aviation Administration (FAA) was granted acquisition reform in 1996, Program Evaluation has reported three times on the status and success of acquisition reform.¹ These evaluations targeted different aspects of acquisition reform for review. In conjunction with these evaluations, Program Evaluation undertook a review of program baseline stability.

The objective of this review was to determine if FAA acquisition programs were maintaining better cost and schedule baseline stability under acquisition reform than was achieved before acquisition reform was implemented. Originally, it was intended that these results would be published as part of the report entitled *Evaluation of Acquisition Reform: The First Three Years: April 1996-March 1999*. However, because this activity measured baseline stability rather than true cost and schedule reductions, and because our sample differed from pre-acquisition reform and acquisition reform programs previously announced by the FAA,² it was decided that the results would appear in a separate document.

Baseline stability is important to the agency for several reasons. First, program baselines are a statement of intention, both internal and external to the agency. Failure to maintain baselines hurts the FAA's credibility with the Department of Transportation, the Office of Management and Budget (OMB), the Congress, and the public. Further, failure to maintain baselines affects the agency's ability to budget reasonably and to plan for National Airspace System (NAS) modernization. Cost or schedule growth can impact budgets across agency programs, and can wreak havoc with the complex and interdependent NAS.

The evaluation was limited to acquisition programs whose primary focus was system development. It did not include acquisitions of contract support. Because of the limitations in available data for programs conducted prior to acquisition reform, samples were limited to programs funded primarily with facilities and equipment (F&E) funds.

The evaluation effort assessed the growth for established program baselines. It did not attempt to assess the accuracy of existing baselines, or to verify the assumptions upon

¹ *Evaluation of FAA Acquisition Reform: The First Year: April 1996-March 1997* dated May 1997; *Evaluation of FAA Acquisition Reform: The First Two Years: April 1996-March 1998* dated May 29, 1998; and *Evaluation of FAA Acquisition Reform: The First Three Years: April 1996-March 1999* dated May 28, 1999.

² Our sample differed from programs previously announced by the agency because we used a strict point in time criterion for choosing pre-acquisition reform and acquisition reform programs. See Appendix A for more details.

which baselines were developed. Such an assessment would require full program reviews for all sample programs; the organization did not have time or resources to conduct such in-depth reviews.

The evaluation team compared the cost and schedule growth³ for agency programs implemented and managed prior to acquisition reform to projected cost and schedule growth for agency programs implemented and managed under acquisition reform. Programs were divided into groups based on size to allow more accurate comparisons.⁴ The results were calculated based on actual differences between the two groups where data were available. For time periods in which no acquisition reform data were available, results were projected using a ratio. For more details on methodology, see Appendix A.

³ For the purposes of this evaluation, the term "schedule growth" is defined as the difference between program schedule estimates at specified points in time.

⁴ The two groups were labeled "large programs" and "small programs." Large programs consisted of sample programs with an F&E cost of greater than \$300 million. Small programs included those with an F&E cost of less than \$300 million.

II. Evaluation Results

A. Schedule Growth

Findings

Overall, the evaluation team found that although FAA programs are still experiencing schedule growth, the agency is improving under acquisition reform. Both small and large agency programs under acquisition reform had less projected schedule growth between contract award and the last operational readiness demonstration (ORD). Small programs under acquisition reform also had less schedule growth projected from contract award to the first ORD. Specifically:

1) Under acquisition reform, both small and large programs are experiencing less schedule growth from contract award to the last ORD than programs prior to acquisition reform. This includes growth actually experienced in the first three years of sample programs and growth either experienced or projected to the program's last ORD. Specific percentages appear in Table 1 below.

Programs	Prior to Acquisition Reform	Under Acquisition Reform
Small Programs		
Growth in first 3 years since contract award	70%	66%
Growth from contract award to last ORD	115%	108%*
Large Programs		
Growth in first 3 years since contract award	33%	8%
Growth from contract award to last ORD	59%	15%*

* Projected

Table 1. Schedule Growth from Contract Award to Last ORD

2) Under acquisition reform, small programs are experiencing less schedule growth from contract award to the first ORD than programs prior to acquisition reform. Large programs are experiencing more schedule growth for the same period. Specific percentages appear in Table 2 below.

Programs	Prior to Acquisition Reform	Under Acquisition Reform
Small Programs		
Growth in first 3 years since contract award	68%	16%
Growth from contract award to first ORD	147%	34%*
Large Programs		
Growth in first 3 years since contract award	24%	36%
Growth from contract award to first ORD	52%	80%*

■ Shaded areas indicate higher growth rate under acquisition reform.

* Projected

Table 2. Schedule Growth from Contract Award to First ORD

The evaluation team did not analyze the reasons for this finding, since such analysis was outside its scope. It appears anomalous that large programs are experiencing less growth at last ORD but more growth at first ORD than programs before acquisition reform was initiated. A possible explanation for the apparent anomaly is that acquisition reform programs have not yet adjusted the last ORD dates in conjunction with slips in first ORD. However, the programs could also be planning to "make up" the slip during deployment.

B. Cost Growth

Finding

Under acquisition reform, the agency is farther from meeting cost estimates than prior to acquisition reform for either small or large programs. Specific percentages appear in Table 3 below.

Programs	Prior to Acquisition Reform	Under Acquisition Reform
Small Programs		
Growth in first 3 years since contract award	5%	10%
Growth from contract award to last ORD	22%	43%*
Large Programs		
Growth in first 3 years since contract award	25%	42%
Growth from contract award to last ORD	66%	110%*

■ Shaded areas indicate higher growth rate under acquisition reform.

* Projected

Table 3. Cost Growth

The evaluation team did not analyze the reasons for these growth patterns, since such analysis was outside its scope. The team noted that small programs experienced twice as much cost growth in the first three years under acquisition reform as they did before acquisition reform was implemented, yet these programs still fell within the ten percent allowable variance for cost growth.⁵ Further, these programs were experiencing less schedule growth than small programs before acquisition reform. A possible explanation is that the FAA is concentrating on fielding these systems on time, with a slightly greater rate of cost growth as a consequence.

⁵ As established by the Office of Management and Budget and Public Law 104-264.

III. Conclusions and Recommendations

While the evaluation team was able to measure whether the agency is experiencing more or less cost or schedule growth based on actual results and projections in these various categories, the evaluation team did not interpret this to mean that the agency is doing either better or worse overall under acquisition reform. The evaluation team did not assess whether the initial baselines in either sample set were realistic when established, nor did the evaluation team challenge projections provided by program offices. Such an assessment would have required full program reviews for all sample programs; the organization did not have time or resources to conduct such in depth reviews. Since most programs were not completed at the time of this review, actual results could not be established and measured.

Nonetheless, these data are important because they represent one quantifiable gauge to measure how the agency is doing with respect to timeliness and cost overall. It constitutes a first step in evaluating agency baselining techniques. FAA work is not completed. Further review is necessary to answer the above questions and determine if the findings are due to problems with the establishment or timing of program baselining.

Comparison to Other Cost and Schedule Reviews

The evaluation team compared its data with that collected by other applicable reviews of program cost and schedule baselines.

The team compared its data to that collected annually by the General Accounting Office (GAO) for its annual analysis of FAA's Modernization Program.⁶ Where samples overlapped, the data were generally consistent with GAO data in all applicable years (1985-1998).

Internal to FAA, the Office of the Associate Administrator for Research and Acquisitions (ARA) conducted a review designed specifically to measure the agency's progress in reducing the cost of acquisitions and the time required to acquire and commission systems in comparison to acquisitions of similar scope and complexity completed prior to acquisition reform.⁷ That study measured progress toward the cost reduction goal as the total cost growth for acquisition programs completed between April 1, 1996, and April 1, 1999, compared to an aggregate sample of programs of similar scope and complexity completed prior to April 1, 1996. Progress toward the schedule reduction goal was measured by the average percent change in the total time required between investment decision and the initial commissioning of new systems for the same time period. That

⁶ See series of GAO documents entitled *Air Traffic Control: Status of FAA's Modernization Program*. A report was issued during each year from 1985-1998.

⁷ The results of this study are reported in *Office of the Associate Administrator for Research and Acquisitions: Performance Report, First Quarter FY1999, Goal 7*.

study projected a 75 percent reduction in acquisition cost and a 56 percent overall schedule reduction.

Our results differ for several reasons. First, our evaluation had a different objective and measured different data. Our evaluation was to determine if the FAA is doing better at maintaining baselines established at program inception. The ARA study was to determine if the FAA could field systems in less total time, at less total cost. Thus our evaluation focussed on *growth in projections*, while the ARA study measured *total schedule and costs*. The two results, however, are not incompatible. It is conceivable that the total time and costs will be reduced under acquisition reform, yet the agency is still not there yet in terms of cost and schedule estimating capabilities.

Recommendation:

The FAA Associate Administrator for Research and Acquisitions⁸ should review the procedures and timing for establishing program baselines to determine if the process could be improved.

⁸ Based on the results of this report, Program Evaluation (ACM-10) is planning to undertake such a review during 1999.

Detailed Methodology

The evaluation team compared the cost and schedule growth for agency programs implemented and managed before acquisition reform to projected cost and schedule growth for agency programs implemented and managed under acquisition reform. This section will address the methodology in three segments: (1) governing assumptions and criteria, (2) sample selection, and (3) data analysis.

(1) Governing Assumptions and Criteria. The team established assumptions for comparing the samples as follows:

- *Sample programs must be compared at similar lifecycle stages.* Programs did not experience the same amount of growth during all stages of their lifecycles. Therefore, data needed to be collected for similar lifecycle segments of programs. The team selected the period from contract award to last operational readiness demonstration (ORD) for comparison. This segment was chosen for several reasons. First, the segment had a definitive beginning and end point for every program, and data were available for the entire segment both in pre-acquisition reform programs and those conducted under acquisition reform. Further, the segment occurs later in the program lifecycle and contributes directly to achieving program results. Finally, the segments prior to contract award were being compared in other evaluations, and the team did not wish to duplicate those efforts.⁹
- *Sample programs must be compared during a similar time period.* Because acquisition reform has been in effect for only three years, comparing program growth during this timeframe to pre-acquisition reform programs that may have more than ten years of data would be problematic. Therefore, the team decided to compare the baseline growth from contract award to contract award plus three years for each sample.
- *Sample programs must be of similar complexity.* A system development program can be quite different in complexity than acquisition of a support contract. Such differences make valid comparisons difficult at best. Therefore, the evaluation team limited the comparison to system development contracts in both the pre-acquisition reform and acquisition reform samples.
- *Sample programs must be of similar size.* A large program with several segments might have vastly different growth rates than a relatively small program. The team decided to separate the sample programs into two

⁹ See *Evaluation of FAA Acquisition Reform: The First Three Years: April 1996-March 1999* dated May 28, 1999, Part II, Chapter I.

categories: Large and Small programs. Large programs were those with F&E costs of more than \$300 million, and small programs were those with F&E costs of less than \$300 million.

(2) Sample Selection. To perform this comparison, the evaluation team selected two program samples.

a. Pre-Acquisition Reform Sample

The evaluation team established the universe of pre-acquisition reform programs as follows:

- ◆ The team established contract award as of December 1993 as the cutoff for programs in the pre-acquisition reform sample so that a three-year time window could be obtained to compare pre-acquisition reform programs to programs managed under acquisition reform. The three year time window was chosen because acquisition reform was initiated in April 1996.
- ◆ The team determined that the December 1985 Master Schedule Baseline Report (MSBR) was the earliest available official data source for schedules that consistently showed the level of detail necessary to obtain contract award dates and ORD dates. Contract award, last ORD, and first ORD were chosen as evaluation milestones because they represent a beginning point, an end point, and a point between those dates for all programs in the universe.
- ◆ The team identified all programs with contract award dates listed in MSBRs between December 1985 and December 1993. The team then removed those programs that did not appear in the MSBR for at least three years following contract award.
- ◆ With aid from the ARA Office of National Airspace System Programming and Financial Management (ASD-310), the team eliminated programs based on cost data availability.

From the 31-program universe established by the above steps, the team established the pre-acquisition reform program sample through the following steps:

- ◆ Because the number of programs in the universe with an initial cost estimate of over \$300 million was small, the team included all five of those programs in the sample:

Capital Investment Plan (CIP) Number	Program Title
21-07	HOST; Air Route Traffic Control Center Expansion
21-11	Voice Switching and Communications System (VSCS)
21-12	Advanced Automation System (AAS)
24-15	Long Range Radar (LRR)
24-18	Terminal Doppler Weather Radar (TDWR)

- ◆ Due to the number of programs in the universe, and in order to obtain a sample of similar size to the acquisition reform program sample, the evaluation team took a random sample of programs with an initial F&E cost of under \$300 million. The programs selected were as follows:

Capital Investment Plan (CIP) Number	Program Title
22-12	Tower Communication System (TCS)
22-17	TPX-42 Replacement (TPX-42R)
23-01	Establish Flight Service Automation System (FSAS)
23-02	Central Weather Processor (CWP)
23-09	Automated Weather Observing System (AWOS)
24-08	Runway Visual Range (RVR)
24-11	Direction Finder (DF)
24-14	Airport Surface Detection Equipment-3 (ASDE-3)
25-07	National Airspace Data Interchange Network (NADIN) 2
64-27	Precision Runway Monitor (PRM)

b. Acquisition Reform Sample

The evaluation team established the universe of acquisition reform programs as follows:

- ◆ The team determined that, to be included in the sample, programs must have reached contract award between April 1996 (when acquisition reform was implemented) and January 1998. January 1998 was the cut-off date so that at least one year of data could be obtained to compare pre-acquisition reform programs to programs managed under acquisition reform.
- ◆ The team reviewed the National Airspace System (NAS) Architecture Version 4.0, Capital Investment Plans, and MSBRs to determine all acquisition programs in existence during the stipulated timeframe.
- ◆ The team identified a universe of 118 current F&E programs.
- ◆ Programs were eliminated from the universe based on the following criteria:
 - The program was not a system or product development program (discussed above).
 - The contract was not awarded between April 1996 and January 1998 (discussed above).
 - The program had too many independent segments to permit evaluation. For example, the Air Traffic Management program (CIP number A05) could be broken down into eighteen different individual segments with separate project assignments. Program management moved funds from segment to segment. Therefore, all of the segments would need to be evaluated. The team did not have the resources or time to adequately cover such a diverse program.

Once these criteria were applied to the universe, a sample of small and large programs emerged, as follows.

CIP Number	Size	Program Title
A04	Large	Standard Terminal Automation Replacement System (STARS)
N12.01	Large	Wide Area Augmentation System (WAAS)
S03.02	Large	Airport Surveillance Radar (ASR-11)
W07	Large	Integrated Terminal Weather System (ITWS)
A07	Small	Operational and Supportability Implementation System (OASIS)

M07	Small	National Airspace System (NAS) Infrastructure Management System (NIMS)
M08.19	Small	ACQUIRE
M33	Small	Advanced Aviation Security Initiatives
W04	Small	Weather and Radar Processor (WARP)

(3) Data Analysis

The evaluation team collected and analyzed schedule and cost data using the following methodology:

a. Schedule:

The evaluation team used the monthly MSBR as the primary source for schedule data because the MSBRs for the pre-acquisition reform programs (1985-1993) and for the acquisition reform programs (1996-current) were official FAA documents distributed FAA-wide. Further, MSBRs were the only consistent source of data available over the entire timeframe. Acquisition Program Baseline (APB) schedules did not always reflect the program schedule at contract award, so they were not always an adequate source of schedule data.

When programs had multiple segments, the evaluation team collected schedule data for all segments that fit the selection criteria for programs.

To measure schedule growth, the team collected data from three points in time for each program or program segment. Contract award was chosen as the “start date” for data collection because it represented a common, consistent beginning point for all programs. The date three years after contract award was chosen as the second point in time because a maximum of three years of program data was available for programs managed under acquisition reform. By analyzing the status of pre-acquisition reform programs three years after their contract awards, comparisons of schedule growth could be drawn between the two groups of programs. The final point chosen was the “end date” of the program, defined as follows:

- The date nearest to the date on which the program “ended” (was withdrawn, was canceled, or was restructured without retaining its identity as a CIP line item under the new program).
- The date nearest to the date of the last ORD for the last segment of the program, if that ORD had occurred by November 30, 1998.¹⁰

¹⁰ November 30, 1998, was chosen because it was the latest date for which MSBR data was available during the review.

- The date nearest to November 30, 1998, if the last ORD for the last segment of the program had not occurred by that date and the program had not been restructured.

The team executed the following steps when gathering program schedule data:

- ◆ The team used the MSBR dated closest to the program’s or segment’s contract award date to determine the planned dates for first ORD and last ORD.
- ◆ The team used the MSBR dated closest to the date three years from contract award to determine the planned dates for first ORD and last ORD at that time (or the actual dates if first ORD or both First and last ORD had occurred).
- ◆ Finally, the team used the MSBR dated closest to the program’s “end date” to determine the actual first ORD and last ORD dates or the projections for those dates if they had not already occurred.

The results were compared in two phases. From contract award to contract award plus three years, the data were aggregated and the totals were compared directly. From contract award to last ORD, the analysis differed slightly. Since none of the sample programs managed under acquisition reform had reached the last ORD milestone, we used a forecast method to determine projected schedule growth at the end of the program. This method used a ratio to forecast new growth based on old growth patterns (see Figure 1).

$\frac{P1}{P2} = \frac{R1}{X}$
<p>P1=Actual growth after first 3 years for programs managed prior to acquisition reform</p> <p>P2=Actual growth at last ORD for programs managed prior to acquisition reform</p> <p>R1=Actual growth after first 3 years for programs managed under acquisition reform</p> <p>X=Forecasted growth at last ORD for programs managed under acquisition reform</p>

Figure 1. Forecast Ratio for Cost and Schedule growth

The forecast was based on the growth rate experienced in the first three years and at last ORD for programs managed prior to acquisition reform. Assuming that the same pattern of growth would continue for programs managed under acquisition reform, the team applied the ratio to the aggregated data and calculated the forecasted growth rate. The team then compared planned schedule completion dates for both first and last ORD at the program's contract award to the adjusted schedule completion dates for first and last ORD at the end of the program.

b. Cost

The evaluation team used CIP budget back-up documents maintained by the ARA Office of National Airspace System Programming and Financial Management (ASD-310) to determine the cost growth for each program in the pre-acquisition reform and acquisition reform samples. The Estimated Cost at Completion/Total Cost figure was collected for each program at the closest available date to each of three points in time: contract award, three years from contract award, and the “end date” for the program. Only F&E funding was included in the cost data collected. All cost data collected was in then-year dollars (costs were adjusted for inflation in the out years).

The results were compared in two phases. From contract award to contract award plus three years, the data were aggregated and the totals were compared directly. From contract award to last ORD, the analysis differed slightly. Since none of the sample programs managed under acquisition reform had reached the last ORD milestone, the evaluation team used a forecast method to determine projected cost growth at the end of the program. This method used a ratio to forecast new growth based on old growth patterns (see Figure 1 on previous page).

The forecast was based on the growth rate experienced in the first three years and at last ORD, for programs managed prior to acquisition reform. Assuming the same pattern of growth continues for programs managed under acquisition reform, the team applied the ratio to the aggregated data and calculated the forecasted growth rate. The team then compared planned cost data for last ORD at the program's contract award to the adjusted cost data for last ORD at program completion.

Acronym List

AAS	Advanced Automation System
APB	Acquisition Program Baseline
ARA	Associate Administrator for Research and Acquisitions
ASDE	Airport Surface Detection Equipment
ASR	Airport Surveillance Radar
AWOS	Automated Weather Observing System
CIP	Capital Investment Plan
CWP	Central Weather Processor
DF	Direction Finder
F&E	Facilities and Equipment
FAA	Federal Aviation Administration
FSAS	Flight Service Automation System
GAO	General Accounting Office
ITWS	Integrated Terminal Weather System
LRR	Long Range Radar
MSBR	Master Schedule Baseline Report
NADIN	National Airspace Data Interchange Network
NAS	National Airspace System
NIMS	National Airspace System Infrastructure Management System
OASIS	Operational and Supportability Implementation System
OMB	Office of Management and Budget
ORD	Operational Readiness Demonstration
PRM	Precision Runway Monitor
RVR	Runway Visual Range
STARS	Standard Terminal Automation Replacement System
TCS	Tower Communication System
TDWR	Terminal Doppler Weather Radar
TPX-42R	TPX-42 Replacement
VSCS	Voice Switching and Communications System
WAAS	Wide Area Augmentation System
WARP	Weather and Radar Processor