How Boeing A&T Manages Business Processes

Pamela Garretson and Paul Harmon

Business Process Management is a hot topic in business circles today. Most companies report that they are investing in business process management. Some are focused on modeling their operations, while others focus on measuring process performance. Some are committed to Six Sigma improvement efforts, while others describe how Information Technology (IT) is being used to automate a key business process. Only a few companies, however, report that they actually use process measures in the day-to-day management of their organization. Everyone agrees that, ultimately, business process management is about *management*, but only a few companies have actually put all the pieces together and have implemented an effective process governance system.

This paper describes how Boeing Airlift and Tanker Programs (A&T) changed itself from an organization in trouble to a world-class performer that has become one of the outstanding examples of the power of a comprehensive commitment to business process management through the organization of its day-to-day management system around business processes.

Boeing A&T is a group within Boeing's Air Force Systems business segment, which, in turn, is a part of Boeing's Integrated Defense Systems (IDS) organization. (See Figure 1.) One of the primary products produced by Boeing A&T is the C-17 Globemaster III Cargo Plane – a huge airplane capable of carrying a payload in excess of 32 tons. The primary customer of Boeing A&T is the U.S. Air Force. The program employs over 7,000 people distributed between facilities located at Long Beach, California; Macon, Georgia; Seattle, Washington; and St. Louis, Missouri.

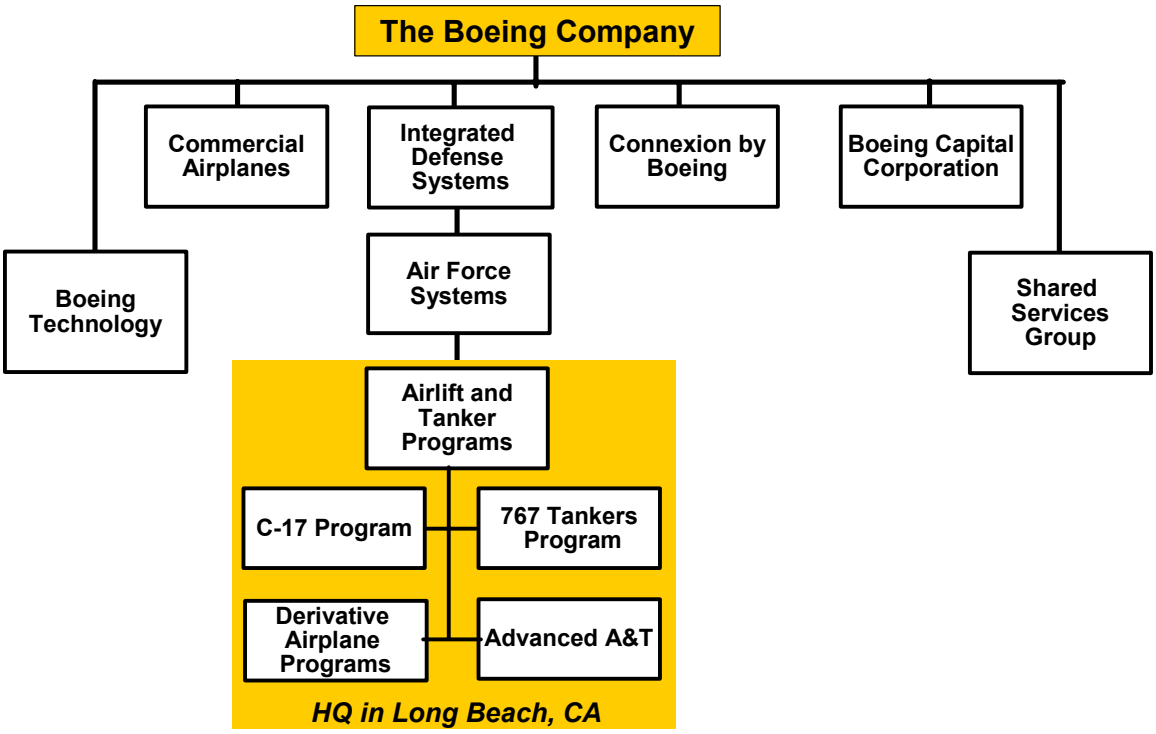

Figure 1. The Overall Organization of the Boeing Company.

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Senior Management's Commitment

The key to any serious process-based governance program is the support of senior management. Senior executives at most companies are willing to support a wide variety of process improvement programs but are usually reluctant to provide the kind of ongoing, in-depth commitment a company needs to really change the way the organization does business. Senior management commitment happened at Boeing A&T because the company does most of its work for a single client – the U.S. Air Force. In the early 90's, that client was very upset with the work the C-17 Program was doing. The program was over-budget and behind schedule, and the Air Force was threatening to purchase no additional aircraft. This threat focused senior management on the need to alter significantly the way the C-17 Program was managing its business.

This management transition began with an executive Leadership Team that focused on how the C-17 Program might be changed to improve its management practices and products. In essence, the C-17 Program, and, later, all of Boeing A&T, committed itself to implementing a management framework based on the Malcolm Baldrige National Quality Award criteria, which emphasize six areas, including leadership, strategic planning, customer focus, information management, human resources focus, and the management and integration of processes, in addition to results. The Baldrige criteria are embedded in a quality management program that is managed by the U.S. Department of Commerce and that recognizes outstanding U.S. companies with an annual Quality Award.[1]

As part of the deployment of the Baldrige criteria,[2] the C-17 Program's focus on process management and integration spawned the Process-Based Management (PBM) approach. The PBM approach starts by defining the organization as a series of processes and by assigning process management oversight responsibilities to senior executive process owners who, in turn, drive PBM downward by assigning process responsibilities to subordinate process owners. Thus, a wide cross-section of the management structure within the C-17 Program, and now within Boeing A&T, has process management responsibilities. In the mid-90's, senior executives not only supported the organization's transition to PBM but assumed leading roles, serving as training role models and participating in joint reviews of processes with the Government customer. Today, ongoing, active commitment of senior executives continues as part of day-to-day process management.

Starting With a Vision and a Plan

Integral to the C-17 Program's successful deployment of not only the PBM approach but the overall implementation of the Malcolm Baldrige criteria was the implementation of a vision that focused on improving performance and quality as well as on customer satisfaction. As the PBM approach was developed and deployed, the Air Force customer participated jointly in the identification and management of key processes.

The C-17 Program's process focus began when there was considerable interest in process reengineering but less emphasis on process management. Although there were some trials and errors along the way, the C-17 Program eventually created the PBM methodology to guide its ongoing efforts. Boeing A&T defines PBM as follows:

> *Process-Based Management (PBM) is a management approach that defines an organization as a collection of processes focused on customer satisfaction and waste reduction by defining measures, and stabilizing and improving processes.*

Boeing A&T goes on to define the characteristics of a Process-Based organization as one that

- Views business as a collection of processes
- Uses strategic plans to drive processes

- Understands the precise relationship between processes and key business results and goals
- Focuses on key customer-driven processes
- Uses work teams to implement processes
- Uses process reports to determine the health of processes
- Manages by data
- Has the patience to work via processes
- Emphasizes sustainable improvements
- Demands improvement in processes across the entire business
- Integrates processes with other initiatives
- Uses common processes and standardization whenever possible

Modeling the Company and Its Processes

The Boeing C-17 Program management team began its process work by defining the program's core processes and its major support or enabling processes and documenting them in an Enterprise Process Model. Over time, the processes were modified as necessary to adapt to the current Boeing A&T organization. Figure 2 provides an overview of the major processes identified in the A&T Enterprise Process Model. One can see from Figure 1 that the model allows each program within A&T to tailor its value chain.

The five tall arrows that run through the middle of the value chain are the five core processes. The two long arrows above and the one below include support processes that help lead or enable the core processes. We've highlighted one process in red on Figure 2 [3]. This is the process for Process Management itself – owned by the Process Management Integration organization – that helps define, deploy, and monitor all the other processes.

The process owners of the top-level core and support processes are called executive process owners. Collectively, they make up the Integration Board at the A&T level and the Process Council at the C-17 level, both of which are tasked with overseeing the deployment and health of the entire PBM effort, in conjunction with the Process Management Integration group.

When PBM was first established, the methodology was used by senior executives to define the core processes in the company. Then those executives deployed it in a top-down manner, to define subprocesses and sub-subprocesses (Figure 3). This effort continued until all of the processes were defined.

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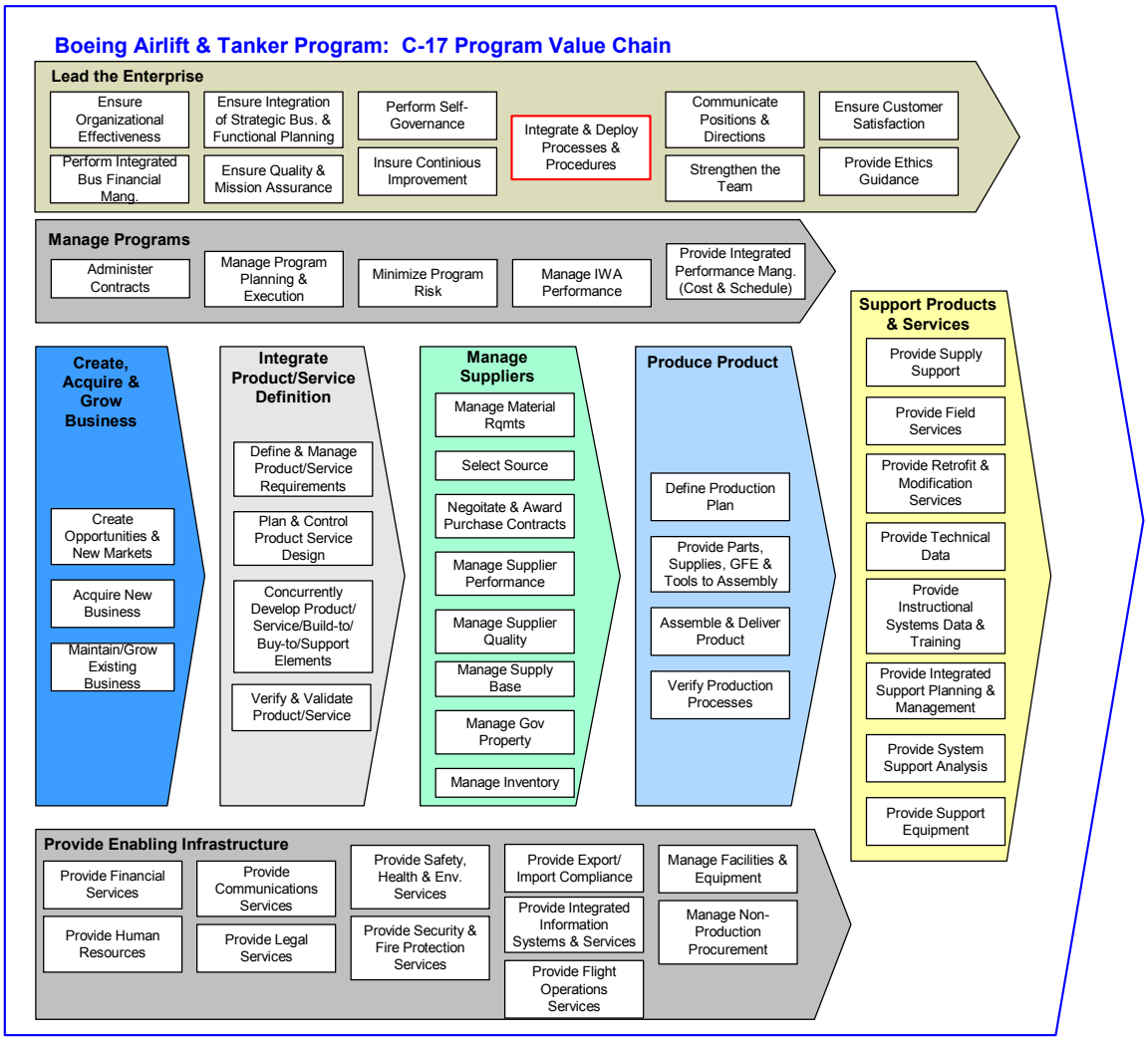

Figure 2. Boeing A&T Program's Core and Support Processes (Enterprise Process Model).

A few complex processes – within Production and Engineering, for example – have been decomposed into as many as five levels of subprocess. Ultimately, a total of slightly more than 300 processes have been identified. Each process has an owner. One individual can be the owner of more than one process, and some individuals own as many as six or seven processes. Thus, the A&T group currently has slightly fewer than 300 process owners.

Today, with the overall process structure in place, the PBM methodology is used both to train new process owners in their responsibilities and to deal with changes that require the addition of processes or major revisions to existing processes.

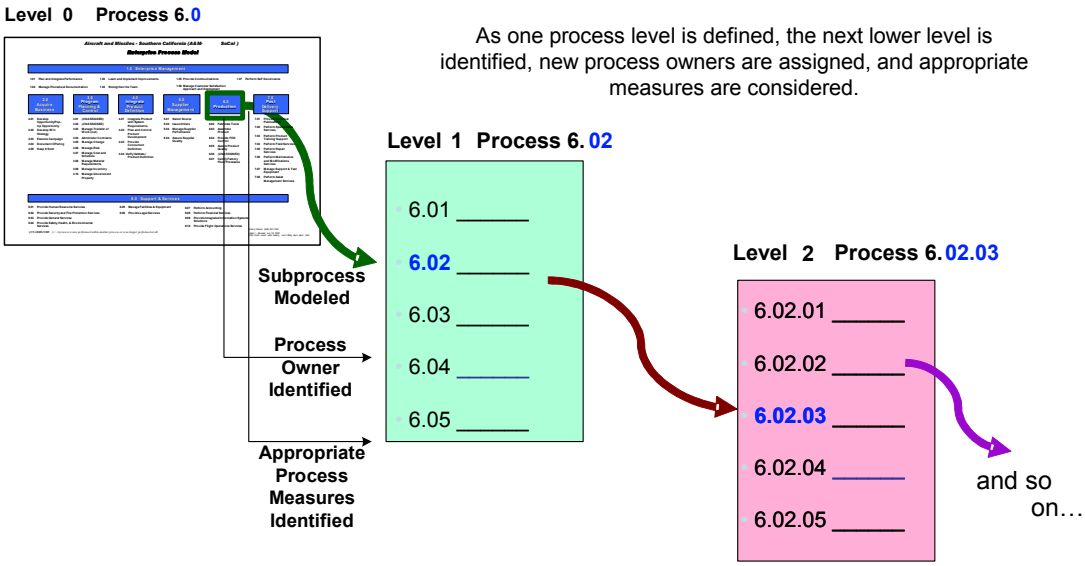

Figure 3. The Iterative, Top-down Definition of Processes.

Figure 4 provides an overview of the seven steps in Boeing A&T's PBM Methodology. The key to the PBM approach is that every process in the Enterprise Process Model is documented and has a responsible process owner. Those processes determined to be most critical to operational performance are additionally measured, managed, and reported on by the process owner. Moreover, process performance measures are aligned from the top to the bottom of the model. Whenever a process fails to meet its goals, the process owner develops a plan to improve the process. The improvements are implemented, and the cycle continues with further measurements and, if necessary, further improvements.

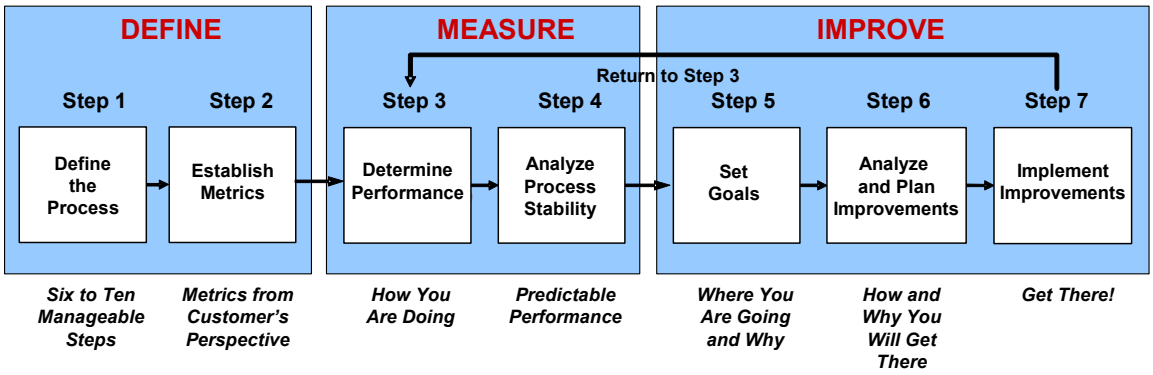

Figure 4. Boeing A&T Seven-Step PBM Methodology.

Processes are modeled using a popular swim lane flow diagram like the one shown in Figure 5. As suggested in Figure 3, the iterative nature of process analysis does not require a given process owner to define his or her process in minute detail. Instead, it requires a general description of the process like the one shown in Figure 5, in addition to a process definition form that provides more detail on supplying and receiving process linkages. Major activity boxes in one process owner's diagram may become the boundaries of subprocesses that are defined, in turn, by other process owners assigned to those subprocesses.

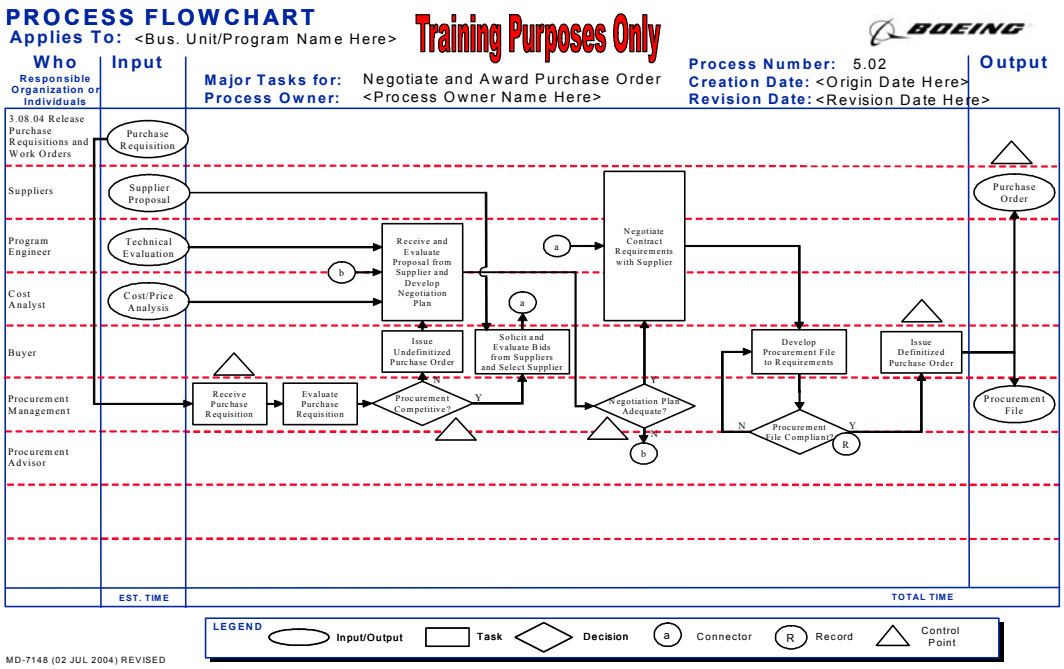

Figure 5. A Process Flow Chart.

All processes are defined and documented by the responsible process owners and stored in a repository maintained by the Process Management Integration group that manages the "Integrate and Deploy Processes and Procedures" process. This group maintains a complete picture of all the processes within Boeing A&T.

Process Owners

A process owner may or may not be a manager. The owners of some lower-level or technical processes are Subject Matter Experts. The owner is familiar with the working of the process and is responsible for the planning, modeling, measurement, and improvement of the process if it is determined that the process should progress to the measurement step. The process owner most often works with a team of individuals to model, measure, and improve the process.

When an individual becomes a process owner, he or she is provided with eight hours of training in process management and a set of tools to help perform the job. If it is determined that the process will go beyond definition into measurement, the owner is also responsible for negotiating an agreement with the customer of the process to assure that the customer concurs with the output of the process. Customers may include external Government customers in addition to internal customers, i.e., individuals within another process who are recipients of the outputs of the first process. In a similar way, the process owner, as a customer of a process further up the chain, must negotiate with one or more process suppliers to assure that his or her process will get the inputs it needs. (Sidebar 1 – at the end of this article – defines these basic terms and concepts.)

The process owner is responsible for ensuring that the process adheres to all requirements and that the output meets the quality agreed to with the process' customer. When it is determined that a process must undergo measurement and improvement, the process owner must also report on agreed-upon metrics each month. The report is made via computer, using the PBM System Boeing has developed, which is discussed later in this article. Process owners also attend process review meetings to assure that the larger process of which their specific process is an element is functioning smoothly.

Executive process owners not only oversee their processes and monitor performance, but they also actively work to support the process owners who are responsible for the processes that make up their high-level processes. Each month, for example, executives are measured on how they provide recognition for at least 1% of their process owners, and on their attendance at process review meetings with their process owners.

Defining Process Measures

Once a process is defined and a process owner assigned, specific measures are determined for the process. Boeing wants to maintain the vertical and horizontal alignment of process measures, which means that many a subprocess defines its measures in ways that indicate how the outcomes of that process will contribute to the achievement of the desired outcomes of its superprocess. (See Sidebar 1 for an explanation of key process terms and definitions.)

Figure 6 provides an overview of the four general categories of Key Performance Indicators (KPIs), or metric categories that Boeing A&T uses. Quality and Timeliness tend to be external measures usually determined by reference to the customer of the process. Efficiency and Cycle Time tend to be internal measures and are pursued to assure that the process does what it does in the most cost-efficient possible manner.

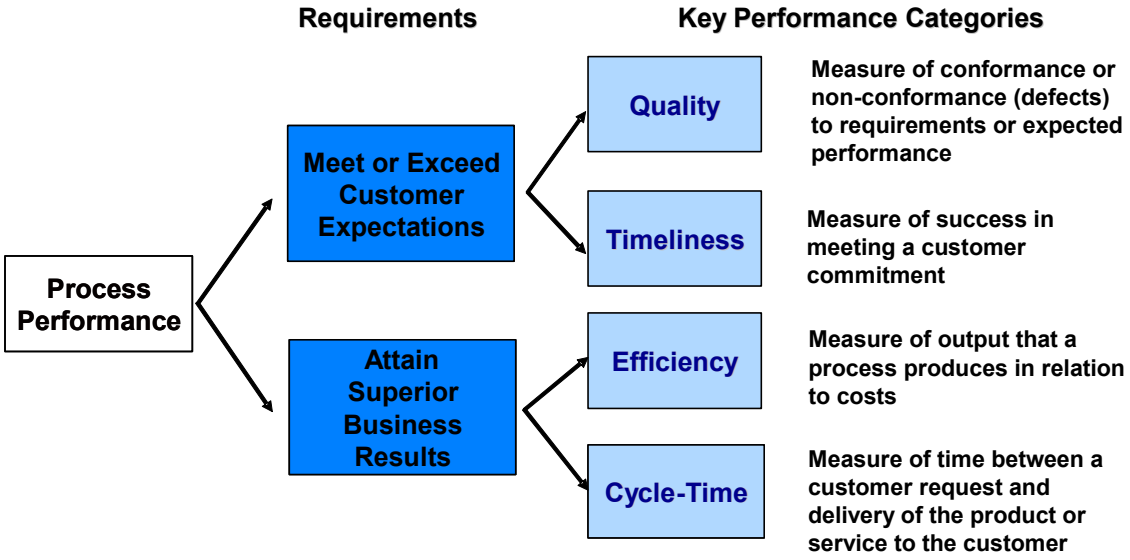

Figure 6. Basic Types of Process Measures.

Most process owners strive to track all four metric categories but may track fewer or more depending on the nature and needs of the individual process. The key is to ensure that the KPIs take into account the goals of the customer and that there is a balanced set of measures, to preclude too strong an emphasis in one performance area that would compromise performance in another.

The Boeing A&T Process-Based Management System (PBMS)

Boeing A&T's Information Technology group (a functional unit, not a process) created and maintains the Process-Based Management System (PBMS). PBMS is a set of software tools and a repository that helps process owners document processes and measures, that gathers and summarizes process performance data, and that stores all process information. Boeing had

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experimented with a variety of modeling and reporting tools but eventually decided to build its own system to assure that everything was integrated to support PBM.

PBMS is available to every process owner. Initial process descriptions and process models are documented using PBMS tools. Process measures are specified and monthly reports are prepared via PBMS to allow an analysis of the performance of each process that is being measured.

Figure 7 illustrates metric reports delivered by Boeing A&T's PBMS program. The bars represent monthly performance on process measures. The lower line that crosses both bar charts is what the process owner and the customer have agreed is acceptable performance. The higher dotted bold line is the actual process goal, that is, the level of performance that both owner and customer agree would be ideal. Any time a bar falls below the lower line it indicates that the output of the process is below the minimum acceptable level.

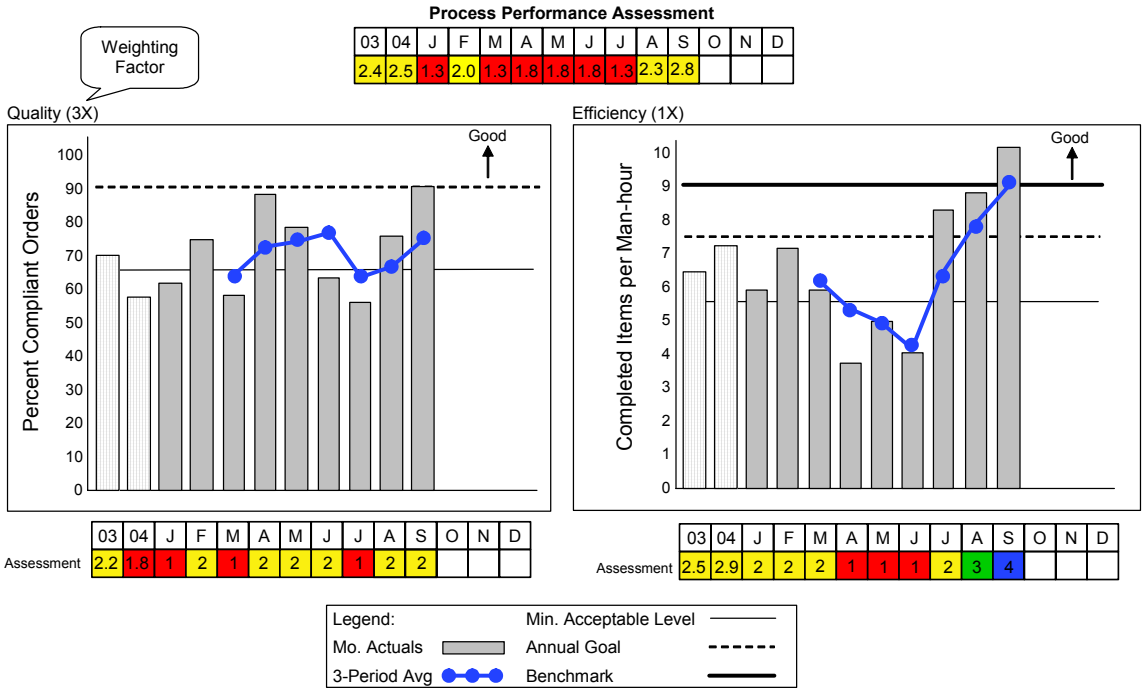

Figure 7. Computer-based Performance Reporting System for Process Owners.

The overall performance of all of the metric panels is summarized in the matrix bar above the two charts. In this case, colors of red, yellow, green, and blue are used to suggest a process is performing below par, is in need of improvement, or is meeting or exceeding goal.

Whenever a process owner has a process that is performing below par, he or she is required to coordinate and submit a plan to improve the process. The performance of processes and the review of process improvement plans are monitored by the Process Management Integration group, which offers technical support when needed. For example, if a process improvement plan requires extensive changes to achieve quality goals, this "process management" process team may facilitate assignment of a Six Sigma Black Belt to assist the process owner.

Figure 8 illustrates a Process Improvement Plan developed by a process owner. The plan is housed in a separate Corrective/Preventive Action System (CPAS) database and then linked to the appropriate process within PBMS.

ACTIONS

ACTION # 1234 **INITIATED:** 01-May-05

INITIATOR: Adams, Art
ASSIGNEE: Adams, Art
PROCESS OWNER: Baker, Bill
PBM No: 5.02
Issue Orders
C/PA SOURCE: PBM Annual Process Improvement
STATUS: Open **DATE:** 07-Oct-05
SUBJECT:
Improve percentage of compliant documentation
PROBLEM STATEMENT:
Percentage of compliant procurement files is not acceptable.
VERIFICATION/ACCEPTANCE CRITERIA:
Percentage of compliant files improved by 20%
ROOT CAUSE ANALYSIS TOOLS USED:
FMEA, 5-Why
ROOT CAUSE STATEMENT:
Buyers are not trained to review files for compliance prior to sending to Procurement Analysis
VERIFICATION CRITERIA:
Compliance checklist implemented and percentage of compliant files increased by 20%

TASKS

Task	Assignee	Subject	Status	Date
1	A. Adams	Develop file compliance checklist	CLOSED	15-May-05
2	B. Baker	Develop file compliance audit process	CLOSED	15-Jun-05
3	B. Baker	Revise file compliance procedure	OPEN	
4	T. Trainer	Develop training course	OPEN	
5	T. Trainer	Provide file compliance training	OPEN	
6	A. Adams	Implement compliance checklist	OPEN	
7	B. Baker	Conduct monthly compliance audits	OPEN	

Figure 8. A Process Improvement Plan Worksheet.

During the initial deployment of PBM, considerable time was spent defining and modeling processes and determining appropriate measures. This effort continues on an annual basis when each process owner validates with his or her customer that the process and its measures are still accurate and effective. When a new process is developed, it often requires months of data analysis to identify just the right measures to track on a monthly basis.

As in any organization, there is turnover among managers and other personnel, and new process owners always need to be trained. In a similar way, existing process owners receive refresher training on a regular basis as enhancements to PBM and PBMS are continually made.

PBM, Process Redesign, Six Sigma, Lean, and Balanced Scorecard

Most companies embrace a variety of process improvement programs. In some cases, the IT department has a process redesign group that looks for automation opportunities. The same company may also have Six Sigma practitioners spread throughout the company and a Balanced Scorecard group working to define management objectives. Unfortunately, in most cases these groups operate in isolation, often duplicating efforts, and, in the worst case, contradicting each other.

Boeing's A&T Program has individuals trained in each of these disciplines. Unlike most companies, however, these groups are not working independently to define tasks for themselves. Instead, they come together in support of PBM. As specific process owners encounter problems achieving their process objectives, they coordinate with the PBM process team to determine how to improve their performance. In most cases, the individual process owner proposes a solution that a team from the specific process can execute. When they need help, the PBM process team provides it, drawing on specifically trained process change practitioners, as needed.

ISO 9000, CMMI, and Sarbanes-Oxley

During the past two years, publicly held U.S. companies have been struggling to define where and how financial decisions occur within their organizations. They have done this to comply with the requirements of the U.S. Government's Sarbanes-Oxley Act, which Congress passed in the aftermath of several accounting scandals. Implementation of the requirements was complicated and, while it was difficult at best to define the requirements, Boeing A&T already had related processes defined. The applicable process owner and process team studied the Sarbanes-Oxley documentation, and then worked through the process diagrams, identifying every activity and decision required by the legislation. Once the initial documentation was finished, the group checked with other specific process owners to assure that their understanding matched the understanding of all the owners involved, and then generated the required documentation. Boeing A&T has built the Sarbanes-Oxley information into its basic process models and can therefore update it whenever the Sarbanes-Oxley requirements change, as a byproduct of routinely updating process changes.

Dealing with Sarbanes-Oxley went relatively smoothly for Boeing A&T, in part, because it has undertaken several similar exercises. Several years ago, the Boeing process team used its process modeling and measurement system to rapidly generate ISO 9001 documentation. It was accomplished by creating a map to show where each item in ISO related to the Boeing PBM structure. Process owners were then assigned to ensure that their process documentation and related procedural documentation were in compliance with the ISO requirements.

Later, the Boeing A&T process owners did something similar to prove to an audit team that the C-17 Program within Boeing A&T was operating at CMMI Level 5.

Most companies face significant challenges when asked to document their ISO, CMMI, or Sarbanes-Oxley compliance because they don't have the detailed data required by these various systems, or at least they can't organize it in any cohesive format. Boeing A&T, on the other hand, has detailed and precise division-wide data that maps to all the requirements that the various standards expect, and it has its data organized according to a comprehensive process hierarchy. Thus, Boeing A&T will be prepared to conform to any future standard that requires that an organization document how its processes are organized and how they are performing.

The Success of the Boeing A&T Transition to Process-Based Management

Figure 9 provides a summary of the accomplishments that Boeing A&T has achieved as a result of its implementation of the Baldrige framework in general and process management in particular since its launch in 1994. Highlights include receiving the Malcolm Baldrige National Quality Award in 1998 and the California state version of the Baldrige Award, the California Awards for Performance Excellence (CAPE) Gold, and the California Governor's Award, in 2002. Although these achievements are impressive, Boeing A&T operates to the philosophy that they are steps on a continuing journey to improvement, one that is rooted solidly in process management.

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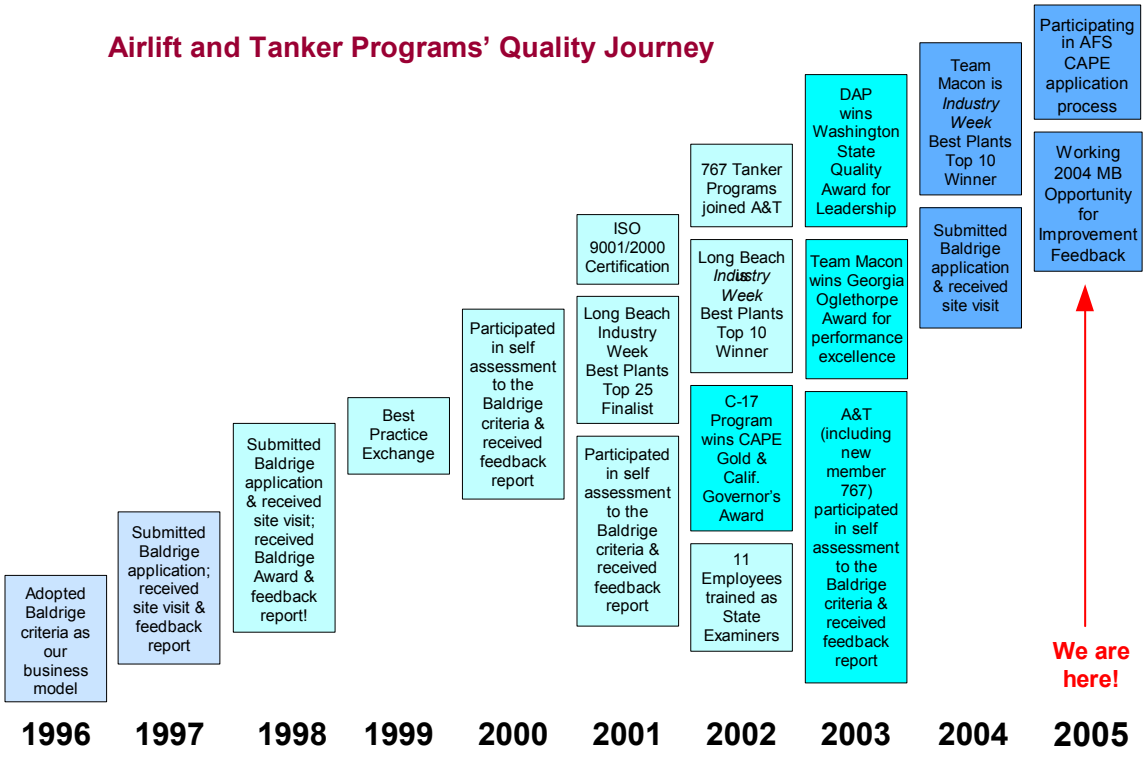

Figure 9. Boeing A&T Achievements from 1996 to 2005.

Synergizing with the improvements gained from the implementation of the Malcolm Baldrige criteria on the C-17 Program and within Boeing A&T, other businesses within Boeing have adopted the Baldrige criteria with much success. Boeing's Logistics Support Systems (formerly Aerospace Support) adopted the PBM methodology as well as the Malcolm Baldrige criteria and was recipient of the 2003 Malcolm Baldrige National Quality Award. In March of 2004, Boeing's IDS organization formally adopted the Malcolm Baldrige Criteria for Performance Excellence as the framework for its business model company-wide. Boeing is additionally embarking on a company-wide process management methodology for all its businesses, which will enable all its programs to operate and report within a common process framework. Meanwhile, IDS is now deploying an automated process management system that will eventually incorporate the Boeing A&T process data currently residing in PBMS.

Summary

Lots of people, today, are talking about Business Process Management. For most, the phrase refers to isolated efforts or, at most, an organization-wide commitment to Six Sigma, performance measurement, or a Balanced Scorecard. Few companies have had the vision and the commitment to organize their entire management effort around processes and to create the infrastructure necessary to integrate and consistently manage all their business processes efforts on a day-to-day basis. Boeing's Airlift and Tanker Programs group is one of the rare exceptions that has not only embraced the vision but followed through and demonstrated the power of the approach.

When one examines the various components of Boeing A&T, one finds elements that are used by hundreds of companies. The difference, however, is that Boeing A&T has pulled them all together into a complete system, and they have placed their business managers, operating as process owners, at the center of the system. Boeing's A&T PBM program isn't something that a

BP group runs. It's simply the way that Boeing's managers run their day-to-day business, as they have for the past 10 years.

Boeing A&T is, today, one of the best organized and managed business organizations in the world, and its performance and quality continue to be maintained on a day-to-day basis by its process owners.

Sidebar 1. Some Basic Process Concepts

Figure A pictures a value chain that is made up of three processes. One of those processes (Core Process 2) is made up of three subprocesses. (Core Process 2 is the superprocess of subprocesses 2.1, 2.2, and 2.3.) This particular process hierarchy has three levels and is made up of a total of seven processes.

Each process has inputs and outputs. The inputs of the Value Chain are also the inputs of Process 1, and the outputs of Process 3 are also the outputs of the Value Chain. The customer of any given process, at any given level, is the process to the right in the sequence. Thus, Subprocess 2.3 is the Customer of Subprocess 2.2. Or, Subprocess 2.2 is the Supplier of Subprocess 2.3. The ultimate customer, in Figure A, is the customer of the C-17 Value Chain -- the U.S. Air Force.

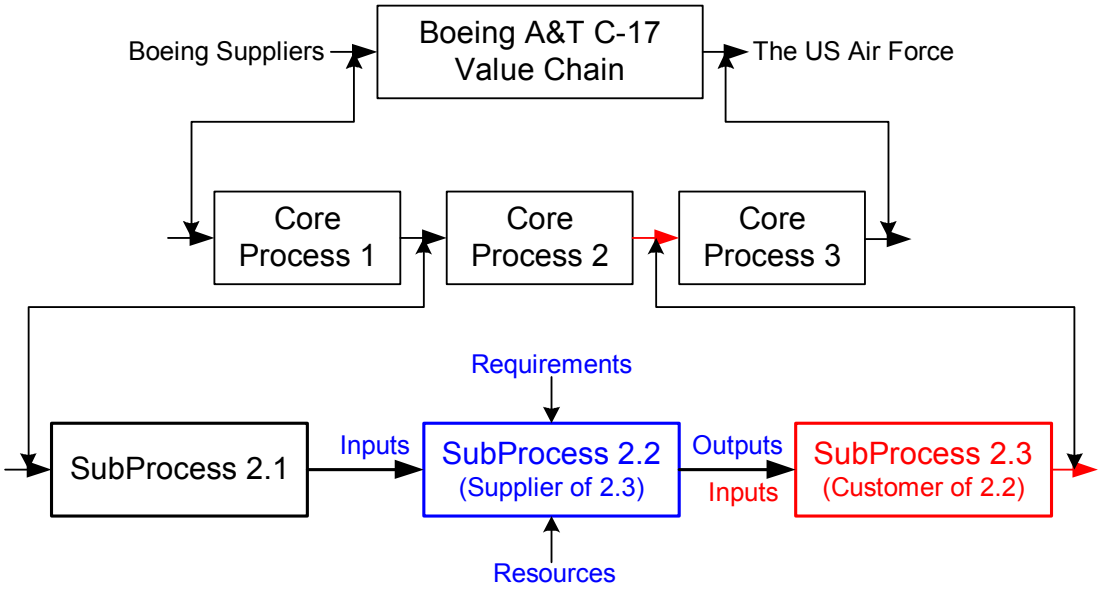

Figure A. Some basic process concepts.

Vertical alignment is achieved by ensuring that the outputs of Subprocess 2.3 are what Core Process 3 needs. Horizontal alignment is assured by being certain that the outputs of Subprocess 2.2 are what Subprocess 2.3 needs.

Process quality (external process measure) is assured by determining that each process' output is on time and of adequate quality. Process efficiency (internal process measure) is determined by assuring that the process is executed in the minimum possible time (cycle time) and by determining that outputs use the minimum necessary resources to achieve the desired outcome.

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Notes

[1] The Baldrige Award is a U.S. government program managed by the U.S. Commerce Department. Information on the Baldrige program is available at http://www.quality.nist.gov The Baldrige Awards are given annually to acknowledge superior companies. They are based on a series of evaluations that consider candidate performance in seven performance categories. The questions about process management are derived from Category 6.

[2] The Baldrige Criteria questions for Category 6, Process Management, include the following concepts:

- **Establishment**: What are your key value creations and key support processes and how does your organization determine them?
- **Requirements**: How do you determine requirements for your key value creation processes, incorporating input from customers, suppliers, and partners?
- **Measures**: What are your key indicators or performance measures to control and improve these processes?
- **Prevention**: How do you prevent rework and defects in these processes?
- **Improvement**: How do you improve these processes?
- **Learning**: How do you share lessons learned?

[3] The **Integrate and Deploy Processes and Procedures process** is one of Boeing A&T's processes, managed by the Process Management Integration group. In effect this is the process that helps Boeing A&T maintain its process health and deployment. Individuals involved in activities that fall within this process perform tasks that one would associate with a PBM Support Group in another organization, and the process owner of this group functions as the Boeing A&T Chief Process Officer. This process is responsible for overseeing the deployment of PBM, training new process managers, monitoring the performance of other processes, assisting process owners who need help, reporting on the process health of the enterprise, and providing other services to the organization. This "process for process management" falls organizationally within the A&T Business Excellence function that is additionally responsible for activities such as A&T Strategic Planning, the A&T Vision Support Plan (a version of a Balanced Scorecard), and the A&T Malcolm Baldrige assessment process.

Pamela Garretson was Director of Business Excellence at Boeing Airlift and Tanker Programs when this paper was first drafted. (She was the process owner of the Integrate and Deploy Processes and Procedures process.) Since then, she has advanced to another position within Boeing, and Eric Anderson has assumed managerial responsibility for PBM deployment.

Paul Harmon is the Executive Editor of Business Process Trends and the author of *Business Process Change* (2003, Morgan Kaufmann).