

# **Metrics for a Platform Team**

by

**John H. Johnson III**

B.S., Electrical Engineering  
Iowa State University, 1988

Submitted to the System Design and Management Program  
in Partial Fulfillment of the Requirements for the Degree of

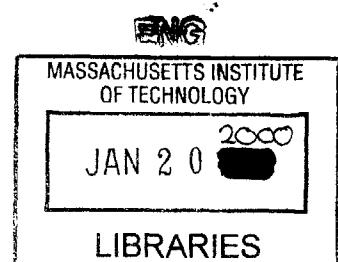
**Master of Science in Engineering and Management**

at the

**Massachusetts Institute of Technology**

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Signature of Author:

MIT System Design and Management Program  
January 14, 1999

Certified by:

*[Signature]* Deborah J. Nightingale  
Professor of Aeronautics and Astronautics  
Thesis Supervisor

Accepted by:

*[Signature]* Thomas A. Kochan  
LFM/SDM Co-Director  
George M. Bushnell Professor of Management

Accepted by:

*[Signature]* Paul A. Lagace  
LFM/SDM Co-Director  
Professor of Aeronautics & Astronautics and Engineering Systems

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Submitted to the System Design and Management Program on January 14, 2000 in Partial Fulfillment of the Requirements for the Degree of Master of Science in Engineering and Management

## **ABSTRACT**

In the ever-increasing competitive culture existing in the global economy, organizations are continuing to strive for success by reengineering, restructuring, and restategizing the way they do business. They are pushed to reduce costs, reduce cycle time, increase productivity, improve quality, and look for new opportunities for growth. In just the past two decades the new innovations in information technology make it possible to gain competitive advantage through information management and measurement. In every organization managers and executives spend extraordinary amounts of time utilizing countless means of measuring and compiling data into seemingly important reports to guide strategic planning and to quantify performance. With this information explosion, managers need to recognize the overall measurement value, identify the waste, and make appropriate changes to optimize utilization to the organization. Without this they waste valuable time and risk leading the company in the wrong direction. A balanced set of metrics need to exist to provide a framework for performance excellence that support the company goals and strategies and align with the enterprise vision.

This thesis develops a framework for a comprehensive evaluation of the Sikorsky Aircraft Platform Teams' measurement system and institutes a method for metric development and utilization. A case study is presented through interviews at Sikorsky Aircraft and Pratt & Whitney. The evaluation consists of literature and competitive benchmarking to compare best practices and target improvement areas, identify the waste, and make appropriate changes to optimize the utilization to the organization. Background is given on metric utilization and development to show a balanced set of metrics which support the company's goals and strategies is needed to provide a framework for performance excellence. In addition, a model for metric development and utilization is generated. This model combines the organizational structure and the Product Development Process of the Sikorsky Platform Teams with methods drawn from literature. Finally, the Sikorsky visions, strategies, goals, and metrics are then mapped to the model to identify deficiencies and improvement opportunities.

Thesis Supervisor: Deborah J. Nightingale  
Title: Professor of Aeronautics and Astronautics

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# **CHAPTER 1**

## **Introduction**

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### **1.0 Statement of the Problem**

In the ever-increasing competitive culture existing in the global economy, organizations are continuing to strive for success by reengineering, restructuring, and restategizing the way they do business. They are pushed to reduce costs, reduce cycle time, increase productivity, improve quality, and look for new opportunities for growth. In just the past two decades the new innovations in information technology make it possible to gain competitive advantage through information management and measurement. In every organization managers and executives spend extraordinary amounts of time utilizing countless means of measuring and compiling data into seemingly important reports to guide strategic planning and to quantify performance. With this information explosion, managers need to recognize the overall measurement value, identify the waste, and make appropriate changes to optimize utilization to the organization. Without this they waste valuable time and risk leading the company in the wrong direction. A balanced set of metrics is needed to provide a framework for performance excellence that supports the company goals and strategies and aligns with the enterprise vision.

### **1.1 Thesis Objective**

This thesis develops a framework for a comprehensive evaluation of the Sikorsky Aircraft Platform Teams' measurement system and institutes a method for metric development and utilization. The evaluation consists of literature and competitive benchmarking to compare best practices and the use of a metric assessment survey. A case study is presented through interviews at Sikorsky Aircraft and Pratt & Whitney. The

results are used to target improvement areas, identify the waste, and make appropriate changes to optimize the utilization to the organization.

In addition, a background is given on metric utilization and development to show a balanced set of metrics need to exist to provide a framework for performance excellence. These metrics need to support the company goals and strategies and align with the overall enterprise vision. Next, a model for metric development and utilization is generated. This model combines the organizational structure and the Product Development Process of the Sikorsky Platform Teams with methods drawn from literature. Finally, the Sikorsky visions, strategies, goals, and metrics are then mapped to the model to identify deficiencies and improvement opportunities.

## **1.2 Sikorsky Company Background**

Sikorsky Aircraft, a subsidiary of United Technologies Corporation, is a world leader in the design, manufacturing and support of advanced helicopters for commercial, military and general aviation users. The main manufacturing facility is based in Stratford, Connecticut and is supported from other outlying facilities in Florida and Alabama. Sikorsky delivered a total of 99 aircraft in 1998 and brought in revenues of 1.6 billion. Core programs at Sikorsky are based on the H-60 aircraft a veteran with over 20 years of production and 1500 units fielded. These programs include the Black Hawk and Navel Hawk aircraft and are being operated by 24 governments around the world and all five branches of the United States armed forces.

## **CHAPTER 2**

### **Methodology**

---

#### **2.0      Introduction**

In this thesis, a framework is developed for a comprehensive evaluation of the measurement system for Platform Teams at Sikorsky Aircraft. Improvement areas are identified and a method for metric development and utilization is presented.

#### **2.1      Evaluating the Measurement System**

The evaluation begins with a literature search of four methods to assess the quality of an organization's measurement system. First, an evaluation of the financial measurements system is described by a "Four Stage Model for Designing Cost and Performance" in the book *Cost & Effect* by Robert Kaplan & Robin Cooper (HBS, 1998). Next, a presentation of the "Process and Metric Maturity Model" from Raytheon Systems Company in *A Management Guide for the Development and Deployment of Strategic Metrics* (Raytheon, 1998) provides a five level categorization of measurement maturity. The third method of metric assessment presented is from the *Malcolm Baldrige National Quality Award Program Criteria for Performance Excellence* (1999). Seven of the nineteen performance-oriented requirements specifically identify the quality of the metric system and are used to pinpoint problematic areas and identify solutions in the measurement system. The last method of metric assessment discussed contains the "Strategic Measurement Model" and a measurement assessment survey from Mark Graham Brown in the book *Keeping Score* (Quality Resources, 1996). This model and survey provide a comprehensive overall assessment of an organization's measurement system.

Utilizing these four methods of assessing the quality of an organizations measurement system, a “Best Practice” method is established to evaluate the measurement system of Sikorsky Platform Teams and Pratt & Whitney Integrated Product Teams. The resultant method includes the use of the Metric Assessment Survey shown in Appendix A and The Ten Requirements for Good Metrics in Appendix B. These help identify the waste in the existing metric system and are used to make appropriate changes to optimize utilization to the organization.

## **2.2 Establishing a New Metric System**

The literature search continues with three methods that define a structure for developing a new measurement system. First, the Balanced Scorecard from the book, *The Balanced Scorecard* (HBS, 1996) by Robert Kaplan & David Norton, provides a method to link all aspects of the company measurement system with the organizational strategies and visions. Next, a detailed seven-step system to designing efficient metrics is presented by John Hauser and Gerald Katz in the article *Metrics: You Are What You Measure* (European Management Journal, Oct. 1998). Finally, the Raytheon Systems Company in *A Management Guide for the Development and Deployment of Strategic Metrics* (Raytheon, 1998) identifies four tools to guide development of a complete measurement system. These methods show a balanced set of metrics need to exist to provide a framework for performance excellence. In addition, metric utilization and development need to support the company goals and strategies as well as align with the enterprise vision.

## **2.3 Sikorsky Platform Teams Case Study**

Following the literature search, a case study is presented through interviews at Sikorsky Aircraft and Pratt & Whitney. The organizational structures and product development processes are described in detail. The “Best Practice” method of metric evaluation, derived from the literature search, is used to target improvement areas, identify the waste, and make appropriate changes to optimize the utilization to the organization. Further assessment is then performed from benchmarking the measurement system at Pratt & Whitney. The company Pratt & Whitney was selected for comparison based on following three reasons: First of all, Pratt & Whitney and Sikorsky Aircraft are both subsidiaries of United Technologies Corporation. Second both companies are world leaders in the design, manufacturing, and support in the aerospace field. And finally, Pratt & Whitney is one of the leading companies integrating “Lean Thinking” into their organization.

## **2.4 Model Generation**

From these interviews and assessments, a model for metric development and utilization is generated. This model combines the organizational structure and the Product Development Process of the Sikorsky Platform Teams with methods drawn from literature. The Sikorsky visions, strategies, goals, and metrics are then mapped to the model to further identify deficiencies and improvement opportunities. From these observations conclusions are drawn and recommendations are presented to improve the metric system of the Platform Teams at Sikorsky Aircraft.

## CHAPTER 3

### Metrics in Perspective: Literature Review

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#### **3.0 Evaluating the Measurement System**

In the quest to find the “Best Practice” in metric development and utilization, the first step is to assess the quality of the measurement system that is already in place. In the following sections four methods of evaluation are discussed. First, Kemper & Norton identify in their book *Cost and Effect* (HBS, 1998) a “Four Stage Model for Designing Cost and Performance.” This model is used to evaluate the financial measurements of an organization. Next, the “Process and Metric Maturity Model,” presented by Raytheon Systems Company in *A Management Guide for the Development and Deployment of Strategic Metrics* (Raytheon, 1998), identifies a five level categorization of measurement maturity. Then utilizing the *Malcolm Baldrige National Quality Award Program Criteria for Performance Excellence* (1999), seven of the nineteen requirements for running an effective world-class organization are presented. These seven requirements specifically concentrate on performance measurements. And finally, the “Strategic Measurement Model” from the book *Keeping Score* (Quality Resources, 1996), is presented with a fifty-question measurement assessment survey that is designed to rate all aspects of the metric system in an organization.

#### **3.1 Financial Measurement**

To begin the first assessment of the measurement system, concentration will be on the financial measurements of an organization. The “Cost System Design Model,” in the book *Cost & Effect* (Figure 1), contains a four-stage system that identifies the condition of the overall measurement system. It divides the organization into four categories: Data

Quality, External Financial Reporting, Product Customer Costs, and Operational and Strategic Control. These categories exhibit certain characteristics during each stage of the Model and are presented below:

**Stage I Systems: Inadequate for Financial Reporting –**

In this stage the cost system is not adequate for periodic financial reporting. Extensive amounts of time and resources are required to close the books each accounting period. Furthermore, variances occur in physical inventories and book values, and there is a lack of integrity and ability to audit the accounts of the system.

**Stage II Systems: Financial Reporting-Driven –**

In this stage the cost and performance data meets the financial reporting requirements. A financial group provides the information and prepares the financial reports. The information does not come directly from activities and business processes. Therefore the organizational costs are highly distorted and the reports typically provide late and unorganized feedback.

**Stage III Systems: Customized, Managerially Relevant, Stand-Alone –**

In stage III the organizational costs are provided by customized approaches separate from the financial system. Accurate financial information is provided by the use of Activity Based Costing for activities, processes, products, services, customers, and organizational units. Activity Based Costing is a system that gives managers a better picture of the economics of their operations by providing accurate information about the resource demands by individual products, services, customers, and activities. The financial information is used to provide relevant, timely performance measurement feedback to the managers and employees on efficiency, quality, cycle time, and continuous improvement activity support.

#### **Stage IV Systems: Integrated Cost Management and Financial Reporting –**

In this final stage, the cost and performance measurement reports are integrated into the culture of the organization. These measures focus on providing improvements to future performance and function in a feed-forward mode.

Activity Based Costing systems are integrated with operational feedback systems. In addition, the actual expenditures of individual organizational units are analyzed and provide efficiencies and capacity utilization information back into the Activity Based Costing system.

## **Cost System Design Model**

<b>Systems Aspects</b>	<b>Stage I Systems</b> Broken	<b>Stage II Systems</b> Financial Reporting-Driven	<b>Stage III Systems</b> Specialized	<b>Stage IV Systems</b> Integrated
<b>Data Quality</b>	<ul style="list-style-type: none"><li>•Many Errors</li><li>•Large Variances</li></ul>	<ul style="list-style-type: none"><li>•No surprises</li><li>•Meets audit standards</li></ul>	<ul style="list-style-type: none"><li>•Shared databases</li><li>•Stand-alone systems</li><li>•Informal linkages</li></ul>	<ul style="list-style-type: none"><li>•Fully linked databases and systems</li></ul>
<b>External Financial Reporting</b>	<ul style="list-style-type: none"><li>•Inadequate</li></ul>	<ul style="list-style-type: none"><li>•Tailored to financial reporting needs</li></ul>	<ul style="list-style-type: none"><li>•Stage II system maintained</li></ul>	<ul style="list-style-type: none"><li>•Financial reporting systems</li></ul>
<b>Product/ Customer Costs</b>	<ul style="list-style-type: none"><li>•Inadequate</li></ul>	<ul style="list-style-type: none"><li>•Inaccurate</li><li>•Hidden costs and profits</li></ul>	<ul style="list-style-type: none"><li>•Several stand alone ABC systems</li></ul>	<ul style="list-style-type: none"><li>•Integrated ABM systems</li></ul>
<b>Operational and Strategic Control</b>	<ul style="list-style-type: none"><li>•Inadequate</li></ul>	<ul style="list-style-type: none"><li>•Limited Feedback</li><li>•Delayed feedback</li></ul>	<ul style="list-style-type: none"><li>•Several stand-alone performance measurement systems</li></ul>	<ul style="list-style-type: none"><li>•Operational and strategic performance measurement systems</li></ul>

**Figure 1. Cost System Design Model (Source: Kaplan & Cooper, 1998)**

Although the model presents only one area of organizational measurement, it establishes a beginning framework to assess the condition of the financial metrics in the organization. This framework identifies new measurement methods such as Activity Based Costing and Activity Based Management but the progression between one stage and another is not immediately clear. Not enough information is given in the model to assess what direction an organization should progress to step through each stage of the model. Further explanation is necessary at each stage to identify root problems in the assessment of the measurement system. The “Cost System Design Model” provides a beginning structure to identify the financial direction an organization should progress in order to direct a new profitable path for the future and get away from just reporting the past.

### **3.2 Metric Maturity**

A further assessment of an organization’s measurement system is performed by using the “Process and Metric Maturity Model” from Raytheon Systems Company (Figure 2). This model categorizes the maturity of an organization into five separate levels. It provides an opportunity to continually assess the progress of the organization against the rest of the world, verifies that priorities and goals are aligned with strategic objectives, and aligns these strategic objectives to the rest of the organization. The five levels are explained below:

#### **Level 1: Initial-**

This is the lowest stage in an organization. At this stage, the organization has many metrics that are individually sub-optimized to meet the specific needs of each group. They lack the organization strategic objective focus and do not align with the customer interest. In addition, the metrics weight heavily on result-orientation and do not provide indications for future performance or strategic planning.

### **Level 2: Vertical Alignment-**

At this level the metrics begin to align with the strategic objectives of the organization. The processes are well documented and deployed across the organization.

### **Level 3: Horizontal Alignment-**

The focus at this level is on the customer. The organization includes core customer-related metrics that are optimized for customer satisfaction and continue to achieve strategic objectives. Furthermore, the metrics allow for seamless work flow between local organizations internal to the enterprise.

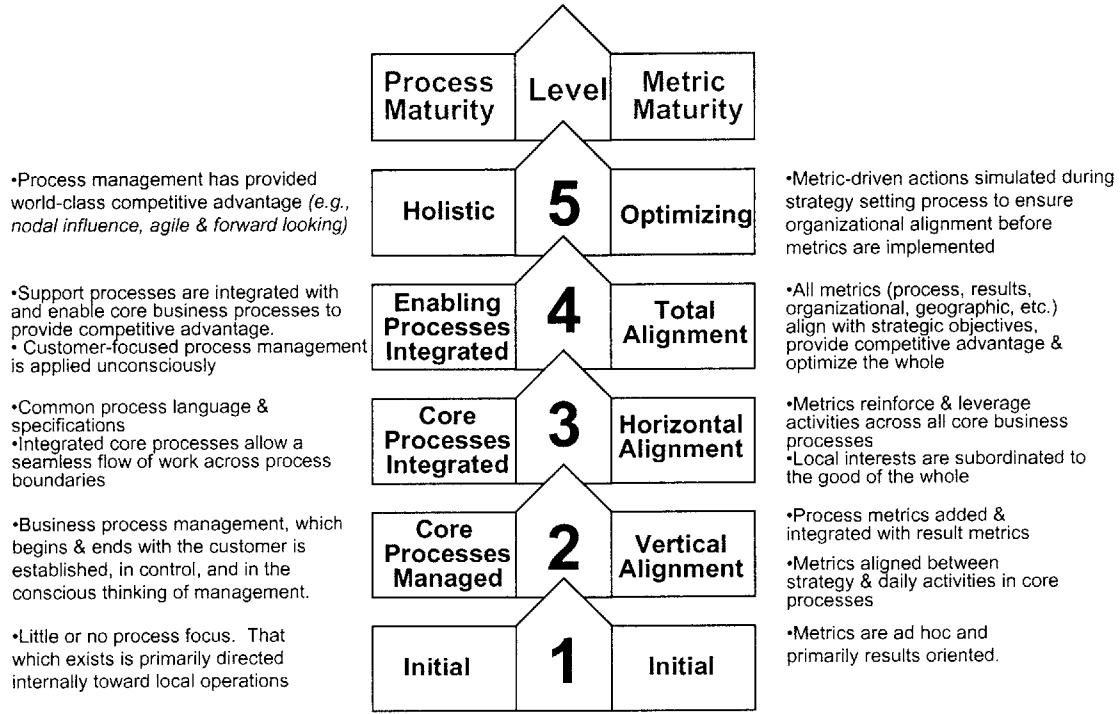
### **Level 4: Total Alignment-**

When the enterprise moves to this level, the metrics provide linkage to the external customer and are integrated into the organization's culture. They also influence behavior, drive action, validate results, and are effectively used to forecast potential problems.

### **Level 5: Optimizing-**

At this optimum level, the enterprise is now able to predict the outcome of using a metric on a strategy before it is deployed.

# Process and Metric Maturity Model



Raytheon Systems, 1998

**Figure 2. Process and Maturity Model (Source: Raytheon System Company, 1998)**

Similar to the “Four Stage Model for Designing Cost and Performance,” the “Process and Metric Maturity Model” establishes a framework to assess the condition of the overall measurement system. The model also provides a tool to identify improvement opportunities and set a standard for common communications and understanding. The levels of the model progress based on metrics that are aligned to other factors in the organization and provide future indications of performance. To further assess the effectiveness of individual metrics, Raytheon Systems Company present a series of questions that can be asked about each metric. A good metric should be strategic, quantitative, and qualitative and answer the following questions:

- 1) Does it clearly define what constitutes business excellence?
- 2) Does it provide the information required to set aggressive yet achievable strategic objectives and stretch goals?
- 3) Does it accurately portray our progress and profitability of achieving both long-term strategic objectives and near-term milestones?
- 4) Does it identify the root cause of barriers?
- 5) Does it focus the organization on the priority improvement needs?
- 6) Does it drive the behavior and actions required to achieve the objectives?
- 7) Does it align work with value?
- 8) Is it easy to use?
- 9) Does it involve everyone?

Measurement systems whose metrics answer these questions correctly are the basis of providing business excellence and optimum measurement maturity.

### **3.3 Performance Excellence Criteria for Metrics**

The *Malcolm Baldrige National Quality Award Program Criterion for Performance Excellence* broadens the measurement assessment to all areas of the organization. For more than a decade the Baldrige Criteria for Performance Excellence has given organizations the opportunity to benchmark their companies against industry leaders and improve their business results by providing a framework for performance excellence through self-assessment. These tools have been used by thousand of U.S. organizations to strengthen competitiveness and improve on the critical factors that drive their business success. The Malcolm Baldrige National Quality Award, which is presented by the President of the United States at a special ceremony, is given to the organization that scores the best in nineteen performance-oriented requirements (Figure 3). Award recipients have typically out performed the Standard and Poor's 500 by 3 to 1.

Recipients also report an average annual growth rate in productivity (in income per employee) of over 9 percent. The award is managed by the National Institute of Standards and Technology and is the responsibility of the Department of Commerce. The Baldrige Award criteria have become a widely accepted set of standards for running an effective organization and places an emphasis on selecting a few key performance metrics that link to the key success factors of the organization. Although the award is a combination of overall company performance, seven of the nineteen performance-oriented requirements specifically identify the quality of the metric system and account for more than half of the scoring. These seven requirements are identified below:

1. Measurement of Organizational Performance

How does the organization provide effective performance measures for understanding, aligning, and improving performance at all levels and in all parts of the organization?

2. Analysis of Organizational Performance

How does the organization analyze performance data and information to assess and understand overall organizational performance?

3. Customer Focused Results

What are the key measures of customer focused results, including customer satisfaction, loyalty, and product/service performance?

4. Financial and Market Results

What are the key measures of financial and marketplace performance results, including financial performance, financial return, economic value, market share/position, business growth, and new markets entered?

## 5. Human Resource Results

What are the key measures of human resource results, including employee well being, satisfaction, development, and work system performance/effectiveness?

## 6. Supplier and Partner Results

What are the key measures of supplier and partner results, including performance and cost improvements resulting from supplier and partner performance improvements?

## 7. Organizational Effectiveness Results

What are the key measures of operational performance results that contribute to the achievement of organizational effectiveness/efficiency, including measurements of key design, production, delivery, productivity, cycle time, regulatory/legal compliance, and accomplishments of organizational strategy?

Utilizing these seven categories, along with the scoring guidelines identified in Figure 4 and Figure 5, an assessment can be made of the quality of the organization's measurements system. Organizations with world-class business results typically score an average above 70%.

## CRITERIA FOR PERFORMANCE EXCELLENCE

<b>Categories/Items</b>	<b>Point Values</b>
<b>1 Leadership</b>	<b>125</b>
1.1 Organizational Leadership	85
1.2 Public Responsibility and Citizenship	40
<b>2 Strategic Planning</b>	<b>85</b>
2.1 Strategy Development	40
2.2 Strategy Deployment	45
<b>3 Customer and Market Focus</b>	<b>85</b>
3.1 Customer and Market Knowledge	40
3.2 Customer Satisfaction and Relationships	45
<b>4 Information and Analysis</b>	<b>85</b>
4.1 Measurement of Organizational Performance	40
4.2 Analysis of Organizational Performance	45
<b>5 Human Resource Focus</b>	<b>85</b>
5.1 Work Systems	35
5.2 Employee Education, Training, and Development	25
5.3 Employee Well-Being and Satisfaction	25
<b>6 Process Management</b>	<b>85</b>
6.1 Product and Service Processes	55
6.2 Support Processes	15
6.3 Supplier and Partnering Processes	15
<b>7 Business Results</b>	<b>450</b>
7.1 Customer Focused Results	115
7.2 Financial and Market Results	115
7.3 Human Resource Results	80
7.4 Supplier and Partner Results	25
7.5 Organizational Effectiveness Results	115
<b>TOTAL POINTS</b>	<b>1000</b>

**Figure 3. Criteria for Performance Excellence**

(Source: Baldrige Criteria, 1999)

## SCORING GUIDELINES FOR APPROACH/DEVELOPMENT

SCORE	APPROACH/DEPLOYMENT
0%	<ul style="list-style-type: none"> <li>no systematic approach evident; anecdotal information</li> </ul>
10% to 20%	<ul style="list-style-type: none"> <li>beginning of a systematic approach to the basic purposes of the Item</li> <li>major gaps exist in deployment that would inhibit progress in achieving the basic purposes of the Item</li> <li>early stages of a transition from reacting to problems to a general improvement orientation</li> </ul>
30% to 40%	<ul style="list-style-type: none"> <li>a sound, systematic approach, responsive to the basic purposes of the Item</li> <li>approach is deployed, although some areas or work units are in early stages of deployment</li> <li>beginning of a systematic approach to evaluation and improvement of basic Item processes</li> </ul>
50% to 60%	<ul style="list-style-type: none"> <li>a sound, systematic approach, responsive to the overall purposes of the Item</li> <li>approach is well-deployed, although deployment may vary in some areas or work units</li> <li>a fact-based, systematic evaluation and improvement process is in place for basic Item processes</li> <li>approach is aligned with basic organizational needs identified in the other Criteria Categories</li> </ul>
70% to 80%	<ul style="list-style-type: none"> <li>a sound, systematic approach, responsive to the multiple requirements of the Item</li> <li>approach is well-deployed, with no significant gaps</li> <li>a fact-based, systematic evaluation and improvement process and organizational learning/ sharing are key management tools; clear evidence of refinement and improved integration as a result of organizational-level analysis and sharing</li> <li>approach is well-integrated with organizational needs identified in the other Criteria Categories</li> </ul>
90% to 100%	<ul style="list-style-type: none"> <li>a sound, systematic approach, fully responsive to all the requirements of the Item</li> <li>approach is fully deployed without significant weaknesses or gaps in any areas or work units</li> <li>a very strong, fact-based, systematic evaluation and improvement process and extensive organizational learning/sharing are key management tools; strong refinement and integration, backed by excellent organizational-level analysis and sharing</li> <li>approach is fully integrated with organizational needs identified in the other Criteria Categories</li> </ul>

**Figure 4. Scoring Guidelines for Approach/Development**

**(Source: Baldrige Criteria, 1999)**

## SCORING GUIDELINES FOR RESULTS

SCORE	RESULTS
0%	<ul style="list-style-type: none"> <li>no results or poor results in areas reported</li> </ul>
10% to 20%	<ul style="list-style-type: none"> <li>some improvements <i>and/or</i> early good performance levels in a few areas</li> <li>results not reported for many to most areas of importance to the organization's key business requirements</li> </ul>
30% to 40%	<ul style="list-style-type: none"> <li>improvements <i>and/or</i> good performance levels in many areas of importance to the organization's key business requirements</li> <li>early stages of developing trends and obtaining comparative information</li> <li>results reported for many to most areas of importance to the organization's key business requirements</li> </ul>
50% to 60%	<ul style="list-style-type: none"> <li>improvement trends <i>and/or</i> good performance levels reported for most areas of importance to the organization's key business requirements</li> <li>no pattern of adverse trends and no poor performance levels in areas of importance to the organization's key business requirements</li> <li>some trends <i>and/or</i> current performance levels – evaluated against relevant comparisons <i>and/or</i> benchmarks – show areas of strength <i>and/or</i> good to very good relative performance levels</li> <li>business results address most key customer, market, and process requirements</li> </ul>
70% to 80%	<ul style="list-style-type: none"> <li>current performance is good to excellent in areas of importance to the organization's key business requirements</li> <li>most improvement trends <i>and/or</i> current performance levels are sustained</li> <li>many to most trends <i>and/or</i> current performance levels – evaluated against relevant comparisons <i>and/or</i> benchmarks – show areas of leadership and very good relative performance levels</li> <li>business results address most key customer, market, process, and action plan requirements</li> </ul>
90% to 100%	<ul style="list-style-type: none"> <li>current performance is excellent in most areas of importance to the organization's key business requirements</li> <li>excellent improvement trends <i>and/or</i> sustained excellent performance levels in most areas</li> <li>evidence of industry and benchmark leadership demonstrated in many areas</li> <li>business results fully address key customer, market, process, and action plan requirements</li> </ul>

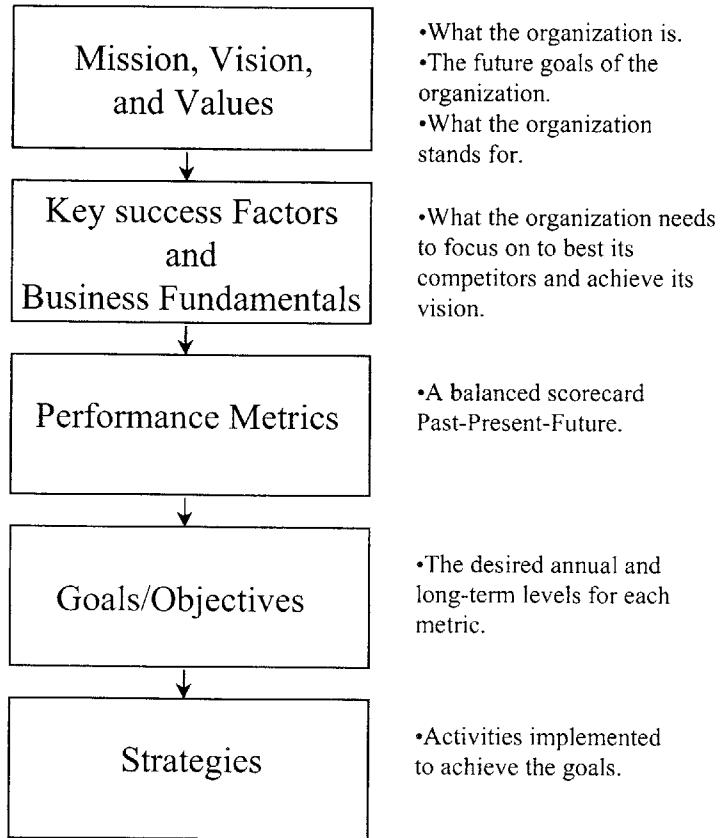
### **Figure 5. Scoring Guidelines for Results (Source: Baldrige Criteria, 1999)**

The *Malcolm Baldrige National Quality Award Program Criterion for Performance Excellence* establishes five different categories of metric utilization: Organizational Performance, Customer Focus, Financial and Market Performance, Human Resource Results, and Supplier and Partner Performance. Each category is further broken down into specific requirements for performance excellence. Through these requirements an organization can begin to pinpoint problematic areas in their measurement systems and identify possible solutions.

### **3.4 Measurement Assessment Survey**

The final model presented, the “Strategic Measurement Model” (Figure 6), is from the book *Keeping Score* by Brown. This model, along with a fifty-question measurement assessment survey, portrays the process for developing an organization’s measurement system and rates all aspects of an organization’s metric system.

# Strategic Measurement Model



**Figure 6. Strategic Measurement Model (Source: Brown, 1996)**

The Measurement System Self-Assessment Survey from *Keeping Score* (below) stems from the model and utilizes fifty questions arranged in nine parts to fully evaluate all aspects of an organization's measurement system. It establishes a score relative to a ranking from 1 to 5, shown below, allowing the organization to benchmark itself against the standards identified in the survey and other organizations.

## Survey Ranking

1. Strongly Agree
2. Agree
3. Somewhat Agree
4. Disagree
5. Strongly Disagree

## **Survey Questions**

### **Part I: Overall Approach to Measurement**

1. The metrics in our database are tightly linked to the key success factors that will allow us to differentiate ourselves from our competitors.
2. Our database was built with a plan, rather than being something that just evolved over time.
3. Our CEO President looks at no more than 20 measures every month to evaluate the overall organization's performance.
4. Measures of performance are most consistent across our business units/locations.
5. We have a well-balanced set of metrics, with about equal amounts of measures/data in each of the following categories: financial performance, operational performance, customer satisfaction, employee satisfaction, product/service quality, supplier performance, and safety/environmental performance.

### **Part II: Specific Types of Measures on your Scorecard**

#### **Customer-Related Measures**

6. Our database includes good hard measures of customer satisfaction/value such as repeat/loss business, returns, and so on.
7. Our organization collects data on both customer satisfaction and perceived value levels using a variety of techniques such as telephone surveys, mail surveys, and focus groups.
8. One survey for measuring customer satisfaction focus on delighting customer rather than just satisfying them.
9. What we ask customers in our satisfaction surveys or discussions is based upon thorough research to identify customers' most important requirements.
10. We combine various hard and soft measures of customer satisfaction and value into an overall satisfaction index.

#### **Employee-Related Measures**

11. We survey our employees at least once a year to determine their satisfaction levels with various aspects of how the organizations run.
12. Employee surveys are anonymous and more than 75 percent are returned each year.
13. Research is done to determine what is important to employees before putting together or buying a survey with standard questions.
14. Our organization collects data on other metrics that relate to employee satisfaction such as voluntary turnover, absenteeism, hours worked per week, request for transfers, stress-related illness, and so on.
15. Individual measures of employee satisfaction are aggregated into an overall employee satisfaction index.

#### **Financial Measures**

16. We have identified a few (e.g., 4 to 6) key measures of our overall financial performance.
17. Financial measures are a good mix of short- and long-term measures of financial success.
18. Financial measures are consistent across different units/locations.
19. We collect financial data on our major competitors to use in evaluating our own performance and in setting goals.
20. The organization aggregates financial data into one or two summary statistics that reflect overall performance, such as economic value-added (EVA) or return on assets (ROA).

## Operational Measures

21. The organization has developed a set of 4 to 6 common operational measures such as value added per employee that are used in all locations/functions.
22. Any process measures that are collected are directly related to key product/service characteristics that customers care about.
23. Cycle time is used as a key operational measure throughout the organization.
24. Operational measures allow us to prevent problems rather than just identify them.
25. The organization has established measurable standards for all key process measures.

## Supplier Measures

26. The organization has a rating system for evaluating supplier performance.
27. Our supplier rating is a mix of hard data such as products returned/shipments rejected, and soft measures such as our satisfaction levels with suppliers' responsiveness.
28. The quality of goods and services purchased from suppliers is measured on a regular basis.
29. Our organization asks suppliers for product data and encourages self-inspection.
30. Staying within our price guidelines is only one of many measures used to evaluate and select suppliers.

## Product/Service Quality Measures

31. Characteristic of product/services that are measured are those that are most important to the customers.
32. If 100 percent of products/services are not checked, then large enough sample sizes are used to ensure that all products/services meet standards.
33. Automated measurement devices are used whenever possible to avoid errors caused by poor human judgment.'
34. Measures for services are related to accomplishments rather than behaviors (e.g., percent of correct orders filled or percent of flights that take off on time vs. smiling when greeting a customer).
35. Measures of product/service quality are expressed as actual numbers rather than percentages of defect-free products/services.

## Safety/Environmental/Public Responsibility Measures

36. The organization collects data on safety and environmental performance at least once a month, using several different metrics.
37. Measures of safety are more behavioral and preventive in nature rather than the typical lost-time accidents.
38. Environment measures go beyond those mandated by the EPA and other regulatory agencies.
39. The organization collects data on regulatory matters and measures of public responsibility such as hours of community service or awards received from community/civic groups.
40. The organization has developed a public responsibility index that is an aggregation of safety, environmental, and community service measures.

### **Part III: Reporting and Analyzing Data**

41. The organization reports data from all sections of its scorecard in a single report to all key managers.
42. Data are presented graphically in an easy to read format that requires minimal analysis to identify trends and levels of performance.
43. Data on customer satisfaction, employee satisfaction, and innovation/growth are reviewed as often and by the same executives as data on financial, operational, product/service, and supplier performance.
44. The organization has done research to identify correlations between customer satisfaction and financial performance.
45. The organization understands the relationship between all the key measures in its overall scorecard.
46. Performance data are analyzed and used to make key decisions about the organization's business.
47. The key measures are consistent with the organization's mission, values, and long term goals and strategies.
48. The organization continually evaluates and improves its measures and methods used to collect and report performance data.
49. Automated and human (e.g., surveys/checklists) measurement devices are calibrated on a regular basis to ensure accuracy and reliability.
50. The measures in the organization's scorecard are the same ones on which annual and longer-term goals are set during the planning process.

The score is calculated by adding up questions 1 to 5 and 41 to 50, this total is then multiplying by 2. The sum is then added to the total of questions 6 to 40. Finally, the table below is used to rank the organization.

#### **Ranking**

Score of 276 - 325 –

World class approach to measuring the organization's performance.

Score of 226 – 275 –

Well-balanced Systematic approach to measurement, some weaknesses.

Score of 176- 225 –

Measurement system is in the middle, off to a good start to reengineering the approach to measurement but have significant weaknesses.

Score of 175 or less –

Long way from having a balanced measurement system.

The survey stresses the importance of focusing on the past, present, and future and includes the measurements for the needs of the customer, shareholders, and the employees. It combines the metric alignment to strategies and visions from the “Process and Metric Maturity Model” with a variation of the five metric utilization categories from the *Malcolm Baldrige National Quality Award Program Criterion for Performance*

*Excellence*. The survey encompasses a comprehensive assessment of the measurement system and provides a tool to identify improvement opportunities.

### **3.5 Measurement Evaluation Summary**

Four methods were presented to assess the quality of an organization's measurement system. First, the "Four Stage Model for Designing Cost and Performance," from *Cost and Effect*, established a framework to evaluate the financial measurements of an organization. It identified new measurement methods such as Activity Based Costing and Activity Based Management but fell short in providing enough information to assess what direction an organization should progress to step through each stage of the model.

Next, the "Process and Metric Maturity Model," presented by Raytheon Systems Company, used a five level categorization of measurement maturity to concentrate on aligning metrics with strategies and visions. It established a framework to assess the condition of the overall measurement system and identified improvement opportunities.

The third method utilized the *Malcolm Baldrige National Quality Award Program Criteria for Performance Excellence*. Five different categories of metric utilization: Organizational Performance, Customer Focus, Financial and Market Performance, Human Resource Results, and Supplier and Partner Performance were established to pinpoint problematic areas and identify solutions in the measurement system.

Finally, the "Strategic Measurement Model" and a measurement assessment survey was presented from *Keeping Score* that focused on the past, present, and future and provided a comprehensive overall assessment of the measurement system.

Utilizing these four methods of assessing the quality of an organization's measurement system, a "Best Practice" method is presented to evaluate the measurement systems of Sikorsky Platform Teams and Pratt & Whitney Integrated Product Teams. Adapting the metric utilization categories identified in the Baldrige Criteria and in *Keeping Score* to the Sikorsky Platform Teams identifies the following four metric utilization categories: Operations/Finance, Other Internal Stakeholders, Customer Satisfaction, and Supplier Performance. The metric utilization category, Other Internal Stakeholders, is further broken down to include the following subcategories: Employee Satisfaction, Safety, Product & Service Quality, and Internal Customer Satisfaction. Utilizing these "Best Practice" metric utilization categories, the Measurement System Self-Assessment Survey is reorganized as shown in Appendix A. Furthermore, Appendix B presents The Ten Requirements for Good Metrics, which is a variation of Raytheon Systems Company's nine questions that can be asked when assessing a metric system. The resultant Metric Assessment Survey and The Ten Requirements for Good Metrics forms the basis used for a comprehensive evaluation of the overall quality of the measurement systems in the following chapters of this thesis.

### **3.6 Establishing a New Metric System**

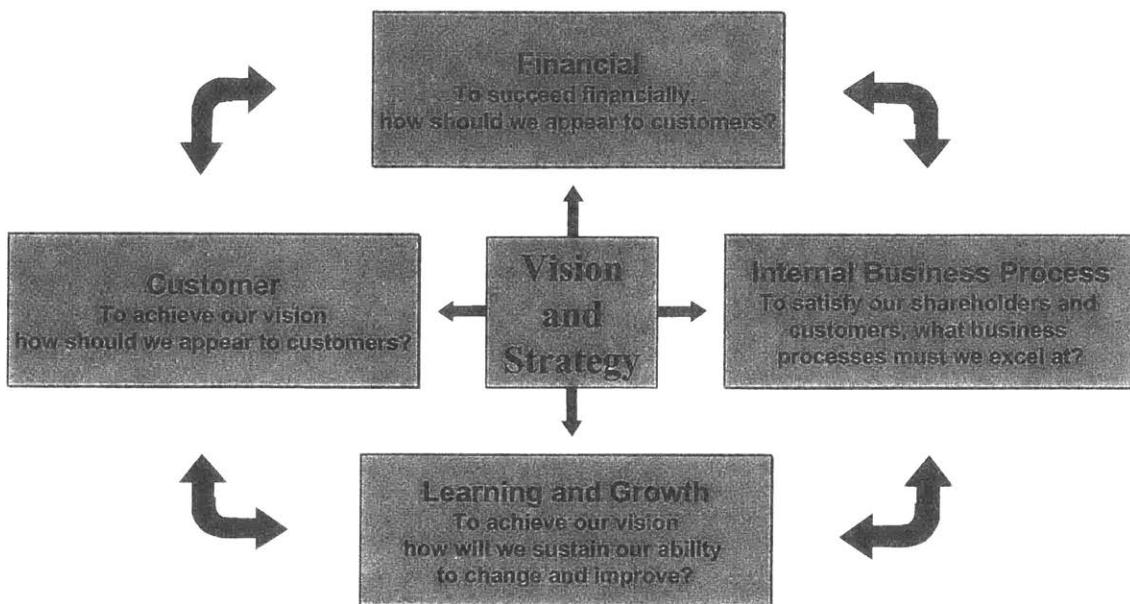
After performing a comprehensive metric evaluation of the current measurement system and identifying improvement opportunities, the next step is to define the structure for developing a new measurement system. In the following sections, three methods of development will be discussed. First, the Balanced Scorecard from the book *The Balanced Scorecard* (HBS, 1996), by Kaplan & Norton, provides a method to link all aspects of the company measurement system with the organizational strategies and visions. Next, a detailed seven-step system to designing efficient metrics is presented by Hauser and Katz in the article *Metrics: You Are What You Measure* (European Management Journal, Oct 1998). And finally, Raytheon Systems Company in *A*

*Management Guide for Development and Deployment of Strategic Metrics* (Raytheon, 1998), identifies four tools to guide development of a complete measurement system.

### **3.7 The Balanced Scorecard Approach**

The first method presented for developing a new measurement system is the Balanced Scorecard from Kaplan and Norton. The Balanced Scorecard is an all-inclusive system that measures the key processes that drive company profitability and links the long-term strategies with short-term results. It first identifies the goals and then breaks them down into measurable metrics. The Scorecard is then used to record whether the company is achieving these goals. In addition, the Scorecard is used as a tool for communicating the ever-changing corporate strategies to the complete organization and especially to the employees responsible for reaching them. The Scorecard identifies four main areas of metric development: Financial, Customer, Learning and Growth, and Internal Business Process (Figure 7). These areas are limited to a few key measurements that focus on the important things that really need to be achieved. Furthermore, the measurements provide feedback on how the departments and business units are performing in each area. The Scorecard requires the metrics to be continually refined to reflect the current company strategies and align with corporate vision.

# The Balanced Scorecard



Source: From Kaplan and Norton, *The Balanced Scorecard*

Figure 7.

## 3.8 Seven Step System to Lean Metric Development

The next approach for metric development presented by Hauser & Katz uses a detailed seven step system to design effective “lean” metrics. This system also incorporates several counter-productive pitfalls to be avoided during the development process. The counter-productive pitfalls of metrics are: Delaying Rewards, Using Risky Rewards, Making Metrics Hard to Control, Losing Sight of the Goal, Choosing Metrics that are Precisely Wrong, Assuming Your Managers and Employees Have No Options, and Thinking Narrowly. These pitfalls are combined with the following seven steps to develop effective “lean” metrics:

### **Step 1. Start by Listening to the Customer**

Identify who the customer is and through direct interaction define what is important to the customer. The metrics should provide incentives to the organization to make decisions and take action, which improve the product with respect to these end-consumer needs. These customers include anyone in the downstream process of the product, purchasing, manufacturing, assembly, marketing, etc. After identifying and prioritizing the customer needs, metrics are found that align the needs with the long-term profitability of the firm.

### **Step 2. Understand the Job**

Identify what is important to managers and employees and how their decisions and actions affect the metrics and the desired outcomes. Salary and bonuses are only a fraction of what is valued by managers and employees. Understand the culture of the organization and develop the measurement system around it to provide employee respect, interesting and exciting challenges, and a good working environment. To further understand the work processes, a detailed road map should be created to track and diagnose the implementation of metrics into the work place. An effective metric system should direct employees to change their efforts and improve their outcomes.

### **Step 3. Understand the Interrelationships**

Balance all the customers in the process to obtain an optimum focus on product/profit. The internal customer needs should be linked with the external customer requirements, and these in turn should link to the internal and external supplier needs. Metrics should reward each group by working together to provide the best design/profitability combination.

#### **Step 4. Understand the Linkages**

Link all efforts to metrics and efforts to outcomes. By using the system engineering tool, the “House of Quality,” the company can link performance metrics to desired outcomes. The desired outcomes are weighted and the “roof” of the House summarizes the interrelationships. This information is used to select candidate metrics. These metrics align employee actions and decisions with the long-term needs of the firm.

#### **Step 5. Test the Correlations and Test Manager and Employee Reaction**

The testing consists of the following two steps. First, the correlations are tested through benchmarking the organization before and comparing it to the organization after metric implementation. Then, manager and employee reaction is tested through surveys and interviews to verify the measurement system is aligned with the company’s strategies and visions.

#### **Step 6. Involve Managers and Employees**

Utilize those who are subject to the metrics systems in the metric development team. Involve managers and employees in the developmental process because they are the front-line of the organization and live with the metrics system everyday.

#### **Step 7. Seek New Paradigms**

The previous steps should not limit the development process and they should be used creatively. New paradigms should be searched for that can be used to achieve the goals. The metric system should free managers and employees to stretch the boundaries and invent new ways of achieving the company goals.

### **3.9 Four Additional Tools for Developing the Metric System**

The final method presented for developing a metric system includes four tools from *A Management Guide For Development And Deployment of Strategic Metrics* by Raytheon Systems Company. The first tool is an overall process for defining the measurement system. Next, the second tool identifies several issues that need to be considered when developing a measurement system. Then, once the measurement system is developed, the third tool helps select the critical few metrics using a three dimensional model. And finally, the fourth tool helps continue to design specific measures that align with the company's strategies and goals.

#### **Tool 1 – Metric Development**

This tool is a four-step process that defines a business level measurement system. Raytheon Systems Company states that this tool is a combination of best practices currently used at various companies.

##### **Step 1- Define Business Excellence**

The following six-stage process is used to define business excellence:

- Describe what success looks like.
- Determine the strategic business objectives and priorities.
- Identify the business processes driving success.
- Provide training on processes and metric best practices.
- Establish strategic measures of success and quantify objectives for the company's shareholders, customers, processes, and people.
- Balance and prioritize the critical few.

##### **Step 2 –Assess Progress**

The following five-stage process is used to assess progress:

- Understand what performance level represents world class.
- Determine the performance level required for sustained competitive advantage in the company's market.
- Quantify the gap between current performance and the company's definition of success.

- Assess the rate of improvement.
- Assess the current management system's performance.

### Step 3 –Identify Improvement Opportunities

The following four-stage process identifies improvement opportunities:

- Identify the improvement needs.
- Set priorities.
- Identify the root causes of inadequate performance and barriers to progress.
- Identify the critical few key performance measures.

### Step 4 –Action Plan

The following six-stage process is the basis for the action plan.

- Develop an approach for managing and using metric information.
- Ensure the vertical and horizontal alignment of metrics and goals across the organization.
- Establish barrier elimination responsibility.
- Realign all reward and reinforcement systems with objectives.
- Monitor progress and take needed action.
- Focus on rapid feedback for learning and expect behaviors consistent with objectives.

## **Tool 2 – Metric Issues**

This tool presents issues to consider in the life cycle of metrics. It is subdivided into the following four categories: Getting Started, Managing Metrics, Using Metrics, and Retiring Metrics. Each category identifies several questions that help develop “good” metrics.

### Getting Started

- Establish clear objectives: Know the purpose of having the metric; what do you want to know when you receive this information?
- Who is responsible? Who is the owner of the metric? Who is accountable for the metric information? Who is the customer or user of the metric?
- How do you get the data? What are the key drivers of the data? How good is the data?

- Is the metric clearly defined?
- How do you calculate your metric?
- How often do you report your metric?

### Managing Metrics

- To aggregate or not to aggregate? At which level of the business is the information most useful?
- When aggregated, does the metric provide the information it was designed to measure or is it providing a different perspective?
- Are you using the metric to learn, to improve, to control, or to report?
- Over time has the customer of the metric changed? If so, how has it changed the way the metric is being used?

### Using Metrics

- How does the information get used and by whom?
- Are the metrics being used to communicate objectives, priorities, and improvement needs?
- Are the metrics creating the desired effects?

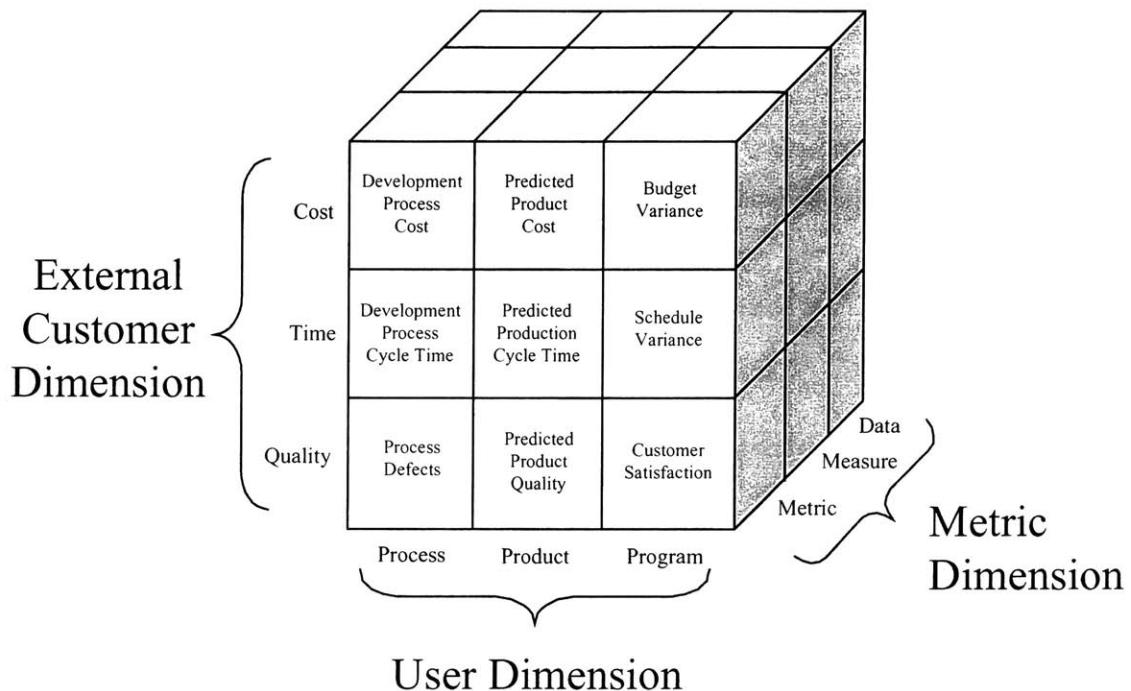
### Retiring the Metric

- Is the metric still providing the information that was intended when it was developed?
- Is this information still needed?
- Is this information more valuable than the cost of collecting and reporting it?
- Are there other metrics competing or in conflict with the metric?
- What are the consequences of not collecting or reporting this metric?
- Does a better metric exist?

## Tool 3 – The Three Dimensions of Metrics

This tool provides a drawing that helps decide when a metric is needed and which metrics are the critical few. The drawing in this example has three rows and columns but may have more depending on the priorities of the company and who needs the metric information (Figure 8).

## The Three Dimensions of Metrics



**Figure 8. The Three Dimensions of Metrics (Source: Raytheon, 1998)**

The three dimensions for this example are: External Customers, Users, and Metrics. As depicted in Figure 8, the key customer concerns are Cost, Time, and Quality. In addition, the internal users are Process Owners, Product Designers, and Program Managers. Finally, the three types of metric information are metrics (a category or set of measures related to a priority or goal), measures (quantitative information; indicators of progress toward the metric goals), and raw data. This example identifies a need for no more than nine metrics. A few critical measures may be the following:

- Process: development process cost, development process cycle time, and process defects.
- Product: predicted product cost, predicted production cycle time, and predicted product quality
- Program: budget variance, schedule variance, and customer satisfaction.

#### **Tool 4 – The Goal-Question-Measure Paradigm**

This tool aligns the metrics with the company goals. It is used to further help selecting and developing specific metrics. The first step is to define the company's strategic objectives and identify the goals necessary to meet these objectives. From here a list of question are assembled that determine if progress is being made toward these goals. Next, metrics are established that answer the list of questions. The development of metrics should strive to answer multiple questions.

Through the use of these four tools a comprehensive measurement system can be developed. Beginning with the tool that provides a step by step construction and a foundation of the measurement system the other tools are then used to mold and optimize metric development and utilization. The Raytheon Systems Company approach is a thorough utilization of best practice methods for metric development.

#### **3.10 Metric Establishment Summary**

Three methods were presented to define the structure for developing a new measurement system, the Balanced Scorecard, a detailed seven-step metric development approach, and four additional tools for metric development. The Balanced Scorecard is used to measure and focus progress toward goal achievement for everyone involved. It defines measurable goals and aligns metrics with company strategies and corporate vision. Next, the detailed seven-step metric development approach combines seven counter-productive pitfalls with a holistic company view to produce effective “lean” metrics. And finally, four additional tools are presented that provide a step by step construction and then optimization of metric development. Each of these methods have their strengths and a combination of these methods will result in a comprehensive metric development tool. Throughout the literature a common theme is presented that the metric system must be customized to each individual application.

In the following chapters, the Sikorsky Platform Teams are presented and a “Vision to Metrics Model” is developed. This model combines the organizational structure and the Product Development Process of the Sikorsky Platform Teams with the best practices of three methods for developing a new metric system discussed above.

### **3.11 Literature Review Summary**

Four methods of metric assessment and three methods of metric development were presented to find the “Best Practice” in metric development and utilization. The Metric Assessment Survey (Appendix A) and The Ten Requirements for Good Metrics (Appendix B) are used in the following chapters as a comprehensive evaluation of the overall measurement system at Sikorsky Aircraft and Pratt & Whitney. In addition, the best practices of the three methods for metric development are combined with the Sikorsky Platform Team’s organizational structure and Product Development Process to create the “Vision to Metric Model”. This model is presented in chapter 6. The “Vision to Metric Model” is used in the following chapters as a “Best Practice” method to establish a new measurement system, identify the waste, and target improvement opportunities for the Platform Teams at Sikorsky Aircraft.

## **CHAPTER 4**

### **Sikorsky Platform Teams**

#### **Case Study**

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#### **4.0 Sikorsky Platform Teams**

The Platform Teams within Sikorsky are a group of multi-functional personnel working together to provide the proposal, design, integration, manufacturing, and testing of a helicopter or a family of helicopters and its associated product and services. These Platform Teams work with a mature product baseline and modify it according to customer requirements. Depending on the integration effort, it is often necessary to remove the helicopter from the assembly line and insert it into the development hanger. The development hanger would then complete the assembly process at a revised rate and upon completion return the helicopter to production. Within Sikorsky there exist six Platform Teams:

- The Black Hawk Platform Team
- The Navel Hawk Platform Team
- The VH Platform Team
- The H-53 Platform Team
- The S-76 Platform Team
- The DMC II Platform Team

Interviews were performed with three of the Platform Teams: the Black Hawk Platform Team, the Navel Hawk Platform Team, and the DMC II Platform Team.

The Black Hawk Platform Team is responsible for the design, planning, tooling, manufacturing, testing, finance, and after market support of the basic Army helicopter configuration. Currently, there are eight programs with over 90 helicopters being developed. These configurations include search and rescue, troop transport, and special operations.

The Navel Hawk Platform Team is responsible for all the activities of the Marine and Navel configurations of helicopters. They are optimized to operate off aircraft carriers. Currently there are six programs with over 40 helicopters being developed.

The DMC II Platform Team is responsible for all the activities of both the basic Army helicopter configuration and the Marine and Navel helicopter configuration that fall into three type of classes:

- 1) Prototype derivative helicopters.
- 2) Helicopter programs with lot quantities of less than two.
- 3) Programs with low-level, low-volume integration efforts.

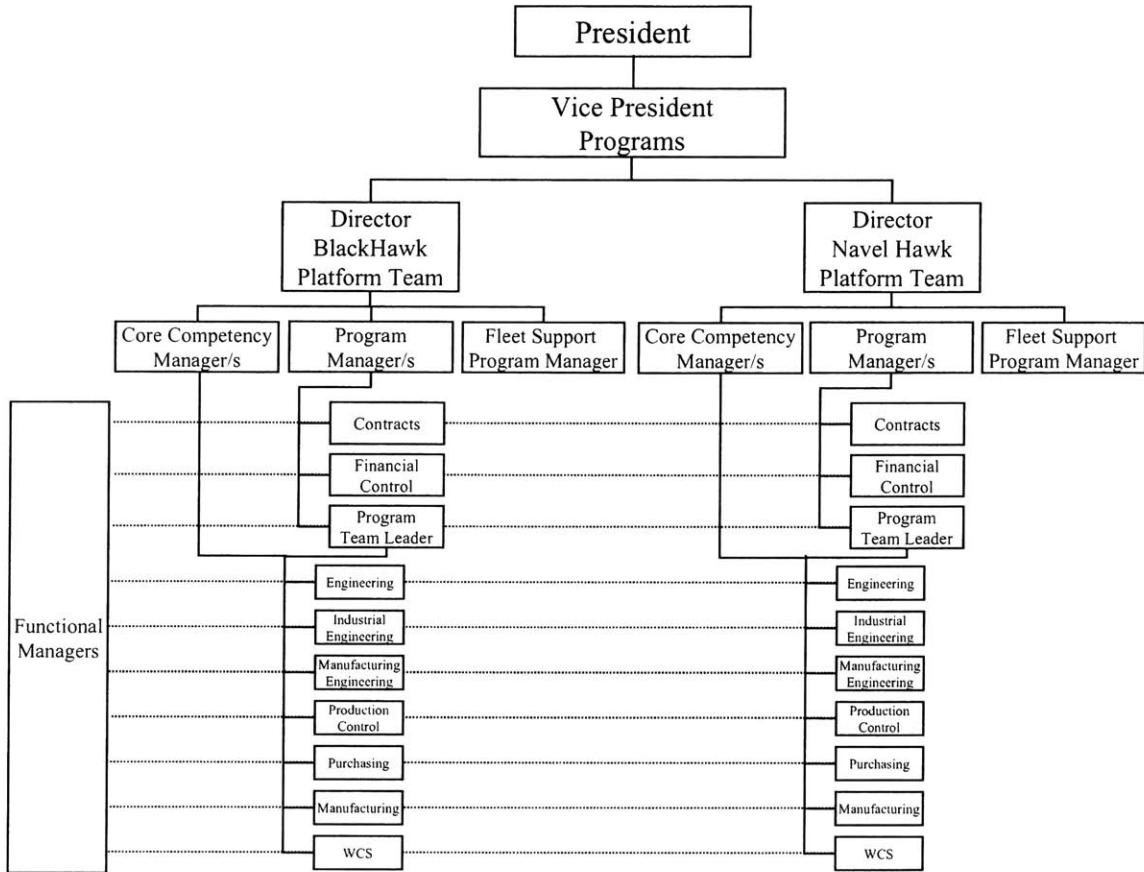
The DMC II Platform is highly specialized in these areas. When a low lot quantity of aircraft is requested, production documentation does not typically have to be created thus lowering product cost. Currently the DMC II has one program with six specialized helicopters being developed.

#### **4.1 Sikorsky Company Structure**

The organizational structures of the Black Hawk and the Navel Hawk Platform Teams are represented in Figure 9. The DMC II Platform Team has a different organizational structure depicted in Figure 10.

Sikorsky Platform Teams represent a Heavyweight Project matrix organization. This structure allows the team to be focused around a particular project and the project manager to have overall budget authority. The objective of this organization is to bring products and services to market with shorter lead times and at lower costs.

## Typical Sikorsky Platform Team Organizational Structure

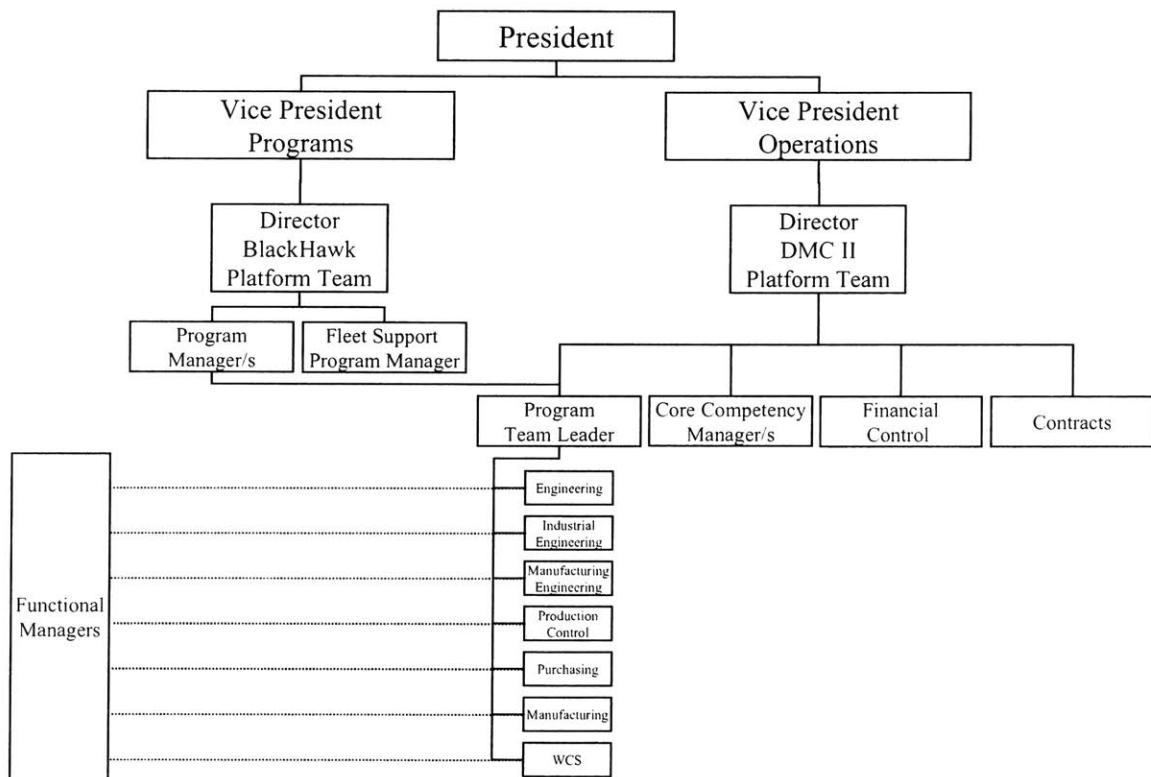


**Figure 9. The Typical Sikorsky Platform Team Organizational Structure**

The DMC II Platform Team is the original prototype platform team at Sikorsky. It is staffed with hand picked, highly motivated, skilled, and energetic members from diverse backgrounds within the company. The reporting structure is different from the typical Platform Team to allow a better integration of the Team Leaders and the multi-functional team with Operations (Figure 10). Furthermore, the Team Leaders report immediately to the Director of the DMC II Platform Team and they are only three tiers away from the President. This reporting structure makes it possible for the multi-functional teams to quickly introduce and implement new techniques and procedures directly affecting and improving operations. Radical departures from standard procedures

were developed for the team. New procedures were introduced such as giving each team member the authority to signoff on any drawing needed for aircraft integration and allowing the use of redlined, hand drawn, documents and drawings as originals. This flexibility and empowerment of the team members made it possible for decisions to be made immediately on the manufacturing floor, reducing integration time significantly. The best practices of the DMC II have been incorporated into the other Platform Teams.

### DMC II Platform Team Organizational Structure



**Figure 10. The DMC II Platform Team Organizational Structure**

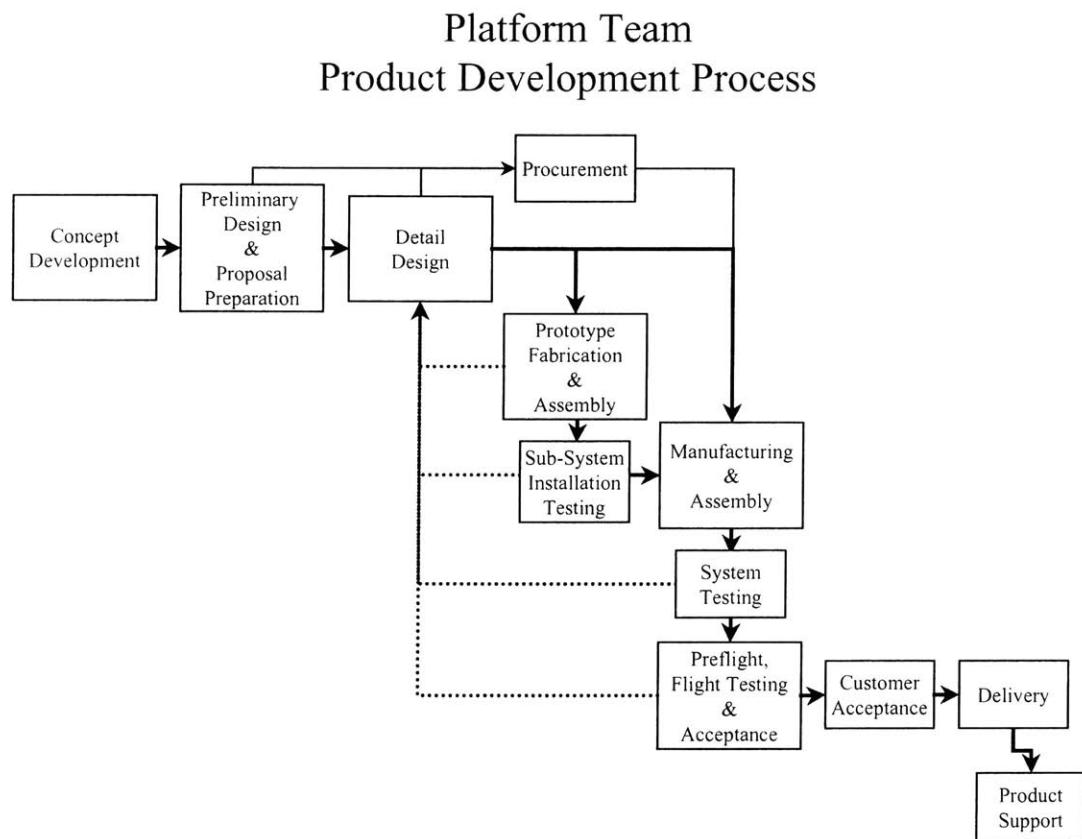
The leadership of the Platform Team is comprised of numerous individuals, all with defined roles and responsibilities. The Director of the Platform Team has full

authority within the Team including profit and loss responsibility. A Core Competency Manager, a Fleet Support Program Manager, and a multitude of Program Managers, (one for each program in the platform) all report to the Director. The Program Managers provide executive leadership and have the authority over the all aspects of the program/s in which he or she is responsible. They provide the principle interface to the customer and have direct reports from Financial Control, Contracts, and a Program Team Leader. Program Team Leaders are responsible for the creation and leadership of a multi-functional team that meet the requirements of the design, development, and manufacturing of the program. The multi-functional team is comprised of individuals from many functional disciplines including: engineering, manufacturing engineering, industrial engineering, purchasing, manufacturing, production control, and world wide customer support. The Core Competency Manager is responsible for interfacing with operations, research departments, and the Functional Managers to ensure a high level of expertise is maintained within the Platform Teams and help meet the strategic objectives and best practices of the Platform Teams. He or she provides the guidance and oversight to the Program Managers and Program Team Leaders to guarantee the correct resources are applied to execute the programs. The Fleet Support Managers provide for and maintain the Platform Team's delivered product. They interface with the customer and provide support in field engineering, spares supply, support equipment, technical publications, product improvements, retrofit activities, training, safety bulletins, and depot maintenance activities.

## **4.2 Sikorsky Product Development Process**

The product development process of all the platform teams is depicted in Figure 11. In the concept stage, under the direction of the Program Manager, the system architects develop a configuration representing the customers' requirements. The Contracts Manager then forms the initial team representing Engineering, Industrial Engineering, Manufacturing Engineering, Production Control, Purchasing, Manufacturing, and Worldwide Customer Support (WCS) for the Preliminary Design and

Proposal Preparation phase. The Contract Manager sets up meetings with the Team Leader to estimate the preliminary schedule and produce the proposal documentation from the configuration necessary for the development of the helicopter. In this phase, the system architects start the preliminary design and collect requirements from the customer, constraints from the company initiative, and meet with each team member to construct the general architecture of the customized helicopter. At this time the purchasing representative begins to provide long lead equipment information, which are items that may be difficult to obtain in the short development schedule of the helicopter. The engineering and manufacturing team members provide interface constraints, mechanical constraints, and cycle time constraints necessary for the new design. Finally, with customer acceptance of the completed proposal and schedule, a contract is written and signed.



**Figure 11. Platform Team Product Development Process**

Once the contract is released, the Detail Design phase begins with the Program Team Leader completing the multi-functional team. The necessary manpower requirements are provided to the Core Competency Manager, who supplies the program with internal and external members from the functional organization. Kick-off meetings are held to establish the design and build strategy, further develop the schedule, and procure material and parts. The initial stages of the build strategy identify which helicopters in the manufacturing flow are available for modification and, if necessary, the stage at which they would be removed from the assembly line and inserted into the development hanger. (Often it is necessary to remove the helicopter from the assembly line due to the extent of the modifications that can not be performed in the normal production flow.) The development hanger completes the assembly process at a revised rate and returns the helicopter to production for flight-testing. Status meetings are held to monitor the aircraft assembly, drawing releases, electrical harness manufacturing, and procurement activity.

As preliminary drawings and harnesses are released, prototypes are fabricated and integrated into the build of the aircraft. In this phase, Prototype Fabrication and Assembly, corrections are made and production drawings and harnesses are released to manufacturing. During the last stages of the build process the test phase begins.

The test phase is broken into three stages. The first stage, Sub-System and Installation Testing, validates the integration of the components and harnesses and the proper operation of the equipment. Following the completion of assembly, whole system testing is performed. This second phase of testing evaluates the equipment in the proper environment by simulating the flight condition of the aircraft. Upon completion of System Testing, the aircraft is returned to production. In the final stage of testing, preflight testing is conducted on the flight field to further verify the functionality of the aircraft and the equipment prior to actual flight. Flight-testing is then performed to verify aircraft performance and equipment functionality in its true environment. During testing,

if corrections are needed, production drawings and harnesses are revised and re-released to manufacturing.

Upon completion of the testing, the aircraft is sent to the paint shop and presented to the customer for acceptance. Once the aircraft is accepted, it is broken down and prepared for delivery. Product Support provides for and maintains the aircraft after delivery. They continue to interface with the customer and provide support in field engineering, spares supply, support equipment, technical publications, product improvements, retrofit activities, training, safety bulletins, and depot maintenance activities.

#### **4.3 Sikorsky Platform Team Metrics**

Metrics are used in each phase of the product development process to status and guide the team through the different phases as described above. Metrics are also used to identify the past and present condition of the organization and plan for its future. In the following three sections metrics are presented from three Platform Teams at Sikorsky Aircraft: the Black Hawk Platform Team, the Navel Hawk Platform Team, and the DMC II Platform Team. Interviews were performed with key members of each of the teams to recognize the metrics being used and their effectiveness. An assessment survey was given to each interviewee, which categorized the metrics into four metric utilization categories: Operations/Finance, Other Internal Stakeholders, Customer Satisfaction, and Supplier Performance. The assessment survey is used to pinpoint metric strengths and weaknesses.

### 4.3.1 Platform Team Operations/Finance

The Operations of activities involve the day to day activities internal to the product development process. Different metrics are used during each phase of the product development process to measure the progress and predict successful completion. These metrics are combined in an overall report to management and presented in weekly meetings. The report consists of the Major Program Schedule Status and the Major Program Cost Status shown in Figure 12 and 13, respectively. The Platform Teams are measured against the bottom line by how well they perform to budget. Each program targets a return on sale (ROS), and reports weekly on meeting its objectives.

Data as of XX/XX/XX				PERFORMANCE TO SCHEDULE											
Program	Program Manager	Qty	1st/Next Delivery	Program Mgmt		Engineering			Mfg. Eng'r	Material	Manufacturing			Customer Service	Program Recovery Date
				Contract Proposals	Program Plan	Design Drawnness	Systems Integration	Test and Qual			Parts Fab	Production Assembly	Modification Assembly	Spares	Publication
Black Hawk															
Program 1	Manager 1	10	Jul-99	●	●	●	◆	◆	●	●	●	●	●	●	Jul-99
Program 2	Manager 2	20	Jul-99	●	●	●	●	●	△	◆	●	●	●	●	
Naval Hawk															
Program 3	Manager 3	10	Nov-99	●	●	△	●	●	●	●	●	●	●	●	
Program 4	Manager 4	20	Dec-99	●	●	●	●	●	△	△	●	△	●	●	Nov-99
DMCII															
Program 5	Manager 5	6	May-99	●	●	●	●	○	○	●	●	●	○	○	
VH															
Program 6	Manager 6	10	Apr-99	●	●	●	●	●	●	●	●	●	●	●	
HS3															
Program 7	Manager 7	10	Mar-99	◆	●	●	●	●	●	●	●	◆	◆		
S76															
Program 8	Manager 8	10	Nov-99	●	●	△	△	●	●	△	△	△	●	●	Oct-99

● Circle = within 2 weeks of plan △ Triangle = within 4 weeks of plan ◆ Diamond = greater than 4 weeks from plan ○ Open Circle = data being compiled  
Blank = not applicable

**Figure 12. Major Program Schedule Status**

Data as of x/xx/xx							PERFORMANCE TO BUDGET					
Program	Program Manager	Price	Budget ROS	Team Outlook ROS	Status	% Budget Spent	Des/Prn	PBOM	Matl Var/ODC	Std Labor	Asy Labor	WCS
Program 1	Manager 1	\$100.0	25.0%	23.0%	YELLOW	90.0%	YELLOW	YELLOW	RED	GREEN	YELLOW	YELLOW
Program 2	Manager 2	\$150.0	18.0%	15.0%	YELLOW	70.0%	GREEN	GREEN	GREEN	RED	RED	GREEN
Program 3	Manager 3	\$200.0	10.0%	8.0%	YELLOW	95.0%	GREEN	GREEN	GREEN	GREEN	RED	RED
Program 4	Manager 4	\$150.0	20.0%	18.0%	YELLOW	80.0%	GREEN	YELLOW	RED	YELLOW	RED	GREEN
Program 5	Manager 5	\$100.0	12.0%	10.4%	YELLOW	75.0%	GREEN	RED	GREEN	YELLOW	RED	GREEN
Program 6	Manager 6	\$50.0	10.0%	9.0%	GREEN	30.0%	RED	GREEN	GREEN	GREEN	YELLOW	GREEN
Program 7	Manager 7	\$25.0	15.0%	12.0%	YELLOW	50.0%	RED	GREEN	RED	YELLOW	RED	RED
Program 8	Manager 8	\$100.0	-11.0%	-12.0%	GREEN	85.0%	GREEN	GREEN	GREEN	YELLOW	YELLOW	GREEN
TOTAL		\$875.0	12.8%									

ROS - Return on Sale, PBOM - Production Bill Of Material, Matl Var/ODC - Material Variance/Overhead Direct Cost, WCS - World wide Customer Support

**Figure 13. Major Program Cost Status**

Initially, during the Concept Development, Preliminary Design, and Proposal Preparation phases, the team is directed only by an end date. The team is required to complete the proposal, preliminary program plan, and initial estimates by this date. This process is executed under a separate overhead budget and is not reported by individual program to the Director. This often results in late proposals and numerous unaccounted funds. The preliminary program plan is the initial measurement of schedule performance. From initial estimates a financial plan is constructed and used as the measurement for primary cost performance. As the project continues, a detailed build plan is spun from the preliminary program plan that combines all of operations into a single plan. The detailed build plan is unique to each Platform Team.

#### 4.3.1.1 Build Plan Metrics

The Black Hawk Platform Team separates the operations into major milestones and the metrics measure schedule performance on milestone delivery dates. Cost estimates for each phase are used to give a budget performance indication. Individual

drawing, harness, part fabrication, production assembly, modification assembly, procurement, test, and qualification schedules are all subsets of the detailed build plan. These measurements are used on the front line to measure performance. Drawing and harness schedules are based on start and completion date and do not include a cost factor per unit. Therefore, earned value is not available. In addition, utilizing only a start and end date does not give proper indication of the present condition of activities. Often a problem begins after the start date and will not be detected until passing the due date, thus not allowing corrective action to keep the activity on schedule.

Part fabrication, production assembly, and modification assembly are based on standard labor and material, while non-standard parts and assembly are estimated based on standard labor and costs. Earned value is available and used to status these activities.

Procurement activities are measured in response to the “need” dates established by the build plan; an electronic type MRP system is in place to order and schedule deliveries. Parts that do not comply to need dates are flagged and handled individually. Delivery dates are negotiated with suppliers and reviewed weekly with management. At the time of procurement individual part costs are also reviewed with management.

Sub-system testing, system testing, and flight-testing which involve extensive engineering resources are all schedule and milestone driven. Cost is based on milestone delivery and standard shop labor. Earned value is available only for shop labor and not for engineering.

In addition to these metrics, the DMC II Platform Team segregates the operations into component families and major milestones in their build plan. Since project estimations of cost and schedule are done with this component segregation, correlation from activities can easily be made back to cost, and an earned value system can be implemented. Percent of activities completed vs. schedule for shop labor and engineering

are also reported to management. Past and present conditions of the project are known, and future potential problems are easily identified and managed.

Finally, the Navel Hawk detailed build plan expands each individual drawing, harness, parts fabrication, supplier part, assembly component, test, and qualification into a start date and completion date. Furthermore, project estimation is recalculated from the original estimate to include the cost and schedule for each of the sections above. This combination provides an earned value system for each drawing, harness, part, assembly, and test. As a micro-managed plan, management can see the past and the present condition of the organization and use the information to forecast the future direction. Although a much better detailed condition of the project is known, there are extensive resources utilized to provide and update this information.

The effectiveness of the metric utilization category, Operations/Finance, is consistent across the different platform teams. The assessment survey indicates high scores for all three Platform Teams (Figure 14). The assessment survey indicates slight weaknesses in benchmarking performance against competitors and keeping the measurements consistent across all the organizations.

Operations/Finance	Black Hawk	Navel Hawk	DMC II			
	Individual Score	Total Score	Individual Score	Total Score	Individual Score	Total Score
There are a few key operational/Financial measures (4-6, value added/employee)	5		5		5	
There is a mix of short and long term measures of success	5		5		3	
Metrics are consistent across organization	4		5		5	
Process measures link to key customer product/service characteristics	5		5		5	
Cycle time is used as a key operational measure	5		5		5	
Measures forecast problems, not just identify	5		5		5	
Data is collected on major competitors to benchmark performance and set goals	1		1		0	
There is a combination of metrics into overall performance (EVA, ROA)	5	86%	5	89%	5	80%

0-Weakest, 5-Strongest

**Figure 14. Platform Team Assessment Survey Operations/Finance**

#### **4.3.2 Platform Team Other Internal Stakeholders**

The Other Internal Stakeholders are broken down into four categories, Internal Customer Satisfaction, Employee Satisfaction, Safety, and Product Service.

##### **4.3.2.1 Platform Team Internal Customer Satisfaction**

The internal customer is represented by the next organization downstream in the product development process, see Figure 11. Detail Design is the internal customer of Preliminary Design and Proposal Preparation, and Prototype Fabrication and Manufacturing are the internal customers of Detail Design. Although each stage of the process is represented in the Operations/Finance metrics, there is no data recorded to identify the satisfaction of the product at each stage. Manufacturing managers complain about the quality of workmanship from the back shops but formal metrics are not used to identify quality. For example, the engineers design for manufacturing ability but no data exists on how effective the design was in reducing labor except as an improvement in the overall earned value. Back shop developmental rework and scrap rates are constantly blamed for poor earned value but are not collected in formal metrics. Assessment survey scores across the three teams are consistently poor and identify a lot of room for improvement (Figure 15).

Other Internal Stakeholders Internal Customer Satisfaction	Black Hawk		Navel Hawk		DMC II	
	Individual Score	Total Score	Individual Score	Total Score	Individual Score	Total Score
Database includes metrics on customer satisfaction/value (repeat/lost, returns)	1		3		3	
Collects data on satisfaction and perceived value using surveys, phone, and focus group	0		0		0	
Surveys for Customer satisfaction identify delights rather than satisfaction	0		0		0	
Surveys are based on research and identify most important requirements	0		0		0	
There is a combination of hard and soft values into overall satisfaction index.	0	4%	0	12%	0	12%

0-Weakest, 5-Strongest

**Figure 15. Platform Team Assessment Survey Internal Customer Satisfaction**

#### **4.3.2.2 Platform Team Employee Satisfaction**

Employee Satisfaction is measured once a year at individual performance reviews. Employee comments, feedback, and suggestions can be made on the back of the forms following his or her review. The Platform Team manager does not report this data to management and rarely is the data used. No other employee satisfaction metrics are collected within the Platform Teams. Assessment survey scores reflect neglected employee satisfaction and all teams report below 16% (Figure 16).

Other Internal Stakeholders Employee Satisfaction	Black Hawk		Navel Hawk		DMC II	
	Individual Score	Total Score	Individual Score	Total Score	Individual Score	Total Score
Surveys 1/yr to determine satisfaction on organizational behavior.	2		0		2	
Surveys are anonymous and >75% are returned.	0		0		0	
Research is done to determine what is important to employees for survey.	0		1		0	
Other metrics are collected on employee satisfaction	0		0		0	
There is a combination of metrics into overall satisfaction index.	2	16%	0	4%	0	8%

0-Weakest, 5-Strongest

**Figure 16. Platform Team Assessment Survey Employee Satisfaction**

#### **4.3.2.3 Platform Team Safety**

Safety is a key concern of the overall company and metrics in lost time, environmental spills, and accident rates are all collected. The company requires safety-training classes each year for every employee to help prevent accidents. The Platform Teams do not specifically report on safety or collect any data of their own and therefore result in a score of 13% in the assessment survey across all three teams (Figure 17).

Other Internal Stakeholders Safety	Black Hawk   Navel Hawk   DMC II					
	Individual Score	Total Score	Individual Score	Total Score	Individual Score	Total Score
There are a few key measures collected monthly	1		1		1	
Measures of safety are behavioral and preventive rather than lost-time type	1		1		1	
There is a combination of metrics into an overall performance index	0	13%	0	13%	0	13%

0-Weakest, 5-Strongest

**Figure 17. Platform Team Assessment Survey Safety**

#### 4.3.2.4 Platform Team Product & Service Quality

Product and Service Quality is measured primarily by the field service representative. The field service representative is on site and communicates daily with the customer. He or she fills out a formal form that provides the progress and satisfaction of the service being supplied to the customer. These forms concentrate on problems that develop after delivery and can be highly subjective based on field service representative experience and opinion. System anomalies and component failures are tracked and sent back to the company for root cause analysis. On time deliveries are reported but history does not exist showing trends. A customer scorecard does not exist including surveys. Therefore, actual customer point of view is not directly measured or reported.

Assessment survey scores between teams differ significantly. The BlackHawk and Navel Hawk Platform Teams report high scores of 90% while the DMC II Platform Team reports a score of 0% (Figure 18). This disparity is a result of the fact that the DMC II Platform Team does not include the Fleet Support Manager (Figure 10) and this function is turned over to the Black Hawk Platform Team.

Other Internal Stakeholders Product & Service Quality	Black Hawk   Navel Hawk   DMC II					
	Individual Score	Total Score	Individual Score	Total Score	Individual Score	Total Score
Characteristics that are measured are most important to the customer	5		3		0	
Metrics of inspection ensure all products/services meet standards	5		5		0	
Metrics are related to accomplishments rather than behavior	4		5		0	
Measures are expressed as numbers rather than percentages of defect free products	4	90%	5	90%	0	0%

0-Weakest, 5-Strongest

**Figure 18. Platform Team Assessment Survey Product & Service Quality**

The assessment survey reports low scores for the effectiveness of the Platform Team Other Internal Stakeholders. Strong internal weaknesses exist in all areas except for Product and Service Quality.

#### 4.3.3 Platform Team Customer Satisfaction

The customer, typical in the aerospace industry, can be a multitude of different people and organizations. The primary customer identified by Sikorsky is the person or organization purchasing the aircraft. Often this is a government with an appointed group to oversee the development and sale. The secondary customer is all the external people or groups that make up the support and operations of the aircraft. During the development phase, the view of the customer is represented in the requirements outlined in the proposal and the contract. Preliminary design reviews and critical design reviews are performed with the customer throughout the program to verify requirements are representative of customer needs. The three test phases, Sub-System Testing, System Testing, and Flight Testing, determine how well the product conforms to these requirements. Program schedule is considered value to the customer and delivery date is recognized as a date set in stone. As identified in Product and Service Quality, the field service representative is the link from the customer back to the organization. No formal customer satisfaction surveys are performed and no other metrics are used by the platform team. The resulting assessment survey scores are low at 20% (Figure 19).

Customer Satisfaction	Black Hawk		Navel Hawk		DMC II	
	Individual Score	Total Score	Individual Score	Total Score	Individual Score	Total Score
Database includes metrics on customer satisfaction/value (repeat/lost, returns)	1		1		1	
Collects data on satisfaction and perceived value using surveys, phone, and focus groups	1		1		1	
Surveys for Customer satisfaction identify delights rather than satisfaction	1		1		1	
Surveys are based on research and identify most important requirements	1		1		1	
There is a combination of hard and soft values into overall satisfaction index.	1	20%	1	20%	1	20%

0-Weakest, 5-Strongest

**Figure 19. Platform Team Assessment Survey Customer Satisfaction**

#### **4.3.4 Platform Team Supplier Performance**

The development and build of the aircraft depends extensively on external goods and services purchased from outside suppliers. Outsourcing of components and activities is rapidly becoming more prevalent. Under the direction of the Team Leader, Purchasing links the suppliers to the product development process. Purchasing uses internal methods to qualify suppliers and are required to maintain supplier relationships. Component testing is completed at the supplier and Sikorsky performs inspection upon delivery to measures quality. Failures and rejections are recorded and root cause analysis is performed providing feedback to the supplier. Assessment surveys scores across all three teams are consistent in the low to mid 70% range (Figure 20).

Supplier Performance	Black Hawk		Navel Hawk		DMC II	
	Individual Score	Total Score	Individual Score	Total Score	Individual Score	Total Score
There are a few key supplier performance measures (4-6, value added/employee)	5		5		5	
There is a mix of hard and soft measures of performance	3		2		1	
The quality of goods and services purchased from suppliers is measured	5		5		5	
Suppliers process their own data and do self inspections/testing	4		4		5	
There are measures of suppliers staying within price guidelines.	2	76%	2	72%	2	72%

0-Weakest, 5-Strongest

**Figure 20. Platform Team Assessment Survey Supplier Performance**

#### **4.4 Summary**

The overall measurement system of the Platform Teams shows weaknesses in every category except the Operations/Finance area. The measures that are used are tightly linked to key success factors of the company and reported to management on a regular basis. There is poor balance between the metrics and many key categories are not measured at all. Metrics are inconsistent across organizations and only the Navel Hawk Platform Team uses the data to do long term planning and set goals. The assessment

surveys return total scores of less than 65% (Figure 21) for all three Platform Teams identifying significant improvement opportunities.

### Metric Assessment Survey

### Black Hawk Navel Hawk DMC II

	Individual Score	Total Score	Individual Score	Total Score	Individual Score	Total Score
<b>Operations/Finance</b>		86%		89%		80%
<b>Internal Stakeholders</b>		31%		30%		8%
Employee		16%		4%		8%
Safety		13%		13%		13%
Product Service		90%		90%		0%
Internal Customer		4%		12%		12%
<b>Customer</b>		20%		20%		20%
<b>Supplier</b>		76%		72%		72%
<b>Overall Approach</b>						
Metrics are tightly linked to key success factors.	5		5		5	
Database was built with a plan / didn't just evolve.	4		5		5	
Are there more than 20 metrics that are used daily?	5		5		5	
Performance Metrics are mostly consistent across organization?	2		5		5	
Well-balanced set of metrics?	2	72%	2	88%	1	84%
<b>Reporting/Analyzing Data</b>						
All organizational metrics are reported in a single report to mgmt.	2		5		3	
Data is reported in easy to read format (graph trends etc.)	5		5		5	
All Data is reviewed on the same period and by all the management.	3		5		5	
Correlations have been made linking customer satisfaction to financial performance	4		2		1	
The organization understands all key measures and relationships used.	5		5		5	
Performance data is used to make key decisions	5		5		5	
Measures are consistent with organizations mission, values, goals, and strategies	5		5		3	
Metrics are continually evaluated and improved.	5		5		5	
Metrics are used to do long term planning and set goals.	2	80%	5	93%	1	73%
<b>TOTAL SCORE</b>		61%		65%		56%

**Figure 21. Platform Team Assessment Survey Total Results**

## CHAPTER 5

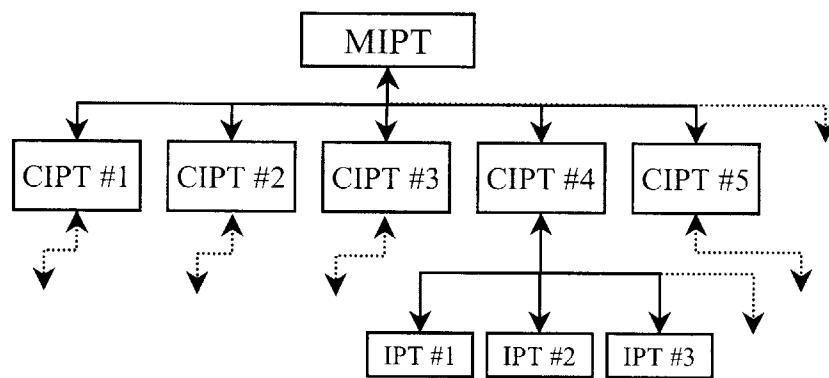
### Benchmarking

### Pratt & Whitney

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#### 5.0 Pratt & Whitney Company Description

Pratt & Whitney (P&W), a unit of United Technologies Corporation, designs, manufactures and supports gas turbine engines and rockets for commercial aircraft, military aircraft, and space propulsion systems. Pratt & Whitney has over 25,000 employees worldwide. They provide twenty-seven armed forces and more than 8000 airlines with Pratt & Whitney engines in more than 150 countries. Pratt & Whitney, in order to continue to be a leader in the industry, reorganized its operations into Integrated Product Teams (IPT) similar to the Platform Teams at Sikorsky. The IPT process was first initiated in 1992 and has become the company's method of conducting everyday business. The IPT structure within the engineering organization has three levels, the Model Integrated Product Team (MIPT), the Component Integrated Product Team (CIPT), and individual IPTs which can be seen in Figure 22.



**Figure 22. Pratt& Whitney Integrated Product Team Organizational Structure**

## **5.1 Pratt & Whitney Company Structure**

The Integrated Product Teams at Pratt & Whitney are cross-functional teams that are accountable for all aspects of a particular engine model from concept to delivery. The engines are designed around a modular, or component concept. Each engine is a combination of separate components where each component contains hundreds or thousands of parts. The Integrated Product Team system architecture reflects the modular concept of the engine design. The MIPTs contain the management team, which is responsible for all aspects of an engine model. These teams consist of financial, engineering, project, program management, and technical and customer support. The management team (MIPT) is responsible for the distribution of budgets to the CIPTs and overall program schedule and priority. They are also responsible to report to executive management and to the customer. Reporting to the MIPTs are the Component Centers (CIPTs), responsible for all engineering aspects of a particular component of the engine model. There is a different Component Center for each module of the engine. The CIPTs contain the team leaders and all the required engineering personnel to design, develop, and provide in-service support for their respective components. These functions are made up of multiple IPTs working within the CIPT (Figure 22). The CIPTs oversee the design and development of a particular engine component.

## **5.2 Pratt & Whitney Company Metrics**

The Integrated Product Teams actively pursue new metric development and implementation. Metrics link tightly to organizational strategies and align with the company vision of becoming a world class supplier of turbine engines and a company that is responsive to the customer needs. Two interviews were conducted at Pratt & Whitney using the assessment survey as a baseline. The metrics of Pratt & Whitney are divided into the four metric utilization categories and identify the present condition of the Integrated Product Teams. They are used as a benchmark for Sikorsky Platform Teams.

### 5.2.1 Pratt & Whitney Operations/Finance

The first metric utilization category is Operations/Finance. Pratt & Whitney's operations and costs are allocated all the way down to the individual components. The raw material cost per pound is measured to identify design cost tradeoffs. They also measure buy-to-fly ratios, which is the minimization of the ratio of finished part weight to raw material weight. These are used to reduce scrap rate. Furthermore, Pratt & Whitney part prices are tracked and trends are identified to help predict future cost problems. Their budgets and schedules are linked through standard costs in an earned value system for both engineering and manufacturing. The Component Centers establish cost and cycle time reduction goals and they are evaluated against these targets. The overhead rates and project spending along with the direct and indirect labor usage are all tracked to justify costs and target improvements. In addition, inventory is also tracked to reduce the costs of the unnecessary holding of parts. The different component center metrics combine to provide an overall program performance and a perfect score on the assessment survey (Figure 23).

Operations/Finance	Individual Score	Total Score
There are a few key operational/Financial measures (4-6, value added/employee)	5	
There is a mix of short and long term measures of success	5	
Metrics are consistent across organization	5	
Process measures link to key customer product/service characteristics	5	
Cycle time is used as a key operational measure.	5	
Measures forecast problems, not just identify.	5	
Data is collected on major competitors to benchmark performance and set goals	5	
There is a combination of metrics into overall performance (EVA, ROA)	5	100%

0-Weakest, 5-Strongest

**Figure 23. Pratt & Whitney Assessment Survey Operations/Finance**

## **5.2.2 Pratt & Whitney Other Internal Stakeholders**

Employee Satisfaction, Safety, Internal Customer Satisfaction, and Product & Service Quality are all subcategories of the second metric assessment category, Other Internal Stakeholders.

### **5.2.2.1 Pratt & Whitney Employee Satisfaction**

Pratt & Whitney understand that the most significant asset in the company is the skill level of the workforce. In this highly technical industry, it takes years of on the job training and mentorship through senior employees to become an expert. The ability to retain the skilled workforce is essential for continued organizational success. Several metrics are used to evaluate employee satisfaction.

- Employees training hours are measured and every employee is required to receive a minimum of 80 training hours per year.
- Attrition rate is also measured to identify the retention of employees.
- Yearly reviews are not only performed from the top down to the employees but also given bottom up for the supervisors.
- Salary and benefit benchmarking is performed to identify industry standards. If they are not in line adjustments are made.
- Surveys are performed by an outside organization every three years that evaluate employee satisfaction and publish the results. Follow up publications address corrective actions and progress toward solutions.

These metrics all combine to provide a score of 64% on the Assessment survey (Figure 24).

Internal Stakeholders	Individual Score	Total Score
<b>Employee Satisfaction</b>		
Surveys 1/yr to determine satisfaction on organizational behavior.	2	
Surveys are anonymous and >75% are returned.	3	
Research is done to determine what is important to employees for survey.	5	
Other metrics are collected on employee satisfaction	3	
There is a combination of metrics into overall satisfaction index.	3	64%

0-Weakest, 5-Strongest

**Figure 24. Pratt & Whitney Assessment Survey Employee Satisfaction**

### 5.2.2.2 Pratt & Whitney Safety

As in most organizations Safety is important at Pratt & Whitney. They measure typical lost time per month and the quantity of accidents are collected. The accidents are broken down by types (body parts, slips and falls, etc.) to specify trends and corrective actions. Pratt & Whitney require environmental hazards and safety training for every personnel. The number of environmental spills and incidents are measured. They also provide ergonomic training and ergonomic offices for every employee and safety glasses must be worn at all times within the factory. These services and metrics are put in place to try to prevent injuries and as the assessment survey indicates with a score of 93% (Figure 25), few improvements are necessary.

Internal Stakeholders	Individual Score	Total Score
<b>Safety</b>		
There a few key measures collected monthly	5	
Measures of safety are behavioral and preventive rather than lost-time type	4	
There is a combination of metrics into an overall performance index	5	93%

0-Weakest, 5-Strongest

**Figure 25. Pratt & Whitney Assessment Survey Safety**

### **5.2.2.3 Pratt & Whitney Product and Service Quality**

Pratt & Whitney uses a balanced scorecard approach when assessing Product and Service Quality. Spare part deliveries and on time responsiveness are measured. They use a survey to determine what measures are important to the customer and to determine quality satisfaction. Other metrics are used including: Shop Visit Rate, Inflight Shutdowns, Thrust Specific Fuel Consumption, Exhaust Gas Temperature Margin, Weight, Noise, Emissions, Airline Delays and Flight Cancellations. These metrics are combined in a scorecard for overall Product and Service Quality. An assessment survey score of 90% (Figure 26) identifies only slightly more work can be done in the area of relating metrics to overall accomplishments.

Internal Stakeholders <b>Product &amp; Service Quality</b>	Individual Score	Total Score
Characteristics that are measured are most important to the customer	5	
Metrics of inspection ensure all products/services meet standards	5	
Metrics are related to accomplishments rather than behavior	4	
Measures are expressed as numbers rather than percentages of defect free products	4	90%

0-Weakest, 5-Strongest

**Figure 26. Pratt & Whitney Assessment Survey Product & Service Quality**

### **5.2.2.4 Pratt & Whitney Internal Customer Satisfaction**

As an internal customer, each Component Center measures their own hardware delivery performance and component quality through defects, scrap rate, and turnbacks. Cost reduction goals are set and metrics evaluate the goals performance. New processes use “Task Tickets” to measure the performance of information and service related requirements against negotiated scheduled milestones. In addition, the affiliated component centers (CIPT) give input to the employee performance reviews. These metrics help improve the quality and performance from one module center to another.

Furthermore, the shop visit rate, inflight shutdowns, airline delays, and flight cancellations, as measured in Product and Service Quality, are broken down by component failure and traced back to the CIPT for root cause analysis. The assessment survey returns a score of 68% (Figure 27) identifying weaknesses in the areas of perceived value and delighting the customer.

Internal Stakeholders	Individual Score	Total Score
<b>Internal Customer Satisfaction</b>		
Database includes metrics on customer satisfaction/value (repeat/lost, returns)	3	
Collects data on satisfaction and perceived value using surveys, phone, focus groups.	3	
Surveys for Customer satisfaction identify delights rather than satisfaction	2	
Surveys are based on research and identify most important requirements	5	
There is a combination of hard and soft values into overall satisfaction index.	4	68%

0-Weakest, 5-Strongest

**Figure 27. Pratt & Whitney Assessment Survey Internal Customer Satisfaction**

### 5.2.3. Pratt & Whitney Customer Satisfaction

To understand the voice of the customer, the Integrated Product Teams have instituted a balanced scorecard approach to assess Customer Satisfaction. A survey-based scorecard is given every quarter to the customers. The correlation between IPT actions and customer perception are established and resultant adjustments in policies are enforced accordingly. Pratt & Whitney uses on time delivery, maintenance costs, part costs, life-cycle costs, and the metrics that are identified in Product and Service Quality to lead to a perfect score on the assessment survey (Figure 28) and help ensure customer satisfaction.

Customer Satisfaction	Individual Score	Total Score
Database includes metrics on customer satisfaction/value (repeat/lost, returns)	5	
Collects data on satisfaction and perceived value using surveys, phone, focus groups.	5	
Surveys for Customer satisfaction identify delights rather than satisfaction	5	
Surveys are based on research and identify most important requirements	5	
There is a combination of hard and soft values into overall satisfaction index.	5	100%

0-Weakest, 5-Strongest

**Figure 28. Pratt & Whitney Assessment Survey Customer Satisfaction**

#### 5.2.4 Pratt & Whitney Supplier Performance

The Integrated Product Teams use outside suppliers extensively to provide necessary parts and services for the development and manufacturing of the product. Long term agreements (3 to 5 years) are heavily negotiated to ensure that best pricing is obtained. The quality of parts from the supplier is measured by inspection and testing prior to every delivery. Pratt & Whitney's receiving department also performs a quality inspection at the time of delivery. Returns, scrap, and rework are all measured and fed back to the supplier. On time delivery performance is also measured. With a low score of 64% (Figure 28) in the assessment survey, Pratt & Whitney's Supplier Performance metrics show the most need for improvement.

Supplier Performance	Individual Score	Total Score
There are a few key supplier performance measures (4-6, value added/employee)	3	
There is a mix of hard and soft measures of performance	1	
The quality of goods and services purchased from suppliers is measured	5	
Suppliers process their own data and do self inspections/testing	5	
There are measures of suppliers staying within price guidelines.	2	64%

0-Weakest, 5-Strongest

**Figure 29. Pratt & Whitney Assessment Survey Supplier Performance**

### **5.3 Summary**

Overall, the measurement system of Pratt & Whitney Integrated Product Teams is consistent across the organization and links tightly to key success factors of the company. Reporting of the metrics is in an easy to read format and is reviewed by management on a periodic basis. Metrics are continually evaluated and utilized when performing long term planning and setting goals. The assessment survey returns an above average total score of 86% and identifies potential improvements in the metric utilization categories of Employee Satisfaction and Supplier Performance.

# CHAPTER 6

## Sikorsky Platform Teams

### Data Analysis

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#### **6.0      Introduction**

To initiate change in an organization it is necessary to identify and validate the problem. In Chapter 3, a “Best Practice” method was identified to evaluate the measurement system of Sikorsky Platform Teams. In this process, the first step is to assess the overall quality of the measurement system that is already in place. This is done with the Metric Assessment Survey contained in Appendix A. The survey segregates the overall measurement system into four categories for use by the Platform Team. The categories are Operations/Finance, Other Internal Stakeholders, Customer Satisfaction, and Supplier Performance. In the next step of the process, further assessment is performed by comparing the Platform Team metrics to the literature. Additionally, the Platform Team metrics are then benchmarked to a similar organization. The third step uses the results of the survey, the literature, and the benchmarking to target improvement areas. A more detailed analysis is then performed of the individual metrics utilizing The Ten Requirements of Good Metrics (Appendix B). This detailed analysis consists of a series of questions to assess the quality and guide the development of each individual metric.

Finally with the assessment complete, the “Vision to Metrics Model” for Sikorsky Platform Teams is developed (Figure 37). This model is used as a “Best Practice” method to establish a new measurement system. The “Vision to Metrics Model” combines the organizational structure and the Product Development Process of the Sikorsky Platform Teams with the three methods for developing a new metric system as identified in Chapter 3. The Sikorsky visions, strategies, goals, and metrics are then mapped to the “Vision to Metrics Model” to identify strengths and weaknesses.

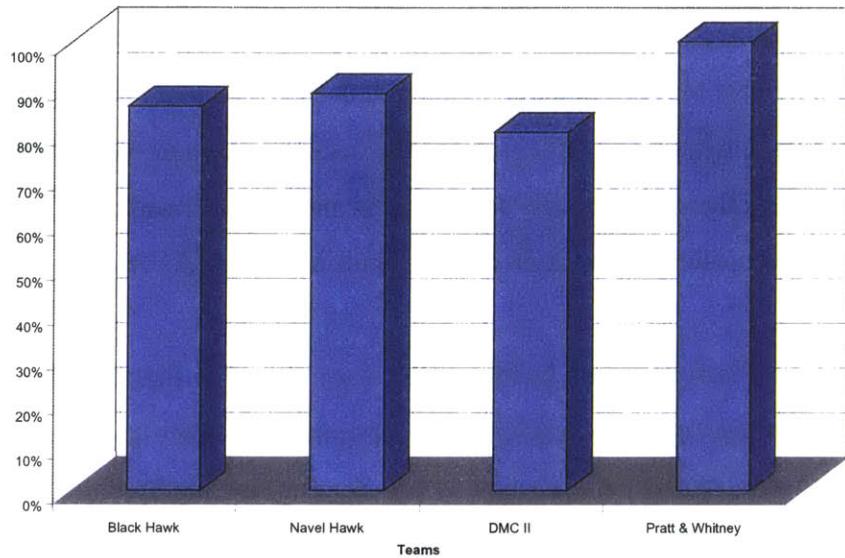
## **6.1 Metric Assessment**

In the following sections, the Sikorsky Platform Team metric system is broken into four metric utilization categories for assessment: Operations/Finance, Other Internal Stakeholders, Customer Satisfaction, and Supplier Performance. Results of the assessment survey, literature, and examples from Pratt & Whitney's Integrated Product Teams are all used to identify strengths and weaknesses in the Sikorsky Platform Team metric system. Further analysis is also performed using The Ten Requirements for Good Metrics (Appendix B).

### **6.1.1 Operations/Finance**

“The key to excellence in any organization is control of its processes to produce reliable and consistent products and services” (Brown, 1996). The Sikorsky Platform Teams consistently score high in the category of Operations/Finance on the assessment survey with scores all above 80% (Figure 30). These scores reflect the use of a few key operational/financial metrics that determine short and long term success of the organization (Appendix B, Requirement 3). These metrics combine budget, schedule, and cost into an earned value system that is used to predict problems and set goals to achieve future strategic objectives. A combination of the metrics is presented weekly to upper management as a return on sale (ROS). This ROS is the target and sets the budget for each of the programs in the Platform Team. Each phase of the Product Development Process (Figure 11) is measured and presented in a weekly report to management (Figure 12 and 13). Even with this high score, improvements can be made to the measurement system.

## Metric Assessment Survey Combined Results Operations / Finance



**Figure 30. Metric Assessment Survey Combined Results Operations/Finance**

One problem is that the initial Product Development Process, the Concept Development, Preliminary Design, and Proposal Preparation phases are all governed only by an end date. This end date does not incorporate cost and therefore does not align work with value (Appendix B, Requirement 7). In addition, even though the metrics are consistent in each program within a Platform Team, a problem exists because they are not consistent across all the Platform Teams. For example, following budget authorization, a detailed build plan is spun from the program plan that is unique to each of the Platform Teams. This build plan combines all of the Platform Team operations into a single plan. The detailed build plan includes individual drawings, harnesses, part fabrication, production assembly, modification assembly, procurement, test, and qualification schedules. Performance is measured in standard labor and material by an earned value system but the Platform Teams differ in their styles and in measuring engineering performance.

The Black Hawk Platform Team, for example does not use an earned value system for its engineering functions. Performance is based on milestone delivery and cost vs. budget by phase. In contrast, the Navel Hawk Platform Team provides an earned value system for engineering by expanding the build plan into a start date, completion date, and estimated cost for each activity. This micro-managed plan, through the use of extensive resources, allows management to see the detailed past and the present condition of the organization. The team can then use this information to forecast the future direction of the project (Requirement 10 of good metrics, Appendix B).

The DMC II Platform Team further differs from the other Platform Teams by segregating the engineering and operations into component families and major milestones. The team uses an earned value system for engineering by correlating activities to cost. Past and present conditions of the organization are known and are used to predict future potential problems (Requirement 10 of good metrics, Appendix B). An advantage of the differentiation is that it identifies problems specific with the integration of a particular component, giving management more information to make corrective decisions. However, a problem exists in the cost estimates of engineering activities of the DMC II Platform Team. The estimates are often not accurate because they are based on personnel experience and not standards. This leads to inaccurate performance measures. To overcome this, Pratt & Whitney uses a documented standard work system that is continually updated to base all their estimates on and guide the organization in day to day activities. Further improvements to the Sikorsky Platform Team measurement system can be identified through comparison with the Pratt & Whitney Integrated Product Teams.

In the “Criteria for Performance Excellence,” the Baldrige National Quality Program states, “Comparative and benchmarking information often provides impetus for significant improvement or changes and might alert organizations to competitive threats and new practices.” Contrary to Sikorsky Platform Teams, Pratt & Whitney Integrated Product Teams, with a perfect score on the assessment survey, (Figure 29) uses

competitive benchmarking and establishes tends for raw material cost per pound and buy-to-fly ratios. The trends are used to identify cost tradeoff opportunities and reduce scrap rate.

The future of cost and performance systems is changing from the traditional earned value systems currently used by Sikorsky and Pratt & Whitney. Robert Kaplan and Robin Cooper in *Cost & Effect* identify companies are moving to Activity-based cost (ABC) systems to provide more accurate information about the costs of processes, products, and customers. Activity-based costing is a system that provides accurate information about the resource demands by individual products, services, customers, and activities. ABC is used to provide relevant and timely performance measurement feedback on efficiency, quality, cycle time, and continuous improvement activity. (Kaplan and Cooper, 1998) Through ABC systems, the organization can begin to calculate the true cost of each major step in their processes and therefore make strategic cost improvements and not sacrifice the integrity of the process. (Brown, 1996)

### **6.1.2 Other Internal Stakeholders**

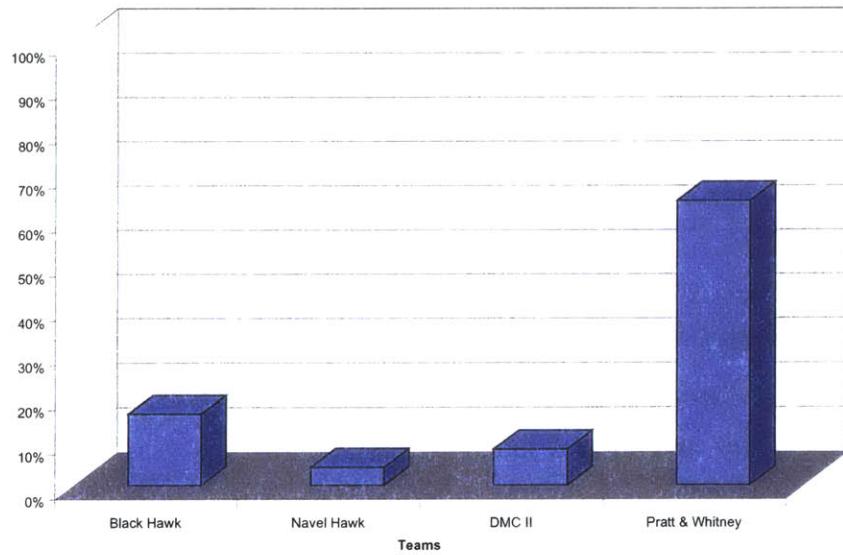
The next category for assessment is the Other Internal Stakeholders. This category is further broken down into four sub-categories: Employee Satisfaction, Safety, Product Service Quality, and Internal Customer Satisfaction.

#### **6.1.2.1 Employee Satisfaction**

Employee health and well being is important to the success of a business according to Mark Graham Brown in *Keeping Score*. The metrics in Employee Satisfaction across all the Sikorsky Platform Teams are identified as one of the weakest categories of the measurement system by the assessment survey (Figure 31). None of the

metrics in this category are reviewed by upper management on a regular basis. With the only required feedback coming from yearly employee reviews, it is difficult to assess the quality of Employee Satisfaction throughout the year and it doesn't appropriately focus the organization on all the necessary improvement needs (Appendix B, Requirement 5). Sikorsky offers outside services and activities for investments, first time home buying, family planning, etc., but without metrics the effectiveness of these services and their relationship to the work environment is hard to determine. In addition, Sikorsky has compensation and recognition packages available, but there is no metric to track appropriate usage.

Metric Assessment Survey Combined Results  
Employee Satisfaction



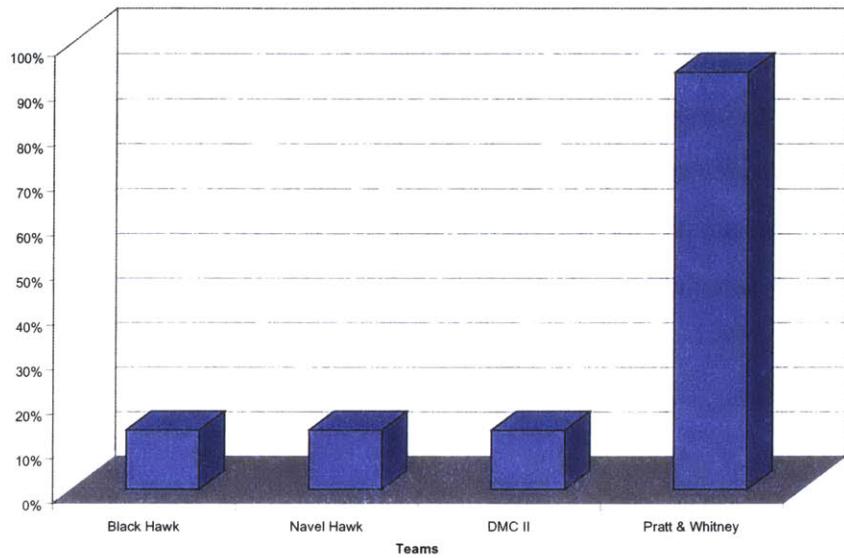
**Figure 31. Metric Assessment Survey Combined Results Employee Satisfaction**

Additional improvements in Employee Satisfaction can be seen through benchmarking the Integrated Product Teams at Pratt & Whitney. Pratt & Whitney's metrics support their belief that one of the most important assets of a company is the skill and experience of the workforce. Employee training, salary and benefit benchmarking, attrition rate, supervisory reviews, and surveys performed by outside organizations help Pratt & Whitney increase employee satisfaction. Brown in *Keeping Score* states that attrition rate, exit interviews, focus groups, interviews, and surveys are additional effective Employee Satisfaction metrics.

#### **6.1.2.2 Safety**

Safety is one of the most important concerns of Sikorsky even though safety ranks very low in the assessment survey (Figure 31). The problem is that the Platform Teams are not specifically responsible to report on Safety. Measurements exist to prevent accidents at the plant but are not used by everybody (Appendix B, Requirement 9). Pratt & Whitney breaks down accidents into types to help isolate problematic areas. They also offer ergonomic training and ergonomic office furniture to prevent injury. These metrics along with mandatory safety training result in a near perfect score in the assessment survey (Figure 32).

## Metric Assessment Survey Combined Results Safety

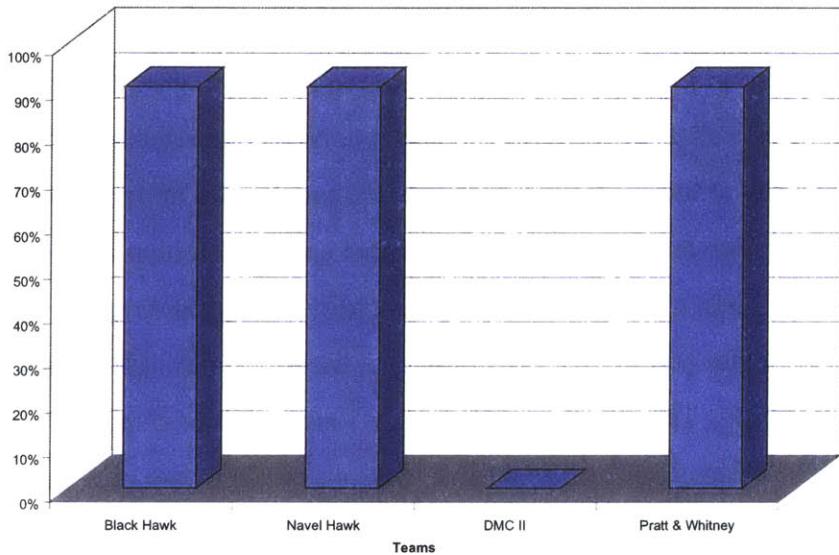


**Figure 32. Metric Assessment Survey Combined Results Safety**

### 6.1.2.3 Product and Service Quality

Metrics for the Sikorsky Platform Teams with the responsibility of Product and Service Quality rank in the 90% range in the assessment survey (Figure 33). This score is obtained by using metrics expressed in numbers that relate to overall accomplishments and verify products and services meet standards. The assessment may be overrated due to the fact that an overall Product and Service Quality scorecard and periodic surveys are not used.

## Metric Assessment Survey Combined Results Product & Service Quality



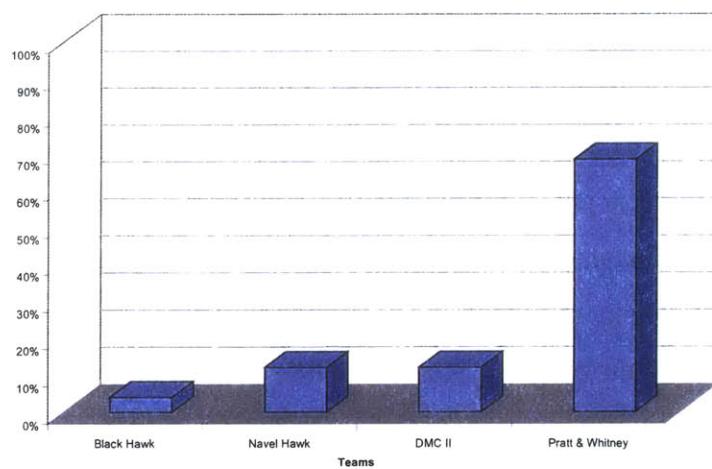
**Figure 33. Metric Assessment Survey Combined Results Product & Service Quality**

"Each individual product or service may have many different attributes or characteristics that need to be measured. The difficulty lies in measuring all the important characteristics and not measuring irrelevant factors" (Brown, 1996). In order to identify the important characteristics, Pratt & Whitney uses a balanced scorecard approach and surveys to verify what is measured and its importance to the customer. They also use trends in the data to provide further information. The scorecard approach can be used to identify new processes at which an organization must excel to meet customer needs and still maintain focus on financial objectives (Kaplan and Norton, 1996). In contrast, Sikorsky utilizes a single report form filled out by the field representative that gives the progress and satisfaction of the service being supplied to the customer. System anomalies, component failures, and on time deliveries are also reported but not tracked. Therefore, history does not exist showing trends.

#### **6.1.2.4 Internal Customer Satisfaction**

Poor performance in the assessment survey is recorded across all the Platform Teams (Figure 34). Each part of the Product Development Process is measured in Operations/Finance but accountability for scrap, rework, and returns are not properly assigned. Root cause analysis from rework and returns is not performed. Metrics do not exist to help identify to the downstream process the satisfaction of work and activities. Pratt & Whitney Integrated Product Teams measure each component center on their own hardware delivery performance and component quality through defects, scrap rate, and turnbacks. Information and service performance is measured through a “Task Ticket” process, which exhibits The Ten Requirements for Good Metrics (Appendix B). In addition, Pratt & Whitney perform root cause analysis on shop visit rate, inflight shutdowns, airline delays, and flight cancellations to track the problem back to the component centers. In addition, a proactive approach can be applied for identifying requirements for Customer Satisfaction such as customer feedback, interviews, and surveys (Brown, 1996).

**Metric Assessment Survey Combined Results  
Internal Customer Satisfaction**

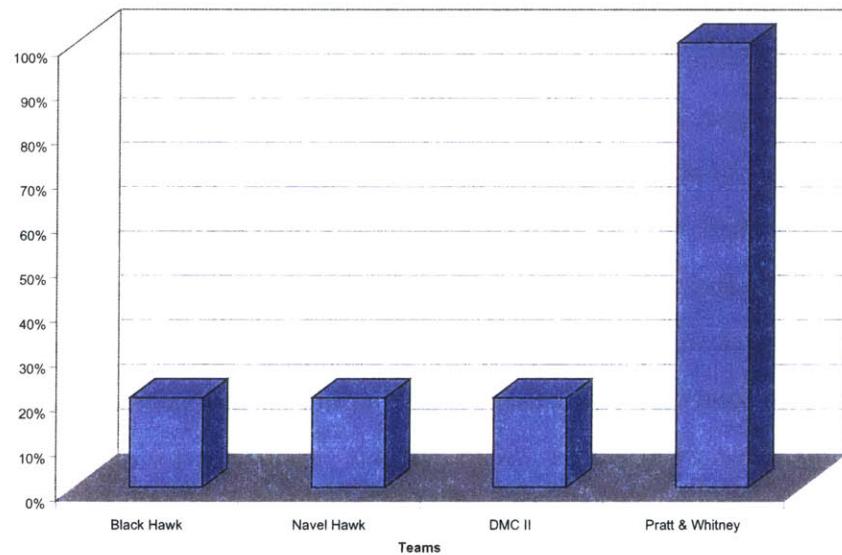


**Figure 34. Metric Assessment Survey Combined Results Internal Customer Satisfaction**

### 6.1.3 Customer Satisfaction

Customer Satisfaction is the next category for analysis. A score of 20% is reported from the assessment survey for all three Platform Teams (Figure 35). This score is one of the lowest in the assessment survey. Outside of the requirements identified in the contract and the design reviews, no other formal measurements are used by the Platform Teams. The Program Manager keeps close contact with the customer through development and manufacturing of the aircraft, but metrics are not collected to identify customer satisfaction. After delivery, the field service representative continues the relationship with the customer. Customer Satisfaction is obtained from a field service report form.

Metric Assessment Survey Combined Results  
Customer Satisfaction



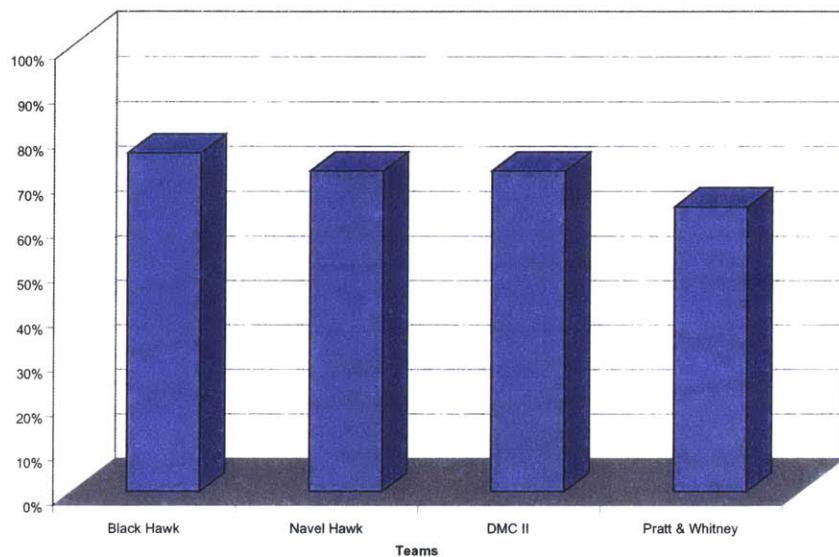
**Figure 35. Metric Assessment Survey Combined Results Customer Satisfaction**

Kaplan and Norton state in *The Balanced Scorecard*, that companies which do not understand their customer needs will observe competitors making inroads by offering products or services better aligned to their customers' preferences. In addition, Mark Graham Brown in *Keeping Score* identifies that hard metrics such as gains and losses of customers, and repeat business should be mixed with customer opinions, perceptions, and feelings into an overall customer satisfaction index. Pratt & Whitney exemplify these points by returning a perfect score on the assessment survey for Customer Satisfaction (Figure 35). Pratt & Whitney have instituted a survey based customer scorecard along with a number of different performance metrics that are determined to be important to the customer. This scorecard is periodically presented to management.

#### **6.1.4 Supplier Performance**

The last category for assessment is Supplier Performance. "A good set of supplier metrics include measures of product/service quality, process variables, price competitiveness, and overall ease of doing business" (Brown, 1996). The Platform Teams score in the 70% range for Supplier Performance in the assessment survey (Figure 36). At Sikorsky, the purchasing team is the link to the suppliers. They qualify and maintain the relationship between the Platform Teams and the suppliers. Sikorsky performs inspection checks on the material when it is delivered and sends it back if there is a problem. Failures and rejections are recorded and root cause analysis is performed which provides feedback to the supplier (Appendix B, Requirement 4). Although these methods are used, no scorecard exists to indicate supplier performance. According to Brown in *Keeping Score*, an effective way to evaluate supplier performance is with 6 to 10 measures. These measures are combined to compute an overall product/service quality index for each supplier. Within Sikorsky Platform Teams, a set of metrics is not available to indicate a supplier is staying within price guidelines or to identify the timeliness of delivery and services completed. Pratt & Whitney however, measures delivery and on time performance along with their incoming inspection.

## Metric Assessment Survey Combined Results Supplier Performance



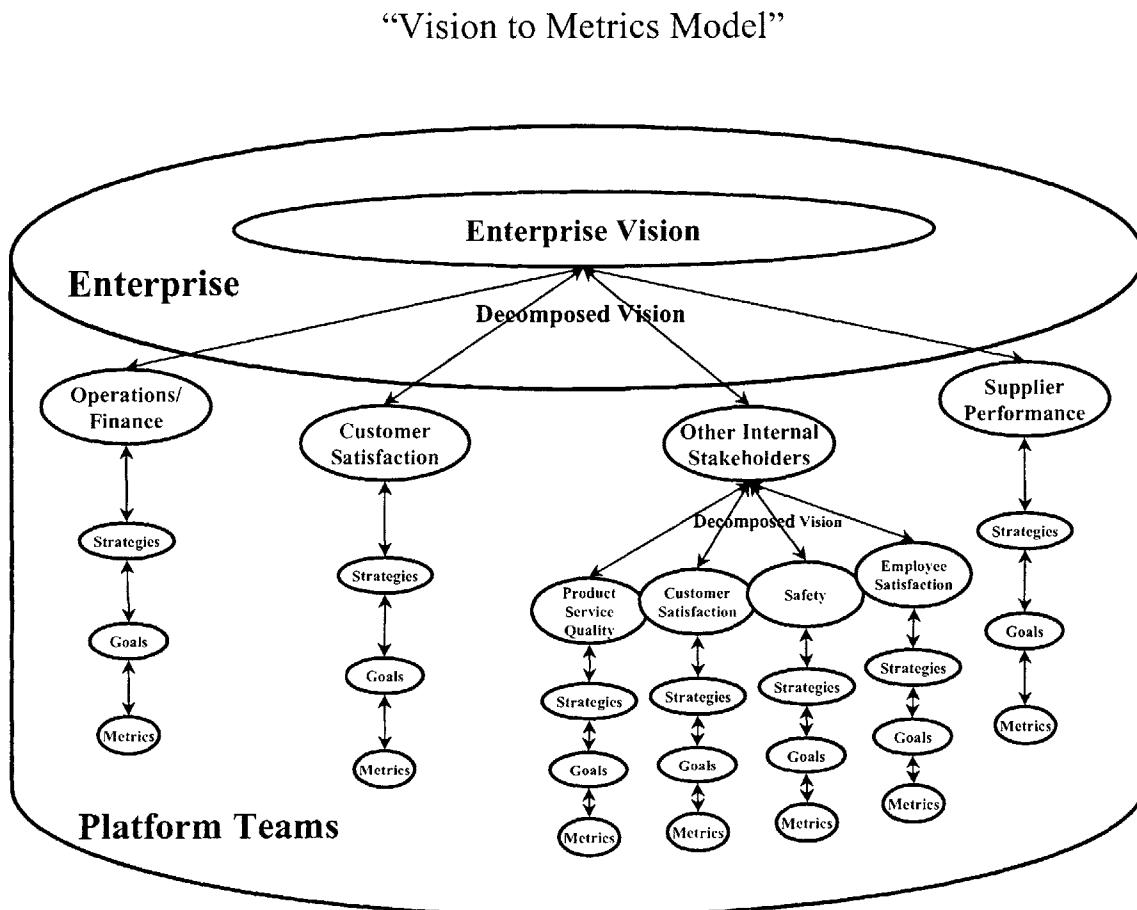
**Figure 36. Metric Assessment Survey Combined Results Supplier Performance**

An additional problem exists because actual price of material and services from suppliers vs. the planned price is not reported and tracked. Therefore, trends do not exist to identify supplier-pricing deficiencies. In addition, the Baldrige Criteria for 1999 identifies training, long term agreements, incentives, and recognition to be included to improve the ability of suppliers and partners to contribute to achieving your organization's performance goals.

### 6.2 Establishing a New Metric System

From the evaluation of the assessment survey a good indication of the overall quality of the existing measurement system is in place and the key areas of improvement were identified. The next step is to focus on the key improvement areas to establish new measurements. The “Vision to Metrics Model” is presented in Figure 37 for Sikorsky

Platform Teams. This model is used as a “Best Practice” method to establish a new measurement system. The “Vision to Metrics Model” combines the organizational structure and the Product Development Process of the Sikorsky Platform Teams with the three methods for developing a new metric system as identified in Chapter 3.



**Figure 37. Vision to Metrics Model**

### **6.2.1 Mechanisms of the Model**

The “Vision to Metrics Model” (Figure 37) begins with an Enterprise Vision and sets up a process to communicate it throughout the organization. Each of the major categories in the Platform Team, Operations/Finance, Other Internal Stakeholders, Customer Satisfaction, and Supplier Performance, decompose the vision into sub-visions related to the groups activities. Strategies are then established to achieve each of these sub-visions. If necessary the strategies are further decomposed into measurable chunks. Goals are then set to help direct and monitor strategy deployment. Finally, metrics are created to quantify progress and maintain focus toward achieving goals. These metrics are collected by each category and combined into indices or scorecards that get periodically reported back up the chain to management. Over time, as the goals and the strategies change, so do the metrics keeping them aligned with future objectives and the overall vision. This ever-changing process is fed by innovation and strategy deployment and uses metrics to maintain focus.

### **6.2.2 Mapping to the Model**

Sikorsky, primarily a functional organization, went through reorganization in early 1998 to implement a team-based design, development, and production process. The goal was to establish a heavyweight project matrix organization. Platform Teams were created around the different product families such as the Black Hawk and the Navel Hawk Platform Teams. A new vision with supporting strategies, goals and metrics were established. These visions, strategies, goals and metrics were presented to the company by management in early 1998 as a road map to the new organization. The Sikorsky vision is “Make every customer a raving fan.” Supporting this vision are the following four categories:

1. Understand our customers’ needs as well as they do in order to deliver products and services that exceed expectations.

2. Implement a team-based design, development, and production process that achieves decisive market speed, cost, and quality advantage.
3. Attract and retain the best people.
4. Use technology to maximize value to the customer

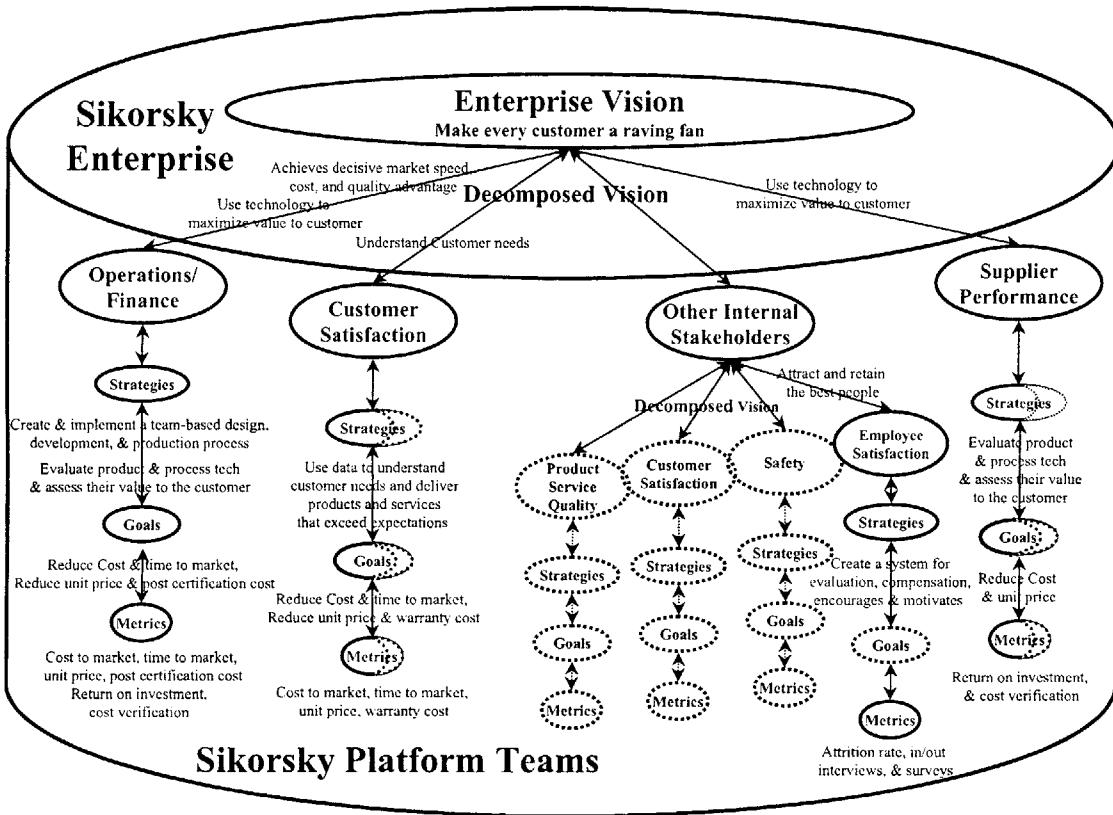
Mapping these to the “Vision to Metrics Model,” the four categories are identified as sub-visions in Figure 38. Sikorsky’s strategies and their associated metrics are presented below:

1. Use data to understand customer needs and deliver products and services that exceed customer expectations for total transportation systems. The metrics are cost to market, time to market, unit price, and warranty cost.
2. Create and implement a team-based design that achieves decisive market speed, cost, and quality advantage. The metrics are cost to market, time to market, unit price, and post certification cost.
3. Create and implement a system for evaluation, compensation, and an organization that encourages and motivates people. The metrics are attrition rate, in/out interviews, and surveys.
4. Evaluate product and process technologies and assess their value to the customer. The metrics are return on investment, and cost verification.

Using the “Vision to Metrics Model” the strategies and metrics are again mapped to the different categories of metric utilization in Figure 38. The following goals were identified by Sikorsky:

1. Reduce cost to market.
2. Reduce time to market.
3. Reduce unit price.
4. Reduce post certification cost.
5. Reduce warranty cost.

## The Sikorsky Organization Mapped to The “Vision to Metric Model”



**Figure 38. The Sikorsky Organization Mapped to the Vision to Metrics Model**

### 6.2.3 Strength and Weaknesses

The reorganization of Sikorsky into Platform Teams supports the first several steps of the “Vision to Metrics Model.” Sikorsky’s Enterprise Vision is decomposed into sub-visions as outlined by the model. Continuing to follow the model the Sikorsky strategies that are presented align with these sub-visions for Operations/Finance, Customer Satisfaction, Employee Satisfaction, and Supplier Performance. Further comparing the Sikorsky enterprise to the “Vision to Metrics Model” identifies several deficiencies, which are depicted in Figure 38 by dashed lines.

The decomposition of the vision into sub-visions completely leaves out product service, internal customer satisfaction, and safety categories. In addition, sub-visions to the suppliers and the customers do not encompass all the necessary requisites. Supplier product/service quality is not addressed, and fulfilling the customer needs do not necessarily include satisfying the customer.

Moreover, the Platform Teams do not utilize many of the metrics and seem only to implement strategy #2, “Create and implement a team-based design that achieves decisive market speed, cost, and quality advantage.” Also, the Sikorsky established goals only refer to cost and cycle time reductions. Goals are not established for the other categories, and therefore may be the reason other strategies are not implemented and the other metrics are not used.

In addition, the metrics identified do not include everything that is necessary to achieve strategy implementation and success. First of all, the sub-vision Understanding the Customer Needs, can not be satisfied with the metrics cost to market, time to market, unit price, and warranty cost alone. As identified in the Customer Satisfaction section above, a combination of hard and soft metrics such as gains and losses of customers, and repeat business should be mixed with customer opinions, perceptions, and feelings to be included into an overall customer satisfaction index. Next, Sikorsky sub-vision #2 regarding employee retention, can not be achieved by just collecting attrition rate, in/out interviews, and surveys. Additional metrics supporting strategies for competitive compensation packages, employee training, and salary and benefit benchmarking identified in the Employee Satisfaction section above can help achieve employee retention.

Overall the metrics system should support the strategic planning and drive deployment of the actions required, thereby achieving Sikorsky’s strategic objectives and aligning with the enterprise vision.

## **CHAPTER 7**

### **Conclusions**

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#### **7.0 Conclusions**

The objectives of this Thesis were 1) to examine what metrics were currently being used in the Platform Teams at Sikorsky and apply a “Best Practice” method for assessment, 2) use the results of the assessment to target improvement opportunities, 3) create a “Best Practice” model to establish a new measurement system, and 4) map the Sikorsky organization to the model to identify strengths and weaknesses.

The “Best Practice” method for assessment is a three-step process that was identified in Chapter 3. Step one is to assess the overall quality of the measurement system using the Metric Assessment Survey contained in Appendix A. Step two is a combination of results obtained from the comparisons of the Platform Team to related literature and to the Pratt & Whitney Integrated Product Teams. Finally, step three is a more detailed analysis of the individual metrics utilizing The Ten Requirements of Good Metrics in Appendix B. These results are used to target improvement areas in each of the metric utilization categories, Operations/Finance, Other Internal Stakeholders, Customer Satisfaction, and Supplier Performance.

The Sikorsky Platform Teams concentrate heavily on the metrics for Operations/Finance. A majority of the metrics in this category are representative of The Ten Requirements For Good Metrics (Appendix B). A few problems still exist. Mainly, the metrics are not consistent across the Platform Teams, and the cost estimates of engineering activities are inaccurate because they are based on personnel experience and not standards. Pratt & Whitney is slightly more thorough by included additional metrics such as competitive benchmarking and establishing cost tends.

The metric utilization category for Other Internal Stakeholders is comprised of Employee Satisfaction, Safety, Product Service Quality, and Internal Customer Satisfaction. The metrics in this category are not well represented in the Sikorsky Platform Teams. First of all, none of the metrics in Employee Satisfaction are reviewed by upper management on a regular basis. The only existing metric is the required feedback coming from yearly employee reviews. Contrary to this, Pratt & Whitney and examples from the literature identify employee training, salary and benefit benchmarking, attrition rate, supervisory reviews, exit interviews, focus groups, and surveys as effective metrics. Secondly, although safety is a crucial concern at Sikorsky, it is not a responsibility of the Platform Teams and therefore metrics are not periodically reported to Platform Team management. Next, Product and Service Quality metrics are expressed in numbers that relate to overall accomplishments and verify that products and services meet standards, but contrary to Pratt & Whitney, do not use scorecard and survey approaches. Finally, Internal Customer Satisfaction metrics are not collected. Each part of the Product Development Process is measured in Operations/Finance but metrics do not exist to help identify to the downstream process the satisfaction of work and activities.

The only metrics in the category of Customer Satisfaction that are used by the Platform Teams come from the requirements identified in the contract and the design reviews. These metrics do not include customer opinions, perceptions, and feelings and fail several of The Requirements for Good Metrics (Appendix B). On the other hand, Pratt & Whitney has instituted a survey based customer scorecard along with a number of different performance metrics to provide an all-inclusive view of Customer Satisfaction to management.

The metrics for the last category, Supplier Performance, do a moderate job in obtaining results. The Platform Teams use inspections, failures, rejections, and root cause analysis metrics to identify product/service quality. Price competitiveness, timeliness of delivery, and a supplier scorecard do not exist to indicate supplier performance.

The “Vision to Metrics Model” (Figure 36) for Sikorsky Platform Teams is used as a “Best Practice” method to establish a new measurement system. It is a step by step process that begins with an Enterprise Vision and finishes by creating metrics. The new metrics align with the vision and can accurately show the progress toward achieving goals and strategies.

Mapping the Sikorsky organization to the model identifies several deficiencies. To begin with, the Enterprise Vision is not communicated functionally to over a third of the organization (Figure 38). Also, many of the metrics and strategies presented by Sikorsky are not utilized because associated goals are not instituted. Additionally, the Sikorsky strategies for understanding the customer needs and employee retention can not be achieved by only using the metrics presented.

In summary, the poor assessment of the Sikorsky Platform Team metric system can be attributed to the lack of a holistic view of the organization. The assessment identifies a balance of metrics do not exist in each of the metric utilization categories. Furthermore, from the mapping of the Sikorsky organization to the model, the underlining problem is shown to be the inadequate dissemination of the vision throughout the organization and the supporting use of associated goals. Without proper alignment to the vision and use of associated goals the metric system can only be suboptimized and will lack the framework for performance excellence.

## CHAPTER 8

### Sikorsky Platform Teams

### Recommendations

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#### **8.0 Recommendations**

The assessment survey in Appendix A identifies weaknesses in three of the four categories for the Platform Teams at Sikorsky. The metric utilization categories Other Internal Stakeholders, Customer Satisfaction, and Supplier Performance all have potential for improvement. Using the “Vision to Metrics Model” for establishing a new metric system, improvements can be made to each of the above categories. John Hauser and Gerald Katz in the article *You are What You Measure* state “Any metrics system which is simply imposed from above without participation from those it impacts is likely to encounter resistance and even sabotage.” Therefore the development of the improvement process should incorporate the employees that are subject to the results. Each step in the “Vision to Metrics Model” for establishing a new metric system should be a combination effort of the personnel directly affected by that category. The composition of the Enterprise Vision should be a combination effort of the president and the executives one tier down. The executives and the directors of each Platform Team then decompose the vision into sub-visions for each metric utilization category. The directors and managers of each of the Platform Team then construct the strategies. If necessary, the strategies are then further decomposed until they are in measurable chunks. Finally, goals and metrics are established by a consortium of managers and employees. This approach involves everybody in the process and leads to buy in and ownership of the improvements. To recommend improvements across the Platform Teams without the collaboration of the organization would be futile. An example of improvements to the category of Employee Satisfaction is described below.

## **8.1 Employee Satisfaction Recommendations**

Sikorsky's existing vision supports employee satisfaction, "Attract and retain the best people." The strategy supporting the vision, "Create and implement a system for evaluation, compensation, and an organization that encourages and motivates people," should be expanded to include continuing to educate the workforce. This strategy then needs to be further decomposed by section into measurable chunks. Creating and implementing a system for evaluation can be decomposed into setting job standards, incorporating employee to manager reviews, and evaluation satisfaction surveys. Goals can then be established to enforce these new strategies. For example, establishing new job standards and manager reviews prior to the next performance review, job standard training for every employee, a high level of evaluation satisfaction, and a high percentage of returns on employee surveys. The metrics supporting these goals are the number of new job standards, job standard training hours completed, evaluation satisfaction rating, and the percentage of surveys returned. A decomposition such as this could then be continued for the rest of the strategies.

Overall, surveys should be periodically performed to find out what is of value to the employee and identify current employee satisfaction. Strategies and goals that retain and satisfy the employee need to be continually evaluated and updated. Metrics should be assessed to verify they support the strategies, maintain focus, and evaluate performance. Finally, an overall employee satisfaction index should be developed from the consolidation of all the metrics. This index should be communicated throughout the organization and be periodically reported to management.

Once a measurement system is in place a process needs to be established to monitor and maintain its effectiveness. A Process Improvement Manager should be assigned to direct new strategy implementation and oversee metric development/deployment. Manager performance and compensation should be linked to the success of meeting strategies and goals that align with the Platform Team visions.

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## Appendix A

### **Black Hawk**

Individual Score      Total Score

#### **Operations/Finance**

There are a few key operational/Financial measures (4-6, value added/employee)	5	
There is a mix of short and long term measures of success	5	
Metrics are consistent across organization	4	
Process measures link to key customer product/service characteristics	5	
Cycle time is used as a key operational measure.	5	
Measures forecast problems, not just identify.	5	
Data is collected on major competitors to benchmark performance and set goals	1	
There is a combination of metrics into overall performance (EVA, ROA)	5	86%

#### **Internal Stakeholders**

##### **Employee**

Surveys 1/yr to determine satisfaction on organizational behavior.	2	
Surveys are anonymous and >75% are returned.	0	
Research is done to determine what is important to employees for survey.	0	
Other metrics are collected on employee satisfaction	0	
There is a combination of metrics into overall satisfaction index.	2	16%

##### **Safety**

There are a few key measures collected monthly	1	
Measures of safety are behavioral and preventive rather than lost-time type	1	
There is a combination of metrics into an overall performance index	0	

##### **Product Service**

Characteristics that are measured are most important to the customer	5	
Metrics of inspection ensure all products/services meet standards	5	
Metrics are related to accomplishments rather than behavior	4	
Measures are expressed as numbers rather than percentages of defect free products	4	

##### **Internal Customer**

Database includes metrics on customer satisfaction/value (repeat/lost, returns)	1	
Collects data on satisfaction and perceived value using surveys, phone, focus groups.	0	
Surveys for Customer satisfaction identify delights rather than satisfaction	0	
Surveys are based on research and identify most important requirements	0	
There is a combination of hard and soft values into overall satisfaction index.	0	

4%

31%

##### **Customer**

Database includes metrics on customer satisfaction/value (repeat/lost, returns)	1	
Collects data on satisfaction and perceived value using surveys, phone, focus groups.	1	
Surveys for Customer satisfaction identify delights rather than satisfaction	1	
Surveys are based on research and identify most important requirements	1	
There is a combination of hard and soft values into overall satisfaction index.	1	

20%

##### **Supplier**

There are a few key supplier performance measures (4-6, value added/employee)	5	
There is a mix of hard and soft measures of performance	3	
The quality of goods and services purchased from suppliers is measured	5	
Suppliers process their own data and do self inspections/testing	4	
There are measures of suppliers staying within price guidelines.	2	

76%

## Appendix A

### **Overall Approach**

Metrics are tightly linked to key success factors	5	
Database was built with a plan / didn't just evolve.	4	
Are there more than 20 metrics that are used daily?	5	
Performance Metrics are mostly consistent across organization?	2	
Well-balanced set of metrics?	2	72%

### **Reporting/Analyzing Data**

All organizational metrics are reported in a single report to mgmt.	2	
Data is reported in easy to read format (graph trends etc.)	5	
All Data is reviewed on the same period and by all the management.	3	
Correlations have been made linking customer satisfaction to financial performance.	4	
The organization understands all key measures and relationships used.	5	
Performance data is used to make key decisions	5	
Measures are consistent with organizations mission, values, goals, and strategies	5	
Metrics are continually evaluated and improved.	5	
Metrics are used to do long term planning and set goals.	2	

**TOTAL SCORE**

138

61%

## Appendix B

### **The Ten Requirements For Good Metrics**

1. The metric clearly defines what constitutes business excellence.
2. The metric provides the information required to set aggressive yet achievable strategic objectives and stretch goals.
3. The metric accurately portrays the progress and probability of achieving both long-term and strategic objectives and near-term milestones.
4. The metric identifies the root causes of barriers.
5. The metric focuses the organization on the priority improvement needs.
6. The metric drives the behavior and actions required to achieve the strategic objectives
7. The metric aligns work with value.
8. The metric is easy to use.
9. The metric involves everyone.
10. The metric provides past, and present conditions and leads to future predictions to achieve success.