Total Quality Management

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Abstract

Quality is everyone’s responsibility. Quality is maintained throughout the organization by leadership and is validated by customer satisfaction, statistical analysis, and audit review. Sustainability of this quality is preserved by enveloping these principles into the culture of the organization. This paper will study a leading manufacturer of private jet aircraft. How Total Quality Management maintains and integrates quality into the organizational culture and preserves sustainability will be examined. We will review how the Management System integrates into the Quality System, how statistical process control is used to validate the aforementioned systems, and how this impacts the corporate culture. Analysis will demonstrate the effectiveness of these systems and provide recommendations for any inadequacy.

## Introduction

You walk into a fine restaurant or an upscale hotel and sense quality all around you. You cannot touch it, yet it is there. Each member of the staff addresses your needs without being pushy and you feel at ease. It is an essence, a certain ineffable form of quality. How do you achieve such quality? It will be demonstrated by this paper that leadership navigates the quality of an organization, while review and verification validates this quality. This ‘closed-loop’ system also generates the main engine of corporate sustainability, the corporate culture. This formula equates to a corporate culture spawns organizations that become known as ‘world-class’.

This paper will concentrate on a company who is the world-class leader in the manufacture and support of large intercontinental private aircraft. It is a combination of effective leadership, responding to customers, and quality compliance to both engineering and regulatory requirements. This has brought Gulfstream through its 52-year history to the pinnacle of the industry. Gulfstream’s flagship private jet aircraft, the G550, was recently named “the ultimate private jet” by International Business Times web-based magazine, (Riffkin, 2010). Gulfstream Aerospace, a subsidiary of General Dynamics, is also known throughout the industry as the leader in product support.

In 2009, Aviation International News Product Support Survey ranked Gulfstream as number one in product support, for the ninth year in a row (Thurber, 2009). The foundation of these achievements has roots that date back to 1957 when military aircraft manufacturer Grumman Aircraft Company initiated a new aircraft program for executive transport.

The first Gulfstream aircraft, the turboprop GI, was conceived from the voice of the customer. The design responded to questions like what types of airports are visited and what are the passenger cabin amenity requirements. What the customer wanted was a ‘mini-airline’ that would take them anywhere, anytime. Despite the critics, the GI delivered the right product and was resounding success. Although controversial at the time, Gulfstream was also the first aircraft manufacturer providing full-scale support. This support included 24 hour parts support and strategically placed ‘Field Service Representatives’.

Today, Gulfstream caters to global Fortune 500 companies as well as the rich and famous. Gulfstream has delivered over 1,500 aircraft to date. Over 30 governments, including the United States operate Gulfstream aircraft for transporting heads of state and fulfilling special missions ("The History of," 2010). Gulfstream has product support sites located throughout the world with the main manufacturing and product support facility located in Savannah, Georgia, The United States has three primary product support sites that include postproduction passenger interior outfitting at Appleton, Wisconsin, Dallas, Texas, and Long Beach, California.

Leadership’s role in directing quality, measurement of quality and how this impacts the corporate culture will be examined by this paper and quantified based on the course textbook, Managing for Quality and Performance Excellence, by James R. Evans and William M. Lindsay, 7th Ed., and other sources as cited. Quality is proven to be everyone’s responsibility. Leadership’s implementation of quality and the validation of quality form the corporate culture as the engine of process sustainability. This paper demonstrates quality as being maintained by leadership and how it is validated by customer satisfaction, statistical analysis, and audit review. Assessments and recommendations will summarize these findings.

**Assumptions and Limitations**

## Researcher’s Qualifications

I have worked on turbine powered private aircraft for over 26 years of the 32 years as an aircraft technician. Having worked on Gulfstream aircraft for 24 years, with 18 years in Quality and 3 years as a customer provides a unique insight to the subject of quality and sustainability at the company. Any expertise is not without limitations however.

Most experience directly related to Gulfstream is derived from the satellite facility located in Long Beach, California only. The main production facility is housed in Savannah, Georgia. Findings from the production arena are based on observations or ancillary experience. The Long Beach facility performs multiple roles for the company with Final Phase, (the completion of production aircraft with no passenger amenities), and Product Support (Service Center maintenance and over-the-counter parts sales).

Gulfstream Long Beach is a FAA certificated Repair Station and is part of the Enterprise FAA Organization Designation Authorization system. These authorities allow the facility to develop engineering modification data for aircraft and perform aircraft modifications, inspections, and repairs. Quality functions as mandated by the U.S. Federal Code of Regulations are maintained by the Quality Control department. Most of my experience in Quality has been associated with these two groups.

Experience as Quality Engineering Supervisor over the past several years has exposed me to our site’s Internal Audit System, Quality Tracking Metrics, and Compliance Publications.

## Limitations

The manufacture of aircraft is not the primary focus of this paper; the Final Phase (interior outfitting) and Product Support Quality Systems are. Gulfstream manufactures both midsize cabin class private jets and large-size cabin class private jets. The large-size cabin class units are the primary base of experience for the author. It also assumes that compliance quality (compliance to mandated regulatory requirements), is assumed. Organizational and customer satisfaction quality will be focus of this paper. It should be noted that compliance quality does play a significant role in highly regulated industries. What is important as it relates to this paper is the integration of compliance quality into lean quality processes.

This paper addresses sustainability as the ability of an organization to continue based on success in the industry. While environmental sustainability is a component of overall sustainability, it is not the focus of this paper. The site also has an Industrial Engineering Group that facilitates Lean Six Sigma, and an Environment, Health and Safety Group, both of which are separate from the Quality Organization. Environment, Health and Safety is also responsible for the Safety Management System. Assessment of these groups as related to this paper is based on limited exposure. Much of the Total Quality Management System has oversight from an enterprise level to bring consistency throughout the organization. Findings may either be specific to the local site or ancillary to the enterprise.

## The Leadership System

## Leadership

 Quality does not happen by itself, it must be pursued. When the leadership of an organization makes the pursuit of quality its top priority the rest of the company falls into place. This is not an automatic result however. Leaders must create a clear direction for the company and communicate this effectively to all employees.

The leadership team at Gulfstream understands this and expects the management team to put into practice quality principles, principles that have put the company at the top of the industry. Customer -focused strategic visions are defined and communicated throughout the enterprise. The organizational strategic mission is identified as Continuous Improvement Objectives that are reviewed annually, at a minimum, and updated continuously. The Enterprise Continuous Improvement Objectives are communicated to each site and each site identifies how it will support the objectives.

At the site level, each department identifies how it will support the Continuous Improvement Objectives and this continues to the individual employee. In this manner, each employee has tangible responsibility of the overall company objectives, providing ownership of the process and pride when success is achieved. Safety and customer satisfaction are at the front of the Continuous Improvement Objectives. Safety begins with each employee. Every conceivable effort is utilized to ensure the safety of the employees. This is an imperative and a source of pride in that we respect one another enough to look out for everyone’s safety.

This focus on safety reverberates to all activities and is reflected in the aircraft as well. If the choice becomes one of schedule versus safety, safety wins out every time. The leadership of the company supports this as demonstrated time after time of sacrificing cost in the name of safety. In the long run however, the cost pays for itself. As the quality guru Philip Crosby states, “Quality is free” (Crosby, 1990). The price of one incident in aviation is high indeed.

## Human Resource Management

 “The human resource is the only one that competitors cannot copy, and the only one that can synergize—that is, produce output whose value is greater than the sum of its parts. Employee satisfaction has a strong correlation to customer satisfaction,” (Evans, J. R., Lindsay, W. M., & Evans, J. R., 2008. p. 268). In an organization with multiple sites, disconnects in communication and site direction can occur unless you have a clear organizational vision. Part of the leadership vision is to reinforce connectivity between sites. Gulfstream has skill sharing across the sites in the form of several avenues.

Lean Six Sigma projects are all available at a single network site. If a need or project is contemplated, this site can be accessed. A project may already be complete for the particular issue, or you may build on an existing project. Work crews who perform maintenance on aircraft also submit Best Practices on items that are accomplished on a regular basis. These Best Practices are like ‘road maps’ to a particular task, for example, engine changes. Teams who become experts at these tasks own the Best Practice that others can use. The owners are publicized and recognized by their peers.

Cross Site Teams and Cross Functional Teams are also used. Statistical data is utilized to identify any areas that need improvement. The Cross Functional Teams use Lean Tools and root cause analysis to fix the cause, not just the problem. Employee suggestion systems (Your Ideas at Work), Kaizen events and ‘Pride Award’ programs are additional resource for employee involvement. The Pride Award program uses employee input to nominate fellow employees for Gold, Silver, or Bronze awards, each with a tangible reward from movie tickets to hundred dollar gift certificates.

Employees also are evaluated during annual review based on a composite of personal performance, site performance, and company performance. Tuition re-imbursement also provides a mutual benefit to employee and company. Many employees bring a wealth of experience to the company. This experience together with an appropriate secondary education provides Gulfstream a competitive advantage in personnel resource leverage. Employee empowerment plays a vital role by identifying those who take pride and ownership in their work, delegation can be used to leverage our resources. It is a win-win for department leads and worker alike.

## The Quality System

## The Voice of the Customer and Quality Definitions

 Meeting or exceeding customer expectations is a popular definition of quality. One of the principles of Total Quality is a focus on customers. Identifying who the customers are is essential in determining what the expectations are. To examine Gulfstream customers it will be necessary to define who external customers are and who the actual consumer is. The consumers are the end user of the product, the one that pays for the aircraft and its subsequent support. This many times can be an organization with one or two top personnel who have final say in matters. Some consumers will have many layers of personnel who have a specific say over certain matters within that organization.

These persons can be within the consumers’ home organization, consultants, or they can be management companies who specialize in turnkey administration for the consumers’ aircraft. Consumers typically do not manage the day-to-day operations of their aircraft. They have personnel who manage the day-to-day operation of the aircraft. Intermediaries to the consumer are our external customers who for the purpose of this paper will be identified simply as customers, or the operator. The external customers who manage aircraft come in many varieties. They can be individuals (part of a flight department for the owner), or they can be part of a larger organization (management companies, government group, etcetera). The direct customer to the service center are typically FAA certificated airframe and power-plant technicians, very professional individuals who know their particular aircraft as well as anyone, and are very savvy to corporate aircraft operations.

## Meeting Customer Demands

Corporate aircraft operations have not changed much since the beginning design of the GI aircraft in 1957. They are designed to go just about anywhere, anytime. Currently Gulfstream management, customers, and key vendors meet twice each year to identify issues, successes, and future product wants. There are customer advisory boards providing key information and to the customer needs. The voice of the customer tells us that downtime and maintainability are key factors. As part of a total quality package, Gulfstream addresses these dynamics in several ways.

 A quality product is vital for success. This includes careful selection of vendors who are stakeholders with mutual interest in a successful product. As announced by Gulfstream in July of 2009, the GV-SP aircraft had a dispatch reliability rate of 99.88 percent, translating to flight delay only once in every 830 plus flights. When failures do occur, several things happen.

The customer gets a call from senior management to apologize and discuss a resolution to the problem. If there is a part failure, Gulfstream is the only manufacturer of corporate aircraft that operates its own parts delivery jet, a Gulfstream G100. The part can be dispatched and arrive at most places in the United States within hours. Service facilities strategically placed can dispatch a team of technicians to arrive on site in a timely manner regardless of where the aircraft may be located on the planet. The life cycle of a component failure does not end there.

Most aircraft are enrolled in the manufactures Computerized Maintenance System, (CMP). CMP is a web-based maintenance-tracking tool that allows the operator to know precisely the continued airworthiness status of their aircraft. All inspection and time-controlled items are tracked, real time, with input from the operator and available globally. This data is also transformed into fleet data that gives Gulfstream timely statistics as to what parts maybe failing prematurely, or what supplier is having trouble with their quality system. Corrective action to the root cause is performed as a proactive activity based on statistical results.

This life cycle is repeated throughout all of the Gulfstream and General Dynamic Service Centers throughout the world to varying degrees. General Dynamics has recently purchased Jet Aviation, a worldwide supplier of aircraft maintenance enhancing our support capabilities. One thing remains constant. Safety, schedule, and aircraft reliability are paramount. Compliance Quality Control is utilized to ensure adherence to mandated regulatory requirements but external customer and consumer quality is everyone’s responsibility.

## Six-Sigma and Statistical Management

## Process Management

Aviation lends itself to a certain level of process control. You must use Maintenance Manuals and there are certain parts of Title 14 of the Code of Federal Regulations, (Aeronautics and Space) that we all must abide by. The Gulfstream lines of aircraft are no different. The aircraft are built and certificated by the Federal Aviation Administration, (FAA), to the Transport Category rules and regulations. These are the same rules and regulations that airline aircraft are built and certificated to.

During the Final Phase process, (post production outfitting), and for significant modification of in-service aircraft, our FAA Organizational Designation Authorization provides stringent project management guidelines. These guidelines, contained in FAA Orders 8110.4, ‘Type Certification’ and Order 8100-15 - Organization Designation Authorization Procedures, are extremely structured providing the necessary fault tolerant process required to certificate complex aircraft and aircraft systems.

The production aircraft are controlled under their Type Design as defined in the FAA approved Type Certificate Data Sheet. Under the Type Certificate Data Sheet for a Gulfstream aircraft is a ‘Top Drawing’ listing a myriad of drawings, breaking down each section and system of the aircraft into various sub-assemblies and parts. Data management controls the drawing release to the floor level and Quality Control verifies installations to proper drawing revision status providing a close loop system.

During Final Phase, (outfitting of the production aircraft), the process is very similar to the production process except for the magnitude and the certification is via Supplemental Type Design. Much of the structure from FAA Orders 8110.4, ‘Type Certification’ is similar to the methodology found in Project Management practices. Documented control procedures are typically written down in a process control plan, Instructions for Continued Airworthiness or travelers. Aircraft maintenance manuals and technical documents provide written instructions to maintain in-service aircraft. Not every maintenance issue can be predicted however. Within Gulfstream are the Technical Operations Group and the Field Services Group. These two groups provide worldwide 24 hours a day support to Gulfstream operators. Each group has access to a complete staff of structural, electrical, and systems engineers.

## Performance Measurement

The textbook Managing for Quality and Performance Excellence identifies four areas of measure for performance. These areas are customer, financial, internal and innovation and learning perspectives, with leading and lagging measures being included. Performance measurement is critical to the organizations success. Honest forthright examination will expose any weak areas and corrective action can be initiated, sometimes before the issue becomes a problem.

Beginning with customer satisfaction, Gulfstream employees a number of methods to obtain feedback, many have been identified previously. Customer advisory boards provide a composite feedback as to operator’s needs, successes with our product and failures. Additionally, each Service Center has customer surveys after every visit. To enhance survey return rate incentives are provided to the team for high return rates. After every visit, a team leader will call the customer to receive feedback. If there is a significant Service Center visit a Field Service representative may personally visit the operator.

During the Final Phase process, defect data is gathered and trended against Six Sigma benchmark. Data is put into Pareto analysis and critical issues are fed back to cross functional team for root cause identification. Corrective action is introduced and the cycle begins again. All of these mediums are continuous and part of feedback into a close-loop system that evaluates and improves company processes.

## Cultural Implications

## Organizational Culture

 “Shared common values lie at the heart of organizational culture. Shared values help turn routine activities into valuable, important actions, tie the company to the important values of society, and provide a distinctive source of competitive advantage” (Schlegelmilch, 1997). With clear vision and communication, Gulfstream leadership institutes Quality Systems throughout the organization. The vision is top down and bottom up. As discussed previously in the ‘Leadership’ section, Management identifies Continuous Improvement Objectives that filter down through the enterprise, down to the individual employee. The individual employee supporting their piece of the pie supporting the system upward, back to the leadership model established.

In this way, the ‘tone’ is set for the culture. The culture of an organization is like a living thing; it must be nurtured and cultivated for it to develop properly. The company must provide the employee the tools necessary to ensure their success. It is up to each individual to do his or her part. The higher up in the management structure an employee is the more influential they are to cultural norms within their sphere of activity. The shorter the distance between the activity and the consumer the more visible the organizational culture becomes.

## The Gulfstream Culture

Gulfstream has been a customer-oriented company from day one and this is reflected in the almost innate sense of each employee to provide customer satisfaction. The model has matured since the early days. In years past, there has been a ‘do whatever it takes mentality’ only. While this was necessary at the time and met the immediate goal of dispatching aircraft, more effective and efficient ways of dealing with the same issues were identified. Today there are more structured methods of getting things done. Single point call in phone numbers, web-based assistance information, well defined focal points for customers to contact, and an established relationship with our customers.

## Recommendations and Summary

## Recommendations

The quality process is a continuous cycle and it is an evolving cycle as well. Years ago, there was a ‘Pursuit of Perfection’ campaign at Gulfstream. Next there were Quality Circles. Sometimes you hear employees, say here we go again, or I remember doing this, what was it called back then? There may be some ring of truth to these observations, but everyone should be reminded, perfection is an elusive ever-moving target. Without growth and a continuous pursuit for excellence, you risk being passed up by the competition.

## Summary

Leadership navigates the quality of an organization. Like the captain of a sailing ship, they need help from the organization. Quality is everyone’s responsibility. Review, the voice of the customer, verification, and audits validates this quality. This ‘close-loop’ system also generates the main engine of corporate self-sustainability, the corporate culture. It is this sum that spawns organizations that become known as ‘world-class’. The fact that Gulfstream has positioned itself to be the leader of corporate jet aircraft in this class is no accident. It has taken thoughtful leadership, careful planning and the organization as a whole to bring it to its rightful place.

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