Total Quality Management: It Works for Aerospace Information Services
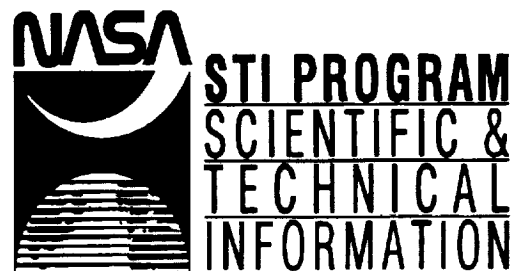
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**NASA STI PROGRAM
SCIENTIFIC &
TECHNICAL
INFORMATION**

TOTAL QUALITY MANAGEMENT:
IT WORKS FOR AEROSPACE INFORMATION SERVICES

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Abstract

Today we are in the midst of information and "total quality" revolutions. At the NASA STI Program's Center for AeroSpace Information (CASI), we are focused on using continuous improvements techniques to enrich today's services and products and to ensure that tomorrow's technology supports the TQM-based improvement of future STI Program products and services. The Continuous Improvements Program at CASI is the foundation for Total Quality Management in products and services. The focus is customer-driven; its goal, to identify processes and procedures that can be improved and new technologies that can be integrated with the processes to gain efficiencies, provide effectiveness, and promote customer satisfaction. This Program seeks to establish quality through an iterative defect prevention approach that is based on the incorporation of standards and measurements into the processing cycle. Four projects are described that utilize cross-functional, problem-solving teams for identifying requirements and defining tasks and task standards, management participation, attention to critical processes, and measurable long-term goals. The implementation of these projects provides the customer with measurably improved access to information that is provided through several channels: the NASA STI Database, document requests for microfiche and hardcopy, and the Centralized Help Desk.

Introduction

The 1958 Space Act, which created the National Aeronautics and Space Administration (NASA), provided for "the widest practicable and appropriate dissemination of information concerning its activities and the results thereof." This dissemination is supported by NASA through its Scientific and Technical Information (STI) Program. One goal of the STI Program is to develop a global program to encourage the creation and exchange of scientific and technical information and to facilitate its use.

In support of the NASA and NASA STI Program goals and objectives, the NASA STI Program's Center for AeroSpace Information (CASI) acquires, performs value-added processing for, and disseminates information of interest to scientists and engineers involved in aerospace research and development. This information is available through the NASA STI Database and the hardcopy and microfiche distribution.

CASI's mission is to support the STI Program in supplying the NASA user community with timely access to scientific and technical information in areas including aerospace and space science industries. Easy access to such information will extend knowledge and facilitate new and further research in these fields. It also will keep NASA and its users in the forefront of today's information revolution, where the amount of available information is rapidly increasing and the tools to access that information are, often, still under development.

This is a revolution that will yield global information systems and enable users to be in command of increasingly powerful workstations that are tied to large, multi-user computational facilities. They will have access to distributed and remote data collection devices, advanced analytical and manipulation tools

and data and information repositories that promote the rapid exchange of data and ideas, and new information dissemination tools such as multimedia and CD-ROM.

Because of these vast changes in the type, volume, and availability of information required, as well as in the rapid technological advances that support these new requirements, it is critical that the STI Program meet this information revolution with a revolution in quality. Not only will yesterday's quality products and services not meet today's requirements — today's quality products and services will not meet tomorrow's requirements. We must respond with quality products and services to guide NASA and its users to and beyond today's steadily increasing number of databases and variety of access channels. We consider Total Quality Management (TQM) as embracing the principles that are necessary to support NASA in carrying out its mission to expand man's knowledge, ensure U.S. leadership in aerospace technology research and development, and to develop world-class resources.

The STI Program's TQM Imperative

The STI Program must improve today's products and services to support the current and future information requirements of the STI community. We must build the infrastructure to ensure that the next generation of improvements supports our requirements for scientific and technical information. Improved products and services and a new infrastructure will provide the quality performance necessary for the information and quality revolutions: a proactive, anticipatory approach; new product innovation; quick decision making; teamwork; and cooperation.

This improvement of products and services cannot be stagnant. Indeed, use of TQM methodology and tools becomes pervasive — with each process, systems are executed better and better. Productivity increases as inefficiency and errors decrease. Customers get higher value products and services at lower cost. The organization's reputation for quality and value expands and demand for its product or service will increase. This cycle, as put forth by Dr. W. Edward Deming, is summarized in Figure 1.

The STI Program's emphasis on customer requirements, both internal and external, guides our imperative for TQM. It drives our goal to refine
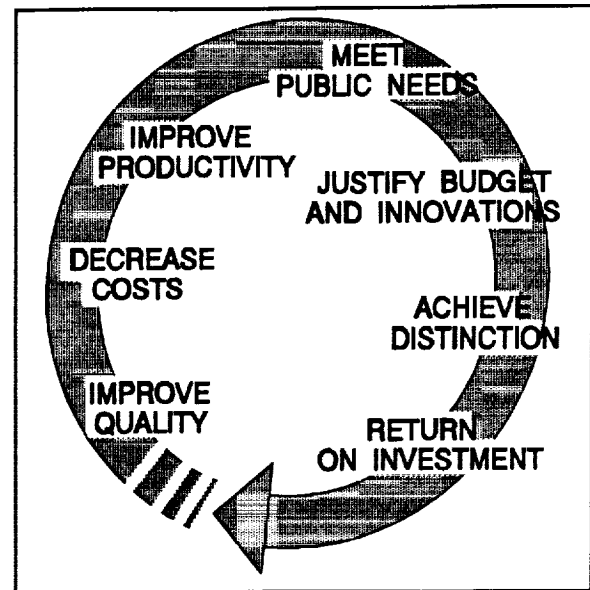

Figure 1. The Deming Chain Reaction

processes that will build in the quality necessary to ensure uniform and superior products and services.

The Evolution of the STI Program's Continuous Improvements Program

The STI Program's TQM initiative at CASI, the Continuous Improvements Program, provides the foundation for Total Quality Management of its products and services. The focus of the program is customer-driven; its goal, to proactively identify processes and procedures that can be improved and new technologies that can be integrated with the processes to gain efficiencies, to provide effectiveness, and promote customer satisfaction.

The STI Program's evolving Continuous Improvements Program at CASI is following the four phase process that is common within organizations who adopt TQM:

Phase I, Establishing the Foundation: Early advocates and senior management commitment.

2

Phase II, Developing Widespread Awareness: Organizational awareness, understanding, and pilot projects.

Phase III, Transforming the Organization: Full, wide-scale deployment; significant results.

Phase IV, Mature, Continuous Process: Stable processes, continuously improving.

As an organization moves through these phases, its planning and control focus changes from management of the end result to management of the process. A domino effect results: first productivity, then lower unit cost and prices, then increased improved service innovations, increased user satisfaction — and, ultimately, an expanded user community.

Phase I of the STI Program's Continuous Improvements Program at CASI had its early advocates in senior management who hired staff dedicated to providing operational improvements. In Phase II this staff began the task of supporting the review of the STI Program's mission and evaluating its systems and processes.

The STI Program's mission of collecting, enhancing the value of, and storing information, and disseminating that information to authorized users has not changed since its inception. Its systems at CASI, both automated and manual, are old. Many of the processes have not changed or have changed slowly only to incorporate policy changes or limited automation. On the other hand, the volume of information and the demand for faster service has increased.

The first barrier CASI encountered in implementing Phase II was culture, which does not change overnight. Some of the staff at CASI have been providing services to the NASA community for as long as the program has been in existence and many have received awards for 5, 10, and 20 years of service. As it would be in any organization poised for change, these staff are resistant to change. Change is outside their comfort zone, and many of them are very comfortable "just the way things are."

Our first hurdle was to overcome the complacency that is common to so many organizations. Our second hurdle was creating the paradigm shift required for redefining "customer," which in TQM is defined as the receiver of a product or service. This

can be the input to the next process or an external user of STI products and services.

We began by selecting several projects that had a high probability of success and that would bring about visible improvements. These early projects gave us insights into the barriers that we had to overcome. The facilitator created teams from multiple functional areas to provide problem solving and to design new processes. The teams, whose members had little experience in team dynamics or problem solving, exhibited all the signs of resistance: complacency, lack of communication, lack of knowledge and understanding, conflicting goals, and resistance to change. They exhibited fear, anxiety, and insecurity. The facilitator worked to establish communication among the team members, understanding that trust must be built to enable "buy-in" to TQM processes. Each team changed with time, with its members reaching a stage of cooperation, communication, enthusiasm, excitement, and buy-in that they later communicated to other staff. Not all teams responded as quickly as others, but all made progress and all projects had measurable success.

As a result of the pilot projects described in the following sections, the Program is now moving to Phase III, Transformation to the TQM Culture. Figure 2 shows how the elements of key management leadership, communications, long-term commitment, a hospitable environment, and employee partnership for quality — all proven in the STI Program's Phase I and II implementations — are key to the success of any organizational culture change. The presence of
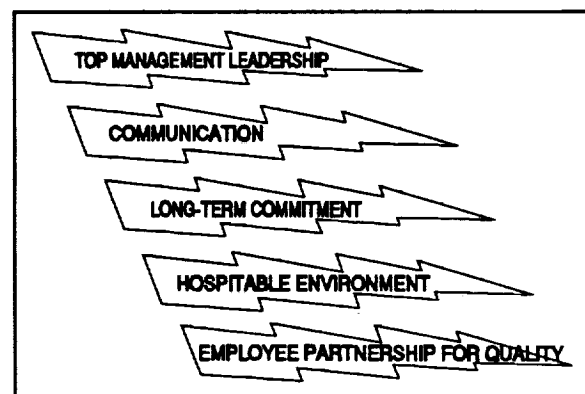

Figure 2. Critical Success Factors for Cultural Change

3

these critical elements in the STI Program's evolving TQM focus predicts the accomplishment of the cultural change that is required for the success of the Continuous Improvements Program.

TQM in Action: the First 4 Pilot Projects

The STI Program used four pilot projects in its implementation of the Continuous Improvements Program: Revised Input Processing, 3-Day Turnaround of Document Requests, Microfiche Quality Improvements, and Centralized Help Desk. These projects served as the first tests for the STI Program's use of TQM methods such as utilizing cross-functional, problem-solving teams for identifying requirements and for defining tasks and task standards, participation from all levels of management, attention to critical processes, and incorporation of measurable long-term goals. They served, as well, as a tool for the development of the STI Program's TQM methodology, which today includes nine steps:

1. Create cross-functional, problem-solving teams.
2. Analyze processes.
3. Identify root problem.
4. Develop new processes.
5. Reach consensus.
6. Develop measurable goals.
7. Devise and execute an implementation schedule.
8. Review successes and lessons learned.
9. Document the results.

Implementation of these projects has provided NASA customers measurable improvement in access to information that is available through several channels: the NASA STI Database, document requests for microfiche and hardcopy, and the Centralized Help Desk. As discussed in the following sections, the STI Program encountered barriers common to the implementation of TQM (see Figure 3). We found the use of the tools that help overcome these barriers to be an evolutionary process, one that is key to our successful transition to a TQM culture. Our goal is to provide an environment that encourages trust, teamwork, and mission focus through cultural change. Training will be an important component of our program.

Revised Input Processing Project

The Revised Input Processing Project was initiated to reduce the time required to process technical
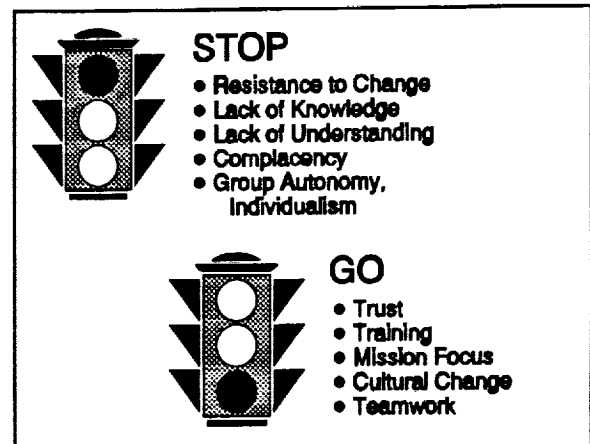

Figure 3. Overcoming the Barriers to TQM

reports for inclusion in the NASA STI Database and to distribute technical reports in the form of microfiche. This project crossed five functional areas: Input Processing, Publications, ADP Technologies, Operations, and Media Conversion.

Current Processing. Input Processing provides bibliographic processing for the scientific and technical reports that are received at CASI from NASA, NASA contractors, other government agencies, and foreign partners such as the European Space Agency. This bibliographic information is added to the NASA STI Database and accessed through RECON (REsearch CONnection, NASA's search and retrieval system) and certain government and commercial databases. The reports are made available to NASA and NASA contractors, the National Technical Information Service (NTIS), and the Government Printing Office (GPO) on microfiche distribution.

Media Conversion creates silver master microfiche of the hardcopy reports and duplicates the silver masters and the microfiche received from other agencies for distribution.

Publications staff create camera-ready copy of the unclassified bibliographic information so that its distribution to subscribers in a twice monthly bibliography of all unclassified technical reports added to the STI Database, *Scientific and Technical AeroSpace Reports (STAR)*, is made possible.

ADP Technologies maintains the programs for

4

processing the bibliographic information, loading the citations to the database, and producing the camera-ready copy. Operations runs the programs to load the citations to the database and produce the publication runs when an issue of *STAR* is completed.

The Root Problem. Customer complaints fell into two related categories: (1) too much time elapsed from the time they sent reports to CASI and the reports appeared on the Database and (2) they did not receive the microfiche copies until weeks after the reports appeared on the Database.

The root of the problem lay in the processes for accomplishing all these tasks. These processes had been instituted years before and were tied to the publication of *STAR*. Other bibliographic, media conversion, and publication activities took place, but these supplementary activities were coordinated and produced during slow periods in the processing of *STAR*.

Distribution of the microfiche, which were produced and duplicated after all reports for a given publication were processed, occurred after the publication of *STAR*, which occurred six weeks after the citations were loaded to the NASA STI Database.

The New Processes. Our solution for overcoming the problem was two-fold: in Input Processing, all reports that were received from Document Supply and completed on a given day (with certain exceptions such as conference proceedings, which are made up of many technical reports) would be forwarded to Media Conversion for processing the following day. This eliminated the 2 to 2-1/2 week delay formerly incurred by holding completed reports for the next issue of *STAR*.

The Measurable Goals. Our goal with this project was to reduce the time required to process technical reports for inclusion in the NASA STI Database and to distribute technical reports in the form of microfiche within a week of the appearance of the citations on that Database. This was our first attempt at improving processes for measurable gain. We calculated that approximately 500 citations could be added to the NASA STI Database on a weekly basis and that the microfiche could be distributed approximately 4 weeks earlier than with the current process.

Barriers to a Fully Functioning Team. The Revised Input Processing Team included representatives from all five functional areas and a facilitator. Although the group was quite willing to participate in interviews and reviews to document the current process, they were not so willing to entertain the possibility of changing the processes. Because these processes had been in effect for many years, changes to the processes had been instituted as exception processing and the groups were tied to the way "things had always been done." Communication was difficult because "selective memory" played a large role in determining the current processes. Getting to a cooperative spirit was difficult because staff had "101 reasons" why processes could not be changed.

There was a feeling of inertia and complacency in the group, and during the analysis and design of the new process, the facilitator had to push team members to action because of tight time constraints. The team lacked understanding and experience in team problem solving, and found it easier to do things as they had always been done. They were afraid that new processes would not work and that they would miss deadlines. They tried very hard to hold on to the old ways, and they were reluctant to consider that new ideas really can work.

Reaching Consensus. The team members were not skilled in team interaction or team problem solving. They demonstrated barriers to teamwork — resistance to change, communication difficulties, time constraints, conflicting goals, lack of understanding, and complacency among the team — and reaching consensus was very difficult. Once it was decided how the project would be limited (only changes that affected our goal would be implemented) and how it would be implemented, however, the team began working very actively together to develop schedules for the new process. Their first steps were to perform an analysis of the current processes and to begin designing and implementing the new processes. Despite working so closely together, team members had doubts about whether or not their implementation plan would work. To reduce this anxiety, Input Processing began a month before implementation to practice processing all series of documents (not only *STAR*) on a daily basis in the number required to meet the goals that had been established. Media Conversion worked to process all reports that were in process so that they would be prepared for the new process. Publications and Operations worked to fit

their staffing and workload schedules to the new process. ADP Technologies worked with each functional area to identify their programming requirements and ensure that these were met. With these successes, enthusiasm crept into the team and they became committed to the project. To ensure continued success, the team met on a daily basis to ensure the schedules were synchronized and that no task was forgotten.

Enthusiasm increased, consensus was the rule, and the day production went into effect the implementation was flawless.

<u>Overcoming Barriers to Success and Lessons Learned</u>. We found that communication was the greatest factor in overcoming problems; later, the comment most expressed regarded the rewards that communication brought. Because the cross functional team was committed to the tasks and had reached consensus, information was exchanged in a positive environment and feedback was provided to all team members. The members of the team began trusting the process and the team members. Early in the process new technology was put forth as the panacea for correcting all problems. But as the new processes fell into place, excitement grew regarding the improvements that change in process would bring. New technology was still seen as a tool for increasing productivity but not the only one. All goals of the project were met and exceeded. The team felt ownership for the project, and its success was celebrated with a pizza party - not a big reward but a beginning.

<u>Results</u>. Implementation of the Revised Input Processing Project yielded results that met the established goals. The scheduled time to load the accessions to the STI Database was reduced from 2 weeks to 1 week. In addition, the system now provides the capability to load accessions in less time if desired, even daily.

Microfiche processing time was reduced from 6 to 8 weeks to 2-1/2 weeks. It is now available within one week of the availability of the technical reports in the NASA STI Database. Table 1 demonstrates the early delivery of microfiche in the Revised Input Processing Production Schedule.

<u>Microfiche Quality Improvements Project</u>

The Microfiche Quality Improvements Project was

initiated to bring microfiche clarity and resolution up to industry standards for microfiche reading, duplicating, and archiving. This project is unique among the four projects in that the functional areas critical to the change process included outside federal agencies over which the STI Program had no control.

<u>Current Processing</u>. Microfiche silver master copies are produced by the Media Conversion staff from the NASA hardcopy technical reports. These silver masters, along with diazo master microfiche from other agencies are duplicated and distributed to requesters. Primary distribution is automatically sent to subscription customers and secondary distribution is sent upon customer request.

<u>The Root Problem</u>. Producing good quality duplicate microfiche that meet standards requires the use of a good quality master. In addition, the microfiche must be free from dust and foreign materials or fingerprints.

A large percentage of the distribution microfiche did not meet standards. Further analysis led to the discovery of multiple reasons for lack of quality:

• Duplicate microfiche produced from CASI-produced silver master microfiche were well within standards. The problem was with the microfiche received from other agencies, which became our input for making duplicates. We could not make the output better than the input.

• Some of the microfiche contained fingerprint smudges, specs of dirt, or other foreign material.

• There were problems with grid misalignment and resolution.

• The micrographics equipment is old and inefficient.

<u>The New Processes</u>. Our solution for overcoming the problem had a dual focus: outside suppliers and internal quality problems. The team identified and implemented several internal processes to improve microfiche quality:

• Revised quality assurance procedures to ensure that all microfiche meet ANSI/AIIM Standards.

• Performed twice-monthly methylene blue tests to

6

Table I. Revised Input Processing Production Schedule

STAR ISSUE	START INPUT	START FILM	LOAD 1	PUBS RUN	DELIV MF	PUB.-STAR	DAYS EARLY*
08	2/26	2/27	3/6	3/16	3/23	4/23	25
09	3/11	3/12	3/20	3/30	4/06	5/08	26
10	3/25	3/26	4/03	4/13	4/20	5/23	25
11	4/08	4/09	4/17	4/27	5/04	6/08	25
12	4/22	4/23	5/01	5/11	5/18	6/23	28
13	5/06	5/07	5/15	5/26	6/02	7/08	28
14	5/20	5/21	5/29	6/08	6/15	7/23	25
15	6/03	6/04	6/12	6/29	7/07	8/08	26
16	6/24	6/25	7/02	7/13	7/20	8/23	27

* Microfiche delivered ahead of previous delivery schedule.

ensure that microfiche meet ANSI/AIIM standards for archival microfiche.

• Incorporated the most recent ANSI/AIIM standards into CASI microfiche specifications.

In addition, staff communicated with the agencies who supply the microfiche in writing, reminding them of the Federal requirements for compliance to microfiche specifications.

Measurable Goals. One goal established for the Microfiche Quality Improvement Project was to devise and implement new internal processes for addressing microfiche quality, based on the AN-SI/AIIM standard. Since suppliers provide the diazo microfiche as part of an agreement with NASA, another goal was to convince the suppliers to provide better microfiche.

Barriers to a Fully Functioning Team. Getting to a cooperative spirit with outside suppliers has been

a real challenge and we have not reached full resolution. Since there is no cost associated with the microfiche, asking the agencies to supply better microfiche does not guarantee success. Our approach is to request that these outside suppliers improve the quality of the microfiche they submit, by reminding them of the federal requirements but not demanding their cooperation.

Internal staff projected resistance to change. Their comments included "we've never worn gloves before to prevent smudges," "they don't affect quality," and "we can still read the microfiche with fingerprints." Communication was poor and negotiating with staff to follow procedures was difficult. They would not buy-in to the change process.

Reaching Consensus. Implementing change to processes that had been in place for a long time required convincing staff that quality could not be guaranteed unless processes were in place to guarantee that quality. Therefore, establishing the criteria to

be used for determining the quality of input or the resulting microfiche provided a good lesson in consensus decision making for the team. They finally adopted Deming's principles: unless variation is controlled, processes are not in control and lack of quality is the result. Fingerprints or foreign material on the microfiche do make a difference, even though you can read the copy. If your input is not meeting standards, you cannot control the variability of your output. Their development of quality criteria finally enabled them to see that many of our customers use the microfiche they receive from CASI to make copies. Each time a microfiche is duplicated, it is not as good as the previous generation. Therefore, if the microfiche we distribute can be read but does not meet industry standards, customer satisfaction levels drop because the microfiche they create from our microfiche may not be readable.

Overcoming Barriers to Success and Lessons Learned. Overcoming the external problems in this area was very difficult because we have little control over outside suppliers. Additionally, many of the team members had been in their positions for a long time and were deeply entrenched in the current processes. To meet the project's goals, the team had to overcome their defense of the current definitions of quality and the current workflow processes. To reach a consensus that readability does not ensure standards are met, the team had to achieve a new definition of microfiche quality and a new understanding that the level of effort necessary to achieve the project's goals was more than simply upgrading CASI's old microfiche duplicating equipment.

Results. New procedures incorporating updated specifications have been put into place, and workflow processes changed. Microfiche that do not meet minimum standards are rejected. We are working with the agencies to get better microfiche, and upgrading CASI's old microfiche duplicating equipment to improve quality and processing speed, as well as to provide incentive and motivation to the staff.

3-Day Turnaround of Documents Project

The 3-Day Turnaround Project was initiated to reduce the amount of time between receipt of a request for a document and receipt of the requested document by the customer. It required a team that crossed five functional areas: User Services, Document Supply, ADP Technologies, Operations, and Media Conversion. The team consisted of members from these five areas and a facilitator.

Current Processes. User Services is responsible for receiving all requests for products. Requests for hardcopy or stock copies are sent to the Document Supply for fulfillment of the order with stock hardcopy. Requests for microfiche are sent to the Media Conversion for microfiche copies or hardcopy blown back from microfiche.

The Root Problem. The root problem lay in the manual processes, which were made more complex by lack of automation. These manual processes yielded an average turnaround time of more than 5 days for document request fulfillment. Also, the team believed that the turnaround time for orders could not be improved because many of the factors influencing the turnaround time were not within their control. For example, if a technical report is not available from stock, microfiche, or blowback, it is ordered from NTIS or from the source; STI Program staff do not have control over the turnaround time from outside sources. Because they felt it impossible to fill 100 percent of the document orders in 3 days, they decided that the project could not be done.

The New Processes. The existing processes were simplified and, where possible, automated. The automated processes perform much of the decision making formerly done by User Services: the order forms are sorted by section and are date- and time-stamped, and reports are generated by section, by age, and by status.

Generation of the order forms was changed from nightly to predetermined intervals throughout the day. (Since the current system implementation only generated the order forms nightly during a batch run, the orders were already 1 day old when received for fulfillment.)

Measurable Goals. The team determined a phased implementation for this project, with the goal for Phase I set to achieve 3-day turnaround for 80 percent of the document requests. With the Phase I implementation all orders placed by 3:00 p.m. on a given day would be placed in the processing cycle the same day.

Barriers to a Fully Functioning Team. Cooperation across these functional areas on the subject of

document requests was not always friendly because someone had to be "blamed" if the 5-day deadline was not met. In addition, some team members had held their positions for a long time: they would forget to include critical steps in the process, so it took a number of iterations to complete the analysis of current processes. Many of these processes were manual and some team members doubted that automation could make the logical decisions that they had to make. Some doubted that the processes in place could be improved; additionally, some doubted that some of the responsibilities currently held by one functional area could be completed by another area without their oversight.

Reaching Consensus. Two of the functional areas had participated in the previous project. With their newly acquired skills and a better team attitude, they contributed strongly to the negotiation required when the team could not reach a consensus that 3-day turnaround of 100 percent of document requests could be achieved. The team negotiated, instead, what they determined to be an achievable goal: a phased implementation. This successful negotiation was an indicator that trust and team skills were increasing.

Overcoming Barriers to Success and Lessons Learned: The need for good communication was paramount in this project, since the document requests are coordinated among the functional areas responsible for delivery. Team members were not convinced that the computer could incorporate the logic of manual processes, such as request coordination, until they saw it work, and today the computer program sorts the order forms by responsible section.

Because the idea that if the order is wrong that someone is to blame still is strong, the trust levels for full implementation of this project will not be evidenced until Phase II. The software development to electronically transfer the order forms to the appropriate functional area also is scheduled for Phase II implementation.

This project had some setbacks in maintaining the goals but the team is meeting each day at 8:30 a.m. to discuss status and problems connected with any order in the queue.

Results. As shown in Figure 4, the 3-Day Turnaround Project is exceeding its Phase I goals: it now is operating at a level of more than 90 percent for
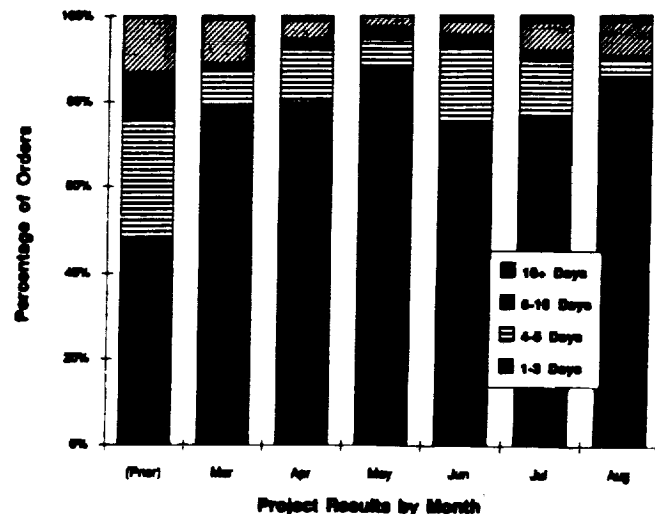
document requests completed within three days.

Figure 4. Document Orders by Turnaround Time

Centralized Help Desk Project

The Centralized Help Desk Project was conceived to provide a central point of contact for customers, and designed to provide information, assistance, and problem resolution for NASA customers. Benefits include fast service, a human contact, and customer satisfaction.

Current Processes. CASI advertises a single telephone number and voice mail for customer calls. User Services and Online Support staff respond to the single telephone number. In addition, a hotline number is available for customers who are having system or telecommunications problems.

Customers do not respond well to the voice mail; when they have the telephone number available, they directly contact the CASI staff they think can respond to their question. These staff respond to the call as best they can and fit the response or the redirection of the call in their daily workload.

Root Problem. The root problem was in the very nature of CASI's decentralized customer response

9

system. Since calls could not be tracked, customers did not always receive a personalized response; the call volume and the quality and timeliness of customer response could not be managed. This impacted customer satisfaction as well as management oversight of workload levels.

New Processes. Our solution for overcoming the problem is multi-faceted:

• Provide a single telephone number that rolls to multiple lines.

• Provide friendly, trained, human contact.

• Provide prompt response to all problems and requests by training staff in user service techniques and educating them in STI Program functions.

• Improve the quality of STI products and services through analysis of customer feedback collected during telephone conversations.

• Utilize an automated call tracking system for data collection and report generation.

Measurable Goals: The goals of the Centralized Help Desk Project are to provide fast, personal service and accurate information to the STI Program customers, and to create a call tracking system that provides management reports. User satisfaction will be measured by customer surveys, the Monthly Center Evaluation Report, and feedback from the callers. Statistics being gathered during the Phase I implementation will provide the basis for measurable goals.

Barriers to a Fully Functioning Team: The barriers to this project were those common to any transition of existing staff to professional customer services staff: a belief that it is impossible to please customers; a lack of understanding that customer satisfaction does not mean saying yes to every request, but rather managing the customer's expectations so that they are satisfied even when the answer is no; a feeling that their services were not appreciated by customers; and a lack of recognition that "going that extra mile" for the customer is each and everyone's job. This lack of understanding and complacency increased the time required to reach consensus.

Reaching Consensus: Reaching consensus was difficult because the team lacked understanding and

agreement on the goals of the project. The team members all held fast to the belief that only they, individually, could respond to customer requests. Reaching consensus required a commitment from each section to provide support (participation by staff from all three functional areas) to the Centralized Help Desk. Since the automation of processes and acquisition of equipment was taking time, the team negotiated an approach to begin implementation before the automated system was in place. They established a physical place for the Help Desk and assigned team members to be available to answer the phone at all times.

Overcoming Barriers to Success and Lessons Learned. To overcome the barriers, STI Program management and staff provided motivational opportunities to improve morale, skill levels, and attitude. We held a contest to name the function and created slogans, and provided customer service training and training in the functions staff would be performing so that they would become more knowledgeable. With implementation we will continue to work with the problems of their accepting the responsibility for being available and projecting a customer service attitude.

Results. The Centralized Help Desk has not been fully implemented, due to delayed receipt of equipment, but comments from the Center Evaluation Report indicate that improvements have been demonstrated in the Phase I implementation. Meanwhile, it is already providing the added benefit of allowing the collection of statistics which will guide us in the full implementation.

Summary

All projects have produced measurable results. All team members learned the value of good communication and the necessity of developing that communication not only within groups and across functional areas but also with the end users and with outside suppliers. This has resulted in improved service quality.

Lessons Learned

Along the path to the implementation of change CASI learned many lessons:

• We could achieve results while learning to func-

tion in a team environment.

• The talent and skills of team members must be uncovered.

• For many reasons — fear, insecurity, inertia, distrust — team members do not immediately buy in to the concept of change. Trust must be developed within the group and consensus reached before real progress can be made.

• Formal training and skill in leadership is necessary for the proper functioning of the team.

• It takes time to develop goals with a customer focus. Often team members feel that they are the experts and, therefore, know what the customer needs and should want. The new perspective will occur only when team members realize that the system they build may be the best in the world, but if it lacks the quality and features desired by the customer, they will not be meeting customer requirements.

• Communication is essential to progress and success.

• To eliminate the fear and distrust, team members must understand the mission, goals, and objectives of the STI Program.

• Definition of success indicators is essential for the development of the goals and objectives and success of the project. Only improving the processes can expand the capabilities of the system, but numerical indicators of success can measure that expansion.

• Most success is seen when team members buy in to the project. Buy-in brings about cooperation, enthusiasm, creativity, and innovation.

Next Steps

It is CASI's goal to implement Phase III, Transformation to the TQM culture. Bringing about this culture change requires a paradigm shift that can only be accomplished by the following:

• Developing widespread awareness
• Providing training/education
• Providing a reward system for employees
• Utilizing TQM tools
• Undertaking projects that provide success stories

• Expanding participation
• Developing metrics based on customer feedback
• Developing a common mission
• Developing strategic goals and action plans

It is the STI Program's belief that there is not a single "right way" to pursue TQM, but that it requires utilizing the tools and techniques that best fit the defined culture shift that is possible within CASI. The TQM techniques are not determined by authorative rules but through ingenuity and innovation. CASI will strive to use the tools and techniques that best fit its culture and quality objectives. Each department will be encouraged to define the areas in which it must be proficient to ensure success and continuous improvement. The path to developing these proficiencies belongs to every staff member at CASI.

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Today we are in the midst of information and "total quality" revolutions. At the NASA STI Program's Center for AeroSpace Information (CASI), we are focused on using continuous improvements techniques to enrich today's services and products and to ensure that tomorrow's technology supports the TQM-based improvement of future STI Program products and services. The Continuous Improvements Program at CASI is the foundation for Total Quality Management in products and services. The focus is customer-driven; its goal, to identify processes to gain efficiencies, provide effectiveness, and promote customer satisfaction. This program seeks to establish quality through an iterative defect prevention approach that is based on the incorporation of standards and measurements into the processing cycle. Four projects are described that utilize cross-functional problem-solving teams for identifying requirements and defining tasks and task standards, management participation, attention to critical processes, and measurable long-term goals. The implementation of these projects provides the customer with measurably improved access to information that is provided through several channels: the NASA STI Database, document requests for microfiche and hardcopy, and the Centralized Help Desk.

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