

R&M Quality Team Concept  
A New R&M 2000 Initiative

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Abstract

The Aeronautical Systems Division's C-17 System Program Office located at Wright-Patterson AFB, Ohio, has introduced a new project management initiative. This new initiative is designed to improve the effectiveness of a company's design organization to recognize and manage the Reliability and Maintainability (R&M) Program in day to day design activities. The new initiative which is called the R&M Quality Team Concept is the idea of Major James F. Guzzi, R&M Manager for the C-17 Aircraft. This aircraft is presently being developed by Douglas Aircraft Company as the Airlifter of the future. The new concept uses R&M Quality Teams and a Review Council, integrated with a structured approach to focus on System Level R&M issues. This new concept has been recognized by Industry and the U.S. Air Force as an "innovative approach" to successfully "influence" and "institutionalize" R&M management commitment throughout the total organization. The development of the R&M Quality Team Concept will be reviewed and summarized in this technical paper.

Introduction

In today's Air Force, the weapon systems of the future are being planned, designed and built. Both the Air Force and Industry face a challenge to "enhance" their capability to provide the needed weapon system "Reliability & Maintainability" to meet the mission and cost requirements for the year 2000 and beyond. These requirements include, as a corollary to performance, the aspect of mobility, survivability, and manpower limitations. These added factors demand that the system acquisition process includes plans to "rethink" our focus on R&M and identify the necessary initiatives to improve the weapon systems "built-in" Reliability and Maintainability. The important point in this paper will be to place the emphasis on "Total System R&M" which is the sum of all the integrated subsystems, support systems and their component parts which will be designed to operate for a specific mission and environment. The challenge to achieve a greater R&M is "on going" and must be achieved.

R&M 2000

The Air Force has a commitment to meet this challenge that will sustain and broaden the emphasis on Reliability and Maintainability in their present and future systems by formalizing a February, 1985, R&M Action Plan known as R&M 2000. This action plan was developed to speed and influence the R&M improvement in these weapon systems, and to institutionalize an "R&M Strategy and Focus" throughout the Air Force and Industry to sustain such an endeavor. Accordingly, at the direction of the Secretary of the Air Force and Chief of Staff, the Air Force has entered the implementation phase for the R&M 2000 Action Plan. One of the objectives of R&M 2000 is to work with the Defense Industry to instill the Air Force's commitment to the increasingly higher need and emphasis for

greater R&M in our weapon systems and related support systems.

The increased emphasis on R&M by the Air Force has created the atmosphere and challenge that called for the implementation of the R&M 2000 Action Plan. The R&M Quality Team Concept was developed to help meet this challenge. The emphasis and focus of this paper will be to review the principles of this new concept and the need to "Recognize and Manage" the R&M operational design requirements to meet the stated R&M 2000 objectives. R&M 2000 clearly advocates increased combat capability and survivability, and decreased costs, manpower, and mobility requirements. Obtaining these objectives will reduce the lifecycle costs of systems, reduce the systems dependency on spare parts, require fewer combat support people and result in more missions per deployed system. With improved maintainability, fewer people with highly specialized skills will be needed and maintenance times to repair systems will be reduced. "R&M" has been identified as the answers that will directly improve the availability of our systems while reducing the need to deploy maintenance personnel and required support equipment. In summary, an improvement in R&M will significantly increase the United States deterrent posture through increased combat capability and insure our ability to defend our freedom and strategic interest while saving our valuable resources.

R&M Quality Team Concept

The R&M Quality Team Concept was conceptualized and developed to focus management attention on the System Level R&M process during Full Scale Engineering Development. The concept is simple, but well founded, and it provides a powerful means to streamline and enhance the communications and System Engineering Process in a total organization. This concept has provided the capability for a directed response to system R&M problems while creating an atmosphere for system change. The approach facilitates R&M engineers and system designers to work as a chartered "team" under the guidance and direction of the R&M Review Council.

Echoing the importance of system integration and management, Ronald D. Gordon, Director of Operations for Communications System Division of GTE's Government Systems Corp., said that corporate culture has solidified design and manufacturing into two separate organizations for too long.

"If we are to make progress against this corporate culture," he said, "the sharp dividing line between design and its functions, all of them, and manufacturing and its functions, all of them, have got to go away. We've got to develop teams somehow to get synergy."

Supporting this observation, the R&M Quality Team Concept provides the integrated "Team" solution. The Concept's model will be introduced and defined as a structured process that contains four interrelated "quality" parts. The parts include:

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1. A charter or standard practice approved by senior management to direct the concept throughout the total organization.

2. An R&M Review Council that meets at least weekly to manage the Program and Reports directly to the program manager. This council comprised of second tier management whose functional organizations are responsible for some part of the R&M program or related activity and who have decision authority.

3. A problem identification and prioritization process which use R&M drivers or indicators to provide the focus on the TOP 20% of the System R&M issues or related problems that effect 80% of the systems performance requirements.

4. The Quality Team itself which is chartered and established by the R&M Council on an "Ad Hoc" basis to solve system R&M issues and report back solutions to the council for implementation. The Teams use PDM and are comprised of individuals from each functional group that is effected by the problem and under control of the Review Council.

The concept process establishes and integrates the lines of communication and focus among the functions in the Vertical direction by the Review Council and the Horizontal direction by the Quality Teams. This process creates an R&M management network within the existing organization. Activity is managed by the Review Council to insure that the "focus" is not diluted in the functional activities and insures that R&M is part of the design effort. In essence, the concept creates a "system engineering" approach that drives the R&M goals to meet the total system level requirements.

Integration provided by this process "Pin-Points" the system concerns that affect the total design process and functional organizational structure. By using information that surfaces from the bottom-up and summarized at the system-level, the "council" can understand and direct resources to the problem that will derive solutions. The ability to solve issues that cross functional lines of responsibility as easily as single functional problems is an accepted power of the concept. The solution is a Team effort that ensures all the principals are a part of the outcome and that R&M is the "Focus" of the solution. With this concept, management is "in control" and has the ability and responsibility to direct the total R&M Program to meet the R&M design objectives. In addition to the functional problem solving, the concept supports other processes and systems that are in existence. For example, under the "R&M Quality Team concept," enhanced Engineering data can be provided to the Logistics Support Analysis (LSA) Process which "defines" supportability requirements and influences design decisions. The results of this enhanced data will allow the Logistics Engineers to focus more time on supportability identification and less time on design considerations. The R&M Quality Team Concept supports integration of the LSA process with the Engineering Design process, and allows the optimum results to take place. The total process is a truly integrated systems engineering approach.

The qualitative value associated with the concept is that management has a new "feel" for the system R&M Program and R&M problems affecting the design process. The R&M program is managed and controlled. This allows the R&M issues to be identified, simplified and addressed on a "Real-Time" basis. Program priorities can be easily addressed and receive immediate attention. For example, System Level indicators were demonstrating that Mean Time Between Maintenance (MTBM) was not meeting contractual design R&M requirements. The Douglas R&M Review Council assessed the scope of the problem and assigned R&M Quality Teams for each major system. The objective was to

"SCRUB" the total design with a focus on MTBM within and across each major system. The capability existed to integrate the organization through "Design Teams" to solve the problem. This was credited to the Quality Team Concept and was accomplished without disrupting day to day functional activities. The results of the "SCRUB" enhanced the overall design while improving MTBM for the total system. Some of the resultant improvements to the system design included: (1) The landing gear and hydraulic system hoses, fittings, and connectors were reduced 20%. (2) Digital controllers, with added built-in-test (BIT), replaced hydromechanical controllers. (3) The aerial delivery control system unit was redesigned to be compatible with the hydraulic system control unit. Similar software and specific cannon plugs were integrated to eliminate one black box. (4) The exterior lighting system was redesigned to include 500 hour life lamps with vibration resistant assemblies vice 100 hour. This effort directly improved the inherent reliability and maintainability of the total weapon system. While achieving defined objectives, the concept is flexible yet structured. It does not replace or alter the existing organizational structure, but enhances the communications and organizational effectiveness. The concept is an R&M Management Enhancement that "overlays" on the existing design process and organization, and institutionalizes the commitment necessary to integrate a total R&M System Engineering Solution.

#### Summary

Through enactment of the R&M Quality Team Concept, management commitment is built-in and the necessary "focus" to provide the most "R&M" for the process is assured. The concept is founded by existing management principles which support R&M 2000 objectives. The results have been very impressive to date demonstrating potential for enhancing the acquisition process. The concept can be used in all phases of the acquisition process and provide the invaluable ability to "manage our transitions from development to production." For example, the concept can link design to manufacturing through the Review Council and "Team" interactions, and provide an R&M focus throughout the Production Transition. This can translate to production quality.

The R&M Quality Team Concept is an idea which time is NOW. The Air Force supports the concept and other similar ideas that answer the R&M 2000 call for a "new look" on how we manage our R&M programs to "insure" a superior yet cost-effective product. We must continue to "manage" the R&M design process and not let the design process manage R&M. The R&M Quality Team Concept is one method to achieve this result.

Douglas Aircraft Corporation is the first company to actively implement the R&M Quality Team Concept. They have accumulated 18 months of experience and have substantially improved their R&M Program. Other companies to include McDonald Douglas, parent company of Douglas Aircraft, and General Dynamics, Fort Worth Division, have expressed interest in applying the concept ideas to their organizations.

The R&M Quality Team Concept has been endorsed by the Aerospace Industries Association of America and by the United States Air Force as an innovative voluntary "means" to meet the R&M objectives in support of R&M 2000. As the concept experience increases, formal studies will be chartered to "quantify" the results. The bottom line is to "create a positive change towards improving "R&M Quality" in our products, and the R&M Quality Teams Concept is one successful management initiative that can provide the results. Interested individuals or organizations can obtain

more information on the concept by writing the author.

This paper is dedicated to Brigadier General Frank S. Goodell, U.S. Air Force, Special Assistant for Reliability and Maintainability (USAF/LE-RD). General Goodell is the individual designated to advocate, direct, and execute the Air Force R&M 2000 Action Plan.

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Major Jim Guzzi is the R&M Program Manager for the C-17 aircraft. He has eighteen years of project management experience including five years with Corning Glass Corporation. Major Guzzi is an Aerospace Engineer who holds master degrees in Business Administration and Systems Management. He attended the Cornell Executive Development Program and the Defense Systems Management College.