1993

NASA/ASEE SUMMER FACULTY FELLOWSHIP PROGRAM

MARSHALL SPACE FLIGHT CENTER
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

TECHNOLOGY UTILIZATION OFFICE
DATA BASE ANALYSIS AND DESIGN

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INTRODUCTION

NASA Headquarters is placing a high priority on the transfer of NASA and NASA contractor developed technologies and expertise to the private sector and to other federal, state and local government organizations. The ultimate objective of these efforts is positive economic impact, an improved quality of life and a more competitive U.S. posture in international markets. The Technology Utilization Office (TUO) currently serves seven states with its technology transfer efforts. Since 1989 the TUO has handled over one-thousand formal requests for NASA related technological assistance. The technology transfer process requires promoting public awareness of NASA technologies, soliciting requests for assistance, matching technologies to specific needs, assuring appropriate technology transfer and monitoring and evaluating the process. Each of these activities have one very important aspect in common: the success of each is highly dependent on the effective and efficient access, use and dissemination of appropriate high quality information. The purpose of the research reported here was to establish the requirements and develop a preliminary design for a database system to increase the effectiveness and efficiency of the TUO's technology transfer function. The research was conducted following the traditional systems development life cycle methodology and was supported through the use of modern structured analysis techniques. The next section will describe the research and findings as conducted under the life cycle approach.

ANALYSIS AND DESIGN

The purpose of the detailed analysis phase was three-fold: 1. the complete and thorough understanding of the TUO's technology transfer process, 2. the analysis of the feasibility of computer system support for the process and 3. the definition of scope for the system to be addressed by the research. The necessary understanding of the technology transfer process was gained using both traditional and structured methodologies. Information concerning the process was compiled from TUO documentation and report examination, personal interviews with all TUO and relevant contractor personnel (including Boeing Computer Support Services personnel), attendance at meetings and presentations, observation of day to day activities and through structured analysis modeling techniques. The process was modeled using the process and data modeling techniques of data flow diagramming and entity-relationship diagramming, respectively. The key processes and the necessary data/information flows and data stores necessary to support them were identified. The high level processes were then hierarchically decomposed down to the primitive process level. Concurrent with this effort the key business entities were identified and the required data were mapped to them.

The results of the analysis described above defined the business processes and entities falling within the established project scope. The scope of the project was defined by the TUO's Technology Assistance Board (TAB) process and more specifically by the problem request (PR) tracking and reporting requirements. The PR's are submitted by the client and can be likened to a customer order in a traditional business system. Receipt of a PR triggers the transaction process. At a high level the process consists of the following subprocesses: log-in (assignment of log-in number and entry into spreadsheet), evaluation (for scope and completeness), TAB review (consisting of further evaluation, assignment of a technology category, assignment of a responsible principal engineer (PE) and identification of appropriate MSFC lab and personnel possessing technology and or expertise to be applied), PE coordination and status reporting for active PR's and PR closure process. Each of the processes comprising a PR transaction were analyzed as to their input, process, output and data storage requirements.

The data modeling aspect of the analysis served to identify and define the key business entities and their relationships. The primary entities are the client - the individual or organization submitting a PR, the problem request, the technology source - the MSFC lab or individual that will address the problem request, and the principal engineer - the TUO individual with assigned responsibility for a given PR. The nature of the relationships among the entities were defined and the entity attribute specifications were developed. The data models were then used to develop the structure of the TUO database.

The analysis of the current TUO system led to the identification of several process related problems and issues. Key among these issues were:

- inability to effectively track PR's
- incomplete PR files
- lack of "strategic marketing" information
- processes heavily dependent on human information resources
- excessive time spent generating correspondence and management reports
- lack of information on technology resources and
- difficulty in coordinating TUO activities.

Based on these problems and issues and other information compiled during the analysis several opportunities for process improvement via computer support were identified. Major among these were the following:

- more effective PR tracking
- more precise and complete PR files

- existence of a non-volatile "corporate" database
- more comprehensive and readily available supporting information resources
- flexible and facilitated correspondence and report generation
- exception reporting
- more formalized procedures for transaction processing and
- facilitated information sharing.

Evaluation of currently available and "to be delivered" hardware and software coupled with an analysis of the operational capabilities of the TUO established the feasibility of developing and implementing a local area network based relational database system to address the problems and opportunities cited above. Such a system will allow implementation of a formal transaction processing system with the degree of information sharing, information archiving, application flexibility, data integrity, and ease of use defined by the end-users during the analysis process.

The recommended system would be developed using Microsoft's FoxPro for Windows relational database management system. This would provide multi-platform use across the PC's and Mac's currently used in the TUO. The Window's network environment would be provided by the Workstation Presentation System (WPS) currently being made available through Boeing Computer Services. The TUO has three such stations currently in operation with several more scheduled for the near future. This system will not only provide information and data sharing among TUO personnel but will serve as a window to the current and proposed E-mail systems which will link personnel to other MSFC organizational units, other NASA centers and to other outside government and private sector organizations. This linkage is of paramount importance in assuring the future effectiveness of the technology transfer process. Additionally, the WPS environment will provide TUO personnel with standard applications packages such as word processing, graphics, project management, presentation software and spreadsheet which afford opportunities for additional support, coordination and information sharing with respect to other aspects of the TUO function than those addressed by this research.

The recommended relational database environment will provide a Windows based, menu driven user interface which should allow easy transition for those TUO personnel currently using the Data General environment for word processing, data table (a limited spread-sheet type application) and e-mail applications. The relational architecture has been designed to offer the highest degrees of application flexibility, data integrity, maintainability, and future expandability. The data tables are designed to consolidate comprehensive information on an entity basis and to provide flexibility in establishing current and

potential future relationships among entities. The designed applications such as standard queries, correspondence generation, report generation and status monitoring were developed to meet the current end-user specified needs. The FoxPro Windows environment provides an applications generator which should allow TUO personnel to develop future applications with only a minimal amount of training. This will allow the TUO to more rapidly and effectively respond to the increasing demand for the transfer of technological expertise from NASA's laboratories.

CONCLUSIONS

This research has involved the analysis of the current process for transferring technologies from MSFC and contractor laboratories to the private and public sectors. The analysis has shown that the technology transfer process is heavily dependent on the timely and effective utilization of distributed information and has provided models to document the process. Most importantly it has established the feasibility and necessity for providing process support through the implementation of a networked database system. A recommended relational database system design has been developed which satisfies the defined end-user requirements and provides capability to handle future projected needs. The eventual implementation of such a system will hopefully serve as a model from which a comprehensive inter-agency system can be developed. Such a system is essential if we hope to render the technology transfer process as effective as it need be to help the country regain our preeminence in technologically driven markets.

ACKNOWLEDGMENTS

I wish to thank all the MSFC and contractor personnel associated with the Technology Utilization Office for their hospitality, time and honesty. Systems analysis methodologies are highly dependent on the willingness of end-users to share information and opinions with the analyst. The TUO personnel are to be commended for their participation in this process. Their hospitality allowed me to feel as "one of the family" during my ten week project. I also wish to extend individual thanks to my NASA colleagues Dr. Ken Fernandez and Ms. Nell Massey for initiating this effort and serving as points-of-contact for my information gathering efforts. Finally, to Mr. Ismail Akbay, the Director of the Technology Utilization Office, I extend my gratitude and appreciation, first as an educator, for providing me a meaningful fellowship opportunity, and second, as a citizen, for his dedication and devotion to the important mission of transferring federally funded technologies to help improve quality of life and provide a return on investment to taxpaying citizens.