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Project Summary

Evaluation and Assessment of UNAMAP

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The Evaluation and Assessment of UNAMAP is a study to determine how best to improve the usefulness and availability of the UNAMAP air pollution dispersion models. The study consists of a technology assessment, data collection and analysis, and specific improvements contained in an implementation plan. The analysis indicates that improvements to UNAMAP are needed in the areas of: (1) model accuracy, (2) model documentation, (3) user support, (4) data collection, (5) data input, and (6) computer compatibility. The study includes the development of an improvement plan which is based on a strategy that is consistent with the long-term objectives for UNAMAP. This strategic framework guides the implementation of improvements and strikes a balance between the goals of advancing dispersion modeling research and transferring technology to the public. Included in the plan is a set of ten specific recommended improvements.

This Project Summary was developed by EPA's Atmospheric Sciences Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

The User's Network for Applied Modeling of Air Pollution (UNAMAP) is a software library of air quality simulation models provided by the Environmental Operations Branch (EOB) of EPA's Atmospheric Sciences Research Laboratory (ASRL). The Evaluation and Assessment of UNAMAP project was designed to facilitate EOB's ongoing efforts to improve the utility and availability of UNAMAP to the public.

The results of the study describe a plan for implementing a series of recommended improvements to the UNAMAP program. The plan consists of a definition of strategy consistent with EPA's objectives for UNAMAP, and the schedule and budget to implement the specific recommendations.

The improvements were derived during the course of the investigation, and were based on two major sets of requirements. Technology requirements determine what computer, data, and modeling technology are available to UNAMAP users now and in the near future. User requirements determine what areas of UNAMAP utilization are most difficult and determine where improvement would be most beneficial. Each recommendation has been formulated both to take advantage of the current technological environment and to help meet expressed and implied user requirements.

The conclusions and recommendations in this study are based on research and analysis which were performed in three phases. The first was a technology assessment to determine technology available to UNAMAP. The second was data collection (by interview and questionnaire) and analysis. The third was the derivation of recommendations.

Technology Assessment

All products follow a pattern of growth which involves changes to the product,

the users, and the market. UNAMAP has followed such a growth pattern. The Technology Assessment Report evaluated the technological environment in which UNAMAP exists today and that in which it will function most effectively in the future. The information was used in subsequent stages of the project to provide evaluation criteria for system alternatives and final recommendations.

The technology assessment found that all components of modeling technology have changed dramatically since the development of the first computerized air quality models in the 1960's. The technology is continuing to change at a fast pace. The report covered three distinct phases in air quality model development: (1) the technology as utilized by UNAMAP Version 6; (2) the technologies used by models currently under development, as well as adaptations made to UNAMAP to utilize current technology; (3) the technological requirements for future models to solve current problems.

In Version 6, the technology applied to the models has progressed, while that of the computer systems used to run them at EPA has not. Although the original Gaussian dispersion mathematics are still used, the UNAMAP models have become more sophisticated and consistent. Adaptations and new processors have increased the models' usability. The UNIVAC 1100 utilized for support, however, represents no advances since UNAMAP was begun in 1973.

New modeling developments have grown from the user community's attempts to deal with today's air quality modeling applications. Model developers are creating models for more challenging environmental problems. UNAMAP users have adapted the models to respond to situations that are different or more complex than those for which the software was designed. Consultants and third-party vendors have contributed more sophisticated data collection and input methods and facilitated the use of new computer technology.

Modeling software must advance to meet both application and user needs. Modeling has become a successful and important tool in protecting the environment. Because of this success, models are needed for even more complex, real-world situations which need representation. Complex regional models are needed by county, regional, and state agencies to study dispersion and transport of pollutants over larger distances. More realistic complex terrain models are needed to represent geographical areas where terrain is a factor.

The typical model user has changed since the advent of UNAMAP. Today, a user may not be a "modeling expert." He may use the models only a few times a year or lack the computer expertise to use mainframe versions easily. Services such as modeling consultants and developers of menu-based microcomputer versions have grown to meet the needs of today's user.

Users expect software which not only fits the application but is also easier to use. In judging ease of use, the user-friendly, microcomputer products available for other applications will be used as criteria against which the UNAMAP software will be judged.

The data used by the models will continue to be provided by the National Weather Service (NWS) or collected at the site in question. Therefore, more consistency of data input and output among the models will be needed to accommodate the novice or infrequent user.

Computer technology will continue its trend toward distributed processing with microcomputers used for an increasing amount of modeling activity, including graphics output. User expectations will also require that data gathering and file transfer technologies in UNAMAP match those available in other application areas.

Data Collection and Analysis

A major portion of the Evaluation and Assessment of UNAMAP project was the collection of data from UNAMAP users and other members of the dispersion modeling community. The data helped define who uses UNAMAP and how the models are used. The data also identified the areas of the modeling process which users felt should be improved.

There were two parts to the data collection activity: personal interviews and mailed questionnaires. In-depth interviews were conducted with 22 representatives of the following organizations:

- EPA (ASRL and OAQPS)
- EPA Regional Meteorologists
- State air quality agencies
- Local or county air quality agencies
- Private industries (as users of the models)
- Educational institutions
- Modeling consultants
- Modeling software marketers

The interviews provided an overview of the UNAMAP system as well as information on the modeling process. The data from the interviews were us to design a questionnaire which w mailed to a larger segment of th UNAMAP community (256 organizations

Usable data were returned in 11 questionnaires. These questionnaire were analyzed, and certain types of da were extracted including a user profil which models are used, and problem encountered in the modeling process. typical UNAMAP user:

- Belongs to one of four major industr groups; consultant, state governmen private industry, or local government;
- Classifies himself as a user of th models;
- Has an experience level which varie by industry group.

The largest portion of th questionnaire dealt with the problem perceived by the users and the suggestions for improvement. Twelv potential problem areas were identifie by Battelle project team members base on conversations with EPA. Questionnair respondents were asked to rank th problem areas as to the severity of th problem. User responses were groupe into low, medium, and high categorie Problem areas scored as medium or hig on the severity scale by all major us groups were further analyzed. Us suggestions to correct these problem were categorized, and a percentage suggestions in each category wa computed.

Six out of the original twelve potenti problem areas were rated as maj problems by the users. These are th problems which Battelle's recommen dations attempt to rectify.

The following table shows the area specified as major problems as well a the potential problems not considere significant by most users:

PROBLEM AREAS

MAJOR PROBLEM	NOT A MAJOR PROBLEM
Accuracy of the models	Choosing a model
Documentation of models	Buying/accessing th model
Support for models	Hardware access
Data collection	Unreliable hardware
Data input	Response time
Hardware compatibility	Other (users could specify problems no listed)

Alternatives were generated from th suggestions and from typical com ponents of technical support in th

informations systems industry. Evaluation criteria and constraints were identified, and used to determine the strengths and weaknesses of the alternatives.

The suggestions and alternatives were evaluated using the technological context described in the Technology Assessment and industry experiences with currently implemented systems as described in the trade literature. Through the evaluation process, Battelle developed a list of recommendations. The recommendations were formulated to address multiple problem areas wherever practical, and to utilize technology which is available to the UNAMAP support staff and model users.

Recommendations

The UNAMAP program has great visibility and impact on the public, including industry, state air pollution control agencies, and community groups. To take advantage of this visibility, UNAMAP needs to provide a centralized modeling service of high quality. The recommended improvements, when taken as a whole, will allow UNAMAP to achieve the following goals:

- To function as *the* public source of newly developed and refined air quality models.
- To distribute models which are easily executed on a variety of commonly-used computers of all sizes.
- To provide a wide set of models which are relatively easy to execute, even for the novice or occasional user.
- To offer modelers a central source of technical information, meteorological data, and user support.

To attain these goals, a long-range strategy and milestones are required. Therefore, the first part of the implementation plan is a strategic framework. This serves as a guideline for the assignment of priorities to the recommendations. The priorities are consistent with the long-term objectives of the UNAMAP program. The strategy is designed to strike a balance between the two objectives of UNAMAP: advancement of research in dispersion modeling, and the effective transfer of modeling technology to the public.

The approaches discussed will first expand the users' ability to use the models, and then serve to advance the modeling technology being used. The initial changes must allow UNAMAP to evolve to meet the current expectations of the modeling community. When using the regulatory models is less difficult, modelers will be able to turn more of their attention to the research aspects of modeling. As in the early days of UNAMAP, the user community will become more involved in the process of testing and validating new models as part of the research cycle.

The strategy can be executed through a set of ten specific recommendations for improvement to UNAMAP. They are the following:

- Establish an electronic bulletin board on a multi-user computer system.
- Provide a set of end-user documentation for all UNAMAP models.
- Provide models which execute on IBM mainframes, DEC VAX computers, and IBM PC's.
- Improve the accuracy of models.
- Develop consistent user-friendly interfaces for all models.
- Consolidate all support for all UNAMAP models.
- Establish a meteorological data clearinghouse.
- Include more special purpose models in UNAMAP.
- Support the collection and use of additional and more accurate meteorological data.
- Support the electronic distribution of UNAMAP documentation and updates.

The report summarizes each recommendation, and discusses implementation tasks and estimated costs.

Based on its contribution to the strategic framework, each improvement can be assigned a priority and a completion time estimate. These two factors are used to generate an implementation schedule and a budget.

Battelle's implementation plan estimates that the five recommendations grouped into the first phase of improvements can be implemented over a schedule of 121 weeks for an estimated cost of $769,000. These are preliminary figures based on current understanding of the work required. The cost estimates are over and above the current EOB budget and are predicated on contracting for all model enhancement and documentation work. EOB resources would be reallocated to perform on-going management functions generated by the recommendations.

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The complete report, entitled "Evaluation and Assessment of UNAMAP," (Order No. PB 88-180 062/AS; Cost: $25.95, subject to change) will be available only from:
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