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Progress Report on ONR ODA Contract

January to September 1975

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During the past nine months, ~~we at the~~ University of Pennsylvania have continued to work on the Operational Decision Aiding Systems Project sponsored by the Office of Naval Research. ~~Our~~ focus has been on advanced computer based techniques to support decision aiding systems. This has been centered on the development and implementation of a prototype decision aiding information system, DAISY, which should aid us in gaining experience with these

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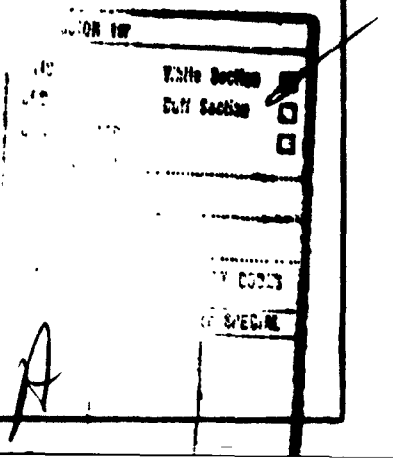
(20.) types of systems.

In January 1975, a team of visitors from the Navy and other contractors on the ODA project visited the University of Pennsylvania for a briefing on the overall plans for DAISY, and for a look at certain advanced techniques (e.g., Natural English Language input) which might prove useful in operational decision aiding systems. Since this visit, we have been working to incorporate the ideas generated at that meeting, and others of our own, into a revised DAISY version which is integrated with the work that the other contractors are performing.

The remainder of this report discusses the changes made to DAISY, the prototype database and triggering system, and the application of these tools to the ONRODA scenario prepared by SRI.



1.0 Introduction

During the past nine months, we at the University of Pennsylvania have continued work on the Operational Decision Aiding Project sponsored by the Office of Naval Research. Our focus has been on advanced computer based techniques to support decision aiding systems. This has centered on the development and implementation of a prototype decision aiding information system, DAISY, which should aid us in gaining experience with these types of systems.

In January 1975, a team of visitors from the Navy and other contractors on the ODA project visited the University of Pennsylvania for a briefing on the overall plans for DAISY, and for a look at certain advanced techniques (e.g., Natural English Language input) which might prove useful in operational decision aiding systems. Since this visit, we have been working to incorporate the ideas generated at that meeting, and others of our own, into a revised DAISY version which is integrated with the work the other contractors are performing.

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2.0 DAISY Version 3

The basic concept of DAISY[1] is that there are four types of entities which DAISY will help a decision maker manage. These are decisions which need to be made, models which may aid in the decision making process, data which can be accessed, and triggers, which are used to alert the decision maker to important pending decisions. In effect, DAISY is a superstructure which helps the decision maker communicate with many other sophisticated computer and mathematical tools to aid in decision making.

We have added several commands to the DAISY system. The command

```
ALERT name condition consequences
```

will cause the database system to monitor for the condition, and to execute the consequences when that condition is noted. It will also send a message to the terminal saying "ALERT name occurred". A typical use might be:

```
ALERT FUELOUT (FUEL LESSP 50) ((WRITE NAME) (WRITE @"IS RUNNING
OUT OF FUEL") (TRIGGER 312) )
```

where 312 is the refueling decision which then becomes added to

the pending list.

The command WRITE "string" simply writes the indicated string on the terminal. It is mainly used for communications with other processes such as the database manager.

The command SET dataname value, causes a message to be sent to the database which will change the value of the named field to the new value.

The command DISPLAY dataname causes the requested dataname to be retrieved from the database and its value printed.

The command RUN MODEL number will cause the specified model to be executed using the data indicated in the model description.

Internally, we have also implemented multi-terminal communication among the database manager and the DAISY and other users. This can be used to drive graphics and other devices.

3.0 Database/Trigger System

In order to study the use and construction of triggering systems, we have implemented a prototype database manager which includes certain simple triggering facilities. This will serve as a vehicle in which we can test implementation of more complex triggers and alerters, and also as a means of getting a real database tied into DAISY. The prototype was written by staff members Prof. Buneman and Mr. Stan Cohen.

This system also has the facilities for communication with multiple independent jobs. This permits one job (terminal) to be updating the data base as an intelligence officer might, while other jobs are simultaneously accessing the database and receiving the trigger outputs.

The most interesting features are a set of LISP constructs called DEMONs. Each demon may be thought of as a LISP program which is executing continuously. They are typically written in the form of LISP conditional expressions. When they become true, the associated actions are executed. Thus

```
(DEMON FUELOUT (X)
 (JCOND (LESSP (FUEL X) 50)
 (SEND DAI @"WRITE" NAME)
 (SEND DAI @"IS RUNNING OUT OF FUEL")
 (SEND DAI @"TRIGGER 312")))
```

would be the actual database form of the DAISY ALERT command

shown in Section 2.0.

The user, when writing the conditions, can either use the standard LISP COND function, in which case the actions will be taken every time the condition is true, or the special JCOND ("Just occurred condition") which is true only once, when the condition of interest has just occurred. In addition the system permits users to access both the OLD and NEW values of variables which are in the process of being updated, which is useful for validation and auditing purposes, as well as triggering.

Further details on this system will be presented in a forthcoming report.

3.1 Standard DBMS/AFS

We have also continued to monitor the work being done under ONR contract NR 049-331 at the University of Pennsylvania, under which a standard CODASYL database management system is being tied to the Adaptive File System developed by the PI. This system is also going to have triggering facilities added to it, and will eventually become the real world database manager for local DAISY data. (Of course, DAISY will also have the facilities to access data from other computers via network links.)

4.0 Application of DAISY to the ONRODA Scenario

During the past several months, the PI, along with Arthur Purves, Ralph Mitchell, and Ruth Zowader (graduate students in Decision Science) have modified the decision structure previously presented to more closely match the SRI scenario. In addition, we have actually entered the set of scenario decisions into a DAISY file, so that we can play through the execution of the ONRODA action.

We have worked on the problem of the planning phase, and will present several alternatives for collecting the information presented in the first part of the ONRODA Scenario report, in the near future.

We have taken the preliminary CTEC database specification[3] and used this to obtain some of the data items which we are using in out demonstrations of the ONRODA scenario. We plan to implement this data structure as soon as it is agreed upon, and contingent upon support for the disk storage space requirements. Both the LISP prototype database system, and the DBMS/AFS systems will be used for the implementation.

5.0 Other Contractor use of DAISY

In spite of our offer at the January meeting, only one other contractor, CTEC, has made any serious request to use or experiment with DAISY. We hope that we can arrange for more testing by others in the near future.

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[1] Hurst, Morgan , and Ness "DAISY: A Decision Aiding Information System," Working Paper 75-01-05, The Wharton School, January 1975.

[2] SRI "ONRODA Strike Warfare Scenario" NWRC Research Memorandum 83.

[3] CTEC, Preliminary Specification of ONRODA Database Requirements.

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