MEMORANDUM FOR:

WJC

This is the preview info for ORD's 14 April (1:30) briefing to D/ODP and you. So far she participated in discussions of the Text Processing and Deductively Augmented Data Manager (DADM) Projects.

Date 4 Apr 85

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Remarks:

Bill: Here is an advanced copy of material relevant to our proposed Intelligent Systems program for FY84. The briefing of [redacted] is planned, now, for the week of ~~8 March~~, but no date has been scheduled. 14 April

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FROM: NAME, ADDRESS AND PHONE NO.	DATE
[redacted] ORD/ISRD [redacted]	11 Mar. 82

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CIA/ORD INTELLIGENT SYSTEMS PROGRAM

ORD is planning to establish a major new program of research and development in the field of intelligent systems. Intelligent systems are "smart" computer programs which can perform logical deductions, solve complex problems, and explain their actions to the systems' users. ORD has been tracking this technology for several years. Recent significant successful applications in universities, government, and industry indicate that this technology has now matured to a level sufficient to warrant a substantial Agency investment. We believe that the techniques of intelligent systems will benefit the Agency through

- Improving the productivity of Agency personnel by performing certain functions which previously required human intervention
- Making computer systems easier to use and understand
- Improving our ability to write and maintain computer programs to perform complex tasks
- Institutionalizing and making more widely available the specific knowledge and expertise of Agency experts in many fields.

In general, intelligent systems technology can help us in the Agency to control the cost of meeting our customers' projected need for more intelligence and better information.

The technology of intelligent systems involves the creation of computerized knowledge bases of factual data, problem-solving heuristics, and logical inferencing mechanisms which are specific to a particular problem domain. Potential Agency applications of this technology include directed search through massive data files, diagnosis of system malfunctions, user-friendly interfaces to complex computer models or networks, image understanding, computer-aided design of micro-electronic circuitry, understanding of natural language text, and many more. The ORD Intelligent Systems Program will investigate both the technology and its application. An important aspect of this program will be the development of an understanding of which aspects of the technology are appropriate for which types of Agency applications.

The primary purpose of the proposed program is to transfer intelligent systems technology to the Agency. In seeking this goal the program has these general objectives:

- To provide continued technical support for initial Agency experimental efforts in developing intelligent systems

- To introduce and demonstrate the value of intelligent systems technology to a wide range of Agency analytical, scientific, and system development functions

- To acquire and develop tools and skills within the Agency to apply intelligent systems to the Agency's information problems.

Hence, the Intelligent Systems Program will concurrently address tool development, actual applications, and understanding the theory behind the intelligent systems/knowledge-based approach.

We believe that widespread use of intelligent systems technology in the Agency is inevitable. However, the cost-effective introduction of this technology to the Agency will require a program of careful experimentation, analysis, and organizational learning regarding the capabilities, characteristics, and use of this type of computer system. The Agency needs to begin now to expand its capacity to absorb this technology and establish in-house expertise and experience in intelligent systems design, development, and use. The proposed program is designed to provide the Agency with the experience we will need as we face the information (and knowledge) processing environment of the Eighties.

Our DDI and DDA counterparts have expressed their interest in the Agency pursuing this technology. We are continuing to work closely with them in the development of this program.

FUNDS:	FY84	FY85	FY86	FY87	FY88
	$1.20M	$1.75M	$2.00M	$1.50M	$1.50M

Additional Staffing Required: +3 positions

1. PROGRAM TITLE: Intelligent Systems

Submitting Agency: CIA

2. FUNDS:

FY84	FY85	FY86	FY87	FY88
$1.20M	$1.75M	$2.00M	$1.50M	$1.50M

3. PROGRAM SUMMARY:

The ORD Intelligent Systems Program is designed to provide the research, development, and technology transfer required to acquire, implement, and effectively use intelligent systems throughout the Agency. Intelligent systems are advanced computer-based information processing systems (hardware and software) which can solve complex problems and perform logical deductions from data and rules provided to them by human experts. These capabilities are typically beyond the current capabilities of today's data processing-oriented systems. The multi-year Intelligent Systems Program will involve efforts in the areas of application development, product evaluation, tools acquisition, and the general process of learning how to build and employ intelligent systems.

4. PROGRAM DESCRIPTION:

4.1 Program Overview

The intelligent systems approach appears to be a major step forward in making the computer easier to use. By raising the level of the interface through which the end-user communicates with the computer we can allow analysts and other personnel to take advantage of the power of the computer without requiring them to become a computer "expert." The technology of intelligent systems is expected to provide the Agency with some new techniques by which we can

- Improve personal productivity
- Make computer systems easier to use
- Perform procedures which were previously difficult or costly to express in traditional computer languages
- Solve some analytical problems that were previously untractable
- Improve our ability to build and maintain computer software
- Increase the general accessibility of the knowledge accumulated by the Agency's substantive experts in particular subject areas.

A principle goal of the development and use of intelligent systems in the Agency will be to increase the use of computers while holding down the costs of system implementation and maintenance.

Information and the knowledge of how to use it are an important and valuable resource of the Central Intelligence Agency. Growing requirements for intelligence production demand that our analysts be able to process, sometimes quite rapidly, considerable amounts of information in a variety of forms. To meet these requirements the Agency is making a substantial investment in automated tools for information handling. Such tools, however, are not always easy to use. Learning vast amounts of computer jargon and protocols can be a confusing and frustrating experience for the analyst and may result in lower productivity. Improved techniques are needed for developing "smarter" system interfaces which will make our information systems easier to use by shifting the burden of communication as much as possible from the end-user to the system itself.

In addition to support for handling vast quantities of information, Agency personnel also need assistance in actually processing and analyzing this information. The process whereby raw data is converted into finished intelligence is often complex and usually involves extensive knowledge and sophisticated skills and expertise on the part of our analysts. The development of this knowledge and expertise is a costly, time-consuming, and labor-intensive process. Our analysts' knowledge requires continual update and revision as world events change, as new intelligence requirements develop, and as new information systems are constructed to provide automated support for handling information. Techniques are needed to enhance the flexibility of our information processing systems, to reduce the overall cost of retraining Agency analysts as the environment changes, to help retain specific subject-area expertise which may otherwise be lost when Agency personnel retire or transfer, and to provide more sophisticated aids for processing increasing amounts of complex data and fusing that information into meaningful and accurate intelligence. One approach to solving these problems is the development of automated systems which can be programmed and modified easily to assist humans in evaluating data and making decisions in a changing environment. We call such automated systems "intelligent systems."

Intelligent systems are computer-based systems which answer questions, perform relatively complex reasoning, manipulate symbols as well as numbers, apply formal and heuristic logic, explain their behavior, and in general solve procedurally-oriented problems with an ability comparable to that of a human expert. The technology is an outgrowth of a branch of Computer Science called Artificial Intelligence which has been studying the

problem of developing more intelligent behavior in computer systems for more than 25 years. Over the past decade the Federal Government (largely through the Department of Defense) has spent hundreds of millions of dollars in support of research and development to provide techniques for building more intelligent systems. More recently, private industry has become interested in the intelligent systems approach and several commercial applications have been developed.

ORD has been tracking this technology for many years. After some early feasibility studies and prototype system development efforts in 1980-81, ORD has concluded that intelligent systems technology offers significant improvements in the application of computer technology to the Agency's problems. The time appears to be right to invest significantly in transferring this technology to the Agency. The multi-year ORD Intelligent Systems Program will follow a three-part strategy of general tool and product assessment, specific Agency application development, and the training of Agency personnel in the techniques of "knowledge engineering." The Agency is expected to improve its intelligence production through this program by providing its analysts with the ability to cope more effectively with the increasing volumes of information and processing requirements which are projected for the Eighties.

4.2 Program Objectives

The proposed program is intended to provide the planning mechanism for the orderly acquisition and use of intelligent systems technology within the Agency. The products of this technology program are expected to have a significant impact on many of the Agency's information processing activities from collection to analysis and reporting as well as the way future information systems are designed and implemented. In addition, we expect to see intelligent systems technology become more prevalent in the tools and systems which the Agency buys. As the capabilities and commercial availability of intelligent system products grow, the internal demand for such services will also grow. The goal of ORD's initiative in this area is to prepare the Agency (system developers as well as end users) to absorb and apply these technologies effectively.

The objectives of this program are:

- To provide continued technical support for initial Agency experimental efforts in developing intelligent systems
- To introduce and demonstrate the value of intelligent systems technology to a wide range of Agency analytical, scientific, and system development functions

- To acquire and develop tools and skills within the Agency to apply intelligent systems to the Agency's information problems.

To accommodate these objectives the program has been designed to encompass continued support of ongoing applications, identification and initiation of new systems employing these techniques, generalization of tools and approaches developed for specific applications, and the training of Agency personnel in how to build and use such systems.

4.3 Intelligent Systems Technology

The aim of intelligent systems technology is to develop "smarter" computer programs, i.e., programs which can communicate on a higher level with end-users and which possess considerable relevant knowledge about specific subject areas. These programs perform functions which previously required human expertise to accomplish and generally were considered beyond the capabilities of ordinary computer programs. Whereas more typical applications of computers might involve information storage, retrieval, processing, and communication, intelligent systems are programmed to employ additional knowledge about the information being processed and use this knowledge to reduce the search time required to find relevant information, to make logical inferences using uncertain data, to plan strategies for achieving some goal, or to converse with end-users in "natural" language rich with their own domain dependent jargon and meaningful operations. The domain specific knowledge and the skills to apply it in intelligent systems comprise what is typically referred to as the knowledge base, and intelligent systems which are structured in this manner are called knowledge-based systems.

The knowledge-based systems approach should be considered when a computer program is needed but there is not enough information about the problem and how to solve it to write a conventional software system specification. In general, conventional computer programs require that an algorithm be known for solving a given problem (e.g., a mathematical formula, a closed procedure that can always arrive at a yes/no decision, or a well-defined series of bit manipulations that always results in the right things being done to the right data.) Knowledge-based systems, however, allow computers to go beyond algorithmic solutions and to address problems where solutions (right or wrong) are not always guaranteed. Such systems typically employ heuristics or rules-of-thumb to select strategies for determining what to do next in trying to solve a particular problem. These heuristics are most often obtained by system designers from human (domain) experts (e.g., image analysts, agronomists, engineers) in a series of interview sessions that function much the way on-the-job training of new professionals might be conducted. The

knowledge of these heuristics and the skill to apply them effectively (usually acquired through years of experience) are what make the individual an expert in his or her particular field and what give the intelligent system its power.

Knowledge-based systems offer promise in problem situations where there are people who, given enough time, can solve the problem. Knowledge-based systems do not possess the ability to solve problems that humans cannot. Neither can they solve problems for which humans cannot articulate how the problem should be solved. However, they can be used to imitate the behavior of scarce human experts in trying various approaches to a problem, offering advice on various aspects to consider or experiments to conduct, or recognizing blind alleys and suggesting alternative strategies. Typically, the body of knowledge compiled in a knowledge-based system represents the combined expertise of several experienced people in a field and hence can serve as a useful consultant to the professional by considering multiple points of view.

Knowledge-based systems have been applied successfully outside the Agency in a number of areas including medical diagnosis, mineral exploration, design and configuration of computers, analysis of chemical structures, and molecular genetics. Current areas of investigation include subjects closer to intelligence production such as automatic image analysis, troubleshooting computer systems, and the management of SIGINT collection. The development of a new substantial knowledge-based system is a medium- to large-scale undertaking involving, perhaps, two to ten person-years divided between the system developers (knowledge engineers) and the domain experts (scientists and analysts) who contribute their knowledge. Smaller applications (involving tasks a human can learn in a month or so) could be operational in a year or less.

Each new application of knowledge-based systems technology does not have to start from scratch. New applications can sometimes be developed from existing knowledge-based systems by supplying new knowledge (facts and rules of behavior). Furthermore, general purpose knowledge base management systems are being developed which provide basic inferencing tools. New applications, then, require the development of the new knowledge base and problem-solving strategies appropriate to the particular subject domain. In addition, tools and aids for knowledge engineers are also being developed which will facilitate the elicitation of knowledge from the experts and the design of the knowledge base.

Knowledge-based system development techniques differ significantly from conventional software methods. The development of intelligent systems is not preceded by writing monolithic

specification and design documents. Instead, knowledge engineers start with extensive interviews with human experts. The knowledge gleaned from these interviews is transcribed into a partial prototype of the final system and presented back to the expert for review and suggestions for modification. Because intelligent systems are typically designed and coded in high-level languages with sophisticated automated development tools, the original functioning prototype can be developed rather quickly and substantial alterations to the design and the code can be made in a relatively short period of time. In this manner, the expert and other end-users become intimately involved with the system as it develops, understand how it works, and insure that the system finally produced addresses the problem as it has evolved (not as it was when the project was originated).

4.4 Potential Agency Applications

There are a number of potential application areas where intelligent systems may be useful in the Agency. These areas include

- Large-scale simulation and modeling aids
- Intelligent assistance for routine processing
- Focusing searches through massive data files
- Diagnosis of system failures
- Automated aids for image understanding
- Computer-aided design of micro-electronic circuitry
- Improved techniques for understanding natural language
- Enhanced interfaces to data base management systems
- Computer-aided instruction

We expect that as the Agency gains experience with intelligent systems technology additional applications will readily be identified.

4.4.1 Simulation and Modeling

One of the most important Agency application areas for intelligent systems is in the development and use of complex analysis models. Initially, we believe that models such as those dealing with military assessment (e.g., MVS, PRIME, Air Defense) or resource assessment (e.g., Soviet Economy, Chinese Agricultural Assessment, Energy Resources Estimation) have the highest potential payoff. Such models are often large and complex and may require 5-8 people to operate and maintain and as much as one year to learn to use. Intelligent system approaches can be used to construct more user-friendly, self-tutorial systems which assist the user in specifying parameters and interpreting results. These systems are designed to be more easily modified with their knowledge explicitly represented in a readily comprehensible form

to accommodate changes in model behavior. The Rule-Oriented Simulation System (ROSS) at Rand Corporation is an example of a large-scale modeling effort. ROSS is a revised (intelligent system) version of a large Advanced Penetration Model previously built for the Air Force to simulate strategic air defenses. Within the Agency, an intelligent front-end to the Hydrology model has been constructed based on the PROSPECTOR system at SRI.

4.4.2 Intelligent Assistants

Another application of the technology is to develop intelligent assistants which can automatically perform routine tasks which involve more detail than the human user cares to remember but more flexibility than current non-intelligent systems exhibit. Examples of such activities include logging in to various computer systems (e.g., via the COINS network), scheduling appointments and maintaining calendars, setting up parameters and complex run streams for computer models, or storing and retrieving data from local files as in an analyst's personal workstation. The Rule-based Intelligent Terminal Agent (RITA) of the Rand Corporation is an example of an intelligent assistant which has successfully performed these types of functions.

4.4.3 Focused Search

In problems requiring extensive searching through massive amounts of data such as SIGINT files, annotated imagery, or text, heuristics can be developed to focus the search to the most likely areas first. Heuristic search techniques have been successfully demonstrated in the DENDRAL system at Stanford University which generates plausible structures for organic molecules from mass spectral data. Systems based on DENDRAL techniques might be developed, for example, to assist in cryptographic analysis where plausible machine settings or encipherment procedures are being sought.

4.4.4 Failure Diagnosis

A fourth potential application area involves the general diagnosis problem of determining the source or cause of system failure by analyzing its symptomatic behavior. In approaching these types of problems, systems can be built which formulate a hypothesis (or diagnosis) and then proceed to organize the available information (which may be incomplete or uncertain) to either confirm or deny that hypothesis. Systems using these techniques may be developed in the Agency to diagnose complex system malfunctions (such as large computer systems or networks), remote system failures (as in orbiting spacecraft), computer security breaches, or even medical diagnosis of selected foreign individuals.

Several diagnosis systems have been successfully built such as MYCIN at Stanford which diagnoses bacteriological infections in human blood, CADUCEUS at the University of Pittsburgh which can diagnose some 500 different disease types of internal medicine, and PROSPECTOR which evaluates geologic site suitability for mineral exploration (developed for the U.S. Geologic Survey by SRI International). In some instances (e.g., the SPILLS system at the Rand Corporation), systems have been built which can recognize that more information is required and ask the end-user a specific question. Such systems may be appropriate to support the intelligence collection process.

4.4.5 Image Understanding

Another high-payoff application of intelligent systems technology is ORD's Image Understanding Program in support of NPIC. This multi-year R&D effort is seeking to develop the capability of automatically recognizing target images in a scene and interpreting the meaning of the activities detected in a series of images. It employs, in part, the ACRONYM intelligent system from Stanford University. In addition to its expert image interpretation task, the Image Understanding Program will also be investigating the integration of multi-sensor information, the assessment of image quality, and the development of an intelligent assistant to track newly developing target activities. The Intelligent Systems Program will complement the Image Understanding Program by conducting research and development in the general tools and techniques of knowledge-based systems. Some of these tools may be of use in the Image Understanding Program. Conversely, the Intelligent System Program will seek to generalize upon the knowledge-based techniques developed for the image understanding work and determine how they might be applied in other areas. Close collaboration is expected among the personnel involved in these two programs.

4.4.6 Computer-Aided Design

An application area currently receiving considerable interest in industry today is that of computer-aided design (CAD) and, in particular, the design of micro-electronic circuitry. An intelligent circuit design tool could be of significant help to OTS in the development of special-purpose integrated circuits where only a few of a kind may ever be produced and hence the entire cost of the design must be borne by the Agency. The EL system of Stallman and Sussman may serve as a basis for building such a tool.

4.4.7 Natural Language Understanding

Considerable work has been done to improve the computer's capability to understand natural language. Many of these techniques are following a knowledge-based approach. Correctly

interpreting natural language sentences would be of tremendous benefit in the Agency in improving the user interfaces of our computer systems and the automatic exploitation of text. Projects involving text obtained from open literature (e.g., Projects APOSTLE and DISCIPLE), transcribed by FBIS (e.g., Project MIDAS), or contained in cables and messages to be routed to the appropriate analyst (e.g., Project SAFE) could all be enhanced by knowledge-based techniques of natural language understanding.

Development projects such as SRI International's LADDER, System Development Corporation's EUFID, and Artificial Intelligence Corporation's INTELLECT have focused on natural language front-ends to data base management systems. Research at Yale, MIT, Maryland, Brown, and Illinois Universities (among others) have investigated the need for knowledge bases which model real world events and relationships as an adjunct to understanding natural language sentences. Understandably, most of this work has focused on understanding English, although some research is being conducted at the University of Texas in understanding other languages as well.

In the area of understanding spoken natural language, the DARPA Speech Understanding Program has developed several techniques of interest which may potentially have longer-term application in the Agency. The knowledge-based approach of Carnegie-Mellon University in the HEARSAY project is noteworthy for its ability to control the interaction of several knowledge sources concurrently to solve problems cooperatively. Successful speech understanding capability might ultimately have application in monitoring foreign broadcasts, transcribing interviews, in covert collection, or in maintaining the physical security of our facilities.

4.4.8 Data Base Management

Large, on-line data bases can be confusing to end-users in terms of knowing the right questions to ask, formulating syntactically correct queries, searching multiple data bases, or drawing inferences from incomplete data. Intelligent systems offer a way to improve the capabilities of our existing data base management systems by providing mechanisms to permit deductive inferencing from existing data using rules of inference compiled by an expert in a particular subject area. SDC's Deductively Augmented Data Manager (DADM) is one such tool that can be used to enhance the current capabilities of our existing data base management systems (e.g., GIMS, RAMIS, or ORACLE).

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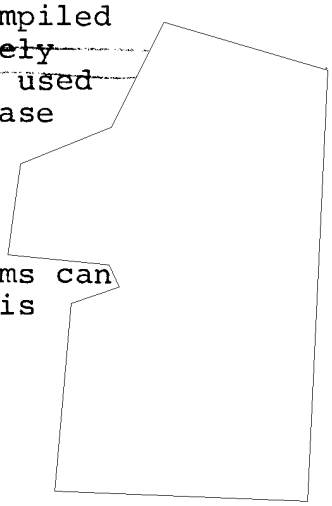

4.4.9 Computer-Aided Instruction

The explanation feature of most knowledge-based systems can be used to explain to the user the logic which the system is

following at any point (i.e., the goal it is trying to reach and the facts that it has already established). This explanation approach has been extended in some projects to develop a system which can instruct end-users in the knowledge which has been built into the system. While obvious application areas for computer-aided instruction techniques might exist in the Office of Training and Education or the Office of Communications, the technology might also be applied with individual systems to make them self-tutorial. The SOPHIE system at Bolt, Beranek, and Newman was developed to teach electronic circuit debugging. The GUIDON system at Stanford University was developed to tutor medical students about the contents of its knowledge base. The GUIDON system constructs a model of each student's performance, can lead the student as well as respond to the student's initiative, and can present and explain medical diagnostic strategies.

4.5 Personnel

The goals of the ORD intelligent systems program will be accomplished along several fronts at once. ORD personnel will serve as program planners, technical contract monitors, and in-house intelligent system experts. In most instances contractors will be employed for the actual design and implementation of any intelligent system application or the refinement of pertinent knowledge engineering techniques. However, to meet the goals of this program, three additional positions will be required in ORD. In addition, it is important to point out that because of the crucial role which application domain experts play in the generation of knowledge for intelligent systems, heavy participation will be required from the principal beneficiaries (experts and end-users) as individual applications are developed.

4.6 Research Issues and Products

A principal product of this program will be the development of actual working intelligent systems for specific Agency applications. The selection of which applications to address and in what order will be an early focus of the overall effort. Subsequently, the evaluation of completed applications and the measurement of success will be another aspect of the research.

Concurrent with the development of specific applications there is the need to build a body of expertise in the Agency on the design issues involved with developing intelligent systems. Such issues include techniques for eliciting and representing expert domain knowledge, identifying and evaluating appropriate intelligent system applications, designing and processing knowledge bases, and implementing and operating intelligent systems (including computer resources, programming languages, and integration with the Agency's computer environment). Issues such as

these will generally be investigated in conjunction with the development of actual applications although occasional study or tool development projects may be performed to obtain a general capability which may be applied to several applications. At times, in-house experimental or prototype applications may be developed to demonstrate a concept or the feasibility of an approach.

A potential spinoff of the proposed program is the development of intelligent systems tools and techniques having general applicability to other computer science concerns such as data base design, information system architecture, or mathematical model development. The transfer of these tools to other system development efforts and, indeed, any potential alteration in the way in which the Agency designs and develops systems will be pursued closely in this program.

4.7 Program Strategy and Schedule

The proposed program encompasses both support to ongoing knowledge-based ORD programs and broadening the range of experimental applications. As a result, part of the proposed budget will support the acquisition of special hardware and software needed to implement and evaluate the application of intelligent systems. The budget will also support the acquisition of an in-house knowledge engineering capability which can be directly useful in applying intelligent systems technology within the Agency. The rest of the funds will be used for contractual support in the development of knowledge-based applications.

This program will build upon and generalize other ongoing ORD and Agency projects; hence, much of the groundwork and early experience with intelligent systems will be prepared in FY82 and 83. These limited ongoing projects will likely continue in FY84 as maturing applications. General tools and techniques will be extracted and any lessons learned will be consolidated into a body of Agency expertise relevant to knowledge engineering. Additional, more substantial applications will be initiated in 1984, as appropriate, and these can be expected to extend for several years of development thereafter. In outlying years it is anticipated that the tools and techniques of knowledge engineering and intelligent systems development will be successfully transferred to ODP, ODE, DDI and other system development and user organizations.

The general operating philosophy of the ORD Intelligent Systems Program will be to adapt existing tools, techniques, and systems to Agency applications and the Agency environment. There appears to be both sufficient R&D funding of the field (by DARPA and others) and intense industrial interest in applying this

technology (such as oil and mineral exploitation, design of integrated circuits, or computer sales hardware configuration) to ensure continued progress. ORD's investment strategy under this program will be to build upon existing intelligent system prototypes in early applications and to learn as much as possible about appropriate techniques of knowledge engineering.

5. EXPECTED PROGRAM BENEFITS

The goal of intelligent systems is not to replace people by machines but rather to assist humans with the more mundane aspects of information processing. By using its preprogrammed knowledge base the computer can perform repetitive functions and routine processing with less human intervention. In this way humans can have more time for creative thinking and analysis. The productivity of the user can be enhanced (rather than reduced) by the computer through the development of better human/machine interfaces, more independent problem-solving on the part of the computer (such as error-correcting or trying alternative approaches), having the capability to explain its behavior to the end-user, and possessing the ability to be easily modified through explicit representation of its knowledge. Ultimately, the payoff of this technology is expected to be the ability to take better advantage of the power of the computer to produce more intelligence with our existing resources.

The primary benefit of intelligent systems to the intelligence consumer will, of course, be an improved finished intelligence product. By consolidating group expertise into one knowledge base which is available as a consultant, an applications office should be able to improve the quality and consistency of its products. Further, because such systems are designed to accommodate change, the Agency should be better able to respond quickly to changing intelligence requirements or "what if" questions from our consumers.

The ORD Intelligent Systems Program will serve the broader Intelligence Community by permitting the sharing of relevant technology and by bringing into focus explicitly the difference in assumptions and inferencing techniques employed by various agencies as such systems are built. Indeed, one significant benefit of constructing any intelligent system is the codification of knowledge in a previously uncodified field. Workers in the ORD program will remain in contact with knowledge engineers from other Community agencies (such as NSA) to share experiences, trends, and new techniques. It is quite possible that intelligent systems developed for CIA applications may have broader application throughout the Community either as a central resource information system, as a distributed copy for other similar applications, or as a general-purpose tool for the construction of other intelligent systems.

6. CONCLUSION

ORD has high expectations for the successful application of intelligent systems technology to Agency problems. However, the development of large-scale expert system applications at this point must be viewed as having some risk. The technology is still developing, and the Agency does not yet have a full understanding of the capabilities and limitations of intelligent systems. Of much lower risk is the acquisition of and experimentation with selected tools and techniques and the development of knowledge-based intelligent assistants and enhanced user interfaces to existing computer models and systems. Recognizing this risk, the ORD approach to intelligent systems will be to develop applications initially from selected well-bounded problem domains and allow those applications to evolve as our understanding of the technology grows. An early task of the program will be to develop criteria for selecting suitable applications, assessing the chances of successfully completing the system, and measuring the degree of success of the results.

Because intelligent systems technology offers a significant increase in the usability of computers, wide use of this technology in the Agency is inevitable. ORD is using these technologies in an increasing number of its projects, at least some of which will lead to operational uses. In addition, intelligent systems technology is receiving wide interest in industry, and we can expect to find aspects of this technology in an increasing portion of the devices and systems which the Agency will acquire. Finally, users of data processing services within the Agency are learning about intelligent systems capabilities, and fairly soon we can expect ADP users to start demanding these types of services and capabilities of the systems they use.