ADVANCED INFORMATION PROCESSING & ANALYSIS

by Terry S. Kees

Ms. Terry S. Kees is a senior intelligence officer in the Central Intelligence Agency (CIA) where she has served since 1968. She has been extensively involved in the design and development of information management systems that support the CIA, as well as being involved in the development and use of automated management systems that support the broader Intelligence Community. In addition to her duties as the Deputy Director of the Office of Research and Development and associated CIA activities, Ms. Kees has chaired of the Advanced Information Processing and Analysis Steering Group (AIPASG) since its being chartered in the Spring of 1991.

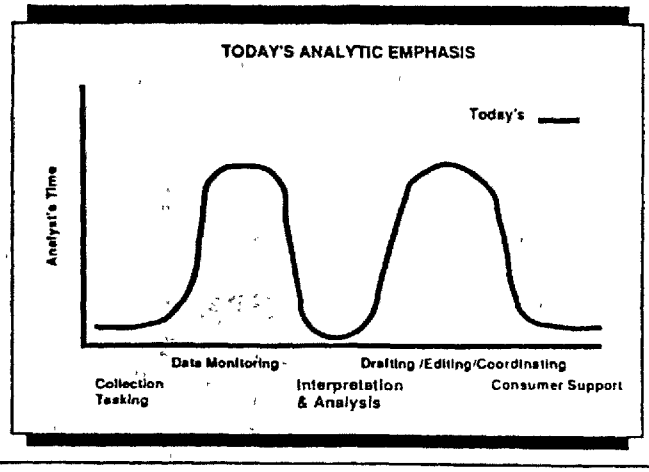
This paper is based on the presentation that the author made to the Advanced Information Processing and Analysis Symposium on 23 March 1992 at the Sheraton Reston Hotel, in Reston, Virginia. This material has been reviewed by the CIA to assist the author in eliminating classified information, if any; however, that review neither constitutes CIA authentication of material no implies CIA endorsement of the author's views.

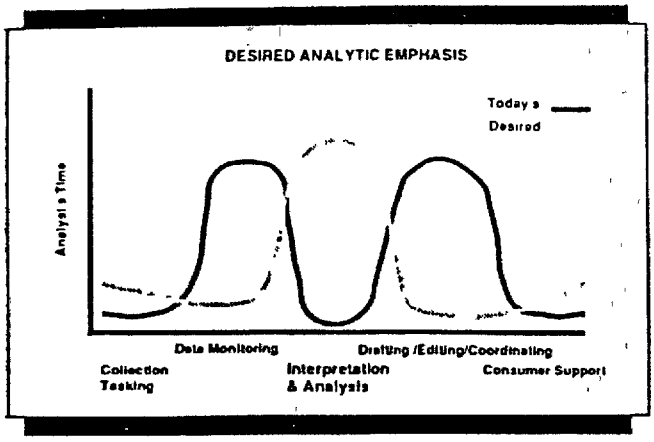
Introduction

Today's intelligence analysis environment is more complex with an ever increasing focus on technology to solve the analysts' problems and to make the information processing and analysis simpler. The scope of the intelligence requirements is broadening while funds and personnel resources are shrinking. Increasing volumes and complexity of information are becoming more common and at the same time the transfer of technology to the user environment to solve these problems has generally been ineffective and inefficient. Many proposed technology solutions are incomplete, while at the same time ongoing R&D efforts frequently focus on the same problems, repeat the same mistakes, and make inefficient use of resources.

Today's analytic emphasis is heavily oriented toward document selection, data extraction and data monitoring, as well as toward the drafting, coordinating and editing of written reports and similar intelligence products This expenditure of time is reflected below in the notional representation of analysts' time; note that there is little time available to be spent on interpretation and analysis.

The Advanced Information Processing and Analysis Steering Group (AIPASG) desires to have an impact on technology development and on the technology insertion to solve high priority information processing and analysis problems. This impact should be achieved in such a manner so that the time spent by the analyst on selecting and monitoring data as well as the time spent on coordinating and editing reports is reduced This reduction would result in a corresponding increase in the time available for use by the analyst in evaluating, interpreting and analyzing the data. This desired shift in analytic emphasis is represented in the notional figure on the next page.





The AIPASG has been established to be a Community mechanism for improving the analytic information processing and analysis environment by steering and fostering technology development in critical information processing and analysis areas. Its membership includes senior representatives of Intelligence Research and development Council (IR&DC) organizations, and other organizations as appropriate, whose interest are compatible with the mission and functions of the Steering Group. The Chairman of the AIPASG is appointed by the IR&DC. It should also be noted that this steering group has subsumed the activities of the former Artificial Intelligence Steering Group (AISG).

Background

In the Spring of 1991, the IR&DC chartered the AIPASG to provide an Intelligence Community mechanism to improve the information processing environment of the intelligence analyst. Based on an IR&DC report titled *National Foreign Intelligence R&D Program A technology Road Map*, the IR&DC's guidance to the AIPASG was that the broad critical technology areas to be addressed by the group be data base systems to include data base management and data fusion, and analytical tools to include automated data processing aids and automated data understanding.

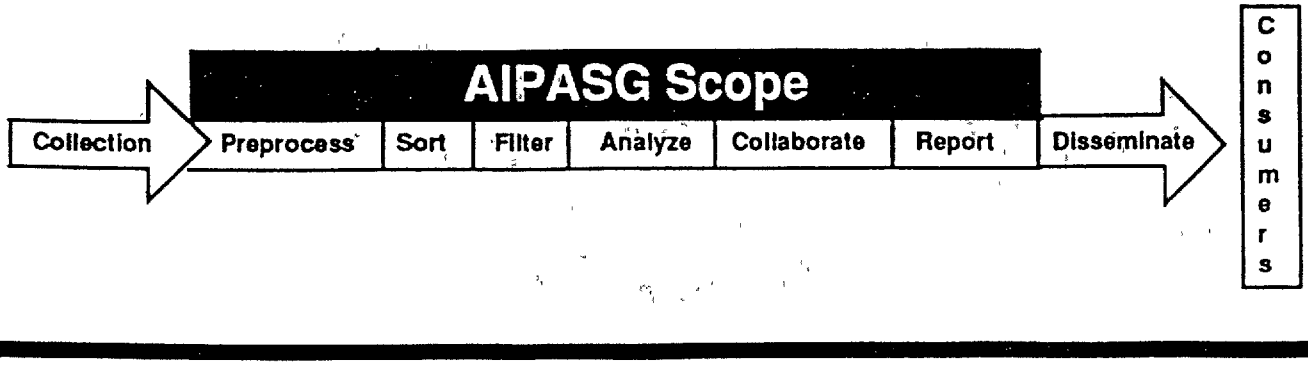
The AIPASG is to focus on these critical technology areas as they apply to the intelligence analyst's information processing environment, from the point of receipt of collected data through the analytical process to the point of having a final product ready for distribution. This range of focus in the analytic environment is represented below.

Mission

In support of the IR&DC, the AIPASG steers and fosters the advancement of technology areas to enhance the intelligence analyst's information processing environment. The steering group facilitates coordination among organizations to reduce duplication of effort, to provide synergy, and to promote resource sharing. This forum serves to energize multiple agencies, industries, universities and the national laboratories to provide innovative solutions to real Community problems. It also promotes and encourages the interchange of technical information and concepts applicable to analytical aids within the Intelligence Community while preserving the autonomy of individual agencies and other Community organizations in implementing research, development, and applications programs.

The AIPASG strives to identify and select critical application areas in the intelligence analyst's environment that could be enhanced and improved with technology advancement or insertion. The AIPASG then identifies commercial- and government-developed high value technologies, methodologies, and products that could directly improve the identified application areas. The AIPASG examines Community, industry, and university analytical tools and data base technology or development programs, as well as related planning efforts; and identifies where joint efforts could extend benefits to the entire Community. In addition, the AIPASG also strives to identify, evaluate, and encourage industry independent research and development in these technologies.

Based on the application area identification and the technology assessments, the AIPASG recommends



monitoring, resource sharing, and funding, as appropriate. As part of this process, it encourages the spin off of self-sustaining activities.

The AIPASG reviews data base systems and analytical tools and maintains a mechanism for sharing those results. The AIPASG reviews annually its mission to adapt to evolving needs and priorities as they emerge.

The AIPASG Process and Activities

In order to achieve its objectives, the AIPASG has engaged in, or sponsored, a variety of activities. It holds monthly meetings, and sponsors symposia and conferences as well as other information gathering and information sharing activities. In particular, it has sponsored an *Advanced Information and Processing Analysis Symposium*, and a *Conference on Automated Tools for Analysis*. It continues to examine ongoing government activities, and tries to understand the Intelligence analysts' problems. It also endeavors to track technology developments that support those problems. The AIPASG goal is that these activities lead to joint programs, technology insertion and technology monitoring, as well as influencing R&D in general.

Advanced Information Processing and Analysis Symposium

In March 1992, the AIPASG sponsored the Advanced Information Processing and Analysis (AIPA) Symposium to encourage the advancement of appropriate technology areas, facilitate coordination among organizations to reduce duplication of effort, provide synergy, and promote resource sharing. It also promoted the interchange of technical information and concepts applicable to analytical aids within the Intelligence Community in implementing research, development, and applications programs.

The invited attendees were members of the analytic community as well as members of the R&D community including the Private Sector, Academia, National Laboratories, and the Government.

The AIPA symposium program participants included presenters of papers, members of special interest working groups, vendor/government exhibitors, and vendor tutorials. Working groups discussed application and technology topics of special interest.

This symposium was successful in bringing together from the information processing and analysis community over 500 attendees and 66 presenters as well as 41 exhibitors.

The goals of the AIPA symposium were to focus on critical application areas in the intelligence analyst's environment that could be enhanced and improved with technology advancement or insertion; to present commercial- and government-developed technologies, methodologies, and products that could impact the improvement of the identified application areas.

The symposium provided a forum for Community members who have similar requirements to meet and provided a basis for monitoring, resource sharing and funding considerations. It focused Community interest on the specific application areas of high priority interest to the AIPASG. It also presented Community, industry, and university analytical tools; software/hardware technology or development programs; and provided a mechanism for sharing information on analytical tools and data base systems. It provided a forum for identifying proven techniques in fielding tools expeditiously and in ways that encourage tool use. It facilitated the identification of potential duplication of effort.

Conference on Automated Tools for Analysis

One AIPASG function is to encourage communication between Community organizations, with emphasis on encouraging joint projects, reducing duplication of research and expenditures, and improving technology transfer. To this end, in October 1991, the AIPASG sponsored a conference on Automated Tools for Analysis. This Conference introduced four projects focusing on applying automated tools to intelligence analysts' information processing environments. The audience participants included project managers, Contracting Officer's Technical Representatives (COTRs), analysts, managers who influence resource allocation for information processing and analysis support, and others who could profit by exposure to the applications, technologies, and approaches that the Conference presented

The four program areas presented were as follows:

- The *Automated System for Analytical Processes (ASAP)* system at the United State Army Foreign Science and Technology Center was designed to automate labor-intensive methods used to analyze open source literature and to integrate it with other types of data. ASAP allows the analysts to sort, arrange, assemble, compare, group, match, search, graph, and build matrices and clusters.

- *Joint National Intelligence Development Staff (JNIDS)* is a joint service organization hosted by the Navy as executive agent and chartered by a memorandum of agreement among the leadership of the DoD Intelligence Community. The staff was formed to apply emerging technologies rapidly to the five basic analyst functions: read/correlate data, file/retrieve data; visualize data; capture knowledge/collaborate, and disseminate/insert data.

• CATALYST: A *Concept for an Integrated Computing Environment for Analysis* is a set of tools based on custom software and commercial products allowing intelligence analysts to manipulate and integrate classified and open source data. The tools address key information management problems facing analysts today Together, the CATALYST tools rest on an infrastructure into which new tools can be added quickly. CATALYST tools are currently in use by analysts in the Office of Scientific and Weapons Research in the CIA Directorate of Intelligence

• The *Marine Corps Intelligence Center Intelligence system (MCICIS)* supports the Intelligence Center mission to provide tailored intelligence and services which facilitate contingency planning and other intelligence product requirements not satisfied by either theater, other service, or national research and analysis capabilities

The goals of the conference were to introduce AIPASG to the Community as an information resource relative to analysts application needs and applicable technologies, to understand project approach effectiveness from managers' and analysts' perspective and to introduce Community members who have similar requirements to satisfy and goals to meet. It also served to identify proven techniques in fielding tools expeditiously in ways that encourage tool use.

The October conference was successful in bringing together approximately 250 analysts and information systems project developers from 15 organizations representing the extended Intelligence Community The meeting consisted of interactive discussions highlighting current and future analyst requirements.

Challenges

The AIPASG has taken as its challenges the conclusions which were drawn from the October conference and reiterated in the symposium as well as in numerous discussions with analysts form the Intelligence Community. These conclusions are summarized as:

1. Information systems that are designed and developed to support the analytic process (defined as, post-collection and prior to intelligence dissemination) need to include the following elements·

• Analyst involvement in the design and development of information processing and analysis systems.

• Intuitive man/machine interface with the analyst/user, minimizing training requirements while increasing the time available for thinking and analysis.

• Easy access to massive amounts of data form a variety of sources

• Automation of the preparatory analysis tasks throughout the processing and analysis chain, leading to the analysts' doing their jobs differently.

• Near-term introduction of hypermedia capabilities, as well as the graphical representation of document contents and the graphical representation of document corpora

• Modeling and simulation capabilities for direct support to analyst functions, being able to fill the gaps in otherwise uncollectible information

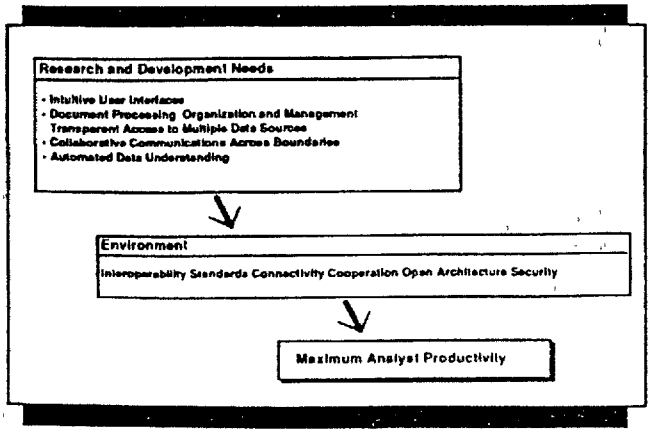
• All (or a maximum) of data in addressable electronic formats.

• Integral planning with the customer in the development cycle for turnover transition and for system operations and maintenance (O&M).

2 The above elements must be provided in a climate of interprogram/ interagency connectivity, interoperability, and standardization in order to achieve maximum analyst productivity.

3. There is also a need to "Do It"; there is the essential value of proceeding to implement the system elements in demonstrable form on some systems, as prototypes and development feedback vehicles.

The application areas as well as these challenges are represented in the figure below.



Current Emphasis

As a result of data gathering and deliberations to date, the Steering Group is focusing on five applications areas to receive priority attention in our ongoing efforts to foster and steer technology development and cooperation across the extended Intelligence Community. These application areas are:

• Intuitive User Interfaces

• Document Processing, Organization and Management

• Transparent Access to Multiple Data Sources

• Collaborative Communications Across Boundaries

• Automated Data Understanding

Intuitive User Interfaces — The goal is to provide analysts an environment which emphasizes the mechanics of using the computer and promotes analysis and thinking The PC window environment marks the beginnings of an improved user

interface, yet more attention to the user is needed by developers in the appropriate application of these current technologies. Additional needs are audio interaction, accommodation of different levels of user experience; use of models of cognitive processes; and use of graphics and colors based on research and understanding about human visual system.

Document Processing, Organization and Management — The goal is to provide analysts an environment which de-emphasizes the mechanics of using the computer and promotes analysis and thinking. The PC window environment marks the beginnings of an improved user interface, yet more attention to the user is needed by developers in the appropriate application of these current technologies. Additional needs are audio interaction; accommodation of different levels of user experience; use of models of cognitive processes; and use of graphics and colors based on research and understanding about human visual system.

Document Processing, Organization and Management — The goal is for analysts to have at their fingertips the documents relevant to analysis needs. Current capabilities include narrow focus data extraction programs that select data based on well-defined and focused subject domains (like terrorism). Ongoing research and development programs include a five-year natural language understanding program for document detection and complex data extraction; and Optical Character Recognition such as forms recognition and logo libraries. There continue to be needs for documents prioritized by relevance, a "super" index across data types (text, imagery, signals, databases), and automatic relevance refinement, intuitive definition of user interest profiles, and machine translation from foreign languages to English. There also exists the need for tools to facilitate navigation, exploration and search in conceptual hierarchy, along with system engineering to scale up from technology development efforts into large operational systems, and an open systems architecture across the Community to allow for improved and more widely spread technology insertion

Transparent Access to Multiple Data Sources — The goal is to allow analysts transparent access to all relevant data. Current activities include advanced technology development in the hypermedia field and the application of commercial tools to access multiple relational data bases without the need for the user's direct knowledge of the detailed data base structures More emphasis is needed for development of generic tools for use across and linkages among free form and structured data bases as well as aids for comprehension of large data structures; and techniques to visualize and navigate in large complex information spaces

Collaborative Communications Across Boundaries — The goal is to allow analysts easy access to individuals and to resources for collaboration. Current activities in this area include evaluation of "groupware"; the use of current hypermedia tools to support collaborative analysis; and E-mail within and across organizations. Additional needs identified include a Community implementation of standards and open systems along with the removal of organizational barriers, shared access to key data sources and advances in information security. Additionally, user involvement in defining and prototyping new tools is essential.

Automated Data Understanding — The goal is to provide the analysts with computers capable of doing automatic content analysis for purposes of filling information gaps and for doing predictive assessments The current activities include simple automated data extraction systems, application specific models and research and development in image understanding systems and in natural language understanding There exist additional needs for automated knowledge acquisition/analytic functions by developers There also exists the need for large data corpora and for standard measurements to test developmental technology; and for the ability to process imperfect data.

Future

The Steering Group, in conjunction with the Intelligence Community and R&D organizations, is continuing to identify those approaches and technologies that should be emphasized under each of the priority application areas, and to identify technology programs that could benefit form joint funding and leverage of resources We will continue to assess the priority application areas and to focus on influencing R&D in support of these applications. We will strive to facilitate technology transfer, insertion and innovation. We will continue to identify and sponsor activities related to the applications and technologies, as well as motivate communication, sharing and joint efforts We have just begun We accept the challenge to have an impact.

...We have just begun... we solicit the R&D community's help...

Also, as we proceed to examine the needs and directions for intelligence analysis support, we would like to solicit the R&D community's help. We are asking them to share with the Steering Group their insights on approaches that they may have aimed at improving analyst productivity and effectiveness, and, in particular, information on programs that, if

implemented, would provide broad benefit across the Intelligence Community. The Steering Group also is

> ***...Of extreme interest are ...innovative approaches to increase analyst effectiveness...***

continually seeking a more complete understanding of the experiences and the environment of analysts as they operate in our increasingly complex and multi-disciplinary environments. Of extreme interest are any attempts made or successes in innovative approaches to increase analyst effectiveness. In any event, the sharing with the members of the Steering Group, views on intelligence information processing and analysis in general is most welcome.

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