Feasibility Study on the Use of Groupware Support for NASA Source Evaluation Boards

FINAL REPORT

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Space Business Research Center
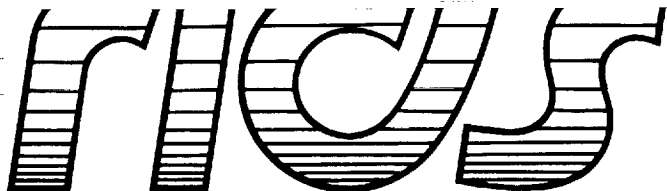University of Houston-Clear Lake

June, 1991

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USE OF GROUPWARE SUPPORT FOR NASA SOURCE
EVALUATION BOARDS Final Report   (Research
Inst. for Advanced Computer Science)   50 p              Unclas
                              CSCL 09B  G3/61    0043114
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The RICIS Concept

The University of Houston-Clear Lake established the Research Institute for Computing and Information systems in 1986 to encourage NASA Johnson Space Center and local industry to actively support research in the computing and information sciences. As part of this endeavor, UH-Clear Lake proposed a partnership with JSC to jointly define and manage an integrated program of research in advanced data processing technology needed for JSC's main missions, including administrative, engineering and science responsibilities. JSC agreed and entered into a three-year cooperative agreement with UH-Clear Lake beginning in May, 1986, to jointly plan and execute such research through RICIS. Additionally, under Cooperative Agreement NCC 9-16, computing and educational facilities are shared by the two institutions to conduct the research.

The mission of RICIS is to conduct, coordinate and disseminate research on computing and information systems among researchers, sponsors and users from UH-Clear Lake, NASA/JSC, and other research organizations. Within UH-Clear Lake, the mission is being implemented through interdisciplinary involvement of faculty and students from each of the four schools: Business, Education, Human Sciences and Humanities, and Natural and Applied Sciences.

Other research organizations are involved via the "gateway" concept. UH-Clear Lake establishes relationships with other universities and research organizations, having common research interests, to provide additional sources of expertise to conduct needed research.

A major role of RICIS is to find the best match of sponsors, researchers and research objectives to advance knowledge in the computing and information sciences. Working jointly with NASA/JSC, RICIS advises on research needs, recommends principals for conducting the research, provides technical and administrative support to coordinate the research, and integrates technical results into the cooperative goals of UH-Clear Lake and NASA/JSC.

Feasibility Study on the Use of Groupware Support for NASA Source Evaluation Boards

FINAL REPORT

Preface

This research was conducted under auspices of the Research Institute for Computing and Information Systems by Dr. Peter C. Bishop, Director of the Space Business Research Center, University of Houston-Clear Lake and Cissy Yoes, Research Associate, UHCL. Dr. Bishop also served as RICIS research coordinator.

Funding has been provided by the NASA Information Systems Directorate, NASA/JSC through Cooperative Agreement NCC 9-16 between the NASA Johnson Space Center and the University of Houston-Clear Lake. The NASA technical monitor for this activity was John Arnold, Assistant to the Director for Engineering, Information Systems Directorate, NASA/JSC.

The views and conclusions contained in this report are those of the authors and should not be interpreted as representative of the official policies, either express or implied, of NASA or the United States Government.

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Executive Summary

Groupware is a class of "computer-based systems that support groups engaged in a common task (or goal) and that provide an interface to a shared environment" (Ellis et.al., 1991). A potential application for groupware is the source evaluation board (SEB) process used in the procurement of government contracts.

This study was undertaken to 1) identify parts of the SEB process which are candidates for groupware support and 2) identify tools which could be used to support the candidate process. The study was conducted for the Information Systems Directorate (ISD) at the NASA Johnson Space Center (JSC) and, therefore, is focused on computer and information system procurement. The study was also confined to tools currently available for rapid implementation.

Two processes of the SEB were identified as good candidates for groupware support:

1. Document Generation -- a coordination and communication process required to present and document the findings of an SEB.
2. Group Decision-making -- a highly analytical and integrative decision process requiring a clear and supportable outcome.

A range of groupware is available to support the document generation process and such support could be highly beneficial in shortening the SEB process time and increasing the consistency and useability of SEB products. A tool with hypertext capabilities is recommended to support the management of the complex findings generation process.

Two categories of tools are available to support group decision making. However, group decision support applications are not currently a mature technology and may prove to be disruptive to the SEB process if implemented at this time. Decision support tools are most effective in support of a well-defined decision process. It is recommended that the SEB decision process be prototyped to assure clear and consistent decision mechanisms across all source boards, and, then, groupware tools be considered in support of the defined process.

The findings and conclusions of this study point to future research that would be beneficial in this domain.

-- Investigate the feasibility of standardized document generation throughout the NASA procurement lifecycle.
-- Determine the requirements for a decision protocol for the SEB process and prototype the process to include GDSS support.
-- Assess the roles and responsibilities of potential providers and the potential users of groupware within NASA.

Feasibility Study on
the Use of Groupware Support
for NASA Source Evaluation Boards

Introduction

The support of groups is a rapidly emerging application for computer systems. Groupware is a class of "computer-based systems that support groups engaged in a common task (or goal) and that provide an interface to a shared environment."(Ellis et.al., 1991). Given the success of computer support for individual work, such as word processing and financial analysis, most forecasters predict equal success for group-oriented software.

A potential application for groupware is the source evaluation process used in the procurement of government (and private) contracts. Source Evaluation Boards (SEB) meet at the NASA Johnson Space Center to evaluate proposals submitted in response to requests for proposals. Some SEBs are also involved in writing statements of work and selecting the criteria for evaluation of proposals in addition to evaluating the proposals submitted and deciding on a recommendation for the final award. The SEB members work closely on these tasks in a team environment-- the environment particularly suited to support by groupware.

Background

The foundations for groupware design have emerged from the field of computer-supported cooperative work (CSCW). CSCW emphasizes the use of computers to facilitate coordination, cooperation, and collaboration of a group of people working together. There are many reasons why computer support for work groups is becoming increasingly important. Today's organizations are becoming increasingly team-oriented. The use of work teams often spans functions and locations of an organization. Coordination of such activity can be time consuming and expensive. Additionally, the workplace is becoming more information-based. The importance and abundance of information has presented new difficulties in the management and analysis of information. The computer is an obvious tool to help in the coordination and analysis of information.

Objectives

1. Identify parts of the SEB process which are candidates for groupware support.

2. Identify tools which could be used to support the candidate parts.

1

Scope

The study was conducted for the Information Systems Directorate (ISD) at the NASA Johnson Space Center (JSC) and therefore is focused on computer and information system procurement. The study was also confined to tools currently available for rapid implementation.

Approach

The RICIS research team gathered information on the existing SEB process and the group tools used to support it. Documentation on ADP procurement was also secured. Nine interviews were conducted of individuals involved in recent SEBs, including representatives from the procurement and legal offices. Parts of the SEB process were identified as candidates for groupware support.

The research team surveyed for tools which are currently available for possible implementation in this procurement activity. Finally, the feasibility for quick implementation of groupware tools to support the SEB for the JSC Information Support Contract was considered.

Findings

SEB Process

The primary objective of the SEB is to apply sound and supportable judgement to the problem of source evaluation. In accordance with the guidelines set forth by the NASA Office of Procurement, the SEB is responsible for the solicitation, receipt, and evaluation of proposals. The SEB provides expert analyses of the offerors' proposals in relation to the evaluation factors, subfactors, and elements contained in the solicitation. SEB is a well defined process of highly integrated tasks, analytical work, and group decision making.

SEB Document Generation

Document generation was identified as the critical coordination process required of the SEB team. This process was also described as the most time consuming. Producing acceptable documentation is essential to the procurement process lifecycle. Presentation of findings and recommendations must fulfill the needs and requirements of the Procurement and Legal Offices, as well as inform the Source Selection Officer of the SEB recommendations.

Products from a SEB include request for proposals, evaluation plan, a report, presentation to the Source Selection Officer and a source selection statement. The report must include the findings and evaluation support of the SEB team.
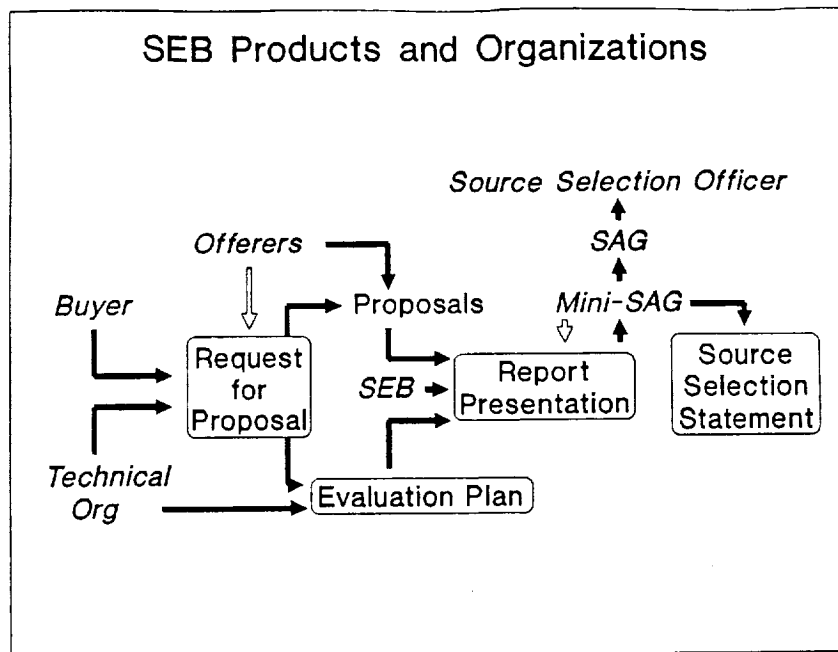
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                SEB Products and Organizations

                                         Source Selection Officer
                                                    ▲
                           Offerers  ───────┐       SAG
                                            │        ▲
           Buyer              ┌──→ Proposals    Mini-SAG ────┐
             │                │        │         ⇩    ▲      │
             │  ┌─────────┐   │   ┌───────────┐  ┌──────────┐
             └─→│ Request │   │   │  Report   │  │  Source  │
                │   for   │ SEB→  │Presentation│ │Selection │
             ┌─→│ Proposal│   └──→└───────────┘  │Statement │
             │  └─────────┘                      └──────────┘
          Technical  │
            Org  ────┘──→ ┌────────────────┐
                          │ Evaluation Plan│
                          └────────────────┘
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Figure 1

Group Decision Activity

The fundamental activity of the SEB is to evaluate proposals
against a specified set of criteria. This evaluation process
requires a group process to generate findings and supporting
evidence, and to rank the findings on a weighted scale. The
proficiency of this group process varies from SEB to SEB.

Reported Problems

Reported problems with previous SEB's included the following:

- confusion regarding what goes where in the report
- shallow evaluation
- lack of adequate documentation
- ratings not supported in narrative
- changes not explained in narrative
- large volume of rework and rewriting often required.

Past Groupware Support

Only one group support tool was identified as used in support
of SEB. This tool is called Form 1 and was prototyped several
years ago by MITRE Corporation in support of the Mission Support
SEB. Form 1 was quickly written to support this particular SEB and
has not been improved, maintained, or supported since its original
use. Form 1 can be described by the following characteristics:

- findings database with associated data attributes and
  attached notes
- dBaseIII Plus implementation with data on diskette
- template fill-in with simple word processing
- reports of findings and data attributes by attribute
- two levels of security.

Applicable Groupware Support

Groupware which might be applicable to the SEB process fell
into two categories-- 1) Document Generation Systems and 2) Group
Decision Support.

Five major categories of tools to support document generation
were identified:

- Word Processor (ex. MS WORD)
  -- easy to use, available
  -- fewer reporting and control features
- DBMS-- (ex. FORM1, dBaseIII)
  -- sort/select for reports
  -- dBase experience required
- Text Retrieval- (ex. Memory Mate)
  -- ad hoc retrieval
  -- few attribute features
- Group authorware (ex.Document Director)
  -- hypertext links
  -- no built-in version control
  -- small installed base
 - Lotus NOTES
  -- infinitely programmable
  -- expensive
  -- steep learning curve

There are two categories of tools available that offer group
decision support:

- Keypads
  -- OptionFinder (Option Tech)
- Decision Rooms
  --TeamFocus (IBM)
  --SAMM (Univ. of Minnesota)
  --VisionQuest (Collaboration Tech)

```
┌─────────────────────────────────────────────────┐
│                  OptionFinder                     │
│             Option Technologies, Inc.             │
│                                                   │
│                                                   │
│   • Hardware                                      │
│        One 10-key pad per person                  │
│        RS232 serial port                          │
│        IBM compatible PC                          │
│        Projection device                          │
│                                                   │
│   • Items                                         │
│        Paired comparison                          │
│        Likert, discrete, or nominal scale         │
│                                                   │
│   • Diplay                                        │
│        Bar chart                                  │
│        X-Y grid                                   │
│                                                   │
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Figure 2

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┌─────────────────────────────────────────────────┐
│              Group Decision Systems               │
│                                                   │
│                                                   │
│   TeamFocus        SAMM            VisionQuest     │
│                                                   │
│   PS/2 Model 80    Unix server     386 server     │
│                                    4 MB RAM        │
│                                    32 MB disk      │
│   PS/2 Model 25    Terminals       PC stations     │
│   PS/2 VGA         B/W             EGA/VGA          │
│                                    Novell          │
│                                                   │
│   Decision room    Decision room   Room or office  │
│                                                   │
│   Facilitator required  No facilitator req  No facilitator req │
│                                                   │
│   Data import                      No data import  │
│                                                   │
└─────────────────────────────────────────────────┘
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Figure 3

Discussion

The objective for an SEB is to produce a clear choice, with strong support, which has no contests to the decisions. Weaknesses of the current SEB process is that it is a long, time consuming task with a large amount of time spent on document generation and management.

Essential to the successful implementation of a document generation tool to support the SEB process is the organization of the overall SEB process to produce the final product and its elements. Advantages to this approach are

* shorten SEB process time
  - by reducing the amount of time rekeying information
  - increased efficiency in handling version control, and

* increased consistency and useability of SEB outputs
  - standardization of document formats
  - structured communication between decision elements.

Document generation by focusing on the final product can be describes as a four step process.

1. Write the final document.
2. Identify
   - constant existing material
   - branch points for contingent material

3. Design a process to
   - make a decision for each branch point
   - develop a new material for each open slot.
4. Conduct the process and branch/insert the output into the document.

The benefits of process definition through document generation include the following:

- pre-formed documents and transfers
- clear products and processes
- more time on task, less on process
- shorter cycle time between events
- less time on rework
- better traceability and documentation

6

The requirements for a document generation tool to support the SEB process would begin with

- Easy to use word processing features (import from different systems)
- create and store text items of any length
- append fixed attributes to text items
- sort/select items according to attributes
- print summary of selected items with or without text
- implement configuration control and security procedures
- print or export to final document format

Analysis of information is the essential task of an SEB. The SEB must make many decisions based on the SEB members evaluation of the information presented in the proposals. These decisions must be well substantiated and documented.

Groupware is available to support this type of analytical decision process. Benefits to the use of Group Decision Support Software (GDSS) include the following:

* reduction in social barriers of communication
  - more participation by all participants
  - more focus on task-oriented communication, and,

* increased satisfaction with decision
  - more depth of analysis
  - traceability of decision criteria.

The requirements for group decision support tools to support the SEB process would begin with

- import and display material
- brainstorm
- categorization
- support various decision types
- easy to learn, easy to use
- run on baseline hardware configuration.

There is a low installed base of such GDSS applications and their utility and usability is uncertain at this time. There is a steep learning curve to effectively use GDSS and implementation of a GDSS application to support the SEB process at this time could prove to be disruptive.

Conclusions

Two processes of the SEB were identified as good candidates for groupware support:

1. Document Generation-- a coordination and communication process required to present and document the findings of an SEB.

2. Group Decision-making-- a highly analytical and integrative decision process requiring a clear and supportable outcome.

Future Research

This study was a cursory evaluation of the feasibility of using groupware to support the SEB process. The findings and conclusions of this study point to future research that would be beneficial in this domain.

-- Investigate the feasibility of standardized document generation throughout the NASA procurement lifecycle.

-- Determine the requirements for a decision protocol for the SEB process and prototype the process to include GDSS support.

-- Assess the roles and responsibilities of potential providers and the potential users of groupware within NASA.

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Appendix

Groupware Tools
for
Source Evaluation Boards (SEB)

Dr. Peter C. Bishop
RICIS Information Systems Research
University of Houston–Clear Lake

Information Systems Directorate
April 24, 1991

Presentation Outline

1. Problems of Group Work

2. Types of Groupware

3. The SEB Process

4. The External Communication Process

5. The Internal Decision Process

6. Process Improvement

7. Next Steps

Reported Problems with Previous SEB's

- What goes where

- Shallow evaluation

- Lack of adequate documentation

  - Ratings not supported in narrative
  - Changes not explained in narrative

- Rework and rewrite

Group Work

Domain:

People manipulating Ideas within a Process

Problems:

Too Much

Too Little

Trades

	Too Little	Too Much
People	Domination by a few	Wrangling, thrashing
Ideas	Pre-mature closure (Satisficing)	Overload (Details, lists)
Process	Jumping right in	Never getting started

A Humane Balance

The Potential of Technology

Groupware

"*...computer-based systems that support groups engaged in a common task (or goal) and that provide an interface to a shared environment.*"*

- <u>Communication</u>
  - Electronic mail
  - Electronic bulletin boards

- <u>Coordination</u>
  - Meeting schedulers
  - Action item systems

- <u>Collaboration</u>
  - Group authoring
  - Meeting support

* Ellis et. al., 1991

Source Evaluation Boards
(SEB)

Objective

- Clear choice
- Strong support
- No contests

Products --

- Request for Proposals (RFP)
- Evaluation Plan
- Report and Presentation
- Source Selection Statement

Phases --

- Pre-solicitation
- Source selection
- Post-selection

SEB Products and Organizations

Source Selection Officer

Source Selection Statement

SAG

Mini-SAG

Report Presentation

Proposals

Offerers

SEB

Request for Proposal
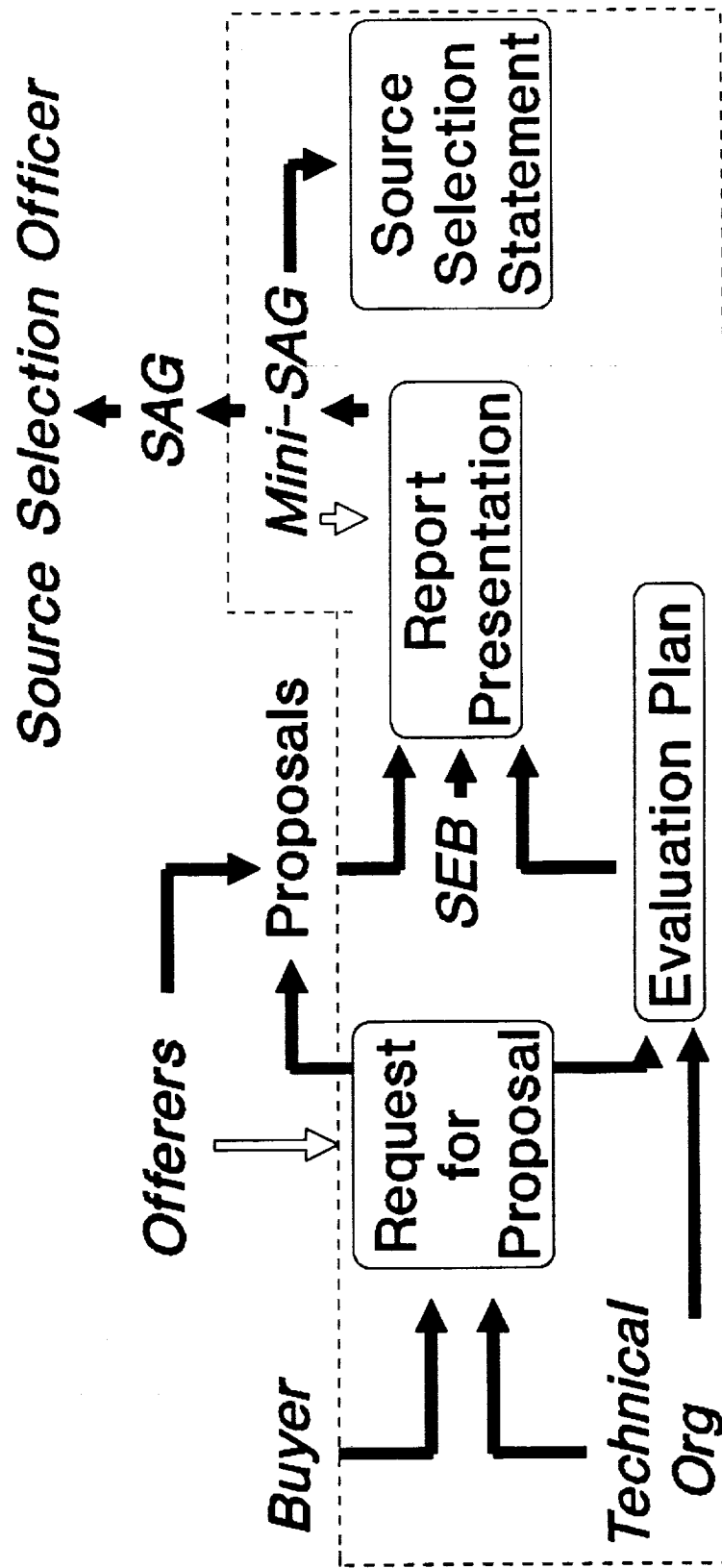
Evaluation Plan

Buyer

Technical Org
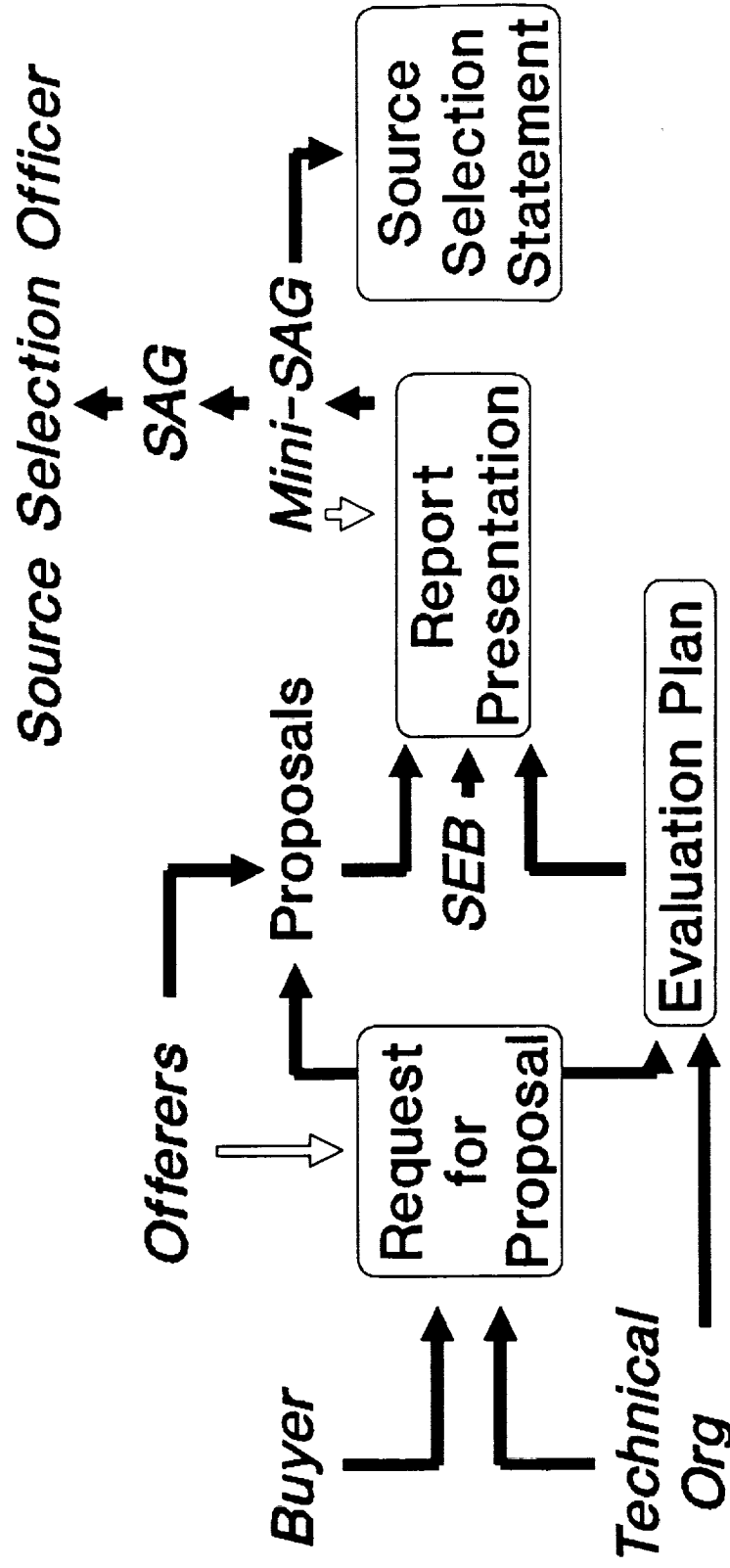
SEB Groupware Study

Propose a set of groupware tools and procedures to support the Source Evaluation Board for the competition of the Information Support Contract (ISC) to be awarded in December 1992.

- The parts of the SEB <u>process</u> which are candidates for groupware support

- The <u>tools</u> which could be used to support those parts

- Any procedures which will increase the effectivenes and efficiency of the process and the tools

SEB Products and Organizations

Study Domain

Source Selection Officer

Buyer

Offerers

Technical Org

Request for Proposal

Proposals

Evaluation Plan

Report Presentation

SEB

SAG

Mini-SAG

Source Selection Statement

Candidate Processes for Groupware Support

● *Intergroup communication*

  – structured messages
  – stable interfaces

● *Intragroup decisions*

  – decision processes
  – private specifications

Intergroup Communication
## *"Templates and Boilerplates"*

> Document
> Generation

1. Write the final document

2. Identify
   - constant existing material
   - branch points for contingent material
   - open slots for new material

3. Design a process to
   - make a decision for each branch point
   - develop new material for each open slot

4. Conduct the process and branch/insert the output into the document

Intergroup Communication
"Structured Messages"

Communication Primitive

Waste basket

Reject

Receiver

Return

Submit

Sender

Accept

Data base
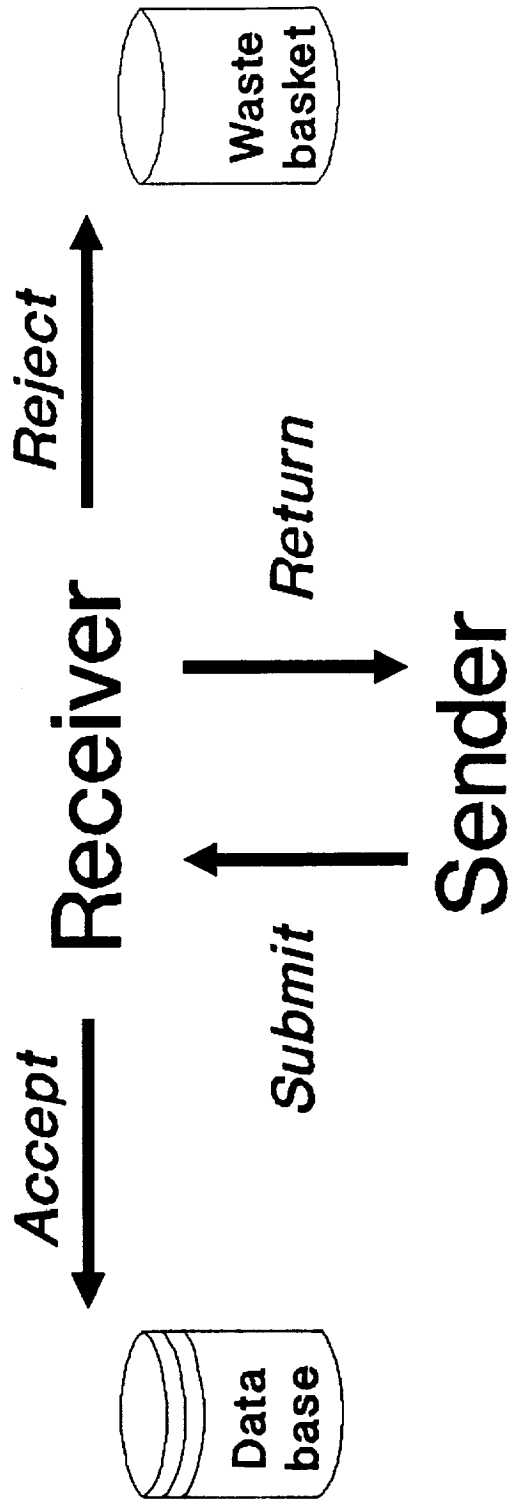
Requirements for
Document Generation Tools

✓ Easy to use word processing features (import from different systems)

✓ Create and store text items of any length

✓ Append fixed attributes to text items

✓ Sort/Select items according to attributes

✓ Print summary of selected items with or without text

✓ Implement configuration control and security procedures

✓ Print or export to final document format

Tool Categories for Document Generation Systems

- *Word processor* -- MS WORD
  - easy to use, available
  - fewer reporting and control features

- *DBMS* -- FORM1 (dBase III)
  - sort/select for reports
  - dBase experience required

- *Text retrieval* - Memory Mate
  - ad hoc retrieval
  - few attribute features

- *Group authorware* -- Doc Dir
  - hypertext links
  - no built-in version control
    small installed base

- *Lotus NOTES*
  - infinitely programmable
  - expensive
    steep learning curve

FORM1
MITRE Corp.

- Findings database
  With associated data attributes
  And attached notes.

- dBase III Plus implementation
  With data on diskette.

- Template fill-in
  With simple word processing.

- Reports of
  Findings and data attributes
  By attribute.

- Two levels of security

Document Director
Bruce G. Jackson & Associates

- Element list (e.g., requirements)
  With associated text, data attributes
  And links to other elements
  Organized in a document tree.

- On-line reports of
  Elements, associated text, and data attributes
  By document or attribute
  In column or text form

- Full word processing
  And printer support

- Four levels of security

- Stand-alone or network version

Benefits of Process Definition Through Document Generation

√ Pre-formed documents and transfers

√ Clear products and processes

√ More time on task; less on process

√ Shorter cycle time between events

√ Less time on rework

√ Better traceability and documentation

Intragroup Decision
"Doing it by the numbers"

1. Identify product, elements, form

2. Conduct decision process (ICODRA)

3. Resolve issues within the decision domain

4. Send product to receiver

Intragroup Decision
Products, Elements, and Forms

Product	Elements	Form
Statement of Work	"Shalls"	Organized List
Section L (Instruc)	"Shalls"	Organized List
Section M (Criteria)	Factors	Allocated List
Competitive Range	Proposals	Yes/No, Subset
SEB Recommendation	Proposals	Ranked List
Proposal Eval	Scores	Sum of scores
Evaluation Support	Strength, weakness	Organized List

Intragroup Decision Process
ICODRA

1. <u>I</u>nitialize the process

2. <u>C</u>reate the raw material

3. <u>O</u>rganize the material

4. <u>D</u>ecide the outcome

5. <u>R</u>eview the decision

6. <u>A</u>ct on the decision

Required Functions for
Group Decision Tools

Initialize   import and display material

Create   brainstorm
import items from individuals

Organize   identify similar, opposite,
and subordinate items

Decide   support various decision types
tailor decision process

Review   display results

Act   display actions, assignments,
deadlines, resources

Additional Requirements for Group Decision Tools

√ Easy to learn, easy to use

√ Able to exchange material with other group tools

√ Runs on baseline hardware configuration

√ (Runs in distributed mode?)

√ (Does not require trained facilitator?)

Tool Categories for Decision Support

Keypads

OptionFinder   Option Tech

Decision Rooms

TeamFocus   IBM

SAMM   Univ of Minnesota

VisionQuest   Collaboration Tech

OptionFinder
Option Technologies, Inc.

- *Hardware*
  One 10-key pad per person
  RS232 serial port
  IBM compatible PC
  Projection device

- *Items*
  Paired comparison
  Likert, discrete, or nominal scale

- *Diplay*
  Bar chart
  X-Y grid

TeamFocus
IBM

Initialize   File Reader

Create   Electronic Brainstorming
Topic Commenter

Organize   Idea Organizer
Issue Analyzer

Decide   Questionnaire
Voting Tool
Alternative Evaluator

Review   Stakeholder Identification
Assumption Surfacing
Policy Formation

VisionQuest
Collaboration Technologies Corp.

Initialize

Create
Brainwriting
Comment Cards

Organize
Compactor
Subgroup Selection

Decide
Voting
Rating
Ranking
Allocation

Review

Group Decision Systems

TeamFocus

PS/2 Model 80

PS/2 Model 25
PS/2 VGA

Decision room

Facilitator required

Data import

SAMM

Unix server

Terminals
B/W

Decision room

No facilitator req

VisionQuest

386 server
4 MB RAM
32 MB disk
PC stations
EGA/VGA
Novell

Room or office

No facilitator req

No data import

Benefits of Decision Support

√ More alternative solutions
Deeper analysis of problem and solution

√ More focus on decision
More focus on task-oriented communication

√ Higher quality decision

√ More effort
More participation, less domination
More consensus
More confidence in decision
More satisfaction with decision and process

√ Possibly more time

Kraemer & Pinsonneault, 1989

SEB Process Improvement

1. Document process

2. Develop quality and process metrics

3. Identify problems in quality and process

4. Develop solutions for problems

5. Implement solutions in next SEB

Implementation Considerations

Risk	Mitigation
Joint ownership and responsibility	Joint process definition
Too much process	Process coordinator
Too much time	Less rework
Changing process and technology	Process > technology
Immature products	Prototype slowly

Next Steps for Groupware in the SEB

- Intergroup communication

  - Write the final documents
  - Decide on document generation tool

- Intragroup decisions

  - Prototype decision process
  - Decide on decision support tool