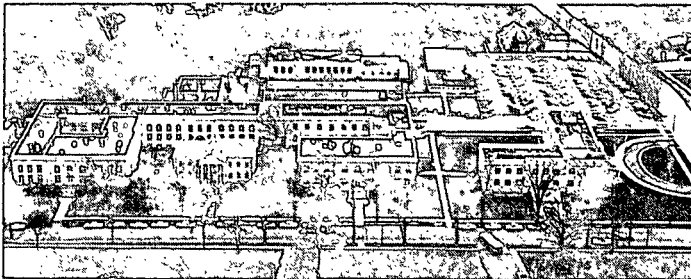


FILE OFFICE ^{C T}

Institute of Paper Science and Technology
Central Files

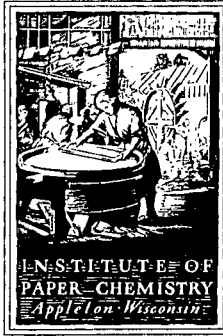


THE INSTITUTE OF PAPER CHEMISTRY, APPLETON, WISCONSIN

STATUS REPORT

To The
Project Advisory Committee
Systems Analysis

March 31-April 1, 1987
The Institute of Paper Chemistry
Continuing Education Center
Appleton, Wisconsin



THE INSTITUTE OF PAPER CHEMISTRY
Post Office Box 1039
Appleton, Wisconsin 54912
Phone: 414/734-9251
Telex: 469289

February 17, 1987

TO: Members of the Systems Analysis Project Advisory Committee

Our work over the last reporting period has been principally devoted to preparing Version 3.0 for release. We hope to release this new version sometime in early March.

The other major activity has been work on a long-range plan for the systems analysis area. The interim meeting in January was a key component in this process. The attached report summarizes that session and sets the framework for continuing that work at the upcoming meeting on March 31-April 1.


In late fall, Jim Rushton announced that he was leaving Bowater to join Applied High Technology, a potential competitor of IPC in the modeling area. Due to the potential conflict of interest, Jim resigned as chairman of the Systems Analysis PAC committee. Ed Kelleher has agreed to take over.

Ed and I have worked together to develop the agenda for the spring meeting. This agenda is different from previous meetings in that very little time will be devoted to a review of the systems work and the bulk of the time will be devoted to planning work. I am working with Ron Mann to coordinate the Users' Group meeting and to utilize them in the planning function. I believe they can contribute significantly, especially in the areas of future MAPPS development, maintenance, and support.

Also enclosed with this report is a letter from Ed Kelleher about the interim meeting and the work that needs to be accomplished at this coming meeting. Please read Ed's letter and this report and think about the remaining planning issues so that we can make this meeting as productive as we possibly can.

I hope you will be able to attend this meeting as the more input we get on the long-range plan, the better the resulting plan. The meeting will be held in the Continuing Education Center, March 31 - April 1, 1987. You should have received the registration material which was mailed by Dr. Yeske's office on January 27. You may register by either returning the form which was enclosed with that mailing or by calling Mrs. Barbara Bisby (414/738-3328) by March 10. Members of the MAPPS Users Group will also be staying at the Center, so please get your reservation request to Barbara as soon as possible.

Sincerely,


Peter E. Parker
Group Leader
Process Modeling Group
Engineering Division

PEP/sjb
Enclosure

1043 East South River Street

Technical Director
West Nyack Board
West Nyack, New York 10994
914-351-2788

Edward G. Kelleher
Director - Environmental and Analytical Technology



February 4, 1987

**Members of the IPC
Systems Analysis PAC**

Everyone who was able to attend our meeting in January to discuss longer-range issues in systems analysis know that it was an extremely productive and worthwhile session. We are grateful to Matthew Gordon Clark for guiding us through the story boarding exercise that was the foundation of the meeting. While we accomplished quite a bit, more remains to be done and we will spend most of our next meeting (March 31 and April 1) trying to finish our planning task. The final product will be a report to the Research Advisory Committee that includes our recommendations for future areas of IPC activity.

The materials sent to you after the January meeting identified seven areas of activity which the Committee deemed important to consider in developing a long range plan. An eighth area was added at the conclusion of the meeting. These areas are:

1. Mathematical Models for the P&P Industry
2. Artificial Intelligence/Expert Systems
3. Process Control
4. Future MAPPS Service and Support
5. Statistical Process Control
6. Mill Manufacturing Information Systems
7. Process Synthesis Mechanisms
8. Computer Hardware and Software Needs

We were able to consider the first three areas in some detail and the results are included in the materials distributed. Ron Montgomery and Peter Parker agreed to develop the eighth area in more detail and to distribute their thoughts before our next meeting. We need to review these four areas at our next meeting and strengthen them, and to consider, if possible, the other four areas (items 4-7).

If we are to make significant progress at our next meeting, each of us needs to do some preparatory work and to come to the meeting with our views on a number of questions related to each area. It would be even more helpful if these views could be stated in writing, even if handwritten. The questions we need to answer include the following:

- What is the purpose of IPC work in an area? What is the recommended scope of IPC work in an area?
- What are the benefits to IPC of work in an area?
- What are the benefits to industry of IPC work in an area?
- What are the expected "products" of IPC work in an area?
- What functioning capabilities does IPC need to work in an area--personnel, equipment, etc.?
- What is the PAC's recommendation regarding an area?
- What priority should be given to an area?

A general question that we all need to consider is "Have we addressed all of the important areas in systems analysis?"

I'm looking forward to our meeting and appreciate your efforts.

EGK:mp
9364R



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PRELIMINARY AGENDA

SYSTEMS ANALYSIS PROJECT ADVISORY COMMITTEE MEETING

The Institute of Paper Chemistry
Continuing Education Center
Appleton, Wisconsin

Tuesday, March 31, 1987

11:30-12:30	Lunch - CEC Dining Room	
12:30-2:00	MAPPS Status Report	Pete Parker
2:00-2:30	Planning Report to RAC Format of Report Method of Formulation Method of Review Schedule	Ed Kelleher
2:30-5:00	Review of Planning Issues Artificial Intelligence Process Control Mathematical Models IPC Hardware/Software Needs	Pete Parker
5:00-7:00	Cocktails and Dinner	
7:00-9:00	Review of Planning Issues Future MAPPS Services and Support Statistical Process Control Mill Manufacturing Information Systems Process Synthesis	PAC Committee

Wednesday, April 1, 1987

7:00-8:00	Breakfast - CEC Dining Room	
8:00-12:00	Discussion of Planning Issues and Development of Draft Report	PAC Committee

PROJECT ADVISORY COMMITTEE - SYSTEMS ANALYSIS

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* date of retirement
2/17/87

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

Status Report

to the

SYSTEMS ANALYSIS

PROJECT ADVISORY COMMITTEE

Project 3471

PROCESS MODELING AND SIMULATION

February 17, 1987

PROJECT SUMMARY FORM

DATE: February 17, 1987

PROJECT NO. 3471 - Process Modeling and Simulation

PROJECT LEADER: P. Parker

IPC GOAL:

To develop and support a marketable computer modeling capability to cover the full spectrum of mill types and problems of interest to Institute staff and member companies.

OBJECTIVE:

To develop and support the MAPPS simulation package.

CURRENT FISCAL YEAR BUDGET: \$150,000

SUMMARY OF RESULTS SINCE LAST REPORT: (September, 1986 - February, 1987)

The release of Version 3.0 was delayed. We expect to release it by early March.

The user specified digester module has been written and has been released to the users.

Three student written modules (BSWASH, OXYG02, SAVALL) have been incorporated into the supported version of MAPPS.

The bleach plant modules have been rewritten and they now function correctly in most circumstances.

STATUS

The work required to prepare Version 3.0 was much larger than originally anticipated. This new release incorporates about 15 new process modules, the bulk of the physical property package, and several new program development tools. These additions required extensive revisions to the Module Documentation Manual, a virtual rewrite of the Programmers Guide, and complete revision of the Users Guide.

Version 3.0 of μ MAPPS will not run, in its entirety on a PC, as the memory requirement is in excess of 640kB. We have modified the structure of μ MAPPS to allow the user to include only those modules necessary for a simulation, which reduces the code to a size that will fit. The price that must be paid is that building a simulation is a two-step procedure, and the user loses the ability to add new module types to the simulation. A side benefit is that the addition of user-developed modules is much easier.

In addition to preparing MAPPS 3.0 for release, our major effort has been working with the PAC in the planning process. In summary, the PAC has identified eight major areas of potential IPC Systems Group work and is preparing a report defining those areas, the resources required, the benefits and costs of each area, and an associated priority for each area.

PLANNING ACTIVITIES

During the fall PAC meeting, it was suggested that the PAC develop a much longer range plan for the Systems Analysis Group than had been done in the past. This proposal was enthusiastically received, but it was quickly recognized that the time available for the regular PAC meeting would be insufficient

for the required work. Therefore, an interim PAC meeting was scheduled for late January, the sole purpose of which would be to initiate the planning process.

Quoting Matthew Gordon-Clark, the purpose of the meeting was:

"...to start the development of a long-range plan in the systems area for The Institute of Paper Chemistry which:

is consistent with the Institute's goals

generates support from the pulp and paper industry

so that

the Institute continues to be a leader in the systems area applied to the pulp and paper industry

quality students are attracted to the Institute

the needs (present and future) of the industry are met."

Matthew Gordon-Clark suggested that the "storyboard" technique be used and volunteered to lead the session. Appendix I contains the minutes of the meeting and Appendices II and III contain copies of all the material generated during the meeting. The remainder of this report is an attempt to flesh out the material in these latter two appendices and to use that material to explain further planning needs.

STORYBOARDING

Storyboarding is one of the many techniques to generate ideas about a variety of topics. In essence, it is a type of structured free-association. In the MAPPS planning session, we developed seven major topics for systems analysis work that needed further consideration. These topics were:

- Mathematical Models for the Pulp and Paper Industry
- Statistical Process/Quality Control
- Artificial Intelligence/Expert Systems
- Process Control
- Dynamic Simulation
- Mill Manufacturing Information Systems

Process Synthesis Mechanisms
MAPPS Expansion to All Mill Sites
Future Maintenance of MAPPS
Simulation Services

The above "header" items were considered in turn and short (single word or short phrase) expressions of a concept were generated for each. These concepts were listed below each idea for later expansion, refinement, consolidation, or possible deletion. These short expressions are listed in Appendix II on the sheet with the header item. When the idea generation reached an apparent point of minimal marginal return, the process was stopped and a broader view of the header topics was considered. Essentially, the question was asked - Do some of these topics logically consolidate into a single topic? It was apparent that this was true and the following seven headers were the result of the consolidation process:

1. Mathematical Models for the Pulp and Paper Industry
2. Artificial Intelligence/Expert Systems
3. Process Control (includes Dynamic Modeling)
4. Future MAPPS Services and Support (including expansion to all mill sites, maintenance, and simulation services)
5. Statistical Process/Quality Control
6. Mill Manufacturing Information Systems
7. Process Synthesis and Software Needs

Three of these topics were chosen for more in-depth discussion, the end result of which was to be an outline of a long-range plan that was to include:

The purpose of the work in the area

The benefits to the industry and to the Institute

The products or result of the work

The resources necessary for the work

People
Equipment
Money

Recommendations and/or future work definition

Small groups developed the outlines in each of three areas, drawing on the short concept statements put forth during the idea generation session. The three areas selected for further refinement were:

Mathematical Models for the Pulp and Paper Industry

Artificial Intelligence/Expert Systems

Process Control

The outlines developed by the three groups are given in Appendix III. The total group then reviewed each of the three outlines and made minor additions and clarifications.

FUTURE PLANNING WORK

During the group review of the three major topics, it became apparent that one important topic had been omitted from the "headers". In the systems area, it will be critical that the group and the Institute have the right mix of computer hardware and software and that this appropriate mix can only be obtained with proper planning. Thus an eighth topic, Computer Hardware and Software Needs, was added to the list of areas for planning consideration.

Three of the eight areas have been considered in some depth. The remaining five must be considered. Ron Montgomery (Union Camp) and Pete Parker (IPC) will put together a planning outline for the Computer Hardware and Software Needs area and will have this outline distributed to the PAC committee prior to the meeting in March. The remaining four topics must be considered at

the meeting, as well as reviewing the previous ones. Appendix IV contains an outline form developed by Ed Kelleher (Champion) that can be used to summarize thoughts on the major planning areas. It would be very beneficial to the planning process if each PAC member reviewed these remaining topics and summarized his thoughts using this form. The more topics that each of us can do, the better will be the resulting plan.

The result of this planning work should be a report from the Systems Analysis PAC to the Research Advisory Committee that contains the following:

Major Work Areas

Rationale for each Work Area

Resources Required and Expected Benefits

Priority for each Work Area

I doubt that we will be able to develop a draft of this report at this meeting, although that is a very desirable goal. At a minimum, however, I hope that we will have discussed each of the major possible work areas and have developed planning outlines for each. With this information, I believe the planning report to RAC can be put together in a reasonably short time and submitted to RAC by early summer.

The MAPPS Group will use the information from these outlines (or the draft report if it is available) to schedule near-term work. In particular, work in any new area must be blended with our work in optimization, performance attribute modeling, and the development of a user-friendly interface.

APPENDIX I

MINUTES OF INTERIM PAC MEETING

January 22-23, 1987

MINUTES OF THE
IPC MAPPS PROJECT ADVISORY COMMITTEE
HELD ON JANUARY 22-23, 1987
AT APPLETON, WISCONSIN

The following PAC members were present:

Dr. Matthew R. Gordon Clark	- Scott Paper Company
Dr. Edward G. Kelleher	- Champion International Corporation
Dr. Ronald Mann	- James River Corporation
Mr. Ronald Montgomery	- Union Camp Corporation
Dr. John Perry	- Kimberly-Clark Corporation
Mr. Charles G. Rapp	- Hammermill Paper Company
Dr. Venki Venkatesh	- The Mead Corporation

The following PAC members were absent:

Mr. James L. Bonner	- MacMillan Bloedel Inc.
Mr. W. Guyton Wilkinson	- Stone Container Corporation

The following members of the Institute were present:

Gary Jones	*Mary Berceau
Peter Parker	*Richard Matula
Wendell Smith	*Mike Schreiter
Clyde Sprague	*Ron Yeske

*Part-time

The purpose of this special PAC meeting was to work on a long-range plan for IPC in the systems area. Prior to starting this work, Clyde Sprague welcomed everyone and reported that because of changes in employment, Dr. James Rushton and Mr. John Dekker had resigned from the committee, and that Dr. Edward Kelleher had agreed to be the committee chairman.

Matthew Gordon-Clark had agreed to lead a process for developing a long-range plan based on storyboarding (a structured form of creative thinking), which he outlined as consisting of four stages:

- 1) The development of a set of major areas (headers) which the group wished to consider.
- 2) The creation of any ideas under each header without any criticism.
- 3) The choice of a set of headers the group is interested in working on. Breaking into small groups to reduce the information generated into the outlines of plan including purpose, benefits (IPC and industry), products, resources required, and any additional comments.

- 4) Review of these plans by the whole group and the determination of future work and/or recommendations.

The procedure was followed. The information generated is attached to these minutes.

It was agreed that three small groups was a reasonable break-up given the number of people present. The three topics chosen and the people who worked on them were:

<u>Artificial Intelligence:</u>	Rapp (leader) Perry, Jones, Gordon-Clark
<u>Mathematical Modelling:</u>	Kelleher (leader) Mann, Parker
<u>Process Control:</u>	Venkatesh (leader) Sprague, Montgomery

On Friday, January 23rd the results were reviewed and an animated discussion ensued. The highlights can be summarized as follows:

Artificial Intelligence

- Is there an appropriate piece of research that IPC can do on A/I?
- A/I is a high risk/high reward area.
- Considerable variance in the PAC members opinions on A/I.

Process Control

- What can IPC offer that is different?
- Equipment cost.
- Needs of small companies against large companies.
- Is large computer required?

General

- Belief in computers as the best way to cause technology transfer.

It was agreed that all PAC members would review the results for further consideration at a later meeting. The MAPPS support area would be put in the same format by the Institute staff for review later.

APPENDIX II

PLANNING CONCEPTS FROM STORYBOARD SESSION

PURPOSE OF MEETING

To start the development of a long-range plan in the systems area for The Institute of Paper Chemistry

which

- is consistent with the Institute's goals
- generates support from the pulp/paper industry

so that

- the Institute continues to be a leader in the systems area applied to pulp and paper
- quality students are attracted to the Institute
- the needs (present and future) of the industry are met

PROCESS FOR THIS MEETING

Jan. 22

1:00-1:45

- Introductions and discussion of the purpose and process for the meeting

1:45-3:30

- Use storyboard technique to generate ideas on a variety of topics in the systems area
- Choose three areas which are of most interest to the group

3:45-5:30

7:00-9:00

- Break into three groups to refine ideas generated into outline of long-range plan

Jan. 23

8:30-12:00

- Report on plans to full group
- Discussion of three plans
- Recommendations and/or follow-up work

PRODUCTS OF THE MEETING

Outline of a long-range plan in three areas

Outline to include

- purpose of work
- benefits to Institute and industry
- products
- functioning capability required
 - people
 - equipment
 - cost

Recommendations and/or future work defined

MATHEMATICAL MODELS FOR PULP/PAPER INDUSTRY

Vendors know nothing
Mobilize IPC how?
Vendors know how
Mobilize whole Institute
Mobilize whole industry
Industry contributions

Performance attributes
Dynamic models
Stochastic
Form of end package?
Paper machine
Graphics
Physical properties
Coating

Endless
Discrete vs. continuous
Unit operations or whole units
How much detail?
First principle models
New versions of existing models
Why do it?
How different from MAPPS
Information transfer
If not IPC, then who?

Acceptance of models
Identifies the knowledge holes
Much needed
Data reconciliation
Quantifies the knowledge base
Integral to all IPC research
Sorely needed
Good student work
Proprietary problems

Is this a long-range issue?
Databases
Effects on staff (not nos.)
Need for generalized modules
Model validation
Esoteric/obscure

STATISTICAL PROCESS/QUALITY CONTROLS

What is it?
Data swamp
Benefits
Computer resources?
Unique to paper industry?
Role in curriculum
Is it part of adaptive control?

Fadish
Conflicting/complementary
Need statistics know-how
Boring to students
Customer feedback
Industry expectations of students
Scheduling and production control

IPC offering
Customer expectations
Disguise lack of knowledge
Uninteresting or interesting
Applications
Service or research

What does IPC offer?
Any more than control charts
Information systems
What folks in mill
Contrary to IPC mission
Encouragement from senior management

Data analysis
Need statistical models?
Need for quality data
No better than measure
Contrary to IPC mission
Interesting research?

ARTIFICIAL INTELLIGENCE/EXPERT SYSTEMS

Languages
Information transfer
Fadish/substance
Qualative/hueristic
Fuzzy data
Standards?
Rapidly changing
Model development tool
Easier simulation maintenance

Infancy
Conflicting or complementary
Decision making
Benefits?
Is it hard to learn?
Applications
General useability
Is model development a better tool?
Friendly interface

Monster computer
Information
Is it new?
Students are attuned to it
Statistical process control?
Elephant gun to kill a gnat
Front end load
Is it another name for mill information system?
Customer expectation (too high, too low)

Knowledge base
Knowledge engineer
Necessary?
Benefits
End product
Integration with MAPPS

PROCESS CONTROL

At mercy of vendors
Reliance on vendors
Vendor dependency
Uninteresting research topic
Useful research?
High user interest
Can of worms
What is unique to industry
Where's it going?
What's new?

Should IPC role be limited to integrating
MAPPS to control
Students need to know
Academic training
What does IPC have to offer?
IPC issue or systems issue
Revenue
Resources
Need for IPC in process control
End package
Simulation - control interface
Appropriate group

Critical control areas?
Is process control stabilized?
Emerging technology
Sensors
Lack of sensors
Sensor development
Is sensor development appropriate?
Data manipulation
Patents
Advocacy for generic understanding

Connection between simulation and process control
Applications of theory
Process models
Can we use a steady-state simulator?
Role of PATs in control
Generic control systems
Control strategy?
Strategy
Algorithms
Competative software issues

Secondary and supervisory control
Distributed control
Networking
Mill-wide data management systems
Control vs. regulation
Adaptive control
Adequate hardware
Hardware volatility
Upgrade existing IPC equipment
Hardware
Mill-wide control software

DYNAMIC SIMULATION

Benefits?

Are processes dynamic?
Use SS to get dynamics
Large time constants
Regulation or control
Insufficient knowledge
Computing power
Insufficient knowledge base
Maintenance problem
Requires good displays

Not useful
Unnecessary
Application areas
Uses
Process disturbance
Process understanding
Just in time

Inventory control
Good for operators
Good for managers
Training
Flexibility in operation
For process control
Startup and shutdown
Mills will have more managed changes
Process upsets

MILL MANUFACTURING INFORMATION SYSTEMS

Is it a separate issue?

People problem

Research or teaching tool

IPC resources?

Proprietary issues

Ties it all together

Emerging high interest area

Why IPC

What does it offer the pulp and paper industry?

Types of databases

Not appropriate for IPC

What is it?

Resources

Database management

Patent issues

Not appropriate for IPC

Is it O.R.

MAPPS and databases

Networking

Precursor for AI?

Computer science problem

Applications

Is it research or teaching area

What is the product?

Useful to students

PROCESS SYNTHESIS MECHANISMS

What is it?
Would it be used?
Other industries use it
Different for other industries?
Design tool
Role of consulting engineering
Patents
Does the industry do design?
Applications

Would it be used?
Advanced A/I
End product?
What is different from others
High risk
Technology generation
IPC resources?
Cogeneration

Applications
Unique product
First principles
Just an application of a known tool
Money saver
marketing tool?
Academic role
Area for quick result

Lack of knowledge base
Infant technology
Interesting research topic
Variation on optimization
Will industry accept it?
Way for consulting company to support IPC
Is it part of computer aided manufacture?
Slow results

Confidentiality
Uniques answer?
Is there a difference?
What's in it for pulp and paper industry?
Will industry understand it?
Service?
Process alternative
Logical evolution from MAPPS

FUTURE MAINTENANCE OF MAPPS

Revenue
Team viability
Uninteresting to students and facility
Mandatory
Buy vs. develop?
Is this a long-range thing?

Revision (E.C.O.)
Wrong computer
Consulting services
Student modules
User maintained models?
AI implications

Transportability
Spin off
Internal coordination
User friendly
Users pay?

Contract in?
Where does it end
System maintenance
Model maintenance
What do other people do?

Enlarging scope
User's group
Cost
How are you doing now?!
What does customer expect

SIMULATION SERVICES

What is it?

Cost

Is this long range?

Is IPC a business?

Necessary evil

Demand?

Will it go if not proprietary?

Public domain vs. proprietary

Self-supporting

Critical to small companies

Professional?

How does it fit?

Appropriate for IPC mission

Junior staff

Marketing tool

Can it be proprietary and fulfill mission?

Source of income

Spin off

Relation to other headers?

Where does it fit into teaching and research?

Issue in team viability

Integrate with other services

Teaching aid

Model validation

Conflict of staff goals

Revenue

Long-range issue?

Contract out

Scope of services?

Student job

More sophistication in IPC than user

Source of good mill information for IPC

How structured

Relationship

Learning experience

Contract in?

Staff needs

MAPPS viability

Important for IPC staff

Mill experience for staff

Conversion from other simulations

SIDE ISSUES

Education

IPC

External

1. Math modeling - CV, RPG, EYM, MAT
2. MAPPS future (2, 3, 4) - JYE, MAT
3. Statistical process control - CHS
4. AI - J, CH, G, P, C, RM, MAT
5. Process control (7, c, e) - P, C, V, CH, R, YM
6. Mill MIS
7. Synthesis - EVG

"MAPPS" EXPANSION TO ALL MILL SITE ISSUES
(WOODS, CONVERTING, POWER, MAINTENANCE)

What is it?
Tool - marketing, teaching
What's missing?
Boring?!
Customized/proprietary modules
Long-range issues?

Why?
Application vs. research
Different from math models
Essential
Knowledge transfer

Marketing tool
Maintenance issue
Bleaching sequences
Is this long-term research?
Integrate other packages

Teaching tool
MAPPS pretty complete
Converting/woods
Do it yourself
Generic software

Breadth vs. depth
What areas are missing?
Customer needs
Should user do it herself?
Code generation language

APPENDIX III

PLANNING OUTLINES:

Mathematical Modeling

Process Control

Artificial Intelligence/Expert Systems

MATHEMATICAL MODEL DEVELOPMENT

Purpose: The purpose of mathematical model development is to use fundamentals to explain process behavior through models for information transfer.

The scope of this effort covers development of MAPPS modules for unit processes not modeled heretofore, new and improved versions of existing modules based on an improved knowledge base, many other types of models, and user tools in support of these models.

Benefits: To IPC:

- service to members
- strengthening of both research and academic programs
- continuing source of good research topics
- integration and cross-fertilization of ideas within IPC
- identification of research needs
- marketing strength for MAPPS and related products
- income from products
- potentially an opportunity for employment for students and others, depending on method of implementation

To industry:

- providing a foundation for expanded future applications of modeling
- a better simulation tool
- improved process simulations resulting in more in-depth process knowledge and higher process efficiency
- better process designs and capital investments
- better understanding of processes
- better identification of knowledge gaps to help guide internal, industry-wide, government-sponsored and IPC efforts
- improved profitability and quality control

Negative benefits (detriments) to IPC and industry:

- some of the tasks involved would not be stimulating to IPC's professional staff
- higher funding requests
- the common perception of modeling/models as being abstract and esoteric makes it harder to convince management of its benefits and to gain acceptance of it as a valuable resource worthy of continued support
- not a "high visibility" effort
- benefits may not be realizable immediately
- decreased freedom of choice for IPC staff if development of a "model" becomes a goal integral to most or all research efforts

Products:

- a more widely applicable MAPPS simulation package
- stand-alone models of many types
- better trained technical manpower
- better educational and training tools are possible
- a better MAPPS simulation package
- better support items such as physical property packages and PATs
- a better-focused IPC R&D program

Requirements:

- an IPC goal to reduce most or all R&D efforts to a form suitable for modeling to facilitate information transfer
- computer science and mathematics support staff
- internal and external education of personnel on modeling and its application
- an industry statement encouraging IPC to reduce R&D information to useable form as a mathematical model
- industry's critical review of models
- access to industrial data
- in-mill training for IPC Systems personnel
- reasonably up-to-date hardware and software tools
- appropriate assistance in development of training tools

ARTIFICIAL INTELLIGENCE/EXPERT SYSTEMS OUTLINE

PURPOSE

1. To make IPC a significant force in the application of A/I technology to the pulp and paper process.
2. To make more effective use of the pulp and paper knowledge and modeling systems.

BENEFITS TO PULP AND PAPER INDUSTRY

1. Additional method of pulp and paper technology transfer.
2. Source of people (employees) comfortable with A/I technology and knowledgeable in pulp and paper industry.
3. Existence of a source of service on A/I applications.
4. Transfer of A/I and knowledge engineering to pulp and paper industry.

BENEFITS TO IPC

1. Integration of new technology into IPC environment.
2. a. Provides a new mechanism for technology transfer.
b. Provides a methodology of systemizing or structuring results of research.
3. Attract quality students and faculty to IPC.
4. Ability to provide a service to the industry and specifically to small companies.

PRODUCTS

1. Generic knowledge base of pulp and paper processes including process economics.
2. "Mechanisms" to allow the use of knowledge in an A/I environment. Could include:
 - a. Procedures to use existing software.
 - b. Specialized software developed for pulp and paper industry.
 - c. Recommendations for configuration systems.
3. Possibility of significant enhancements to MAPPS package for decision making.
4. Students comfortable with A/I systems and knowledgeable in the pulp and paper industry.
5. Expertise in application of A/I techniques to the pulp and paper industry.
6. Seminars, continuing education in A/I, knowledge transfer technology.

RESOURCES/REQUIREMENTS

1. Two people in area one of whom will be a knowledge engineer.
2. Computer facilities
 - a. Research/systems (not shared for other applications) mini - cost > \$100K
 - b. Student - AT's with software \$10K each
3. Training (education) of IPC personnel in A/I technology, seminars, consultants.
4. Library resources - journals, timesharing, books, publications.

RECOMMENDATIONS

1. On no account develop inference engines, hardware, or fundamental software.
2. Must commit stated resources for an extended time or not at all.
3. Development of a joint application with a member company at a single site within four years would be the most expeditious means of demonstrating the utility to the industry.
4. If IPC does not commit itself to A/I technology, it runs the risk of significantly reduced effectiveness in the systems area.
5. The technology appears to be a high risk but also a high reward area.

PROCESS CONTROL OUTLINE

Purpose: Elevate performance of existing and new process control evaluating/optimizing process control system alternatives.

Develop a center of excellence in process control for the pulp and paper industry.

Products:

Academic 1. Quality manpower

Research 2. • Sensors

- Software
 - Dynamic simulation
 - Supervisory control
 - Data analysis
 - Models
 - Control theory

• Process control models

• Control strategies

Service 3. • Consulting

• Software package

• Custom analysis/design

Benefits: To IPC:

1. Complementary to MAPPs and other research areas.
2. Center of excellence that fits each of three missions.
3. Pathway to other major universities.
4. Potential revenue source.
5. Complements academic program.
6. Unique center - no serious competitors.

To industry:

1. Fills a need - industry has no other center producing quality manpower or expertise.
2. Quality manpower specific to industry and problem area.
3. Improved mill operations
 - Product uniformity and quality
 - Higher equipment efficiency capacity
 - Improved utilization of control and other capital
4. Permits alternatives to commercial packaged systems - internal design - external design to specs
 - Adaptability to process or product changes

RESOURCES

People: Leader }
Team } 5+ FTE - Primary group
Students }
Electronics and microprocessor support

Hardware: Mainframe computer
Control lab

- representative of real control systems
- microprocessors

APPENDIX IV

PLAN OUTLINE FORM

IPC Systems Analysis PAC

Respondent: _____

Area: _____

What is the purpose of IPC work in this area?

What is the recommended scope of IPC work in this area?

What are the expected "products" of IPC work in this area?

What are the benefits to IPC of work in this area?

What are the benefits to the P&P industry of IPC work in this area?

What functioning capabilities does IPC need to work in this area (personnel, equipment, etc)?

What should be the PAC's recommendation regarding IPC work in this area?

What priority should be given to work in this area on a scale of 1-10 (1=low;10=high)?