IPRO 303

Information Design for Plant Management to Predict Equipment Failure

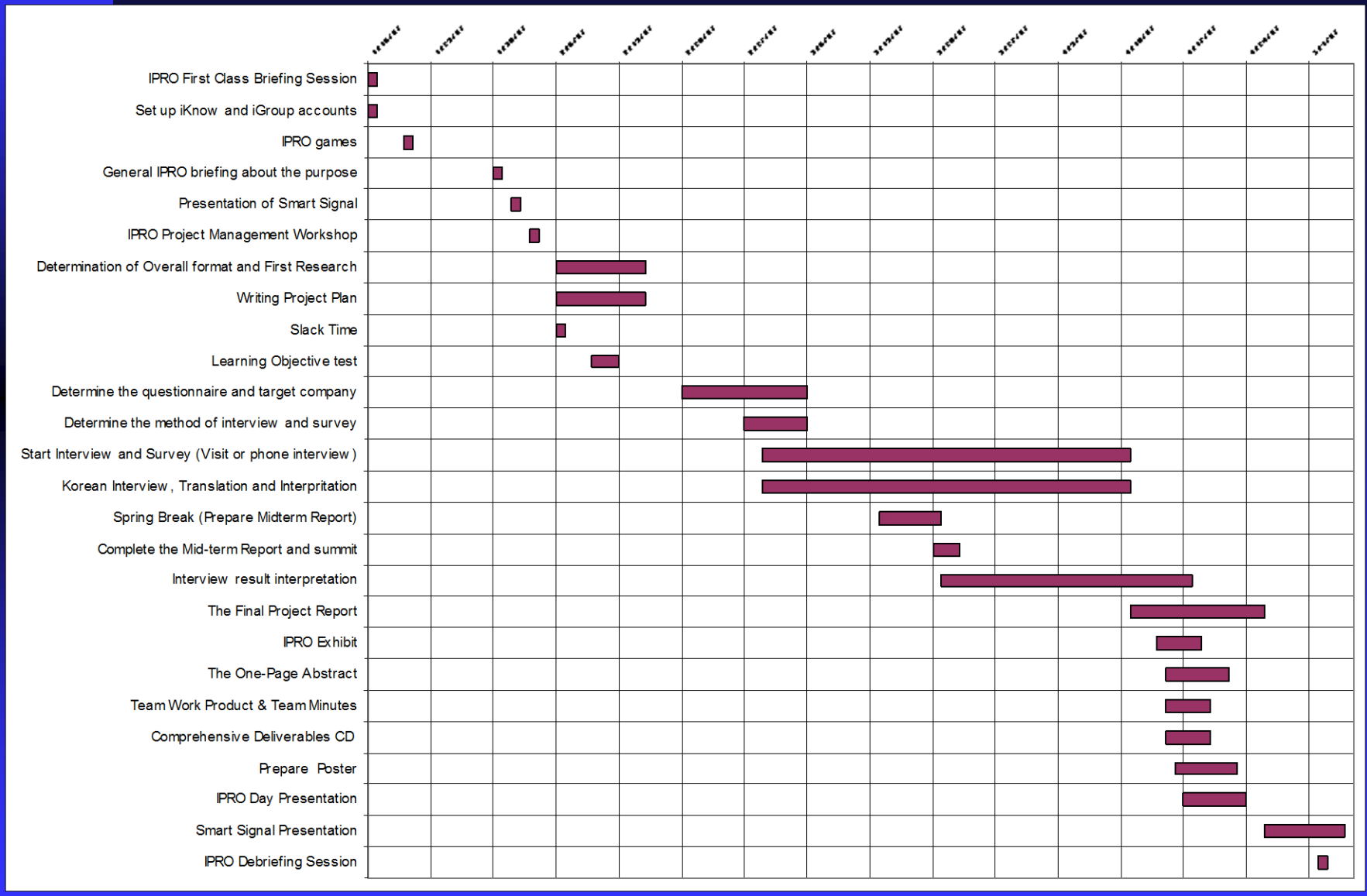
Our Sponsor: SmartSignal

- SmartSignal – Software company which provides early warning of equipment failure in power, oil and gas industries
- Unexpected equipment failures affect profits and may also impact environment and safety

- Problem
  - Delivered warnings of equipment failure are only useful for select experts.

- Objectives
  - Define what decisions must be made during a planned outage
  - Research who is making the decisions and what information they use
  - Make recommendations that will make SmartSignal their product more useful to plant personnel

Project Plan



Project Plan Overview

- Debriefing with SmartSignal
- Finding contacts
- Writing an interview scrips
- The interviewing process
- Data analysis
- Results and conclusions

Teams

- IPRO 303 team leader - Jamie
- Contact team – John, Mohhammed
- Interview team
  - US – Michael, Kevin T., Kevin H., Sarunas
  - Korea – Taeho, Migun, Chihwan
- Analysis team – Amanda, Mohhammed, Kevin T., Kevin H., Taeho, Migun, Chihwan, Jamie
- Deliverables and Monitoring – Jamie, Michael, Amanda, Sarunas

Contacts

- IIT Faculty with connections to power plant industry
- Personal Contacts
- Department of Energy

Faculty with connections to power plant industry

- Professor Mohammad Shahidehpour
- Professor Ali Emadi
- Professor Alexander J. Flueck
- Professor Gerald Saletta
- Professor Joe Pinnello
- Professor Javad Abbasian
- Professor Jamal Yagoobi
- Professor Herek Clack

Hurdles for contact team

- Power Plants with in and out of state.
- Excessive mails and calls.
- Networking.
- Scheduling interviews.
- Forwarding questionnaire and code of confidentiality.

Develop Interview Questions

- Develop a list of questions for interview
- Obtain guidelines for interviewing from Business and Psychology department
- Get feedback from Smart Signal
- Revise & complete interview questionnaire and translated for foreign interview

Interview Methodology

- Correct Interview Format
- Clear Question Phrasing
- Active Listening
- Confidentiality

Sample Interview Questions

- How are you involved in selecting equipment to be maintained during planned outage?
- What information do you use to make the selection?
- How do you get this information?
- What other factors do you take into consideration?

Interviews

- A total of 20 interviews from various power plants

Positions Interviewed

- Plant Managers
- Maintenance Managers
- Operations Managers
- Engineering Managers
- Process Specialists
- Shift Supervisors
- Planners
- Others

Interview Methods

- Power Plant visits
- Teleconference
- E-mail

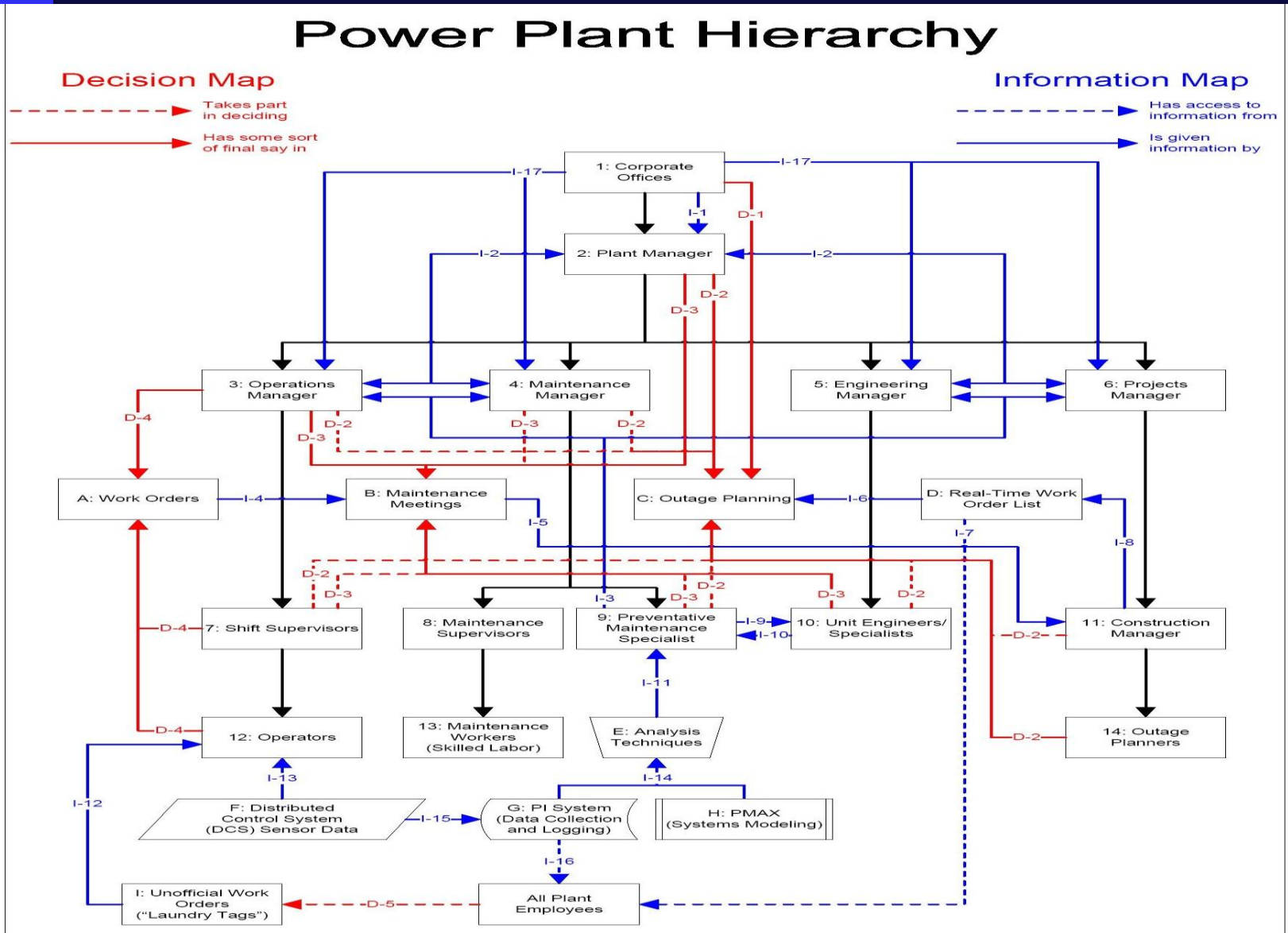
Ethical Problems Encountered

- Anonymity of our sponsor
- Privacy of interviewed power plant personnel

Analysis

- Table of answers
- Table of statistics
- Identify decision making groups
- Map information flow
- Map decision making flow

Results


Power Plant Hierarchy
Decision Map
Takes part in deciding
Has some sort of final say in
Information Map
Has access to information from
Is given information by
1: Corporate Offices
2: Plant Manager
3: Operations Manager
4: Maintenance Manager
5: Engineering Manager
6: Projects Manager
A: Work Orders
B: Maintenance Meetings
C: Outage Planning
D: Real-Time Work Order List
7: Shift Supervisors
8: Maintenance Supervisors
9: Preventative Maintenance Specialist
10: Unit Engineers/ Specialists
11: Construction Manager
12: Operators
13: Maintenance Workers (Skilled Labor)
E: Analysis Techniques
14: Outage Planners
F: Distributed Control System (DCS) Sensor Data
G: PI System (Data Collection and Logging)
H: PMAX (Systems Modeling)
I: Unofficial Work Orders ("Laundry Tags")
All Plant Employees
I-1
I-2
I-3
I-4
I-5
I-6
I-7
I-8
I-9
I-10
I-11
I-12
I-13
I-14
I-15
I-16
I-17
D-1
D-2
D-3
D-4
D-5

Result Interpretation

- Power plant personnel who will most likely benefit from SmartSignal
  - Operations Manager
  - Maintenance Manager

Conclusion

- Hierarchy of:
  - Power plant groups
  - Information (data) flow
  - Decision making flow
- Identified groups who would benefit the most from SmartSignal solutions.

Progress

- Contacts
- Decision flow
- Identified groups of interest

A day in the life of planned maintenance

- A story of decision making and information flow in three acts

Act 1 – Something Breaks

- Unit Operator
- Preventive Maintenance Specialist
- Boiler Process Specialist (Our Hero)

Act 2 – The Maintenance Meeting

- Operations manager
- Turbine and Water Process Specialist
- Boiler Process Specialist (Our Hero)

Act 3 – Money Talks...

- Plant manager
- Operations manager
- Boiler Process Specialist (Our Hero)

Smart Signal – Just in time!!

Questions