IPRO 303
Fall 2008

Wind Power Generation

Cost Impact of Equipment Failures

Background

SmartSignal, *our sponsor*

SmartSignal Inc. offers software which models machine and equipment behavior, and can distinguish between normal and abnormal conditions.

This information is used by machine operators to proactively deal with potential problems before they cause faults and unplanned downtime.

smartsignal

Problem Statement

SmartSignal's Objectives:

1. Explain faults that are occurring in wind turbines and why

- Gain a general understanding of how wind turbines work
- Identify turbine components and major failures
- Determine turbine faults
- Determine most costly/most common reasons for turbine downtime

2. Provide detailed overview of current maintenance practices and procedures

- Provide listings of maintenance procedures available
- The advantages and disadvantages of current maintenance practices
- Determine who is responsible for maintenance (i.e. manufacturers or 3rd parties)

3.Technical Business Case

smartsignal

The Team Structure

Initially, to better tackle the various objectives the team subdivided into three groups.

Team 1- The Research Team:
members: Jesus Cervantes, Samad Erogbogbo, Robert Keane, Kristina Lakiotis, Mithun Michael

This sub group will be involved in researching how wind turbines work and identifying the major failures that this IPRO team will be focusing on.

Team 2- The Questionnaire team:
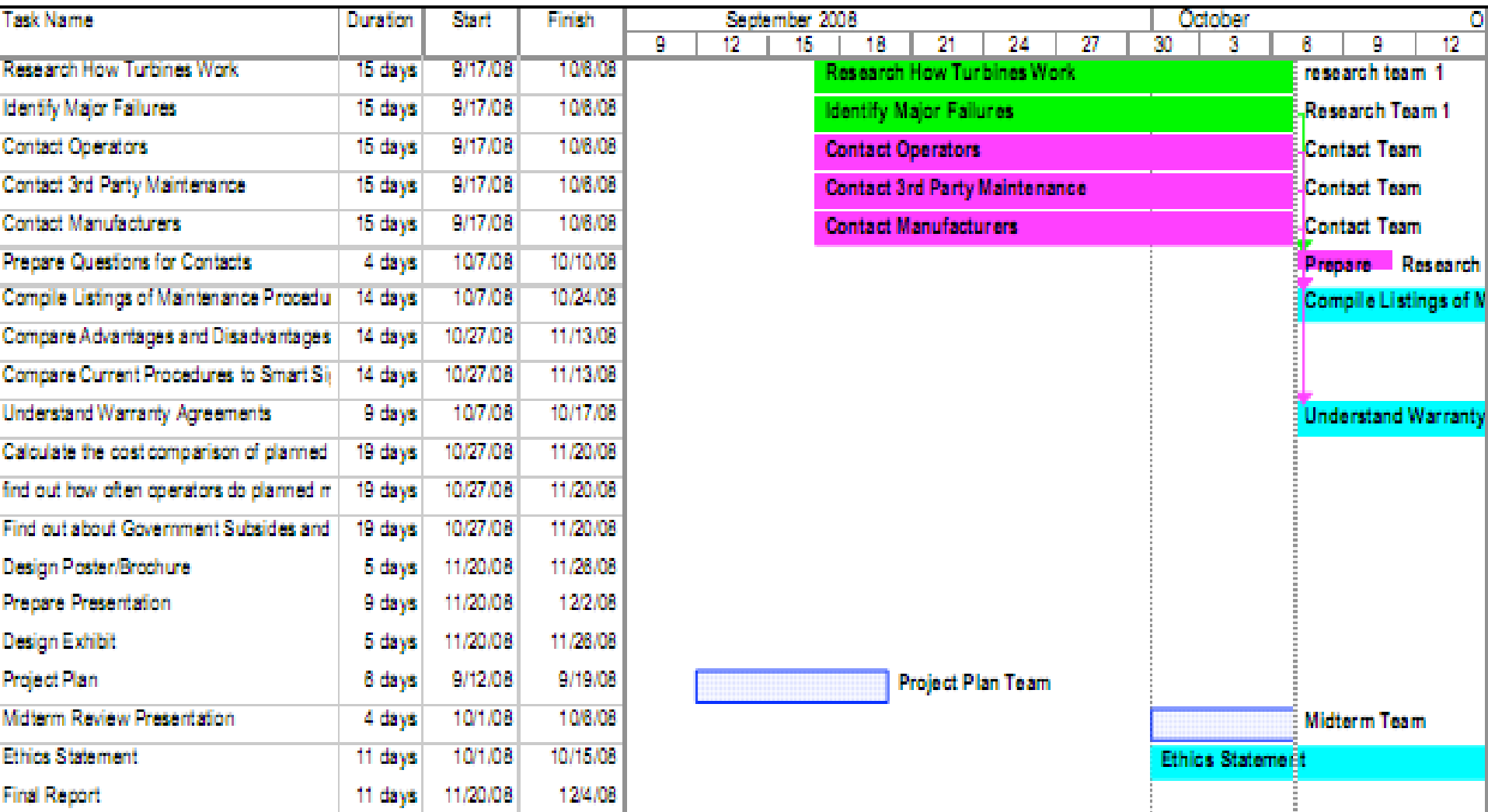members: Sara Claxton,Earl Fairall,Aaron Melko, Viral Patel, Donald Ruffatto

This sub group will be in charge of preparing questionnaires for the contact team.

Team 3- The Contact team:
members: Christopher Catalina, Olaoluwa Adeola, Richard Ike

The contact team will be responsible for contacting operators, third party maintenance, and manufacturers to schedule interviews.

smartsignal

Gannt Chart (Progress)

Task Name	Duration	Start	Finish	September 2008						October			
				9 / 12 / 15	18	21	24	27	30	3	6	9	12
Research How Turbines Work	15 days	9/17/08	10/8/08	Research How Turbines Work						research team 1			
Identify Major Failures	15 days	9/17/08	10/8/08	Identify Major Failures						Research Team 1			
Contact Operators	15 days	9/17/08	10/8/08	Contact Operators						Contact Team			
Contact 3rd Party Maintenance	15 days	9/17/08	10/8/08	Contact 3rd Party Maintenance						Contact Team			
Contact Manufacturers	15 days	9/17/08	10/8/08	Contact Manufacturers						Contact Team			
Prepare Questions for Contacts	4 days	10/7/08	10/10/08							Prepare	Research		
Compile Listings of Maintenance Procedu	14 days	10/7/08	10/24/08							Compile Listings of M			
Compare Advantages and Disadvantages	14 days	10/27/08	11/13/08										
Compare Current Procedures to Smart Si	14 days	10/27/08	11/13/08										
Understand Warranty Agreements	9 days	10/7/08	10/17/08							Understand Warranty			
Calculate the cost comparison of planned	19 days	10/27/08	11/20/08										
find out how often operators do planned m	19 days	10/27/08	11/20/08										
Find out about Government Subsides and	19 days	10/27/08	11/20/08										
Design Poster/Brochure	5 days	11/20/08	11/26/08										
Prepare Presentation	9 days	11/20/08	12/2/08										
Design Exhibit	5 days	11/20/08	11/26/08										
Project Plan	6 days	9/12/08	9/19/08	Project Plan Team									
Midterm Review Presentation	4 days	10/1/08	10/6/08							Midterm Team			
Ethics Statement	11 days	10/1/08	10/15/08							Ethics Statement			
Final Report	11 days	11/20/08	12/4/08										

Project: Ipro303
Date: 10/7/08

Task		Milestone	◆	External Tasks		
Split	....	Summary		External Milestone	◆	
Progress		Project Summary		Deadline	⬇	

smartsignal

Research Team

Tasks:

- Gather general information about wind turbine systems
- Research faults specific to turbine components. List the most commonly occurring and the costliest.
- Find information regarding currently installed models of wind turbines and associated operational problems
- Research wind turbine monitoring systems, fault prevention and maintenance practices

Progress:

- Team has successfully gathered information detailing turbine system components and its operation.
- Started documenting our findings into reports.

Research Team

Challenges and major obstacles:

- There is so much information on wind turbines available, it was difficult at first to know where to start.
- An open ended research is challenging given the time constraints.

Overcoming these problems:

- Prioritize what information is needed and most critical.
- Narrow down research topics and clearly define the scope.
- Divide the research work amongst team members

Future work to be done:

- Conduct more specific research.
- Complete and then compile the research work into an easy to read format that can be utilized for the rest of the project.

smartsignal

Questionnaire Team

Tasks:

- Compile a list of general questions to be used during the initial phase of conducting verbal/telephone interviews.

- Prepare a comprehensive questionnaire (paper based) that will help gather statistical data and specific technical information about wind turbine technology and maintenance practices.

Progress:

- Incorporated research team findings, compiled a list of general questions.

smartsignal

Questionnaire Team

Challenges and major obstacles:
- Extracting statistical data from electronic reports
- Phrasing questions appropriately.

Overcoming these problems:
- Decrypted the electronic documents and extracted the data.
- Scheduled a meeting with IIT's psychology department to prepare for working successfully with outside contacts.

Future work to be done:
- Examine the data gathered from reports and compile to a spread sheet.
- Use the above to design illustrative charts/diagrams which will be useful for our sponsor
- Collaborate with research team to prepare the questionnaire.

smartsignal

Contact Team

Tasks:

- Contact turbine manufacturers and wind energy companies to understand fault occurrences and current maintenance practices.

Progress:

- Succeeded in gathering contact information and complied a detailed list of contacts for :

    Turbine manufacturers
    Companies with wind farms
    Universities with wind energy projects.

- In the process of contacting the above by phone/email.

Contact Team

Challenges and major obstacles:

- Contact information leads to corporate offices rather than wind industry personnel or specialists.
- Manufacturers are unwilling to divulge (sensitive) information.
- Contacts are reluctant to participate in live interviews.
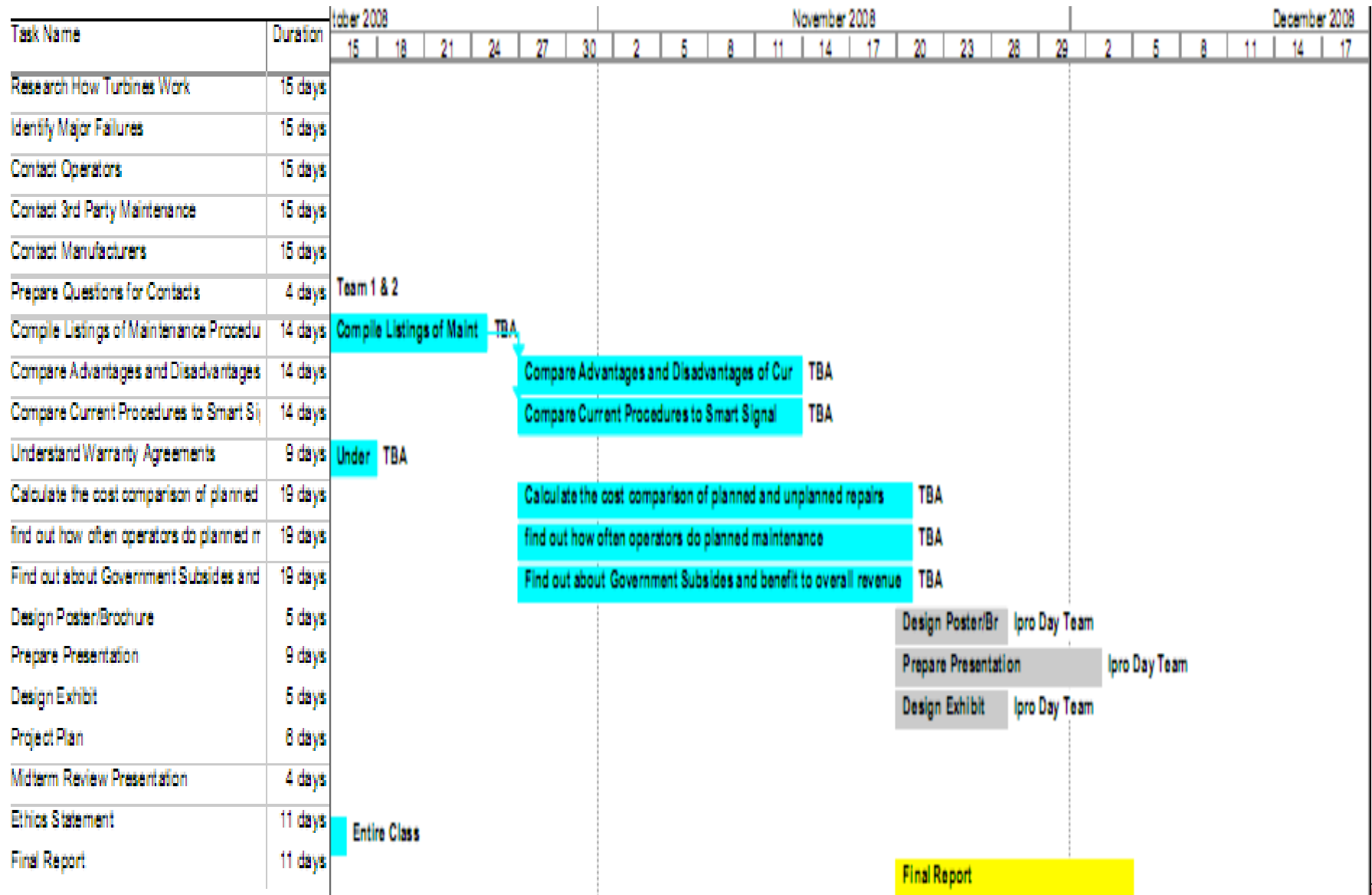
Overcoming these problems:

- Use the help of the psychology department to better our interviewing skills
- Rephrase questions in a manner that is both persuasive and also puts the interviewee at ease.

Future work to be done:

- Establish industry contacts. Find companies willing to do initial phone interviews.
- Follow up with a detailed questionnaire.

smartsignal

Gannt Chart (Future Tasks)

Task Name	Duration
Research How Turbines Work	15 days
Identify Major Failures	15 days
Contact Operators	15 days
Contact 3rd Party Maintenance	15 days
Contact Manufacturers	15 days
Prepare Questions for Contacts	4 days
Compile Listings of Maintenance Procedu	14 days
Compare Advantages and Disadvantages	14 days
Compare Current Procedures to Smart Si	14 days
Understand Warranty Agreements	9 days
Calculate the cost comparison of planned	19 days
find out how often operators do planned m	19 days
Find out about Government Subsides and	19 days
Design Poster/Brochure	5 days
Prepare Presentation	9 days
Design Exhibit	5 days
Project Plan	8 days
Midterm Review Presentation	4 days
Ethics Statement	11 days
Final Report	11 days

October 2008 — November 2008 — December 2008

Timeline markers: 15, 18, 21, 24, 27, 30, 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 2, 5, 8, 11, 14, 17

Team 1 & 2

Compile Listings of Maint — TBA

Compare Advantages and Disadvantages of Cur — TBA

Compare Current Procedures to Smart Signal — TBA

Under — TBA

Calculate the cost comparison of planned and unplanned repairs — TBA

find out how often operators do planned maintenance — TBA

Find out about Government Subsides and benefit to overall revenue — TBA

Design Poster/Br — Ipro Day Team

Prepare Presentation — Ipro Day Team

Design Exhibit — Ipro Day Team

Entire Class

Final Report

Some future IPRO team tasks

- **Schedule a meeting with our sponsor, *SmartSignal***
    - Present progress report, and discuss future plan of action.
    - Mid course correction if necessary.
- **Generate new teams to carry out the new tasks.**
- **Team visit to a wind farm.**

Ethics

The IPRO team is to consider these issues.

1. Honoring the confidentiality agreement with our sponsor, SmartSignal, when dealing with our contacts.

2. Actions to be taken should unequal contributions amongst team members occur.

3. Address how communication among IPRO team members may be impacted by our cultural diversity

How to work with these issues:

1. Break up into groups, and discuss these issues from different perspectives.

2. Fix a date for ethics discussion, and each group shares their ideas and conclusions.

smartsignal

Conclusion

Thank you for listening!

QUESTIONS?

Cover page: http://www.ecofuss.com/wp-content/uploads/2008/04/offshore-wind-turbines.jpg
Animation: http://www.originenergy.com.au/2039/files/renew_wind.gif

smartsignal