Organizational Risk Model

ECS Human and Organizational Risk Modeling

HORM Report[1]

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1. Progress Report

This report presents the progress on the NASA Organizational Risk Model (ORM), for HORM Milestone #1, KESS #2 and ECS #3 under the Engineering for Complex Systems Program (ECS).

1.1. Data Collection

Observations of Team X at JPL were made on two occasions: February 11-12, 2003 and April 22-25, 2003. The February observation was the CMU team only and met the objective of introduction to the Team X process. The April data collection effort was coordinated with Stanford University and the University of Illinois, Urbana-Champaign. All modeling was completed using the data collected from the April collaborative effort. The model data collection focused on the Team X CSSR mission design.

In addition to observation, interviews were conducted on April 23 and 25, 2003 with three team leaders, a system engineer and a risk measurement and modeling analyst.

A follow-up survey was completed in June for the Team X CSSR mission design. The survey included questions from all three university modeling teams, see Appendix A. Previous efforts to gain completion of the survey in April and May were unsuccessful. This accounts for the time lag between the sessions and the survey results.

1.2. Computational Models and Tools

In order to meet the objectives of the Organizational Risk Model, the ORA tool was developed and the Construct model was extended. The ORA tool produces a static snapshot of the organization whereas the Construct model produces dynamic organizational analysis. ORA and Construct are designed so they can be docked. ORA input can be used to parameterize Construct and Construct output can be input into ORA. In this way, a full complement of social network measures can be obtained for temporal analysis.

1.2.a. ORA

ORA is the organizational risk analyzer. Its purpose is to assess the level of possible organizational risk and the factors that contribute to this risk. All measures are based on the meta-matrix and take in to account the relations among personnel, knowledge, resources and tasks. These measures are based on work in social networks, operations research, organization theory, knowledge management, and task management. For a full description of the ORA measures see Appendix B.

1.2.b. Construct

Construct is a multi-agent model for the co-evolution of agents and socio-cultural environments. Based on observation of the Team X process and the technological and human networks involved, the following changes in Construct were made:

- **publish/subscribe system**
- **large screen broadcast tech.**
- **past missions database**
- **sidebars**

In addition, the following changes are scheduled for phase II implementation:

- **interdependencies**
  - **human network**
  - **technology network**
- **pooled, sequential, reciprocal tasks**
- **multi-tasking**
- **error cascades**

The previous changes were implemented in phase I as these technologies and group interaction method are key to the team's strategic management of the interdependencies and tasks as well as being channels for error propagation. The phase I changes needed to be implemented first. For more description about the current changes see Appendix E.

2. Modeling CSSR Team X

Data for CSSR Team X was collected as described in the data collection section above. The following is a high level description of CSSR Team X based on this data collection.

CSSR Team

Team X, located at JPL, is a concurrent engineering design team specializing in unmanned space missions. The CSSR Team X was composed of 20 team members plus the proposal manager and a second facilitator who filled in for the lead facilitator's absence in session 3. Of the 20 team members, two were staffing the mission design position. The two mission design personnel were aggregated in to one position node and no distinction is made as to the two separate personnel. The aggregation brings the number of positions to 19 and data was collected from these 19 positions plus the program manager and the second facilitator

Functional Roles

Each member on the team is a functional expert and represents a unique functional area. The separation of the design team into functional areas forces knowledge distribution into specialized channels. Each functional expert is responsible for designing their particular subsystem of the spacecraft. The two exceptions to this responsibility are the systems engineer and the facilitator. The systems engineer is responsible for maintaining the central database for the group. The facilitator is responsible for overseeing the activities of the group and for assuring that design goals are accomplished.

Design process
The design process requires individually designed subsystems to be successfully integrated into one system. Team X accomplishes this by concurrently designing subsystems and iteratively integrating the system to meet scientific and fiduciary objectives. The concurrent integration task requires pooled, sequential and reciprocal activities. The concurrent engineering design is supported by concurrency and integration as well as a strong, well-established culture. Concurrency is supported by warroom co-location of the design sessions and multifunctional team composition. Integration is supported by co-location, computer systems and analytic methods.

Interdependencies
High interdependencies exist between subsystems and are characteristic of the complexities of space missions. Changes in one subsystem cascade throughout the system and cause changes in other subsystems. Team members develop mental maps of the interdependencies. These mental maps help guide the members through the design process. The existence of high interdependencies requires frequent two-way communication with more complex interactions needing face-to-face discussion. Knowledge management and communication are key factors to the successful completion of a design with high subsystem interdependencies.

Warroom –integrated human and technological networks
The warroom is an open space room fitted with telecommunication technology to support the mission design process. Co-location affords frequent face-to-face communications and reduces response latency to very short time periods among the multifunctional experts. For example, as complex exceptions occur, small sub-groups called sidebars will form to handle the problem and manage the interdependencies. The computer systems help to manage the design process and communication. Computer systems are in two basic classes - engineering tools and information technologies. The engineering tools are specifically designed for each subsystem and used individually by each expert. The information technologies are used in three ways. The first use is to transfer information seamlessly between the individual engineering tools by way of a central database. This helps to manage the interdependencies and to alleviate human communication transfer of non-complex information. This allows for the human interactions to focus on complex problems. The second use is to broadcast information visually to facilitate group discussion. This is done via three large screen at the front of the warroom. Each screen displays different information. The last use is to guide the design process. The facilitator uses output from the central database to organize the design process and evaluate the state of the spacecraft design. The human and technological networks are integrated in the warroom environment. The interoperability of the human and technological networks is used to manage and coordinate the design process and subsystem interdependencies.

Facilitator
The facilitator is a key position as this position requires system-wide expertise. System-wide expertise is required to not only manage the interdependencies but to converge the specialized knowledge of the group to achieve an integrated design. The facilitator controls the flow of the design session and displays high situational awareness. This

position is also responsible for assuring a common operational picture among the team members.

Design Accuracy
The accuracy of the mission design is mainly undeterminable. There is not an adequate testing environment on earth and space mission completion is temporally lengthy.

Additional information
Mark, G. (December, 2001). Extreme Collaboration. *Communications of the ACM.*

2.1. CSSR Team X MetaMatrix

Based on the data collection, a metamatrix framework for Team X was completed for use in computational analysis. The metamatrix framework is shown in Figure 1 and followed by a description of each matrix. Two distinct metamatrices were made because data was collected on two separate facilitators. The distinctions for these metamatrices are other team member's perception of each facilitator and the perceptions each facilitator has of the other team members and the engineering process. Each metamatrix represents the team when led by the respective facilitator. The metamatrices were input to both ORA and Construct. The metamatrix for each facilitator is in Appendix C.

Figure 1	People	**Technology**	**Knowledge**	**Tasks**
People Relation	**Social Network** *Who knows who*	**Technology Network** *Who uses which tech.*	**Knowledge Network** *Who knows what*	**Assignment Network** *Who does what*
Technology Relation		**Operability Network** *Which tech. interfaces with which tech.*	**Encoded Network** *What is in which tech.*	**Tool Network** *Which tech. helps perform which task*
Knowledge Relation			**Interdependency Network** *What informs what*	**Needs Network** *What is needed to perform which task*
Task Relation				**Precedence Network** *Which tasks must be done before which tasks*

Note: The project manager is considered exogenous to this network as this position provides occasional consultation on an as needed basis, is not directly related to interdependencies between the positions, and does not directly contribute to the knowledge network. Therefore, the total number of positions in the analysis is 19.

Social Network – There are 19 positions in this Team X design session. The positions and seating layout are shown in Figure 2. This figure includes the project manager position that is exogenous to the analysis. The co-location of the group allows for communication to occur between any pair of positions so the social network is a fully connected graph. The number of nodes = 19 and the number of edges = 171.

Technology Network –

- Engineering tools – each position has their own engineering tool. This is represented as 17 dyads where one node is the engineer and the other node is the technology. The 17 dyads include each position except for the systems engineer, facilitator and proposal manager.
- Publish/subscribe system – this database connects to each of the engineering tools and the systems engineer is directly responsible for maintaining this system for pre-session and session work. There is a direct tie between this database and the systems engineer and the facilitator.

Note: each of these tools have the ability to be broadcast onto any of the three large screens at the front of the room so that the entire group may see the display at the same time. The publish/subscribe system is almost always displayed on the center screen throughout the entire session. The left-side screen is dominated, with a few exceptions, by the configuration graphics from that respective engineer's tool. The right-side screen is dominated, again with a few exceptions, by the trajectory visualization from that respective engineer's tool.

Note: There is a database of past missions but this database does not seem to be used during the actual sessions. It is used during the pre-session work and some values in the publish/subscribe database are set according to data obtained from this tool.

Operability Network – There are 17 engineering tools, the publish/subscribe system, database of past missions and 3 large screens for a total of 22 technologies. The engineering tools and the publish/subscribe system are in a star structure whereas the publish/subscribe database is the hub and each individual engineering tool is connected to the hub bi-directionally. Each of the engineering tools and the publish/subscribe system can send (one-way) to any of the 3 large screens. The database of past missions is stand-alone. There are 88 directional ties among the 22 nodes.

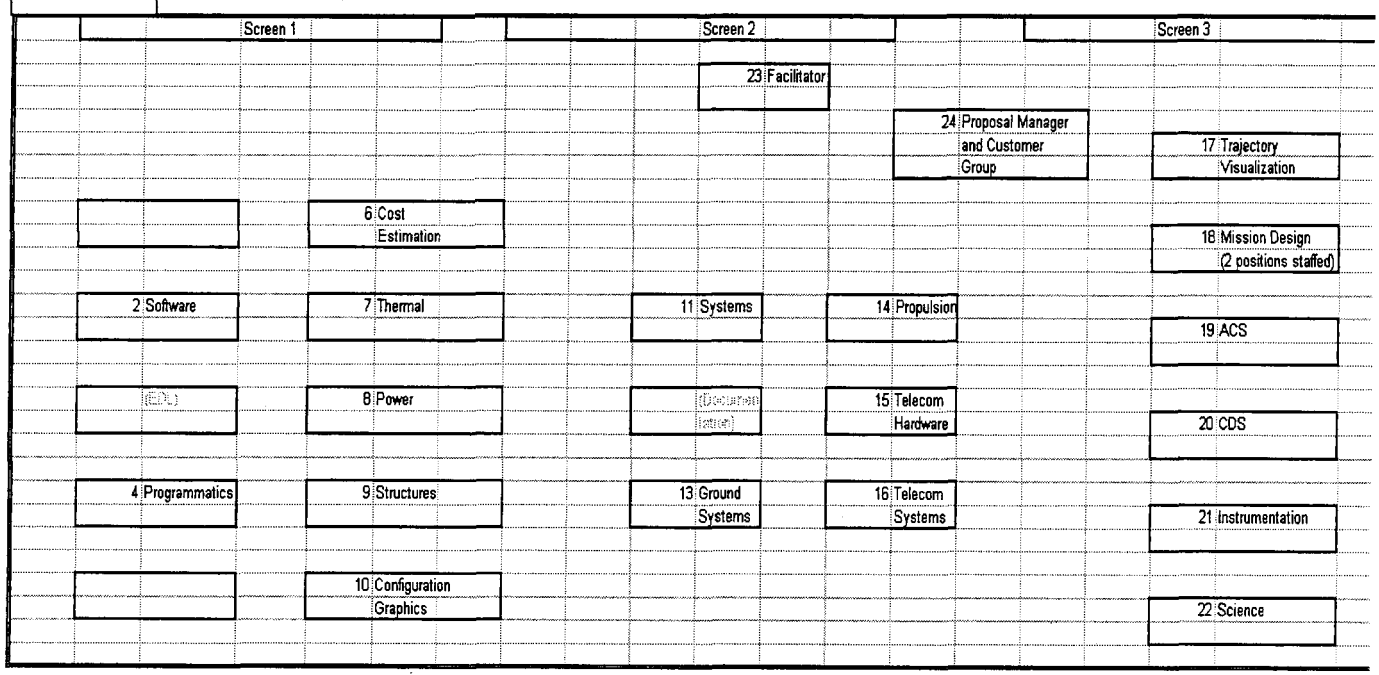
Knowledge Network – Knowledge is represented at a high level and is aggregated by position level because there is no low level detail on the knowledge breakdown within positions. The survey collects data on expertise level within 19 knowledge (position) areas where the knowledge about Proposal Mgmt. is included but knowledge about the CDS position is missing. Expertise is rated on a four point scale (0 = none, 1 = beginner,

2 = intermediate, 3 = expert). Each knowledge area is represented by 3 bits. If a member was rated as having no knowledge of that area they receive 0's in all three bits. If a member was rated as either a beginner, intermediate or expert then they receive one, two or three 1's respectively. This network is bipartite with a set of 19 nodes representing the members of Team X and a set of 57 nodes representing the knowledge distribution.

Encoded Network – This bimodal network has 57 knowledge nodes and 22 technology nodes. Each engineering tool has ties to its respective knowledge. The publish/subscribe system, database of past missions and the 3 large screens have access to all knowledge except for Proposal Mgmt. which is only in the database of past missions. At this high level of data input, it is not a good representation of the Team X process and structure.

Interdependency Network – An approximation of the interdependencies was obtained from the survey data. This network is 57 nodes by 57 nodes. Each knowledge area is represented by 3 bits and strength of dependency is shown by the number of bits receiving a 1. A strong dependency has a 1 in all three bits, a moderate dependency has a 1 in two of the three bits and so forth.

Figure 2



Assignment Network – Task is aggregated to the position level as well due to high level data. Each position is responsible for developing their respective subsystem and the facilitator has the task of overseeing the overall design. Therefore this is a bimodal graph with 38 nodes (19 positions, 19 tasks) and 19 edges (one between each position and its task).

Tool Network – This network is a bimodal graph with 19 task nodes, 22 technology nodes and 112 edges. Each subsystem position is linked to its respective engineering tool and all positions use the publish/subscribe system, database of past missions and the 3 large screens to accomplish their task.

Needs Network – An approximation of the interdependencies was obtained from the survey data. This bimodal network is 57 knowledge nodes by 19 task nodes. Each knowledge area is represented by 3 bits and strength of need is shown by the number of bits receiving a 1. A strong need has a 1 in all three bits, a moderate need has a 1 in two of the three bits and so forth. The CDS knowledge is missing and this task is subsequently an isolate.

Precedence Network – There is no data in support of constructing this network.

2.2. ORA Analysis

The ORA output for the two metamatrices are shown in Appendix D. The objective of ORA is to locate graph level and node level vulnerability. The following are high level interpretations of the results.

Graph level

The graph level measures indicate that Team X is optimally designed to perform their task.

Resource allocation risk

Team X has high congruency (resource = 1.0, knowledge = 0.7), low negotiation (resource = 0.0, knowledge = 0.9), low communicative need (0.0) and low redundancy (assignment = 0.0). These measures are characteristic of teams optimally designed around a particular task. A few of the high redundancy measures look to be anomalies and warrant explanation. Resource redundancy (4.9) is high due to many technological resources being shared – publish/subscribe system, broadcast screens and database of past missions. This redundancy is central to the communication and coordination of Team X and contributes to efficient performance. This measure is not considered detrimental. Access redundancy follows the same line of reasoning as resource redundancy. Knowledge redundancy (5.0) is high due to the understanding of other positions expertise and to the mental maps of the team and interdependencies. This is also essential to the performance of Team X and leads to the ability to integrate design. This measure is not considered detrimental.

Communication risk

Team X has small diameter (1.0), flat hierarchy (0.0), good efficiency (0.00) and high clustering (1.0). There is very minimal communication cost and information flow is rapid. These measures are characteristic of teams optimally designed around a particular task.

Task risk
The task risk measures are uninformative due to a lack of task definition and granularity.

Interpretation
Team X is tuned to high performance for their design task. Experience has shown that substantial improvements are difficult to realize when teams are so optimally designed. The cons to this type of design to task team is that these teams are usually not adaptive and do not perform well when faced with a new task. The tight clustering and rapid information flow mean that incorrect information can cascade through the network just as fast as correct information. Also, this type of team is prone to group think.

Overall Risk
It does not seem likely that Team X will be undertaking different tasks other than design so adaptability is not an issue. The structure of the group does promote information flow which can lead to increased error propagation if incorrect information is introduced and undetected.

Node level
The node level measures indicate several critical members of Team X. The following is a list of the top three members for each of the knowledge exclusivity, potential knowledge work load, actual knowledge workload and cognitive load measures.

knowledge exclusivity	potential knowledge workload	actual knowledge workload	cognitive load
4.5 (therm)	0.91 (therm)	0.048 (facil1)	0.23 (therm)
2.2 (facil1)	0.66 (system)	0.046 (therm)	0.20 (facil1)
1.8 (missn)	0.63 (facil1)	0.041 (system)	0.20 (system)

Interpretation
Thermal, facilitator 1 and systems consistently fall within the top three rankings of each measure. These three individuals are critical to knowledge acquisition and application. These results indicate that the team should protect against turnover of these individuals. Thermal is in the top ranking for three of the four measures. This indicates his unique and valuable expertise as well as the potential for this individual to emerge as a leader.

Traditional centrality measures
The traditional measures of centrality are not meaningful for this analysis due to the team being co-located and having the ability to directly communicate with each other.

Overall Risk
There is a critical employee turnover risk for Team X which has a reliance on key individuals. This turnover risk is associated with the risks of productivity and effectiveness as well as property and economic. This risk also poses a knowledge

management challenge as loss of key expert knowledge or the inability to timely transfer knowledge due to only a few having the resource can impact performance negatively.

2.3. Construct Analysis

Two virtual experiments were run using the Team X revised version of Construct. The first experiment was motivated by observation of the Team X design sessions and tests to see if facilitator style has a tradeoff effect for point design and trade space exploration. The second experiment uses the ORA analysis of turnover risk as a basis for testing to see what effect the turnover of key individuals has on Team X.

2.3.a. Experiment 1 – Facilitator style tradeoff effect on point design and trade space exploration

Observations of the Team X design sessions indicate that facilitator management style varies greatly. The individual management styles may affect point design and trade space exploration differently.

Survey data collected from Team X was used to code to represent the individual management styles. The survey data used is as follows:

- Knowledge every team member has of each subsystem on a 4 point scale (none, beginner, intermediate, expert)
- Perception of the degree of task dependence each member has on other members. This is on a 4 point scale (none, little, moderate, enormous)

The network data on task dependency verifies that there is a difference in management style between the two facilitators. Figures 3 and 4 show the ties of strong (enormous) task dependence among Team X members when each facilitator is in charge. Figure 3 shows that team members have task dependency on facilitator 1 as the ties are directed to him. This demonstrates that facilitator 1 drives the Team X sessions and has a tighter control over the tasks and coordination. Figure 4 shows that facilitator 2 depends more on the team members as ties are directed to the team members. This demonstrates that facilitator 2 opens up the Team X sessions and decentralizes decisions more.

For purposes of the experiment the following two definitions are used:

- Point design – consensus decision making to converge knowledge and integrate design.
- Trade space exploration – exploration of an agents own position domain to make accurate decisions. This includes coordination with other position domains that are closely related.

Figure 3 – Task dependency network, Facilitator 1

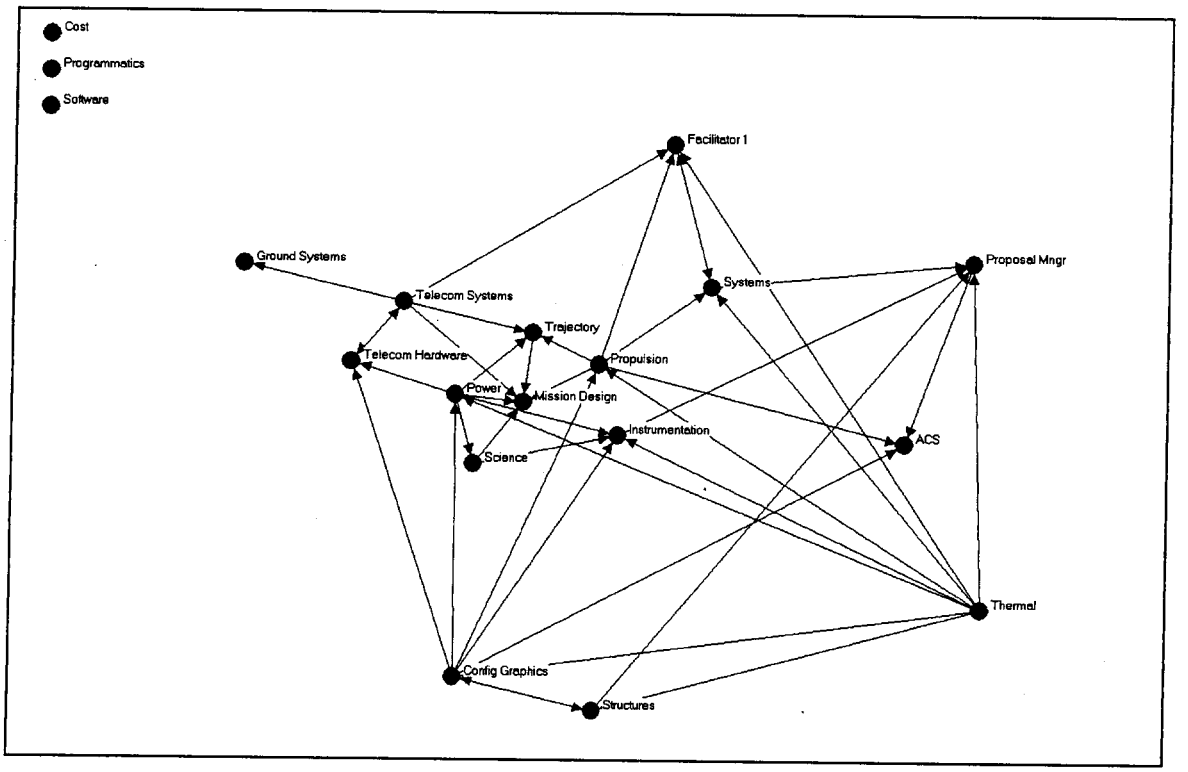
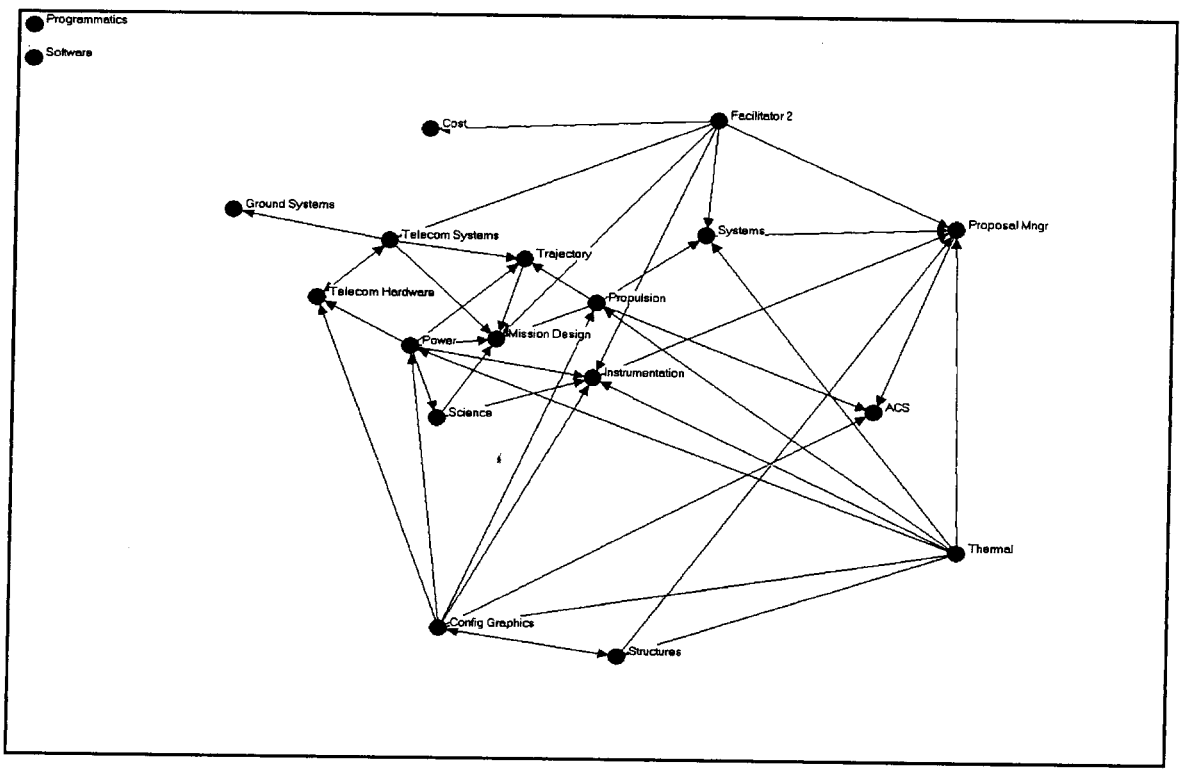


Figure 4 – Task dependency network, Facilitator 2



The knowledge and task dependency networks for each facilitator were input into construct and experiments run for the point design and trade space exploration objectives. Figure 5 shows the results for point design and Figure 6 shows the results for trade space exploration.

Figure 5

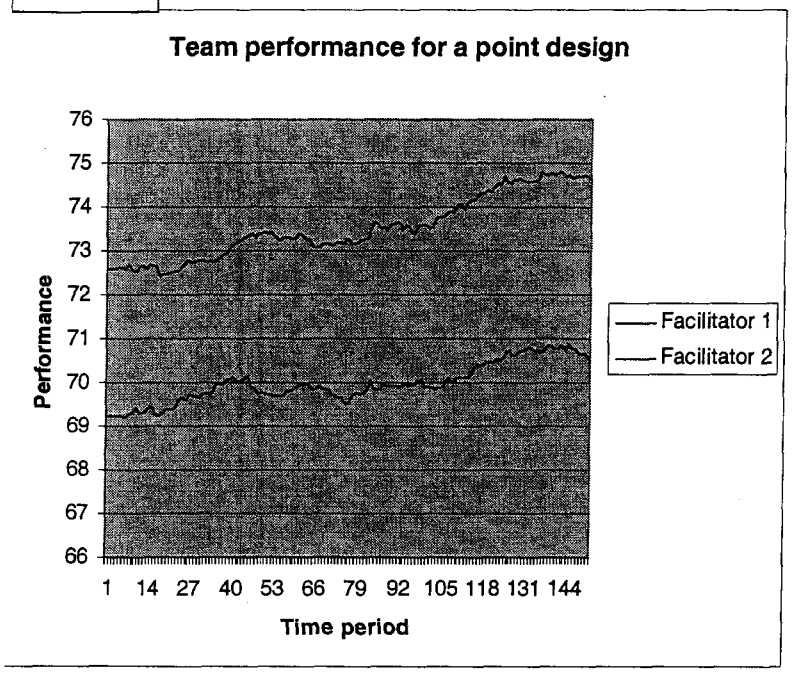
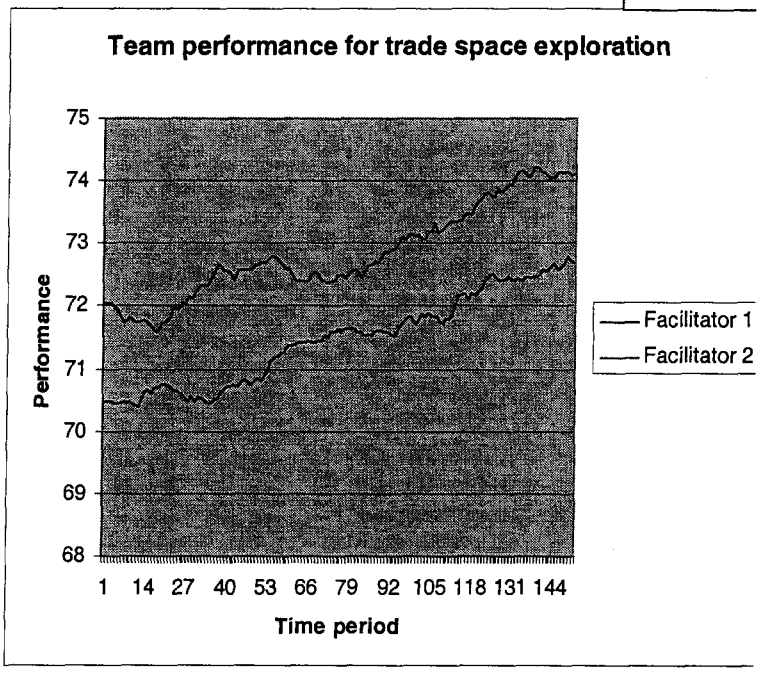


Figure 6



The results of the experiment show that facilitator 1 has a greater impact on the performance of a point design whereas facilitator 2 has a greater impact on the performance of trade space exploration. The management style of facilitator 1 drives the agents to come to consensus and converge the design. The management style of facilitator 2 lets the agents explore their space, which they are naturally inclined to do. The tradeoff here is productivity vs. effectiveness. From a risk perspective, management should be aware of this tradeoff and try to balance the two for optimal team performance that meets both time and safety goals. See Appendix E for additional information on experiment 1.

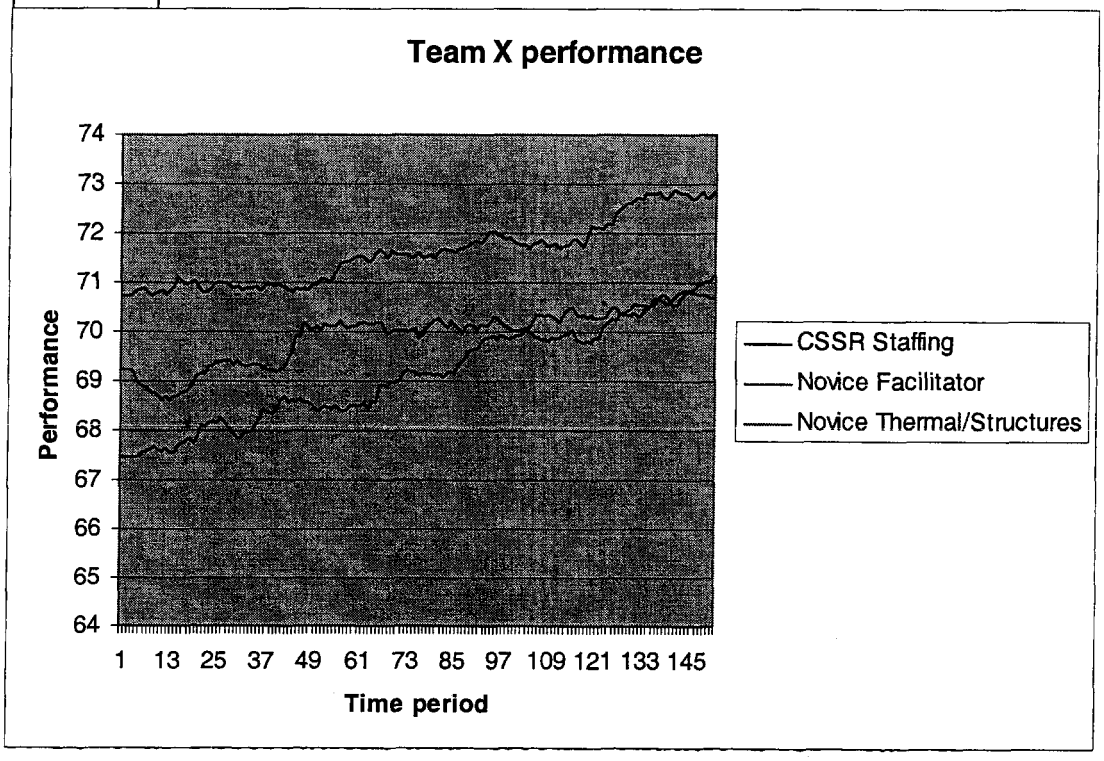
2.3.b. Experiment 2 – Turnover risk

A turnover risk experiment was run based in the identification of critical members from the ORA analysis above. The critical members are thermal, facilitator 1 and systems. Only facilitator 1 was used in these experiments. Facilitator 2 was not included. The survey data on the knowledge of every team member of each subsystem was used as input to Construct. Three conditions were run in this experiment:

1) Original CSSR staffing (baseline) – the exact knowledge base obtained from the survey was used.
2) Leadership change – the knowledge of the facilitator 1 reduced to average, lowering the expertise level. This represents someone with limited experience taking the role. All other staffing and knowledge base representations remained as they were for the CSSR staffing.
3) Key experts change – the knowledge of the thermal person and the systems person were reduced to average, lowering the expertise level. This represents people with limited experience staffing these positions. All other staffing and knowledge base representations remained as they were for the CSSR staffing including facilitator 1 – there is no leadership change.

Figure 7 shows the results of the experiment. Team X relies heavily on key expert personnel. The performance under conditions 2 and 3 are much worse than the baseline demonstrating that a leadership change or a key experts change will negatively impact the team. The loss of facilitator 1 poses the most risk to Team X performance. The decrease in performance for condition 1 was more than the decrease shown for condition 2. This is meaningful since there was a change in only one position for condition 1 as compared to a change in two positions for condition 2. It is also surprising given that thermal was highest ranking in three of the four knowledge measures in ORA. The results demonstrate the importance of leadership in this environment. As stated in the ORA analysis, the turnover of key members poses productivity, effectiveness, property and economic risk and a knowledge management challenge. See Appendix E for additional information on experiment 2.

Figure 7



Recommendations are made based on general observation as well as ORA and Construct results. Appendix F contains more detail on the general observations and recommendations.

3.1. General Observations

Team X has created a successful concurrent engineering process. This team is optimally designed to perform the task of mission design. Team X uses a mixture of multifunctional teams, computer integration and analytic methods to achieve concurrency and integration. Integration methods such as co-location and information systems are appropriate as the environment has functional differentiation, cross-functional requirements, uncertainty, complexity and frequent two-way information flow. The matrix structure of the organization is congruent with a concurrent engineering team and the culture of Team X is highly supportive of the process.

3.2. Recommendations

- Create handover procedures
- Increase trade space exploration
- Increase documentation
- Develop a measure of risk based on design changes
- Create a mentoring program for the facilitator position
- Create publish/subscribe system error checking routine

3.2.a Create handover procedures

Observation concluded that hand-over to a position substitute in a member's absence is inadequate. The substitute spent a substantial amount of time gaining understanding of the situation. The Team X design session has a limited time frame. The lack of hand-over poses a productivity risk and effectiveness risk and is a knowledge management challenge.

Recommended procedures should include:

- Absentee spending extra time at the end of their last session preparing material for the substitute
- Material distribution to the substitute well prior to the session they will attend

3.2.b. Increase trade space exploration

Trade space exploration is limited to time constraint. Interviews indicate that design changes are often made in later phases and that cost differentials are a criticism. The lack of trade space exploration presents effectiveness and social risks.

Recommend increasing subsystem input into the pre-session phase to infuse knowledge and explore more space prior to the sessions. Pre-session phase is recommended because there is a productivity and effectiveness tradeoff within the session (see Construct results, Experiment 1).

3.2.c. Increase documentation

Interviews indicate that a large variance by position exists in the documentation of decision rationale. It is believed that documentation is open-ended. This can pose a risk at the team and individual level. The associated risks are productivity, effectiveness, professional and social. This is a major knowledge management challenge.

Recommend using a question format for documentation to provide a framework for increasing the input. Also, documenting the existence of unexplored trade space may help protect against later criticisms.

3.2.d. Develop a measure of risk based on design changes

Track the frequency and severity of design changes by subsystem and also aggregate the changes into a system measure. The measures are an indicator of risk and uncertainty by subsystem design and overall design, especially for effectiveness risk

3.2.e. Create a mentoring program for the facilitator position

ORA and Construct Experiment 2 results show that the facilitator is a critical member of the organization and there is a substantial turnover risk for this position. There are productivity, effectiveness, property and economic risks associated with facilitator turnover.

Recommend creating a mentoring program to develop experience and system-wide expertise. Carefully select people who have a potential for leadership, people skills and the ability to see the broader systems view. Certain subsystem positions have a propensity for developing system-wide knowledge – examples are Systems Engineer, Thermal.

3.2.f. Create a publish/subscribe system error checking routine

It was observed that many values were questioned for recency during the run-through of the systems worksheet at the end of each session. Assuming all design calculations are correct there are two errors that can occur – a member forgets to publish and a member forgets to subscribe. These errors may go undetected due to the high complexity of the task and the limits of human attention and memory. This poses an effectiveness risk.

Recommend creating a routine to compare the systems worksheets values to the respective subsystems values and report discrepancies. The computer can easily detect these errors and appropriate attention can then be given to correcting them.

4. HORM Next Steps

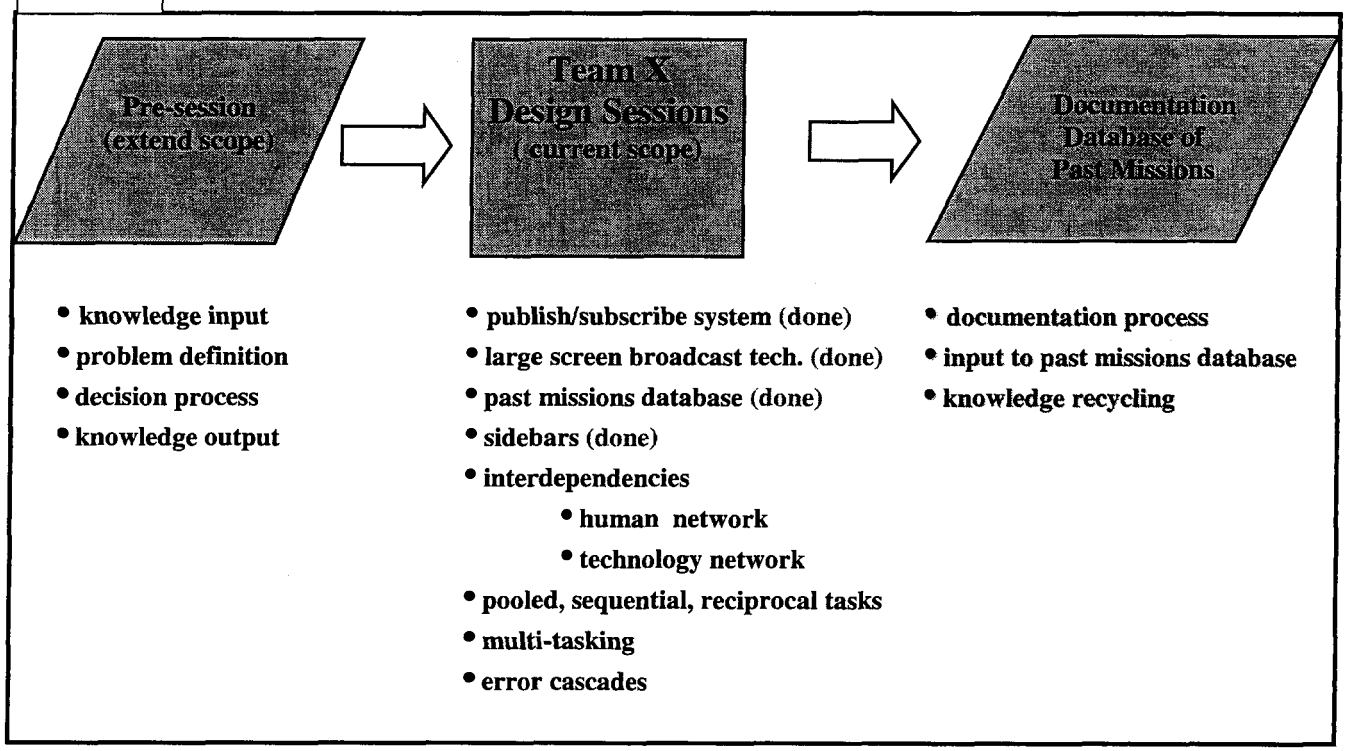
The modeling and analysis has mainly concentrated on Team X. Some preliminary information gathering has occurred on NASA ISS mission control by way of interview with Valerie Shalin. Model changes made for Team X should be applicable to the other NASA teams, namely VIPeR and ISS mission control. For example, sidebars can occur in VIPeR and ISS mission control and the broadcast technologies are in use for ISS mission control. Modeling of the VIPeR and ISS mission control teams will provide

secondary validation for the modeling changes already made. The next steps include expanding the Team X model as well as beginning the first iteration models for VIPeR and ISS mission control. Appendix G contains more information about the HORM next steps.

4.1. Expansion of the Team X Model

The next steps for the Team X representation include a more in-depth modeling of the design sessions as well as expanding the scope of the model to include pre-session and post-session analysis. Figure 8 provides an overview of the Team X modeling effort.

Figure 8



Team X Design Sessions
The phase II model design will implement representations of the human and technological network interdependencies, pooled/sequential/reciprocal tasks, multi-tasking and error cascades. This phase will add granularity to the model which allows for more specified analysis of organizational risk drivers. This will require additional interview, survey and observational data.

Pre-session
This expansion of scope will involve preliminary investigation and data collection to understand the pre-session process and how it feeds into the actual design session. Specific understanding of the pre-session inputs and outputs, problem definition and decision processes needs to be obtained. It is obvious that decisions made in the pre-

session have an influence on the actual design sessions. Risk analysis would not be complete if it does not capture the pre-session process and the respective relationship to the design sessions. This expansion in scope will be best accomplished through observation, interview and survey data collection. The grounded theory approach worked well for the phase I data collection and design and is recommended here.

Post-session
The post-session is another expansion in scope and concentrates on the documentation process. The main objective is to understand how design session knowledge gets archived and re-used in future design sessions (knowledge recycling). Modeling this piece of the knowledge management process is important to risk analysis. There may be organizational learning opportunities that are missed and existing knowledge that is not utilized. Again, the grounded theory approach is recommended.

4.2. Begin VIPeR Team Model

The following is an outline of the tasks to complete the first iteration of the VIPeR team model:

- Before SimStation introduction
    - Observation and Interviews – necessary to gain adequate understanding of the team and processes (team composition, knowledge distribution and transfer, coordination, etc…)
    - Demo of SimStation – understand:
        - Knowledge contained within
        - Interdependence mapping
        - Human interface and other methods of knowledge transfer
    - Data from Bonnie Parke's SimStation and Risk surveys
- After SimStation introduction
    - Observation and Interviews – understand how the team processes have changed
    - Data from Bonnie Parke's SimStation and Risk surveys
- Virtual Experiments
    - Simulate the effects of SimStation
    - Knowledge management experiments based on the team distribution of knowledge including system-wide experts
    - Team productivity and effectiveness
    - Collaboration and coordination strategies
- Use Before and After data to validate model

4.3. Begin ISS Mission Control Model

The following is an outline of the tasks to complete the first iteration of the ISS mission control model:

- Observation and Interviews – necessary to gain adequate understanding of the team and processes (team composition, knowledge distribution and transfer, dynamic and real-time environment, coordination, etc…)
    - Handover process is crucial

        - Change in team size and composition
        - Documentation process
        - Methods of knowledge transfer
    - Controller attrition rates
- Data from Bonnie Parke's Risk survey
- Virtual Experiments
    - Reduced team and handover
    - Turnover
    - Knowledge management experiments based on the team distribution of knowledge
    - Team productivity and effectiveness
    - Collaboration and coordination strategies