

**DECISION MODEL FOR SELECTING  
THE BEST TELECOMMUNICATION  
SWITCHGEAR FOR FAA AIR TRAFFIC CONTROL  
CENTERS**

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## **Abstract**

Lockheed-Martin is engaged in a competitive bid for a modification and overhaul of the FAA telecommunications system. Competitors for this contract are MCI-WorldCOM and a team comprised of Harris and Sprint/Qwest. Each of these potential contractors will be requiring the products of equipment providers such as Lucent and Cisco. These suppliers will provide the contractors with equipment to outfit the FAA connecting backbone fiber completing the Local Area Networks (LAN) and Wide Area Networks (WAN). To efficiently determine an equipment provider, many tools have been used in aiding the Request For Proposal committee. Upon receipt of the bids, the information will be scored and evaluated by the FAA with a final selection made shortly after in which the FAA will enter into formal negotiations.

## **Background**

The Federal Aviation Administration (FAA) has issued a Request For Proposal (RFP) to upgrade the telecommunications equipment which links the twenty-two major air traffic control centers in North America. This network of circuits provide the means for center to center ground communications and provide a back up to air to air communications and a back up for air to air communications, which supports the routing of commercial air traffic. This equipment upgrade involves the installation of new state of the art switches, which support voice, data and video. This new technology enables the FAA to streamline their communication needs by routing these services through one network as compared to the existing technology, which has independent voice, data, and video networks. In the past eighteen months the existing equipment has had unacceptable failure and availability rates that have affected the overall performance of the system. Through this procurement the FAA anticipates increasing its reliability/availability to 99.99999% (five nine's) for ground based telecommunications traffic.

In order for the vendor responses to be deemed compliant, the FAA has listed a set of minimum qualifications/criteria, which is listed in Section XX of this plan, which all vendors must adhere to. There is an extremely rigid testing process that will be conducted jointly between the contractor and the FAA prior to acceptance for installation. Also, a key part of the proposal response involves the method that such equipment will be transitioned into service and the

approach to be used for a seamless cut-over (zero down time while switching circuits from old equipment to new equipment).

The RFP states the FAA will evaluate responses based on:

- Equipment specification compliance
- A transition plan that offers the least risk to the FAA
- A delivery schedule consistent with the urgency surrounding the current state of the existing equipment
- A response that provides the best value.

## **Opportunity**

The opportunity is that Lockheed-Martin has the chance to pick the best supplier, due to the fact that the proposal is looking for the best product that meets FAA requirements. This will also provide the best overall value. To do this we will use software to facilitate this decision making process. This software that we will be using is called ExpertChoice, and utilizes the Analytical Hierarchy Process (AHP) to make an educated and weighted decision. The possible suppliers in the current situation are Lucent Technologies, Cisco Systems, Alcatel, and Marconi/Fore. The four possible suppliers are well known in the communication industry, and could be considered comparable in all aspects. This makes it even more important that there is some foundation to the decision as to who should be the supplier for this contract. Each group has been given the same bid package, and will be expected to forward the bid by the given date.

## **Vendor Evaluation**

The criteria that will be used to evaluate each of the four suppliers will be:

- 1) Cost: will be measured by total Non-Recurring Engineering. This means that it will look at the cost with installing the new system and the new hardware itself, but will not be concerned with maintenance and recurring items.
- 2) Mean Time Between Failures (MTBF): means the time between the current and last occurrence that the items need to be repaired other than scheduled removal and repairs.

- 3) Watts Required: is the amount of energy in watts that the hardware needs at a minimum. It does not state that the watts required cannot be more, it just states that this is the minimum required to run effectively.
- 4) Battery Power Life, We are looking for the product that will run the longest when it is on backup battery mode.
- 5) On-Site Repair Response Time: is the time from when an emergency call is placed to the supplier to the time that a supplier representative is on-site.

""Mean Time Between Failure", "Watts", "On-Site Repair Response Time", Cost, and Battery Power Life, these five items will be the criteria that the prospective suppliers will be judged upon on the first round. It should be noted that the sequence of importance is as follows, Mean Time Between Failure, Cost, On-Site Repair Time, Battery Power Life, and Watts required. This hierarchy was organized into Expert Choice at the goal level by, preference and intensity, by those judging the suppliers.

## **Selection**

The selection process will depend upon the results of the AHP model using ExpertChoice. The AHP gives us a better framework with which to model this complex decision scenario. The framework will ensure a better understanding of the problem, criteria and ultimately assist us in determining the final selection. The data was accumulated as part of a Lockheed Martin proposal, and reflects supplier data provided by each supplier. The ranking of the suppliers, with respect to the bid criteria, was handled by John Moore, Steve Savage, and Jason Roach. This ranking was organized, measured, and structured based upon experience and knowledge of the industry and issues. This ranking system measures intensity of pair wise comparison of each measuring criteria. From this model we were able to determine how the suppliers compared to each other with changes in preference and intensity. The data was modified as discussion evolved on each of the criteria. Through the comparison and the conversation, it was determined that the most important factor is Mean Time Between Failure, as opposed to the initial thoughts of cost being the most important.

## Decision Model

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### Goal

The goal of this decision model is to select the best telecommunication circuit switches for the FAA.

### Primary Objectives

The following primary objectives were identified to be the most critical in regards to the decision goal:

- Cost Installation of system and the infrastructure hardware
- MTBF Average operating hours between failures
- Watts Minimum energy requirement for hardware
- Battery Power Life Maximum time equipment can operate in back-up power mode
- On-site repair response time Emergency response time by vendor representative

The figure below show the criteria and the weighted relationship with respect to choosing between Switch Edge Devices.

Expert Choice 2000 C:\WINNT\Profiles\jbroach\Personal\gw\224\project\Project A.ahp

File Edit Assessment Synthesize Sensitivity-Graphs View Go Tools Help

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**To Choose between Switch Edge Devices**

- Cost (L: .259)
- Mean Time Between Failure (MTBF) (L: .348)
- Watts (L: .090)
- Battery Power Life (L: .115)
- Onsite Repair Response Time (L: .188)

Alternatives: Ideal mode

|                 |      |
|-----------------|------|
| Lucent PSAX-230 | .137 |
| Cisco MGX-8850  | .360 |
| Alcatel 7470    | .319 |
| Marconi/Fore AS | .184 |

Information Document

| Alternatives | Product          |
|--------------|------------------|
|              | (Switch Edge Dev |
| Lucent       | PSAX-2300        |
| Cisco        | MGX-8850         |
| Alcatel      | 7470             |
| Marconi/Fore | ASX-1000         |

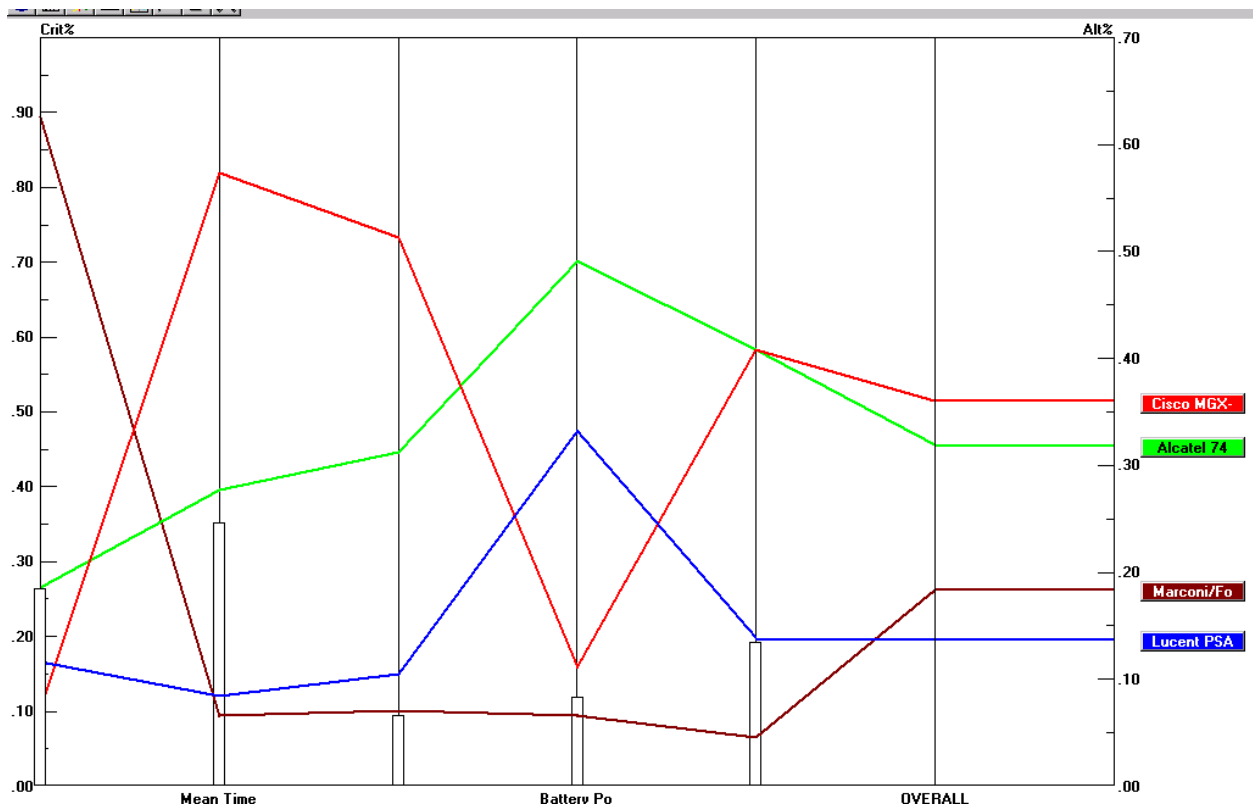
## **Results and Analyses**

Through the use of the graphical pairwise comparison function in Expert Choice, weights were derived for the five primary objectives. This enabled us to determine priorities for the stated criteria. These weights were agreed upon by the team as measures of intensity relative to each other. As can be seen the Mean Time Between Failure was given the largest preference. Within the telecom industry, down time is expensive, and can end up being more costly than the initial price of the equipment. The second most important factor or criteria is the initial cost of the equipment itself. The initial cost of the equipment is what many project managers see up front and is easiest to quantify. It is very easy to know the up front price of the equipment, however, it is much harder to see the cost of future repairs, potential upgrades to the system, and overall maintenance or not-recurring engineering. Another driver in the cost of the equipment is the On-Site Repair Response Time. The quicker the response time, the fewer dollars wasted with equipment downtime. The least critical in the decision making process are the Watts Required and the Battery Power Life. These do not affect overall dollars as much as the other criteria, and have thus been weighted accordingly. It is safe to say the majority of the preference was placed on attributes effecting dollars.

- Cost - .259
- Mean Time Between Failure - .348
- Watts Required - .090
- Battery Power Life - .115
- On-Site Repair Response Time - .188

## Sensitivity Analysis

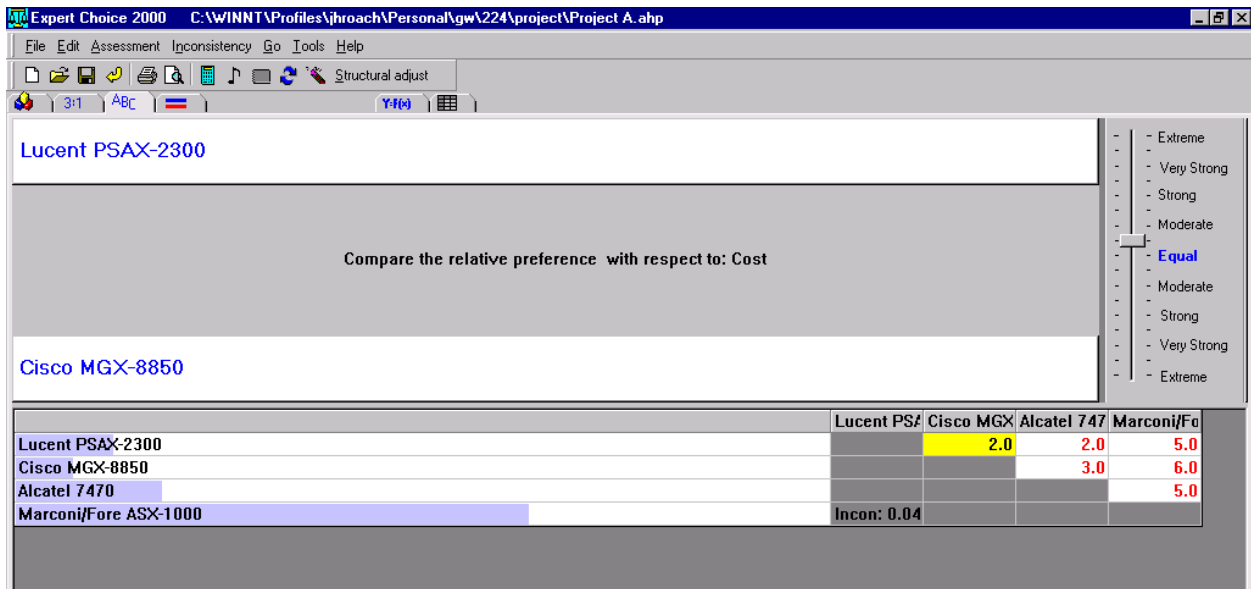
Figure 1-a shows through a performance sensitivity analysis between the four alternatives, that Cisco Systems measured strongest due to their favorable reliability environment of MTBF.



Where Cisco was weak was in the area of Battery Power. It should be noted that if at a later date it was desired to change the priority of the criteria used, it could be done. Within Expert Choice, there is an ability to move the intensity evaluation of the criteria, and see how the choices is more in relation to each other. This enables the model to be developed at an early stage and then changed if different opinions deem it necessary.

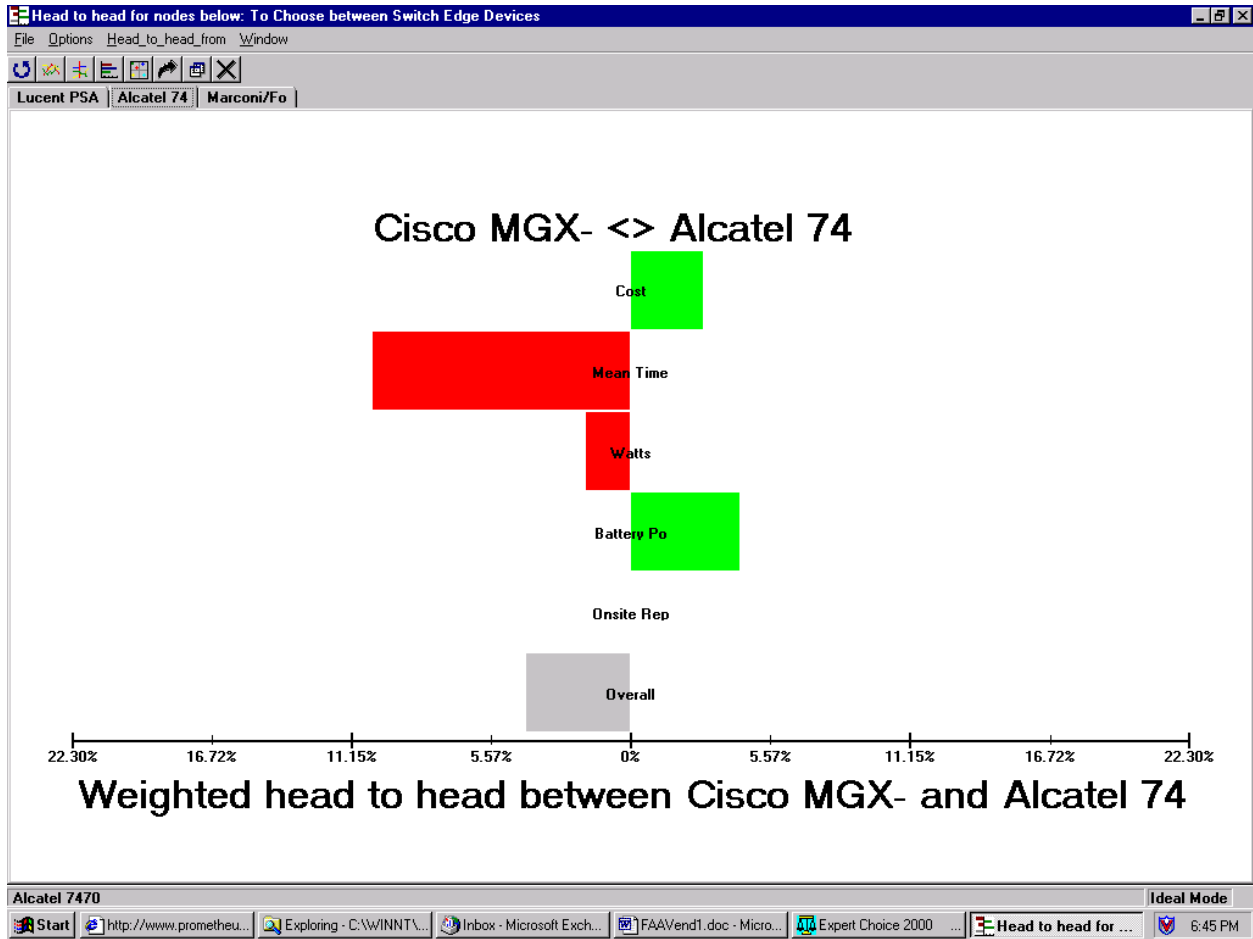
The team performing this analysis structured the complexity as a hierarchy and have derived the ratio scale measures through pairwise relative comparisons. This pairwise comparison was performed utilizing the five parameters mentioned earlier. The comparison incorporates

redundancy thereby permitting us to derive accurate priorities. This redundancy is noted by the Icon box in the figure below. As shown, there is a comfortable level of accuracy in the pair wise comparison because the Icon is less than the value of 1. It is important to realize that decisions should not be changed in the comparison just because a value is greater than one. However, this is a good way to check for either errors or relative judgment.



Another important tool used in the decision comparison is the head-to-head tool. This allows one to look at the attributes or criteria of two alternatives relative to just each other. The figure below shows the top two alternatives, Cisco and Alcatel. This figure illustrates that the Mean Time Between Failure is a major factor in driving the overall preference for Cisco material.





## Conclusion

The choice of Cisco was made after reviewing all the scenarios. Cisco offers the best overall value to Lockheed Martin and the FAA. It is hoped that this “Best Value” will be strongly considered by the FAA when it makes its decision on the prime contractor. Cisco has offered to the team to work very close with the Lockheed Martin and work on improving it’s products, in particular, on the attributes that are most important to Lockheed Martin and the FAA,