Study Guide and Assignment 3


HOMEWORK #3
Due: two weeks from assigned
Type: Individual; 3 parts; deliverable
Please submit it in electronic form. PDF files, PPT or Word Files.

Reference:
- Class lecture on AHP
- “Selecting the Way to the Moon: The Choice of the Lunar Orbital Rendezvous Mode” by J. Logsdon

Problem 1

Earlier this week, you read “Selecting the Way to the Moon: The Choice of the Lunar Orbital Rendezvous Mode” by J. Logsdon (Aerospace Historian, 1971). In this paper, the author discussed how the Apollo program chose LOR as their baseline concept of operations. Use our in-class discussion and information available in the following documents to revisit this decision:


Revisit the Apollo mission mode decision using the Analytical Hierarchy Process (AHP). First, use AHP to create a 4x4 prioritization matrix and rank the following four Figures of Merit using Apollo era priorities: crew safety, program cost, schedule (e.g. how quick can we get to the Moon), and extensibility for lunar base build-up. Are the resulting weightings and order what you expected?

Next, rank the EOR, LOR, and Nova Direct mission modes against each of the four criteria listed above. Combine the results to determine which mission mode is the most preferred. Do your results agree with the decision made by the Apollo program? Briefly discuss.

Please show all the matrices used in your AHP computations. HINT: there should be a total of 10 matrices.
Problem 2
Consider the current NASA exploration architecture. What do you consider the top four figures of merit for executing this program? For each figure of merit, define its meaning and provide a rationale for why you think it is important. You should provide 2-3 sentences supporting each figure of merit. Note that the Presidential Directive for NASA’s Vision for Space Exploration has been posted to Blackboard for your reference.

Problem 3
There has been much debate over the proper use of the Analytical Hierarchy Process (AHP) in the decision making process. In class, we discussed the AHP algorithm/procedure and the pros and cons associated with this approach. Now that you are familiar with AHP, read the following two articles from The Journal of the Operational Research Society. The author of the first paper (R.D. Holder) criticizes AHP, while the author of the second paper (T.L. Saaty) defends AHP.


Based on these papers, our in-class discussion, and your experience in answering Problem #1 write 2-3 pages addressing the following topics:
1) What are the major pros and cons of using AHP?
2) NASA lists AHP as one of its recommended decision-making approaches in both the 1995 and 2007 Systems Engineering Handbooks. Would you also recommend this tool for use in engineering problems? Why or why not and under what circumstances?