

The Integrator

INCOSE North Star Chapter



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North Star Newsletter

INCOSE North Star Newsletter Communication

Welcome to year two of The Integrator!

Contact Eileen.Arnold@incose.org to contribute articles, topic suggestions, and usable information for our members.

Eileen Arnold, Editor

Systems Engineering at its Best!

16 Rules of Engineering Design

As a design engineer, while a full-time employee at the Honeywell Aeronautical Division and later a consultant to both private and public organizations, I observed the practices of other design engineers. This experience led me to develop the following set of rules of engineering design that if followed rigorously will lead to excellent results. You, dear reader, may likely find other rules that should be added to the list, or may feel that some of the rules listed are not important.

1. Consider the system to be designed as a field of requirements and characteristics. To make genuine progress, it is absolutely necessary to take the time to study the problem for which an engineering solution is desired in as broad an interdisciplinary context as the problem requires, understanding and documenting all of the desired

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WELCOME, North Star NEW Members!

David Jones	Kirk Keeney Conslt	LMCO
Philip Lau	Logistics Engineer	LMCO
Karla Spencer-George	Senior SE	LMCO
John Woods	Systems Engineer	LMCO
Steven Yahr	Sr Staff Log Engineer	LMCO

Chapter Presidents Corner

Bob Hunter
ATK

Welcome to the INCOSE North Star Chapter. As your president, I hope to bring you the most professionally beneficial experience possible in 2006. The Leadership Committee has planned a suite of events that I hope you will find interesting and useful. We have, as is our custom, adopted a theme for the year as a planning tool. This year's theme is "Systems Engineering Interaction with Other Disciplines".

We will keep you up-to-date as changes in our schedule occur (the presence of change being one of the few things we can count on). Our communications will take the form of announcements at our meetings, this newsletter, and the <http://www.incose.org/northstar> website. In addition to information on future events, our website also includes most of our past presentations and many useful links.

The Leadership Committee is always on the lookout for new ways to add value to your membership. Please feel free to contact any of the Leadership Committee members with any ideas you have regarding possible programs, services the chapter might offer, or other potential value-adders. If you have the desire to get more actively involved, be sure to ask a Leadership Committee member about attending a committee meeting. In addition to chapter activities, you will find that, due to INCOSE's international standing, there are opportunities for involvement at the regional, national, and international levels, in addition to our local chapter activities.

So, this year - attend the presentations, get involved in the organization, network with your peers; make the most of your 2006 INCOSE experience!

- performance, environmental, social, and economic requirements.
2. Develop criteria carefully and thoroughly from your study of requirements. Too often engineers are tempted to jump into detailed design before searching out and understanding all of the criteria.
 3. Identify all trade-off issues. By considering such issues explicitly with the criteria firmly in mind, the task of design is clarified and organized.
 4. Develop all reasonable alternatives within each trade-off issue. The designer who has not examined alternatives carefully before committing to a design cannot defend the design rationally and then becomes emotionally “locked in” to one approach.
 5. Study each alternative until the choice is clear, rational and optimal. This is hard work, but if not done rationally the design may have fatal flaws. Such a process creates designs that are difficult or impossible to better, which is the objective of a good designer.
 6. Seek and listen humbly to comments from anyone who will listen. By explaining your ideas and listening to comments, you clarify them. A difficulty many engineers have is failing to listen humbly, particularly to an outsider. Arrogance is disastrous to good design. A good designer must be humble, which is a rare attribute.
 7. Seek advice from the best experts available in every specialty area. It should be obvious that none of us can know the details of every specialty required, yet there is often an innate desire to try to develop a design ourselves. The best design will take advantage of the best information available anywhere, from anyone.
 8. Consult with manufacturing engineers at every stage of design. In the United States, particularly, all too many design offices have left manufacturing considerations to the end of the design process, and by grading manufacturing engineers lower than design engineers have informed the able engineer where to concentrate.
 9. Recognize that while emotion is a fundamental driving force in human behavior, emotion must not select alternatives. A good design engineer must be free of emotional “hang-ups” that inhibit making use of all information available, calmly sorting through the pros and cons of each approach before recommending a solution, and being willing to accept someone else’s idea when objective analysis shows it to be superior.
 10. Recognize and avoid NIH (Not Invented Here). The human emotion that says “we can do it better than you can” is okay if it is controlled, but when it prevents an engineering office from making good use of ideas developed elsewhere, it is destructive.
 11. Consider the overall economic implications of each design decision. This requires good market and economic analysis to parallel design analysis. A design is good if it can win in a highly competitive market, and it can do so only by taking economics into account at every step.
 12. Minimize the number of moving parts. Some engineers become fascinated with extremely complex designs, but they too often are subject to more failures and end up with higher life-cycle cost. Examine carefully the function of each part.
 13. Consider the consequences of failure in every design decision. It is easy to design something if failures are not considered. A good design requires that the best engineers perform careful failure-modes-and-effects analysis as a fundamental part of the design process.
 14. Use commercially available components wherever practical. The temptation to “design it yourself” is strong, but it is expensive and does not take into account that a design engineer cannot be a specialist in very many areas of engineering.
 15. Design for function. A Japanese engineer reduced the cost of a magnetron for an infrared oven from over \$500 as developed by an American engineering firm to under \$5 by asking himself what the magnetron is really supposed to do.
 16. Analyze thoroughly. It is much cheaper to correct designs through analysis than after hardware is built. Design of a truly cost-effective, high-performance system requires the best of modern engineering analysis.

J. Edward Anderson, Ph.D., P. E.

Emeritus Professor of Mechanical Engineering

“When you can see failure as an inspiration and success as an opportunity then you have learned the secret to success.” Anonymous

North Star Chapter Website

<http://www.incose.org/northstar>