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INCOSE Chesapeake Chapter
International Council on Systems Engineering

E-Newsletter

May 2015

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President's Point of View

Mr. George Anderson
INCOSE CC President
george.anderson@incose.org

Awnings Up and Tulips Everywhere

You know that winter is defeated when the tulips bloom and many of the older homes in Baltimore City break out their awnings. Awnings may not be the mass fashion statement that they were around the turn of the last century, however, their architectural statement and utility can still be welcome to those who experience subliminal feelings of comfort when "under canvas" during a rainstorm. In contrast, modern aluminum or fiberglass substitutes are almost always annoying.

A real canvas awning is a fascinating system with an interesting life cycle. The fundamental concept also has a rich history dating back at least to the Roman Colosseum. [1] The Loane Brothers Company in Baltimore claims to have made the first awnings in America around 1850 from a pattern brought from France. [2] In a tribute to the timelessness of the awning, the Loane Family is still in business today and their employees have erected my porch awning every spring for the last 15 years.)

Rigging an awning is a skill that I recognize is not easy to learn. Sails and awnings are similar in that their shape can only be established by adjusting tension on the supporting ropes. In contrast, modern structures typically replace the ropes with beams and trusses. These carry the loads in both tension and compression and need fewer adjustments over their

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This is the monthly newsletter for INCOSE Chesapeake, a local chapter of INCOSE International. We are a not-for-profit organization dedicated to providing a forum for professionals practicing the art and science of Systems Engineering in the Northern & Central Maryland & Southern Pennsylvania area.

Join INCOSE Today

The Chesapeake Chapter is always looking for volunteers to speak at our upcoming meetings! Please contact our 2015 Programs Director, Glenn Townson, if you would like the opportunity to speak or can recommend someone.

The Chesapeake Chapter of INCOSE is proud to recognize

lifetime.

Notable examples of other early tension structures are the Wright Brothers first airplane, the Conestoga wagon, a suspension bridge and the bicycle wheel.

As a Chapter, we want to avoid the mode of governance that resembles the tedious process of adjusting the ropes on a tension structure and, instead, create a robust administrative structure more attuned to and benefitting from our profession as systems engineers.

I believe that the 2015 Chesapeake Chapter Operations Plan completed in April is the BOD's rope reduction documentation. In this plan we are doing the systems engineering up front and providing a solid basis for the year's activities. Here are some areas in the plan that I believe create a solid basis for making efficient and realistic progress:

- A graphic that explicitly aligns our mission with goals, objectives, initiatives, and metrics. (Appendix A)
- See also the Goals Grid to understand how the BOD has mapped the year's decision challenges. (Appendix A)
- Updated Chapter needs. (Appendix B) If needs are not realized there will be no growth.
- An explicit implementation schedule for duties and activities specifically required by the bylaws. These include the annual election of BOD members and the annual financial audit. Other items are the submission of the Circle award data and submission of reports to INCOSE INTERNATIONAL.
- Last, a detailed budget that allocates discretionary amounts for each Director permitting flexible execution and allowing the BOD in session to concentrate on strategic issues.

I could go on but my point is to remind everyone that the plan is always available on our web site and provides a comprehensive window into how we will operate. I sincerely hope that our members will not treat the plan like shelf ware because the Chapter cannot succeed if the BOD is the only group aware and engaged in 2015.

In other news:

- The Honorable Stephen Welby is leaving the Deputy Assistant Undersecretary of Defense for Systems Engineering position and being nominated for Assistant Secretary of Defense for Research and Engineering. No word yet on his replacement.
- The DoD Architecture Framework (DoDAF) version 2.02 has been updated as of January 31, 2015, to Change 1. My reading of the change suggests that there is a new author who is reinforcing the primacy of the Metamodel (DM2).
- The Chapter ESEPS held a summit meeting on Saturday morning at the Engineers Club of Baltimore to discuss the state of Systems Engineering in MD. David Fadeley, our first Chesapeake ESEP was the meeting moderator. The meeting marked a historic first for INCOSE and the attendees intend to meet quarterly going forward.
- WISE continues to have good attendance at their luncheon meetings. I attended the April 24, 2015 meeting along with Past President, Erik Devito and Treasurer, Kent de Jong. The program was a panel discussion featuring women who had succeeded as entrepreneurs and business owners. This was a very successful event and more details will be provided in an after action report by WISE.

the following organizations for sponsoring our endeavours to expanding the understanding and appreciation of Systems Engineering in the local area:

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My closing thought for the month is to comment on a query that came my way recently. The question was: What is the target attendance number for our monthly meetings? The short answer is that our attendance rates are slowly rising cumulatively but vary each time with the speaker, weather, other events and the timeliness of our advertising. When we do everything well, we can expect a high of 50 and 25 when we do less. The attendees are not the same each time and we do have many walk-in guests. Also, we should realize that the monthly membership meeting is just our baseline service. Of more importance to the membership at large are our training courses, tutorials, and special events. These capture the special needs and interests of our members but at a higher attendance cost. For instance, we are planning a three day hands-on class for IBM Rational System Architect with DoDAF in June and the expected cost will run around $1800 including meals and training texts. Dr. Mark Maier presented his seminal tutorial on Architecture last year and I heard many laments from people who wished they had known about the course beforehand.

Please check the web site and newsletter for our offerings and use our on-line registration to efficiently pay for the event. No ropes here!

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[1]https://www.youtube.com/watch?v=UtwG_ziYI0Y)

[2]http://www.loanebros.com/aboutus/index.html)

George Anderson - INCOSE Chesapeake Chapter President

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A SPECIAL ANNOUNCEMENT

President's Cup

May 3, 2015

I have received the important announcement from INCOSE INTERNATIONAL that the Chesapeake Chapter has won the 2014 President's Award for Outstanding Achievement. This award is granted to one chapter each year that scores highest on the Circle Award submissions.

Clearly, this is a cause for celebration and individual reflection on how well we have demonstrated systems engineering best practices both in executing the Chapter's mission and in the promotion of Systems Engineering education throughout the technical community in Maryland.

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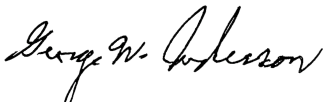
Our 2014 President, Erik Devito, deserves singular praise for leading us to victory and providing innovation and inspiration along the way. Please join me in thanking Erik and all who supported him. Erik will accept the award at the INTERNATIONAL Symposium in July 2015, and I know he will want to see as many chapter members present as possible. Elsewhere in this issue we have an order page for purchasing embroidered Chesapeake Shirts for those attending.

I also want to offer heartfelt thanks to our sponsors, employers, and customers who all share significant credit for going well beyond the call of duty in providing the Chapter with the encouragement and resources to serve our customers. These services evolved from a program of continuous improvement and we even created exciting and innovative new ones. None of this is easy and many hours of volunteer service should and will be recognized as we move through our programs this year.

Being number one has ramifications other than the sense of accomplishment that I hope everyone will surely feel. We are now the INCOSE Chapter to emulate. All our activities, processes, governance documents and the growing library of YouTube videos are already being scrutinized and analyzed. No pressure, but we need everyone to help keep our performance and can do attitude consistent with our image! Some call this eating your own dog food.

Thanks everyone, and please consider attending the IS in July.



George Anderson, President

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20 May, 2015 (6:00pm - 8:00pm): The Hype and Realities of Additive Manufacturing

John A. Slotwinski, Ph.D; Additive Manufacturing Development Engineer at The Johns Hopkins University Applied Physics Laboratory

Presentation: The vision of additive manufacturing, which is fueled by recent and significant media coverage in both the popular and scientific press, is a spectacular view of potential things to come. Some have said that additive manufacturing will usher in a new industrial revolution that will forever change manufacturing supply chains, defense logistics, health care, and how consumers acquire manufactured goods. Highly-publicized examples of spectacular parts made via additive manufacturing have led some to conclude that this future vision is a certainty. This vision must be tempered though, by the technical challenges that currently prevent more widespread adoption of the various additive manufacturing technologies. In this talk I will highlight

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recent successes in additive manufacturing, describe current technical challenges and related research to overcome those challenges, and try to separate what I believe to be the hype and reality in the future vision of additive manufacturing.

Click here for more details:(www.incose-cc.org)

Go to www.incose-cc.org/registration/ to register

Parsons Auditorium, Bldg 1
Johns Hopkins University Applied Physics Laboratory
11100 Johns Hopkins Road
Laurel, MD

Map and Directions

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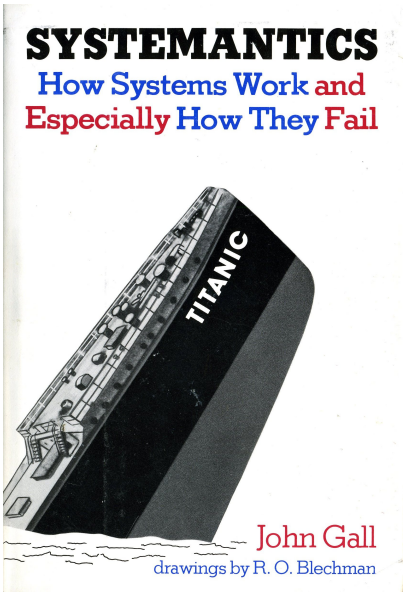
A Few Uncomplimentary Thoughts on Systems

by George Anderson



I enjoy reading just about anything non-fiction that is either old or relates to my broad technical interests. The only real exception to old books is the occasional textbook or manual. Not surprisingly over the years, I have acquired information that I realize may be applicable to the practice of Systems Engineering.

Not too long ago, a book entitled SYSTEMANTICS[1] came my way and presented a charmingly different discourse on the inherent limitations of systems. The author, John Gall, a medical doctor and faculty member at the University of Michigan presented a series of rules, theorems and axioms to describe system behaviors.

His definition of systems included humans, but argued that generalized rules should apply equally to the other components as well. These would include structural entities such as governments, companies, airlines and the complex technology used to execute their operations.

The strength of his work was in the examples he used to demonstrate the rules. Many, if not most, of the examples were negative in their view of systems capabilities or the ability to meet the designers' requirements. His introductory words are:

SYSTEMS IN GENERAL WORK POORLY OR NOT AT ALL (1:2)

The discussions of system dysfunction were entertaining but at the same time represented a challenge to many things that I thought were settled principles of systems thinking. The challenge was delivered in a forthright series of statements that fundamentally said: systems did not perform in the way we expect, the system opposes its own proper function and the system does not do what it says it is doing. These statements meant little until the

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This Newsletter is to serve our members and is open to all for contributions. Do you have an interesting idea for an article? A review of a new book related to engineering? Let us know. We'd love to hear about. It may wind up in a future issue of our Newsletter.

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author presented specific examples. (1:92-93)

For me, the best example dealt with meeting human needs. To paraphrase:

The goal was satisfying a desire for a fresh apple to eat.

- In the non-system case, a person goes to an orchard and picks a fresh apple off the tree.
- In the small system, a person buys an apple from a local merchant who gets the apples fresh from a local orchard perhaps 20 miles away.
- Finally, the big system is the supermarket chain that receives apples from thousands of miles away that are picked green and are ripened using a controlled process during transit that produces an apple that does not taste as good as the orchard fresh one. (1:37)

This is an example of Dr. Gall's Operational Fallacy or: "The function performed by a system is not operationally identical to the function of the same name performed by a man." And, "A function performed by a larger system is not operationally identical to the function of the same name as performed by a smaller system". (1.35)

An important final insight is: "….most of the things we human beings desire are non-systems things." (1:37)

This is a very powerful idea that is not always appreciated in designing large or complex systems and conversely explains the success of electronic systems gadgets such as GPS and Smartphones.

At no point did the author express optimism that systems could actually be without problems or meet their full capability. For instance, he is an early discoverer of the maxim that: "A complex system can fail in an infinite number of ways". (1:93) This is today related to Murphy's Law[2] or Metcalf's Law[3] and is the province of the Failure Modes & Effects (FMEA) methodology.

In all, there are 32 Basic System Axioms, Theorems and Corollaries that comprise Dr. Gall's science of SYSTEMANTICS. Of these, several would suggest positive rules for systems life cycle management. This strong bias towards the inherent limitations and misbehavior of systems is what makes this book stand out from others. Reading elsewhere, there are good design rules for technology, but when the human is placed in the system either as an individual or a group, most systems can become unstable and unpredictable.

I am reminded of my participation in the design and development of the A-10 aircraft back about the time this book was published in 1975. The preliminary design of the aircraft was sound but the human factors design of the cockpit controls took a long time to sort out. There was a great debate over automatic or manual changeover of the primary and emergency flight control systems in the event of hydraulic failure.

The systems designers employed all the arguments that are heard today for automation. The logistics and operations teams disagreed and supported a manual system. Today, we know that the automatic system was inherently a wrong solution. It took authority away from the pilot to choose the time of

changeover and it was a source of what we would call today latent undetected failures.

The manual system could be tested and, more importantly, the pilots were able to practice the flight control changeover during training flights. The automatic system did not have this feature and was activated using only the input from a single sensor.

Years later in the Gulf War, a female A-10 pilot, Captain Campbell had a loss of hydraulic pressure due to a missile strike and used the system to recover the aircraft and fly to her home airfield. She praised the manual system as working just as she had practiced in training.[4] The message here would seem to support Dr. Gall's Theorem that: New Systems Generate New Problems or Systems Should Not Be Unnecessarily Multiplied.

Overall, SYSTEMANTICS is a thought provoking look at the negative side of systems behavior and although the book is out of print, it has a growing following on engineering blogs. There are also later works that continue to refine Dr. Gall's rules and provide more examples of systems misbehavior.

My example of the A-10 aircraft manual flight control reversion system is just one example of the application of systems thinking that I have gained through my own varied engineering experience. I may be motivated by Dr. Gall's example to share more complex systems stories in the future.

In the meantime, I urge everyone to read Dr. Gall's book, SYSTEMANTICS, and find insight or validation in your own concepts of systems thinking while considering that:

GREAT ADVANCES ARE NOT PRODUCED BY SYSTEMS DESIGNED TO PRODUCE GREAT ADVANCES. (1:93)

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[1] By John Galt, Quadrangle/The New York Times Book Company, Inc., 1975)

[2] Stated as: If anything can go wrong- it will.

[3] Metalf's law states that the value of a network increases in proportion to the number of its nodes squared (N2). It also increases the complexity and failure modes by the same amount.)

[4] https://www.youtube.com/watch?v=F9DBckCiISE)

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Where Is Arthur Fry

by Zane Scott

We often think of creativity as the ability to envision the need for something that we create to fill that need. This is the classic "inventor" scenario. But creativity can also be the vision to see new uses for something that already exists.

Dr. Spencer Silver was a 3M Senior Research Chemist looking for a super-strong adhesive in his laboratory. Instead he produced a "low tack" adhesive that stuck with the application of pressure but, while it adhered with enough strength to hold paper in place, it was sufficiently weak to disengage without tearing the surfaces. In addition it would re-adhere repeatedly.

Silver saw the new adhesive as a spray product that could be applied to surfaces (like bulletin/white boards) allowing them to hold documents pressed (posted) on them. He evangelized his idea within 3M but got nowhere until a fellow researcher, Art Fry, heard his pitch. Fry sang in his church choir and used little pieces of paper to mark the morning's hymns in his hymnbook. He saw Silver's adhesive as a way to hold the bookmarks in place as he turned back and forth following the order of service. Instead of spraying the adhesive onto the receiving surface he applied a small amount to the bookmarks. They then stayed in place until intentionally removed at the end of the service.

As they say, "The rest is history!" and after some additional development work Post-It Notes became a huge commercial success for 3M. The point is that this success needed not only the genius of the inventor, Dr. Spencer Silver, but the vision of the researcher, Arthur Fry, who saw the adhesive in a whole new way.

In the systems engineering world we hold a powerful set of tools in our hands. Model-based systems engineering (MBSE) is a potent problem solving method especially in the company of a powerful tool like Vitech's CORE®. We owe a great debt of thanks to the intellectual giants like Jim Long who positioned us in a place of such power over our problem space.

But if we are to really unleash the true power of MBSE and its tools we need the Art Fry type vision that will allow us to see the method and tools in new ways. We need to recognize that Model-based Systems Engineering is really Model-Based Problem Solving!

What does that mean? In general parlance the term engineering implies a tangible "things" focus. In fact, the dictionary tells us that engineering is "the art or science of making practical application of the knowledge of pure sciences, as physics or chemistry, as in the construction of engines, bridges, buildings, mines, ships, and chemical plants." But the power of MBSE has a wider potential.

Systems are not just physical. Read Peter Senge's Fifth Discipline or Russell Ackoff's Redesigning Society. Both provide an excellent look at systems and why they are not limited to the physical. Airplanes and tanks and submarines are systems- but so are healthcare delivery processes and regulatory structures.

In an industry pointed primarily at a shrinking market sector we sorely need the "Art Fry" genius to leverage the "Spencer Silver" tools and methods we have at hand. It is a new way of seeing how we can serve customers and the new vision of who our customers might be that can expand our market space and economic possibilities. Are you out there Arthur Fry?

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HOW TO RECOGNIZE YOU HAVE A SYSTEMS PROBLEM

by John Thomas

As a senior manager, has this ever happened to you?

A senior executive finds "herself" faced with a product that is incurring major cost overruns or schedule delays. When she asks what the problem is, she's told, "The requirements keep changing." Or perhaps she hears, "A system component has to be significantly redesigned."

These responses could be indications that there is a problem with product quality, choice of technology, or manufacturability difficulties. But there's just as much chance that the culprit is a system problem.

To determine whether you do have a system problem, you need to perform three tests. These tests will show if delays and cost overruns are arising for one or two reasons. The first could be because the components of the product don't interface with each other as a system. This is analogous to putting together a child's bike. If the parts in the box don't fit, then you won't have something that looks like a bike.

The second could be due to incomplete requirements that went into building the components, which would result in a system not functioning as expected. In the bike example, even if the parts do fit, the bike may not work as intended. For instance, the bike doesn't stop properly because the brakes don't have proper contact with the wheels.

Test #1: Are the complaints of changing requirements primarily coming from the component builders? If so, the team that is responsible for the system design has not finished their work (completion of the design or integrity of the design). As with the bike analogy, the team is continuing to finalize the design of the bicycle. And as it does, the team realizes that the gears ordered from the component builder will make it too difficult to pedal. Trying to get it right, the technical team changes its requirements to the gear manufacturer.

Test #2: Are the cost overruns or schedule delays caused by the system not behaving as expected during system test-and-integration activities? If so, your technical team didn't have the time to ensure the interfaces were fully defined and properly described to the component builders. You might have components that fit together, but won't function as intended. As with the bike, you finish the assembly and discover that a rider can only pedal backward, due to the incorrect interface between the crank, the gear and the brake.

Test #3: Are the cost overruns and schedule delays arising because the user or investor is reporting that the system is not interacting with other systems as expected, and so expensive and time-consuming component fixes are needed to generate user or investor acceptance? The bike runs fine, but accessories, such as a standard aftermarket odometer, do not function properly.

If your answer is "yes" to any of the preceding questions, then your delays and cost overruns are probably the result of a system problem, and the root of the issue is the components were acquired before the system design was completed. The component builders have only a portion of the critical information they need to build proper components that will work within the system. So the built components either will not interface with each other, or will not have the integrated capabilities that would allow the system to function as it should. This will result in components and integration activities having to be reworked, often at great cost.

The risks associated with a system problem can be reduced if certain steps are taken before the project begins. If the senior executive is experiencing delays and cost overruns, she should ask herself: are there sufficient numbers of qualified system engineers, early enough, on the project? And equally important – do the systems engineers have the time to fully complete the design before the components are acquired? If not, the organization's programs will continually face delays and overruns.

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Upcoming Events and Announcements

- **May 20, 2015:** Dinner Lecture - 3D Printing; John Slotwinski
- **June 17, 2015:** Dinner Lecture - TBD
- **June 29 - 1 July, 2015:** Course on DoDAF 2.0 Modeling with IBM Rational System Architect V.11.4; by AVNET's Ed Vail
- Interested in Jobs Networking? Contact Mark Kaczmarek at mkaczmarekengr@comcast.net

Keep up with the latest news and events. Find out about our new Board of Directors. Explore our extensive library of previous lectures from our Monthly Dinner Meetings. Learn of the Benefits of Joining INCOSE. Check out Systems Engineering education in the local area. All this and more awaits you at our INCOSE Chesapeake Chapter Website.

For any comments or suggestions about this newsletter please e-mail our President, George Anderson or our Communications Director, Pat Williams. We value your feedback.

Board of Director Officers, 2015
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- Past President: Mr. Erik DeVito
- President Elect: Mr. John Boccio
- Treasurer: Mr. Kent DeJong
- Secretary: Mr. Mark Kaczmarek

Directors at Large
- Communications: Mr. Pat Williams
- Programs: Mr. Glenn Townson
- Membership Committee: vacant

Please use the Forward email link below so we can invite your friends to join our mailing list. Thanks in advance.

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