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# TWG Times

INCOSE TRANSPORTATION WORKING GROUP

## Welcome

Welcome to our spring 2016 edition of the INCOSE Transportation Working Group (TWG) newsletter.

This is our sixth newsletter and it is only possible with the volunteer support that our contributing members provide – thank you on behalf of the TWG membership! We wish to validate that our activities, and indeed the basic mission, of the TWG meets the needs of the membership. To that end we are organizing a member survey this year and look forward, in advance, to your critical input into that process.

We hope to see a lot of you in Edinburgh at the IS2016 event this year! It has been a few years since our international organization has met outside of Sector 1 and this will be a fantastic opportunity to strengthen relationships with colleagues and fellow transportation engineers in sectors 2 and 3, especially in advance of the IS2017 event being held in Australia next year.

The safety and security of modern interconnected Transportation systems are becoming ever more important and the TWG is increasingly interfacing with other working groups and encouraging the systems approach to improving this domain knowledge within the Transportation sector.

We look to you for guidance in our efforts over the coming months and also to help the TWG promote the use of Systems Engineering processes and tools throughout the world.

The next year promises to be an exciting period for all of our members – we hope you enjoy this 2016 Spring Newsletter and please pass it along to your colleagues or co-workers who might share an interest!

Yours in Systems,

**Dale, Nita and Simon**

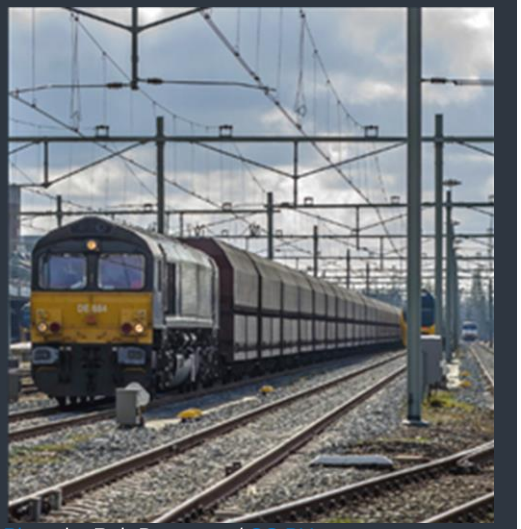

Photo by Rob Dammers / CC BY

## Transit SE: The View From the Field

By: Alain Kouassi, Parsons

Construction projects are generally designed around the use of CSI specifications format. These formats are fully established and aim to standardize design and construction specifications. The CSI format includes a MasterFormat which is a master list of numbered subject titles for organizing information about construction work results, requirements, products, and activities. This facilitates the common filing and retrieval format than is applied throughout the construction industry.

When a Design Build Contractor is hired to manage and build a project and as a result the entire CSI process, the Contractor is by default responsible for the integration of the specifications. These specifications are generally organized in Division levels. However, when several contractors or subcontractors are commissioned, the role of a party responsible for integration becomes a critical project issue that needs to be carefully managed by the Acquirer. This is prevalent in large infrastructure projects such as transportation systems deployments which include a significant number of interfaces and integration issues that need to be managed.

To resolve the integration issues caused by the complexity of interfaces and the lack of standard Integration specifications in typical design and construction specifications, some organizations have proposed the use of a Specification developed after the CSI format that focuses on integration. At the East Side Access project in Manhattan, NY, the General Engineering Consultant, as the Designer of Record, developed such specification focusing on integration to provide overall integration responsibilities to a contractor. This contractor was responsible for systems within its scope of procurement, as well as the integration between its systems and other project elements.

During the development of the Integration Specification, two school of thoughts emerged: one group from the design team wanted to specify integration under Division 1 specification. Another group thought that specifying integration under Division 1 would create an enormous risk. The argument the second group advanced was the general content of typical Division 1 (General Requirements) specifications.

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## this issue

# IW 16: Look Back

By: Jean Souza, Stellar Solutions

The 2016 INCOSE International Workshop was held in Torrance, CA. There was a lively and energetic TWG working session, where the TWG 2016 Annual Plan was presented and discussed. There was a TWG hackathon, in which live updates to the TWG website, Connect site and LinkedIn were made. And finally, the TWG partnered with Jesse Glazer of the US Federal Highway Administration (FHWA) and Phyllis Marbach of the INCOSE Agile Working Group to put on a very successful webinar.

In transportation, we are always keenly aware of who is representing an agency and who is representing a contractor. When the TWG puts on an event we want participation from public and government agencies as well as contractors and universities but often have to search for ways to get agency engagement. So when Jesse Glazer of the (US) came to me asking if INCOSE could partner to put on a webinar on Agile software development I was in. We could fill a critical need for our domain users and support TWG outreach simultaneously. However, we needed an expert in Agile software development so crossing the Working Group boundaries was in order. Phyllis Marbach, of the INCOSE Agile Working Group as well as the San Francisco Bay Area Chapter Transformational Systems Engineering Caucus (of which I am also a member), stepped up and thus the webinar "Bending Over Backwards- the use of Agile Systems Engineering on ITS Projects" was born.

Jesse, with his firm idea of the end product, worked with Phyllis (Agile), Ed Fok (FHWA), Jenn Russell, myself and Simon Smith. Simon provided the introduction, Jesse went over the role of the FHWA in software procurement, Phyllis presented "Introduction of Agile Methodologies "and "Comparing Traditional and Agile Systems Engineering." Ed Fok, wrapped up the session with "The Use of Agile Methods in ITS." Alan Benson said the following about the webinar:

"Since learning about agile at IS15, Caltrans has integrated agile development processes into our existing systems engineering lifecycle for the implementation of software. The IW16 TWG Agile webinar validated the reason for Caltrans to move to the new agile processes. The webinar gave us the final details on developing our new process, which has proven to reduce schedule and cost, along with quicker feedback from our system stakeholders." We considered this webinar a great success with roughly 200+ participants from the FHWA, state and local agencies, consultants and universities attending virtually and about 20 people attending in person. You can find the presentations to this webinar at the INCOSE TWG website and scroll down to "IW2016 Presentations."

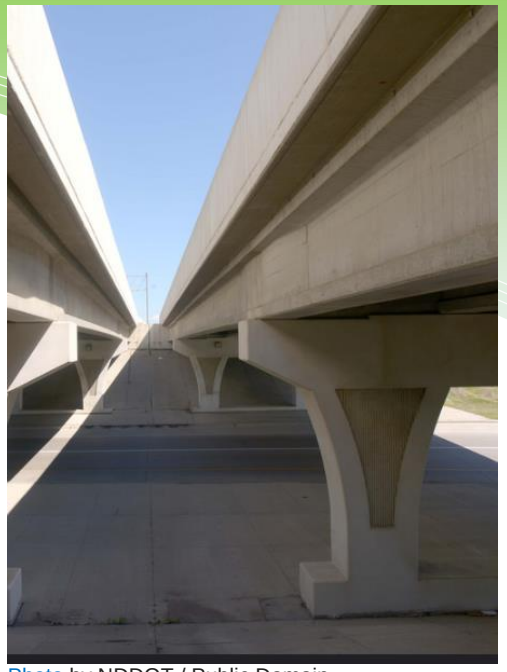

Photo by NDDOT / Public Domain

# TWG Action Plan 2016

By: Simon Smith, IBI Group

The 2016 TWG Action Plan has been released following a period of TWG member review. The Action Plan forms part of our three-year strategic plan and is updated yearly at the International Workshop by the steering committee with an opportunity for member collaboration through a conference call and a follow-on review period. The Action Plan describes our planned activities for 2016 against each of our four strategic objectives (defined in the Strategic Plan) and is organized by Steering Committee functional group (co-chairs, outreach, member services, administration and industry liaison). The Action Plan for 2016 is now available on the INCOSE TWG website.

# Supplier News

By: Konstantinos Vilaetis, New York Air Brake

The Rail Supplier Community has Systems Engineering principles deeply rooted in its core, always looking for ways to provide Systems that meet their customer's needs. This spans both development and application sides, aiming to innovate and improve operational efficiency of rail end users.

In 2016 there are a lot upcoming events that showcase amongst others, Systems & Systems Engineering from various Rail Suppliers while also providing networking opportunities for SE professionals.

1. APTA Rail Conference, Phoenix AZ, June 19-22 The schedule includes 6 different tracks with systems engineering interests in many of them.

2. APTA Annual Meeting, Los Angeles CA, September 11-12 This is the main APTA event, bringing together transportation professionals to engage in workshops and network.

3. InnoTrans 2016, Berlin Germany, September 20-23 This is a world-wide event, showcasing the latest in Rail Systems. Mobility 4.0 will be one of the panel discussion themes, including panelists from major rail suppliers.

4. RSI/CMA Rail Expo, Omaha NE, October 2-4, This Rail Supplier Institute and Coordinated Mechanical Association North America event includes educational technical sessions, as well as the latest and greatest exhibits from a variety of rail suppliers.

# Steering Committee Update

By: Simon Smith, IBI Group

The TWG organization chart sees the addition of two new roles this year, along with a new face and the return of a familiar one! New for 2016 are the Academic Liaison and Government Liaison roles. The Academic Liaison role aims to promote engagement with academic institutions across the globe to develop and deliver more systems engineering content in their courses, and promote SE within transportation as a viable career path. The Government Liaison role exists to engage government institutions and agencies (on the national, regional or municipal level) to promote the awareness and uptake of SE.


2016 also sees a new face and the return of a familiar one! Allison Ruggiero of New York City Transit's Systems Engineering team has joined the steering committee in the role of Administration (North America). Allison has already played an important part in keeping the TWG website and LinkedIn pages up to date, for which we are very grateful. Allison replaces Malcolm

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# Website is Live

**By: Allison Ruggiero, NYCT and Andrew Mark, Scott Lister**

**W**e're are happy to say that the Transportation Working Group webpage is up and running! Great efforts were made by the attendees of this year's INCOSE International Workshop to update and publish the new webpage on the INCOSE website. Come and check it out to learn about upcoming events like the TWG Program that is part of 2016 International Symposium and quarterly webinars presented by your fellow Systems Engineers, to access member-only Case Studies, and to review TWG At-Large Meeting Minutes and presentations from past IS and IW gatherings.

Additionally, please connect with the TWG on LinkedIn. This is a beneficial forum to interact with other individuals passionate about applying Systems Engineering practices, post discussions, share interesting articles, and even announce job openings within your agencies to interested members.

We'd like to encourage each of you to continue accessing the TWG webpage and LinkedIn resources to become more involved in INCOSE and TWG events, news, and topical discussions and spread the word about these sites to other interested individuals.

# IS16 Program

**By: Nita Rabadia, HS2**

**T**his year's International Council on Systems Engineering (INCOSE) International Symposium 2016 (IS16), is coming to the UK and will be held in Edinburgh from 18th to 21st July. The IS16 Technical Programme has been finalised. The IS16 Transportation Working Group Programme provides an overview of the related Transportation Papers/ Panel and Roundtables that will be held. There is a great line up this year.

These events are a great opportunity for listening/sharing ideas across different industry sectors (Academia/ Health Sectors/ Automotive/ Infrastructure and Transportation to name just a few), they also attract global participation from key government agencies/suppliers and those who are looking for networking opportunities to enhance their knowledge and careers.

# Upcoming Webinars

**By: Rhianne Evans, Birmingham Centre for Railway Research and Education**

• 27th May, "Connected Vehicles – Reference Architecture and Tools" Tom Lusco and David Binkley, ITERIS

• 29th July, "Steampunk System of Systems Engineering: A case study of successful System of Systems engineering in 19th century Britain" Rhianne Evans, University of Birmingham

• September "A Holistic Program Life-Cycle Approach to RAM - Insights .. from California High-Speed Rail" Oliver Hoehne, WSP PB

• December "SE & Integrated Corridor Management" Alan Benson, Caltrans

Subscribe to the TWG Youtube channel.

# TWG program for IS16

**T**he International Symposium 2016 (IS16) is fast approaching and as always the TWG has an exciting program of events planned. The TWG flyer is below - see you in Edinburgh!

**Saturday, July 16 and Sunday, July 17**

*All Day* — Systems Engineering Tutorials throughout weekend; topics include: *Architecting SoS; Building SE Business Case; Integrating Agile Development; Systems Resilience Fundamentals; SE Trade-Off Analyses*

Corporate Advisory Board Meetings *(CAB representatives only)*

*Sunday 1600-1830* — Join TWG members for evening drinks and networking *Thomsons Bar - 182-184 Haymarket Terrace, Edinburgh EH3 8EB*

**Monday, July 18**

*1330-1445* — Selling Systems Engineering by Searching for the Sweet Spot *(Richard Beasley and Anne O'Neil)*

*1530-1655* — **Transportation Roundtable Part 1:** Unravelling complexity: how transportation is tackling systems issues in multi-project, multi-contract deliveries *(Meg Downing – Highways England, Derek Price – Network Rail Infrastructure Projects, Nick Facchina – Sydney Trains, Andrew Hunter – Thales)*

**Tuesday, July 19**

*0800-0930* — **Keynote:** Energy as a System *Prof John Loughhead, Chief Scientific Advisor, Department of Energy and Climate Change, UK*

*1000-1210* — **Transportation Panel :** Verification and Validation Applications and Limitations in Civil Infrastructure Projects - The Case of US and European High Speed Rail Projects *(Alain Kouassi, Oliver Hoehne, Nita Rabadia - HS2, Marco Ferrogalini - Bombardier and Matthew Hause)*

*1330-1410* — Case Study: A Model Based Systems Engineering (MBSE) Framework for Characterising Transportation Systems Over the Full Life Cycle *(William Scott, Gary Arabian - TfNSW, Richard Fullalove - TfNSW and Peter Campbell)*

or **Panel:** Developing Junior SEs - a global comparison of different approaches in different sectors *(Duncan Kemp; Clive Roberts, Charles Critchett, Meaghan O'Neil Dale Brown)*

*1415-1455* — Developing and implementing systems engineering and project management processes at CSIT - a small Canadian company in public transportation *(Claude Laporte, Nicolas Tremblay, Jamil Menaceur and Denis Poliquin)*

or A framework for integrating reliability and systems engineering: proof-of-concept experiences *(Hossein Neizan Hosseini and Torgeir Welo)*

*1530-1610* — UK Railway System Performance – Gaining Insight Through Systematic Analysis and Modelling *(Bradley Hyland, Amir Toossi, Nigel Best, Amy Bradford: Network Rail)*

or Impact of System Integration on Reliability and Maintainability *(James Armstrong)*

*1615-1655* — Infrastructure/Train Borne Measurements in support of Railway System Performance Modelling *(Lloyd Barson, Amir Toossi, Wilson Fung: Network Rail)*

*Evening* — Transportation Working Group Dinner - Join us for networking with colleagues over dinner at A Room in the West End. *RSVP required to Sue Fursey, Sue.Fursey@hs2.org.uk*

**Wednesday, July 20**

*0800-0930* — **Keynote:** Smart Cities *Julie Alexander, Director for Urban Development, Siemens*

*1045-1125* — The future of systems integration within civil infrastructure: A review and directions for research *(Jennifer Whyte)*

*1330-1455* — **Panel:** Systems integration in civil infrastructure *(Jennifer Whyte)*

or **Panel:** Making SE happen in your organization: the Learning Journey *(Tim Ferris; Richard Beasley, Alice Squires, Hillary Sillitto, Andy Bourne (TfL LUL), Anne O'Neil)*

*1530-1730* — **Transportation Roundtable Part 2: Introducing and utilizing Systems Engineering in transportation agencies and major programs** *(Paul Thomas - London Underground, Melissa Jovic – Transport for New South Wales, David Traub-Warner – IBI Group / Tel Aviv Red Line Underground Stations Design Project)*

*Evening* — INCOSE Conference Banquet

**Thursday, July 21**

*1000-1210* — TWG Working Session *Join your TWG colleagues for a working session to contribute to IS2017 preparation and advance working group objectives.*

# Member in Focus: Laura Uden, President, NSI Engineering

By: David Rojas, SFMTA

*Laura Uden, PhD, PMP, CMQ/OE, CSEP, is President of NSI Engineering. NSI consults in the fields of construction and transit project management, business process definition and improvement, and design quality assurance and quality control. Projects include a Bay Area Rapid Transit (BART) extension and High Speed Rail design.*

**DR: I associate quality assurance with the manufacturing/construction phases of a project. What type of improvements can it make in the conceptual and detailed design phases of infrastructure projects?**

LU: Most of work that that we do involves early project development phases. My company is primarily focused on the design side of quality assurance, although we perform quality management for construction as well. There are two components to quality management: quality assurance and quality control. Quality assurance involves setting up methods by which quality happens. Quality control is the actual checking and testing activities. Our role includes design of quality management procedures, staff training, and auditing against procedures. As soon as a procedure is written, you have QA involved. For example we are currently supporting a project to develop procurement documents for the modernization of the BART (Bay Area Rapid Transit) train control system. The QA team is developing procedures to make sure that the specifications are checked, that there is a process for issues to get resolved, and that client comments are incorporated. These procedures need to meet certain requirements. For projects receiving federal dollars, the FTA Guidelines, which are based on the ISO 9001: 2008 requirements, suggest that fifteen quality elements be incorporated into the Quality Management System.

**DR: What outcomes, tangible to the client, can robust quality assurance make?**

LU: Owners can have confidence that what is designed and built meets project requirements and any local or federal standards. The owner can also be confident in the continued viability of the project through the operations and maintenance phases. The general public can have more confidence that project will be safe and sound. For example, some of the failures occurring in the western span of the San Francisco-Oakland Bay Bridge represent the failure of management to heed warnings about quality issues. When a comprehensive quality management system is in place, which includes procedures for how quality issues are documented and resolved, this is less likely to occur.

**DR: How can quality assurance improve system engineering processes?**

LU: Quality assurance is actually one of the systems engineering processes, as described in ISO/IEC 15288:2008 and the INCOSE Systems Engineering Handbook. For the work experience portion of my Certified Systems Engineering Professional (CSEP) application I primarily described my work in quality assurance.

**DR: Describe the state of quality assurance at typical organization you have consulted for?**

LU: This is a hard question to answer. The nuclear power, pharmaceutical, automotive, and medical device industries have a developed a high capability: the construction industry is pretty far behind in comparison. Government agencies that are undertaking infrastructure projects do not have to worry about competition. The agencies are implementing quality programs now, but this push has been partially due to the publication of the FTA 2012 Quality Management System Guidelines, which are based on ISO 9001. From the provider side, to move the state of quality in the construction industry forward requires the Contractors establish more rigorous procedures, develop QC checklists, and build in quality activities (QC and QA) into the project schedule. More Contractors are developing corporate quality systems, which is helping ensure consistency across projects. From the owner side, it just requires that the agencies decide that quality an important focus, and include additional requirements in their contractual documents. The California High Speed Rail Authority (CHSRA) is a good example of a project that is advancing the state of the art of quality and not just implementing the basics. The Authority is using Malcolm Baldrige Quality award criteria as their basis for performance in this area, and is trying to implement lean principles even within their own processes.

**DR: How are these quality systems maintained after you leave?**

LU: It's not easy for us as a Subcontractor to ensure quality systems are maintained on other projects going forward: we can normally only influence the projects we work on. One way we've been able to influence future projects is that, in some cases, the agencies have liked our quality systems so much they required their use by other Primes on future projects. The construction industry is a project-oriented industry. Within construction companies and consulting firms there is sometimes very little sharing of best practices and lessons learned, so it can feel like each project is starting over with a blank slate. Organizations may hire a quality consulting firm for one project and drop quality efforts in subsequent projects. Unless the Contractors develop corporate level quality procedures you cannot ensure the same level of quality will be maintained project to project.

**DR: What sort of tools do you use day to day?**

LU: We don't have any special software tools. For the most part, our tools are procedures, forms, and checklists written using Word or Excel. In some organizations or with some types of projects, certain software is used by the client which we can draw on for our quality checklists. For example on the BART train control modernization project and on the High Speed Rail Program, DOORS is being used to track the implementation of requirements for the entire lifecycle of the asset. We also do statistical analysis for trending of the measurements we've collected, to see if certain types of issues are trending upward and need to be addressed, and if they are, we do a root cause analysis. But most of this work can be done using the basic Microsoft Office Suite..

**DR: What was your first "big break" into transportation quality engineering?**

LU: My Bachelor's degree is in Industrial and Systems Engineering, so my courses focused on quality. My start with quality assurance began when I worked

*(continued on pg. 6)*

***(Kouassi, continued)***

Most design and construction engineers do not tend to review carefully Division 1 specifications. The industry looks at the set of General Requirements as specifications that are addressed by program and project management teams, not engineering nor construction teams.

As integration starts during the design and continues throughout the project development lifecycle, it may be prudent to separate out general requirements which include price and payment procedures, administrative requirements, mobilization requirements etc, from technical requirements that involve functions, performance, operations, logic, etc. The final solution for the East Side Access project was to develop a stand-alone Integration Specification. This specification was included in Division 13 – Special Construction. This division was used because it appeared to be most appropriate element of the MasterFormat for the project.

During the execution of the construction process, several individual contractors found it hard to respond to another entity in charge of integration. Although language existed in the specifications to indicate other contractors were required to collaborate with the entity in charge of integration, that contract requirement was very difficult to enforce. The Project Acquirer was obligated to be involved in the role of integration to make sure that all parties were working together.

This example shows that standardizing the use of the development of an Integration Specification in traditional Division level CSI specification could prove beneficial to the transportation and construction industries, especially considering the complexities and long life cycle of infrastructure projects.

***(Smith, continued)***

Thomas of WSP-PB who was supporting TWG Administration for 2015, thank you Malcolm for your help. Allison is joined this year by Andrew Mark, of Scott Lister. Andrew has re-joined the steering committee in the role of Administration (International) after a brief hiatus in which he changed companies and had a baby! Congratulations Allison and Andrew and welcome aboard.

***(Rojas, continued)***

for the Electrical Power Research Institute (EPRI) doing process improvement work in various power plants. Process and quality fit together really well. Then I was part of a team working for Lockheed on a proposal for a nuclear powered spacecraft. Based on that experience, I began working on quality assurance for the BART Extension to the San Francisco Airport.

**DR: How does PMP certification translate to your day to day work?**

LU: The certification translates directly into my day to day work. One of the problems the construction industry has is that quality is not valued as much as the other aspects of project management. Organizationally, per FTA requirements, the Quality Manager is supposed to report at an equal level with the PM, reporting to the Principal in Charge. Many firms don't include quality representatives in regular project management meetings, and do not consider the Quality Manager to be a lead on the team. We're trying to change that situation, increase the appreciation of quality as an equal partner on the PM team. Being able to speak PM language is critical to being considered part of the project team. On High Speed Rail, we're working to integrate quality with risk management, which is compliant with the change in the ISO 9001 standard from the 2008 version to the 2015 version. Many project risks are risks about not meeting project requirements, and quality is defined as meeting client requirements.

**DR: Is there value in systems engineering master's degree? Too theoretical?**

LU: My Master's degree is in systems engineering management, and I was fortunate to be able to design much if it myself, as it wasn't an existing degree. As a student I wanted to focus on improving entire systems instead of individual processes. For my thesis I looked at the Industrial and Systems Engineering program holistically, from the curriculum to advising to departmental management, and identified areas for improvement. It included identifying gaps in the curriculum, as it didn't actually contain much system engineering coursework, developing improvements based on flowcharts, surveys and research, implementing changes, and measuring the impact. In general, I would say there's a real value in an SE Master's Degree, and every engineer should have at least once SE course, as it would lead to more people understanding and discussing the SE lifecycle, including the Vee Diagram. Although we don't always discuss it in that fashion, the work in the Vee Diagram happens on every construction project: the requirements are provided in the contract documents and in professional, national, and local codes and standards, the requirements are checked to be in the design documents through the QC activities and checklists, and verified through the QA audits, and the testing and inspection ensure the requirements exist in the constructed product. SE as a concept is great – one of our challenges is how to explain it in layman's terms so more people understand and apply the concepts.

*I'd like thank Laura for taking time out of her busy schedule to talk. Thanks Laura!*

# IS17 Look Ahead

**By: Simon Smith, IBI Group**

**A**lthough our minds are very much on the forthcoming Symposium in Edinburgh this summer – looking to next year, the Symposium travels to Adelaide, in Australia. Adelaide, which was voted Australia's best city in 2014, is known for its wine and beaches. From a TWG perspective, we are starting to organize our thoughts for IS17 and have identified a small group of locally-based TWG volunteers who will support us with local logistics and planning. From your perspective: start thinking about Adelaide now and how you might support your business case for travel, and remember the deadline for submissions of IS17 papers and panels is **November 2016**. Don't leave it until the last moment to write that paper!

# And finally.....

## A Growing Library of Case Studies

**By: Bruce Elliott, Altran**

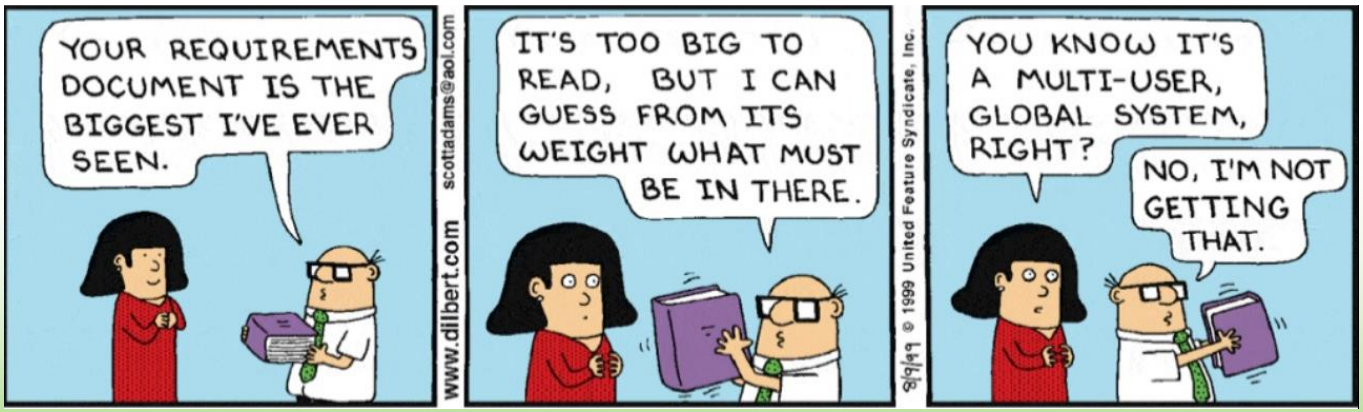
The TWG Case Studies sub-group is pleased to welcome Kenneth Diemunsch as a new member. Kenneth is working with Bruce Elliott, Kevin Fehon, Bob Gave and Jonathan Hulse to extend the TWG library of case studies. You can find the case studies on the TWG Connect Site. The current version has 14 Transportation case studies and, for comparison, 1 case study from another domain. A typical case study is 2 or 3 pages in length, describes a project on which SE (or some part of SE) was applied and explains how this application made the project turn out better.

The library is designed to help you explain the benefits of SE to audiences – perhaps work colleagues or managers – who, while interested in SE, find it difficult to see its benefits clearly. Do, please, make use of this resource.

The TWG sub-group assembles each case study by carrying out a structured interview with senior members of the project over the phone and then writing this up, for checking by the interviewees. This makes the process painless for the project staff and provides some objectivity and consistency in the case studies.

We did recently enter a lean period, with few projects to talk to. However, this seems to have come to an end. We have carried out three interviews this year, with a US highways projects, a US metro project and a UK heavy rail project, and hope to add these to the library soon.

We do have further projects to talk to but we are always looking for more. If you are aware of any transportation projects that might provide a basis for future case studies, Bruce Elliott would be pleased to hear from you. It does not matter if the contributing project did not carry out a comprehensive programme of SE activities; if the experience illustrates the value of a single aspect, such as sound requirements management, then it will advance the cause. To suggest a case study or to ask questions, please contact Bruce at bruce.elliott@incose.org or bruce.elliott@altran.com.

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