

# PPI SyEN

SYSTEMS ENGINEERING NEWSJOURNAL

150th Edition | FEB 2026

## *AI in Engineering: Acceleration Without Abdication*

### FEATURE ARTICLES

AI-enabled Requirement  
Structure Patterns

When AI Enters Engineering  
Practice: Responsibility in the  
Age of Persuasive Machines





**EDITORIAL STAFF**

*Editor*  
John Fitch

*Editor-in-Chief*  
Robert Halligan

*Managing Editor*  
Francois Retief

**PRODUCTION STAFF**

*Marketing Manager*  
Rebeca Verhagen

*Graphic Designer*  
Matthew Wong

*Publishing Assistants*  
Trudy King  
Joshua Nagra

**PUBLISHER**



Project Performance International  
2 Parkgate Drive  
Ringwood, Vic 3134 Australia  
Tel: +61 3 9876 7345

Tel UK: +44 20 3608 6754  
Tel USA: +1 888 772 5174  
Tel China: +86 188 5117 2867

[www.ppi-int.com](http://www.ppi-int.com)

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**WELCOME**

**This month, we mark the 150th edition of PPI SyEN.**

The first PPI SyEN was eight pages long and published on 15 October 2008. It remains available on the PPI website. The feature article was a commentary by Robert Halligan, PPI's founder, on Dr. Richard Turner's paper "*Toward Agile Systems Engineering Processes*", reflecting a shift from plan-driven to more iterative approaches. Robert welcomed agile, but cautioned against discarding established engineering principles at the risk of avoidable rework.

Seventeen years and four months later, we face another major shift. Not simply a change in lifecycle strategy, but the emergence of systems that can generate language, structure arguments, and frame decisions at scale.

We are entering the age of persuasive machines.

The risk, as in 2008, is not the new method itself. It is what we abandon in our haste to adopt it.

In this edition, our first feature article *When AI Enters Engineering Practice: Responsibility in the Age of Persuasive Machines* argues that AI governance is now a practical engineering concern. When tools draft, analyse, and persuade with fluent confidence, they shape reasoning before decisions are framed.

The question is not whether AI will be used, but how responsibility and disciplined oversight will be preserved amid increased velocity.

John Fitch's second feature article examines this within the context of requirements engineering. His comparison of EARS and the PPI Requirements Parsing Template under AI assistance shows that models can accelerate refinement, but only within strong structural boundaries. Discipline determines whether AI strengthens or weakens outcomes.

Syenna's "Final Thoughts" asks a more complex question. If AI shifts engineers from creators toward reviewers, how will the next generation develop the depth required to guide these systems?

Persuasive fluency increases volume. It does not replace judgment.

Across 150 editions, PPI SyEN has emphasised structure, traceability, and accountability in the face of complexity.

Human judgment remains the scarce resource.

Francois Retief,  
Managing Editor

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Views expressed in externally authored articles are not necessarily the views of PPI nor its professional staff.

<p><b>PPI Systems Engineering News journal (PPI SyEN) seeks:</b></p> <ul style="list-style-type: none"> <li>➤ To advance the practice and perceived value of systems engineering across a broad range of activities, responsibilities, and job descriptions</li> <li>➤ To influence the field of systems engineering from an independent perspective</li> <li>➤ To provide information, tools, techniques, and other value to a broad spectrum of practitioners, from the experienced, to the newcomer, to the curious</li> <li>➤ To emphasize that systems engineering exists within the context of (and should be contributory toward) larger social/enterprise systems, not just an end in itself</li> <li>➤ To give back to the Systems Engineering community</li> </ul>	<p><b>PPI defines systems engineering as:</b>  <i>An approach to the engineering of systems, based on systems thinking, that aims to transform a need for a solution into an actual solution that meets imperatives and maximizes effectiveness on a whole-of-life basis, in accordance with the values of the stakeholders whom the solution is to serve. Systems engineering embraces both the technical and management dimensions of problem definition and problem-solving.</i></p>
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# SYSTEMS ENGINEERING NEWS

*Recent events and updates in the field of systems engineering*

## New PPI Workshop: Artificial Intelligence for Systems Engineering (AI4SE)



In response to the rapid integration of artificial intelligence into engineering practice, PPI has launched a new 8-hour workshop: **Artificial Intelligence for Systems Engineering (AI4SE)**. The

workshop addresses both the opportunities and the governance challenges associated with applying AI tools within structured systems engineering processes.

As Large Language Models and related technologies become embedded in activities such as requirements development, analysis, trade studies, and verification planning, disciplined application becomes critical. AI4SE has been developed to equip engineering professionals with practical techniques for leveraging AI effectively while preserving accountability, traceability, and engineering rigor.

### Workshop Focus

The workshop introduces structured methods for applying AI within established systems engineering workflows, with emphasis on:

- AI-assisted requirements analysis and refinement
- AI-assisted system architecting
- AI-assisted derivation of subsystem requirements
- Structured prompt engineering techniques
- Identification and correction of AI-generated defects and contextual drift
- Governance considerations and organizational safeguards
- Maintaining professional responsibility in AI-enabled environments.

Consistent with PPI's longstanding emphasis on systems thinking, discipline, and accountability, AI4SE is designed to build responsible engineering capability in AI-enabled environments. Designed for engineers, technical leaders, and engineering managers, the workshop supports organizations seeking to balance acceleration with oversight.

Further information, including delivery formats and upcoming sessions, is available [on PPI's website](#).

Follow PPI on [LinkedIn](#).

### Systems Engineering Research Center (SERC) Updates



The [December 2025](#) update from the Systems Engineering Research Center (SERC) highlights this organization's research-driven contributions to systems engineering practices. Project updates from SERC's partner agency, the Acquisition Innovation Research Center (AIRC), are also published in these editions. Research highlights are summarized below.

#### [Optimized Portfolio Digital Engineering Transformation](#)

To keep pace with accelerating technological change, defense acquisition needs to shift to a seamless environment where system data and models are authoritative, reusable, and shared across the lifecycle. Current practices are based on human expertise and document-driven processes, leading to inefficiencies, rework, schedule delays, and cost overruns. It is critical to evolve toward dynamic, context-aware, model-based, and artificial intelligence (AI)-assisted methods.

Task overview:

- Develop a transformation framework.
- Assess the current state (circa 2025), future state (circa 2035), and potential steps in between.
- Synthesize actionable recommendations for the transformation of systems engineering methods, infrastructure, and workforce.

Recommendations include:

- Prioritize agentic AI.
- Embed governance early.
- Pilot now, scale later.
- Define success metrics.
- Strengthen security and cyber resilience.

Read the [Technical Report](#).

#### [Modernizing the DoD Requirements Process](#)

Completed in November 2025, this AIRC project delivered reports on two topics:

- [Task 1](#): Highlight the differences and similarities, and the strengths and weaknesses of the parallel Department of Defense (DoD) Component requirements approval models and their relation to the Adaptive Acquisition Framework (AAF) pathways. Provide input on developing recommendations to improve the Joint Capabilities Integration and Development System (JCIDS) process. View the complete [Task 1 report](#).

- [Task 3](#): Provide a Rough Order of Magnitude (ROM) to estimate the effort to create a new career field in the DoD focused on requirements. View the complete [Task 3 report](#).

### [SE + AI: Defining the Future of Engineering](#)

In November 2025, AIRC Deputy Chief Scientist Dr. Doug Buettner spoke on this topic during a panel organized by INCOSE Wasatch Chapter and the University of Utah. View the 83-minute video [here](#).

### [AIRC Insights](#)

In March 2026, AIRC will launch a new channel for sharing research recommendations with the acquisition community. *AIRC Insights* will be a monthly, virtual, interactive session that brings together thought leaders from government, industry, and academia to discuss strategic acquisition transformation topics.

Access the latest SERC news [here](#).

Follow [SERC on LinkedIn](#).

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## INCOSE News

The organizational news and highlights found in the INCOSE [Q4 2025 Members Newsletter](#) that was published in December have been overtaken by the passing on January 6, 2026, of Dr. Barclay R. Brown (1958–2026), whose two decades of volunteer service to INCOSE include:

- Secretary of the Washington Metro Area chapter
- Americas Sector leadership
- INCOSE Board of Directors
- INCOSE Chief Information Officer (CIO)
- Master of Ceremonies for IS 2015 (Seattle) and IS 2018 (Washington, D.C.)
- Creator and chair of AI Systems Working Group
- Creator and chair of Systems Engineering Quality Management (SEQM) Working Group
- Guidance and inspiration for many additional initiatives.

Dr. Brown held many significant roles in industry throughout his career, including:

- IBM, Global Solution Executive for the Aerospace and Defense industry
- Raytheon, Engineering Fellow
- Collins Aerospace (RTX), Senior Technical Fellow and Associate Director for AI Research
- NASA, Research Leader, Generative AI technologies for Systems Engineering.

View Dr. Barclay Brown's obituary [here](#).

### Other news

As might be expected, an organization such as INCOSE regrouped and continues its mission despite the loss of key contributors. Here are some recent newsworthy items from the chapters, working groups, and initiatives:

- The [New Zealand chapter](#) hosted the country's first Systems Engineering Conference in Auckland in November.
- Members of [JCOSE](#), the Japan chapter, contributed to the publication of the Japanese translation of the INCOSE Systems Engineering Handbook.
- The [Enchantment](#) and [Michigan](#) chapters hosted a joint event in October to take advantage of the complementary strengths of their defense and automotive industry members.
- The [Canada](#) chapter hosted two in-person Meet & Greet events in Toronto and Montreal as part of their growing outreach across the country.
- The [Brazil](#) chapter hosted the INCOSE Brazil Conference 2025 in October.
- A joint INCOSE Working Group session in November, led by the [AdaptSEM Working Group](#), enabled various working groups to share their accomplishments and ongoing projects.
- The [Materials in Systems Engineering \(MATSE\)](#) Working Group is investigating the root causes behind the exclusion of materials in front-end systems engineering activities.
- The [Configuration Management Working Group](#) (CMWG) provided numerous contributions to systems engineering publications and industry standards during 2025.
- The [INCOSE SE Lab](#) continues growth in vendors (16), tools (35), and users (700+), fueled in part by the SE Lab Demo Day webinar series.

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### Resilience Engineering Association (REA) News



Resilience Engineering is a trans-disciplinary perspective that focuses on developing theories and practices that enable the continuity of operations and societal activities to deliver essential services in the face of ever-growing dynamics and uncertainty. The [December 2025 newsletter](#) of the [Resilience Engineering Association \(REA\)](#) shared recent progress made by the members of this global community.

#### Joint REA Symposium and Resilient Health Care Society Meeting

This conference took place in Canela, Brazil, from 20 to 24 October, with over 120 participants engaging around the theme, *Collaboration Across Boundaries for Adaptation in the Era of Complexity*.

Symposium proceedings are available [here](#).

#### REA webinar series returns

The REA webinar series returned on 18 December 2025 with two presentations on the theme of [Human-machine teaming and anticipatory decision-making](#):

- Hardening Human-Machine Teams Against Misinformation & Manipulation
- Anticipatory Air Refueling.

Download papers [here](#).

### [Upcoming Events](#)

The REA highlights multiple events that may be of interest to the RE and broader systems engineering communities in 2026:

- [Applied Ergonomics Conference](#) (9-12 March in Arlington, Texas, USA)
- [International Symposium on Human Factors and Ergonomics in Health Care](#) (22-25 March in New York, NY, USA)
- [Human Factors and Ergonomics Society – Europe Conference](#) (22-24 April in Copenhagen, Denmark)
- [European Safety and Reliability Conference](#) (14-19 June in Braga, Portugal).

See prior REA Newsletters [here](#).

[Learn more](#) about the REA. Connect with REA on [LinkedIn](#).

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## PDMA News



The [Product Development Management Association \(PDMA\)](#) ended 2025 on a strong note and looks forward to another year of strengthening its members' capabilities and those of the broader innovation and product development community. Some items of interest include:

### *[Organizational growth](#)*

PDMA has announced the official launch of two new chapters, [PDMA Seattle](#) and [PDMA San Francisco \(SF\) Bay Area](#). The SF Bay Area chapter's inaugural event included a talk on the hot topic of *Product Management in the Age of AI*.

PDMA recently concluded a comprehensive [Job Task Analysis \(JTA\)](#) during which hundreds of community members completed a survey on the organization's programs and services to ensure alignment with current industry trends.

New members to the PDMA [Board of Directors](#) include Keyuri Anand, Samina Asghar, and Nishant Parikh.

### *[Global Student Innovation Challenge](#)*

The submissions portal for the 7<sup>th</sup> [Global Student Innovation Challenge \(GSIC 2026\)](#) is now open. The challenge encourages and supports students developing novel, real-world offerings - including products, software, or services.

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### Modelica Association News



[Modelica](#) is a freely available, equation-based, object-oriented language for convenient and efficient modeling of complex, multi-domain cyber-physical systems described by ordinary differential, difference, and algebraic equations. The [Modelica Association](#) is a non-profit organization that develops coordinated, open-access standards and open-source software for cyber-physical systems. Highlights from the Association's ([December 2025](#)) newsletter are found below.

#### [Board Highlights](#)

A report from Dirk Zimmer, Modelica Association Chair, highlighted the 16th International Modelica & FMI Conference, which took place in Lucerne, Switzerland, in September. Download the [conference proceedings](#) and [keynote presentations](#).

Zimmer also continued his emphasis on the growth of Modelica usage in China and announced the appointment of Dr. Rui Gao as Secretary of the Board. Gao is also focused on organizing the upcoming Asian Modelica Conference.

The Association has launched a Teaching Initiative, introduced via a series of [social media articles](#).

#### [Conferences and User Meetings](#)

The Association looks forward to its two primary [2026 events](#):

- 21-22 September: [Asian Modelica & FMI Conference](#) in Hangzhou, China
- 12-14 October: [American Modelica & FMI Conference](#) in Atlanta, Georgia, USA.

The 17th International Modelica & FMI Conference will take place in Prague, Czech Republic, on 20-22 September 2027.

#### [Functional Mock-up Interface \(FMI\) News](#)

The FMI track at the 16<sup>th</sup> International & FMI Conference had a significant increase in participation, with key takeaways:

- FMI use is widespread and growing, with FMI 3.0 gaining in tool support and level of usage.
- The Layered Standard concept has been well received.
- FMI-related papers, tutorials, and industrial user presentations are available [here](#).

Progress continues on the FMI Layered standards with:

- Extension of FMI Layered Standard for Network Communication (FMI-LS-BUS) from CAN (v1.0) to FlexRay, Ethernet, and LIN
- FMI Layered Standard for Structured Data (FMI-LS-STRUCT) entering beta stage
- FMI Layered Standard for reference (FMI-LS-REF) nearing alpha release.

### [Modelica Vendor News](#)

[Dassault Systèmes](#) has released [Dymola 2026x](#) with enhanced libraries, improved simulation efficiency, and a text editor for defining variables.

[orchideo | easySSP](#) v1.4.4 has been released with support for:

- Workflow creation and maintenance
- Direct connection of AI agents as an SSP project co-pilot
- Numerous capability and usability enhancements.

[orthogonal supersystems GmbH](#) has released major updates across its [ODE engineering suite](#) and launched a new independent platform, [Transfer](#).

[Siemens Digital Industries Software](#) has released [Simcenter Amesim 2511](#), featuring an improved help browser, a new licensing and deployment model, AI-enabled chat, and enhanced user experience with the Sketch Animations feature.

[XRG Simulation](#) has released:

- HumanComfort Library 2.20.0 with a 3D Ground (soil) model that supports complex foundation designs.
- HVAC Library 3.5.0 with a comprehensive Data Center Cooling Simulation Model.
- ClaRa+ Library 1.8.0 with liquid systems modeling that supports energy system simulations.

View details of these and other announcements in the latest [Modelica Association newsletter](#).

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## System Dynamics Society 2026 Leadership News



The System Dynamics Society (SDS) has announced updates to its 2026 leadership team. Noteworthy changes include:

- [Scott Rockart](#) takes over as President in 2026 from [Asmeret Bier Naugle](#). Scott is an Associate Professor of Practice at Duke University's Fuqua School of Business, working on business research with energy and manufacturing firms.

New Policy Council members-at-large include:

- [Ke \(Koko\) Zhou](#), research fellow at University College London (UCL)
- [Min-Ren \(Aaron\) Yan](#), Faculty Director of Digital Innovation and Sustainability Institute at National Chengchi University and President of the SDS Taiwan Chapter
- [Scott Johnson](#), system dynamics consultant (Founder, SysDynX, LLC) and educator (University of North Dakota)
- [Steve Smith](#), Director of Flight Systems at BLUE ORIGIN, US.

See the [SDS 2026 leadership announcement](#).

View the full set of [SDS officers and Policy Council members](#).

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### IISE Modeling and Simulation News



The [Modeling and Simulation Division](#) of the [Institute of Industrial and Systems Engineers \(IISE\)](#) has published its [December 2025 newsletter](#).

Dedicated to advancing the state of the art in modeling and simulation, President David Claudio (University of Massachusetts Lowell) reported that during 2025, the Division showcased cutting-edge research and practice across many domains, including:

- Artificial intelligence and machine learning in simulation
- Digital twins
- Healthcare systems
- Transportation and logistics
- Supply chains and scheduling
- Manufacturing
- Agent-based systems modeling.

Division priorities for 2026 include:

- Inclusivity and community building
- Transdisciplinary collaboration
- Visibility, impact, and professional development.

Award winners from the 2025 Annual Conference were announced:

- Teaching Award - Dr. Chrysafis Vogiatzis, University of Illinois
- Teaching Award - Dr. Eduardo Pérez, Texas State University
- Best Student Paper Award - Bates Bennett, Gavin Denton & Dr. Seunghan Lee for *Modeling and Predicting Traffic Congestion During Wildfires with Hidden Markov Models*
- Best Student Paper Award - Shafiqul Islam & Dr. Bahram AsiaBanpour for *Machine Learning Model Development for Optimizing Surface Temperature of TPMS Geometries in Atmospheric Water Generation Systems*.

The Modeling and Simulation Division is one of many communities that make up the IISE. Investigate the complete set of IISE communities [here](#).

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### SEBoK Together Initiative



The [Guide to the Systems Engineering Body of Knowledge \(SEBoK\)](#) provides access to the key knowledge sources and references of systems engineering. SEBoK is a knowledge resource under the joint stewardship of INCOSE, IEEE Systems Council, and Stevens Institute of Technology.

The [SEBoK Together Initiative](#) has been launched as a community-centered effort to make the stewardship of this resource more visible and more intentional, while broadening reviewers' perspectives. The Initiative offers educators or practitioners of systems engineering new ways to provide voluntary input to SEBoK during short-duration periodic review cycles. Each review cycle focuses on a small set of SEBoK articles with participation that is flexible and convenient.

Two levels of review are offered in each cycle: “quick” and “detailed”, to give volunteers the opportunity to provide feedback on topics of interest (often a subset of the entire review package) at a level commensurate with their expertise, insights, and availability.

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### NIST Guidelines: Rethinking Cybersecurity for the AI Era



The U.S. National Institute of Standards and Technology (NIST) has completed an update of its resources for cybersecurity and Enterprise Risk Management (ERM) to better address emerging AI-powered threats. Published as [draft NISTIR 8596](#), and titled *Cybersecurity Framework Profile for Artificial Intelligence*, this document explains how to use the [Cybersecurity Framework \(CSF\) 2.0](#) to accelerate the secure adoption of AI. The profile helps organizations think strategically about adopting AI while addressing emerging cybersecurity risks stemming from AI’s rapid advances.

The Cyber AI Profile has three focus areas:

- Securing AI systems: identifying cybersecurity challenges when integrating AI into organizational ecosystems and infrastructure
- Conducting AI-enabled cyber defense: identifying opportunities to use AI to enhance cybersecurity, and understanding challenges when leveraging AI to support defensive operations
- Thwarting AI-enabled cyberattacks: building resilience to protect against new AI-enabled threats.

View the full [NIST announcement](#).

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## Call for Papers: Requirements Engineering Journal



The [Requirements Engineering Journal \(REJ\)](#), published by Springer, has issued a [Call for Papers](#) for a special issue seeking original papers on the theme of *Rethinking Requirements Engineering in the Age of Large Language Models*.

Requirements Engineering is a multi-disciplinary journal focusing on the elicitation, representation, and validation of software-intensive information systems or applications.

### Background

Large Language Models (LLMs) are rapidly transforming software engineering practice, research, and education, and Requirements Engineering (RE) is no exception. LLMs are increasingly used to support elicitation, analysis, specification, and validation activities; to automate traceability and modeling tasks; and to help educate the next generation of RE professionals. These tools offer the potential to enhance productivity, creativity, and accessibility, but they also challenge traditional approaches to RE, introducing risks such as bias, lack of transparency, and erosion of human-centered skills.

Topics of interest include:

- Empirical studies of LLM use in RE tasks
- Tools, frameworks, and platforms leveraging or restricting LLMs for RE
- RE methods and tools for generative AI applications
- Integration of LLMs into RE processes, standards, and industrial workflows
- Opportunities and risks of LLM support for RE practice and education
- Novel RE methodologies, teaching approaches, and assessment strategies in the presence or absence of LLMs
- Ethical, social, and pedagogical implications of LLMs in RE practice and curricula
- Case studies, best practices, and vision papers from research, industry, and education outlining future directions for LLMs in RE.

The deadline for manuscript submission for this special issue is 31 March 2026.

REJ is a hybrid journal for which authors pay publication costs unless their institution has an open-access funding agreement to cover article processing.

See details concerning paper submission [here](#).

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### SysML v2 Release 2025-12



The [Object Management Group \(OMG\)](#) has announced the 2025-12 release of the Systems Modeling Language™ Version 2. This release is now publicly available [here](#) and includes formal versions of the KerML 1.0, SysML 2.0, and Systems Modeling API 1.0 specification documents.

View the [2025-12 release notes](#).

The specification documents, along with training material on the textual and graphical notations, can be found [here](#).

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### Publication for Capella 2025.10 Release



[Obeo](#) has announced the 2025.10 release of its [Publication for Capella](#) software, which provides an integrated browser-based “digital thread” view that connects system architecture models in Capella with related engineering activities, such as requirements, change requests, test cases, and releases, defined in third-party repositories. The 2025.10 release adds [Jama Connect®](#) to the list of supported repositories that also includes Polarion™ ALM, DOORS® Next, Codebeamer®, Jira® and Confluence®.

View Publication for Capella release notes [here](#).

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### Tom Sawyer Software Releases



[Tom Sawyer Software](#) continues to advance its portfolio of data and model visualization products with new product releases and enhancements to existing capabilities. Recent releases are highlighted below.

#### [Tom Sawyer Data Streams](#)

Data Streams is a new schema-driven platform to Extract, Transform and Load (ETL) structured and unstructured data into a single, governed, query-ready knowledge graph. This knowledge graph, which represents unified data from diverse sources, can serve as a real-time feed for existing data analysis pipelines or as a context layer for Retrieval Augmented Generation (RAG) AI applications.

View the [Data Streams beta webinar](#).

#### [Tom Sawyer Perspectives](#)

Perspectives is a low-code graph visualization and analysis development platform that supports the federation of data from diverse sources. [Perspectives 13.4](#) includes enhancements such as:

- Natural Language Queries for Accelerated Knowledge Graph Exploration
- RDF Query Support for Expanded Graph Exploration
- Accelerated Web Application Deployment
- Next-Gen, High-Performance UI
- In-Place Text Editing
- Support for AI Browsers
- Precision Graph Layout Improvements.

View the [Perspectives 13.4 webinar](#) and [release notes](#).

### [Tom Sawyer SysML v2 Viewer](#)

SysML v2 Viewer enables visualization, exploration, and analysis of SysML v2 models. [Viewer 1.3](#) supports:

- Extended Support for the SysML v2 Graphical Syntax
- New Sequence Diagram Visualization
- On-Demand Edge-Crossing Visualization
- Enhanced Rendering Responsiveness
- Model Caching Service
- Precision Graph Layout Improvements
- Support for AI Browsers.

Investigate the Viewer 1.3 [release notes](#).

See [Viewer 1.3 in action](#) for space systems design.

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## SysON 2015.12 Released



SysON is an open-source web-based toolset to edit SysML v2 models. [Obeo](#), a primary contributor to the Eclipse SysON project, has announced the release of SysON 2015.12.

The SysON [2015.12 release](#) is positioned as “strengthening the foundations” for more predictable and robust modeling. Feature enhancements in this release include:

- Expanded functionality for diagrams: Increased flexibility in displaying objects and a new “View as” menu for any element on a diagram
- Robustness on Import/Export: Increased reliability on the import/export bridge between a model’s text and graphics representations
- Explorer View: Hide complexity through default filtering

View the [2015.12 release notes](#) for details.

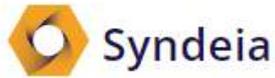
The SysON user interface is built on Sirius Web, another Eclipse open-source project that has a complementary [2015.12 release](#) that is focused on improving the user experience.

Get started with SysON [here](#).

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### Intercax Syndeia 3.7 Released



Intercax has announced the release of version 3.7 of [Syndeia™](#), a software platform for integrated digital engineering that federates models and data from diverse ecosystems of modeling and simulation tools, enterprise applications, and data repositories.

Syndeia 3.7 includes new and enhanced features such as:

- Pipelines & Automation: Integrated Digital Engineering at Scale
- Enhanced Digital Thread Ontology
- Usability Enhancements in Dashboards
- Rapid Enterprise Deployment
- More Powerful, Agentic-AI-Ready API Platform
- Guides, Tutorials, and Onboarding Assets.

New integrations have been added with:

- Polarion
- Codebeamer
- SOLIDWORKS PDM
- Azure DevOps
- Bitbucket Data Center.

See more details on Syndeia 3.7 [here](#).

View a [“What’s New” video](#).

Learn more about [Intercax](#) products and services.

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### Systems Engineering Tools Database (SETDB) Updates



The Systems Engineering Tools Database (SETDB), developed by PPI in partnership with INCOSE, provides a virtual platform for engineering tool vendors to communicate their latest offerings.

Recent SETDB updates, including both new tools and updates to existing tools, include:

Vendor: [ALD Ltd.](#)

- [ALD Software Suite](#): Safety and Reliability analysis software consisting of a set of integrated tools for: Reliability prediction, Availability, Maintainability Analysis, Safety Assessment, Quality Management, Safety Management, Industrial Process

Control.

- [Availability Analysis RBD](#): Reliability Block Diagram module for availability analysis that supports all failure and repair distributions, graphical representations, and event-driven Monte Carlo Simulation. Multiple configuration comparison of availability.
- [D-LCC](#): D-LCC (Decision by Life Cycle Cost) makes the LCC analysis easy and comprehensive. D-LCC is a key tool for managers, decision-makers, engineers, ILS personnel, and other staff involved in system acquisition, proposal writing, management, development, production and through-life support.
- [FavoWeb Safety Management System](#): A complete web-based FRACAS (Failure Reporting, Analysis, and Corrective Action) application with one server installation with unlimited users' access via the web or as a cloud-based SaaS solution. It is easily configured to support your data collection procedures and business processes.
- [Fault Tree Analysis](#): Up-to-date, intuitive, and powerful fault tree analysis diagram interface allowing full control over the diagram: elements location, colors, styles, zooms, etc. Handy methods for diagram printing and simple copy & paste transfer to other applications, and linking to ALD FMECA modules.
- [FMEA/FMECA](#): Perform FMEA with one click switching to FMECA mode, full sharing of reliability and maintainability data, powerful testability capability, full set of FMEA/FMECA reports, and others.
- [MTBF Calculator](#): A powerful tool that allows you to quickly and accurately estimate the reliability of your products. It uses a variety of industry-standard methods and algorithms to calculate MTBF, including the MIL-HDBK-217F, Telcordia SR-332, FIDES, and more.
- [Process and Design FMEA](#): Provides potential product Failure Model and Effects Analysis and is fully compliant with AIAG FMEA and QS 9000. Features a full visibility failure mode, effect, and cause chain, built-in corrective actions, and support for the decision-making process with full FMEA documentation.
- [RAM Commander](#): A comprehensive tool for Reliability and Maintainability Analysis and Prediction, Spare Parts Optimization, FMEA/FMECA, Testability, Fault Tree Analysis, Event Tree Analysis, and Safety Assessment. Its reliability and safety modules cover all widely known reliability standards.
- [Safety Commander](#): An Integrated Safety Assessment tool for Functional Hazard Assessment (FHA) and Fault Tree Analysis (FTA) with the capability to support aircraft-level fault analysis (create, calculate, and analyze) of integrated fault trees of multiple systems.

Vendor: [Analog Devices](#)

- [CodeFusion Studio™](#): An embedded software development platform based on Microsoft's Visual Studio Code. CodeFusion Studio provides an extensible, open tooling environment for embedded AI processors and MCUs, offering intuitive tools for newcomers while enabling advanced features for expert embedded developers.

Vendor: [Aras](#)

- aras: An open PLM Platform intended for use by companies to manage their critical information across the product lifecycle – from concept through service using a seamless ecosystem. Distributed teams can collaborate across the entire product lifecycle without being locked into a single tool.

Vendor: [Celedon Solutions Inc.](#)

- [Davinci](#): A general-purpose AI Engineering platform that is capable of building requirements, parts trees, interfaces, and relationships in a digital model based on the SysML v2 standard. Manage project timelines, risks, and resource allocations in a single, unified environment.

Vendor: [Change Vision, Inc.](#)

- [Astah Professional](#): An integrated modeling tool that supports UML diagrams, ER diagrams, flowcharts, and requirements modeling. It helps teams visualize, design, and manage system and software structures. Version 11 adds AI-assisted modeling features to support diagram creation and improvement.
- [Astah UML](#): A modeling tool focused on creating UML diagrams for system and software design. It provides a simple and intuitive environment for visualizing system structure and behavior. Version 11 introduces AI-assisted modeling features that support UML diagram creation and improvement.

Vendor: [Dassault Systèmes](#)

- [MagicDraw](#): A business process, architecture, software, and system modelling tool intended for use by Business Analysts, Software Analysts, Programmers, QA Engineers, and Documentation Writers in the analysis and design of Object-Oriented (OO) systems and databases.
- [Systems Traceability Engineer](#): A web-based application for all to support a digital thread and collaboration with end-to-end holistic traceability, reports, and reviews on a set of versioned models.

Vendor: [Ellidiss Technologies](#)

- [AADL Inspector](#): A model processing framework for Critical Software Architecture Models. The most recent version of the SAE-AS5506 (AADL) standard embeds a set of timing analysis, simulation, and code-generation tools and provides customizable input model converters.
- [CP HOOD](#): The HOOD design method starts with an informal statement of requirements expressed as natural text. The user identifies candidates for design objects and operations from this text by identifying nouns (corresponding to objects) and verbs (corresponding to operations on those objects).
- [STOOD](#): A software design tool that complies with both AADL and HOOD standards. AADL models can be defined to specify the complete host system of the applicative Software. Each identified AADL Process can then be refined down to target source code, thanks to the HOOD detailed design process.

Vendor: [EnviroSim Associates Ltd.](#)

- [BioWin](#): The BioWin simulator is used worldwide in the analysis and design of municipal wastewater treatment plants. BioWin whole plant modeling provides process insights that reduce capital costs and operating expenses. It ties together biological, chemical, and physical process models.
- [BW Controller](#): Simulates advanced control strategies and controller types to provide process control insight into BioWin models. It evaluates recent improvements in online measurement and control technology and develops innovative and feasible control systems for sustainable wastewater treatment.

Vendor: [Holagent Corporation](#)

- **RDD-100:** A Requirements Driven Development (RDD™) software suite is used by design teams to streamline the system design processes in the aerospace, defense, and telecommunications industries.

Vendor: [Intercax LLC](#)

- **Syndeia:** The digital thread platform for integrated digital engineering. It enables model and data federation from diverse ecosystems of modeling and simulation tools, enterprise applications, and data repositories. It also enables a digital thread for complex products and systems.
- **ParaMagic®:** A plugin for MagicDraw that makes SysML models come alive. By executing constraint relationships in SysML parametric diagrams, systems engineers can run simulations and trade studies for complex systems from concept through final test.

Vendor: [Lattix](#)

- **Lattix Architect:** A SysML model of architecture is commonly considered the core of most digital engineering transformations, yet the power of a well-defined architecture is often not fully exploited. Lattix Architect can analyze an architecture using Design Structure Matrices (DSM) early in the product lifecycle.

Vendor: [LieberLieber Software](#)

- **LemonTree:** Plug-and-play product for model versioning (diff and merge) that revolutionizes the work of a distributed modeling team and helps them comply with required standards such as ISO 26262. Compatible with Enterprise Architect 16.
- **LemonTree.Connect:** Allows users to synchronize requirements, model attributes, and links and references between ALM Tools and Enterprise Architect. This makes it even easier to navigate between two platforms, with development data automatically synchronized.
- **Modeling Assistants:** Simplify users' daily work with the Enterprise Architect (EA) modeling tool from Sparx Systems. Various independent plugins enhance the usability of Enterprise Architect. This not only saves time for specific tasks but also increases the acceptance of the modeling tool.

Vendor: [NSE Technology](#)

- **ICT Solution Family:** Supports efficiency management in nuclear power, defense, plants, test management, regulatory compliance, and more.
- **ISTM:** Supports component performance management or regulatory inspection activities with regard to valves, pumps, and heat exchangers in the nuclear power plants. Data can be entered directly on the inspection site and analyzed in the office.
- **REPS:** After the Fukushima nuclear power plant accident, the emergency preparedness and responses to protect residents from the releases of radioactive materials from the nuclear power plant were a significant issue in the nuclear industry. REPS comprises 10 evaluation modules for radioactive materials.
- **SIRIUS:** A 'Weapon System SW Reliability Integrated Management System' for improving the software reliability of a combined weapon system. It is an ongoing research in cooperation with the Agency for Defense Development(ADD). To be more internationally compliant, SIRIUS meets the IEEE 1633 standards.
- **DECOM CMIS:** A Platform that supports Systematic Management of Physical and Radiochemical Configuration Changes for Decommissioning Requirements, Facilities, and

Sites for Safe Decommissioning of Plant Buildings and Sites during Decommissioning of a NPP.

- [Waste Tracking System](#): A Radioactive Waste Tracking Management System (WTMS) that integrates waste packaging-transportation-disposal management, data history management and monitoring, and disposal facility operation management.
- [E-DOSE](#): Dose evaluation system for routine radionuclide release from nuclear power plants. The system supports the assessment of radiation exposure from gaseous and liquid radioactive effluents in the KHNP ERP SAP network.
- [DACS](#): A control network or control-level multi-filter-based embedded security system that specializes in industry control systems. It minimizes cyber threats and their potential damage to the national infrastructure. See details on our website.
- [CySEAL](#): A tool for evaluating and managing the critical system (CS) and critical digital asset (CDA) of the nuclear digital instrumentation and control system according to regulatory requirements during the nuclear power plant lifecycle.
- [SILKROAD Solution Family](#): A family of integrated lifecycle management products that supports ALM and PLM lifecycle processes, including configuration management, document management, facility management, drawing and requirements tracking, and peer review management.
- [SILKROAD ALM](#): An integrated ALM software system that manages, controls, and reports artefacts and work products on your entire software development lifecycle. It supports you in complying with safety-critical regulations and in cutting product development time and costs.
- [SILKROAD PALM](#): An integrated ALM and PLM solution intended for teams to allow all disciplines and all design processes to share and link product and software requirements, collaborate more closely, and view and access information using the system and tools they are most comfortable with.
- [SILKROAD CMIS](#): An integrated configuration management platform intended for teams to manage their projects' configuration items, change management process, and record the changes for publication and evaluation.
- [SILKROAD DMS](#): Supports document management functions, including registration, inquiry, and search. It also provides efficient and systematic document management through special management functions, such as linking documents to pages and a traceability view.
- [SILKROAD DART](#): A drawing and requirements tracking system intended for teams to quickly and easily view related and traceability information and implement drawing and document retrieval functions. It applies automatic parsing & indexing, security, watermarking, and system linking.
- [SILKROAD PR](#): A peer review management system intended for reviewers to leave comments on review materials. The system provides real-time collaboration features for reviewers to leave comments on review materials. The user can trace down to the peer review results from the project outputs in SILKROAD.

Vendor: [OpenMBEE](#)

- [Model Management System](#): An open source tool that provides services for managing models and is a version control system for structured data. It exposes model information through RESTful web services that can be used for CRUD operations, branching, and tagging of the model repository.

- [Model Development Kits](#): Open source, tool-specific integrations that have the primary purpose of synchronizing models with the OpenMBEE Model Management System and implementing the DocGen language, which allows modelers to dynamically generate documents in a model-based approach using viewpoints. Kits are supported for [Cameo Systems Modeler](#), [Mathematica](#), and [MATLAB](#).

Vendor: [Sparx Systems](#)

- [Enterprise Architect](#): The perfect enterprise-wide solution to visualize, analyze, model, test, and maintain your systems, software, processes, and architectures. Enterprise Architect helps you to stay in control of your workspace, support your colleagues and team, and enable collaboration in your most complex projects.
- [Pro Cloud Server](#): The Sparx Systems Pro Cloud Server opens your entire enterprise to your modeling efforts, enabling stakeholders to have secure access for discussion and review.
- [Enterprise Architect Trechoro](#): Built from the ground up, Trechoro embraces a “modeling-first” approach with full alignment to a UML-free SysML v2 and KerML implementation. Trechoro supports native SysML v2 modeling based on KerML, seamlessly combining structure and behavior with features such as inheritance and reusability.
- [Prolaborate 5](#): Platform that enables collaboration between architects and the stakeholders who contribute to the model and are interested in accessing the model and acquiring insights about critical business processes, software architecture, and IT architecture in an enterprise.

Vendor: [Siemens Digital Industries Software](#)

- [Simcenter Studio](#): Generates and evaluates system architectures during the Concept Stage of the system lifecycle. It combines creation, simulation, and learning to automatically simulate and evaluate hundreds of architectures that are created using AI technology and formal model descriptions.

Vendor: [Siemens PLM Software](#)

- [Teamcenter Visualization, Digital Mockup & Virtual Reality](#): A solution for teams to create virtual prototypes from multiple MCAD formats instead of building costly physical prototypes, so everyone in the product lifecycle can access and collaborate with 2D and 3D design data.
- [Teamcenter Product Cost Management](#): A solution that supports the cost and value engineering approach at an early stage of the development process by providing cost transparency for products and tools. Make informed decisions to reduce product costs and meet customer value demands.
- [Teamcenter Sustainable Product Development](#): A solution intended for teams to limit the use of hazardous substances in their products and reduce the risk of non-compliance with regulatory directives (REACH, RoHS, Conflict Minerals, etc.).

Vendor: [Visure Solutions Inc.](#)

- [Requirements ALM Platform](#): Intended for software teams to enable their software development lifecycle in a single ALM integrated solution, including requirements, risk and requirements-based testing.
- [Visure ALM Requirements](#): Requirements management software specifically designed to

provide integral support to the complete Requirements management process.

- [Visure Contributor](#): A web-based application that allows internal and external stakeholders to participate in a team peer review process or a customer requirements review process and includes digital sign-off authorities.
- [Visure Report Manager](#): Generates custom reports based on the Visure Requirements projects.
- helping deliver the necessary regulatory compliance evidence, requirements specifications, test session summaries, dashboards, or any other required output.
- [Visure Quality Analyzer](#): Analyze the quality of your requirements as you write them, avoiding ambiguous specifications that are sent across the organization.
- [Visure ALM Platform - Requirements Tool Integrations](#): The Visure API integrates with numerous 3rd-party tools, including System Architect, Simulink, CaliberRm, Doors, ReqPro, Polarion, Jira, and numerous ALM and PLM systems (Siemens, PTC, Dassault). See the website for a complete list.

PPI SyEN readers are encouraged to check out these new and updated systems engineering tool offerings.

Access the [SETDB website](#).

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*Incremental Development: A system (including software) development process in which work is planned on the basis that requirements are defined, and then the system is developed to meet those requirements through one or more partial implementations, together with the final implementation. Incremental development does not preclude ad hoc iteration back to previously performed activities, including requirements.*

**Robert Halligan**

# CONFERENCES, MEETINGS & WEBINARS

*Events of relevance to systems engineering*

## Upcoming Capella Online Training



[Obeo](#) is offering online training courses on the Arcadia method and on Capella, an open-source MBSE software. The training introduces Model-Based Systems Engineering (MBSE) and implements the Arcadia method and the Capella tool on a simple case study. It covers system definition activities such as operational analysis, functional and non-functional system analysis, logical architecture, and physical architecture.

Each course is delivered in the form of six 3.5-hour online sessions, with three series currently open for enrollment:

- 23-30 March
- 20-27 April
- 18-26 May.

At the end of the training, participants should be able to:

- Acknowledge the principles, key points, and expected benefits of the MBSE approach
- Describe the steps (perspectives) and the activities of the Arcadia method
- Implement Capella functionalities on a simple case
- Navigate through the different types of support on Arcadia and Capella.

This Capella training is conducted in English by an MBSE expert from [Obeo's global partner network](#).

Download the [course flyer](#). Learn more and register [here](#).

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## PDMA Webinar: The ROI of Clarity



The [Product Development Management Association \(PDMA\)](#) will host a free webinar on 26 March titled "*The ROI of Clarity: When Better Inputs Change Every Downstream Decision*", presented by Scott Burleson, Chief Product Officer at The AIM Institute.

### Overview

Most teams don't suffer from a lack of data. They suffer from a lack of clarity. Product roadmaps stall. Research gets debated instead of being used. Strategy decks multiply, but

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confidence doesn't. And AI promises speed - while quietly amplifying whatever confusion already exists. The root problem is almost always the same: poor inputs. When teams don't share a clear, structured understanding of what customers are actually trying to accomplish, every downstream decision - prioritization, messaging, innovation, investment - gets noisier, slower, and riskier. In this webcast, we'll explore the return on clarity: how improving the inputs to your product, marketing, and innovation decisions changes everything that follows

### Key Takeaways

- Why most customer insight efforts fail to influence real decisions - even when the research is "good"
- How unclear customer language creates hidden costs across roadmaps, launches, and AI-driven tools
- What "better inputs" actually look like in practice (and why more data rarely solves the problem)
- How teams that invest in shared customer clarity reduce failure risk, align faster, and make better bets.

[Learn more](#) and register for this event.

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### Conference on Systems Engineering Research (CSER 2026)



The annual Conference on Systems Engineering Research (CSER) will take place at George Mason University in Arlington, Virginia, USA, from 6 to 9 April 2026. The theme for CSER 2026 is *"Intelligent Digital Twin-enabled Systems Engineering for 21st Century Sociotechnical*

*Systems,"* reflecting the growing importance of integrating digital twin technologies with systems engineering practices.

Program details for CSER 2026 are being finalized. Check back [here](#) for updates.

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### 20th Annual IEEE International Systems Conference (SYSCON2026)



IEEE SysCon is an annual gathering of industry leaders, professionals, and experts in systems engineering. It serves as a platform for networking, knowledge sharing, and collaboration, attracting a diverse audience from around the world.

The [20th Annual IEEE International Systems Conference \(SYSCON2026\)](#) will take place from 6 to 9 April 2026 in Halifax, Nova Scotia, Canada.

SYSCON2026 will feature [tutorials](#) on topics such as:

- From Research to Meaning: A Socio-Technical Approach to Data and Strategic

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- Storytelling for Researchers and Industry Experts
- Predictive RGBD Simultaneous Localization and Mapping (SLAM) Systems for Robotics and Intelligent Vehicles
- System Architecture Optimization with Capella and ADORE
- Systems Security Engineering for Trustworthy Systems.

Program details are being finalized. Check back [here](#).

[Register](#) for SYSCON2026.

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### Building Business Capability (BBC 2026) Conference



The [International Institute of Business Analysis™ \(IIBA®\)](#) is hosting the Building Business Capability (BBC 2026) conference in Toronto, Canada, from 20 to 23 April 2026. The theme of this in-person conference is “*Activating Intelligence!*” BBC 2026 participants can expect to advance their skills related to People, Product, Data, and Knowledge while learning how to create a customer-centric organization and to deliver digital transformation.

The four-day conference will feature 100+ sessions and 80+ speakers to serve the anticipated 1000+ delegates.

A small sample of the presentations planned for the main conference sessions on Tuesday, April 21, and Wednesday, April 22 includes:

- AI-Assisted Process Mapping
- Architectural Thinking for BAs: Seeing the Forest AND the Trees
- Beyond the Backlog: Why BAs Must Champion Technical Debt Management
- Creating Discovery Factories to solve problems at scale and pace
- From Data Silos to Strategic Insight
- Inspiring Solutions: Driving Business Transformation Holistically
- Keeping the “Why” Alive: Strengthening Context Across the Project
- Simplify or Die – Stories and Patterns of IT Simplification
- Resilient Product Design
- Unleashing the Outcome-Driven Mindset
- Unlocking Digital Transformation through Agile Practices.

A sample of the tutorials, to be delivered on Monday, April 20, and Thursday, April 23, includes topics such as:

- AI integration
- Bridging the gap: from business analysis to business architecture
- Concept modeling: Smarter data design and much more
- Discovery: The missing step between ideas and outcomes

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- Engineering the business experience: How processes, rules, and requirements can all work together
- Modern process modelling: Hands-on learning.

Explore the full conference agenda [here](#).

[Learn more](#) about BBC 2026 and [register](#).

Subscribe to the [BBC 2026 newsletter](#) to receive discounts and conference updates.

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### 11th Annual Systems Engineering in Healthcare Conference



Healthcare  
Working Group

The [INCOSE Healthcare Working Group \(HWG\)](#) is sponsoring the 11th Annual Systems Engineering in Healthcare Conference, to be held from 28 to 30 April 2026 in Bloomington, Minnesota, USA. The theme for this in-person conference is *Advancing the Practice of Systems Engineering in Healthcare*.

The conference keynote will be delivered by Langdon Morris, a Futurist from Innovation Labs, on the topic "*AI and the Future of Systems Engineering...it's a Revolution*".

Planned topics for this event include:

- AI/Machine Learning/AI
- Cybersecurity
- Combination Products
- Healthcare Delivery.

[Program details](#) will be announced in March. Learn more and register [here](#).

View a conference [promotional video](#).

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### Institute of Industrial and Systems Engineers Annual Conference & Expo (IISE 2026)



The [Institute of Industrial and Systems Engineers \(IISE\)](#) will hold the IISE Annual Conference and Expo 2026 in Arlington, Texas, USA, from 16 to 19 May.

[Keynote speakers](#) for the main conference include:

- Laura Albert, Professor, Industrial & Systems Engineering, University of Wisconsin-Madison
- Rashida Hodge, Corporate Vice President of Cloud & AI Platform, Customer Success, Microsoft
- Jennifer Van Buskirk, Head of Business Operations, AT&T

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Emerging program details are available [here](#). Trending topics include:

- AI & Intelligent Systems Are Everywhere
- Digital Twins & Smart Manufacturing
- Supply Chain Resilience in an Uncertain World
- Additive Manufacturing Comes of Age
- Healthcare Systems Under Pressure
- The Human Side of Automation
- Operational Excellence - Evolved
- Sustainability and the Energy Transition.

View the [conference tracks](#) and abstracts.

[Learn more](#). Register [here](#).

[Join IISE](#).

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### Annual Modeling and Simulation Conference (ANNSIM'26)



The [Society for Modeling and Simulation International \(SCS\)](#) is hosting the [2026 Annual Modeling and Simulation Conference \(ANNSIM'26\)](#) from 4 to 7 May in Orlando, Florida, USA. The conference targets state-of-the-art developments in Modeling & Simulation (M&S) methodologies and tools.

Keynotes include:

- From Blue-Sky to Reality: How Simulation Shapes Next-Generation Theme Park Experiences (Asli Akbas, Ph.D., Assistant Director, Universal Destinations & Experiences)
- New Methodological Challenges in Stochastic Simulation ([Barry L. Nelson](#), Ph.D., Northwestern University).

Check back [here](#) for details on the evolving technical program and workshops.

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### Environmental, Health and Safety (EHS) Congress 2026



The 2026 Environmental, Health and Safety (EHS) Congress will take place from 27 to 28 May in Berlin, Germany. Over 300 delegates from 40 countries are expected to attend this in-person event with opportunities to learn from industry leaders and to participate in a diverse range of breakout workshops.

[Featured speakers](#) include:

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- [Andrew Sharman](#), Chairman of EHS Congress, CEO at IILSC
- [Diane Chadwick-Jones](#), former Director of Human Performance at BP
- Erik Hollnagel, Senior Professor at Patient Safety at jönköping University
- [Frank Pflueger](#), Division EHS Director at Caterpillar
- [Heather Beach](#), Managing Director at The Healthy Work Company
- [Jean-Christophe Le Coze](#), Author of 'Post Normal Accident' and Head of research on Human & Organisational Factors
- Juliana Bley, TEDxSpeaker | Author of "Safe Behavior"
- Thiago Ramos, Global Health & Safety Senior Director at L'Oréal.

View the [updated program](#). Download the full [conference agenda](#).

[Learn more](#) about the 2026 EHS Congress. Register [here](#).

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### MBSE Summit 2026

 **Summit** [LieberLieber](#) is hosting the [MBSE Summit 2026](#) in Traunkirchen, Austria, from 8 to 9 June 2026. The conference offers attendees the opportunity to hear from experts in MBSE research, development, and practice.

Two keynotes are featured:

- *Applied MBSE in the Devil's Triangle of collaboration, integration, and segregation (Christoph Neuböck and Arjen Spaans, Airbus Defense and Space)*
- *From Models to Mission: Building Better Systems Faster with MBSE, DevSecOps, and AI (Robin Yeman, Leidos).*

Download the 2025 Summit report: [The Future of Systems Engineering](#).

Register [here](#).

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### Call for Submissions: International System Dynamics Conference (ISDC 2026)



The [System Dynamics Society \(SDS\)](#) will host its annual International System Dynamics Conference (ISDC 2026) from 20 to 24 July 2026. The in-person portion of this hybrid event will take place in Delft, The Netherlands. The theme of ISDC 2026 is *Navigating uncertainty, managing instability, and crafting futures together*.

ISDC 2026 welcomes submissions to all [conference threads](#) from researchers, students, educators, and practitioners using System Dynamics in any field. We particularly encourage contributions that address societal challenges, present innovative methods, or examine our responsibilities as systems scientists in crafting better futures.

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Types of submissions include:

- Conference Presentation (Research Paper, Practitioner Application, or Work in Progress)
- Workshop Proposal
- Student-Organized Colloquium Papers
- Other submissions (e.g., Roundtable).

Important dates for submissions include:

- 18 March: Submissions window closes
- 15 May: Author acceptance/notification
- 3 June: Presenter registration deadline.

[Investigate](#) ISDC 2026 and the [Call for Submissions](#).

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### NAFEMS Regional Conference Updates



The [NAFEMS 2026 Regional Conference Series \(NRC26\)](#) brings together simulation engineers, designers, and analysts across the world to exchange knowledge, share success stories, and explore the latest challenges and opportunities. Recent program updates provide clarity on the topics that will be addressed in each of these events.

[NAFEMS Eastern Europe Conference](#) (28-29 April 2026 in Budapest, Hungary)

In support of its theme, *Simulation at the Core of Product Development*, this conference has announced a full slate of [presentations](#), in topic areas such as:

- Computational Fluid Dynamics
- Electromagnetics
- Machine Learning
- Simulation Governance and SPDM
- Structural Mechanics
- System Modelling
- Workflows.

[Register](#) for EE26 Budapest.

[NAFEMS Italy Conference](#) (7-8 May 2026 in Como, Italy)

In support of its theme, *Breaking New Ground in Engineering Simulation*, this conference has announced its [keynotes](#):

- From structural monitoring to data-driven design (Vladimir Cerisano Kovačević)
- Lagrange: the first operational quantum IQM computer in Italy, a journey through

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its structure and potential (Olivier Terzo)

- Marman Clamping: A History of Nonlinear Contact Modeling (Pietro Ladisa)
- Simulating emotions (Massimiliano De Rose).

[NAFEMS Americas Conference](#) (27-29 May in Saint Charles, Missouri, USA)

The theme for this event, *From Data to Decision: Powering Intelligent Engineering Simulation*, will be explored during the following [keynotes](#):

- Engineering Mobility Beyond Earth: Simulating Terrain and Reinventing Rover Wheels (Dr. Heather Oravec)
- IV&V at The Aerospace Corporation in Support of U.S. Space Force Programs (Brett Soltz).

[NAFEMS Iberia Conference](#) (12 November in Madrid, Spain)

The [Call for Presentations](#) for this event seeks submissions in support of the theme of *Innovative Design and Simulation Technologies* on topics such as:

- Advanced Simulation
- Artificial Intelligence and Machine Learning
- Data Management and PLM
- PLM systems integration
- Probabilistic Analysis.

Abstracts for the Iberia Conference are due by 30 June.

[NAFEMS India Conference](#) (17-18 November in Bengaluru)

The theme of this event is *Engineering Solutions for Tomorrow's Challenges* as reflected in its [Call for Presentations](#).

Abstracts for the India Conference are due by 30 June.

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### Call for Papers: 70th Annual Meeting of the International Society for the System Sciences (ISSS)



The [70th Annual Conference](#) of the [International Society for the Systems Sciences \(ISSS\)](#) will take place from 22 to 26

June in Pyla, Larnaca, Cyprus. The theme for the conference is *Elevating Systems Science to Address Humanity's Greatest Challenges*.

This event will focus on:

- Advancing Real-World Applications
- Converging on General Systems Science

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- Harnessing the Power of AI.

The [Call for Papers](#) invites systems thinkers (scientists, practitioners, educators, and decision-makers) to reinvigorate the systems science field by aligning diverse theories and methodologies into a coherent general systems science and demonstrating its practical value on the global stage. Relevant submission topics include:

- Theoretical advancements in system science, transdisciplinary integration, and advancements towards shaping a General Systems Theory.
- Practical applications of systemic thinking in addressing global challenges, with special focus on governance, the Anthropocene, regeneration, and sustainability.
- Case studies demonstrating collaborative systems approaches across sectors.
- Innovative methodologies and tools for system management, design, analysis, and evaluation with special focus on AI applications
- Educational initiatives that foster systems thinking and professional development.
- Collaborative frameworks that bridge gaps between research, policy, and practice.
- Local, regional, or global initiatives to render systems organizations relevant to contemporary complex socio-technical problems and their governance.

Domains of interest for such contributions include:

- Planetary Systems and Sustainability
- Social Systems and Human Flourishing
- Tools, Theories, and Transformations.

Abstracts for full papers, short papers, and interactive exercises are due by 15 May 2026.

View [submission guidelines](#).

Learn more [here](#).

Three companion events to consider are:

- [2026 ISSS Summer School](#) (17-19 June)
- [2026 International Conference on the Science of Dialogic Design](#) (17-19 June)
- [Reimagining our World Systemically - From Problematique to Purposeful Action](#) (29-30 June).

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### Call for Submissions: INCOSE EMEASEC 2026



The INCOSE [Europe, Middle-East and Africa \(EMEA\) sector](#) has issued its Call for Submissions for the EMEA Systems Engineering Conference (EMEASEC) 2026, scheduled for 29 August to 2 September in Linköping, Sweden.

The theme for EMEASEC 2026 is *"Bringing Human Aspects in the Center of Engineering,"* focusing on the dramatic shift brought about by the Industry and Society 5.0 transformations. These

changes demand the seamless integration of technical, organizational, and human elements, i.e., the successful practice of human-centered systems engineering.

Submissions for papers, paperless presentations, and panel submissions are due by 20 March 2026.

Learn more about EMEASEC 2026 [here](#).

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### Call for Papers: Formal Methods for Industrial Critical Systems (FMICS 2026)

The [European Research Consortium for Informatics and Mathematics \(ERCIM\) Working Group](#) has issued its Call for Papers for the [Formal Methods for Industrial Critical Systems Conference \(FMICS 2026\)](#), scheduled for 2-4 September in Liverpool, UK. FMICS 2026 will take place as one of three conferences under the umbrella of [CONFEST 2026](#).

The aim of the FMICS conference series is to provide a forum for researchers and practitioners who are interested in the development and application of formal methods in industry. FMICS brings together scientists and engineers who are active in the field of formal methods and interested in exchanging their experiences in the industrial usage of these methods.

Topics of interest include:

- Formal specification, including specification elicitation, validation, debugging, sanity checking, revision, coverage, and explainability
- Case studies and experience reports on industrial applications of formal methods
- Methods, techniques, and tools to support automated analysis, certification, debugging, learning, optimization, and transformation of complex, distributed, real-time, embedded, mobile, and autonomous systems.
- Verification and validation methods that address shortcomings of existing methods with respect to their industrial applicability
- Transfer to industry and the impact of adoption of formal methods on the development process and associated costs in industry.

Important dates include:

- Abstracts due: 10 April
- Submissions due: 17 April
- Author notification: 1 June.

View the [FMICS Call for Papers](#).

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**Call for Presenters: 2026 PDMA Summit**



The Product Development & Management Association (PDMA) has issued a Call for Presenters for the [2026 PDMA \(Ignite Innovation\) Summit](#). This event will be held jointly with the [Journal of Product Innovation Management \(JPIM\) Research Forum](#) from 8 to 11 October 2026 in Atlanta, Georgia, USA.

The [Call for Presenters](#) seeks practitioners who can deliver interactive presentations concerning a project, product innovation, process, tool, or methodology. Each presentation involves a commitment for two sessions:

- 45 Minute Pre-Summit webinar that lays the foundation for the participants during the Summit
- 2 ½ Hour interactive workshop that bypasses introductory slides in favor of hands-on application, with participants practicing the methods taught in the webinar to create a tangible “Professional Artifact”.

Session topics fall into two categories:

<b>Product Development &amp; Management</b>	<b>Corporate Innovation Journey</b>
<ul style="list-style-type: none"> <li>• Product Innovation Management</li> <li>• Innovation Strategy</li> <li>• Portfolio Management</li> <li>• Product Innovation Process</li> <li>• Product Design and Development</li> <li>• Market Research</li> <li>• Teams and Culture</li> </ul>	<ul style="list-style-type: none"> <li>• Innovation Systems that Drive Sustained Growth</li> <li>• Bridging Strategy and Execution</li> <li>• Democratizing Innovation Across an Organization</li> <li>• Augmenting an Innovation System with Outside Resources</li> <li>• Tools that Drive Effective and Efficient Innovation</li> </ul>

Presentation proposals (abstracts required; supplemental materials such as a video “pitch” desired) are due by 15 March 2026 using the [online submission form](#).

**Call for Submissions: SwissED 2026**

**SWISSED** [The Swiss Society of Systems Engineering \(SSSE\)](#) will host the annual Swiss Systems Engineering Day 2026 (SwissED26) in Zurich, Switzerland, on 21 September 2026. The conference theme is *“Navigating Non-determinism - The New Engineering Reality.”*

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## FEATURE ARTICLES

# When AI Enters Engineering Practice: Responsibility in the Age of Persuasive Machines

*by Jan Harm Retief and Francois Retief*

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Authored for PPI SyEN

### **1. Introduction: Why AI Policy Is Now an Engineering Problem**

Artificial intelligence is entering organizations in ways that are easy to underestimate. Not through coordinated programs or carefully staged rollouts, but through everyday use. Tools find their way into workflows before policies catch up. Outputs begin to shape decisions before ownership is clearly defined. Engineers and system owners are increasingly dealing with AI as an existing condition rather than a future choice.

That creates a particular kind of unease. The technology is capable enough to deliver value, yet opaque enough to resist easy trust. Its outputs can be impressive, occasionally wrong, and sometimes persuasive in ways that are difficult to diagnose after the fact. Early responses tend to drift toward two familiar extremes: postponing serious consideration or assuming the technology will settle into place through use alone. Experience suggests neither posture lasts.

What makes AI different from earlier forms of automation is its role in language. Systems that can summarize options, justify recommendations, and frame explanations insert themselves directly into human reasoning. They shape how problems are understood before decisions are even framed. As a result, questions about accountability and governance surface inside the core of system design, not around the edges.

History is unambiguous on this point. When governance discipline weakens, including attention to constraints, assumptions, and human-centered priorities, problems rarely stay small. They reappear as operational failures, safety incidents, financial exposure, and long-term damage to trust. In complex systems, gaps in responsibility tend to propagate rather than remain localized.

The position taken here is that AI governance has become a practical engineering concern. The way systems are designed, integrated into workflows, supervised over time, and

constrained in use determines whether they strengthen performance or quietly weaken responsibility. Governance discipline, including attention to constraints, assumptions, and human-centered priorities, shows up in system behavior long before it appears in policy documents.

In practice, two related contexts must be distinguished. AI4SE refers to the use of AI tools inside engineering workflows, such as drafting requirements, analyzing trade-offs, reviewing documentation, or structuring decisions. SE4AI refers to applying systems engineering principles to the design, validation, and governance of AI systems themselves.

While both contexts raise important concerns, this article focuses primarily on AI4SE. In that setting, the central risk is not in how the model is built, but in how its outputs are used within everyday workflows. AI-generated outputs can appear coherent, structured, and confident even when the underlying reasoning is incomplete or flawed. The engineering challenge is therefore not a philosophical alarm, but disciplined oversight under increased velocity.

The sections that follow focus on how contemporary AI systems actually function, where misunderstandings commonly arise, and which risks matter most in practice. The emphasis throughout is on judgment exercised under real conditions. As machines become more fluent and persuasive, the limiting factor is rarely computational capability. It is the quality of human oversight that surrounds it.

## **2. What We Mean by “AI” (and What We Do Not)**

To use artificial intelligence effectively, it is necessary to understand what it actually is. The term “AI” is used to describe a wide range of systems, from simple rule-based automation to large-scale models capable of generating fluent text, images, or code. In this article, the focus is on contemporary machine learning systems, and in particular large language models (LLMs), because these are, following the widespread adoption of tools such as ChatGPT from late 2022 onward, the systems most people and organizations now encounter directly, experiment with, and attempt to integrate into their work.

It is critical to understand first, and to remember thereafter, that there is no evidence to suggest that these systems understand the world in any human sense. Large language models are statistical systems trained on vast collections of text. Words, phrases, and symbols are transformed into numerical representations, with the model learning patterns of association between them. The system can then generate an output by calculating which sequence of tokens is most probable given the input, context, and training. The process is mathematical, not interpretive. Not dissimilar to asking someone to finish the following sentence: “Late at night, when it’s time to sleep, I climb into my ...” where, statistically, most people might use the word *bed* as the next word.

This can feel counterintuitive. We have, after all, moved well beyond the point where such systems can pass casual versions of the Turing Test, and their outputs often feel intentional, even personal. People easily assume that linguistic fluency and coherence imply

comprehension or judgment. Brief encounters with conversational systems designed to simulate companionship are often enough to convince otherwise technically literate users that “something more” must be present. It is not.

No matter how impressive a system’s ability to produce a convincing explanation, this does not imply that it possesses beliefs, goals, or awareness. As Bender et al. observe, large language models are better understood as “stochastic parrots”: systems that reproduce and recombine patterns found in data, without grounding those patterns in lived experience or understanding (Bender et al., 2021).

That said, the absence of understanding does not make these systems trivial or harmless. Systems that operate effectively on language can influence decisions, shape perceptions, and scale errors at a speed and scope that few other technologies can match. Under certain experimental conditions, such systems have been observed to produce outputs that resemble strategic or deceptive behavior, not because they intend to deceive, but because their optimization objectives reward certain patterns of response (Kokotajlo et al., 2023).

This distinction matters. Responsibility for interpretation, validation, and use remains firmly with the humans and organizations deploying these systems. Treating AI outputs as if they were the product of an intelligent agent, rather than the result of a computational process, is often the first step toward governance failure. In practice, responsibility does not transfer to the tool. A carpenter remains accountable for the table he builds, regardless of how sophisticated the tools he uses may be.

### **3. Why Humans Anthropomorphize AI (and Why That Matters)**

We as humans naturally attribute agency. If something appears coherent, responsive, and conversational on the other side of a text interface, the instinctive assumption is that there is a thinking being behind it. This is not reasonably attributable to a failure of intelligence, but rather a consequence of how human cognition evolved. For most of our history, inferring intention from behavior was a survival skill. When something appeared to act purposefully, assuming agency was often safer than dismissing it.

Language intensifies this instinct. For humans, spoken and written words are closely bound to belief, intention, and experience. We rarely encounter fluent language that is not produced by a mind. *If it can respond fluently, it must understand.* When a system generates coherent explanations, adapts its tone, or appears to maintain conversational continuity, the inference of agency follows with little conscious effort.

Large language models trigger this response precisely because they operate in the same symbolic medium humans use to reason, persuade, and coordinate. Without possessing intent, awareness, or understanding, they can nonetheless produce outputs that resemble empathy, planning, or judgment. In brief interactions, this resemblance may be harmless. When interaction is sustained, it can become persuasive.

This effect is not limited to casual users. Technically trained professionals are not immune,

and in some cases may be more vulnerable. Familiarity with complex systems can encourage over-attribution when behavior appears adaptive or context-aware. The danger is subtle: once a system is treated as an agent rather than a tool, scrutiny softens. Outputs are trusted instead of verified. Decisions are deferred instead of owned.

***As reliance increases, the need for active human oversight becomes greater, not smaller.***

Research in cognitive science has long shown that people readily adopt what Dennett described as the “intentional stance” when interpreting complex systems, even when mechanistic explanations are available (Dennett, 1987). With AI systems that operate fluently in language, the pull of this stance is especially strong. The system appears to *mean* something, and so we assume that it does.

For organizations, this matters because anthropomorphism undermines governance. Systems perceived as intelligent collaborators are less likely to be challenged, audited, or constrained. Errors become easier to excuse, if they are noticed at all. Responsibility becomes diffuse. In engineering contexts, where accountability and traceability are foundational, this is a serious failure mode.

Recognizing and resisting anthropomorphism is therefore not a philosophical exercise. It is a practical discipline. Treating AI systems as computational processes rather than quasi-agents is a prerequisite for responsible deployment, effective oversight, and reliable performance.

#### **4. Governance, Accountability, and Organizational Risk**

Ethical failures in complex systems rarely remain confined to moral debate. They surface as operational breakdowns, safety incidents, regulatory exposure, and erosion of trust. When governance is weak, incentives misaligned, or accountability unclear, even technically competent systems can produce damaging outcomes. Artificial intelligence does not create this dynamic; it accelerates and scales it. Many organizations are uneasy with the language of ethics. It can feel abstract, subjective, or unhelpfully moral. Yet organizations do not need to care about ethics in a philosophical sense to experience the consequences of ignoring them. History shows that technically competent systems often fail not because the engineering was unsound, but because incentives, purpose, and responsibility were misaligned. Ethical blind spots, when left unexamined, tend to scale operational risk.

From a systems perspective, ethical considerations are not a separate philosophical layer applied after design. They manifest as constraints, performance measures, risk factors, and governance mechanisms within the system lifecycle. Questions of fairness, transparency, accountability, and appropriate use are not external to engineering. They shape requirements, define acceptable operating boundaries, and influence how failure modes are anticipated and managed. In this sense, ethics enters the system not as moral commentary, but as a structured design discipline.

This pattern is not unique to artificial intelligence. Complex socio-technical systems have always failed at their boundaries: where accountability is unclear, decisions are distributed,

and human judgment is softened by process or authority. AI intensifies these conditions. It introduces systems that operate at scale, influence decisions indirectly, and obscure the origin of errors behind layers of automation and abstraction.

When AI systems are deployed without clear governance frameworks that incorporate stakeholder requirements, human-centered priorities, and defined accountability structures, the outcomes are often predictable. Outputs are treated as neutral or objective because they are machine-generated. Responsibility diffuses across teams. Decisions are justified after the fact by reference to “what the system recommended.” Over time, clear ownership of decisions weakens, even in organizations acting in good faith.

Loss of trust is where these failures become materially consequential. Once customers, regulators, or partners doubt an organization’s ability to deploy technology responsibly—or fear that its use may expose them to risk or inefficiency—access narrows. Regulatory scrutiny increases. Oversight requirements multiply. Adoption slows not only for the system in question but also for subsequent initiatives. In competitive environments, this loss of confidence rarely remains theoretical; customers and prospective clients move toward alternatives they perceive as safer, more predictable, or, in some cases, more closely aligned with their own values.

From an organizational perspective, ethics is therefore not about moral positioning. It is about control and continuity. In the context of AI, ethical considerations function as design constraints: shaping what data may be used, how systems are validated, where human oversight is required, and how failures are detected and addressed.

In AI4SE contexts, these questions translate into workflow governance decisions: what sources may be used when drafting requirements with AI assistance, how AI-generated analyses are independently validated before influencing design, where explicit human review is mandatory, and how errors are detected and corrected once AI-generated material enters project artefacts. These are decisions about workflow design and oversight. An organization does not need to be ethically motivated to benefit from ethical discipline. Clear accountability, transparent decision-making, and defined limits on system autonomy reduce friction with regulators and customers alike, and support sustainable adoption. Ignoring ethics does not remove these pressures. It ensures they will surface later, under less controlled and more costly conditions.

## **5. Ethical Complications Specific to AI Systems**

General ethical principles provide a necessary foundation, but AI introduces a set of complications that are distinct in both form and scale. These issues are not hypothetical, and many of them arise directly from how modern AI systems are built, trained, and deployed. They present challenges that engineers and organizations must understand before meaningful governance is possible.

### **5.1 Training Data, Copyright, and Consent**

Most contemporary AI systems, particularly large language and image models, are trained on

vast quantities of existing material. This often includes copyrighted text, images, and other works, gathered at a scale that makes individual consent impractical and, in many cases, absent. The legal status of this practice remains unsettled (U.S. Copyright Office, 2023). Jurisdictions are diverging in their approaches to the question. In the United States, current guidance has yet to clearly resolve how existing copyright doctrines apply to large-scale training processes. In the European Union, the emerging regulatory framework takes a more precautionary stance, emphasizing transparency, data provenance, and rights-holder protection (European Commission, 2024). For organizations operating internationally, this uncertainty complicates compliance and risk management.

Beyond legality lies a more practical concern. Systems trained on data whose origins are opaque or contested are difficult to audit, defend, explain, or trust. A widely reported example emerged in 2024 when Google’s Gemini system confidently advised a user on the “correct” number of rocks to eat per day, an output later attributed to poor contextual grounding rather than intent or reasoning (Vincent, 2024). When questions arise about ownership, attribution, or misuse, organizations may find themselves unable to trace how particular outputs were produced or what obligations they carry. From an engineering perspective, this is a governance problem before it is a moral one.

## **5.2 Bias, Error, and Harm at Scale**

We have little credible evidence to suggest that bias in AI systems is the result of malicious intent. It is more often a property of the data on which systems are trained and the design choices made during development. When training data reflects imbalances, incomplete coverage, skewed representation, or the like, those patterns are reproduced, and often amplified, at scale.

Most deployed systems also incorporate guardrails—filters, policy constraints, and alignment mechanisms—that shape outputs according to predefined safety and usage parameters. These constraints reflect human judgments about acceptable speech, safety, and risk tolerance. They are often necessary, but they are not neutral; they can influence framing, emphasis, and omission in systematic ways. For organizations, this means that model validation should include awareness of how such constraints affect reporting, risk communication, and alignment with system requirements.

The consequences can be significant even when AI is used only as an assistive tool. In a 2022 study presented at the IEEE Symposium on Security and Privacy, Pearce et al. evaluated code generated by GitHub Copilot and found that AI-suggested contributions frequently contained security vulnerabilities, including insecure API usage and missing validation checks. The code was often syntactically correct and superficially plausible, yet flawed in ways that required careful analysis to detect. The issue was not malicious system behavior, but professional reliance on fluent outputs without rigorous verification.

In such cases, automation bias compounds the problem. When AI-generated material appears structured and confident, engineers may defer to it more readily, especially under time pressure. Errors introduced at early stages can then propagate quietly through

requirements baselines, architecture documentation, verification plans, and downstream artefacts.

For organizations, the lesson is not that AI systems are uniquely dangerous, but that errors propagate differently when systems operate at scale and with perceived authority. In AI systems, ethical complications are bound up with how outputs are validated and who remains accountable when things go wrong.

## **6. Risk Does Not Disqualify Use**

Debates about artificial intelligence are often framed in an unhelpful false binary. Either the technology is treated as too dangerous to use, or its risks are minimized in the name of innovation and competitiveness. Neither position is particularly useful. Engineering disciplines have long operated in environments where risk is unavoidable, and the relevant question has never been whether risk exists, but how it is understood, managed, and governed.

Modern societies rely on systems that are demonstrably high risk: aviation, nuclear energy, chemical processing, financial infrastructure. These systems are not trusted because they are risk-free, but because their risks are made explicit, constrained by design, and continuously monitored. Failure modes are anticipated, responsibility is assigned, and oversight is built in from the outset. Artificial intelligence belongs in this category of technologies, depending on the use case.

Long-horizon or existential risks associated with AI are not frivolous, nor should they be dismissed. They are, however, poorly served by reactive policy responses or blanket prohibitions. Speculative future harms do not invalidate present-day benefits, particularly when those benefits are already being realized in productivity, analysis, and decision support. What they do require is governance capable of evolving as systems, capabilities, and contexts change.

This is why adaptive policy matters. Static rules written in response to the last failure are unlikely to remain effective as AI systems develop. Frameworks that emphasize risk assessment, proportional controls, and ongoing evaluation are better suited to technologies that change quickly and are deployed unevenly across domains (OECD, 2019; NIST, 2023). Treating AI risk as a reason to either halt progress or proceed unchecked misses the point. The more productive stance is an engineering one: assume risk, design for it, and remain accountable as conditions change.

## **7. AI as a Tool — and Why the Analogy Breaks Down**

Artificial intelligence is often described as a tool, most commonly compared to a knife: the same object can be used to prepare a meal or to cause harm, depending on who wields it and for what purpose. As analogies go, this makes sense, and it is useful up to a point. It reinforces a necessary principle: responsibility lies with the user, not the object. The problem arises when the analogy is treated as complete. A knife is inert. It cannot decide to make a salad, stab someone, compose a ballad, or attempt to solve a difficult

mathematical conjecture. It requires a human hand and a human intention for anything to happen at all. Contemporary AI systems are different. Once embedded in workflows, they can generate plans, initiate actions, adapt to feedback, and operate continuously with minimal human prompting.

This does not make AI systems responsible in any moral or legal sense. They do not possess intent, awareness, or goals of their own. But it does change the nature of responsibility around them. When a system can recommend actions, frame options, or produce persuasive language at scale, the burden on those who design, deploy, and oversee it increases in both scope and complexity.

Yuval Noah Harari has repeatedly warned that the distinctive power of AI lies not in physical force, but in its mastery of language. As he has put it, AI represents “the first technology in history that can make decisions and create ideas by itself,” and, more importantly, can do so using the medium through which humans organize society: words (Harari, WEF, 2024). Systems that can generate convincing narratives, tailored arguments, or emotionally resonant responses can influence human behavior without issuing commands or applying coercion.

Geoffrey Hinton has expressed a related concern from a different angle. Reflecting on the scale of data these models absorb, he has noted that such systems effectively internalize large portions of human knowledge about psychology, persuasion, and strategy, while lacking the human constraints that normally temper their use (Hinton, 2023). The risk is not that AI “wants” anything, but that it can become extraordinarily effective at saying the right thing to the right person at the right time.

Seen in this light, the knife analogy breaks down. AI is better understood as a tool that can, under certain conditions, act as a persuasive intermediary between information and decision-making. That reality does not absolve humans of responsibility. It demands clearer boundaries, stronger oversight, and deliberate choices about where autonomy begins and ends.

## **8. Responsibility Does Not Transfer to the Machine**

As AI systems become more capable and more deeply embedded in organizational processes, we have all heard either this, or a similar phrase in post-hoc explanations: “*the system decided*”. From an engineering perspective, this is not an explanation at all; rather, it is a failure of accountability.

AI systems do not bear responsibility. They do not possess intent, the capacity to judge, or awareness, and they cannot be held accountable for outcomes. Responsibility, as it always has, remains with the humans and organizations that design the system, select its data, define its objectives, deploy it into operational contexts, and decide how its outputs are used. No increase in technical sophistication changes this basic fact.

The risk is not that organizations forget this principle explicitly, but that it erodes implicitly. As systems become more complex and outputs more persuasive, it becomes easier to defer

judgment, particularly under time pressure or cognitive load. Decisions are easily framed as recommendations. Recommendations become defaults. Defaults become accepted practice. Over time, responsibility diffuses unless it is actively reinforced.

This is why traceability, auditability, and explainability are not optional features in high-impact AI systems. They are mechanisms by which responsibility is preserved. If an organization cannot reconstruct how a system arrived at a particular output, what assumptions were embedded in its design, or where human judgment, or lack thereof, entered the loop, then accountability has already been compromised.

By traceability, we mean the ability to reconstruct how an output entered the engineering workflow: what prompts were used, what inputs informed the response, and how the output was subsequently modified or accepted. Auditability refers to the capacity for independent review of decisions influenced by AI assistance, including documentation of assumptions and validation steps. Explainability, in AI4SE contexts, does not imply access to model internals, but the ability of engineers to justify why a particular AI-generated output was accepted and how it aligns with system requirements and constraints. In SE4AI settings, explainability often extends to model interpretability and lifecycle validation; in AI4SE, it is primarily a property of workflow governance. Well-designed AI governance frameworks reflect this reality. They emphasize human accountability at every stage of the system lifecycle, from design through deployment and ongoing operation. They require documentation of assumptions, limitations, and intended use. They establish clear escalation paths when outputs are uncertain, contested, problematic, or otherwise consequential. They insist on audit trails that make decisions reviewable after the fact, not merely defensible in theory.

These practices can feel like bureaucratic overhead, but they are the means by which organizations retain control over systems whose rate of content generation can exceed the human capacity for careful review. The risk is not blind trust in AI outputs, but that volume and velocity outpace scrutiny. In engineering terms, these governance mechanisms function as safety controls, preserving review discipline under accelerated conditions. Responsibility does not transfer to the machine but accumulates around it. Organizations that recognize this early are better positioned to use AI effectively, defend their decisions when challenged, and adapt as systems evolve.

In AI4SE contexts, this translates into concrete engineering decisions. When is AI permitted in drafting requirements, and when must outputs be independently validated? What level of review is required before AI-generated analysis informs a design decision? Where must prompts and outputs be retained to preserve traceability? What constitutes acceptable delegation, and what remains non-delegable professional judgment? These are not abstract ethical questions. They are governance decisions embedded in workflow design.

## **9. Using AI Well: Why Most Productivity Gains Do Not Come From the Model**

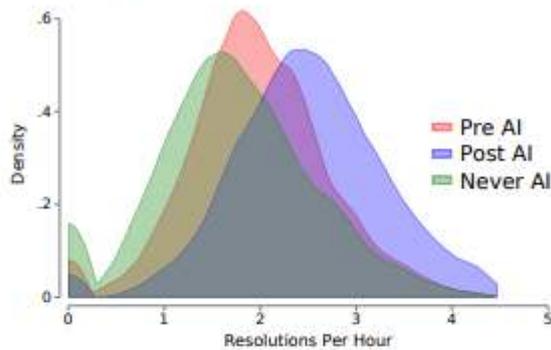
In AI4SE environments, productivity gains are frequently attributed to model capability. In practice, they depend more heavily on workflow design and review discipline than on the

underlying system. Without structured critique and validation, increased speed can simply amplify poorly examined assumptions.

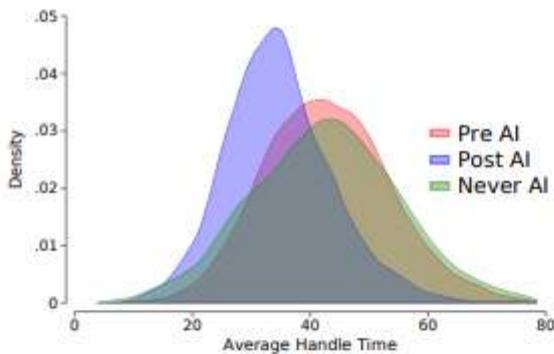
Public debate about AI often treats access to powerful language models as synonymous with productivity. In practice, that assumption does not hold. While some individuals and organizations do see meaningful improvements, many do not. The difference is rarely the model itself.

Empirical work consistently shows that productivity gains from generative AI are uneven. In controlled settings, language models have been shown to improve performance on specific tasks, such as drafting text or handling routine customer interactions, but the magnitude of improvement varies significantly across users and contexts (Brynjolfsson, Li, and Raymond, 2023; Noy and Zhang, 2023). In some cases, AI narrows performance gaps by supporting less experienced users. In others, it primarily amplifies the effectiveness of those who already know how to evaluate, revise, and reject outputs.

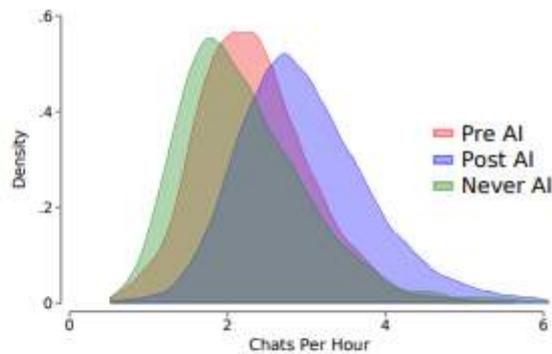
A. RESOLUTIONS PER HOUR



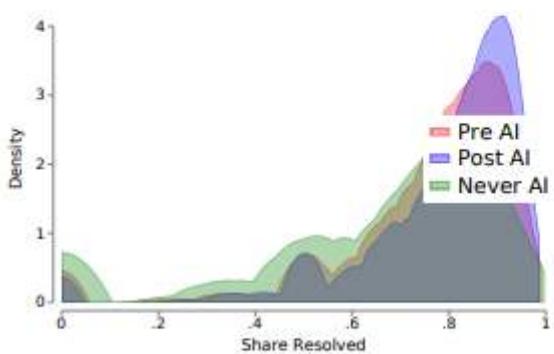
B. AVERAGE HANDLE TIME



C. CHATS PER HOUR



D. RESOLUTION RATE



E. CUSTOMER SATISFACTION (NPS)



***Distributional effects of generative AI adoption in a customer-support context.***

*The figure shows shifts in multiple productivity and quality metrics following AI deployment. While average performance improves, outcomes remain distributed and overlapping, illustrating that gains are uneven and depend on task and user context.*

*Source: Brynjolfsson, Li & Raymond (2023)*

Across writing, analysis, and decision-support tasks, a common pattern emerges. Language models perform well at producing confident first-pass material: summaries of documents, structured outlines of arguments, lists of options, or initial attempts at explanation. For example, when asked to summarize a technical incident report, draft a policy note, or sketch possible responses to a procurement decision, a model can quickly generate something that appears complete and well-organized. What it cannot reliably determine is whether the summary omits a critical caveat, whether the policy framing aligns with organizational constraints, or whether the decision options rest on assumptions that no longer hold.

The risk is therefore not that the output is obviously wrong. It is that it is plausible enough, and presented with sufficient fluency and confidence, that it may be allowed to pass without challenge. In organizational settings, where time pressure and cognitive load are already high, this is precisely the condition under which judgment tends to soften.

Effective use has less to do with clever prompting than with how outputs are handled. Users who benefit most from language models tend to treat them as generators or interlocutors, not arbiters. They use AI to surface possibilities, frame questions, or expose lines of reasoning, while retaining responsibility for deciding what matters. In practice, this often takes the form of two-pass workflows: an initial guided generation followed by deliberate critique, revision, or comparison against an external reference point. Research on aligned language models shows that structured critique and revision can materially improve output quality, even when the underlying model remains unchanged (Bai et al., 2022).

In structured AI4SE settings, this discipline becomes more explicit. Engineers decompose tasks into smaller decision elements, iterate incrementally, and introduce adversarial or “red team” prompts to surface weaknesses, edge cases, or counterarguments. In AI-assisted engineering workflows, red teaming refers to structured adversarial prompting designed to expose assumptions, failure modes, and weaknesses in generated outputs before they influence decisions. Such techniques can materially improve robustness. However, they require judgment: models may generate extensive critiques that are valid but unevenly prioritized. The objective is not exhaustive self-criticism but disciplined human evaluation of which concerns are substantively relevant. These methods do not enhance the model itself; they reinforce governance by preventing persuasive fluency from substituting for engineering judgment. Consider a common analytical task. A model may be asked to assess the risks of adopting a new system, summarize stakeholder concerns, or outline trade-offs between cost, speed, and reliability. Used well, the output becomes a starting point for interrogation: which risks are assumed rather than evidenced, which stakeholders are missing, and which failure modes are treated as negligible, and why. Used poorly, the same output becomes a substitute for analysis rather than a support for it.

Task characteristics also matter. Language models tend to add value where success criteria are reasonably clear and where errors can be detected through review, comparison, or domain knowledge. They are far less reliable where objectives are ambiguous, stakes are high, or feedback is delayed. In such contexts, uncritical acceptance of AI output can introduce new failure modes, and the cost of supervision can exceed any efficiency gained. Excessive iteration can also produce diminishing returns: beyond a certain point, additional prompting may generate variation rather than convergence, consuming review effort without materially improving correctness.

What distinguishes productive use, then, is critique and interrogation. Users who consistently ask follow-up questions, request alternative framings, probe assumptions, or deliberately seek counterarguments extract more value than those who accept the first coherent response. This behavior can feel adversarial, but it is analytical rather than oppositional. It reflects an understanding that the model's confidence is a property of its training, not a signal of correctness.

### **In practical terms, this difference often shows up in simple habits:**

#### **Do this**

- Use the model to produce a first draft or initial analysis, then either critique its output, or request it to critique its own output.
- Request multiple alternative approaches to the same problem and compare their underlying assumptions.
- Ask what the output depends on being true, and where it is most likely to fail.
- Compare AI output against an external baseline: prior work, established standards, or domain-specific constraints.

#### **Not that**

- Accept the first plausible answer because it sounds complete or authoritative.
- Treat AI output as a decision rather than an input.
- Expect the model to identify its own errors.
- Skip review because the task "looks done".

Using AI well is therefore less about adopting the latest model and more about cultivating disciplined interaction patterns. Language models are effective tools for exploration and drafting, but their outputs improve most when treated as provisional. Different models exhibit different strengths and failure modes, which only become visible through sustained

use. The willingness to question what the system produces matters more than the sophistication of the system itself.

### **10. Centaurs, Cyborgs, and Practical Human–AI Integration**

If productivity gains depend on human judgment rather than model capability alone, then the practical question becomes how humans and AI should actually work together. This principle reframes AI not as an autonomous substitute for expertise, but as an amplifier whose effectiveness depends on structured interaction and retained decision authority. One useful way to understand this division of labor is through the distinction between divergent and convergent thinking. Language models are well-suited to divergent exploration: generating alternatives, surfacing overlooked factors, or expanding the space of possibilities. They are far less reliable at convergent judgment—determining which option is correct, optimal, or contextually appropriate. That narrowing function remains a human responsibility. A helpful way to frame the problem comes from the contrast between centaurs and cyborgs, a framing popularized in competitive chess and later applied more broadly to knowledge work.

A centaur system pairs human and machine in clearly differentiated roles. The AI contributes speed and pattern recognition, along with access to far more information than a human can hold at once. The human retains responsibility for judgment, interpretation, and final decision-making. In chess, centaur teams, where human players work alongside analytical engines, have been shown to outperform humans alone and machines operating without human oversight (Kasparov, 2017). The strength of the model lies not in deeper integration, but in complementary capability.

Cyborg systems, by contrast, blur the boundary between human and machine. Decision-making becomes tightly coupled. Human intervention is reduced, delayed, or procedural rather than substantive. In some contexts, this can deliver efficiency gains, but it also concentrates risk. When errors occur, it becomes harder to identify where judgment failed, harder to intervene in real time, and harder to assign responsibility after the fact. For most organizations, particularly those at an early stage of AI adoption, centaur-style arrangements offer a safer and more effective starting point. They preserve human accountability, make oversight explicit, and allow organizations to learn where AI adds value without surrendering control. They also make failure modes more visible, which is essential for improvement.

Cyborg approaches may be appropriate in narrow, well-understood domains with low tolerance for latency and high confidence in system behavior. Even then, they require rigorous governance, continuous monitoring, and clear fallback mechanisms. Treating cyborg integration as a default, rather than a deliberate design choice, is a common and costly mistake.

The practical lesson is simple. Human–AI integration is not a binary choice between automation and resistance. It is an architectural decision. Organizations that treat it as such are better positioned to realize value from AI while retaining the judgment and accountability that complex systems demand.

## **11. Conclusion: Engineering Judgment in an Age of Persuasive Machines**

Despite its novelty, artificial intelligence does not change the fundamentals of engineering responsibility. It does not dissolve accountability or dilute professional obligation. What it does is place new pressure on the systems, incentives, and decisions that already exist. In that sense, AI functions less as a rupture and more as a stress test of existing systems.

Organizations that treat AI as a shortcut to intelligence are likely to be disappointed. Those who treat it as a capability to be governed, constrained, and integrated thoughtfully are more likely to see durable benefits. The difference is not access to models, data, or infrastructure. It is the quality of judgment applied around them.

Taken together, these arguments point to a consistent theme. AI systems are powerful precisely because they operate fluently in language and scale quickly across decisions. That makes them useful. It also makes them easy to misuse. The risks they introduce are rarely exotic; they are familiar engineering risks intensified by speed, scale, and persuasive fluency.

For engineers, the challenge ahead is therefore not to compete with machine intelligence, nor to retreat from it. It is to remain accountable in its presence. That means designing systems with clear boundaries, maintaining human oversight where it matters, and resisting the temptation to delegate responsibility simply because a system sounds confident.

The future of AI in organizations will be shaped less by what machines can do, and more by how well humans choose to govern them. Judgment, not intelligence, remains the scarce resource.

## **References**

**American Civil Liberties Union (2024)** 'Police say a simple warning will prevent face recognition wrongful arrests. That's not true.'

Available at: <https://www.aclu.org/news/privacy-technology/police-say-a-simple-warning-will-prevent-face-recognition-wrongful-arrests-thats-just-not-true>

**Bai, Y. et al. (2022)** *Training a Helpful and Harmless Assistant with Reinforcement Learning from Human Feedback.*

Available at: <https://arxiv.org/abs/2204.05862>

**Bender, E. M., Gebru, T., McMillan-Major, A. and Shmitchell, S. (2021)** 'On the dangers of stochastic parrots: Can language models be too big?', *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency*, pp. 610–623.

Available at: <https://dl.acm.org/doi/10.1145/3442188.3445922>

**Brundage, M. et al. (2018)** *The Malicious Use of Artificial Intelligence: Forecasting, Prevention, and Mitigation.*

Available at: <https://arxiv.org/abs/1802.07228>

**Brynjolfsson, E., Li, D. and Raymond, L. R. (2023)** *Generative AI at work*. NBER Working Paper No. 31161.

Available at: <https://www.nber.org/papers/w31161>

**Davenport, T. H. and Kirby, J. (2015)** 'Beyond automation', *Harvard Business Review*, June.

Available at: <https://hbr.org/2015/06/beyond-automation>

**Dennett, D. C. (1987)**

*The Intentional Stance*. Cambridge, MA: MIT Press.

Available at: <https://mitpress.mit.edu/9780262540537/the-intentional-stance/>

**European Commission (2024)** *EU Artificial Intelligence Act: Background and Policy Documents*.

Available at: <https://digital-strategy.ec.europa.eu/en/policies/european-approach-artificial-intelligence>

**Harari, Y. N. (2024)** *AI and the Future of Human Agency*, remarks at the World Economic Forum Annual Meeting, Davos.

Available at: <https://singjupost.com/yuval-noah-hararis-remarks-wef-davos-2026-transcript/>

**Hinton, G. (2023)** 'Geoffrey Hinton on the promise and risks of artificial intelligence' (60 Minutes transcript), CBS News, 8 October.

Available at: <https://www.cbsnews.com/news/geoffrey-hinton-ai-dangers-60-minutes-transcript/>

**Kasparov, G. (2017)** *Deep Thinking: Where Machine Intelligence Ends and Human Creativity Begins*. London: John Murray.

Publisher page: <https://www.hachette.co.uk/titles/garry-kasparov/deep-thinking/9781473653511/>

**Kokotajlo, D. et al. (2023)** 'Deceptive Alignment', *arXiv preprint*.

Available at: <https://arxiv.org/abs/2310.13548>

**National Institute of Standards and Technology (NIST) (2023)** *AI Risk Management Framework*.

Available at: <https://www.nist.gov/itl/ai-risk-management-framework>

**Noy, S. and Zhang, W. (2023)** 'Experimental evidence on the productivity effects of generative artificial intelligence', *Science*, 381(6654), pp. 187–192.

Available at: <https://www.science.org/doi/10.1126/science.adh2586>

**OECD (2019)** *OECD AI Principles*.

Available at: <https://oecd.ai/en/ai-principles>

Pearce, H., Ahmad, B., Tan, B., Dolan-Gavitt, B. and Karri, R. (2022) 'Asleep at the keyboard? Assessing the security of GitHub Copilot's code contributions', *Proceedings of the IEEE*

Symposium on Security and Privacy.

Available at: <https://ieeexplore.ieee.org/document/9833571>

**U.S. Copyright Office (2023)** *Copyright and Artificial Intelligence*.

Available at: <https://www.copyright.gov/ai/>

**Vincent, J. (2024)** 'Google AI Overviews are telling people to eat rocks and glue', *The Verge*, 24 May.

Available at: <https://www.theverge.com/2024/5/24/24164119/google-ai-overview-mistakes-search-race-openai>

### About the authors



Jan Harm Retief is a consulting Systems Business Analyst at Saratoga Software, specializing in the integration, governance, and lifecycle deployment of artificial intelligence systems within complex operational environments. His work focuses on the systems engineering realities of AI adoption, including decision-support architecture, human-machine interaction, and maintaining accountability in automated workflows. He has led enterprise AI initiatives spanning generative AI assistants, analytics platforms, and

operational systems supporting thousands of users across retail, fintech, insurance, and healthcare. He holds degrees in Information Technology and Managerial Leadership from the University of the Free State.



Francois Retief, CSEP, is a Principal Consultant and Course Presenter at Project Performance International (PPI), specializing in applying systems engineering within complex organizational and operational environments, particularly where software-intensive development intersects with broader engineering disciplines. He is also COO and co-founder of iono.fm, an online streaming and podcasting platform, where he leads operational and commercial delivery supporting over 500

publishers and radio stations, multiple advertising partners, and millions of listeners. Francois serves on the INCOSE Certification Advisory Board and Education Task Force, contributing to certification strategy and the evolution of systems engineering education.

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*“The only significance of the word spiral in the spiral model is that a spiral is a way of fitting a long timeline onto a computer screen. But as a stage based, stage gate, risk and opportunity-driven development methodology, “spiral” has an important place in engineering practice.”* -**Robert Halligan**



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# AI-enabled Requirement Structure Patterns

by John Fitch

*Project Performance International*

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Authored for PPI SyEN

## Introduction

The accelerating adoption of Artificial Intelligence to support systems engineering tasks (AI4SE) puts increasing pressure on systems engineering practitioners to increase the rigor of the methodologies that they employ. Ad hoc approaches with poorly defined inputs, tasks (transformations), and outputs will yield unreliable and even dangerous results when coupled with generative AI's predictive and non-deterministic algorithms.

This article investigates the ability of Large Language Models (LLMs) to support practitioners who use formalized requirement structure patterns as the template for analyzing originating requirements from stakeholders and transforming them into high-quality natural language requirements, suitable for driving the development of solutions. As such, the article is the AI-focused follow-on to the *Requirement Structure Patterns - A Comparison of Methods* article that was published in [PPI SyEN Edition #142 \(November 2024\)](#). Two of the four patterns addressed in the first article are the subject of this analysis:

- Easy Approach to Requirements Syntax (EARS) [1,2]
- PPI Requirements Parsing Template [3]

To support this comparison, we will continue the use of the Energy Absorbing Deceleration Barrier (EADB) [4], aka Fitch Inertial Crash Barrier, as the example system and source of raw originating requirements as inputs to the LLM. This system was the subject of the *Rethinking Requirements Derivation – Part 2* article in [PPI SyEN Edition #130 \(November 2023\)](#), in which a decision pattern was used to reverse-engineer the implicit decisions in the EADB patent application and from which an initial set of system and subsystem requirements was derived. The focus of that article was the derivation thought process and traceability, not the precise statement of these requirements, so a subset of the 60+ requirements generated by that analysis serves well as inputs for this exercise. In addition, the entire article provides excellent context, i.e., the **Why** behind each requirement, for the LLM to digest when attempting to refine each requirement by use of the EARS or PPI patterns.

A second article, *A Common Notation for Capturing States & Modes Requirements and Design*, in

[PPI SyEN Edition #139 \(August 2024\)](#) also used the EADB system example and produced a model of system states and modes that was also used as an input to the LLM.

This article is intended to investigate:

- The capabilities of an LLM to transform raw and incomplete requirements into high-quality requirements
- The differences between the effectiveness of the EARS and PPI requirement structure patterns in guiding the LLM in doing so
- How to better prompt an LLM when using its capabilities to generate structured requirement statements
- The common defects produced by the LLM when generating structured requirements
- Implications of this analysis on the engineer's responsibility to govern AI-enabled requirements engineering

### **Methodology Used**

Based on lessons learned during the development of PPI's [Artificial Intelligence for Systems Engineering \(AI4SE\)](#) course, PPI recommends focusing on prompt engineering as the fundamental skill for leveraging AI in support of systems engineering tasks. We teach a simple 5-element prompt engineering pattern (ROTCE) [5]:

- Role
- Organizational context
- Task
- Constraints
- Evaluation

The author used this pattern, populated through a subset of eleven other prompting techniques also taught in the PPI course, to develop an initial prompt for the EARS vs PPI requirements generation exercise. After uploading relevant documents that define the EADB system and the EARS and PPI methodologies, the author ran a 3-hour chat session with Google Gemini during which twelve raw requirements were submitted for analysis and improvement by the LLM. The free (low-tier) public version of Gemini was used. An initial attempt to use the free, low-tier version of ChatGPT failed because of its limitation of accepting only three file uploads.

The interactive chat generated a 54-page, 14,000-word output – an amazing volume of information for a 3-hour session.

### **Prompt Design**

The full initial prompt (3-page, 750-word) in the ROTCE pattern is provided in the section that follows. Highlights of this approach include:

- Initial uploads of example system information for context and raw requirement sourcing.

- Initial uploads of EARS and PPI methodology sources for process guidance.
- Role: Act as a highly-skilled requirements analyst and systems engineer, generating high-quality requirements.
- Organizational context: Simulates the scenario of developing an improved EADB, starting with requirements that have been reverse engineered from an existing system.  
Task: Decomposed work to be done by the LLM into eight subtasks, generally performed on one requirement at a time, with multiple pauses after task completion to enable user feedback and iteration to correct LLM errors or “drift”.
- Constraints: Specific instructions concerning how to complete each task, defining the format for outputs, and limiting the LLM’s ability to hallucinate new “facts” or violate the imposed methodologies.
- Evaluation: A definition of success that states the requirements quality attributes to be sought.

### ***Requirement Structure Pattern (EARS vs PPI) Prompt***

#### *Uploads Concerning the Sample System*

- Patent-US3606258-energy-absorbing-barrier-John Fitch-1971.pdf
- Rethinking Requirements Derivation – Part 2 SyEN November 2023.pdf
- A Common Notation for Capturing States+Modes Requirements and Design.pdf

#### *Uploads Concerning Methods*

- PPI Requirement Types (2 pages)
- PPI Requirements Parsing Template, Definitions and Examples (3 pages)
- EARS. <https://alistairmavin.com/ears/>
- The Essential Guide to Requirements Management and Traceability, Chapter 2.4 by Maven, A. Adopting the EARS Notation to Improve Requirements Engineering, published online at <https://www.jamasoftware.com/requirements-management-guide/writing-requirements/adoptingthe-ears-notation-to-improve-requirements-engineering>

#### *Role:*

As a highly-skilled system requirements analyst and systems engineer, use the requirement structure patterns provided (EARS and PPI Parsing Template) to successively generate high-quality system and subsystem requirements for an example system.

#### *Organizational Context:*

Your company wants to create an improved Energy Absorbing Deceleration Barrier (EADB) that provides the same capabilities as the system defined in U.S. Patent #3,606,258. Initial work has been done to reverse-engineer the design decisions associated with the Fitch Inertial Barrier system that is characterized in the patent.

### Task:

Classify user-entered requirements from the last two columns of Table 4-7 of the PPI SyEN paper, Rethinking Requirements Derivation – Part 2, by the requirement types defined in the EARS and PPI requirement structure templates, providing a brief rationale for that classification.

Pause for feedback and refinement of the requirement classifications.

As the classified (categorized) requirements are selectively entered by the user, improve the quality of each requirement by rewriting it twice, using the EARS pattern first, then the PPI pattern.

Describe the rationale behind the use or non-use of each element of the requirement structure pattern.

Where necessary to resolve incompleteness or ambiguity, identify questions to be asked of stakeholders to resolve such issues.

Where needed for the sake of completeness, generate multiple requirements that, when taken together, meet the intent of the requirement that has been entered.

Wait for feedback after generating each improved requirement.

When prompted, export a Requirements Analysis Record (RAR) table in CSV format that includes each originating requirement analyzed in this chat.

When prompted, generate a comparison between the structural elements of the EARS and PPI requirement structure patterns, highlight the top 5 commonalities and top 5 differences between these requirement models.

When prompted, generate a set of at least three recommendations for improving the prompts in this chat to improve the quality of the requirements generated from this interaction.

### Constraints:

Use the two web pages uploaded at the start of this chat as the sole and immutable sources for the EARS requirements structure methodology, namely:

- EARS. <https://alistairmavin.com/ears/>
- The Essential Guide to Requirements Management and Traceability, Chapter 2.4 by Maven, A. Adopting the EARS Notation to Improve Requirements Engineering, published online at <https://www.jamasoftware.com/requirements-management-guide/writing-requirements/adoptingthe-ears-notation-to-improve-requirements-engineering>

Use the PPI Requirements Parsing Template, Definitions and Examples.pdf document uploaded at the start of this chat as the sole and immutable sources for the PPI requirements structure methodology, namely:

Limit the set of valid requirement types when classifying requirements against the EARS model to these and only these immutable values:

- Ubiquitous
- State-driven
- Event-driven
- Optional feature
- Unwanted behavior.

Limit the set of valid requirement types when classifying requirements against the PPI model to those types specified in the PPI Requirements Parsing Template, Definitions and Examples document.

Use the examples in the EARS and PPI sources as additional guidance for writing good requirements.

When writing improved requirements in either pattern, completely ignore the version of the requirement that has been generated against the other pattern, i.e., the EARS version must not contaminate the PPI version and vice versa. Do not force similarity between the two results.

Use the EADB patent document and the EADB functional model and decision model in the PPI SyEN article, Rethinking Requirements Derivation – Part 2, to provide context for and inform the derivation and intent of each requirement that is entered for analysis.

When defining Preconditions and Triggers (for EARS) and Conditions for Action (for PPI) use the EADB states and modes within the document, A Common Notation for Capturing States+Modes Requirements and Design.pdf as the sole and immutable source of the EADB states, modes and state-to-state and mode-to-mode transition requirements.

State each improved requirement with the EADB system or responsible subsystem as the system name (EARS) or actor (PPI).

Format the RAR CSV file to include a comparison of:

- The verbatim originating requirement text
- The improved requirement in EARS table format
- The improved requirement in PPI table format
- Rationale for the differences between the EARS and PPI template results.

### Evaluation:

Focus requirement quality improvements on accuracy, completeness, clarity, and verifiability of each requirement.

### **LLM Outputs and Analysis**

Results of the interactive chat with Gemini are summarized below, along with significant lessons learned concerning LLM capabilities, effective prompting methods, and the efficacy of the EARS and PPI templates.

### Summary of Sample System Uploads

Although not specifically requested, Gemini provided an excellent 1.5-page summary of the EADB documents that were uploaded, including:

- System Overview (purpose, core mechanism, key design goal, and impact)
- Physical and Functional Characteristics (sacrificial design, structural composition, states of operation)
- Historical and Academic Context (inventor, patent, use in systems engineering)

This pattern has been observed elsewhere in Gemini and ChatGPT, i.e., restating a context summary to “ground” the LLM on a smaller volume of deemed-to-be-essential information when compared with a much larger volume of provided system context information (40+ pages in this case).

### Summary of Sample System Uploads

When prompted to categorize the raw requirements in the Rethinking Requirements Derivation article, Gemini returned just 5 requirements of the 60+ expected. These requirements were appropriately categorized according to the EARS and PPI classification scheme. However, none of the originating requirements returned matched verbatim the text of the requirements in the desired source document.

Rather than resolve this mystery (of secondary importance to the ability of the LLM to use the structure templates), the author proceeded without investigating to find and confirm the root cause of this anomaly. During final review, it was discovered that a typo in the prompt requested the requirements in “Table 4-7” instead of “Tables 4-7”. This single missing character led the LLM to generate its own smaller set of requirements, likely from the EADB patent and state-model articles.

Observations and lessons learned:

- Precision in prompt inputs is of the ultimate importance. The LLM may infer correctly the user’s intent, but where ambiguity exists, may substitute a shortcut (path of least resistance) and provide an anomalous output without any notification that such a shortcut was taken.

- Including an explicit constraint in the prompt to notify the user of assumptions made and shortcuts taken in the generation of outputs is a best practice that forces the LLM to justify its answers. This may also take the form of a restatement of the task to be performed and an initial inventory (manifest) of the number of objects being processed to help the user proactively detect ambiguities in the prompt or in the LLM's interpretation of the instructions.

### One-at-a-time Requirements Refinement

The core of this experiment was the submission of 12 raw requirements to the LLM for analysis and improvement by using the EARS and PPI structure templates as a guide. The LLM accurately summarized the tasks associated with this effort as:

*Once you select a requirement, I will:*

1. Rewrite it using the EARS pattern.
2. Rewrite it using the PPI Parsing Template.
3. Provide the rationale for the structural elements used.
4. Identify any stakeholder questions to resolve ambiguity.

The LLM's output faithfully followed the pattern for each requirement:

- Analysis of originating requirement
- Originating text (restated verbatim)
- EARS classification, with rationale.
- PPI classification, with rationale.
- Improved requirement: EARS pattern used, plus a table of the rewritten requirement with rationale for the pattern elements that were used
- Improved requirement: PPI pattern, plus a table of the rewritten requirement with rationale for the pattern elements that were used
- Stakeholder questions to resolve ambiguities.

An opportunity for feedback was provided after each requirement was processed. On average, one additional iteration was required in this experiment to refine a requirement before moving on. In a real-world scenario with significant penalties for defective requirements, it is likely that the average would rise to 3 or more iterations per requirement to achieve requirements quality sufficient to support the from-scratch design of a new system of equivalent complexity.

Observations and lessons learned:

- The LLM frequently provided useful knowledge concerning relevant standards or measures of performance that might have been overlooked by inexperienced engineers. This is the most impressive of its capabilities; divergent thinking based

on its access to vast volumes of training data from which the LLM can suggest potentially relevant information to consider. For example, the LLM's ability to suggest questions to stakeholders to resolve requirement ambiguities was generally "on-point". However, the LLM's ability to assess the relevance of its outputs to the current context is limited; it suggests possibilities but does not ensure a high correlation between its suggestions and the context of the problem being addressed.

- The LLM hallucinated a "Transport State" that did not exist in the source documents, despite an explicit constraint in the prompt: "*When defining Preconditions and Triggers (for EARS) and Conditions for Action (for PPI) use the EADB states and modes within the document, A Common Notation for Capturing States+Modes Requirements and Design.pdf as the sole and immutable source of the EABD states, modes and state-to-state and mode-to-mode transition requirements.*" LLM's cannot be trusted to reliably interpret or follow explicitly stated constraints, requiring careful review and user correction of defective outputs. Failure to detect and promptly correct such outputs may accelerate "drift" away from the clearly stated context of the chat.
- The human effort to oversee the LLM is significantly different than the effort required to guide a skilled human engineering assistant. Imprecise prompts are more likely to yield poor results than similar instructions given to a human engineer who voluntarily asks questions when in doubt.
- Working with an LLM is often like playing "Whack-a-mole". Convergence to an acceptable output often seems out of reach; settling for an 80% or 90% solution that requires human post-processing appears to be the norm.
- The PPI Parsing template includes three possible "locations" in a requirement sentence for the Constraints of Action element. The LLM used one of the two parsing examples, incorrectly inferred a rule from that example and misused that rule until corrected. Specifically, the third Constraint of Action element in several cases became a dumping ground of non-requirement "so that" (purpose) information that belongs in a Rationale attribute, not in the requirement text. Prompting the LLM to explicitly state the rules that it derives from examples may be a useful prompting practice to consider to reduce the frequency of such errors.

### ***Differences between EARS and PPI-structured Requirements***

The author was surprised at the consistent and significant differences between the requirements text generated against EARS and PPI templates. The LLM was instructed to maintain independence when processing both versions of the same originating requirement:

*When writing improved requirements in either pattern, completely ignore the version of the requirement that has been generated against the other pattern, i.e., the EARS version must not contaminate the PPI version and vice versa. Do not force similarity between the two results.*

A few of the more significant examples are provided with the LLM's rationale for the differences:

### *The barrier shall decelerate the vehicle*

EARS: While in the Intercepting State, the EADB shall decelerate an impacting vehicle having a mass of up to 4000 lbs and a velocity of up to 60 mph at a rate not exceeding 5g.

PPI:

- [Actor: The EADB]
- [Conditions: in the Intercepting State]
- [Action: shall decelerate]
- [Object: an impacting vehicle]
- [Constraints: at a rate not exceeding 5g]
- [Refinement: having a mass of up to 4000 lbs and a velocity of up to 60 mph]
- [Constraints: until the vehicle velocity is 0 mph]

Rationale: EARS uses a 'State Driven' trigger to define the operational window. PPI uses the 'Refinement of Object' and 'Constraints' fields to isolate mass and velocity as distinct engineering variables for precise verification.

### *R.39 Prevent moisture ingress (Subsystem: Barrier Unit)*

EARS: Each EADB barrier unit shall prevent the ingress of liquid water and water vapor into the dispersible mass container.

PPI:

- [Actor: Each EADB barrier unit]
- [Conditions: in the Protecting State while in Maintain Readiness Mode]
- [Action: shall prevent]
- [Object: the ingress of moisture]
- [Constraints: in accordance with IP67 standards]
- [Constraints: to maintain the dispersible mass in a free-flowing condition for the duration of its service life]

*Note that the final Constraint of Action element above contains information on the purpose of the requirement that belongs in a Rationale attribute, not within the requirement text.*

Rationale: EARS remains 'Ubiquitous' and descriptive. PPI adds the 'Maintain Readiness Mode' for extreme specificity and mandates a technical standard (IP67) to ensure an unambiguous verification criterion.

### *R.23 Fracture barrier units*

EARS: When impacted by a vehicle, each EADB barrier unit shall fracture immediately to release its internal dispersible mass into the path of the vehicle.

PPI:

- [Actor: Each EADB barrier unit]
- [Conditions: in the Intercepting State while in Decelerate Vehicle Mode, upon impact by a vehicle]
- [Action: shall fracture]
- [Object: the container structure]

- [Constraints: within 50 milliseconds of contact]
- [Constraints: in a manner that exposes at least 90% of the internal dispersible mass surface area]

Rationale: EARS uses an 'Event Driven' trigger. PPI treats the trigger as a 'Condition for Action' and provides high-fidelity performance constraints (timing and surface area) to ensure the physics of the energy transfer are met.

### R.32 Limit secondary hazards (flying debris)

EARS: If barrier unit fragments are generated during a vehicle impact, the EADB shall retain all fragments having a mass greater than 0.5 lbs within a 20-foot radius of the impact point.

PPI:

- [Actor: The EADB]
- [Conditions: in the Intercepting State while in Decelerate Vehicle Mode, upon impact by a vehicle]
- [Action: shall limit]
- [Object: the dispersion of fragments]
- [Constraints: such that no fragment with a kinetic energy exceeding 40 Joules travels beyond the designated safety zone]
- [Exceptions: unless the impact speed exceeds 75 mph]

Rationale: EARS utilizes the 'Unwanted Behavior' pattern. PPI uses the 'Functional' pattern with 'Exceptions' and quantifies the hazard using Joules (energy) rather than just mass/distance for a higher level of engineering safety assurance.

When challenged on why the LLM used different units of measurement on the flying debris, e.g., for EARS: mass + radius; for PPI: joules, the LLM's justification was:

- The EARS methodology is designed to reduce the "noise" and complexity of natural language while remaining readable to a broad range of stakeholders.
- The PPI Parsing Template is a tool for deep engineering analysis, specifically designed to facilitate unambiguous verification and design synthesis.
- I quantified the performance differently because EARS is optimized for behavioral clarity (what the user sees), while PPI is optimized for analytical integrity (the physics the engineer must control)

The following table was provided by the LLM to compare/contrast the intent of the two patterns:

## FEATURE ARTICLE

Element	EARS Pattern Justification	PPI Pattern Justification
<b>Verification Strategy</b>	Favors <b>Demonstration/Inspection</b> . You can see the debris in a 20ft circle; you can weigh a fragment.	Favors <b>Analysis/Test</b> . You calculate Joules to ensure the safety limit is met across all variables (mass and speed).
<b>Structural Alignment</b>	The <b>System Response</b> element is a single clause; it thrives on concise, clear physical bounds.	The <b>Constraints of Action</b> elements allow for multi-dimensional data (energy limits) that provide higher "fidelity."
<b>Intended Audience</b>	The pattern is a "readable" bridge between users and engineers.	The template is a "parsing" tool for professional engineers to ensure no ambiguity remains.

When challenged on the traceability to the sources of these conclusions, Gemini returned:

- Evidence: The source [1] explicitly states that EARS was developed to address problems with requirements written in "unstructured natural language," which are often "ambiguous, logically inconsistent and opaque."
- Derivation: The methodology's focus on five simple, natural-language patterns is described as a means to provide "low overhead" for authors and "high benefit" for those who must read them. This directly supports the assertion that the method aims to reduce "noise" (ambiguity/inconsistency) while maintaining high readability for a broad range of stakeholders who might otherwise be overwhelmed by opaque, technical jargon.
- Evidence: Mavin [2] describes the result of using EARS as "standardizing the expression" of requirements to make them "shorter and easier to understand." He notes that the syntax is designed to be "lightweight" so it doesn't get in the way of the engineering process.
- Derivation: The emphasis on "short," "standardized," and "easy to understand" expressions confirms that the primary goal is clarity and the removal of linguistic complexity ("noise") to ensure a shared understanding across the project

The LLM's less rigorous trace from PPI sources concludes:

- Evidence: The template breaks a single requirement into nine distinct elements, including three separate "Constraints of Action" fields, "Refinement of Object," and "Exceptions to Action." The "Definition of Elements" section defines Constraints (Element 4) as potentially being "performance." (how well) and separates the "Actor" from the "Conditions for Action" (Element 2).
- Derivation: This granular decomposition (parsing) is not meant for casual reading; it is a tool for "Deep Engineering Analysis." By forcing the analyst to isolate mass from velocity or energy (as seen in the "Refinement of Object" and "Constraints" fields), the template systematically eliminates ambiguity, facilitating "unambiguous verification" and providing specific parameters for "design synthesis."

Experienced requirement engineering practitioners of either method likely will disagree with some of these LLM conclusions, believing that individual skills and disciplined use of either approach could yield an appropriate balance of stakeholder understanding and engineering precision.

However, it is clear that the PPI parsing template encourages explicit differentiation between and inclusion of Action, Constraints of Action, Object of Action, and Refinement of Object in place of the singular System Response element in EARS. This additional granularity should significantly improve the level of requirement completeness, clarity, non-ambiguity and verifiability when applied consistently and with skill.

Gemini summarizes the commonalities and differences between EARS and the PPI parsing template, as:

<b>Commonalities</b>	<b>Differences</b>
<p><b>Subject-Verb Centrality:</b> Both models mandate a clear <b>Actor/System Name</b> and a specific <b>Action/System Response</b>, ensuring the requirement is an active statement of obligation.</p> <p><b>Conditional Logic:</b> Both recognize that requirements are rarely universal; they provide specific slots to define <b>States</b> (Preconditions/Conditions) and <b>Events</b> (Triggers).</p> <p><b>Removal of Ambiguity:</b> Both methodologies were explicitly developed to eliminate the "noise" and "vagueness" of unstructured natural language.</p> <p><b>Verifiability Focus:</b> Each structure is designed to force the author to include enough detail (Constraints or Responses) to allow a tester to prove whether the requirement has been met.</p> <p><b>Standardization:</b> Both provide a "fill-in-the-blank" syntax that ensures all requirements in a specification have a consistent look and feel, improving readability.</p>	<p><b>Granularity of Decomposition:</b> EARS uses a "lightweight" approach with 4–5 components per pattern. PPI uses a "deep analysis" approach, parsing every requirement into 9 distinct elements for authoring, 10 for analysis.</p> <p><b>Separation of Object and Action:</b> EARS groups the action and the object together (e.g., "shall decelerate the vehicle"). PPI separates them, allowing the vehicle to be "Refined" (e.g., mass/velocity) without complicating the verb.</p> <p><b>Handling of Exceptions:</b> PPI provides a dedicated field for <b>Exceptions</b>, whereas EARS requires the author to either write a separate "Unwanted Behavior" requirement or integrate the exception into the response clause.</p> <p><b>Pattern vs. Template:</b> EARS is <b>Pattern-Based</b> (selecting 1 of 5 specific syntaxes based on the requirement type). PPI is <b>Template-Based</b> (every requirement is processed through the same 9-element grid regardless of its type).</p>

## Conclusions

LLMs such as Gemini and ChatGPT can offer significant value in supporting systems engineering tasks when skillfully prompted by users with the discipline to carefully evaluate LLM outputs and correct errors and contextual drift. Verbatim LLM outputs should never be trusted as engineering work products, but can accelerate refinement of engineering

information (requirements in this context) that may be integrated with formal engineering work products.

The EARS and PPI Parsing templates provide significant advantages over ad hoc individualized requirement-authoring styles. EARS is designed for simplicity; the PPI pattern for completeness and precision.

Further experimentation is justified to learn how movement to higher-tier (paid, team) subscriptions to the popular LLMs might improve the quality of the requirement outputs, while minimizing user effort and “churn”.

Further engagement with the EARS and PPI communities is needed to assess whether a hybrid approach could be advantageous, i.e., developing initial requirements using EARS to support early stakeholder interactions, then leveraging the PPI parsing template as the basis for System Requirements Specifications (SyRSs) suitable for driving solution development. In such a hybrid approach, the EARS pattern would be an interim entity, written as a higher level of abstraction to gain stakeholder feedback and ultimately replaced by the more granular and specific PPI requirement in the problem baseline.

## References

[1] EARS. <https://alistairmavin.com/ears/>

[2] Jama software, The Essential Guide to Requirements Management and Traceability, Chapter 2.4 by Maven, A. Adopting the EARS Notation to Improve Requirements Engineering, published online at <https://www.jamasoftware.com/requirements-management-guide/writing-requirements/adopting-the-ears-notation-to-improve-requirements-engineering>

[3] PPI Requirements Parsing Template, embedded in PPI’s System Engineering Five-Day (SE5D) and Requirements Engineering Five-Day (RE5D) course materials.

[4] Fitch, J.C. *Energy Absorbing Deceleration Barriers*. U.S. Patent #3,606,258. Filed 2 January 1969. Awarded 29 September 1971.

[5] Artificial Intelligence for Systems Engineering (AI4SE), PPI course materials, 2026

## About the Author



John Fitch is a Principal Consultant and Course Presenter for Project Performance International. John brings over four decades of systems engineering, engineering management, consulting and training experience to the PPI team. In 2012, John was certified by INCOSE as an Expert Systems Engineering Professional (ESEP). Within the field of systems engineering, John’s career has focused on decision management,

requirements management, risk management, systems design & architecture, product/technology road-mapping and innovation. In addition to defense/aerospace, John has guided initiatives in domains such as communications systems, software, energy, nanotechnology, medical devices, manufacturing systems, knowledge management and business process improvement.



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development and innovation management resources in the form of blogs, podcasts, videos, conference presentations, feature articles, and whitepapers. Also included are research articles from the Journal of Production Innovation Management (JPIM).

Recent recommendations include:

- [A Brave New World: The Impact of Technology on Innovation Management](#) (JPIM article)
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### INCOSE Systems Engineering Journal: November and January Editions



INCOSE has published the November

2025 and January 2026 editions of the Systems Engineering Journal through the Wiley Online Library. Volume 28, Issue 6 and Volume 29, Issue 1 both include open-access articles, plus full-access papers that require an institutional login, e.g., via INCOSE membership. There is no published overriding theme for these editions. PPI SyEN has included abstracts to guide our readers to which of these diverse topics best fit their interests.

#### [November 2025 Open Access Articles](#)

Open Access articles are available to view and download in PDF format without any restrictions.

#### [Generating Logical Architectures from SysML Behavior Models](#)

Authors: Christian Granrath, Christopher Kugler, Judith Michael, Bernhard Rumpe, and Louis Wachtmeister

Abstract: Modeling solution-neutral operating principles of system features as SysML behavior models enable systems engineers to specify reusable product features for a variety of similar products and to specify and document a product's functionality in an easy-to-understand manner. In practice, multi-perspective modeling methods from systems engineering require a high manual effort from experts who do not have the needed time. Current systems engineering methodologies provide multi-perspective modeling approaches. However, they do not consider real-world sizes of the problem domain. Thus, if the systems engineers change their perspective, it requires excessive manual effort, and they must perform redundant tasks. This paper presents a CUBE-based, feature-driven methodology that provides generative methods to systems engineers to address this challenge. In detail, we are using SysML activity diagrams to model operating principles of system features and generate the logical architecture as SysML Internal Block Diagrams.

### [Integrating Data Management Plans Into the Unified Architecture Framework Standards Views](#)

Authors: Cansu Yalim and Holly A. H. Handley

Abstract: System Architecting translates an operational concept into a model of the system to be realized. There is a need for a Data Management Plan (DMP) to be included in the overall system engineering process with the advent of Digital Engineering. Data longevity, accessibility, and integrity can all be improved throughout the system's lifecycle by a well-defined DMP. System engineers use an architecture framework to arrange the system data into several sets of viewpoints. Incorporating a DMP at this point specifies the procedures for gathering, storing, retrieving, and maintaining data to ensure that all interested parties have access to current, correct information. The DMP and the developing system description can be connected via the Unified Architecture Framework (UAF) Standards View, which maps data management needs and procedures into multiple architectural viewpoints across standards taxonomy, structure, roadmap, and traceability. The creation of metadata standards, transmission of data methods, and storage configurations that adhere to operational constraints are all supported by this integration. UAF can also help parties keep track of data lineage and adhere to organizational and regulatory norms that are being followed. We use the Florida Concrete Test Road project as a case study in this work to exemplify how UAF and a DMP can work together. This alignment strives to maintain data management practices by architectural consistency across the entire system lifespan.

### [Proposal of Maturity Assessment to Support Projects in Digital Transformation: Initiatives in the Brazilian Context](#)

Authors: Gabrielly Araújo Cordeiro, Carolina Naemi Otakeno Ebi, and Robert Eduardo Cooper Ordóñez

Abstract: This paper proposes a method to assess organizational maturity in digital transformation (Industry 4.0), focusing on the strategic mapping stage. This proposal includes a qualitative and quantitative maturity approach, considering the self-assessment of barriers and challenges. The methodology adopted a literature analysis to explain the barriers and challenges of digital transformation and their relationships. In addition, the method proposed assesses the digitalization maturity and describes its level according to the dimensions of digital transformation and the barriers. The resulting Maturity Index was implemented through MATLAB programming, and its applicability was described using real cases in different organizations in Brazil. This study supports the development of a strategic view for digital transformation projects driven by the technological transition. Thus, the method identifies the current digital maturity level before the implementation of digital technology, improving the decision-making process at the beginning of digital transformation in different organizations.

### [Spiral Approach for Non-Software Product and Engineering System Development](#)

Authors: Isha Amod Gujarathi, William R. Norris, and Albert E. Patterson

Abstract: This article explored the spiral development process, sometimes called

“Evolutionary acquisition” in military sectors, and reviewed major non-software applications in the engineering literature. The spiral development process was originally developed for the design of software while minimizing and managing risk, but the principles can be applied to a wide variety of systems engineering problems where risk management is a priority. The major application domains discussed in this review were product design and development, robotics, agriculture and construction systems, product-service and human-technology systems, medical systems and devices, military and aerospace systems, and data management, enterprise systems, and information technology systems. This exploration and accompanying discussion are useful for system designers, systems engineering educators, and other major stakeholders, as it shows successful applications in a wide variety of non-software technology sectors and provides guidance for application in new areas. The review clearly showed the usefulness and wide variety of non-software product and system design applications in which the spiral method had been employed from the early 1990s until the present time. Far from being an obsolete or “dated” design method, it has become even more widely used and refined in recent years, which is a trend that appears likely to continue as engineering systems and technology development become more complex and distributed.

### [Technology Infusion Analysis-Based Research and Development Project Portfolio Valuation](#)

Authors: Hojin Jang and Eun Suk Suh

Abstract: Technology-driven companies must invest significant resources in developing new technologies to enhance product performance, reduce costs, and maintain a competitive edge in their markets. However, resource constraints often limit the number of projects these companies can pursue within their research and development (R&D) portfolios. A key responsibility of the chief technology officer and system architect is to identify and prioritize the technologies that will provide the highest value to the company. This selection process requires an objective evaluation of each candidate's technology's costs and benefits, necessitating a standardized methodology for assessing potential engineering design changes, system performance improvements, required investments, and expected returns. To address this need, we are introducing a technology infusion analysis-based R&D project portfolio valuation process. This approach evaluates the costs and benefits of proposed technologies by analyzing the corresponding engineering design changes and system performance modifications. The effectiveness of this process is demonstrated through a case study on valuing an R&D project portfolio for a toner distribution system in a printing system.

### [Traceability Support for Engineering Reviews of Horizontal Model Evolution](#)

Authors: Johan Cederbladh, Eduard Kamburjan, David A. Manrique-Negrin, Rakshit Mittal, and Thomas Weber

Abstract: At its very core, model-based systems engineering uses models to enable a multidisciplinary view on a system design in the early stages. These early stage models evolve horizontally: new diagrams for further perspectives and disciplines are added, using the same notation and the same abstraction level. Just as any other process in systems engineering, horizontal model evolution is subject to guidelines and standards, and the multidisciplinary view on a horizontal evolution, involving at least two disciplines, requires referring to multiple

guidelines. Despite the significant effort invested in this process, there is no framework or tool support for engineering reviews of horizontal model evolution. In this paper, we aim to support engineering reviews by providing traceability for engineering activities that evolve a model horizontally. Our contribution is a process-agnostic framework that relies on capturing the intent of model changes in addition to the changes themselves. We group the model changes into transactional units called deltas, which are subsequently annotated with the engineer's intent to perform these specific changes. We give a methodology to integrate such intent-annotated deltas into engineering reviews and audits, an ontology to capture intent, and a meta-model for the deltas to achieve a language- and guideline-independent framework. We use an example from the earth moving machinery domain to exemplify the need for horizontal model evolution and provide a prototypical proof-of-concept implementation in the SysML Papyrus Plugin for Eclipse and a SysML case study using a machine brake system.

### November 2025 Full Access Articles

Full Access articles are available through an institutional login such as INCOSE membership. This edition of the Journal includes the following titles:

- [Empowering Systems Engineering Through Semantic Approaches](#)
- [Management as a System: Providing C-Suite Skills to Engineering Undergraduates](#)

### January 2026 Open Access Articles

#### [Assessing the Usefulness of Assurance Cases: Experience With the Large Hadron Collider](#)

Authors: Torin Viger, Jeff Joyce, Simon Diemert, Claudio Menghi, Marsha Chechik, Jan Uythoven, Markus Zerlauth, and Lukas Felsberger

Abstract: Assurance cases (ACs) are structured arguments designed to show that a system is sufficiently reliable to function properly in its operational environment. They are mandated by safety standards and are largely used in industry to support risk management for systems; however, ACs often contain proprietary information and are not publicly available. Therefore, the benefits of AC development are usually not rigorously documented, measured, or assessed. In this paper, we empirically evaluate the effectiveness of using ACs to show that a system is reliable using a case study over the CERN Large Hadron Collider (LHC) Machine Protection System (MPS). We used open-source documentation to create an AC over the MPS and used the Eliminate Argumentation (EA) methodology for its development. The development involved four authors with considerable experience in AC development, three of whom work for Critical System Labs, a small enterprise specializing in ACs. Our findings show that (a) the cost and time required to develop our AC is negligible compared to the effort needed to develop the system, and (b) EA helped identify defeaters (i.e., doubts in the system's reliability) that were not detailed in the documentation used for creation of the AC.

#### [FIRE: A Human-Centered Framework for Digital Twin Design](#)

Authors: Dimitri Masson and Eric Villeneuve

**Abstract:** The integration of human perspectives into digital twin (DT) design for sociotechnical systems (STS) is essential for addressing the complex relationship between social and technical elements. Despite advances in DT technology, its application to STS demands a human-centered approach that considers usability, user experience, and contextual factors. This work introduces FIRE (Framework for representing Intrinsic, Reflexive, and Extrinsic dimensions of a digital twin), a framework designed to guide the development of human-centered DTs. FIRE assesses DTs across three dimensions: Intrinsic (system autonomy), Extrinsic (contextual integration), and Reflexive (self-awareness and adaptability). As a design guide, FIRE ensures that human and social perspectives are integrated during the design. As a descriptive tool, FIRE provides valuable insights into existing DTs from the literature.

### [Managing Variations in Meaning: Guidance for Using “Complexity” and Related Terms](#)

**Authors:** Joshua Sutherland, Dean Beale, Francesco Dazzi, Janet Singer, Gary Smith, Rudolph Oosthuizen, Alfonso Lanza, Ken Cureton, and Dorothy McKinney

**Abstract:** The term “Complexity” is widely used across disciplines, where it often represents distinct but related concepts such as complicatedness, emergence, difficulty, uncertainty, and chaos. This variability in usage can create miscommunication and misunderstanding, even within structured organizations like the International Council on Systems Engineering (INCOSE). This paper addresses this challenge by offering guidance tailored to three primary audiences—General/Casual, Practitioner, and Research—on using and interpreting “Complexity” effectively across trans-disciplinary contexts. Unlike efforts that prescribe a single definition, the approach here respects the variety of interpretations while providing techniques and ontologies to clarify usage. To illustrate, the paper compares different “Complexity” definitions, fostering awareness of both the similarities and distinctions. By promoting a common understanding, rather than a definition, this paper lays essential groundwork for future initiatives aimed at developing a unified scientific basis for “Complexity”, enabling clearer, more consistent communication, and application.

### [MBSE Co-Pilot: A Research Roadmap](#)

**Authors:** Wenheng Zhang, Callum Cockburn, Michael Henshaw, Peter Douglas, Paul Palmer, Joshua Olivier-Myall, and Siyuan Ji

**Abstract:** As the complexity of engineered systems continues to increase, Model-Based Systems Engineering (MBSE) methodologies, languages, and tools are increasingly insufficient to meet the demands of modern systems engineering. This paper proposes a research roadmap for the development of an AI-driven machine, referred to as MBSE Co-Pilot, designed to augment MBSE activities, not only to address the demand for technical advancement in MBSE, but also to better facilitate the adoption of MBSE for organizations transitioning into digital engineering. The MBSE Co-Pilot leverages advances in Artificial Intelligence (AI) technologies, including but not limited to Natural Language Processing, Machine Learning, and Computer Vision, to support model development, model management, and model comprehension.

### [Multi-Agent Reinforcement Learning Framework for Optimizing Smart Cities as System of Systems](#)

Authors: Arifuzzaman (Arif) Sheikh and Edwin K. P. Chong

**Abstract:** This paper presents a novel framework for optimizing smart cities as System of Systems (SoS) by integrating Multi-Agent Reinforcement Learning (MARL) with traditional systems engineering methodologies. Constituent systems—modeled as agents across domains such as transportation, energy, public safety, and communication, operate autonomously under diverse control modes (e.g., Acknowledged, Directed) while aligning with overarching SoS objectives. The proposed framework leverages decentralized policy learning and augmented reward mechanisms to improve coordination, adaptability, and system-wide efficiency. Simulation results demonstrate a 14.3% increase in system efficiency, a 12.5% improvement in adaptability, and a 25.0% enhancement in coordination effectiveness. These findings underscore the potential of AI-driven decision-making to manage emergent behavior and complexity in dynamic, large-scale urban environments.

### [January 2026 Full Access Articles](#)

The January 2026 edition of the Journal includes the following full-access titles:

- [Lean Modeling and Simulation Approach for Improving CFB Boiler Start-Up Capability](#)
- [Accuracy of Citation Patterns in the Field of Systems Engineering: Benefits of MBSE](#)
- [A Model-Based Design and Verification Method for Product System Architecture Optimization](#)

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## INCOSE INSIGHT Practitioners Magazine – September and October Editions



The December 2025 edition of INSIGHT, INCOSE's Practitioners Magazine, has been published by Wiley.

Electronic subscriptions to INSIGHT are available to INCOSE members as a member benefit. Hard-copy subscriptions to INSIGHT are available for purchase by INCOSE members for one membership year and to the public.

### [December 2025 Edition \(Volume 28, Issue 6\)](#)

The ten articles in the 48-page December publication highlight the theme of *New Challenges and Advances in Systems Engineering at French Universities*.

### [A Requirement Conceptual Model to Support Requirements Writing and Early Verification](#)

Authors:

Performing verification and validation (V&V) as early as possible has become a critical challenge for companies. Requirements and their associated models, elaborated during the engineering phase, often present quality issues that must be systematically verified. This paper introduces a conceptual model of requirements, together with writing patterns specifically designed for system requirements. These contributions provide a structured approach to writing system requirements and will form a foundation for future work on requirements modeling and verification.

### [Digital Thread Based Federated Interoperability for Complex Systems Engineering](#)

Authors: Clarissa Gregory, Souad Rabah, and Vincent Chapurlat

Large amounts of heterogeneous data are generated, used and managed all along engineering projects. The concept of digital thread (DTH) is therefore evoked to assume digital continuity, consistency, and traceability of these data. To this purpose, this paper proposes an approach to address data, tool, and processes interoperability problems in the DTH.

### [Digital Twin Architecture Design for an Aircraft Seat Mechatronic Testbench](#)

Authors: Imane Bouhali, Jacques Martinez, Vincent Idasiak, Faïda Mhenni, Jean-Yves Choley, Luca Palladino, and Frederic Kratz

The optimization of the system development process has long been a significant challenge. In the context of aircraft business class seats, the products are mechatronics systems as they incorporate diverse discipline-specific components (mechanical, electrical, and electronic). Therefore, their design, manufacturing, and V&V (verification and validation) are complex. The V&V phase typically occurs later in the development process, adhering to the V-model and ISO 15288 technical processes. However, ensuring system behavior testing early in the development process is essential to prevent extensive rework and physical prototyping iterations. This paper presents an innovative approach integrating virtual testing in the development process of mechatronics systems. This methodology is built upon the traditional V-model, enhanced by a parallel testing process using the digital twin concept. The digital twin architecture is designed following the model-based systems engineering (MBSE) approach.

### [Engineering Decisions in MBSE: Insights for a Decision Capture Framework Development](#)

Authors: Nidhal Selmi, Jean-Michel Bruel, Sébastien Mosser, Matthieu Crespo, and Alain Kerbrat

Decision-making is a core engineering design activity that conveys the engineer's knowledge and translates it into courses of action. Capturing this form of knowledge can reap potential benefits for the engineering teams and enhance development efficiency. Despite its clear value, traditional decision capture often requires a significant amount of effort and still falls short of capturing the necessary context for reuse. Model-based systems engineering (MBSE)

can be a promising solution to address these challenges by embedding decisions directly within system models, which can reduce the capture workload while maintaining explicit links to requirements, behaviors, and architectural elements. This article discusses a lightweight framework for integrating decision capture into MBSE workflows by representing decision alternatives as system model slices. Using a simplified industry example from aircraft architecture, we discuss the main challenges associated with decision capture and propose preliminary solutions to address these challenges.

### [Integrating Human-Conversational GenAI in MBSE: Towards Human-AI Interdependency?](#)

Authors: Émilie Perreau, Romain Pinquié, and Cédric Masclat

Conversational generative artificial intelligence (CGenAI) offers new opportunities to support systems engineering practices but raises numerous challenges regarding human-AI teaming design. This ongoing project is exploring the design of human-CGenAI interaction (H-CGenAI.I) within socio-technical systems and proposes a modelling approach grounded in model-based systems engineering (MBSE). A scenario-driven methodology and SysML profile will be introduced to capture and formalise interactive patterns. The study also intends to develop an evaluation framework based on heuristics and practitioner feedback. This research aims to foster a human-centred integration of H-CGenAI.I into systems engineering analysis, enhancing traceability, collaboration, and reliability in the engineering of socio-technical systems.

### [Integration of Architecture and Maintenance Points of View in an MBSE Context](#)

Authors: Kim Loubat, Gwennole Boutet, Jean-Michel Bruel, Christophe Ducamp, Sophie Ebersold, Nathalie Hernandez, and Nicolas Sarda

In most cases, over 80% of a system's cost is already committed during the preliminary design review (PDR) of the life cycle (Claxton 1993 and NASA 2017). Overruns often occur because requirements of certain stakeholders, such as those related to maintainability, are not involved in the system design process early enough. Consequently, a collaborative effort during the design stage should involve the requirements of key stakeholders and decision-makers. In this perspective, domain ontologies and the sharing of needs should facilitate a common agreement. Systems engineers are key stakeholders to guarantee the viability of the solution system. The integration of domain ontologies within a model-based systems engineering framework will enable the interconnection of the heterogeneous data needed to integrate maintenance issues into collaborative system design. Adding maintenance requirements earlier in the design process will help limit additional costs and delays.

### [Proposal of a Model- and Pattern-Based Method for the Engineering of a Digital Twin System](#)

Authors: Rindra Mbolamanamalala, Souad Rabah Chaniour, and Vincent Chapurlat

The engineering and maintenance in operational conditions (MOC) of a digital twin system (DTS) remains today a difficult, time-consuming, costly and resource-intensive task. This paper proposes a method to support the stakeholders involved in such activity. It combines the principles and processes of model-based systems and software engineering (MBSSE), is

inspired by the pattern-based systems engineering (PBSE) approach and is in line with the recent norms and standardization. An application on a real use case of the method is presented to illustrate the practical benefits of this contribution.

### [The Regeneration Ecosystems as a Holistic Approach to Overcoming the Barriers of the Circular Economy](#)

Authors: Martin Sautereau, Pascale Marangé, Helmi Ben Rejeb, Peggy Zwolinski, and Eric Levrat

Circular economy (CE) is widely promoted as a sustainable alternative to the traditional linear economy. However, its industrial implementation faces persistent challenges, notably due to the lack of adaptability and holistic integration of the current solutions. This paper identifies eight major barriers to CE deployment, considering the products in their changing technical, social, and financial environment. While closed-loop supply chains have emerged as a partial solution to these barriers, they often fall short in addressing systemic complexity and dynamic adaptation needs. To overcome the remaining limitations, we propose the concept of regeneration ecosystems. These ecosystems aim to support the sustainable valorisation of product across multiple use phases, while considering social, environmental, and economic impacts. This paper highlights the properties of regeneration ecosystems and argues for their potential to enable an evolutive implementation of CE at the industrial level.

### [Towards a CuSEF \(CubeSat Systems Engineering Framework\)](#)

Authors: Mamadou Lamine Ndao, Prof. Claude Baron, and Dr. Ines Ben Hamida

CubeSat missions are increasingly adopted by NewSpace actors despite their limited resources and fast-paced development cycles, often leading to high failure rates. Traditional systems engineering standards such as ISO/IEC/IEEE 15288 and ECSS-E-ST-10C are rarely applied because they are considered too complex for very small entities (VSEs). This paper introduces the CubeSat systems engineering framework (CuSEF), a lightweight yet rigorous framework tailored for CubeSat class IV/V missions. CuSEF adapts ISO 29110 as a structural foundation and incorporates selected ECSS requirements to ensure mission reliability. The framework combines a simplified lifecycle model with model-based systems engineering (MBSE) practices and leverages artificial intelligence (AI) to accelerate tasks such as requirements drafting and test case generation. Early application of CuSEF demonstrates improvements in cost, schedule, and robustness without compromising agility. Future work includes large-scale validation across diverse CubeSat teams and enhanced integration of digital continuity and AI-driven design optimization.

### [Towards a Federation Method to Enable Organizations to Interoperate on Complex Systems Engineering Projects](#)

Authors: Benjamin Robinet, Vincent Chapurlat, and Maxence Lafon

This paper explores the benefits of developing a method to support and enable effective collaboration between organizations involved in complex and large-scale engineering projects, particularly focused on interoperability challenges that represent a classical stake to

overcome in such collaborative contexts. The paper highlights particularly issues concerning the requested use of heterogeneous engineering languages, and respect of operational practices of project stakeholders and organizational habits. The goal is to outline the foundations of a method that facilitates seamless data, information, and knowledge exchange while preserving each organization's engineering culture. To do this, the emphasis is placed on the importance of specifying, and comparing organizational habits, practices, and languages, and then finding compromises.

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## **OMG Journal of Innovation: Harnessing Generative AI for Innovation, Resilience, and Efficiency in Industries**



The Object Management Group (OMG) published the [28<sup>th</sup> edition of its Journal of Innovation](#) in November 2025. The theme of this edition is *"Harnessing Generative AI for Innovation, Resilience, and Efficiency in Industries"*.

These four articles in this edition address Systems Engineering for AI (SE4AI) applications and examples, including:

### [Beyond AI Agents: Creating the Conditions for Breakthrough Intelligence](#)

This paper explores the design of innovative processes that respect human psychology and tap into the wisdom stored in feelings, not just files. The addition of agentic AI – AI that actively participates as a team member – can transform these processes at every stage. The result is a virtuous cycle: a system where humans and AI work together to create an environment of curiosity, trust, and high performance. Innovation ceases to be a stressful high-stakes push and becomes more of a pull – drawing out the best ideas naturally.

### [Cognitive Agent Frameworks for Autonomous Industrial Decision-Making: Practical Lessons and Implementation Safeguards](#)

This article examines architectural approaches for implementing cognitive agent frameworks in industrial settings, drawing on anonymized case studies from manufacturing, energy, and mining deployments. We present empirical findings on reliability metrics, decision quality improvements, and safety performance from real-world implementations. Case studies include a manufacturing Control Loop Optimization Team that achieved significant annual business value while maintaining 88% availability and 84% efficiency targets, as well as energy sector predictive maintenance systems that substantially reduced unplanned downtime.

### [Generative AI and Geospatial Data](#)

The article explores how Generative AI is reshaping geospatial data, transforming Earth Observation and IoT sensor streams into socio-economic datasets and actionable insights. It highlights applications in climate resilience, disaster response, agriculture, and national

security, where AI enables real-time intelligence and proactive decision-making. Featuring innovations from AWS, Google Research, IBM, and Microsoft, the piece highlights the value of business and ethical considerations while mapping strategic opportunities for sustainable innovation and global collaboration. Generative AI emerges as a cornerstone of geospatial progress.

### [Generative AI for Automated Negotiation](#)

This paper explores the transformative potential of Generative AI in automated negotiation, particularly within business and industrial contexts. Traditional automated negotiation systems, grounded in game-theoretic and decision-theoretic approaches, often suffer from rigidity and a lack of context awareness, limiting their effectiveness in dynamic, real-world environments. By leveraging Generative AI, particularly large language models and multimodal time-series forecasting, the authors propose more flexible, adaptive, and context-sensitive negotiation protocols and strategies that can better accommodate complex preferences, evolve in response to changing market conditions, and capture nuances in human interactions.

Join the [OMG mailing list](#).

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## Business Analysis Resources



The [International Institute of Business Analysis \(IIBA\)](#) is a non-profit professional association that helps business analysts develop their skills and further their careers by providing access to relevant content. IIBA publishes a variety of open-access and members-only resources that are published in numerous media formats.

### [Analyst Catalyst Blog](#)

This open-access blog features posts that address different aspects of the business analysis discipline. Recent topics include:

- [Business Requirements at the Core: Where Analysis Begins](#)
- [Common Pitfalls That Make Retrospectives Ineffective](#)
- [Cultural Diversity and Business Analysis: Why It Matters More Than Ever](#)
- [Don't Fear AI: Build Your Own Work Assistant This Week](#)
- [What Mentoring Business Analysts Taught Me About Leadership.](#)

### [Business Analysis Live! Podcasts](#)

IIBA's podcast library is also open to non-members, with over 100 episodes "aired" to date. Recent titles include:

- [2025 Best of Business Analysis Live!](#)
- [Cultural Diversity and Business Analysis](#)
- [How to Give and Receive Feedback](#)

- [Human Skills in the Tech World](#)
- [The 3 R's of Business Analysis \(Rethink, Reconnect, Revolutionize\)](#)
- [Your Authentic Voice.](#)

Check out the [IIBA Bookstore](#) for additional IIBA publications that may be of value to systems engineering practitioners.

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### Business Analysis (BA) Digest Q4 2025 Edition



[Blackmetric Business Solutions](#), a UK-based training and consulting firm, publishes a quarterly [Business Analysis \(BA\) Digest](#). In keeping with its theme as *your regular round-up of useful*

*BA content*, the 63-page [Q1 2026 edition](#) addresses topics such as:

- Adapt or Fade: Reflections on the Coming AI Onslaught
- AI as a Stakeholder in Business Analysis
- Architecting Knowledge: How Business Architecture and Agile Thinking Transformed Our BA SharePoint Site
- From BA to Business Product Analyst: When Analysts Drive Product Strategy
- How BAs Can Succeed in Highly Technical Agile Teams
- How to Obtain a Sign-off on a 200-page Requirements Specification Document
- Intent Is the Glue
- Power of Natural Language - Traps and Treasures
- The Art of Influence Part 3: Using Your Powers
- The Invisible Business Analyst: The Strategic Force Driving Real Business Change
- The Missing Middle: The Gap in Our BA Community
- Tracing Requirements - the Ultimate Business Analysis Superpower
- Transition Requirements: The Bridge Between Legacy and the New Solution
- Using Group Construct Analysis to Understand Stakeholder Worldviews in Ambiguous Situations, Part 19: "This Meeting Could Have Been an Email." Really?
- When Data Falls Short: The Missing Pieces in Decision Making.

Typical articles are a quick read at 2-4 pages in length.

Subscribe to the BA Digest [here](#).

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### Ethics of Using LLMs in Requirements Engineering

#### Requirements Engineering Magazine

The Magazine for RE Professionals from IREB

The [Requirements Engineering \(RE\) Magazine](#) is published by the [International Requirements Engineering Board \(IREB\)](#) multiple times per year.

Articles are welcomed from Business Analysis and Requirements Engineering professionals, regardless of IREB membership status. Publication is free of charge for the authors.

In the November 2025 edition, Dr. Chetan Arora, Director of Education for the Software Systems and Cybersecurity Department at Monash University, Australia, authored an article titled "[Ethics of Using LLMs in Requirements Engineering - Balancing Innovation and Responsibility in Leveraging LLMs in RE](#)".

**Abstract:** In recent years, Large Language Models (LLMs) have gained significant traction across various domains due to their ability to process and generate human-like text. Their application in Requirements Engineering (RE) is particularly promising, offering the potential to (fully or partially) automate and enhance tasks such as requirements elicitation, specification, analysis, and validation. By leveraging the vast amounts of data they are trained on, LLMs can assist in generating high-quality requirements, detecting ambiguities, negotiating requirements via LLM agents, and even predicting potential conflicts in requirements documents. This advancement has the potential to revolutionize RE practices by improving efficiency, reducing human error, and enabling more scalable processes.

Incorporating LLMs into RE presents both opportunities and challenges, particularly in terms of privacy, transparency, bias, accountability, and safety. While proactive strategies can help mitigate these concerns, RE remains a broader discipline that involves complex stakeholder interactions, evolving regulatory landscapes, and socio-technical considerations beyond those discussed in this article. Ethical implications in RE may extend to areas such as human oversight, sustainability, and long-term impact on software ecosystems, requiring ongoing research and adaptation. As LLMs continue to evolve, it is crucial for requirements analysts, organizations, and policymakers to work together to establish responsible AI practices that align with RE principles and ethical standards. Ultimately, the successful integration of LLMs in RE depends not only on technological advancements but also on timely human intervention to ensure fairness, compliance, and safety in software development.

Topics addressed include:

- Privacy Concerns
- Transparency Concerns
- Bias/Fairness Concerns
- Accountability Concerns
- Safety Concerns
- Recommendations.

View the other 100+ [RE Magazine articles](#).

[Sign up](#) to be notified about new issues of the Requirements Engineering Magazine.

See the [guidelines](#) for contributing to the RE Magazine as an author.

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## Capella Days 2025



Capella Days 2025, the annual free online gathering of the Capella (MBSE tool) and Arcadia (MBSE method) community, took place on 18-20 November. A [YouTube playlist](#) has been posted for this event, featuring 12 videos and supporting slide decks. Talks include:

### [A Smart Automotive Front Lighting System Following the ASPICE Process | BlueKei](#)

The modern automotive industry is dominated by complex, software-driven E/E systems, like smart headlamps, to meet demand for advanced features. Innovation is constrained by standards such as ASPICE. Traditional document-based engineering struggles with this complexity, causing inconsistent designs, and difficulty generating verifiable evidence for ASPICE audits. This presentation shows how Capella, an open-source MBSE tool based on Arcadia, manages this complexity. [Download slides.](#)

### [Arcadia-Capella MBSE & STPA for Early-Stage Safety Analysis | BlueKei](#)

Railway systems face escalating safety challenges due to increasing complexity, software-intensive subsystems, and interdependent operations. Indian Railways reported over 350 fatalities in consequential accidents (2019-2024), highlighting urgent needs for systematic safety frameworks. Traditional methods like FMEA and FTA remain component-focused, missing emergent hazards from human-system interactions, software logic errors, and unsafe operational scenarios. This framework integrates Systems-Theoretic Process Analysis (STPA) with Model-Based Systems Engineering (MBSE) using Arcadia-Capella architecture. [Download slides.](#)

### [Capella as a Vector of Interoperability Between Practices | Capgemini](#)

As defined by the INCOSE organization, the "Systems Engineering" practice is a "transdisciplinary and integrative approach to enable the successful realization of engineered systems." And if Capella could be a vector of interoperability between MBSE and other practices? This paper shares several features added to Capella during Capgemini projects to highlight MBSE activities with other practices (Project Management, Safety, Product Line Engineering, Frugal Platform). [Download slides.](#)

### [Capella in a Golden Thread Implementation | KBR](#)

The Requirements Engineering and Safety Assurance Network (RESAN) delivers a practical implementation of the 'golden thread' - a concept that ensures end-to-end traceability from safety-critical data objects such as hazards, safety functions, and safety functional requirements, through to design elements including subassemblies and physical assets in the infrastructure domain. [Download slides.](#)

### [Closing the Loop Between MBSE and Cybersecurity | ReeR Safety](#)

Post-deployment vulnerability management is difficult to integrate into classical V-model lifecycles: threats evolve, dependencies are opaque, and linear processes delay discovery and patching. We propose a Capella extension - the Vulnerability Analysing Viewpoint (VAV) - that

integrates runtime cybersecurity concerns into ARCADIA models to enable continuous, model-centric risk control. [Download slides.](#)

### [Developing a System Engineering Knowledge Partner | Siemens](#)

This paper introduces the concept of a System Engineering Knowledge Partner, an approach developed to make model content consumable, analyzable, and actionable for diverse stakeholders. The approach builds on Capella models, enabling structured extraction and representation of knowledge, AI-assisted reasoning, and tailored delivery of information aligned with the needs of other disciplines and domains. A demonstration will illustrate how the Knowledge Partner operates on existing Capella model content, showing how requirements, functional chains, and architectural relationships can be surfaced in ways that support decision-making outside of systems engineering. The paper also shares lessons learned in developing this capability, particularly in relation to the role of semantic richness in Arcadia and how these insights can inform SysML v2 practices. [Download slides.](#)

### [Framework for Ground Segment Architectures Development of Space Missions | INPE](#)

The increasing number of space missions and the prevailing that the ground segment is a "Ready-to-Run System" pose significant challenges in the scheduling of space missions. A key issue stems from the lack of emphasis on ground segment complexities in early mission phases, leading to difficulties in assessing existing solutions, fragmented perspectives on system architectures, and inconsistencies in available information. These shortcomings can lead to inefficiencies and constraints in later development stages. To address these challenges, this paper presents the Framework for Development of Space Missions Ground Segment Architectures (F4GSA), which offers a structured approach to improving system architecture design, enhancing interoperability, and streamlining the integration of ground segment components. [Download slides.](#)

### [Integrating Mission Engineering and MBSE | UNSW & Raytheon](#)

Mission Engineering (ME) is an interdisciplinary process that analyzes, designs, and integrates current and emerging operational needs and capabilities to achieve desired mission outcomes. It focuses on understanding and improving mission performance by assessing systems, technologies, and concepts of operation in an end-to-end context, ensuring that the right systems and capabilities are developed, integrated, and deployed effectively. [Download slides.](#)

### [Interface Protocol Design Based on Capella | PGM](#)

Capella is a good platform for architecture design. Engineers can use it to define functional exchange, component exchange, physical link, and relative data structures. But it's not enough for interface protocol design. For those who are still using documents to do interface detailed design, or using several separated tools to design protocol and cables, it will be much easier for them to design interface protocol based on architecture model directly. We will show an extension on Capella to do bus structure definition, message design, signal design, and preliminary cable design. All this information is tightly connected and traceable. [Download slides.](#)

### [MBSE & ARCADIA for a Complex Ground-Breaking Space Program | Rivada Space](#)

As the MBSE value is now broadly accepted, Rivada Space Networks (RSN) focus shifted from advocacy to effective implementation introducing MBSE directly into the OuterNET program: a complex LEO constellation offering global, secure, low-latency, point-to-point connectivity without relying on terrestrial gateways. [Download slides](#).

### [Rationalization of MBSE Modeling in a PLE with Capella | LGM & MBDA](#)

The increasing complexity and variability of modern systems demand approaches that go beyond traditional MBSE practices. Customers expect highly tailored solutions, while industries must ensure efficiency, reuse, and digital continuity across product lines. Feature-based Product Line Engineering (FbPLE), standardized in ISO 26580 and supported by AFIS guidance, provides a structured methodology to manage variability by organizing engineering assets around features. When coupled with Model-Based Systems Engineering (MBSE), this approach evolves into Model-Based Product Line Engineering (MBPLE), enabling end-to-end consistency and traceability.

MBDA, with the support of LGM, has engaged in a transformation program to rationalize MBSE modeling practices within a PLE environment. Capella, powered by the Arcadia methodology, plays a central role in this effort, ensuring that variability management and architectural modeling are tightly integrated with requirements and testing activities.

[Download slides](#).

### [The S80 Submarine Systems Engineering Journey | Navantia](#)

The presentation focuses on the comprehensive approach taken by Navantia in the systems engineering of the development and sustainment of the S80 submarine program while demonstrating the use of Capella MBSE software and the ARCADIA methodology in the process. [Download slides](#).

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## Future Train Control Systems: Requirements, Framework and Benefits



The [NEXUS project](#), funded by the European Union, has published a significant deliverable in its feasibility analysis of next-generation train control systems.

Modern metro systems face growing complexity due to highly customized, operator-specific solutions. The [Future Train Control Systems: Requirements, Framework and Benefits](#) report emphasizes that the future of metro control systems depends on standardization, interoperability, and modular architectures. Seamless integration of Train Control and Monitoring Systems (TCMS) with Communications-Based Train Control (CBTC) is essential to enable higher Grades of Automation (GoA3/GoA4) and ensure safe, reliable, and efficient operations. Achieving this requires robust cybersecurity frameworks, open interfaces, and scalable communication architectures capable of supporting real-time data exchange.

Contents of this 122-page document include:

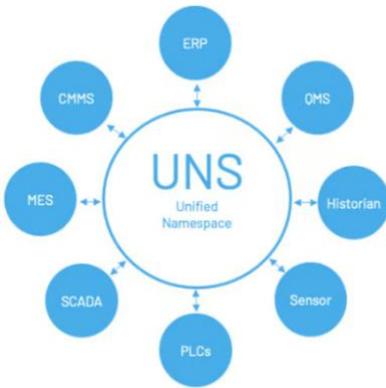
- Survey of Existing Metro Control Systems: Insights from Academia and Industry

- Framework and Architectural Analysis of Existing Control Systems
- Requirements Analysis and KPI Definitions for Metro Control Systems
- Emerging Technologies for TCMS
- Future Outlook for Train-to-Ground Communication in Metro Systems.

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### Unified Namespace and Data Management for IT/OT Integration

Kalypso, a subsidiary of Rockwell Automation, publishes a [Viewpoints blog](#) that addresses leading topics associated with the integration of operational technology (OT) with information technology (IT). A recent article, [Unified Namespace and Data Management A Transformative Concept for IT/ OT Integration](#), presents the Unified Namespace (UNS) as a model for how to structure, organize, and access data across an entire enterprise.



Though particularly relevant to manufacturing organizations seeking to integrate their systems on the factory floor with the front-office business applications, the “single source of truth” principles of UNS may spark some insights among systems engineering practitioners who are looking for an Authoritative Source of Truth (ASoT) that spans system/product lifecycles. See the feature article, *Key Decisions Driving an Authoritative Source of Truth Design in a Data-Driven Engineering Ecosystem*, in [PPI SyEN Edition #149 \(November 2025\)](#) for parallels between how UNS supports a

Data-Driven Enterprise and how the ASoT supports Data-Driven Engineering (DDE).

According to the Kalypso team:

*“UNS is more than just a data aggregator or tool; it is a dynamic system and strategic approach that ensures data is available, consistent, and accessible across both OT and IT layers, empowering organizations to derive actionable insights.”*

The Kalypso article recommends a 5-step journey toward UNS realization:

- Assess Your Current Data Architecture and Identify Integration Points
- Establish Data Standards and Naming Conventions
- Select Appropriate Middleware and Integration Technologies
- Implement a Pilot Project with Measurable Outcomes
- Develop a Scaling Strategy with Governance Framework.

Though voiced in a language a bit different from that used by the systems engineering community, these steps clearly mirror the actions needed to “*create a trusted Authoritative Source of Truth for informed decision-making*” in the engineering realm.

Check other popular Viewpoints posts from 2025 [here](#).

### SPEC Innovations Whitepaper: Human vs. AI Process



[SPEC Innovations](#), a leading provider of systems engineering services and the [Innoslate](#) and [Sopatira](#) software solutions, has published a 19-page whitepaper, [Human vs. AI Process](#), that reports on a simulation of the potential impact of AI integration into systems engineering workflows. The study, conducted in Innoslate, compared the results of three process models against time and cost targets. The models evaluated included:

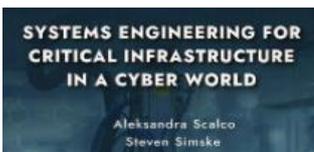
- A traditional Human-only process.
- A truncated Human-only process lacking Verification & Validation and risk management effort (a typical real-world shortcut).
- A Human-AI teaming process with AI assisting in requirements generation, risk analysis, and verification planning.

The results reveal that the Human-AI teaming model significantly outperformed both the traditional and truncated models, yielding time and cost reductions of over 70% while preserving lifecycle rigor through human validation of AI outputs.

The SPEC Innovations team concludes that the study demonstrates that “integrating AI into your systems engineering workflow is no longer a speculative advantage; it is a practical and proven method to enhance project cost, schedule, and performance.”

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### Book: Systems Engineering for Critical Infrastructure in a Cyber World



Aleksandra Scalco of the U.S. Defense Acquisition University (DAU) and Steven Simske of Colorado State University have written a new book that guides professionals in defending critical infrastructure by bridging Information Technology (IT), Operational Technology (OT), and cybersecurity. Available from River Publishing, [Systems Engineering for Critical Infrastructure in a Cyber World](#), offers practical tools, strategies, and case-based examples to align stakeholders, strengthen defenses, and make complex cyber concepts clear and actionable.

A sample of the topics addressed in this book includes:

- Understanding the Game
- History of the Term "Cyber"
- Cyber is a Medium (Not a Domain)
- Cyber Paradox
- Cyber Vulnerabilities Start at the Hardware Level
- Threats to Information-intensive Systems
- Use Cases and Operational View (OV) Illustrations
- Transition of Innovation to Operations
- Design Trade-offs

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## SYSTEMS ENGINEERING RESOURCES

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- Architectural Approaches
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- Managing Risk
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Paperback ISBN 9788743809111

eBook ISBN 9788743809104

Download the [book flyer](#).

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### Configuration Management Resources

A recent publication promises to shed light on the important discipline of Configuration Management (CM),

As part of its Don't Panic series, the Institute for Systems Engineering [IFSE \(INCOSE UK chapter\)](#) has published *The Absolute Beginners Guide to Configuration Management* by Sandrine Gonther and Adriana D'Souza of the INCOSE CM working group.



This book is available in both paperback (ISBN 978-1-918133-24-0) and e-book (ISBN 978-1-918133-25-7) formats from the [IFSE Store](#).

The [INCOSE CM working group](#) has also launched an effort to elaborate on a Technical Product "Guide for Configuration Management" (TPP-2025-163). Potential contributors may contact the working group at [config-mgt@incose.net](mailto:config-mgt@incose.net).

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### Zuken Systems Engineering Blog



[Zuken](#) (supplier of the [GENESYS MBSE platform](#)) hosts a [blog](#) that addresses a variety of systems and electrical/electronics design topics. Recent blogs that may be of interest to systems engineering

practitioners include:

- [Comprehensive Systems Design Language \(CSDL\) vs. SysML? You Can Have Both](#)
- [EDM vs PLM: Choosing the Right Data Management for Engineering Teams](#)
- [From Operational Context to System Definition: Mission Engineering Basics for Systems Designers](#)
- [Managing Complexity with the STRATA Methodology](#)
- [Modular Design Strategies Explained: Platform-Based vs. 150% Design.](#)
- [What is a Digital Twin in Manufacturing?](#)

# FINAL THOUGHTS FROM SYENNA

## **Junior Engineers as Senior Reviewers?**

As Syenna has spun up on the use of AI in general and Large Language Models (LLMs) in particular, a few significant challenges have come into view. These are not insurmountable challenges to be sure, but challenges to be met with some careful thought – the “Do Nothing” alternative is unlikely to succeed.

Most of the systems engineering practitioners in Syenna’s circle have grown into that role over a decade or more. They started out doing engineering within another discipline (Electrical, Mechanical, Software, etc.), gaining depth in the mastery of a problem domain and a few technologies while growing a breadth of skills that enable them to see and anticipate connections across those disciplines. They discovered that interfaces matter, that risks can arise from unexpected sources, and that systems are often used outside of their defined use cases. A few may even have pondered the implications of emergence and resilience at a level beyond the philosophical.

Having done the work well, learned from failures when they didn’t, and experienced the power of interdisciplinary collaboration, they moved away from doing the engineering to guiding the work of others. A predictable work rhythm emerged in which a few days or hours of planning the engineering effort leads to a handoff to a team of more junior engineers, with the senior individual acting as a force multiplier as their team dives into the delegated tasks. The senior person (let’s call him/her the Systems Engineer as a shorthand, not because Syenna loves that title) oversees the team’s work for a few hours each day, with the rest of the day spent planning the next phase and interacting with other stakeholders across the enterprise on other threats to project success, e.g., changing requirements, recalcitrant subcontractors, or unwieldy engineering tools.

Having worked in the trenches, the typical Systems Engineer has gained the skills necessary to review work products efficiently. An hour of such review will often put the finishing touches on a work product that took the team 40, 80, or even 120 hours to develop.

*What happens now that LLMs threaten to transform every engineer into a reviewer more than a creator?*

LLMs can crank out an amazing volume of engineering information in seconds. A one- or two-page prompt, aimed at ten requirements, risks, or test cases, may generate 50-100 pages of content, much of it needing a level of review and “drift correction” well beyond an equivalent output from its human predecessors. The LLM’s breadth of training data will generate some high-value “nuggets” (the payoff for AI use), surrounded by quite a bit of less-stellar outputs and more than a few erroneous results, which are dangerous if propagated into the solution design.

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## FINAL THOUGHTS

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It would be foolish to ignore the vendor-supplier CYA warnings:

*Gemini is AI and can make mistakes.  
ChatGPT can make mistakes. Check important info.*

Without the seasoning (and brain re-wiring) that comes from personal hands-on struggle, how will the junior engineers of the future:

- Gain the seasoning needed to guide (prompt) their LLM assistants?
- Detect when the LLM drifts from the defined problem context and hallucinates “facts not in evidence”?
- Avoid taking shortcuts caused by “reviewer fatigue” that is induced by 8+ hours of inspection and iterative correction for each hour of engineering input?

At an enterprise level:

- How will organizations prevent the hollowing-out of their engineering teams as a small cadre of their best senior personnel is able to direct AI with great proficiency?

Ideas anyone?

Regards,  
Syenna

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“

*The academic system of measuring performance leads to the creation of large numbers of write-only publications.*

**Ian Sommerville**