



## **Summit Background and Introduction**

**FINAL - 9.Oct, 2024**

*An international group of high-level representatives from academia, industry, government agencies, and professional organizations convened on 8 and 9 October at Delft University of Technology. They discussed technical, economic and societal challenges of today's complex systems and articulated the need for multi-disciplinary competencies for systems professionals which are in high demand worldwide. They endorsed a "Call for Action" directed to the global systems policy, analysis, management, and engineering, communities, to mitigate current system workforce deficits.*

### **CALL for ACTION**

#### **Systems Needs and Context**

- 1. The effectiveness of transformations in our society, such as in the energy, transportation, aerospace, communication, agriculture, or health domains, depends upon multi-disciplinary system workforces. These are scarce and require development.*
- 2. Systems have become increasingly complex, interdependent, self-adapting and interconnected digital ecosystems. Sustainability and circularity drive public and commercial undertakings. Their realization frequently demands cooperation of social, environmental, economic, legal, regulatory, engineering, and technology stakeholders to generate lasting societal or market value. Inter-disciplinary system and team competencies are needed to align stakeholder perspectives.*
- 3. For systems to meet their intended goals, social acceptance, and economic success the systems workforce should, from the outset, apply an end-to-end architecting approach spanning from concept to retirement. Trust in complex systems will increase through an early understanding of critical realization issues, such as risks, cost, schedule, interdependencies, sustainability, and societal impact.*

## **Systems Realization**

4. *Product developments require critical systems thinking and architecture design across many product layers from sub-assemblies to system of systems. Success of system integrators and suppliers increasingly depends on system competencies across the product supply chain and life-cycle.*
5. *The rapid growth of software intensive systems demands close cooperation of hardware- and software experts from the early phases of systems architecture development to ensure seamless system interaction throughout the life-cycle. Artificial Intelligence (AI) will increasingly support system developments and will become elements of integrated systems.*
6. *Modelling, simulation and virtual reality engineering tools need to advance to enable systems data correlation and seamless exchanges during development, manufacturing, and operation.*
7. *Systems understanding and judgement are rooted in specific domain competencies. Coupling these with technological acumen, innovative curiosity, pragmatism, and effective team cooperation is essential for success.*
8. *Systems engineering and project management disciplines have strong interdependencies. Their life-cycle based processes and tools, along with their professional guidance, need to be aligned to ensure problem solving and value driven approaches for systems realizations.*

## **Acquiring System Competencies**

9. *Acquiring systems competencies is a life-long journey. It should involve critical systems thinking in schools, broader systems education in universities, and periodic updates for systems teachers, experts and practicing engineers. A paradigm shift is needed for ensuring the availability of systems workforce. Adjustments of university curricula and industry training concepts should involve advancing technologies, digital tools, agile practices, and the growing global access to knowledge as fundamental drivers for change.*
10. *Systems competencies are best learned by engaging students and professionals in real world problems through multi-disciplinary learning opportunities, e.g. capstone projects applying state-of-the-practice tools. System-level reviews should be held periodically to reinforce the importance of addressing cross cutting issues. Cooperation between academia, industry, government agencies, and professional organizations should be strengthened to enhance systems understanding and realization competencies.*

11. *Systems workforce careers often evolve from assembly, to subsystems, and system integration competencies. Multiple career paths can potentially lead to system architect, chief engineer, project or program manager or chief technical officer. Related career guidance for systems workforces should be developed by professional organizations for pragmatic application by the global systems community.*

### **Endorsed on behalf of the Summit Delegates**

- *Summit Chair: Prof.dr.ir. T.H.J.J. van der Hagen, Rector Magnificus & President of the Executive Board, Delft University of Technology*
- *Chair of the Context and Systems Needs Theme, Henk van Houten, Chair of the Board of the Netherlands National Academy of Engineering (NAE), NL*
- *Chair of the Industry System Workforce Needs & Sustainment Theme, Jan van Vlerken, Senior Vice President System Engineering, ASML*
- *Chair of the Education of System Engineers Theme Prof. Dr. Emma Sparks, Rector and Dean, University of New South Wales, Canberra*
- *Chair of the Government Agencies System Workforce Needs, Roles & Contributions Theme, Larry D. James, Lt Gen USAF (Ret), former Deputy Director NASA JPL, USA; currently Strategic Advisor to the SmartSat Cooperative Research Center, Australia's Space Research Organization, and Professor of Space Innovation at Monash University, Melbourne, Australia*
- *Chair of the Professional Organizations System Needs and Opportunities Theme, Prof. Dr. Daniel Hastings, President American Institute of Aeronautics and Astronautics*
- *Summit Architect: Prof. Dipl.-Ing. Heinz Stoewer, M. Sc. and the Associate Theme Chairs David Nichols, Kerry Lunney, Prof. Dr. Eberhard Gill, Twan de Wit, Steve Records*

### **Enclosures:**

- *Recommendations resulting from the five Summit Themes & the complete list of Endorsements*
- *Additional information, incl. the keynote presentations and a summary of the experts meeting on "How AI can enhance Systems Engineering" are at: <https://systems-workforce.eu>*