Systems Engineering Competency Framework

What are the Competencies?

### Systems Thinking
- Systems concepts
- Super-system capability issues
- Enterprise and technology environment

### Holistic Lifecycle view
- Determine and manage stakeholder requirements
- System design:
  - Architectural design
  - Concept generation
  - Design for...
  - Functional analysis
  - Interface management
  - Maintaining design integrity
  - Modelling and simulation
  - Select preferred solution
  - System robustness
- Integration & Verification
- Validation
- Transition to operation

### Systems Engineering Management
- Concurrent engineering
- Enterprise integration
- Integration of specialisms
- Lifecycle process definition
- Planning, monitoring and controlling

For more information visit: incoseuk.org

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With contributions from Sandra Hudson (lead author) of General Dynamics United Kingdom Limited and the INCOSE UK SE Competencies Working Group

Many organisations have tailored the framework and are actively using it to:
- Identify individual’s and the organisation’s competencies in Systems Engineering
- Identify learning and development opportunities
- Standardise job roles and descriptions
- Aid recruitment and direct interview questions
- Develop Systems Engineering training programmes

Evaluation:
A Guide to Competency Evaluation is also available and is designed as a companion to the Systems Engineering Competencies Framework document. It gives guidance on how to evaluate people against the competency framework.

Does your organisation know what makes a good systems engineer?
The Competency Framework can help!

What are the Competencies based on?
The Systems Engineering Competencies developed are consistent with the following:
- International Standards Organisation ISO15288
- EIA632
- INCOSE Systems Engineering Body of Knowledge & Handbook
**COMPETENCY AREA - Systems Thinking: System Concepts**

**Description:**
The application of the fundamental concepts of Systems Engineering. These include understanding what a system is, its context within its environment, its boundaries and interfaces and that it has a lifecycle.

**Why it matters:**
Systems Thinking is a way of dealing with increasing complexity. The fundamental concepts of Systems Thinking involves understanding how actions and decisions in one area affect another, and that the optimisation of a system within its environment does not necessarily come from optimising the individual system components.

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### EFFECTIVE INDICATORS OF KNOWLEDGE AND EXPERIENCE

<table>
<thead>
<tr>
<th>AWARENESS</th>
<th>SUPERVISED PRACTITIONER</th>
<th>PRACTITIONER</th>
<th>EXPERT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is aware of the need for systems concepts</td>
<td>Understands systems concepts</td>
<td>Able to identify and manage complexity with appropriate techniques in order to reduce risk</td>
<td>Able to review and judge the suitability of systems solutions and the planned approach</td>
</tr>
<tr>
<td>Aware of the importance of:</td>
<td>Understands the system lifecycle in which they are working</td>
<td>Able to predict resultant system behaviour</td>
<td>Has coached new practitioners in this field</td>
</tr>
<tr>
<td>■ system lifecycle</td>
<td>Understands system hierarchy and the principles of system partitioning in order to help manage complexity</td>
<td>Able to define system boundaries and external interfaces</td>
<td>Has championed the introduction of novel techniques and ideas in this field which produced measurable improvements</td>
</tr>
<tr>
<td>■ hierarchy of systems</td>
<td>Understands the concept of emergent properties</td>
<td>Able to assess the interaction between humans and systems, and systems and systems.</td>
<td>Has contributed to best practice</td>
</tr>
<tr>
<td>■ system context</td>
<td>Can identify system boundaries and understands the need to define and manage the interfaces</td>
<td>Able to guide supervised practitioner</td>
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<tr>
<td>■ interfaces</td>
<td>Understands how humans and systems interact and how humans can be elements of systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ interactions amongst systems and their elements</td>
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</tbody>
</table>

*Figure 1 - Typical table extracted from the competency framework*