Sysnovation Tool Belt

No.	Systems Engineering Competency	Value Added	Potential Systems Engineering Tools	INCOSE SEHv4
1	Understand **problem/opportunity** that needs to be addressed and clearly communicate the system **purpose** (Level n).	The system is not successful unless it fulfills its purpose by addressing a specific problem (or opportunity). If it does not have a viable purpose, it should not be pursued.	Problem/Opportunity Statement System Purpose Statement Five Whys Six Honest Serving Men - What and Why and When and How and Where and Who SWOT - Strengths, Weaknesses, Opportunities, Threats ConOps - Concept of Operations Document Project Charter SEMP - Systems Engineering Management Plan	BMA PP
2	Understand and analyze all relevant **customer requirements** and needs.	The system is not successful unless it fulfills its customer and user/operator/maintainer needs. Many times the true customer needs are not known. Provides the basis for validation.	OpsCon - Operational Concept Document Use Cases/Scenarios User Stories Personas uc - Use Case Diagram [SysML] VOC - Voice of Customer	SNRD
3	Understand and analyze all **business and other stakeholder requirements** and needs.	There are more stakeholders than the customer and user. The system is not successful unless it fulfills all of its stakeholder needs. Provides the basis for validation.	VOB - Voice of Business VOR - Voice of Regulator VOT - Voice of Technology Stakeholder Identification CATWOE - Clients, Actors, Transf, Weltanschauung, Owner, Environ Constraints PESTAL - Political, Economic, Social, Technological, Environmental, Legal StRS - Stakeholder Requirements Specification *(for all stakeholders)*	SNRD
4	Understand the system (Level n) **context** within its environment and its **boundaries** (Level n and Level n+1).	Understanding what is in and out of scope and how actions and decisions in one area affect another.	Context Diagram Boundary Diagram Enabling Systems	SNRD SRD AD
5	Identify, define, and control **interfaces** across the system boundaries (Level n) and between system elements (Level n+1).	Poor interface management can lead to incompatible systems elements and increased system integration time.	N-Squared Diagram DSM - Design Structure Matrix ibd - Internal Block Diagram [SysML] ICD - Interface Control Document IWG - Interface Working Group	AD
6	Define, analyze, and manage the system **functionality/behavior** (Level n) (including nominal/off-nominal scenarios, corner conditions).	Behavioral (Functional/Logical) Analysis is a way to understand what the system has to do. Functions help refine requirements and the physical design.	FFBD - Functional Flow Block Diagram act - Activity Diagram [SysML] sd - Sequence Diagram [SysML] stm - State Machine Diagram [SysML]	SRD
7	Ensure that the requirements for all **lifecycle stages** are addressed at the correct times.	Failure to address the lifecycle requirements (also know as the "ilities") at the proper time can lead to features never being achieved or achieved at an escalated cost.	Reliability, Availability, and Maintainability (RAM) Logistics/Supportability Usability/Human Systems Integration (HSI) Training Needs System Safety (including FMECA - Failures Modes, Effects, and Criticality Analysis) System Security Resilience/System Survivability Changeability Commonality Interoperability Manufacturability/Producibility Affordability Environmental Impact/Disposability/Sustainability	SNRD SRD AD DD SA ES
8	Utilize **analysis, modeling, and simulation** to provide early indications of system performance (Level n) and ensure high confidence in the design.	Early modeling and simulation results can confirm integrated performance, reduce risk, and allow the exploration of alternate scenarios.	Effectiveness Analyses Models Simulations	SNRD SRD AD DD SA
9	Define, analyze, and manage the system **technical requirements** (Level n).	Requirements provide a clear definition of what the system needs to do, how well, and under what conditions. Provides the basis for verification.	SyRS - System Requirements Specification (SyRS), Including: - Threshold/Objective Requirements - Margin - Growth/Spare Requirements - Acceptance Criteria (Up-Front Definition) - Requirements Attributes req - Requirements Diagram [SysML]	SRD

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10	Leverage bi-directional **traceability** *(up* to parents at Level n-1, *out* to peers at Level n, and *down* to children at Level n+1) to manage requirements development and changes.	Allows insight into top-down and bottoms-up impact assessment for potential requirements changes and compliance issues.	RTVM - Requirements Traceability and Verification Matrix StRDB - Stakeholder Requirements Database SyRDB - System Requirements Database SyERDB - System Element Requirements Database	SNRD SRD AD DD PAC
11	Manage the **integrated technical performance** of the system (Level n).	Integrated technical performance must be monitored and controlled throughout development. The emergent properties must be managed at the system level.	MOE - Measure of Effectiveness MOP - Measure of Performance TPM - Technical Performance Measure SE Leading Indicators Measurement Repository	SNRD SRD AD DD MEAS
12	Ensure **technical risk** is at an acceptable level for the system (Level n). Manage the **risks and opportunities** throughout the development process.	Risks that are unaddressed may result in cost and/or schedule impacts, and may also result in expensive rework and/or non-compliances. Opportunities that are unaddressed may result in missed benefits.	ROMP - Risk & Opportunity Management Plan ROMB - Risk & Opportunity Management Board Risk & Opportunity Repository Technology Roadmaps *(if new technology involved)* TRL - Technology Readiness Level *(if new technology involved)* ImpACT - Importance/Availability/Capability/Timeframe *(if COTS involved)*	RM
13	Define/recommend balanced solutions via a formal **decision making** process.	The organization/project needs to make and support the tough decisions that give the best balanced system solution.	Trade-off Study *(including presentation of results & recommended decision)* Make vs. Buy Decision *(including presentation of results & recommended decision)* Decision Analysis (Decision Matrix, Pugh Concept Selection, AHP, K-T Analysis, etc.)	DM ACQ
14	Define, architect, design, analyze, and manage the system **physical elements** (Level n+1).	The physical design drives all of the lower-level components.	Physical Hierarchy Diagram Physical Block Diagram pkg - Package Diagram [SysML] bdd - Block Definition Diagram [SysML] ibd - Internal Block Diagram [SysML] par - Parametric Diagram [SysML]	AD DD
15	Leverage **technical reviews** to focus on the integrated technical performance, compliance to requirements, and risk of the system (Level n).	Need to have meaningful technical reviews that focus on the integrated technical performance, compliance, and risks.	Peer Reviews TIM - Technical Interchange Meeting Technical Design Review Action Item Repository DHOAS - Dead Horse on a Stick	PAC
16	Define, analyze, and manage (derivation and allocation) the **system element requirements** (Level n+1).	The component developers need a clear understanding of what they need to design and release.	Requirements Allocation Requirements Derivation SyERS - System Element Requirements Specification, Including: - Threshold/Objective Requirements - Growth/Spare Requirements - Acceptance Criteria (Up-Front Definition) - Requirements Attributes req - Requirements Diagram [SysML]	SRD AD DD
17	Manage the **system integrity**. Ensure the overall coherence and cohesion of the evolving system (Level n) is maintained.	Failure to effectively manage configurations to deal with necessary changes can lead to cost overruns.	TRB - Technical Review Board CCB - Change Control Board Baselines	CM
18	**Integrate** system elements (Level n+1) virtually together in a logical sequence to avoid wasted effort. Perform early integration on key/high risk elements.	Integration of the system component must be intentional to avoid unnecessary delays and overruns.	Integration Analysis, Models, & Simulations to Predict Compatibility Virtual Builds Mockups and Prototypes	INT
19	Use virtual **verification** early and often to ensure the system (Level n) as designed meets its technical requirements.	Need to ensure we "built the system right" (meets its system requirements).	Verification Analysis, Models, & Simulations to Predict Compliance Virtual Builds Mockups and Prototypes	VER
20	Use virtual **validation** early and often to ensure the system (Level n) as designed meets the needs of the customer/end user.	Need to ensure we "built the right system" (meets its customer and other stakeholder requirements).	Validation Analysis, Models, & Simulations to Predict Acceptance Virtual Builds Mockups and Prototypes	VAL

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