Definition Guidelines for SIRA
Version 0.0

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Disclaimer: This document is under development and not yet final.

0.1 System under Consideration (Technical system)

The system under consideration is the system whose lifecycle is under consideration according to [1]. The ISO RAMS standard for railway defines the system as "a set of elements which interact according to a design, where an element of a system can be another system, called a subsystem and may include hardware, software and human interaction"[1]. These elements include products, processes, procedures, information, techniques, facilities, or services. Human interaction is included in the definition of system of interest, but human is not a part of the system of interest. It, therefore, can be called a technical system or a system.

0.2 Human (People)

Human or people refer to individual or group of individuals who have connections to the system of interest in the form of for example stakeholders. Stakeholders have different interests and power to influence the system. They can be users, operators, owners, service providers, producers, or other humans who directly or indirectly have interest in the system. They may cooperate or compete with the system of interest, monitor, regulate, manage, maintain, replace, or dispose it.

0.3 Environment of system

Environment consists of all relevant parameters that can influence or be influenced by the system of interest in any lifecycle phase. One may refer to the related environment as context, surrounding, or super-system. Relevant regulations, industry standards, or supporting facilities in the course of normal or specific operational conditions are part of the system environment.

0.4 Human–System

As explained earlier, human can have different roles and consequently different relations with the system of interest. The relation can be physical, logical, emotional, etc. This relation can influence or be influenced by the system of

interest. Human factors, operational and safety culture fall under the category of human-system relation.

0.5   System–Environment

The system of interest has relations with its environment. The relation between a system and its environment can be physical or non-physical.

A physical relation is often realised through technical installations. The physical relation (or interface) often takes place in the form of mechanical, energy, or information relation [3].

0.6   Human–Environment

The human-environment relation often falls out of the scope of the system under consideration in the technological design, but it may have dominant influence on the system. Change of regulations in a dynamic and competitive political context or policy-making that influences the system are examples of human-environment relations for the system of interest. These relations often becomes very complex for systems where multiple stakeholders are involved.

0.7   Integration Meta Model

Integration Meta Model highlights three fundamental elements of system, human, and environment and their interactions which are human-system, system-environment, and human-environment.

0.8   Subsystems Integration

Subsystems integration refers to combination of two or more components. In other words, integration of components leads to subsystems. Both subsystems and components are parts of a system and cannot independently function. Components or subsystems integration are often the earliest action in physical integration. For example, the V model suggests starting integration from this level. Integration of components occurs often in production or assembly stage.

0.9 Systems Integration

The systems engineering standard practice defines integration as a technical process for integrating the elements of a system. In this context, a successful system integration leads to a system that works and delivers the required functionalities without any failure. At system level integration, the focus is mainly on components, subsystems, or interfaces. The SE handbook recognises that integration of human and system is not a technical process and recommends focusing on human systems integration (HSI) across the design or engineering of systems [5].

0.10 Human-Systems Integration

Human systems integration (HSI) is the interdisciplinary technical and management process for integrating human considerations within and across all system elements according to HSI focuses on the human, an integral element of every system, over the system life cycle.HSI considers domains such as human factors engineering (human performance, human interface, user centred design), workload (normal and emergency), training (skill, education, attitude), personnel (ergonomics, accident avoidance), working condition and health (hazard avoidance).

0.11 System of Systems (SoS) Integration

System of systems is a combination of two or more independent systems. A "system of systems" (SoS) is a system whose elements are managerially and/or operationally independent systems according to the systems engineering handbook. As results, the interoperability of the integrated systems or subsystems usually is not achievable by an individual system alone. The relations among a system and other systems have been discussed elsewhere for example by Mo Jamshidi in the context of System of Systems [6].

0.12 Socio-technical Integration

System of systems needs to integrate with the society in order to optimally deliver its services. SoS requires to obey national or international regulations

in order to be able to deliver its services. Besides, the cultural aspects play a major role for its acceptance within a society [8]. For example, the communication language, accepted norms and value, or expected services have impacts on system of systems and its sustainable performance [9].

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