

Paper for Consideration by HSSC11

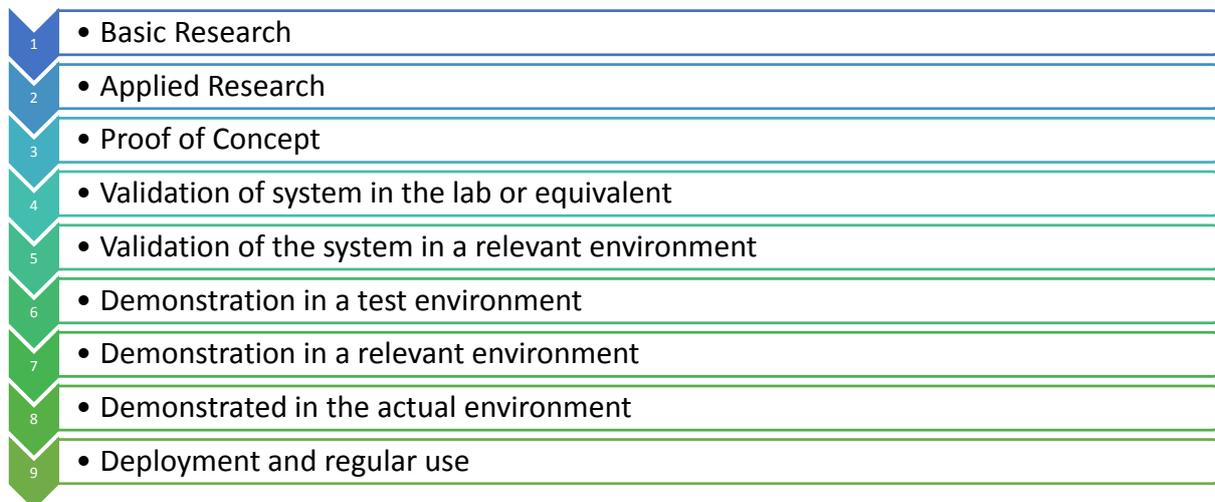
S100 Technical Readiness Levels

Submitted by:	S100 Working Group
Executive Summary:	This paper proposes that the S100 Working Group adopt the concept of S100 Technical Readiness Levels to objectively measure and indicate the operational capability of individual S-100 product specifications. If the S100WG endorses this concept, then it will be proposed to the HSSC for incorporation into S-97 and also as part of the S100 Product Specification Development Lifecycle.
Related Documents:	S-97 – Guidebook for developing S100 Product Specifications
Related Projects:	Any S-100 based product specification

Introduction / Background

The concept of technical readiness levels is not a new one. It was first developed by NASA¹ to manage technology development and risk and utilizes nine individual Technical Readiness Levels (TRLs) which describe the progression of an idea from the research stage to where the idea has become a product in regular use.

The following figure shows the nine readiness levels developed by NASA.



Analysis/Discussion

A key issue when developing new product specifications within the S-100 framework is the ability to communicate to the wider community the completeness of the specification and its readiness for operational use. This is also further complicated by the many different types of operational settings for product specifications under development and not all of which require all S-100 components.

What is clear from the TRL concept is that it shows a progression from an idea to regular use, which mirrors the process of development of an IHO product specification from proposal to operational use. By mapping a subset

¹ https://en.wikipedia.org/wiki/Technology_readiness_level

of required Readiness Levels for a product specification under development and then tracking them within an S-100 process, the IHO community will gain a clear understanding of whether the specification is ready for endorsement and approval. This will also allow other non-IHO stakeholder organizations who are leveraging the S-100 framework to gauge when their product specifications meet an appropriate readiness level for transition to live operation.

In order to have a specification that conforms to S-100 and to ensure that it is ready to produce data that can be used in a live context (including its use within type approved navigation systems) this paper proposes the mapping of the nine NASA Technical Readiness Levels (TRLs) into five “S-100 Readiness Levels”.

The following table lists the prerequisite components to meet each S-100 Readiness Level. Note that it is required that all S-100 based product specifications conform to S-100 and both the Feature Catalogue and the Portrayal Catalogue must use the published S-100 infrastructure and process for creation and maintenance.

Required product specification component	(TRL5) Level 1 v1.0.0	(TRL6) Level 2 v1-2.0.0	(TRL7) Level 3 >v2.0.0	(TRL8) Level 4 >v2.0.0	(TRL9) Level 5 >v2.0.0
Main Document (Defines the relevant parts of S-100 that are required for the product specification)	X	X	X	X	X
A Default Encoding	X	X	X	X	X
S-100 Compliant Feature Catalogue	X	X	X	X	X
<i>DCEG</i>	X	X	X	X	X
S-100 Compliant Portrayal Catalogue NOTE: Not every specification will need a portrayal catalogue – this should be determined as part of the development process and stakeholder feedback		X	X	X	X
Data Quality Checks		X	X	X	X
Test Data Sets		X	X	X	X
<i>Data Validation (and test datasets)</i>		X	X	X	X
Exchange Catalogue		X	X	X	X
Encryption / Digital Signatures			X	X	X
Interoperability				X	X ¹
Alerts and Indications				X	X ¹
Operational data					X

(X¹ = ECDIS only)

Level 1: Contains the minimum amount of components needed to comment the development of test datasets and system prototypes. This should be considered the final stage of development before demonstration begins. and would typically be Edition 1.0.0 of a Product Specification

Level 2: Includes additional items such as data quality checks and test data sets so that the product specification can be demonstrated in prototype environments. This would typically map to Edition 1.n.n - 2.0.0 of a product specification. Depending on the end-user requirements of the product specification, Level 2 can be implemented in an operational context. Subsequent S-100 Readiness Levels are then dependent on operational requirements of the product within navigation systems.

Level 3: Builds on level 2 and includes a fully featured and documented exchange catalogue's and (optionally) an encryption layer for the data and implementing system. At this level prototype systems, products or processes should be demonstrated in a real world environment.

Level 4: Intended only for use in vessel navigation systems such as ECS and ECDIS. At this level the developer of the product specification needs to ensure that documented considerations have been given to interoperability via S-98 and alerts and indications functionality. At this level there should be a baselined and compliant system, process or product that is shown to operate or function as expected.

Level 5: System, process or product is deployed and used routinely. At this stage data and compliant systems are readily available for operational use. This stage include functionality for machine-based check of up-to-dateness (i.e. automatic warnings and Update Status Reports). The functionality required for up-to-dateness could be provided within individual product specification or be provided through S-128 Catalogue of Nautical Products.

Conclusions

Introducing the concept of S100 Readiness Levels into the product specification definition and rollout phases will provide the IHO and the broader community of product specification developers and implementers with a clear picture of what is required for implementation and operational use of a product developed under the S-100 framework.

Recommendations

It is recommended that the HSSC discuss the concept of S100 Readiness Levels and propose it to the for adoption followed by additions to IHO S-97 – Guidebook for the development of S-100 based product specifications.

Action Required of HSSC

The HSSC is invited to:

- a. endorse the concept of S-100 Readiness Levels (SRL)
- b. agree to this concept for inclusion into S-97 and delegate to the S100WG to implement and develop a compliance scheme.