

Report to HSSC-16

S-100 Infrastructure Centre Establishment Project Team (ICE PT)

Submitted by:	ICE PT Chair
Related Documents:	See Annex 1 for a summary of infrastructure related decisions taken by Assembly, Council and HSSC
Related Projects:	S-100 Security Scheme Project Team

Chair:	Until January 2024: Iji Kim, KR From March 2024: Benjamin Hell, SE
Vice-Chair:	Benjamin Hell, SE (until March 2024, currently vacant)
Secretary:	Kevin Dickens, US (NGA)
Member States:	CA, CN, FR, KR, NO, SE, US, UK
Expert Contributor Organisations:	IC-ENC, NTUA (GR)
See Annex 3 for full details	

Summary

The ICE PT appreciates the valuable efforts of the Republic of Korea and other important contributors to develop and maintain the tools and services needed to operate the S-100 ecosystem. With S-100 soon entering the operational phase, the ICE PT strongly supports the need for a robust and permanent development and maintenance regime, covering the technical and administrative S-100 infrastructure components under the remit of the IHO.

Therefore, a permanent IHO technical infrastructure centre should be established during the period 2024–2026. It would provide an umbrella for the management, development and maintenance of the knowledge, resources, processes, information and technology needed to operate the S-100 ecosystem in a reliable and secure way. The infrastructure centre should be an integral part of the IHO, preferably as a unit of the IHO Secretariat and thereby under the (indirect) governance of the IHO Member States collectively.

Please note that this proposal does not aim to present the comprehensive administrative mechanics behind what may need to happen within the organisation of the IHO and its Secretariat. It aims to build on the current state of S-100 Infrastructure by presenting the resource requirements for our future.

Establishing a permanent technical and operative infrastructure is a major step for the organisation of the IHO and its Secretariat, requiring well informed decisions. As a result, this Project Team report is probably more comprehensive than what is usual for HSSC. The most important information for HSSC decision making can be found in sections 5 and 6 of this report.

The proposed actions required by HSSC are summarized in section 8 on page 16, which also includes a proposal for the name of the IHO infrastructure centre.

1. ICE PT Work Plan as decided at HSSC-15

The ICE PT work plan is part of the [HSSC Work Plan as decided at HSSC-15](#). The Project Team tasks are to develop the management documents and operating plan for the proposed S-100 Infrastructure Centre, in particular:

- A. Propose role, scope, function and governance of the S-100 Infrastructure Centre
- B. Propose composition, identify financial considerations, and suggest working procedures
- C. Propose location
- D. Propose the timeline for the establishment of the Infrastructure Centre
- E. Support the HSSC with the creation of documents required to submit the proposal to the IHO Council
- F. Conduct the 2023 and 2024 meetings of the S-100 ICE PT

The ICE PT [Terms of Reference](#) also mention an additional objective to consider a preliminary work plan for the proposed S-100 Infrastructure Centre.

This report contains proposals related to work plan items A–D. Proposals regarding working procedures, financial considerations (both part of WP item B) and a preliminary work plan are still work in progress. Based on this report, the ICE PT stands ready to support HSSC with a proposal to the 8th meeting of the Council (work plan item E).

2. Modus operandi (WP item F)

The PT has had participants from eight IHO member states (CA, CN, FR, KR, NO, SE, US, UK) and expert contributors from Greece and IC-ENC. The IHO secretariat has been represented by Technical Director John Nyberg and Assistant Director Yong Baek. Also, the HSSC Chair has participated in the ICE PT meetings.

Mrs. Iji Kim (Republic of Korea) chaired the PT until January 2024, before she left her position at KHOA in February 2024. After that, the PT was led by vice chair Mr. Benjamin Hell (Sweden), who was elected to assume the chair position at the PT-5 meeting in March 2024. Mr. Kevin Dickens (USA) has volunteered as the PT's secretary.

The PT has met five times, including two physical meetings back-to-back with regular meetings of the S-100WG and TSM (Table 1).

MEETING	DATE	LOCATION	CHAIR	VICE CHAIR	SECRETARY
ICE PT-1	2023-09-07	VTC	Iji Kim (KR)	Benjamin Hell (SE)	-
ICE PT-2	2023-10-26	VTC	Iji Kim (KR)	Benjamin Hell (SE)	Kevin Dickens (US)
ICE PT-3	2023-11-17	Singapore	Iji Kim (KR)	Benjamin Hell (SE)	Kevin Dickens (US)
ICE PT-4	2024-02-06	VTC	-	Benjamin Hell (SE)	Kevin Dickens (US)
ICE PT-5	2024-03-18 2024-03-19	Monaco	-	Benjamin Hell (SE)	Kevin Dickens (US)
PLANNED, PENDING CONTINUATION OF PT WORK PLAN AS DECIDED BY HSSC:					
ICE PT-6	2024-07-01	VTC	Benjamin Hell (SE)	-	Kevin Dickens (US)
ICE PT-7	S-100WG9	Genova			

Table 1: Meetings of the ICE PT

The PT's latest list of Decisions and Actions can be accessed on the [PT's web page](#).

3. On-going IC-ENC funded IHO Operational S-100 Infrastructure Study

In February 2024, there was an opportunity to seek financing from the IC-ENC Special Activity Fund. A joint proposal by the IHO Technical Director and the acting ICE PT chair to finance an IHO infrastructure related study by a third party was accepted in March 2024.

The aim with this study is to let an external consultant review and evaluate the Infrastructure Centre proposal as put forward by the ICE PT. Furthermore, the study can deepen some of the knowledge required to plan the Infrastructure Centre establishment in more detail. As of this writing,¹ the procurement of such consultancy has been initiated, and results from the study are expected in July 2024.

4. The current components of S-100 related infrastructure and their management

4.1. Technology, processes and information

As part of the development of S-100, several components that are essential for the operation of the S-100 ecosystem have been developed. This includes technology, such as software and database applications, but also processes and information.

The ICE PT appreciates that many of the technology components have been developed and operated through in-kind contributions from the Republic of Korea and the Korea Hydrographic and Oceanographic Agency (KHOA) over the past decade. Major examples are the IHO Geospatial Information Registry (GI Registry) and the various catalogue building tools. Without the generous support from the Republic of Korea, the development of S-100 would still be at a much lower technical level today.

Other components have been developed and maintained by other entities, such as the IHO Secretariat, IHO working groups or external companies. This is especially the case for the operative processes around S-100.

The table in Annex 2 summarizes the majority of the current components of S-100 related interim infrastructure, and the maintenance responsibility for the respective component.

The current interim S-100 infrastructure lacks a broad scale and coherent management structure which would enable proactive prioritization across components handled by different organisations as well as component lifecycle management and change management in general. This includes shortfalls in long-term financial stability with regards to the development and maintenance costs related to S-100 infrastructure components.

The ICE PT made the assumption that the majority of the costs for S-100 infrastructure components are staff costs and that costs for e.g. basic IT infrastructure are comparably small.

4.2. Personnel

The current labour force working with S-100 related infrastructure is summarized in Table 2 and consists of:

- Approximately three full-time equivalent employments in the Republic of Korea (mainly external consultants contracted by KHOA), financed in-kind by the Republic of Korea. They are working as technology specialists mainly with the development of S-100 related software tools and databases.

¹ 7 May 2024

- Approximately two full-time equivalent employments at the IHO Secretariat located in Monaco and financed by ordinary IHO budget. The relevant work is part of the current roles of Technical Standards Support Officer, Assistant Director and IT Manager, see Table 2 below.
- Additional resources are provided in-kind by other organizations (e.g. NGA/NIWC, PRIMAR) or contracted by Member States (e.g. NOAA/Portolan Science).

ROLE	LOCATION	FULL TIME EQUIVALENTS	FINANCING
Technical Director	MC	10%	IHO
Assistant Director (ADDT)	MC	30%	IHO
Technical Standards Support Officer (TSSO)	MC	80%	IHO
IT Manager	MC	35%	IHO
Tech specialists (several)	KR	300%	KR
Project officer	MC	30%	KR

Table 2: Resources currently working with S-100 infrastructure. The full time equivalents are approximate and comprise only tasks related to the S-100 infrastructure. Note that additional resources at other organisations are not listed.

It should be highlighted that the people currently bearing the knowledge about the S-100 infrastructure components are probably the most important asset to consider for the establishment of a permanent infrastructure centre.

5. Prioritized critical items that need to be stabilized as soon as possible

Together with relevant technical experts within the S-100WG, the ICE PT has identified two items where prioritized development of tools and processes are critical and urgent for achieving the S-100 target transition date of 2026-01-01:

1. Quality control and secure delivery of S-100 catalogues and S-164 test datasets
2. Operative processes for the S-100 Part 15 security scheme

The ICE PT proposes that HSSC should consider these items as particularly critical infrastructure components and prioritize their development and management accordingly.

If required, these items could be candidates for additional interim IHO funding as per Council decision C7/10 (see Annex 1), during the establishment phase of a permanent infrastructure.

5.1. Quality control and secure delivery of S-100 catalogues and S-164 test datasets

For an efficient implementation of S-100 in end user systems, the availability of correct machine readable S-100 information is essential. This means that authoritative S-100 schemas and quality controlled catalogue files for S-100 based product specifications need to be made available by IHO for implementers in a secure manner. Furthermore, once S-164 test datasets for ECDIS type approval will have reached operational maturity, even these datasets will need to be made available from an authoritative IHO source in a secure way.

The feature, portrayal and interoperability catalogues are complex XML documents, some of which potentially also including machine-executable LUA code. Currently, no formalised structure exists for their review and subsequent distribution and use by end users. Given the dire consequences of their misuse, corruption or incorrect content a more structured, inclusive and rigorous approach to the distribution and authoring process is needed for the implementation of “live” catalogues.

This topic has been discussed in the S-164 sub group under the S-100WG and there are suggestions on how the catalogue delivery process could be strengthened.²

5.2. Operative processes for the S-100 Part 15 security scheme

The operation of IHO's new S-100 Part 15 based security scheme relies upon both technology and administrative processes and legal processes, which together ensure the integrity of the security scheme.

Currently, different entities deal with these components. For the key management technology, the IHO Secretariat is technically supported by PRIMAR. Administrative processes are mainly being developed by the IHO Secretariat, while the Security Scheme Project Team focuses on the legal matters that are important for the security scheme process.

In order to ensure the long-term integrity as well as a smooth implementation of the S-100 security scheme, the development and maintenance of the required technology and processes should be handled within a common, holistic management regime with solid knowledge in the field of cybersecurity.

6. Recommendation to establish a permanent, resilient IHO infrastructure centre

6.1. Introduction

The ICE PT has identified four areas of S-100 related support services that currently need to be prioritized in order to ensure a smooth implementation and operation of S-100:

1. Support of the S-100 based Product Specifications lifecycle
2. Management, maintenance and operation of the IHO Geospatial Information Registry
3. Support of navigation system type approval
4. Management, maintenance and operation of the IHO S-100 Part 15 based Security Scheme

These areas are further described below. It should be noted that this scope of an IHO technical and administrative/procedural infrastructure is limited to the current needs of the highly prioritized implementation and operation of S-100, but may need to be adjusted or broadened in the future as new needs arise. Areas that have been discussed by the ICE PT, but are currently considered out-of-scope, include e.g. INTOGIS and the IHO e-Learning resources.

Most of the current components of S-100 related infrastructure, in the form of technology, processes and information, can be assigned to one or more of the above mentioned four areas. However, there is a need to solidify the management of these components and their lifecycles.

The table in Annex 2 maps each currently known interim S-100 infrastructure component against the respectively most relevant S-100 related support service. This could provide a starting point for managing the required support services in a coherent manner.

The required transition from the current setup to a permanent and resilient IHO technical infrastructure, including clear structures for change management, is the main focus of the following proposals and recommendations of the ICE PT.

6.2. Role (WP item A)

The ICE PT sees a need to strengthen the existing "interim S-100 infrastructure" and make it more future proof. Therefore, the fundamental goal of the Infrastructure Centre is to provide a sustainable

² E.g. the recent papers [S100WG8-6.19](#), [TSM10-8.2a](#) and [TSM10-8.7](#) contain more details on secure catalogue distribution.

structure for the management, maintenance and further development of the existing infrastructure parts.

Because of the fact that the scope of the infrastructure managed by the IHO will probably undergo changes in the future and may eventually also include items that are not strictly related to S-100 operations, the ICE PT proposes that the infrastructure should be named “IHO Infrastructure Centre”. Alternative names include “IHO S-100 Infrastructure Centre” (as originally proposed by Assembly, Council and HSSC) or “IHO Technical Infrastructure Centre”.

The ICE PT proposes to define the role of the IHO infrastructure centre as follows:

Role

The role of the IHO {S-100|Technical}³ Infrastructure Centre is to support the development, operation and management of IHO {standardized|governed} products and associated IHO services with a common base infrastructure.

Its initial focus will be to get S-100 operational.

Explanatory notes:

- The term *IHO standardized/governed products* refers to IHO standard compliant products in general, and the term *associated IHO services* refers to the basic services that the IHO needs to provide to enable production, distribution, use, and lifecycle management of such products. In relation to the current S-100 related needs, the *associated IHO services* encompass the scope of the infrastructure as defined below in section 6.3.
- The term *base infrastructure* comprises technology, information, processes and management, as further described in section 6.4 below.
- The ICE PT envisions that there may be items not strictly related to S-100 implementation, which also could benefit from eventually being managed by the IHO Infrastructure Centre. However, given the decision that S-100 implementation is presently the highest priority strategic goal of the IHO, the IHO Infrastructure Centre should initially focus on supporting to achieve this goal before IHO would consider broadening its scope.
- Changes to the defined role of the IHO Infrastructure Centre should be handled as outlined in the recommendations about governance (section 6.5).

6.3. Scope (WP item A)

In order to support the S-100 Critical Infrastructure Framework and the operation of S-100 based products, the ICE PT has identified four prioritized distinct services which are required for a number of specific operations in the S-100 ecosystem. These services should be managed and operated by the IHO Infrastructure Centre.

All infrastructure services also include training and documentation in support of the respective target groups.

The ICE PT has started to analyse these four services in more detail (stakeholders, work items, software components, dependencies etc.), based on how the present interim S-100 infrastructure is organized. Further deepening this analysis will be part of the IC-ENC funded infrastructure study.

The ICE PT proposes the following initial scope of the IHO Infrastructure Centre:

³ Curly braces for alternative phrasings; underline indicates ICE PT preference

Scope

The IHO {S-100|Technical} Infrastructure Centre shall provide the following services:

- 1. Support of the S-100 based Product Specifications lifecycle*
- 2. Management, maintenance and operation of the IHO Geospatial Information Registry*
- 3. Support of navigation system type approval*
- 4. Management, maintenance and operation of the IHO S-100 Part 15 based Security Scheme*

All above services include training and documentation in support of the respective target groups.

Support of the S-100 based Product Specifications lifecycle

This infrastructure service aims at the drafting, revising, releasing and publishing S-100 based product specifications, and supporting them during their full lifecycle.

Key stakeholders are various IHO working groups and project teams as well as the IHO secretariat. Servicing the product specifications relies upon a significant amount of technology, in the form of various software tools, documentation platforms and the IHO Geospatial Information Registry. It also relies upon S-97 based processes and operative components such as S-100 catalogues.

Management, maintenance and operation of the IHO Geospatial Information Registry

A core element of the S-100 ecosystem is the IHO Geospatial Information Registry (GI Registry). It consists of an IT system containing the various registers. Operating the GI Registry and its content is a precondition for several other S-100 infrastructure services.

Stakeholders of the GI Registry include the domain control bodies (IHO and external), IHO Member States, the Working Groups and Project Teams dealing with S-100 based product specifications as well as the IHO Secretariat operating the GI Registry. The technical systems are currently hosted in the Republic of Korea.

High level management guidance for the GI Registry is available in S-99.

Support of navigation system type approval

This infrastructure service aims at providing the data required for the type approval of navigation systems, namely ECDIS.

The stakeholders of this service are ECDIS original equipment manufacturers and the S-100WG with several sub groups and project teams.

The S-164 test dataset, together with the applicable IEC standard, are the basis for ECDIS type approval. A fully functional S-164 test dataset includes a large number of screen shot images defining the on-screen visual appearance of ECDIS functionality. At present, these screen shots are being generated using KHOA's "shore ECDIS" software. Furthermore, S-164 needs to be packaged, signed and partly encrypted in order to test system compliance with the S-100 security scheme.

Management, maintenance and operation of the IHO S-100 Part 15 based Security Scheme

The new IHO S-100 security scheme is an essential part of the S-100 operative ecosystem. Therefore the IHO Infrastructure Centre should take care of its lifecycle management as well as the operation of the security scheme.

Stakeholders include data producers (such as the IHO Member States' hydrographic offices), data distributors and ECDIS manufacturers.

In order to ensure integrity of the security scheme, it should be managed from a holistic perspective encompassing both the required processes, the associated technology and its information content. A profound knowledge of IT security, best practices regarding crypto key management and solid administrative procedures regarding the reliability of scheme participants are necessary to achieve the desired results.

In parallel with the ICE PT, HSSC has also established the S-100 Security Scheme PT, focusing on the development of administrative processes for the new S-100 Part 15 security scheme. The results of the Security Scheme PT, such as processes and administrative documentation, should be incorporated in the long-term maintenance structure proposed here.

6.4. Function (WP item A)

For each of the services, the S-100 related IHO Infrastructure comprises the following:

- Development and maintenance of operative components, such as processes and information
- Development and maintenance of the associated technology components, such as IT systems and software
- The tactical management needed for the individual components, based on strategic directions provided by IHO

The IHO Infrastructure also includes some purely operative tasks, see below.

All components of the infrastructure services should be viewed from a lifecycle management perspective, with regard to the development of prioritized new functionality, the short- and long-term maintenance of the component, and finally the controlled decommissioning of functionality or the component as a whole.

Operations related components usually are processes and/or information and could be items such as:

- Process documentation
- Information models
- Templates and forms

Technology components could be items such as:

- Applications
- IT systems
- Technical documentation
- Software code

These components exist in order to support specific operations, carried out within or outside of the IHO Infrastructure Centre itself. Operations that should be included within the Centre are:

- IHO Geospatial Information Registry operations
- S-100 Part 15 Security Scheme operations
- S-100 catalogue distribution
- S-100 based Product Specification quality control and testing

In order to provide this function, the tactical management of the Centre should be capable to provide structured prioritisation, short and long-term planning as well as managing functional requirements.

In essence, the function of the IHO Infrastructure Centre could be seen as providing a structure for the management of core knowledge, and thereby people, needed to operate the S-100 ecosystem.

In summary, the operating concept of the IHO Infrastructure could look like the diagram in Figure 1.

Operations managed outside of the IHO Infrastructure Centre	IHO Infrastructure Centre			IT operations managed by "general IT provider"
	Operative components	Tactical management of components	Technology components maintenance	
Supported operations: <ul style="list-style-type: none"> Product Specification development and maintenance Navigation system type approval 	Lifecycle management of: <ul style="list-style-type: none"> Operative processes <ul style="list-style-type: none"> Forms Templates Testing documentation Information structure <ul style="list-style-type: none"> Data models User support (process) Operations: <ul style="list-style-type: none"> GI Registry operations Security Scheme operations Catalogue distribution PS testcycle 	Implementation of directional strategic management provided through IHO Technical Director: <ul style="list-style-type: none"> Prioritisation <ul style="list-style-type: none"> Short-term Long-term Plans Requirements management 	Lifecycle management of (dev/test/prod): <ul style="list-style-type: none"> IT Systems Code Software tools User support (tech) Systems security 	<ul style="list-style-type: none"> IT infrastructure Pure IT support

Figure 1: Operating concept of the IHO Infrastructure

The ICE PT proposes the following function for the IHO Infrastructure Centre:

Function

The IHO {S-100|Technical} Infrastructure Centre’s function should be structured to provide lifecycle management for operative and technological components needed to support the services that lie within the scope of the Centre.

Its tactical management should be capable to provide structured prioritisation, short and long-term planning as well as managing functional requirements.

The IHO {S-100|Technical} Infrastructure Centre should also provide operations for the IHO GI Registry, the S-100 Security Scheme, S-100 Catalogue distribution as well as S-100 based Product Specification quality control and testing.

6.5. Governance (WP item A)

The governance of the IHO Infrastructure Centre should be defined based on the management structure required to achieve the goals related to the IHO infrastructure. The ICE PT sees a need for management on three levels (Figure 2): Strategic management for providing direction, tactical management for planning and prioritizing, and operative management for executing and delivering.

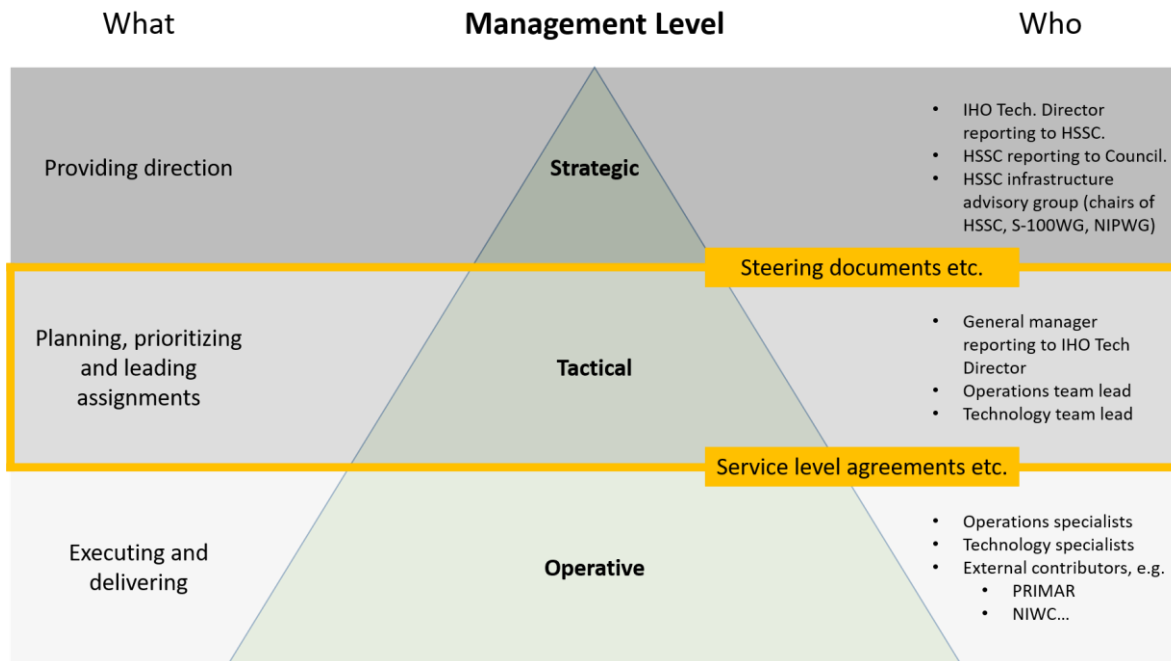


Figure 2: IHO Infrastructure management levels

Being an intergovernmental organisation, the strategic management level should be under the ultimate control of the IHO Member States, at the same time as strategic decision making should remain sufficiently agile to serve the needs of the operative unit that the IHO Infrastructure Centre is. The ICE PT acknowledges that according to the IHO Convention Article V.(e).(xi), the Assembly shall decide upon the IHO's operational services, unless this responsibility has been delegated to the Council.

The tactical management of the IHO Infrastructure Centre should further strengthen the operative nature of the Infrastructure Centre's work. At an operative level, management needs to ensure that results and operations are delivered based on clear service level agreements.

Based on these arguments, the ICE PT proposes the following governance of the IHO Infrastructure Centre within the existing structure of the IHO:

Governance

The IHO {S-100|Technical} Infrastructure Centre should be an integral part of the IHO Secretariat. Its permanent staff should be employed by the IHO Secretariat. The IHO Infrastructure Centre should be led by the IHO Director responsible for IHO Work Programme 2 ("IHO Technical Director").

On a strategic level, the IHO Technical Director will be the link between IHO Member State fora, in particular HSSC, and the tactical management of the IHO {S-100|Technical} Infrastructure Centre.

In matters related to the scope and function of the IHO Infrastructure Centre, the IHO Technical Director should report to HSSC and will be advised by an IHO Infrastructure Advisory Board, which should consist of the chairs of HSSC, S-100WG and NIPWG.

In human resources related matters, {as well as financial matters,}⁴ the IHO Technical Director should report to the Secretary General of the IHO.

On a tactical management level, the functions of a general manager, an operations team lead and a technical team lead would be required. Note that these functions would not necessarily require the manning of separate positions. Any external technical contributions delivered to the Centre, e.g. on an in-kind basis, would also be coordinated by the tactical management of the Centre.

Changes to the role of the IHO {S-100|Technical} Infrastructure Centre should be decided upon by the {Council|Assembly}.

{Major|significant} changes to the scope of the IHO infrastructure services and/or the function of the IHO Infrastructure Centre should be decided upon by the {HSSC|Council|Assembly}.

The ICE PT has identified the potential need of amending the IHO resolutions M-3, in order to cover the overarching governance of the IHO Infrastructure and IHO's extended operative responsibilities, which arise from the implementation of S-100. Therefore, the ICE PT proposes:

HSSC should task the ICE PT to analyse the IHO Resolutions M-3, in order to propose amendments covering the IHO {S-100|Technical} Infrastructure Centre to HSSC-17 for endorsement, and eventually Council-9 and Assembly-4 for any decisions to amend the IHO Resolutions.

6.6. Composition (WP item B)

It is important to highlight the importance of integrating the IHO Infrastructure Centre with the IHO Secretariat, in order to provide long-term organisational stability as independent from specific organisations as possible.

On an operative level, the operations and technical teams, respectively, will require manning several specialist positions. The function of these positions partly corresponds to the existing work force of the interim S-100 infrastructure existing today. However, the current work force is not sufficient for the more comprehensive IHO commitments when S-100 becomes fully operational.

Apart from the role of the IHO Technical Director, it is likely that even the relevant Assistant Director will have a significant role at least during the establishment period of the Infrastructure Centre.

It is envisioned that the required work force would initially be approximately five to ten full time equivalent employees, filling the roles outlined in Table 3.

ROLE	LOCATION	FULL TIME EQUIVALENTS	FINANCING
Technical Director	MC	30%	IHO
Assistant Director (ADDT)	MC	40%	IHO
IT Officer (ITO)	MC	25%	IHO
General Manager	Tbd.	100%	Tbd.
Technology team lead	Tbd.	100%	Tbd.
Technology specialists (several)	Tbd.	300%	Tbd.
Operations team lead	Tbd.	100%	Tbd.
Operations specialist / TSSO	MC	80%	IHO
Operations specialists	Tbd.	200%	Tbd.
Project officer	Tbd.	10%	KR

⁴ To be decided, possibly depending on financing mechanisms.

Table 3: Anticipated roles for the IHO Infrastructure Centre, with approximate work load in full time equivalents. Does not include potential additional resources for the security scheme operation, depending on the needs of the processes that the Security Scheme PT is currently identifying.

It is important to highlight that presently, a significant part of the knowledge (i.e. people) required for maintaining and operating the S-100 ecosystem is located in the Republic of Korea as well as at the IHO Secretariat in Monaco. Therefore, the ICE PT considers the possibility for the Republic of Korea to host parts of the IHO Infrastructure Centre, see below in sections 6.7 and 6.8.

Figure 3 summarizes the envisioned structure of the Centre.

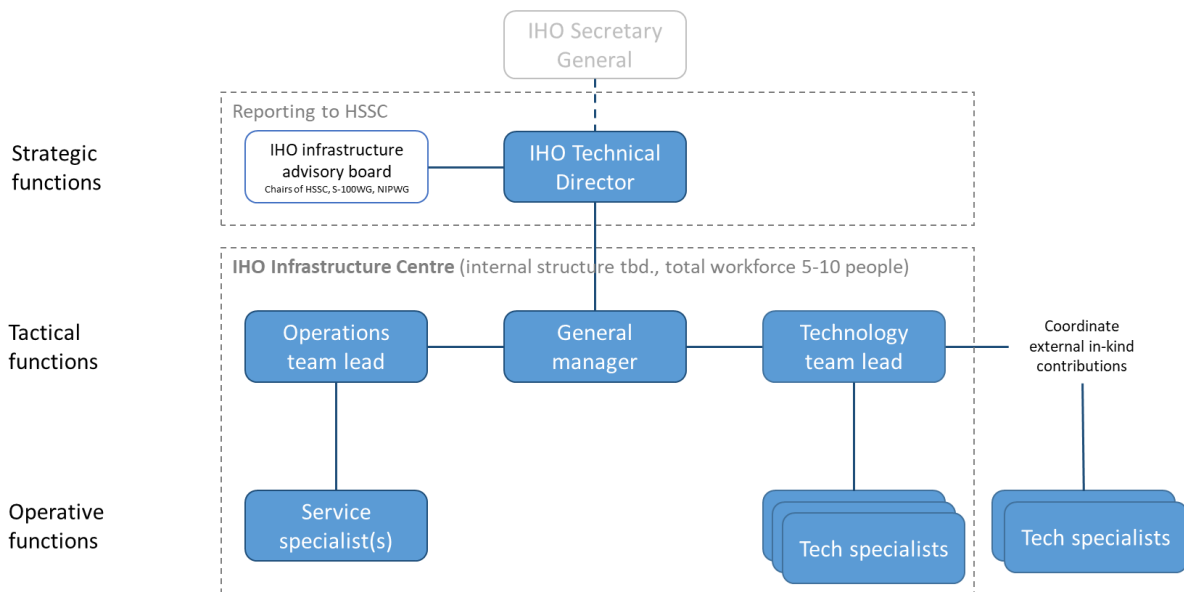


Figure 3: The proposed composition of the IHO Infrastructure Centre

Based on this, the ICE PT proposes the following composition:

Composition

The IHO {S-100|Technical} Infrastructure Centre should be an integral part of the IHO organization, i.e. organized under the Secretariat, irrespective of where actual work force may be located physically. It should be managed by the IHO Technical Director.

The positions staffed by the IHO {S-100|Technical} Infrastructure Centre should initially cover the following functions:

- *General manager*
- *Technology team lead*
- *Technology specialists*
- *Operations team lead*
- *Operations specialists, possibly even including resources for the administration of the IHO S-100 Part 15 security scheme*

The details regarding the internal structure of the IHO {S-100|Technical} Infrastructure Centre should fall under the responsibility of the IHO Technical

Director, within the confinements of the IHO budget as decided upon by Assembly and Council.

6.7. Financial considerations (WP item B)

The ICE PT greatly appreciates the strong support of the Republic of Korea and KHOA to the interim S-100 infrastructure in existence today. This also resulted in a significant financial investment of the Republic of Korea in the S-100 ecosystem.

Within the current budget of the IHO, the above proposed staffing of the IHO Infrastructure Centre will not be possible. Consequently, increasing the IHO budget to cover operationalizing the S-100 ecosystem, would require raising Member State contributions or alternative financing mechanisms.

Generally, such additional financing could come from a combination of three sources:

- End users (e.g. S-100 ECDIS, S-57 ECDIS or other end users)
- Data producers (e.g. IHO member states collectively, through opt-in mechanisms or individually in-kind)
- System implementers (e.g. S-100 ECDIS and/or ECS OEMs)

The ideal financing mechanisms should:

- Secure funding on a long-term with good predictability
- Accelerate the S-100 market adoption
- Not increase S-100 implementation thresholds for data producers with already limited capacity
- Consider the limitations of depending on a single organisation as funding source

The ICE PT has currently no clear preference for any financing mechanism.

However, the Republic of Korea has expressed commitment to continue supporting S-100 implementation on a long term basis and governed by solid contractual arrangements. Consequently, correspondence between the IHO Secretariat and the Republic of Korea in this matter is on-going, and this report will be updated if and when new information becomes available.

6.8. Location (WP item C)

It is important to distinguish between the geographical location of the Centre's resources and its organisational placement within the IHO. The location of resources should be determined based on the consideration of various factors, independently of the Centre's organisation as an integral part of the IHO secretariat.

It should be acknowledged that much of the current knowledge about the IHO infrastructure components is located in Monaco and in the Republic of Korea. To ensure a smooth transfer of this knowledge, maximize the use of the interim infrastructure components, and in the interest of leveraging experience and opportunity, the IHO Infrastructure Centre would be well situated in either of these locations, i.e. at the IHO Secretariat in Monaco with an official permanent IHO office responsible for the infrastructure or in the Republic of Korea directly managed by the IHO Secretariat.

Significant resources to the IHO Infrastructure Centre from a specific Member State may also influence the potential location of the IHO Infrastructure Centre. Therefore, the ICE PT suggests the Republic of Korea as the potential host country, taking into account their significant contributions over the past decade and the perspective of continued support with resources.

6.9. Timeline for the establishment (WP item D)

The ICE PT envisions a three stage process for the establishment of the IHO Infrastructure Centre. Until permanent governance and management structures are established,

HSSC should task the ICE PT with supervising the establishment of the IHO Infrastructure Centre, if so decided by Council-8.

Stage 1 (2024): Continued development and stabilizing critical components

Subject to approval by the HSSC (HSSC-16), continue the development and maintenance of the existing interim infrastructure components, with a special focus on stabilizing the most critical components (S-100 catalogue distribution and S-100 Security Scheme operation, see section 5). The continuation of the valuable contributions by the Republic of Korea and KHOA is important for these steps.

Stage 2 (2025): Develop management and transition process

Subject to approval by the Council (C-8), establish and recruit the management of the IHO Infrastructure Centre. The initial primary focus of the management team will be to develop a detailed plan for the transition of the infrastructure components from their current maintenance regime to the umbrella of the IHO Infrastructure Centre. The preparation of the components for the transition (knowledge transfer, documentation, technology) will be supported by the Republic of Korea. During 2025, the Infrastructure Centre general manager will lead the on-boarding of the infrastructure components.

Stage 3 (2026): Permanencing the IHO Infrastructure Centre

An official opening ceremony during the IHO Assembly (A-4) could bring special attention to the establishment of the IHO Infrastructure Centre. The Assembly should also decide upon any changes to the IHO Resolutions (M-3) related to the governance of the IHO Infrastructure Centre and the IHO Secretariat's additional operative responsibilities (see section 6.5).

6.10. Work procedures and preliminary work plan (WP item F)

Apart from the governance related considerations and a proposal for the overarching timeline for the establishment, the ICE PT has not yet started to develop more detailed work procedures and a preliminary work plan for the IHO Infrastructure Centre.

7. Suggested outline of an HSSC proposal to the IHO Council (WP item E)

According to the ICE PT, HSSC should in its report to Council-8 propose to establish the IHO Infrastructure Centre according to the role, scope, function, governance and composition as described above (sections 6.2 to 6.6).

The IHO Infrastructure Centre should be organized as a part of the IHO Secretariat and be led by IHO's Technical Director. Its technical staff should be located where the technical knowledge for the currently needed technological resources exists. The currently most appropriate location for the technology specialists would therefore be in the Republic of Korea. Concrete proposals regarding the location and/or financial support will be reported as more information becomes available, hopefully in time for HSSC-16 but at least prior to Council-8.

Both the operational and the technical staff should be directly employed by the IHO Secretariat. Within the current budget of the IHO, the proposed staffing of the IHO Infrastructure Centre would not be possible. The staff cost could, however, partly be covered by contributions from an IHO Member State, if adequate contractual arrangements can be made that ensure medium to long term financial security for the IHO.

The time line for the establishment of the IHO Infrastructure Centre should follow the stages outlined in section 6.9.

8. Actions required of HSSC

The HSSC is invited to:

- a. Note the report.
- b. Consider the recommendations given by the ICE PT and propose establishing a permanent IHO Infrastructure Centre (official name to be discussed) to the Council.
- c. Consider *quality control and secure delivery of S-100 catalogues and S-164 test datasets* as well as *operative processes for the S-100 Part 15 security scheme* as particularly critical infrastructure components and prioritize their development and management accordingly.
- d. Task the ICE PT with supervising the establishment of the IHO Infrastructure Centre, if so decided by Council-8.
- e. Task the ICE PT with analysing the IHO Resolutions M-3, in order to propose amendments covering the IHO Infrastructure Centre to HSSC-17 for endorsement, and eventually Council-9 and Assembly-4 for any decisions to amend the IHO Resolutions.
- f. Agree upon the proposed new ICE PT work plan, see Annex 4, also adjusting the name of the PT, as applicable (e.g. "IHO Infrastructure Centre Project Team").

Annex 1 Summary of infrastructure related decisions taken by Assembly, Council and HSSC

Assembly decision A3/14

The Assembly:

- a) recognized the need to establish the S-100 Infra Center and approved the foundation of a new Project Team under HSSC with a three-year work plan including the establishment of the S-100 Infra Center and to prepare for the actual implementation period with consideration of the possible location of the Center.
- b) requested HSSC to propose to the Council to establish the S-100 Infra Center and how it can support the S-100 framework.
- c) tasked Council to report to the 4th IHO Assembly the progress of its three year operation including the establishment of the S-100 Infra Center.

HSSC decision 15/05

HSSC Chair Group to set up a new S-100 Infrastructure Centre Establishment PT (S-100 ICE PT) under HSSC and HSSC Chair to report on the progress at C-7. HSSC approved the TORs drafted in an ad hoc session at HSSC-15. (KR, SE are nominated Chair and Vice-Chair, initial list of interested parties as declared at HSSC-15: US, UK, DK, SE, FR, NO, IN, CA).

See also [HSSC CL01/2023](#).

HSSC report to C-7

Following an A-3 proposal ([PRO 2.2](#)) by the ROK, the A-3 recognized the need to establish a S-100 Infra Center and approved the foundation of a new Project Team under HSSC to propose to the Council how such an Infra Center could be established (A3/14). At HSSC-15 the Committee approved TORs for this Project Team which will be established as the S-100 Infrastructure Center Establishment PT, S-100 ICE PT. The S-100 ICE PT will be chaired by the ROK (SE Vice-Chair) and several MS indicated already at HSSC-15 that they will contribute in the PT. The HSSC Chair and the IHO Technical Director will also be active participants. As described under paragraph 6 of this report, it is essential for the IHO to establish a stable structure for S-100. The setup, including management, of a S-100 Infra Center is an important part of this. Progress of the S-100 ICE PT will be reported by HSSC to the Council.

While noting that a sustainable business model of the S-100 Infrastructure Center will need to be defined and proposed by the S-100 ICE PT for approval, the IHO must secure firm and sustainable management of the administration and technology for S-100 and it is likely that additional funding will be needed. The A3 proposal by USA et al (PRO 3.5) suggested to explore options for alternative fund generation to support capacity building and other IHO initiatives. A-3 agreed to set up a project team under IRCC to work on this task. The A3 decision noted that funding could be used to support capacity building and other IHO initiatives. Thus it is important to recognize that additional funding resources should also be considered, if needed, for initiatives such as S-100 Infrastructure and is not limited to capacity building only. Therefore, *HSSC invites the Council to endorse the principle that additional funding resources (A3/20 and IRCC15 Decision 41) should be considered for the setup of a sustainable technical and administrative infrastructure around S-100 including standards development to meet the S-100 timeline.*

Council decision C7/09

In accordance with Decision A3/08(b), the Council endorsed the principle that additional funding resources (Decision A3/20 and IRCC15 Decision 41 refer) should be considered for setting up a

sustainable technical and administrative infrastructure around S-100 including standards development to meet the S-100 timeline.

Council decision C7/10

In parallel of the establishment of the S-100 Infrastructure Centre, the Council tasked the HSSC to identify at their next meeting the current or emerging components that are critical in the implementation of the S-100 Roadmap that could candidate for being funded by the IHO (project based in the short term on one hand, longer term operational mode for standards maintenance on the other hand).

Council decision C7/12

Following the update provided by the HSSC Chair on the work plan of the S-100 ICE PT, the Council invited HSSC Members, then IHO Member States to provide their views on the recommendations delivered by the PT, as soon as they become available and no later than HSSC-16.

Annex 2 Currently existing interim S-100 infrastructure components

Component	Category 1	Category 2	Currently maintained by	Applicable Infrastructure Service
GI Registry / Concept register	Information	Process	IHO Secretariat	GI Registry
GI Registry / Data dictionary register	Information	Process	IHO Secretariat	GI Registry
GI Registry / Metadata register	Information	Process	IHO Secretariat	GI Registry
GI Registry / Portrayal register	Information	Process	IHO Secretariat	GI Registry
GI Registry / Producer code register	Information	Process	IHO Secretariat	GI Registry
GI Registry / Product specification register	Information	Process	IHO Secretariat	GI Registry
Proposal form for the Concept register	Information	Process	IHO Secretariat	GI Registry
Proposal form for the Feature Catalogue Builder	Information	Process	IHO Secretariat	GI Registry
Template for entries in the Product Specification Register	Process	Information	IHO Secretariat?	GI Registry
Template for requesting a new Domain in the IHO GI Registry	Process	Information	IHO Secretariat?	GI Registry
Geospatial Information Registry System	Technology		KHOA/KRISO/Green Blue	GI Registry
Basic Portrayal Catalogue	Information		KHOA	Product Specifications
S-100 UML Schemas	Information		Portolan Science	Product Specifications
S-100 XML Schemas	Information		Portolan Science	Product Specifications
DCEG composer	Technology		KHOA	Product Specifications
Feature Catalogue Builder	Technology		KHOA/KRISO/Blue Map	Product Specifications
IHO GitHub	Technology		IHO Secretariat	Product Specifications
KHOA S-100 Viewer	Technology		KHOA	Product Specifications
NIWC S-100 Viewer	Technology		NIWC	Product Specifications

OpenS100 S-101 ENC Viewer	Technology		KHOA	Product Specifications
Portrayal Catalogue Builder	Technology		KHOA/Blue Map	Product Specifications
S-100 Standard Toolkit Launcher	Technology		KHOA/Blue Map	Product Specifications
S-98 Interoperability Catalogue Builder	Technology		KHOA	Product Specifications
Symbol Editors (XSLT)	Technology		KHOA/Blue Map	Product Specifications
Security Scheme key management	Process	Information	IHO Secretariat	Security Scheme
Security Scheme Administration software	Technology		PRIMAR	Security Scheme
S-164 catalogues	Information	Process	S-100WG	Type Approval
S-164 screen shots	Information	Process	KHOA/S-100WG	Type Approval
S-164 test data sets	Information	Process	S-100WG	Type Approval
KHOA Shore ECDIS	Technology		KHOA	Type Approval

Annex 3 ICE PT membership (as of 2024-03-19)

MEMBER STATE	ORGANISATION	NAME	
CANADA	Canadian Hydrographic Service (CHS)	Andrew	Roberts
CHINA	China MSA	Juan	Wang
CHINA	China Waterborne Transport Research Institute	Jianan	Luo
FRANCE	SHOM	Gaël	Morvan
FRANCE	SHOM	Yann	Keramoal
REP. OF KOREA	Korea Hydrographic and Oceanographic Agency	Martin	Park
REP. OF KOREA	Korea Research Institute of Ships & Ocean Engineering	Sewoong	Oh
SWEDEN	Swedish Maritime Administration	Benjamin	Hell (Chair)
UNITED STATES	NOAA	Julia	Powell
UNITED STATES	NGA	Kevin	Dickens (Secretary)
UNITED KINGDOM	UK Hydrographic Office	Tom	Richardson
NORWAY	Norwegian Hydrographic Office	Geir Arne	Håland Nordhus
EXPERT CONTRIBUTORS			
Greece	NTUA	Stelios	Contarinis
-	IC-ENC	James	Harper
Sweden	HSSC Chair	Magnus	Wallhagen
IHO SECRETARIAT			
-	IHO	John	Nyberg
-	IHO	Yong	Baek

Annex 4 Proposed revised IHO Infrastructure Centre Establishment PT work plan (June 2024–May 2025)

1. Note that, apart from a name adjustment (as applicable), no changes to the ICE PT Terms of Reference are considered essential to cover the continued work of the PT.

ICE PT Tasks

To develop the management documents and operating plan for the IHO Infrastructure Centre and supervise its establishment. This includes in particular:

- A. ~~Propose role, scope, function and governance of the IHO Infrastructure Centre~~
- B. ~~Propose composition~~, identify financial considerations, and suggest working procedures
- C. Propose location
- D. Propose the timeline for the establishment of the IHO Infrastructure Centre
- E. Consider a preliminary work plan for the proposed IHO Infrastructure Centre
- F. Support the HSSC with the creation of documents required to submit the proposal to the IHO Council
- G. Supervise the establishment of the IHO Infrastructure Centre, if so decided by the IHO Council
- H. Analyse the IHO Resolutions M-3, in order to propose amendments covering the IHO Infrastructure Centre
- I. Conduct the 2024 and 2025 meetings of the ICE PT

Task	Work Item	Priority H-high M-medium L-low	Milestones	Start Date	End Date	Status P-planned O-ongoing C-Completed	Contact Person	Affected Pubs/Standard	Remarks
A1	Agree upon role	H		Jun 2023	Mar 2024	C	Chair		
A2	Agree upon scope	H		Jun 2023	Mar 2024	C	Chair		

A3	Agree upon function	H		Jun 2023	Mar 2024	C	Chair		
A4	Agree upon governance	H		Jun 2023	Mar 2024	C	Chair		
B1	Agree upon composition	H		Jun 2023	Mar 2024	C	Chair		
B2	Identify financial considerations	H		Mar 2024	2025	O	Chair		
B2	Suggest working procedures	M		2024	2025	O	Chair		
C1	Agree upon location	H		2024	2025	O	Chair		
D1	Agree upon establishment timeline	H				C	Chair		
E1	Draft initial work plan for IHO Infrastructure Centre	M				P	Chair		
F1	Support HSSC with C-8 proposal	H		Jun 2024	Oct 2024	O	Chair		
G1	Supervise establishment of management structure for prioritized critical services	H		Jun 2024	Dec 2024	P	Chair		
G2	Supervise establishment of Centre	H		Nov 2024	2025	P	Chair		
H1	Analyse M-3 with regard to the need to cover the IHO Infrastructure Centre organisation	M		Jun 2024	Mar 2025	P	Chair		

I1	Conduct ICE PT meetings (VTC and/or physical)	M		2024	2025	P	Chair		
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