Electron Ion Collider, Brookhaven National Laboratory			
Doc No. EIC-SEG-PLN-020	**Author:** J. Rochford	**Effective Date:** February 1, 2022	**Review Frequency:** 1 years
Plan: EIC Interface Managemet Plan			**Version:** 1.0

Electron Ion Collider Plan

Interface Management Plan

February 1, 2022

Prepared by:

James Rochford
James Rochford (Feb 18, 2022 09:45 EST)

Date: Feb 18, 2022

James Rochford, Systems Engineer
Electron-Ion Collider
Brookhaven National Laboratory

Reviewed by:

Date: Feb 24, 2022

Thomas Russo, Systems Engineer
Electron-Ion Collider
Brookhaven National Laboratory

Allison Lung
Allison Lung (Feb 28, 2022 13:40 EST)

Date: Feb 28, 2022

Allison Lung, Deputy Project Director
Electron-Ion Collider
Thomas Jefferson National Accelerator Facility

Approved by:

Ferdinand Willeke
Ferdinand Willeke (Feb 28, 2022 14:13 EST)

Date: Feb 28, 2022

Ferdinand Willeke
Deputy Project Director/ Technical Director
Electron-Ion Collider
Brookhaven National Laboratory

Electron Ion Collider, Brookhaven National Laboratory			
Doc No. EIC-SEG-PLN-020	**Author:** J. Rochford	**Effective Date:** February 1, 2022	**Review Frequency:** 1 years
Plan: EIC Interface Managemet Plan			**Version:** 1.0

CC List

Jim Yeck
EIC Level 2 WBS Managers
EIC Level 3 WBS Managers
EIC Systems Engineers
Technical Systems Division Management
Associate Director of Accelerator Systems

Electron Ion Collider, Brookhaven National Laboratory			
Doc No. EIC-SEG-PLN-020	**Author:** J. Rochford	**Effective Date:** February 1, 2022	**Review Frequency:** 1 years
Plan: EIC Interface Managemet Plan			**Version:** 1.0

VERSION HISTORY

Version #	Effective Date	List of Reviewers	Summary of Change
1.0	2/1/2022	W. Akers, K. Baggett, C. Cullen, K. Smith, J. Tuozzolo	Initial Release

Electron Ion Collider, Brookhaven National Laboratory			
Doc No. EIC-SEG-PLN-020	**Author:** J. Rochford	**Effective Date:** February 1, 2022	**Review Frequency:** 1 years
Plan: EIC Interface Management Plan			**Version:** 1.0

TABLE OF CONTENTS

LIST OF ACRONYMS

DCB Design Change Board
EIC Electron-Ion Collider
ICD Interface Configuration Document
IDD Interface Definition Document
IRD Interface Requirements Document
ISD Interface Specification Document
L2M Level 2 Managers (Own the Physics and Functional requirements)
L3M Level 3 Managers (Own the Technical Specifications and contribute to defining the Functional Requirements)
MICD Master Interface Configuration Document
SBMS Standards Based Management System
SEG System Engineering Group
TLE Technical Lead Engineer (Engineer responsible for delivery of final system/component design)

Electron Ion Collider, Brookhaven National Laboratory			
Doc No. EIC-SEG-PLN-020	**Author:** J. Rochford	**Effective Date:** February 1, 2022	**Review Frequency:** 1 years
Plan: EIC Interface Managemet Plan			**Version:** 1.0

EIC Interface Management Plan

1. PURPOSE AND SCOPE

The purpose of this document is to define the process which controls and manages all technical interfaces for the EIC project. All sub systems of the EIC will be governed by this plan. See [5.1, 5.2, 5.3] for more details on the EIC purpose, project, and its major systems. The plan is part of the requirement management process described in [5.4, 5.5] and sets forth the process to control all technical interfaces.

2. DEFINITIONS

None

3. ROLES AND RESPONSIBILITIES

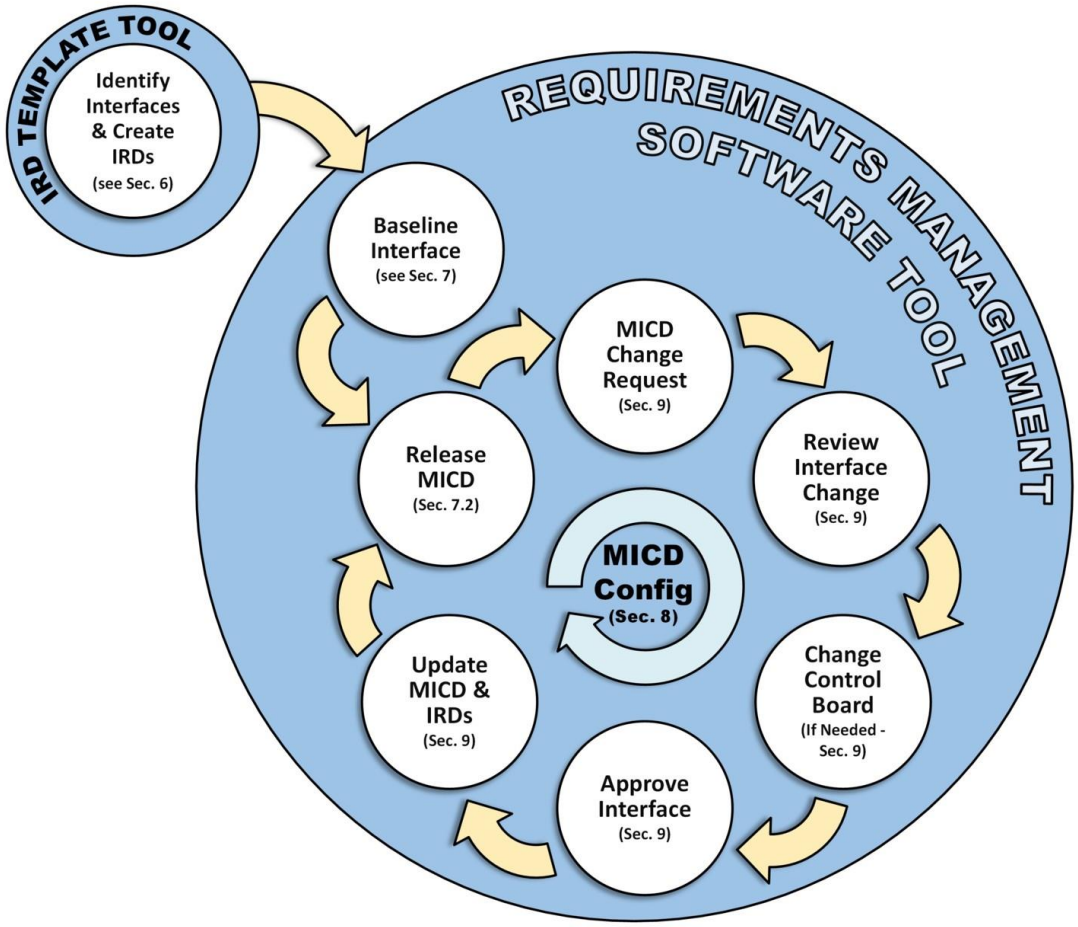
The EIC technical director has authority for the overall EIC design. Each EIC L2 system owner (see Table 1 which identifies the EIC L2 systems) is the project design authority for their respective system. They are responsible to review and approve all technical interfaces included within their systems. All sub-level managers (L3 and below) are responsible to identify the technical interfaces within their respective systems and sub systems. They must ensure all pertinent technical requirements needed for their interfaces are captured in the appropriate Interface Requirement Document (IRD). Sub-level managers are responsible to provide the interface requirements, which are reviewed and approved by the system managers or their delegates. Sub-level managers are responsible for all revisions needed to any of the interfaces they manage. Note all sub-level managers shall act under the direction and with the approval of the L2 system manager.

Table 1: List of all Level 2 subsystems which combined create the EIC

#	General Requirement Document	WBS Element	L2 System Abbreviation
1	EIC Electron Storage Ring GRD	6.04	ESR
2	EIC Hadron Storage Ring GRD	6.05	HSR
3	EIC Interaction Region GRD	6.06	IR
4	EIC Electron Injector GRD	6.03	EI
5	EIC Strong Hadron Cooling GRD	6.05.07	SHC
6	EIC Detector GRD	6.10	DET

4. PLAN

4.1. The Interface Management Process



4.1.1. Summary of the Interface Process

The interface management process is shown in Figure 1. The process starts with a review of the system by the L2 managers and sub managers. The first step is to identify all relevant interfaces.

Once the interfaces are identified they are reviewed, and a consensus is reached on what interfaces are critical for the system operation and need to be controlled. The data for all critical interfaces is then collated using the format created with the template tool [5.6]. The template tool is then used by the SEG to create an Interface Requirement Documents (IRD) for the collated data. These tasks are carried out at the level of each system, subsystem, or component, it is at the discretion of the system managers to decide at which level these should be aggregated. When all the IRDs are created they are reviewed (by L2 & SEG) and approved for release. Once released they are uploaded into the requirement management software tool by the SEG. The SEG will then use the requirements management software to aggregate all the components, sub systems and systems into a complete database called the Master Interface Configuration Document (MICD). Then the MICD it is baselined and released to all stake holders. During the project if the interface requirements and\or the design of any critical interface needs to change, an MICD change request is submitted using the IRD change request template [5.7]. The change is then recorded and reviewed by the L2 managers, subsystem managers and SEG. If the change is approved the SEG will update IRD and the final MICD. The updated MICD is then released to the relevant stakeholders.

4.2. Interfaces

4.2.1. Interfaces definition

An interface is the boundary between any pair of systems, subsystems and/or components. At the interface one or both connected systems will have a dependency (*a need to be fulfilled*) on the other connected system. To satisfy that dependency, something needs to be transmitted across the interface. The transmission across that interface can be a flow in (I) or out (O) in either direction, a bidirectional exchange (X) or a static transmission (S) with no physical media being exchanged. There are four categories of interfaces: physical (P), material flow (M), energy flow (E), and information flow (I), these define the nature of the connection between the systems. In the exchange one system will be considered the Consumer and the other the Supplier. Any interface may serve multiple functions. A much more detailed description of how interfaces and their dependencies are defined is presented in [5.8]. The taxonomy required to define interfaces is also detailed in [5.8].

4.2.2. Interface Configuration Documents

The following documents are key to defining and controlling interfaces

- Interface Requirements Document (IRD)
- Interface Configuration Document or Interface Configuration Drawing (ICD)
- Interface Definition Document (IDD)
- Master Interface Configuration Document (MICD).

The IRD: ***Captures all the relevant requirements*** **that exist at every interface in a system,** for example, physical (mechanical), mass flow, energy flow, information flow and any other physical constraints. This information is typically managed by the L3 manager in a format of their choosing. It contains the specific details that are required at the interface. For example, the electrical power that needs to be transmitted, the mechanical force which must be reacted, the required digital transmission rate, the control parameters which need to be supplied, etc. This information is collected and input into the MICD spreadsheet by the systems engineers.

The ICD: ***These documents present the details of a design solution for the interface which meets the IRD requirements,*** for example, it could be a drawing showing the number and types of connectors at an interface, a table defining the electrical power to be transmitted at the interface, the calculated mechanical properties needed, a 3d conceptual design etc. Typically, this type of information is contained in documents drafted under the responsibility of the Technical Lead Engineers (TLE). This information is collected and input into the MICD spreadsheet by the systems engineers.

The IDD: ***These documents define the actual technical details of the final design solution for the ICD;*** Typically, these are controlled documents which are provided by the end item provider, for example a technical specification for the interface. They may be created in consultation with the TLE or their representative. For example, the design of a vacuum valve from a commercial Vendor, the control software developed and supplied by a national laboratory etc. The IDD should provide full the details of what the provider will supply.

MICD: ***This is a database of all interfaces in a system***, it captures the interface type, its relationship to neighbor interfaces and the position of the interface in the system hierarchy. The MICD and Requirements Traceability [5.5] are maintained in the same database.

4.2.3. Creation of IRDs

Interface definition starts with collecting the requirements for an interface in a standardized way. A standardized template [5.6] will be used by each system manager to create the IRDs for their respective systems. By utilizing a standardized template for IRD creation, the process of identifying interfaces is consistent across the project. This reduces confusion and allows for better traceability across multiple Interfaces and IRDs.

4.2.4. Filling out the template

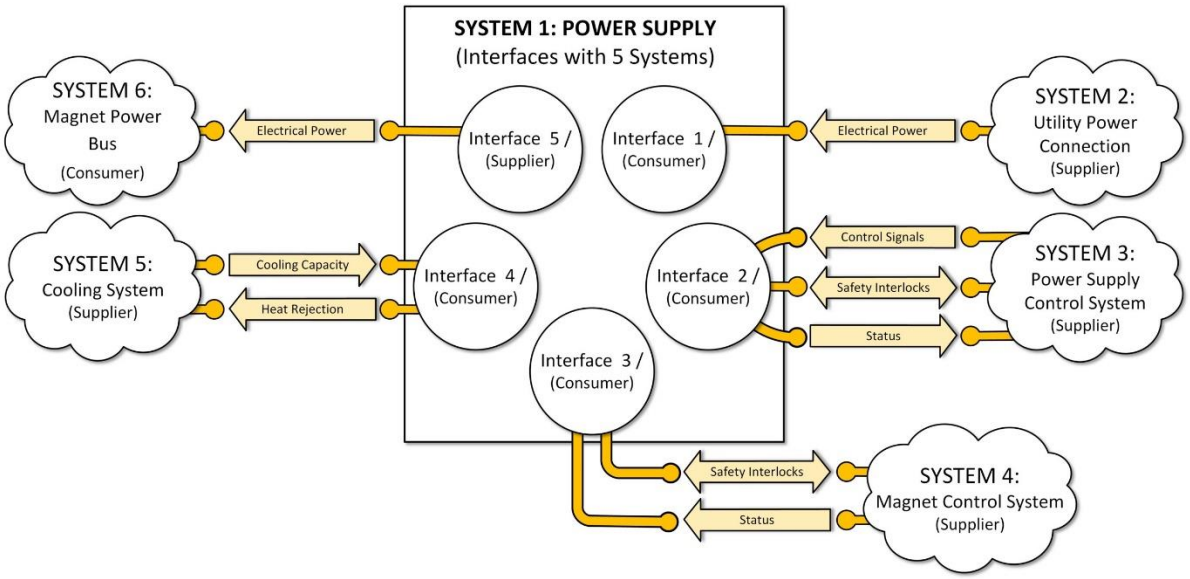


Figure 1: A multiple function interface example for a power supply, showing all the major interfaces and what flows across them along with the suggest roles for Supplier and Consumer at each interface.

For purposes of the template, an interface is defined as a point where two separate systems interact. In the requirement template document [5.6] one system is considered the Supplier and the other the Consumer. The Supplier system is fulfilling a requirement needed by the Consumer interface. The template user is expected to identify the Consumer and Supplier systems at the interface. Note at times the definition of Supplier vs. Consumer may be somewhat arbitrary, e.g., an interface which conducts electrical power from system 1 to system 2, but which also conducts thermal power from system 2 to system 1, with system 1 acting as a heat sink. Other examples may be where a single interface has multiple functions, and the Supplier \Consumer relationship is not clear as shown in Figure 2. In these situations, the TLE and system managers will need to form a consensus on which system is the Supplier and which the Consumer. For the purposes of

requirements management, the interfaces in any system are only counted as being in the scope of that system if they are identified as Supplier interfaces for that system. For example, in Figure 2, system 1, the power supply is regarded as only having one interface since only one interface in the system since only one of its interfaces is defined as a Supplier interface. This avoids the double counting of interfaces whilst collecting the requirements for multiple systems.

In the Interface Requirement Document Template [5.6] the user will enter the information for each interface into the set fields in the template, examples are shown in Figures 3 to 5 below. All fields in the template should be filled out or set to NA. The information required is described below and uses the template example defined [5.6] for clarity. The information is broadly grouped into 3 categories, the Supplier system information, the consumer system information, and the interface categorization information.

Supplier System Information

Interface Requirement ID	Supplier system					
	Interface description	*IF Num #*	*IR Num #*	*Parent L2 system*	*Sub-sys Acronym*	*Interface Requirement statement*
I-HSR-ARC-SEC-MAGNET-QUAD-PS.1.1	*HSR Arc section Quadrupole magnets Power connection.*	*1*	*1*	*HSR*	*ARC-SEC-MAGNET-QUAD-PS*	*The HSR Arc Section quadrapole power supply interface which feeds the quadrupole's in family 1 of the arc, see functional req, F-HSR-ARC-SEC-xx*
I-HSR-ARC-SEC-UTILITY.2.1	*HSR Arc section Quadrupole magnets utility power supply connection.*	*2*	*1*	*HSR*	*ARC-SEC-UTILITY*	*The Upstream quadrupole power supply for the Arc section shall be fed from the HSR 220V bus connection in RHIC Section XX*
I-HSR-ARC-SEC-MAGNET-QUAD-COOL.1.1	*Cooling connection to HSR Arc section Quadrupole magnets.*	*1*	*1*	*HSR*	*ARC-SEC-MAGNET-QUAD-COOL*	*The Upstream quadrupole power supply for the Arc section shall cooled with glycol coolant.*
I-HSR-ARC-SEC-MAGNET-QUAD-COOL.1.2	*Cooling connection to HSR Arc section Quadrupole magnets.*	*1*	*2*	*HSR*	*ARC-SEC-MAGNET-QUAD-COOL*	*The heat rejected by the upstream power supply shall rejected into the Glycol Chiller unit to maintain the power supply operational temperature <80F.*

Figure 2. The interface requirement template data required for the Supplier system. (The blue text are an examples, which refer to Figure 2 above). In this example the ARC-SEC-MAGNET-QUAD-PS (yellow) is a Supplier for the 1st requirement and the ARC-SEC-MAGNET-QUAD-PS (green) is the Supplier for the remaining 3 requirements.

The Interface ID: A unique name for the interface *(This is not input by the template user but generated by the spreadsheet from the information below).* e.g. in Fig 3 the generated ID for the 1st requirement is *"I-HSR-ARC-SEC-MAGNET-QUAD-PS.1.1". This is interpreted as follows; I-*

defines the requirement as an interface requirement. "*HSR-ARC-SEC-MAGNET-QUAD-PS" identifies the sub system as the HSR Arc section quadrupole magnet supply.* The ".1.1" indicates it is the 1st requirement of the 1st Supplier interface in the system. Because it is counted and captured in this system it considered a Supplier interface by default. See [5.12] for a clear definition on the taxonomy given here.

Interface description: A description of the interface, where it is which systems it connects etc. For example, "HSR Arc section Quadrupole magnets Power connection".

Interface Number: A unique sequential number identifying the interface with respect to all Supplier interfaces in the systems scope. In the above example the 1st row shows it is Interface #1 of #1 Supplier interfaces in the "HSR Arc section Quadrupole magnets Power Supply".

Interface Requirement Number: A unique sequential number identifying the Interface Requirement with respect to all requirements for that Interface. In the above example, the last row is Requirement number #2 of the requirements for the 1st Interface of "ARC-SEC-MAGNET-QUAD-COOL".

Supplier parent L2 system: This is the high level L2 system this Interface Requirement traces back to. In the template, it is selected from the dropdown list, see Table 1 for L2 system Abbreviations. In the example above it is "HSR" the Hadron Storage Ring. Note in this example both sub systems have the same L2 parent, but it could be an interface that also separates different L2 parent systems.

Sub system Acronym: A user generated Acronym for the subsystem which owns the Interface requirement. In the above example it is the "ARC-SEC-MAGNET-QUAD-COOL" i.e. for the chiller unit for the HSR ARC Quadrupole power supplies. See how the taxonomy traces the heritage of the system back up to the L2 system level. Note the taxonomy chosen should be consistent across all related interfaces, e.g., the Arc Section Dipole Power Supply would be "ARC-SEC-MAGNET-DIP-PS."

Interface Requirement Statement: What Requirement the Supplier system must supply at this interface to meet the consumer system need. For example, line 1 from Fig 3, *"The Upstream interface from the straight section into the Arc section shall have a power connection to feed*

quadrupoles in family 1 of the ark see functional req, F-HSR-ARC-SEC-xx". F-HSR-ARC-SEC-xx may say something like the HSR ARC section Quadrupoles must be able to focus the electron beam for all configurations and energies of the EIC as set forth in the EIC master parameter table document.

Consumer System Information

Consumer system				
Parent L2 System	Sub-sys Acronym	Requirement ID	Functional\Performance Requirement	Requirement Documentation
HSR	ARC-SEC-MAGNET-QUAD	F-HSR-ARC-SEC.xx	The arc section quadrupole's shall be capable of focusing the quadrupole's to meet all the requirements of all HSR operational modes set forth in [10] (where [10] contains all the operational parameters the HSR must meet)	HSR requirements document G-HSR-01 >> F-HSR-ARC-SEC.xx
HSR	ARC-SEC-MAGNET-QUAD-PS	P-ARC-SEC-MAGNET-QUAD-POWER.xx	The utility feed needed for the HSR arc section quadrupole power supply's shall be a nominal 20A @ 220V (+/0.01A)	HSR requirements document G-HSR-01 >> F-HSR-ARC-SEC.xx
HSR	ARC-SEC-MAGNET-QUAD-PS	F-HSR-ARC-SEC.xx	The cooling system for the HSR arc section quadrupole power supply shall use 2KW Glycol chiller units.	HSR requirements document G-HSR-01 >> F-HSR-ARC-SEC.xx
HSR	ARC-SEC-MAGNET-QUAD-PS	F-HSR-ARC-SEC.-xx	The HSR arc section quadrupole power supply Glycol chiller units shall be able to reject 2KW of power to the ambient sorroundings and maintain an inlet temperature of 70 (+/-5)F.	HSR requirements document G-HSR-01 >> F-HSR-ARC-SEC.xx

Figure 3. The interface requirement template data required for the consumer system. (The blue text is an example, refer to Figure 2). In this example the ARC-SEC-MAGNET-QUAD (green) is a consumer for the 1st requirement and the ARC-SEC-MAGNET-QUAD-PS is a consumer for the remaining 3 requirements (yellow).

Parent L2 system: The high level L2 system this requirement traces back to. In the template it is selected from the dropdown list, see Table 1 for L2 system Abbreviations. In the example above it is the Hadron Storage Ring so "HSR" is chosen.

Sub system Acronym: The subsystem which is the customer interface for the requirement. In the 1st row of the above example it is the "ARC-SEC-MAGNET-QUAD". Again, note the Taxonomy used must trace the heritage of the system as defined in [5.12] and this must be consistent over all sub-systems.

Functional requirement ID: The ID number of the Functional Requirement in the Consumer system which the Supplier interface needs to satisfy. For example, "F-HSR-ARC-SEC-xx".

Functional requirement: A summary of the Functional Requirement in the Consumer system which the Supplier interface needs to satisfy "The arc section quadrupoles shall be capable of focusing the quadrupoles to meet all the requirements of all HSR operational modes set forth in the master parameters tables for the EIC"

Requirement Documentation: Which higher level General\Functional Requirement documents does the Functional Requirement (above) trace back to. In the example in Fig 4, the functional requirement F-HSR-ARC-SEC-XX traces back to the Global requirement G-HSR-ARC-SEC-01 and both are contained in the "HSR requirements document".

Interface categorization									
IRD Name	*Type of interface*	*Flow wrt to Supplier*	*Interface category*	*Integration team*	*Integrator Scope*	*Specification Documents*	*Verification Method*	*Verification Documents*	*Requirement Clarification*
HSR-requirements.xlsx (this document)	*ELEC*	*O*	*E*	*BNL CAD power supply group*	*All*	*ICD HSR-ARC section-power supplies*	*Demonstration/Test*	*Quadrupole commissioning testing plan*	*Magnet power supplied by PS to magnet*
HSR-requirements.xlsx (this document)	*ELEC*	*O*	*E*	*EIC Utilities Team*	*All*	*ICD HSR-ARC section-power supplies*	*Demonstration/Test*	*HSR power supply testing procedure xxx*	*PS power supplied by electrical distribution system*
HSR-requirements.xlsx (this document)	*THERM*	*O*	*M*	*EIC Utilities Team*	*All*	*ICD HSR-ARC section-power supplies*	*Demonstration/Test*	*HSR power supply chiller unit commissioning tests*	*chilled coolant flowing out of chiller into Power supply*
HSR-requirements.xlsx (this document)	*THERM*	*I*	*E*	*EIC Utilities Team*	*All*	*ICD HSR-ARC section-power supplies*	*Demonstration/Test*	*HSR power supply chiller unit commissioning tests*	*Heat flowing from power supply to chiller tobe rejected in the chiller room*

Figure 4. The Interface Requirement Document Template data required for the consumer system. (The blue text is an example, refer to Figure 2).

Interface categorization

Interface Requirement Document (IRD): IRD can be either a MS Word document, a PDF document, or an Excel workbook containing and listing containing the details of one or more interfaces for various systems and components.

Type of interface: Table 2 below lists the types of interfaces. In the template this is selected from the dropdown list. For more details of the definitions of these see [5.8]. In the example it's an electrical connection so type "ELEC" is selected.

Type	Type of interface
BEAM	Energy beam interfaces, including lasers, optics, quality, energy, etc.
CRYO	Cryogenic interfaces for helium, nitrogen and other cryogenic fluids.
ELEC	Electrical interfaces, including power, grounding, switching, etc.
GAS	Interfaces for gas or air.
MECH	Dynamic mechanical interfaces to include, dampers, actuators, drives, etc.

PHYS	Connecting interface, flange, structural support, floor loading, etc.
SIG	Communications, control, interlocks, and other signal interfaces.
THERM	Heating & cooling interfaces to include HVAC, LCW, process water, etc.
VAC	Vacuum interfaces.

Table 2 Type of interfaces defined for the EIC.

Flow direction with respect to the Supplier: What is the flow direction for the transmitted component with respect to the Supplier system. In the template, the flow direction is selected from the dropdown list; the options are in, out, exchange, static and none. In the 1sr row of the example, in Fig 5 the selection O (out) was selected implying the electrical power flows from the power supply to the Arc Section Quadrupoles. For a full description of the definitions see [5.8].

Interface category: What is the interface type. In the template it is selected from the dropdown list, the options are Physical, Material flow, Energy flow, Information flow, None. In the 1st row of the example E (Energy Flow) was selected implying the interface is transmitting energy i.e., electrical power. For a full description of the definitions see [5.8].

Integration team. This is the team responsible to integrate, install, and/or commission the interface. In the template it is a freeform input, in the 1st row of example for the power supply "BNL CAD power supply group" was entered.

Integrator Scope: what is the Integrator expected to do to complete the Supplier system supply. In the template this is selected from the drop-down list, the options are Install, commission, Verify and All. In the above example "All" was selected Implying the BNL CAD power supply group will install commission and verify the function of the interface.

Specification Documents: Any documents containing the technical details of the interface e.g., the ICD documents and\or any IDD documents. At the start of the project these may not be available but will be added as the project proceeds. In the example on the 1st row for the power supply "ICD HSR-ARC section-power supplies" was entered indication this document contains the ICD (these are documents which define the interface solution that needs to be delivered), IDD (Documents which contain the information for the actual design like Technical specifications, manufacturing drawings, etc.)

Verification Method: How is the requirement verified. In the template it is selected from a drop-down list; Inspection, Demonstration/Test and Analysis. In the 1st row of the example "Demonstration/Test" was selected indicating the electrical function of the interface will be tested to demonstrate it functions as required. Note all verification must be carried out in compliance with the project QA process [5.10].

Verification Documents: Any documents needed to carry out the verification for example documents detailing the how the commission will be carried out or what testing is required or any relevant QA procedures consistent with [5.10]. In the 1st row of the example it is set to "Quadrupole commissioning testing plan" ie this document defines the testing that will be carried out to verify the interface function.

Requirements Clarification: Any other information needed to clarify the Interface Requirement in the example it is set to "Magnet power supplied by PS to magnet".

Each interface requirement will take one line in the Tab, it is suggested that each L2 system is contained within one Excel workbook, with all sub-systems contained on separate worksheets in the workbook. Once that data for each system is complete, it will be reviewed by the system managers and approved for release. Once released, the data contained in the completed workbook will be used to create the system IRD. The IRDs will then be uploaded into a commercial software package capable of integrating the details. The software package will then aggregate all the interface definitions to create a single the Master Interface Configuration Document (MICD).

4.3. Baselining interfaces

To summarize the baseline process, the SEG will collect all the completed IRD documents. The IRDs will be consolidated into a singular, common database the Master Interface Configuration Document (MICD) using commercial software. The process will be carried out in 2 steps:

- The IRD scope assessment detailed in section 4.3.1.
- IRD baseline approval and release of the MICD detailed in 4.3.2.

4.3.1. IRD scope assessment

IRD scope assessment is a review of the information used to create the MICD. This is managed by the SEG with the support of L2M and L3M. Its purpose is to:

- Evaluate the completeness and scope of MICD.
- Identify all interface gaps\mismatches and errors in the MICD
- Reach a final consensus that the entirety of the interfaces required will be accounted for in the MICD.

The review may be carried out at a L2, L3 system level or at a component level as required. Where interfaces need correction, the SEG will notify the relevant L3Ms to correct the interface details, then the subset of interfaces to be corrected and reassessed. The process will be iterated upon as required until all interfaces in the entire system are judged sufficient to allow the entire EIC to meet all the top level GRDs defined for it. The state of completeness will be assessed by the SEG, L2 managers and L3 managers, they will ensure the MICD is ready for release.

4.3.2. IRD baseline approval and release

Once the IRD scope assessment process is completed, the SEG will baseline the approved MICD in the requirements management software tool. This will be submitted to project document management team for approval and release [5.12].

4.4. MICD Configuration

The MICD sets the baselined state for all interfaces. The SEG will maintain this document including any future changes proposed to the baseline. The SEG will create a revision list for the MICD which identifies all changes (proposed and approved). This will be started once the MICD is baselined. The SEG will periodically review the MICD revision list with the L2M, L3M and the relevant system owners. The SEG will also periodically review all interfaces requesting the respective system owners review their systems for any interface changes. The SEG will update the revision list as needed and periodically distribute this to all EIC interface stakeholders. Any revision proposed to an interface ICD or IRD which will change any of the interface requirements listed in the MICD will need to go through the interface revision process.

4.5. Revision of interfaces

Once interface requirements are baselined and approved, any changes and additions are performed using the IRD change request procedure outlined below. Figure 4 shows the interface change process.

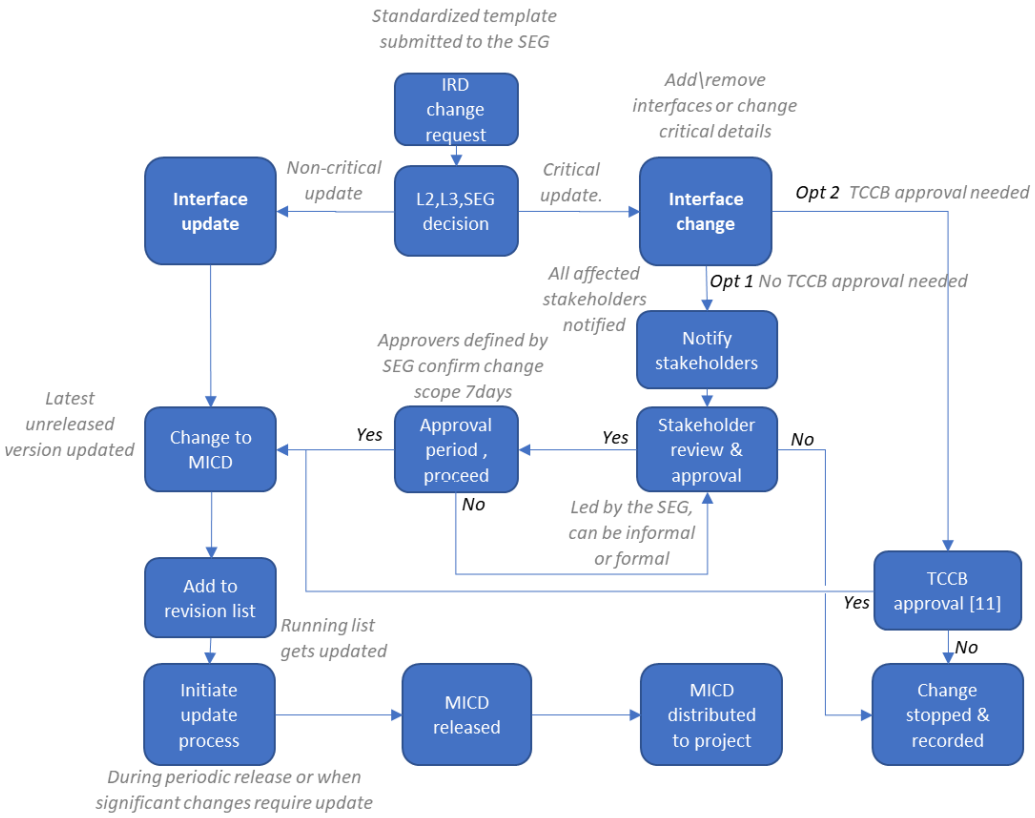


Figure 5 Interface requirement management flow process

4.5.1. Interface change request

An IRD\ICD change request is initiated by the L3 manager (or their deputy) requesting the change. They submit the information to the SEG using a standardized interface change request template [5.9]. It lists all the required information necessary to update the interface in the MICD. The SEG processes this request in consultation with L2 and L3 managers and determine if the change request is an **interface update** or an **interface change**.

Interface Update: Non-critical updates of interface information that does not require the involvement of other interface stakeholders. Examples may include:

- Minor changes to interface wording and descriptions for better clarity
- Updates to listings of supporting interface documents
- Changes to verification information

Interface Change: Critical updates of interface information that requires involvement of other interface stakeholders: Examples include:

- Addition of new interfaces
- Deletion of existing interfaces
- Change in stakeholder scope or involvement
- Modification of critical interface detail (change in scope, major changes in interface details, etc.)
- Any change which conflicts with the baseline requirement for the interface

4.5.2. Interface update

Since an Interface Update consists of a non-critical update to an interface, the update is made directly to the MICD document, and the change noted on the Revision List. All L2 managers and L3 managers are notified of the interface changes during the periodic release of the Master ICD, no additional stakeholders need be notified of this change.

4.5.3. Interface change

Once an interface change request is approved, the SEG with L2M and L3M will be decided if the change trips the thresholds which invoke the formal EIC project change procedure [5.11] or not. The decision will be made to.

1. Proceed with the change without TCCB approval
2. The change needs to go before the project TCCB.

If **option 1** is selected, once the change is approved by the system managers the SEG will notify all the affected stakeholders of the proposed change unless it is referred to the TCCB in that instance the TCCB process will notify the affected stakeholders. The SEG will then arrange a review of the change to obtain a consensus among all the stakeholders of the proposed change.

Once all stakeholders agree in principle, the SEG conducts a short approval period in which all the designated stakeholders must document their approval for the interface change request (e.g., email) to approve the interface change request. This may be an iterative step between all the parties.

If **option 2** is selected the review and approval process will carried out as part of the formal TCCB change process [5.11] it the TCCB approves the change it goes directly to updating the MICD. Once the changes are approved either by option 1 or option 2 the SEG will then make the update to the MICD and note the change in the MICD Revision List.

4.5.4. MICD revision/release

After an interface change requests has been processed, a new revision of the MICD is released. The frequency of release depends on the number of interfaces change requests since the previous release. It is anticipated that the release process will initially be more frequent than later in the Project lifecycle as all the systems mature. The exact timing of the releases will need to be agreed with all the stakeholders. The release process will be performed by the SEG.

5. REFERENCES

5.1 doi:10.17226/25171., National Academies of Sciences, Engineering, and Medicine, "An Assessment of U.S.-Based Electron-Ion Collider Science", The National Academies Press, Washington, DC, 2018.

5.2 EIC-ORG-PLN-010, Dept of Energy EIC mission need CD-0 approval

5.3 BNL-221006-2021-FORE, EIC Conceptual Design Report CD-1

5.4 EIC-ORG-PLN-010, Electron Ion Collider L1 Requirements (Global Requirements Document)

5.5 EIC-SEG-PLN-016, EIC Requirements Management Plan

5.6 EIC-SEG-PLN-TBD, IRD template

5.7 EIC-SEG-PLN-TBD, IRD Change Request Template

5.8 EIC-SEG-PLN-TBD, A Taxonomy for Dependencies and Interface Management

5.9 SBMS at BNL, Configuration Management Plan

5.10 EIC-QAG-PLN-002, Quality Assurance Plan for the EIC

5.11 EIC Change control Process, Project change control process

5.12 EIC-ISG-PDN-001, Management of EIC Documents and Records