



International Council on Systems Engineering
A better world through a systems approach

Model-based System Verification Applied to Spanish Navy's S80 Class Submarine Sustainment Case Study

Jose Torres Garcia, Shashank Alai, David Fernandez Gonzalez,
Benedetta Iezzi, Miguel Eduardo Orozco Castano, Isabel Ainhoa
Nieto Sevilla

 **Navantia** accenture  **SIEMENS**



INCOSE International Symposium 2025 | Ottawa, Canada



Presenter Bio

Authors:

Jose Torres (Navantia)

Shashank Alai (Siemens)

David Fernandez Gonzalez (Accenture)

Benedetta Iezzi (Siemens)

Miguel Eduardo Orozco Castano (Accenture)

Isabel Ainhoa Nieto Sevilla (Navantia)



Jose Torres

Digital Transformation – Submarine Business

Navantia

Cartagena, Murcia, Spain

jtorres@navantia.es

+34 682015082



Shashank Alai

Solution Architect – MBSE Solutions

Siemens Digital Industries Software

Cincinnati, OH USA

shashank.alai@siemens.com

+1 (513) 576-2888

Outline

- Background
- Introduction
- Methodology
- Conclusion



S81 Isaac Peral

Spanish Navy Challenges

- Current Needs
- S80 TLS Program
- SoS Challenges

The Spanish Navy Needs

Sustainment Admiralty Vision

III. La eficacia operativa y la eficiencia en la gestión como objetivos permanentes del arsenal. En tres vertientes diferenciadas (3E):

- **Operational availability of units and its systems** Nivel posible de disponibilidad operativa de las unidades y de sus sistemas, equipos y componentes. La calidad de las acciones de sostenimiento y el menor consumo del recurso "tiempo", en mantenimiento o para la restauración de una capacidad, darán una buena medida de esta.
- **Cost efficiency** De forma que se maximice el rendimiento de la disponibilidad presupuestaria para cubrir las necesidades de las unidades a sostener y del propio arsenal. El rendimiento obtenido de los créditos asignados será el factor más relevante para su medida.
- **Environmentally friendly** Objeto de lograr una óptima gestión de residuos (conforme a los estándares más exigentes) y aumentar la eficiencia energética, incluso mediante la autogeneración de energía no contaminante, para tratar de alcanzar al objetivo de una huella cero de CO2. Los factores "contaminación" y "mínimo gasto energético" son los de mayor relevancia.

VII. El conocimiento preciso en todo momento de **current status of units** y **status prediction** permita adelantarse a sus necesidades de sostenimiento mediante la **prescription of solutions**.

The S80 TLS Program Organization

Cross-Enterprise Stakeholders



OTACV S80

TLS Program Office

ISDEFE

ILS Engineering

- ILS Engineering



Isdefe

Spanish Navy

Operational Expertise

- Operational analysis



Navantia

Technical Authority

- Design changes and evaluation
- Configuration management

 **Navantia**



S80 TLS Program

Roadmap



Continuous relationship with Suppliers for the Submarine Life Cycle

**TLS
Preparation**

**TLS Support
Kick Off**



Delivery

2021

2023

2030

Transition Phase

- TLS Team Conformation ACV
- Elaboration of plans (Maint./Supply/Engineer/Mngmt.)
- Elaboration of Agreements with OEM
- Data Management System
- Infrastructure Setting Up
- Establishment of Program KPI's

First TLS Phase: 7,5 years

- Development of the TLS Activity
- Collecting data and updating ILS
- Cost Reduction Objectives
- Monitoring the level of availability and performance

Second TLS Phase: X years

- Transferring risk to the industry
- Payment linked to Availability and program performance
- Transfer requirements to the industry
- Development of the TLS Activity
- Cost Reduction Objectives



ARSENAL DE CARTAGENA
OTACV

SoS Challenges

S80 Program Challenges

SoS Complexity

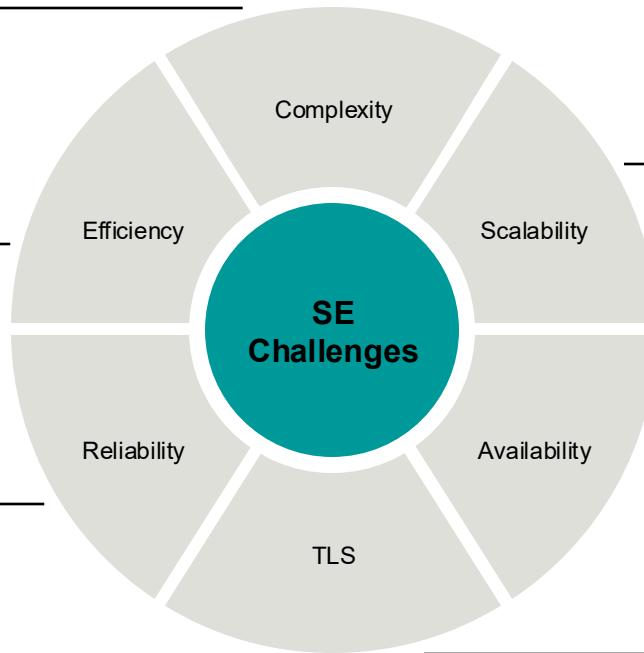
More complex systems integration for navy fleet missions

Operational Efficiency

Through cost evaluation of operation and maintenance

System Reliability

Maintain reliability metrics based on current status of the asset



Scalability

Re-use of existing technology or engineering between project phases and across different projects

Mission Availability

Mission success to be evaluated in terms of capabilities needed

Through Life Support

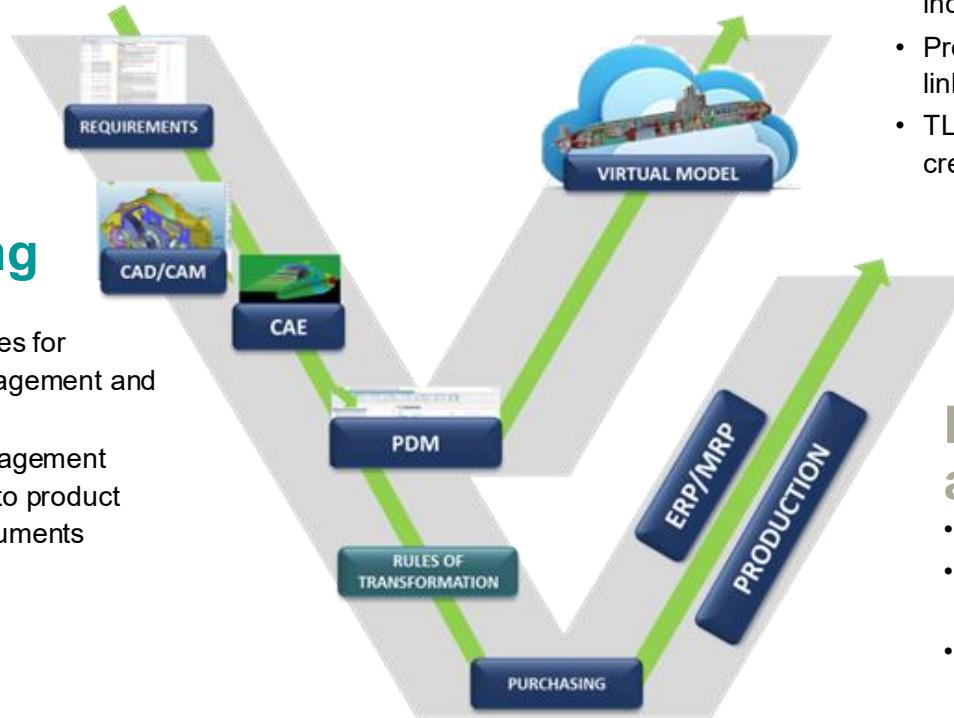
Plan, execute and improve document based preventive TLS

Navantia Systems Engineering Process

Document-based approach is not scalable

Systems Engineering

- Document based
- Stand alone features for requirements management and simulation
- Configuration management integration limited to product design and its documents



Design deliverables:

- Engineering product structure (eBOM) including verification properties
- Product documents and 3D models linked to product structure nodes
- TLS information document based created in stand-alone software

Product realization and verification:

- mBOM created based on rules
- PDM/ERP integration. BOM and documents are pushed to the ERP
- Product realization and verification status recorded in ERP

Acquisition Program SE vs SoS Challenges

S80 Program SoS Challenges

SoS Complexity

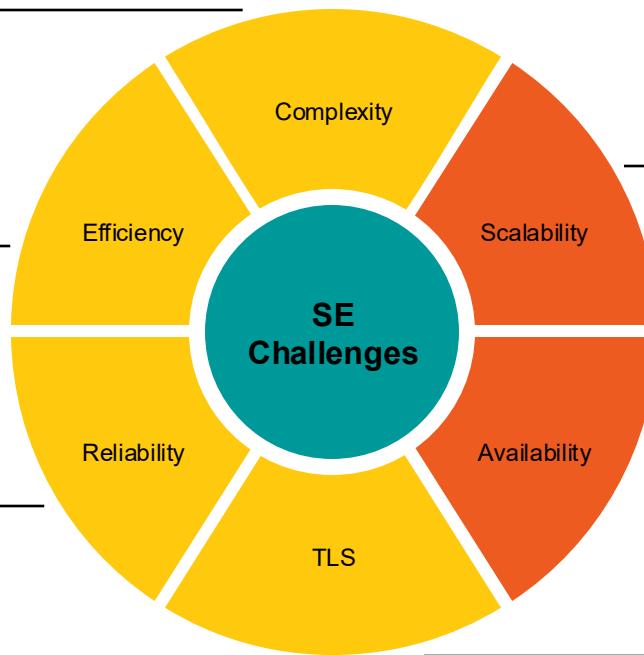
The Sub-system document-based approach requires rebuilding the systems engineering deliverables to be capability oriented

Operational Efficiency

Efficiency was evaluated in a sub-system base, obtain the operational efficiency requires rebuild the analysis

System Reliability

Current status of the asset didn't belong to input parameters of reliability assessment



Scalability

Re-use of items or slight modification of items forces a deep change impact analysis and modifications in deliverables

Mission Availability

Success of the mission is based on performance of different sub-systems, assessing the availability requires re-build the engineering.

Through Life Support

Document-based approach not ready to support lifecycle updates efficiently



Challenge hard to solve



Challenge very hard to solve

TLS Program SE vs SoS Challenges

S80 Program SoS Challenges

SoS Complexity

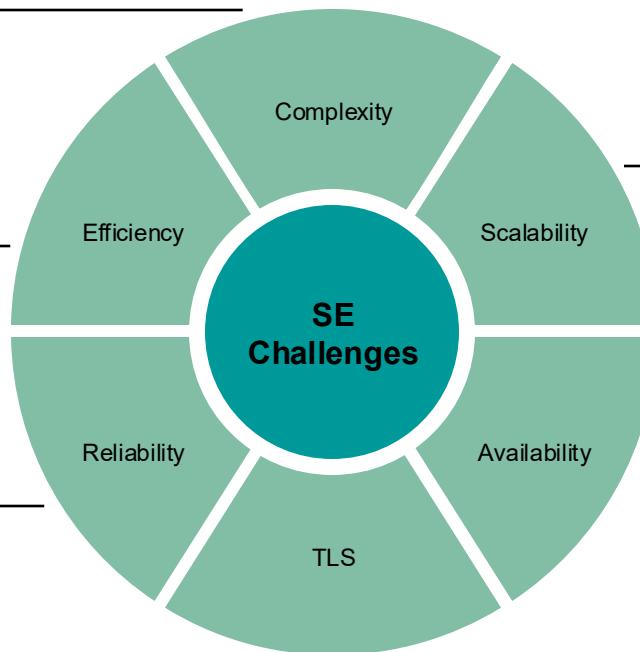
Model artifacts and relationships help manage complexity by enabling different views of the system

Operational Efficiency

Operational view and parameters can be generated and used as a driver of cost of maintenance

System Reliability

Reliability metrics based on current status of the asset integrated in model, predicted reliability of every capacity integrated in the model



Scalability

Model portions can be reused and copied, library of models available

Mission Availability

Mission success to be evaluated in terms of capabilities that can be evaluated in the model

Through Life Support

Simulation, machine learning and other tools to be applied to improve Through Life Support



Challenge integrated in model based approach

Document Based Verification Request Process

Average Lead Time 2-14 days. Every simulation run requires the same process.



Model-Based Verification Request Process

Average Lead Time 2-10 days when creating/updating the model..



Average Lead Time < 1 day if simulation update is not required.

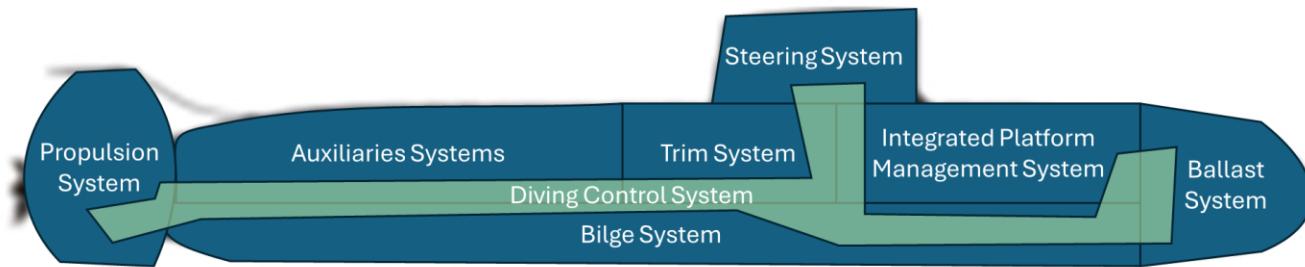


Project Introduction

- Diving Control System
- Integrated Sustainment System
- Objectives

Diving Control System Complexity

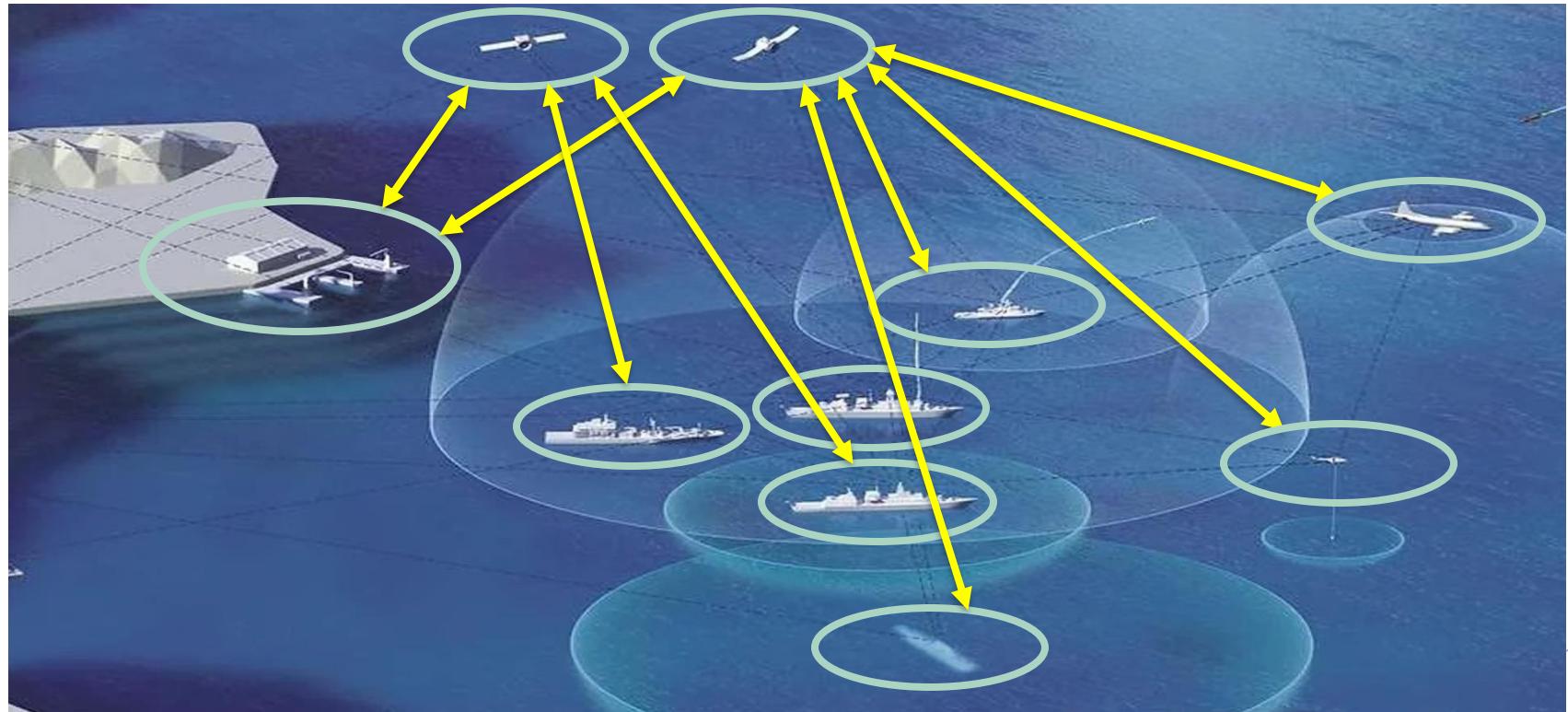
System of Interest (SoI)

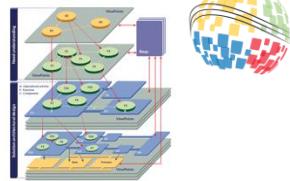


- Integrates several subsystems but is developed using DBSE
- Not managed as a distinct subsystem within the S80 Product Breakdown Structure
- Design intent captured in disparate documents
- Plays a key role in ensuring the reliability, availability and safety of the S80 class units
- Need to capture well-formed system representation in digital models
- Modular system architecture and libraries

The Vision for Integrated Sustainment System

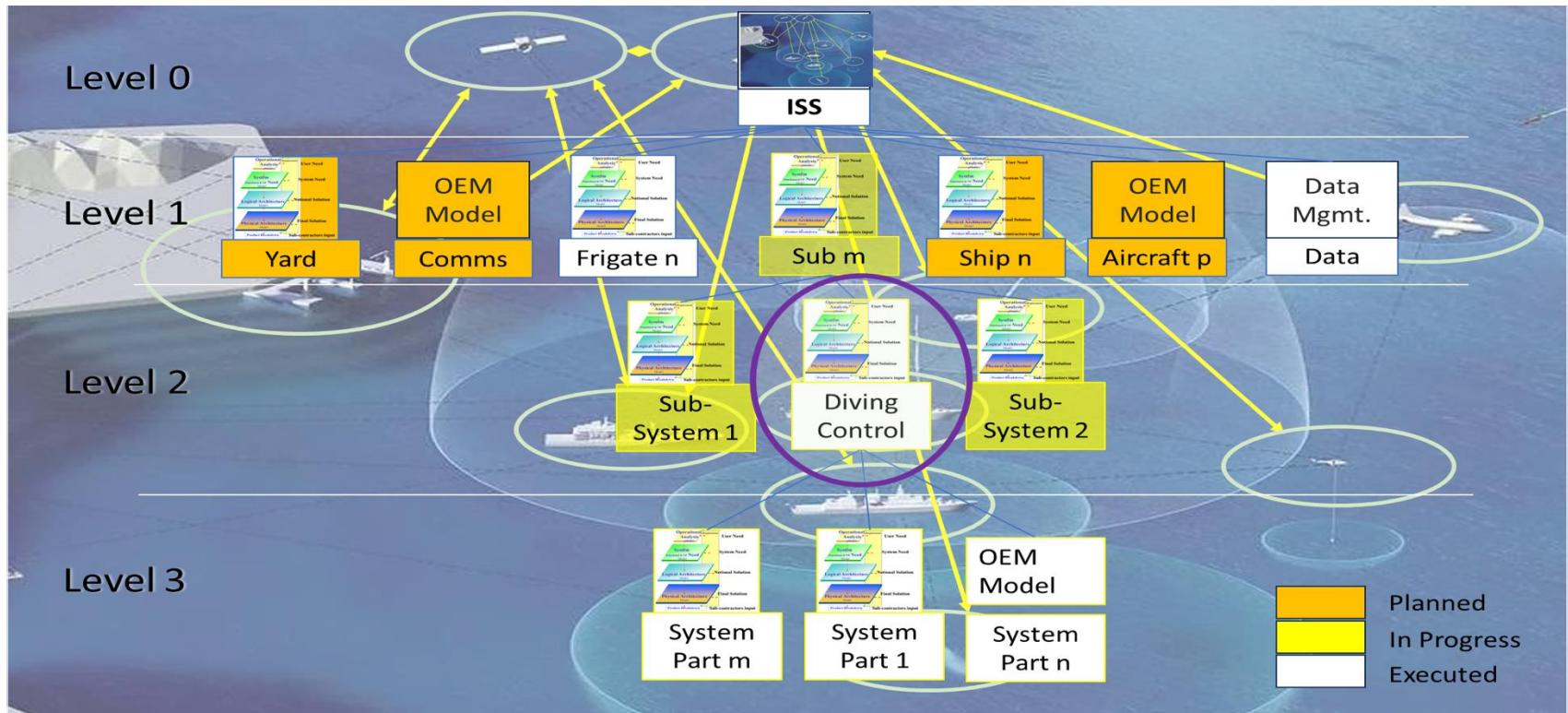
Complex maritime environments demand modular approach



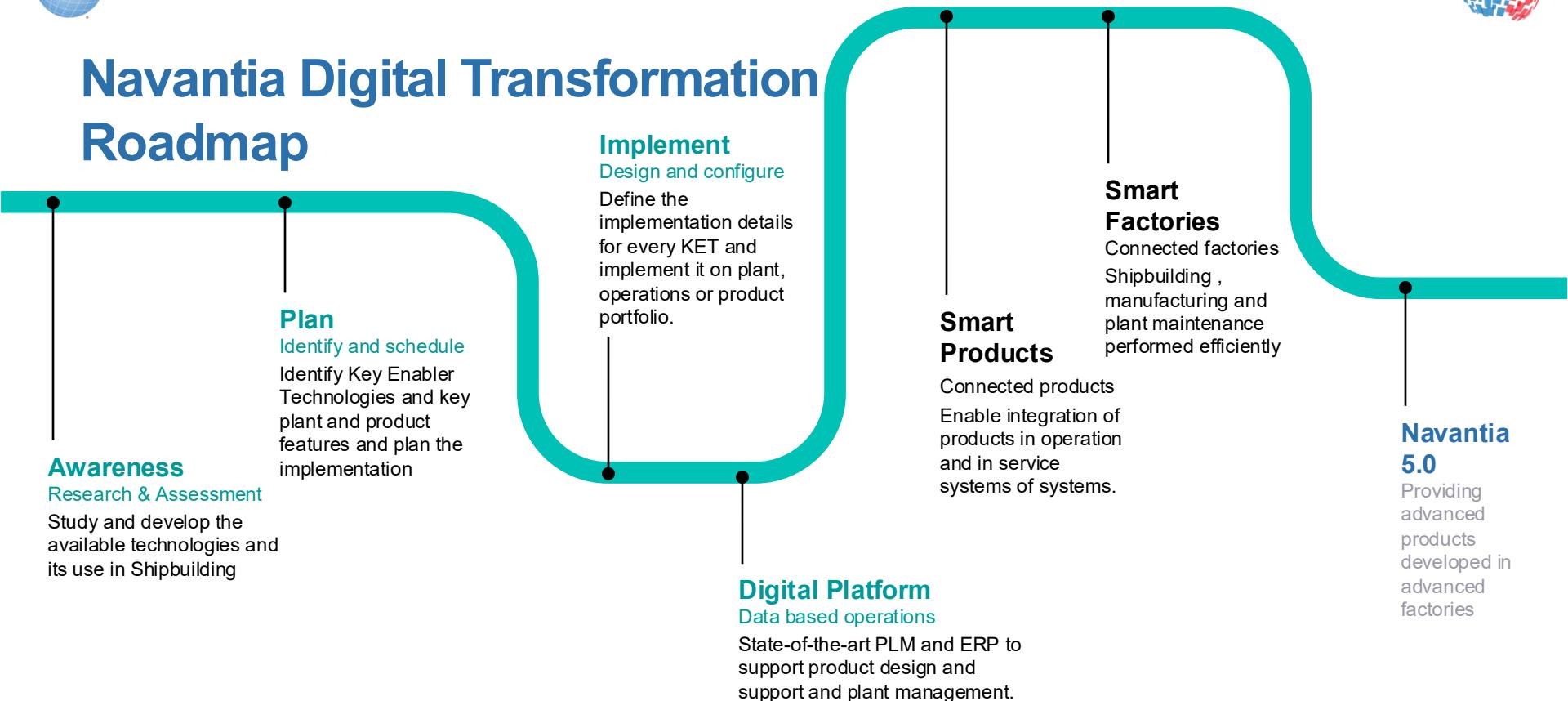


The Vision for Integrated Sustainment System

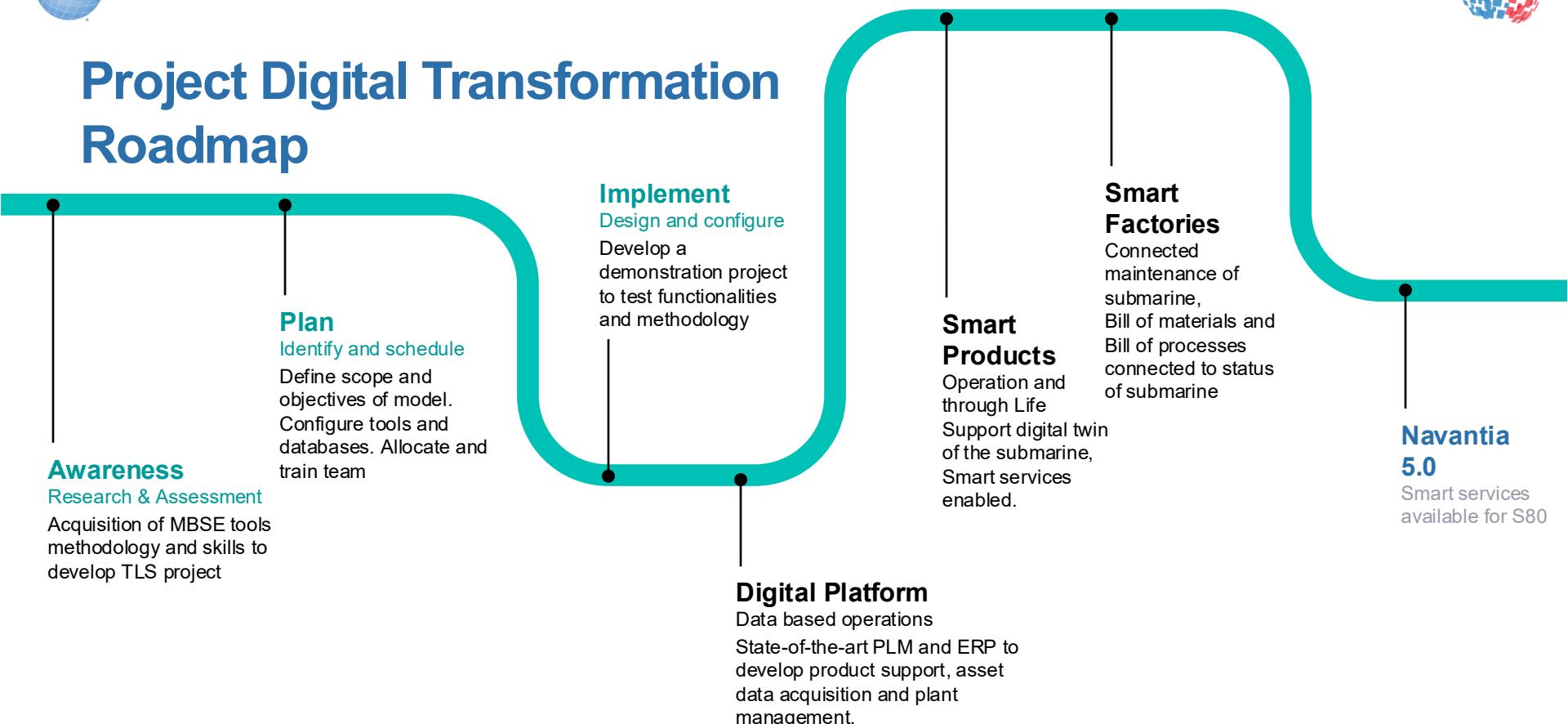
Complex maritime environments demand modular approach



Navantia Digital Transformation Roadmap



Project Digital Transformation Roadmap



Objectives

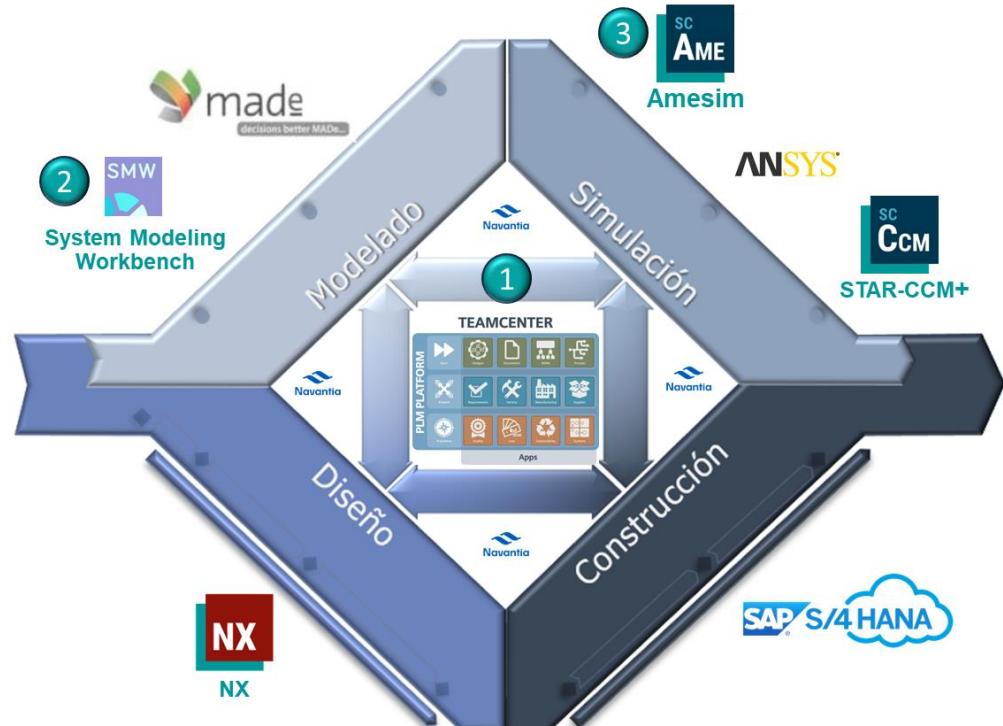
1. To define a structured process for model-based system verification that can be applied to sustainment
2. Develop the system architecture definition for the DC System and integrate it within the SoS hierarchy
3. Assess the architecture for the reliability, availability and safety use cases by:
 - developing dedicated verification packages with relevant datasets for each use case
 - developing dynamic simulation models to assess performance for each use case

Methodology

- MBSE Tools
- Process Roles
- Process Flow & Results

Process Tools

- MBSE Orchestration:
Teamcenter
- System Architecture Authoring:
System Modeling Workbench
- System Simulation:
Teamcenter Simulation,
Simcenter Amesim



Process Roles



- **RAMS Engineer:**

- responsible for defining program safety targets and milestones
- collaboration with the System Engineer to review system requirements and targets and with the simulation engineer to verify the same



- **System Engineer:**

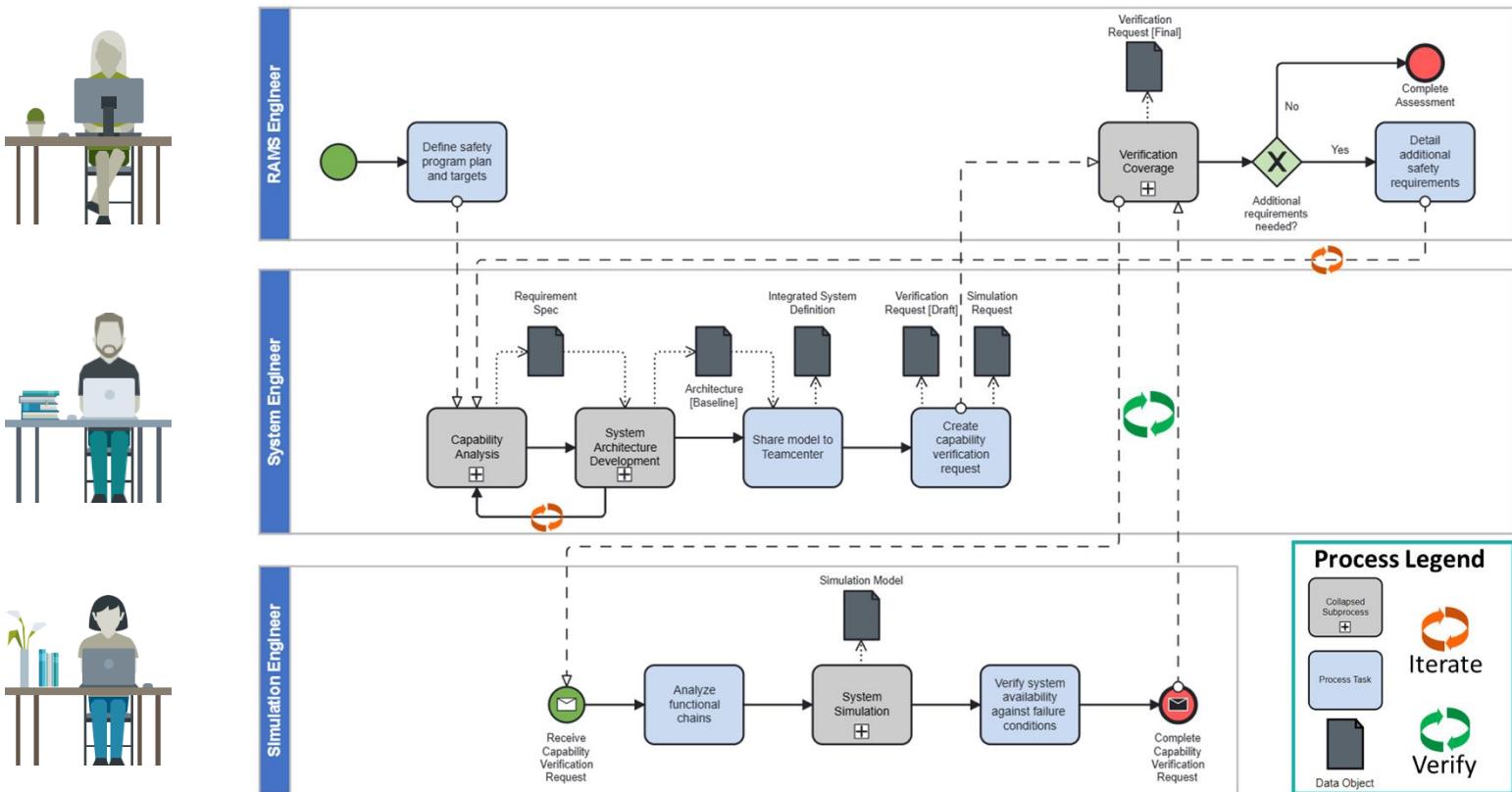
- responsible for defining the system architectures, allocating requirements and managing the lifecycle of model artifacts in the integrated environment
- creating architecture verification packages



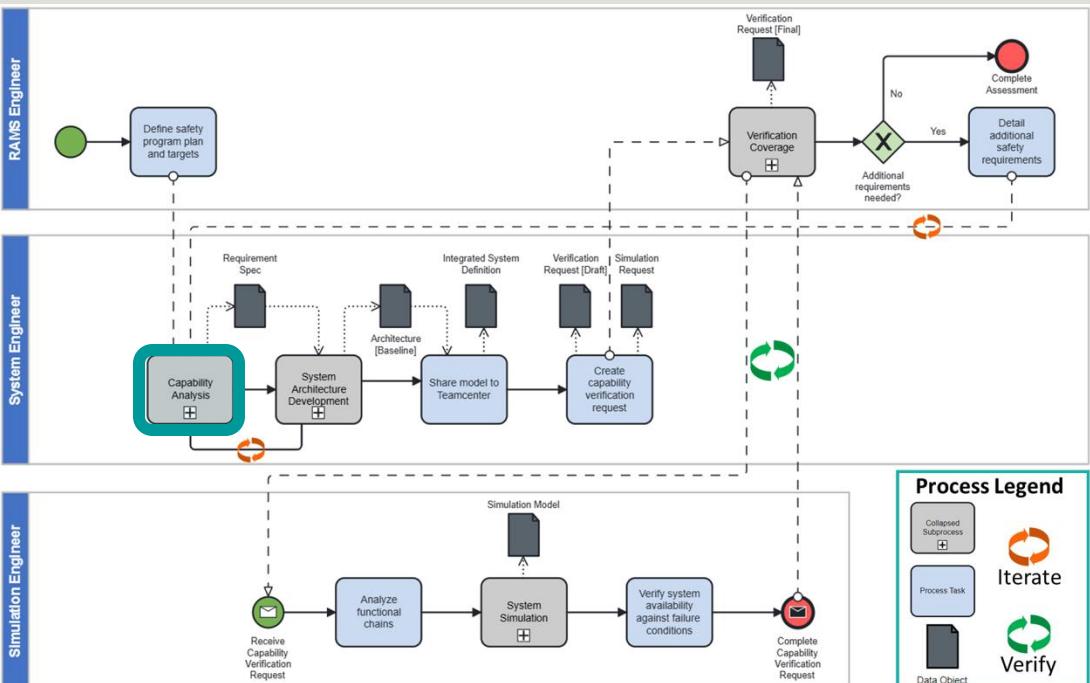
- **Simulation Engineer:**

- responsible for performing dynamic simulations of the control system
- analyzing the failure modes based on the safety requirements and targets
- verification reporting

Process Flow



Capability Analysis



Inputs:

- Enterprise safety program plan, safety targets, schedules
- MBSE orchestration environment readiness
- Reusable architecture description documents

Activities:

- Operational capability definition (capability BOM)
- System modeling scope definition per capability

Outputs:

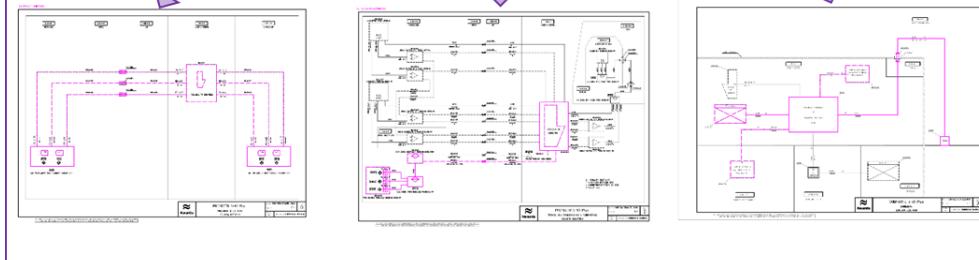
- Capability BOM (configurable)
- System modeling work plan

Capability Analysis

Operational
Capabilities BOM

 S80P-FBW-025309/A-CONTROLAR FBW VENTILACIÓN DE LASTRES
 S80P-FBW-025338/A-CONTROLAR FBW DETECCIÓN DE AGUA
 S80P-FBW-025333/A-CONTROLAR FBW GOBIERNO DE EMERGENCIA
 S80P-FBW-025337/A-CONTROLAR FBW VELOCIDAD

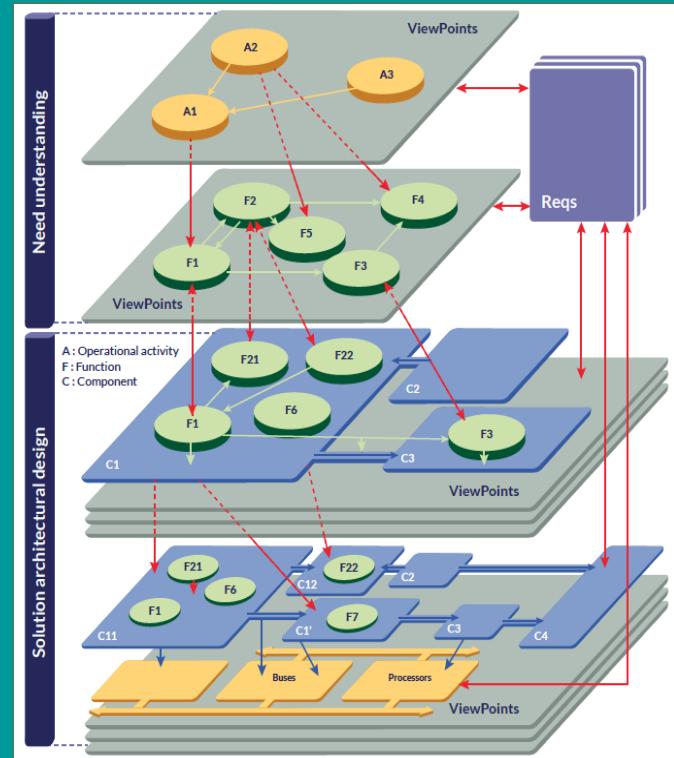
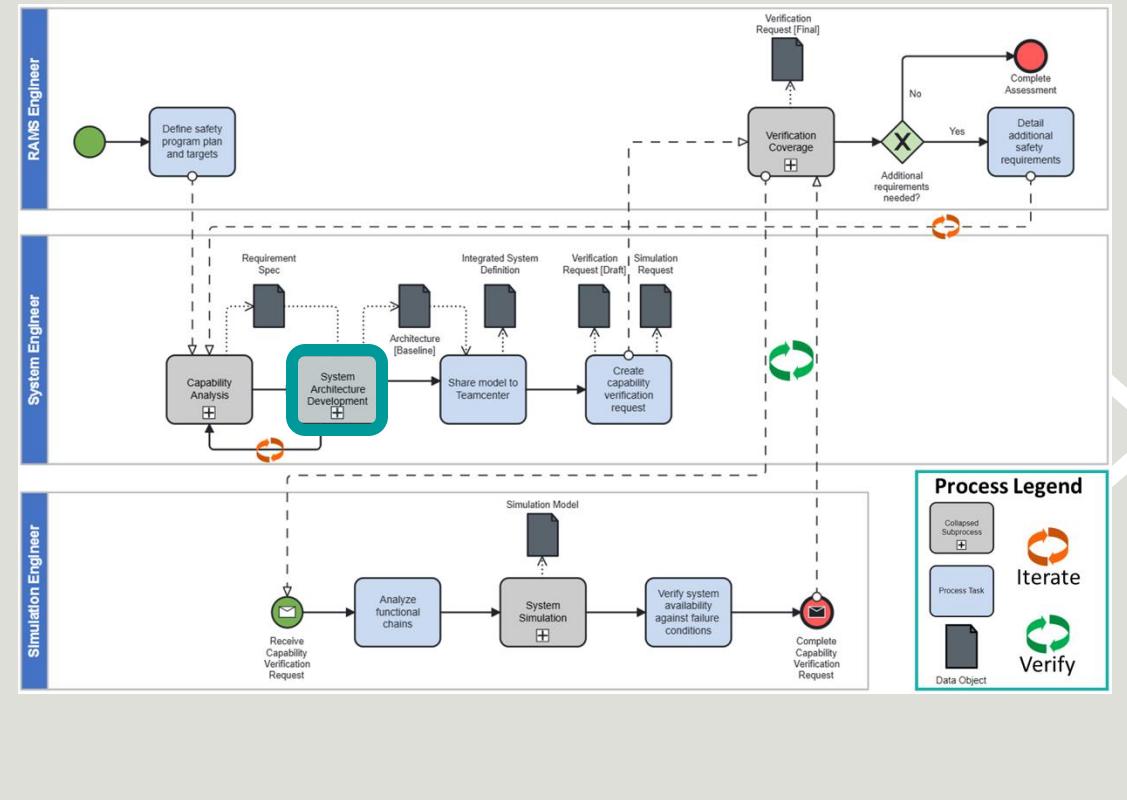
System scope per
capability



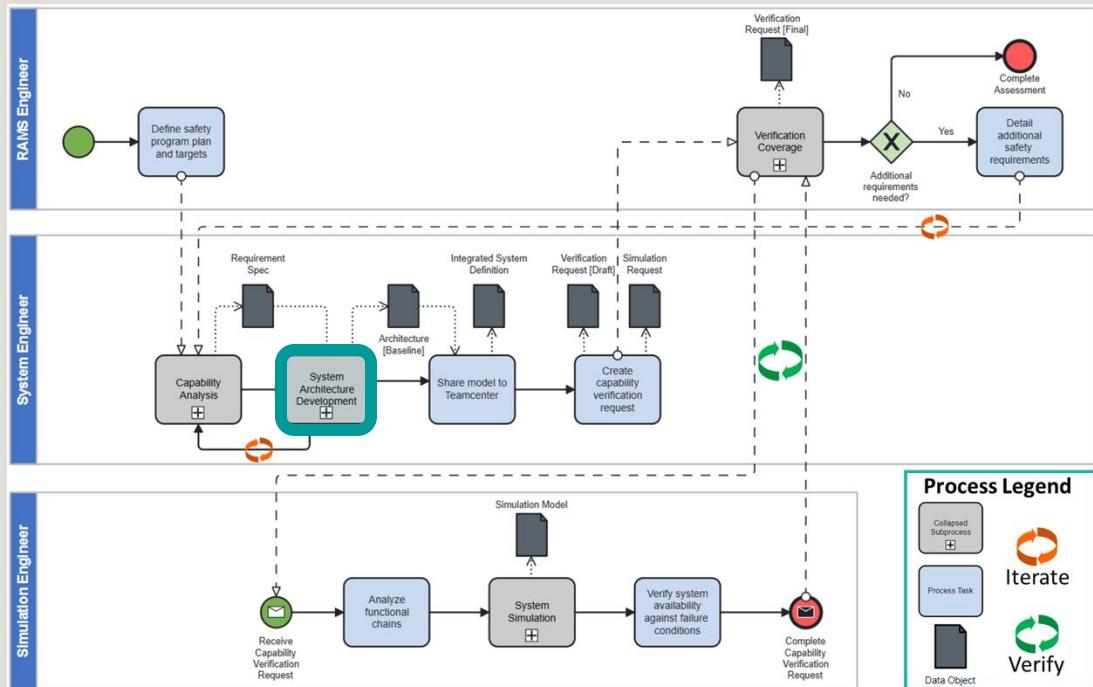
Modeling Workplan
Definition



System Architecture Development



System Architecture Development (Operational Analysis)



Inputs:

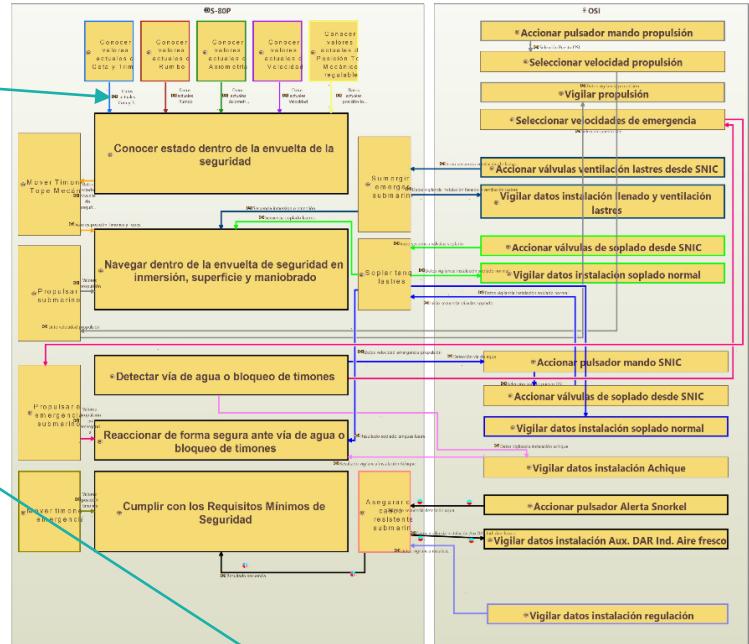
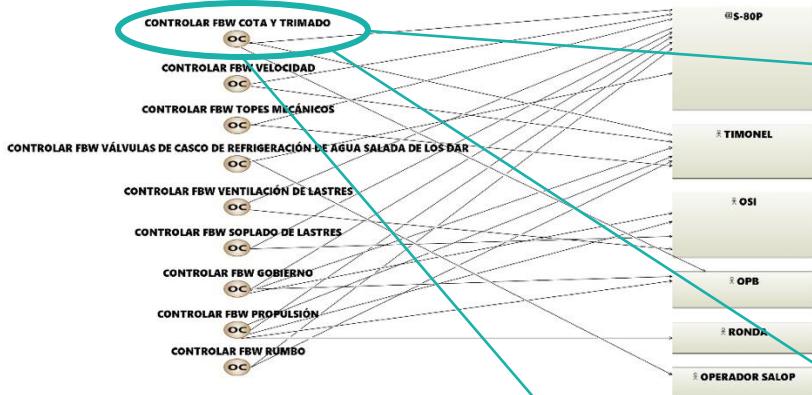
- SoS, mission, stakeholder requirements
- REM (Navy Staff Requirements)

Activities:

- Model SoS capabilities
- Define operational behavior
- Define operational architecture
- Refine / allocate stakeholder needs
- Analyze operational model

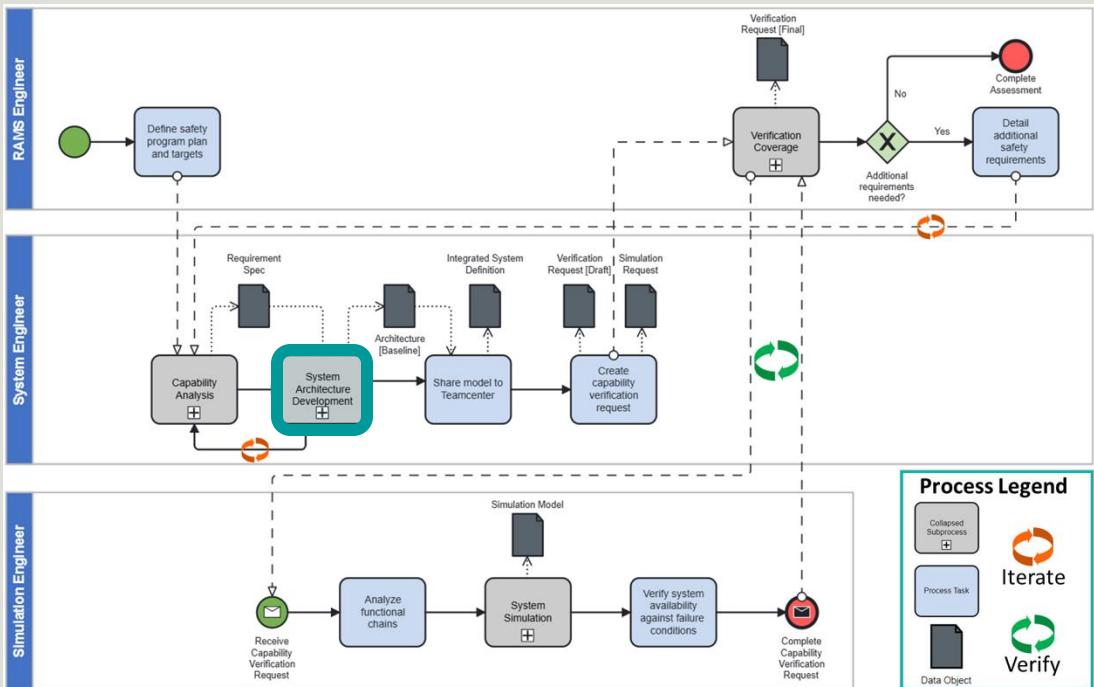
Outputs:

- Operational interface constraints
- Refined SoS requirements



- CONTROLAR FBW COTA Y TRIMADO
- CONTROLAR FBW RUMBO
- CONTROLAR FBW AXIMETRÍAS DE TIMONES DE BUCEO
- CONTROLAR FBW VENTILACIÓN DE LASTRES
- CONTROLAR FBW TOPES MECÁNICOS
- CONTROLAR FBW GOBIERNO
- CONTROLAR FBW PROPULSIÓN
- CONTROLAR FBW VÁLVULAS DE CASCO DE REFRIGERACIÓN DE AGUA SALADA DE LOS DÁR
- CONTROLAR FBW DETECCIÓN DE AGUA EN POCHETO VALVULÓN
- CONTROLAR FBW NUEVA ALERTA SNORKEL
- CONTROLAR FBW VIGILANCIA DE EMERGENCIA
- CONTROLAR FBW VÁLVULAS DE CASCO DE REFRIGERACIÓN DE AGUA SALADA DE LOS DÁR
- CONTROLAR FBW DETECCIÓN FLUJO INCONTROLADO A TRAVÉS DEL TANQUE DE REGULACIÓN
- CONTROLAR FBW SOPLADEO NORMAL EN USO DE EMERGENCIA
- CONTROLAR FBW Detección de Agua en Tanque de Purgas
- CONTROLAR FBW PROPULSIÓN DE EMERGENCIA

System Architecture Development (System Analysis)



Inputs:

- Operational architecture
- System capabilities

Activities:

- Model system capabilities
- Define and allocate system/actor functions
- Contextualize system-of-interest
- Generate SA views

Outputs:

- Blackbox architecture model (configurable)
- System requirements spec
- Functional scenarios spec

System Analysis

Misión: Control remoto de las funciones necesarias para permitir al submarino hacer inmersión, superficie y maniobrar dentro de los límites de la Envoltura de Seguridad

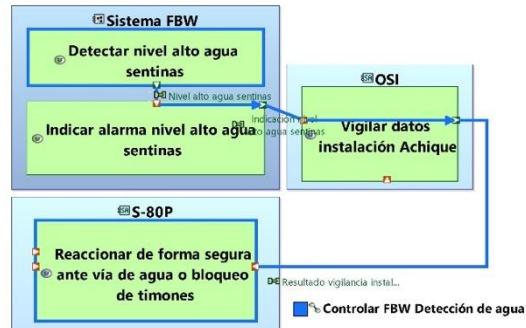
Sistema FBW

M

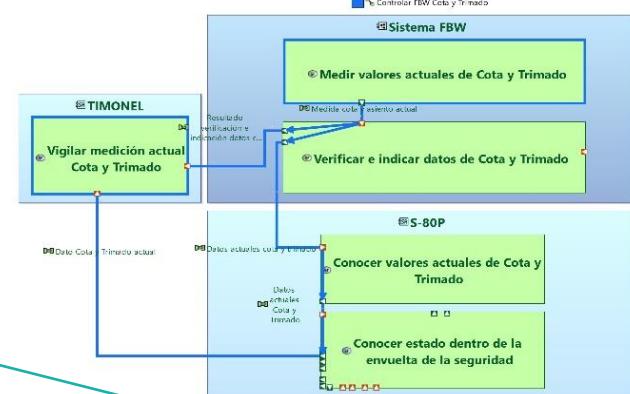
- C CONTROLAR FBW COTA Y TRIMADO
- C CONTROLAR FBW VELOCIDAD
- C CONTROLAR FBW TOPES MECÁNICOS
- C CONTROLAR FBW VENTILACIÓN DE LASTRES
- C CONTROLAR FBW SOPLADO DE LASTRES
- C CONTROLAR FBW PROPULSIÓN
- C CONTROLAR FBW GOBIERNO
- C CONTROLAR FBW RUMBO
- C CONTROLAR FBW DETECCIÓN DE AGUA
- C CONTROLAR FBW GOBIERNO DE EMERGENCIA

DC System Capabilities

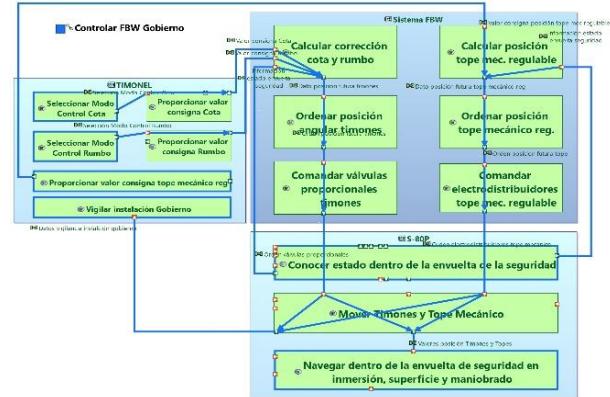
Control Water Detection



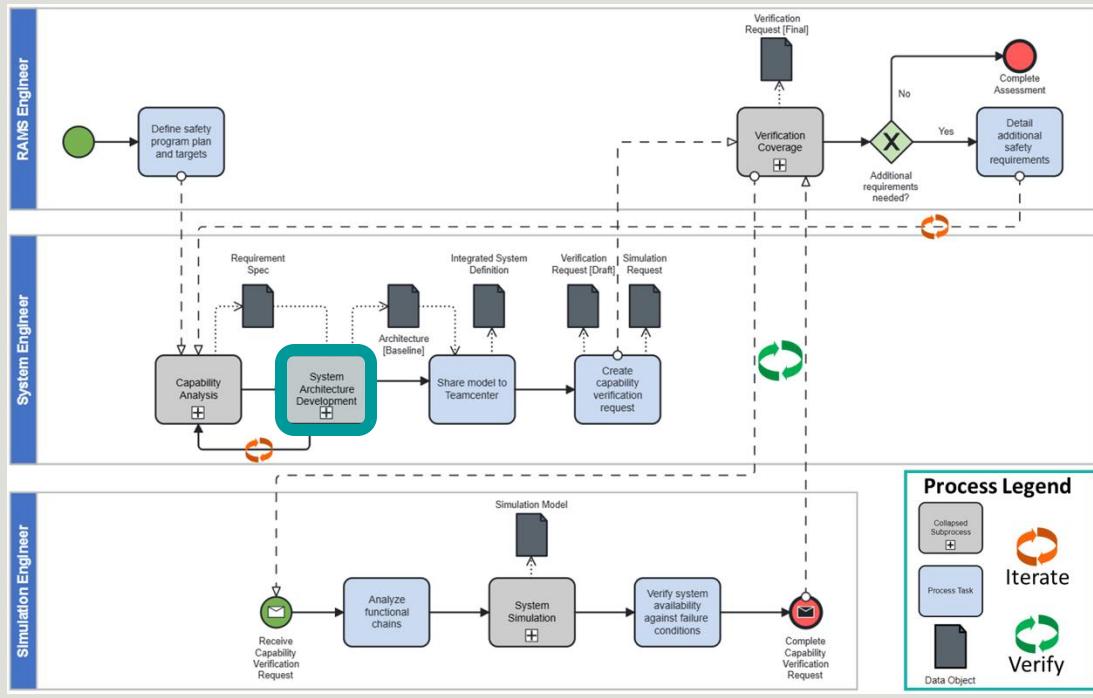
Control Depth



Control Rudders



System Architecture Development (Logical Architecture)



Inputs:

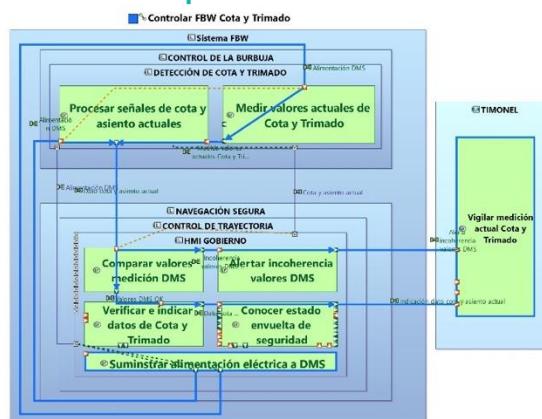
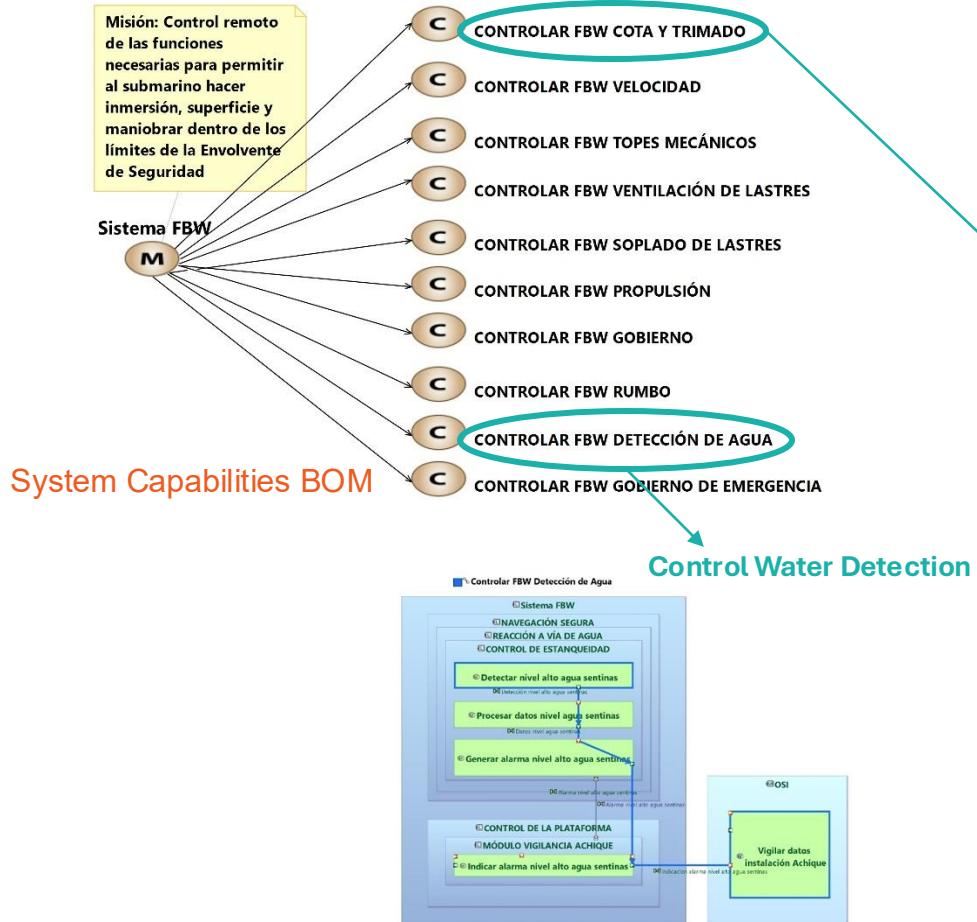
- Blackbox system architecture
- DC system requirements

Activities:

- Decompose logical system
- Allocate functions to logical components
- Define internal interfaces (white box)
- Generate stakeholder concerns (views)
- Requirement / parameter traceability

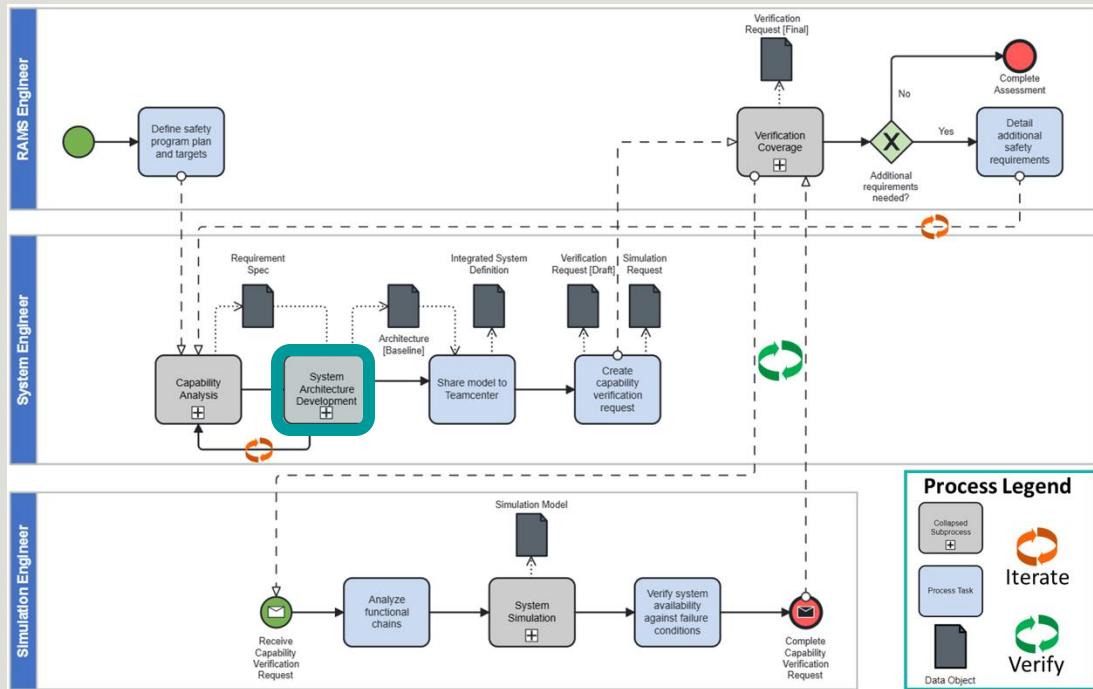
Outputs:

- Logical architecture model (configurable)
- Performance allocation & traceability
- Performance verification views



Logical Architecture Views

System Architecture Development (Physical Architecture)



Inputs:

- Logical architecture
- Subsystem requirements (draft)

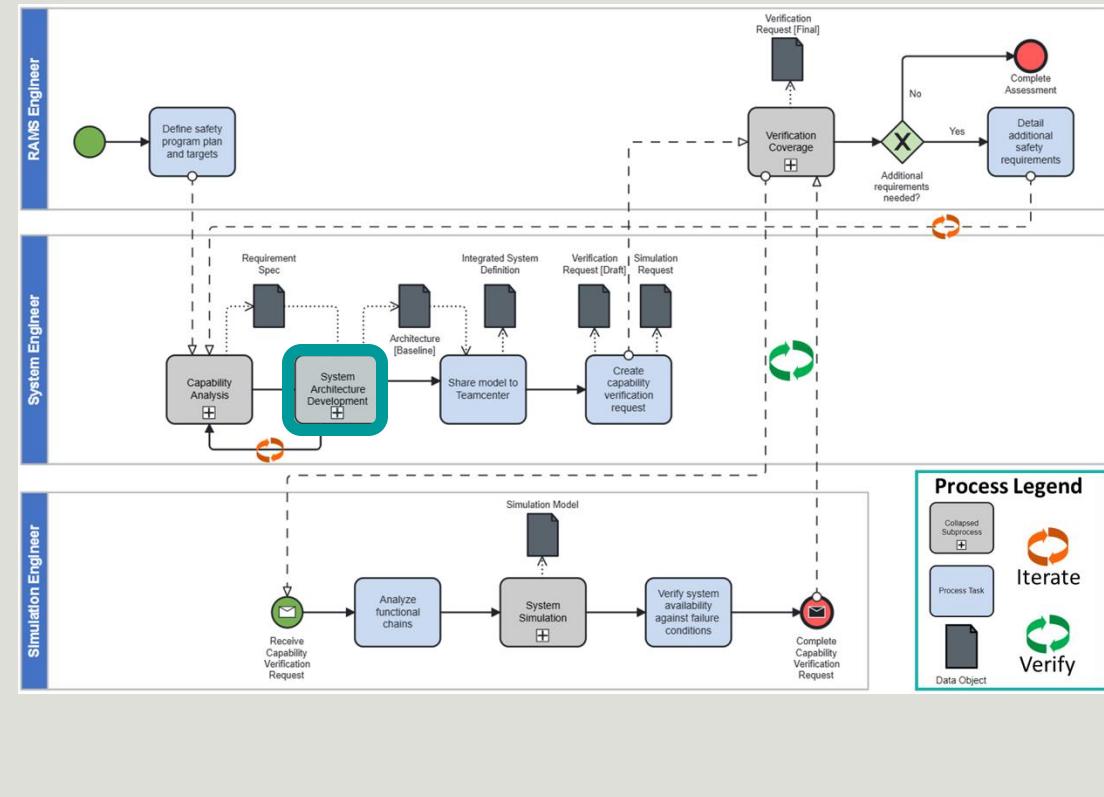
Activities:

- Perform system to subsystem transitions
- Generate reusable subsystem libraries
- Allocate logical components to physical components
- Generate physical architecture views
- Save libraries to PLM

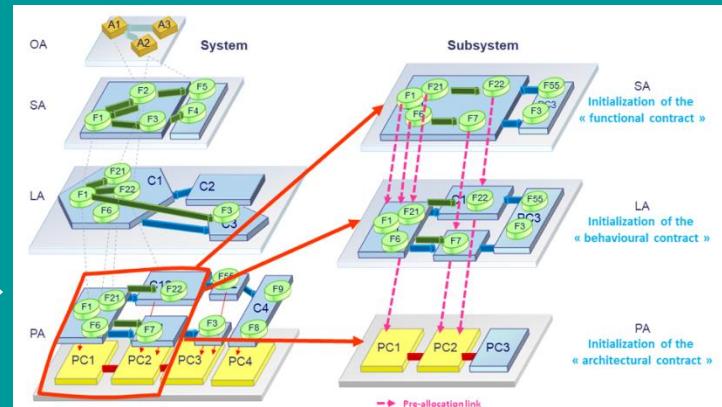
Outputs:

- Physical architecture model (configurable)
- Preliminary PBS

System Architecture Development (Physical Architecture)

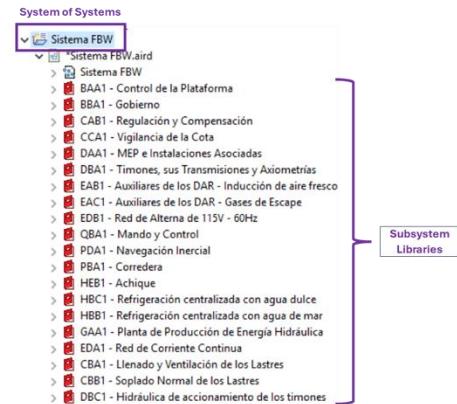


Automated system to subsystem transitions



System

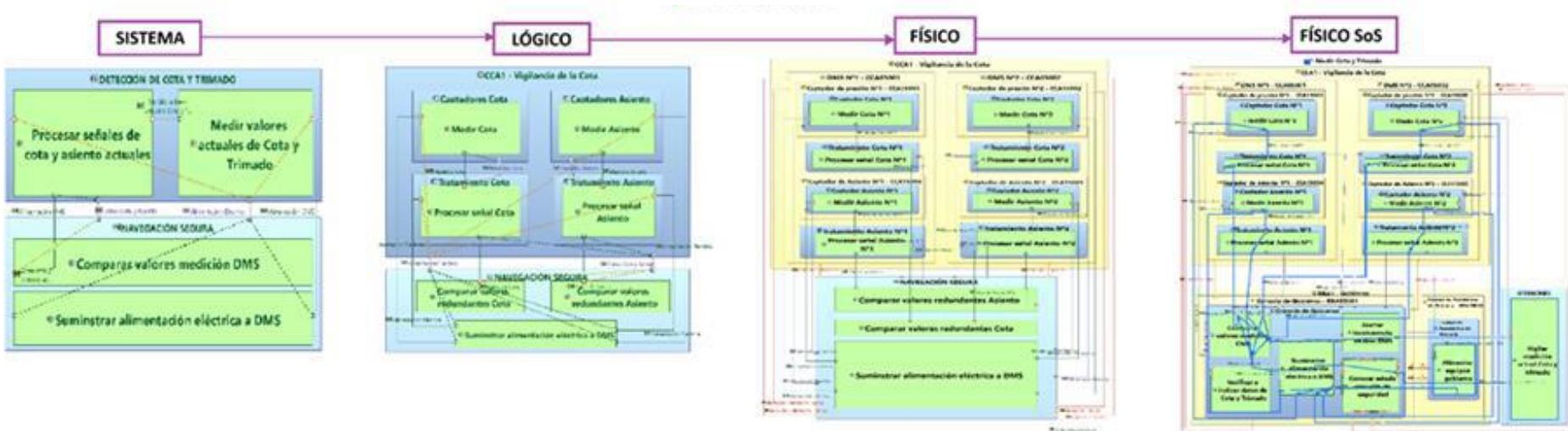
Subsystem



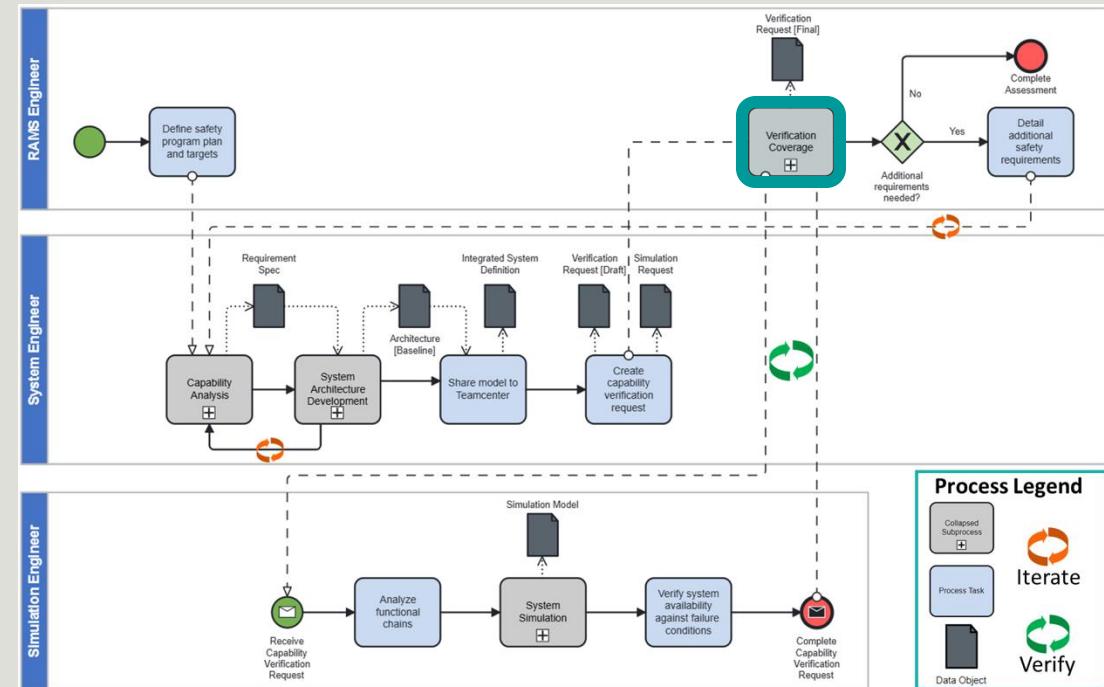
Physical Architecture

Librería Subsistema CCA1

023073/A - CCA1 - Vigilancia de la Cota



Verification Coverage



Inputs:

- Physical architecture model for performance simulation
- Simulation requirements, input/output parameters, variables

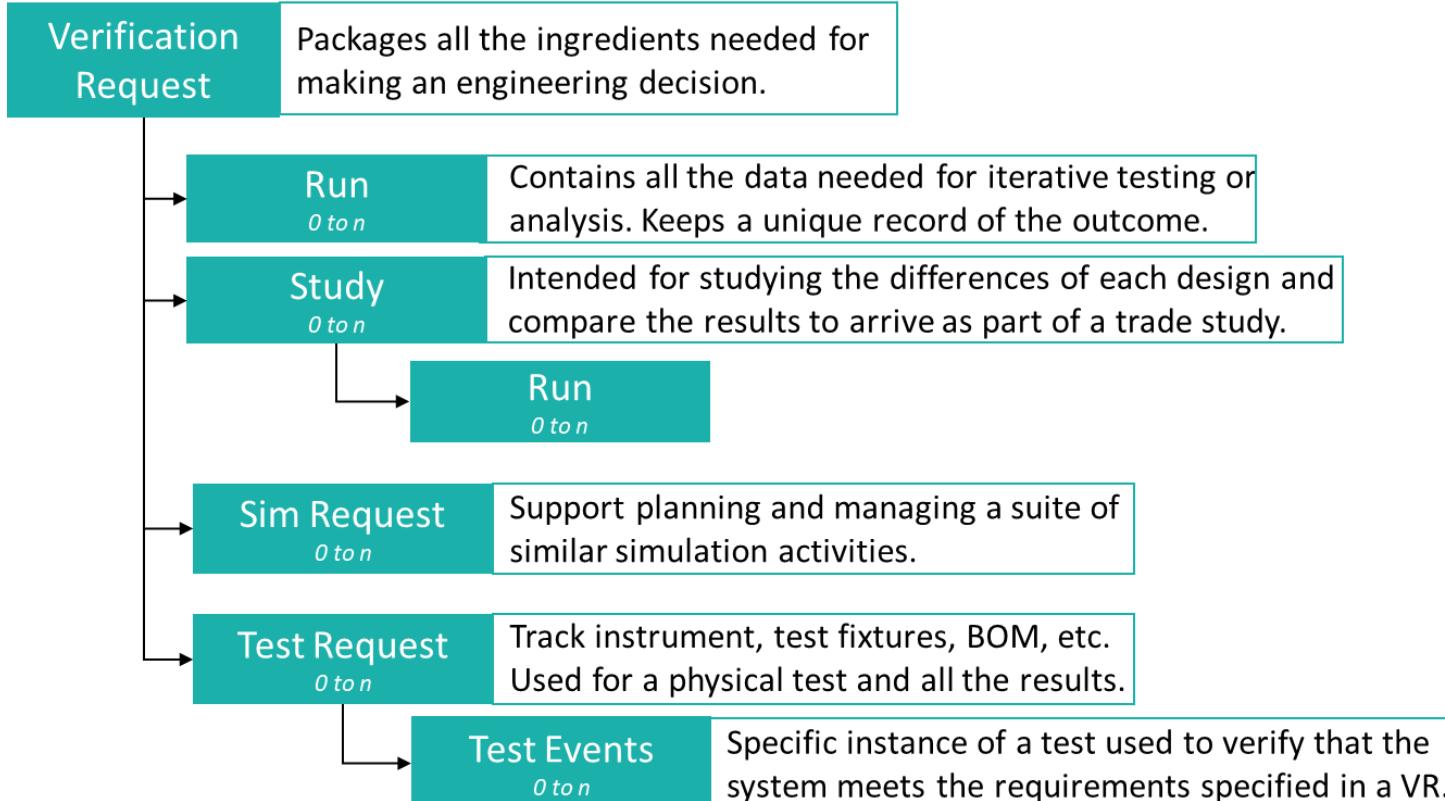
Activities:

- Create verification request packages
- Define simulation requests corresponding to functional chains
- Ensure VR/SR coverage
- Submit VR to workflow

Outputs:

- Verification request package
- Attached verification assets

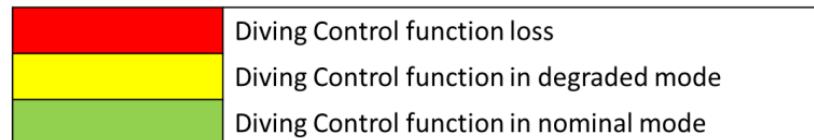
Verification Request Data Structure



Verification Use Cases

1. Assessment of the availability and reliability of the DC system based on the failure modes of the components (single failure):

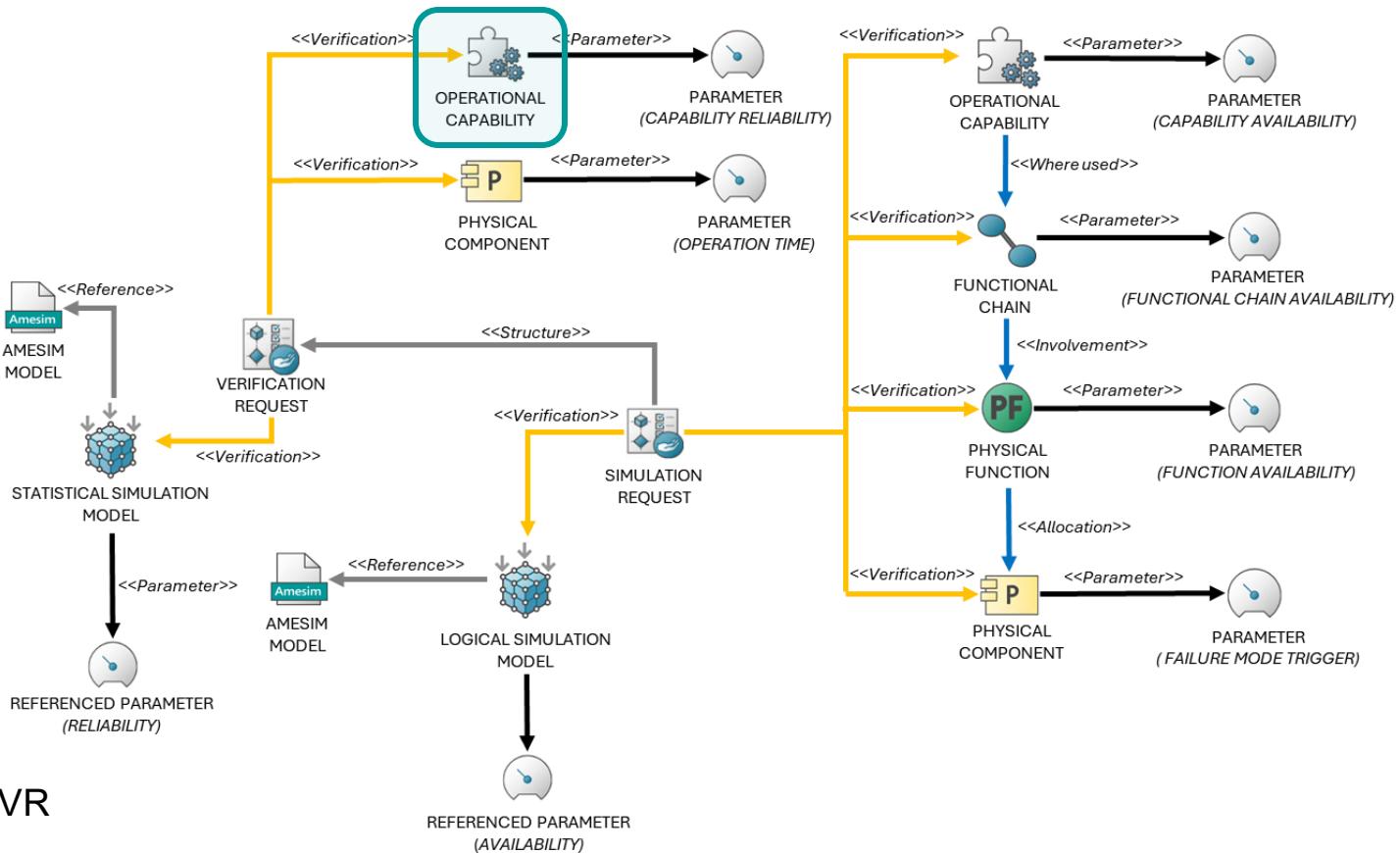
- Traceability between operational capabilities, functional chains and physical systems
- Verification request driven by operational capabilities of the S80
- Logical simulation model to analyze reliability and availability
- DC functional availability assessment based on state chart execution



2. Analysis of the response of the DC system to an external failure (casualty cases).

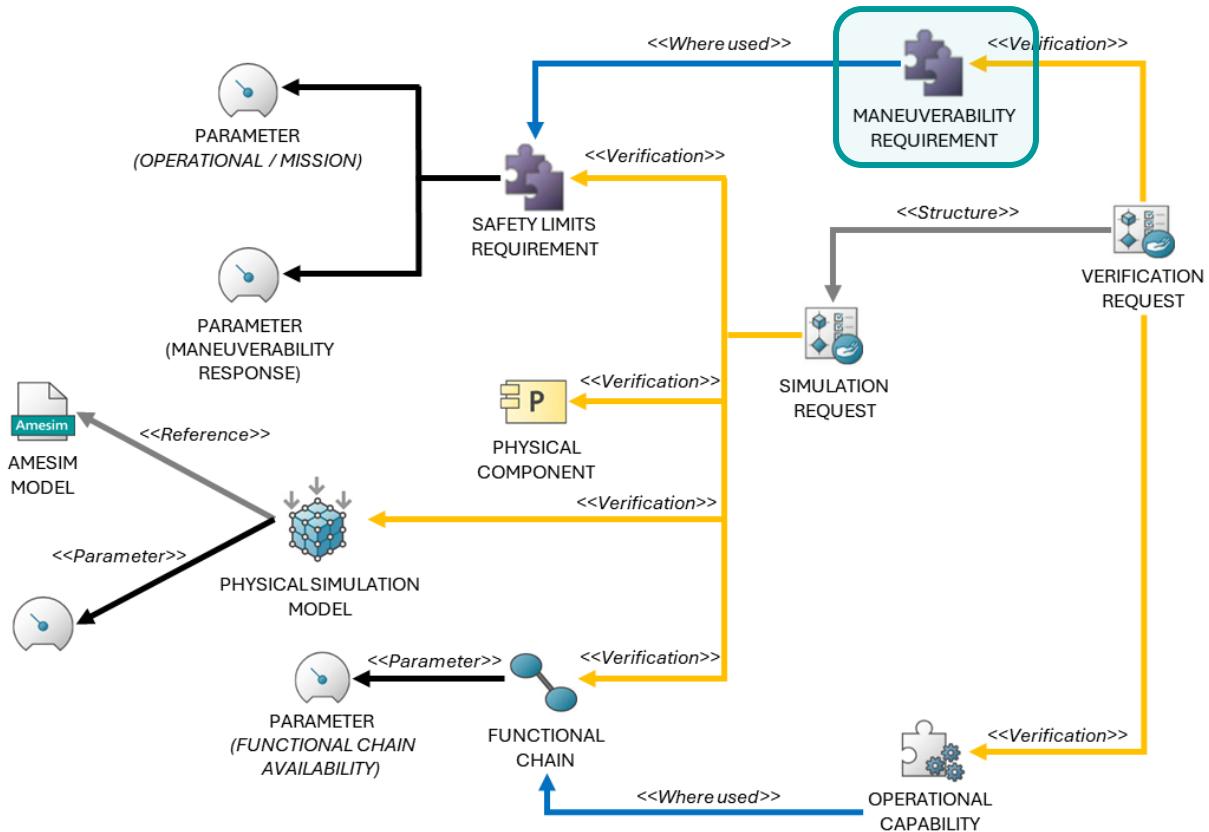
- Verification request driven by “Maneuverability” requirement
- 1D simulation model to analyze system safety based on a set of casualty cases

Assessment of the availability and reliability of the DC system based on the failure modes of the components (single failure)

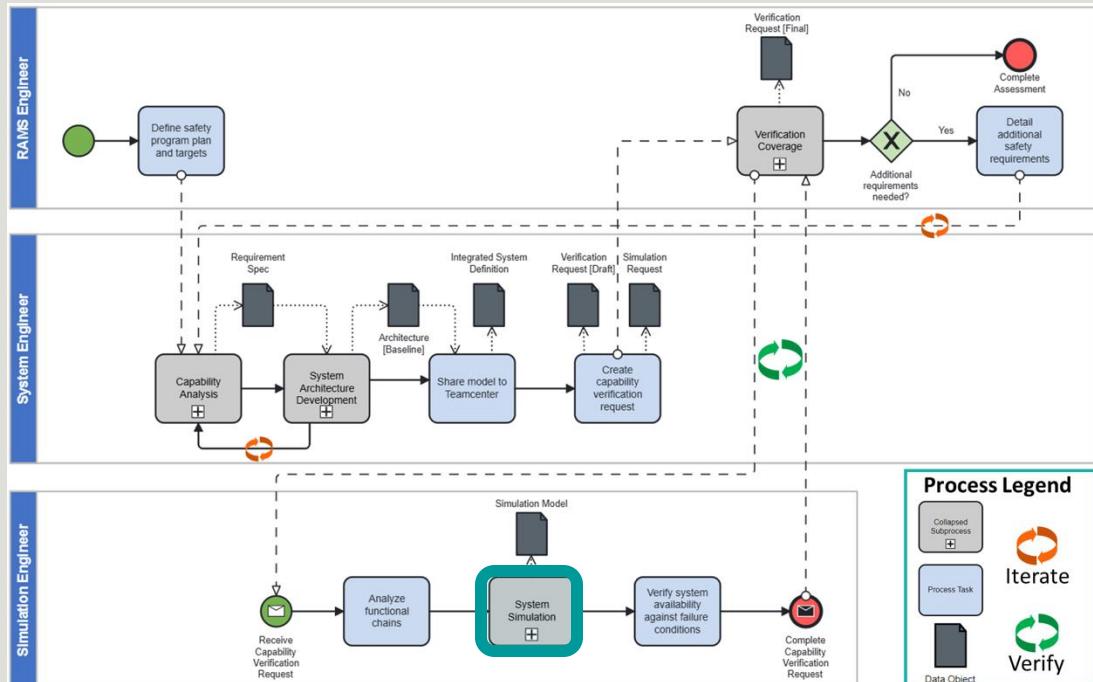


Initiate VR

Analysis of the response of the DC system to an external failure (casualty cases)



System Simulation



Inputs:

- Verification request
- Integrated system definition including architecture artifacts
- Simulation requirements, reusable simulation models

Activities:

- Launch simulation in managed mode
- Analyze system for reliability, availability and safety
- Report verification results

Outputs:

- Verification results
- Architecture refinement proposals

Assessment of availability and reliability of the DC system based on the failure modes of the components (single failure)

Reliability calculations based on
Operation Time as Input

PARAMETERS	
Result	Measure
Pass	98.9057
Pass	99.9807
Pass	98.9736
Pass	99.9758
Pass	99.9758
Pass	149.42
Pass	23.7675
Pass	21.7054
Pass	21.7054
Pass	0

Final Reliability Assessment on Capabilities

Name	Result	Type
CONTROLAR FBW COTA Y TRIMADO	Pass	Capability Revision

Capability verification
object in Teamcenter
(involving functional
chains)

F110-005774/A-Controlar FBW
Cota y Trimado
Controlar FBW Cota y Trimado
ID: 005774
Revision: A

‘Reliability’ VR

Link

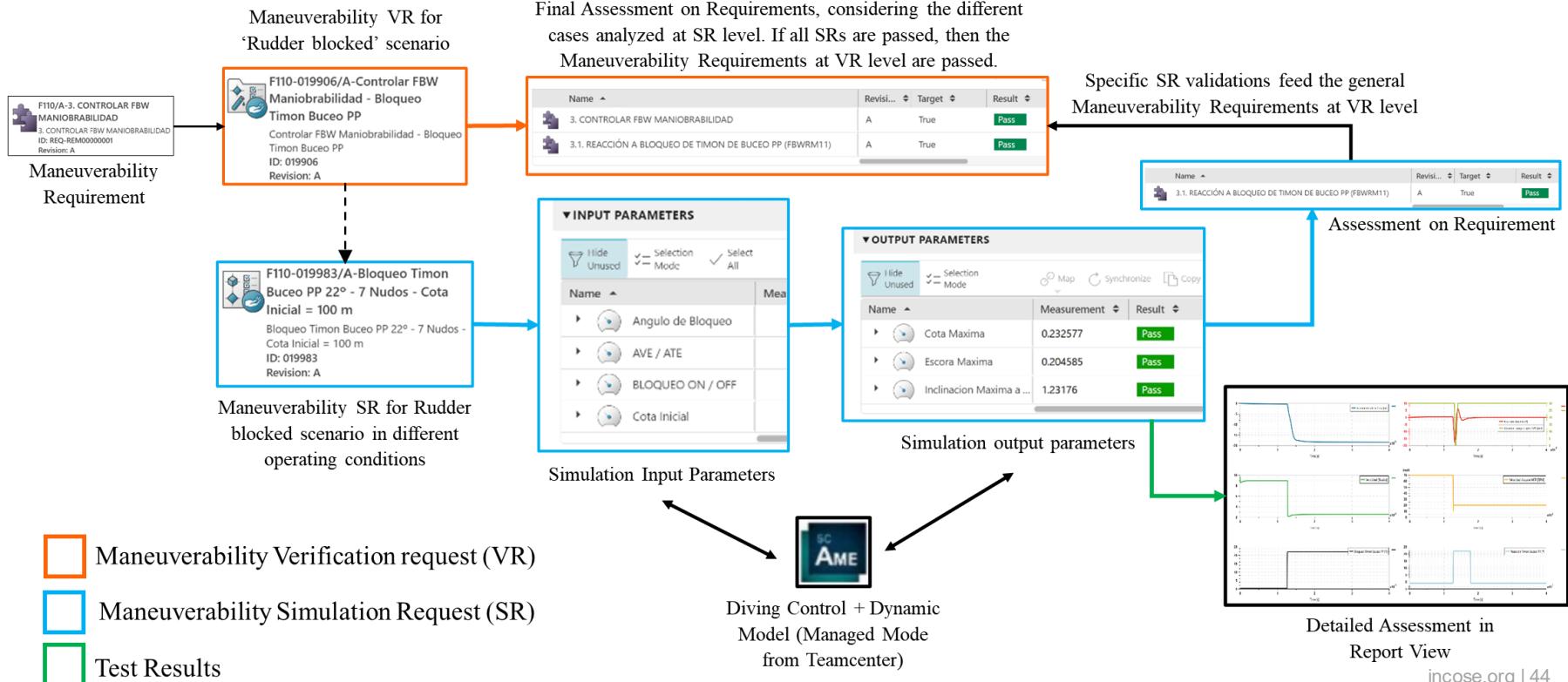
F110-019892/A-Medir Cota y
Trimado - 1B1 (FALLO CAPTADOR
COTA N1)
Medir Cota y Trimado - 1B1 (FALLO
CAPTADOR COTA N1)
ID: 019892
Revision: A

‘Availability’ Simulation
Request per failure mode

Availability & Reliability
Simulation Model
(Managed mode from
Teamcenter)

INPUT PARAMETERS	
Name	Measurement
1	Input
2	Output
3	Output
4	Output
5	Output
6	Output
7	Output
8	Output
9	Output
10	Output
11	Output
12	Output
13	Output
14	Output
15	Output
16	Output
17	Output
18	Output
19	Output
20	Output
21	Output
22	Output
23	Output
24	Output
25	Output
26	Output
27	Output
28	Output
29	Output
30	Output
31	Output
32	Output
33	Output
34	Output
35	Output
36	Output
37	Output
38	Output
39	Output
40	Output
41	Output
42	Output
43	Output
44	Output
45	Output
46	Output
47	Output
48	Output
49	Output
50	Output
51	Output
52	Output
53	Output
54	Output
55	Output
56	Output
57	Output
58	Output
59	Output
60	Output
61	Output
62	Output
63	Output
64	Output
65	Output
66	Output
67	Output
68	Output
69	Output
70	Output
71	Output
72	Output
73	Output
74	Output
75	Output
76	Output
77	Output
78	Output
79	Output
80	Output
81	Output
82	Output
83	Output
84	Output
85	Output
86	Output
87	Output
88	Output
89	Output
90	Output
91	Output
92	Output
93	Output
94	Output
95	Output
96	Output
97	Output
98	Output
99	Output
100	Output
101	Output
102	Output
103	Output
104	Output
105	Output
106	Output
107	Output
108	Output
109	Output
110	Output
111	Output
112	Output
113	Output
114	Output
115	Output
116	Output
117	Output
118	Output
119	Output
120	Output
121	Output
122	Output
123	Output
124	Output
125	Output
126	Output
127	Output
128	Output
129	Output
130	Output
131	Output
132	Output
133	Output
134	Output
135	Output
136	Output
137	Output
138	Output
139	Output
140	Output
141	Output
142	Output
143	Output
144	Output
145	Output
146	Output
147	Output
148	Output
149	Output
150	Output
151	Output
152	Output
153	Output
154	Output
155	Output
156	Output
157	Output
158	Output
159	Output
160	Output
161	Output
162	Output
163	Output
164	Output
165	Output
166	Output
167	Output
168	Output
169	Output
170	Output
171	Output
172	Output
173	Output
174	Output
175	Output
176	Output
177	Output
178	Output
179	Output
180	Output
181	Output
182	Output
183	Output
184	Output
185	Output
186	Output
187	Output
188	Output
189	Output
190	Output
191	Output
192	Output
193	Output
194	Output
195	Output
196	Output
197	Output
198	Output
199	Output
200	Output
201	Output
202	Output
203	Output
204	Output
205	Output
206	Output
207	Output
208	Output
209	Output
210	Output
211	Output
212	Output
213	Output
214	Output
215	Output
216	Output
217	Output
218	Output
219	Output
220	Output
221	Output
222	Output
223	Output
224	Output
225	Output
226	Output
227	Output
228	Output
229	Output
230	Output
231	Output
232	Output
233	Output
234	Output
235	Output
236	Output
237	Output
238	Output
239	Output
240	Output
241	Output
242	Output
243	Output
244	Output
245	Output
246	Output
247	Output
248	Output
249	Output
250	Output
251	Output
252	Output
253	Output
254	Output
255	Output
256	Output
257	Output
258	Output
259	Output
260	Output
261	Output
262	Output
263	Output
264	Output
265	Output
266	Output
267	Output
268	Output
269	Output
270	Output
271	Output
272	Output
273	Output
274	Output
275	Output
276	Output
277	Output
278	Output
279	Output
280	Output
281	Output
282	Output
283	Output
284	Output
285	Output
286	Output
287	Output
288	Output
289	Output
290	Output
291	Output
292	Output
293	Output
294	Output
295	Output
296	Output
297	Output
298	Output
299	Output
300	Output
301	Output
302	Output
303	Output
304	Output
305	Output
306	Output
307	Output
308	Output
309	Output
310	Output
311	Output
312	Output
313	Output
314	Output
315	Output
316	Output
317	Output
318	Output
319	Output
320	Output
321	Output
322	Output
323	Output
324	Output
325	Output
326	Output
327	Output
328	Output
329	Output
330	Output
331	Output
332	Output
333	Output
334	Output
335	Output
336	Output
337	Output
338	Output
339	Output
340	Output
341	Output
342	Output
343	Output
344	Output
345	Output
346	Output
347	Output
348	Output
349	Output
350	Output
351	Output
352	Output
353	Output
354	Output
355	Output
356	Output
357	Output
358	Output
359	Output
360	Output
361	Output
362	Output
363	Output
364	Output
365	Output
366	Output
367	Output
368	Output
369	Output
370	Output
371	Output
372	Output
373	Output
374	Output
375	Output
376	Output
377	Output
378	Output
379	Output
380	Output
381	Output
382	Output
383	Output
384	Output
385	Output
386	Output
387	Output
388	Output
389	Output
390	Output
391	Output
392	Output
393	Output
394	Output
395	Output
396	Output
397	Output
398	Output
399	Output
400	Output
401	Output
402	Output
403	Output
404	Output
405	Output
406	Output
407	Output
408	Output
409	Output
410	Output
411	Output
412	Output
413	Output
414	Output
415	Output
416	Output
417	Output
418	Output
419	Output
420	Output
421	Output
422	Output
423	Output
424	Output
425	Output
426	Output
427	Output
428	Output
429	Output
430	Output
431	Output
432	Output
433	Output
434	Output
435	Output
436	Output
437	Output
438	Output
439	Output
440	Output
441	Output
442	Output
443	Output
444	Output
445	Output
446	Output
447	Output
448	Output
449	Output
450	Output
451	Output
452	Output
453	Output
454	Output
455	Output
456	Output
457	Output
458	Output
459	Output
460	Output
461	Output
462	Output
463	Output
464	Output
465	Output
466	Output
467	Output
468	Output
469	Output
470	Output
471	Output
472	Output
473	Output
474	Output
475	Output
476	Output
477	Output
478	Output
479	Output
480	Output
481	Output
482	Output
483	Output
484	Output
485	Output
486	Output
487	Output
488	Output
489	Output
490	Output
491	Output
492	Output
493	Output
494	Output
495	Output
496	Output
497	Output
498	Output
499	Output
500	Output
501	Output
502	Output
503	Output
504	Output
505	Output
506	Output
507	Output
508	Output
509	Output
510	Output
511	Output
512	Output
513	Output
514	Output
515	Output
516	Output
517	Output
518	Output
519	Output
520	Output
521	Output
522	Output
523	Output
524	Output
525	Output
526	Output
527	Output
528	Output
529	Output
530	Output
531	Output
532	Output
533	Output
534	Output
535	Output
536	Output
537	Output
538	Output
539	Output
540	Output
541	Output
542	Output
543	Output
544	Output
545	Output
546	Output
547	Output
548	Output
549	Output
550	Output
551	Output
552	Output
553	Output
554	Output
555	Output
556	Output
557	Output
558	Output
559	Output
560	Output
561	Output
562	Output
563	Output
564	Output
565	Output
566	Output
567	Output
568	Output
569	Output
570	Output
571	Output
572	Output
573	Output
574	Output
575	Output
576	Output
577	Output
578	Output
579	Output
580	Output
581	Output
582	Output
583	Output
584	Output
585	Output
586	Output
587	Output
588	Output
589	Output
590	Output
591	Output
592	Output
593	Output
594	Output
595	Output
596	Output
597	Output
598	Output
599	Output
600	Output
601	Output
602	Output
603	Output

Analysis of the response of the DC system to an external failure (casualty cases)



Conclusion

- Lessons Learned
- Future Direction
- Additional Information

Lessons Learned

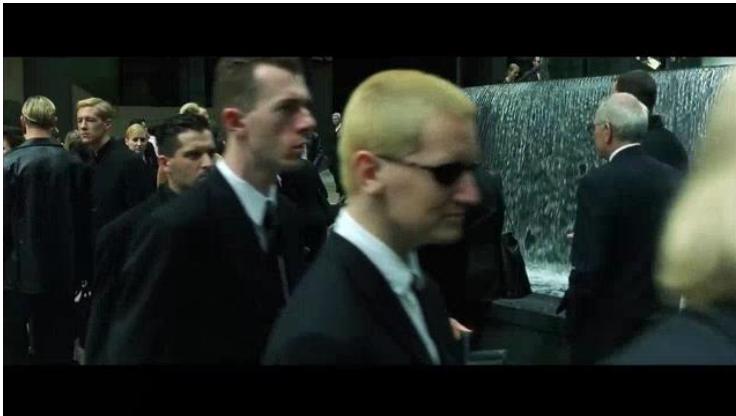
Immediate and perceived benefits



The S80 Sustainment Program

The foundation of the digital twin, the structure

Front-End



- PLM, virtual mock-up
- Performance metrics
- Cost metrics
- Reliability metrics

Back-End



- Systems Engineering
- Configuration Management
- Simulation
- Data management

The S80 Sustainment Program

The foundation of the digital twin, the promise



Future Directions

Extending MBSE across the Navantia enterprise and beyond

- **Project Level:**

- Complete model of S80 submarine
- Focus on trading-off maintenance scope scenarios for efficient budget allocation

- **Corporate Level:**

- MBSE Framework including standard configuration, model governance, business rules, best practices, model libraries and infrastructure support – from concept design to disposal
- Foster reuse of models and model-based design, building and product support

- **European Defense Level:**

- Common framework for naval vessels ship digital architecture, digital platform and digital engineering processes (EDINAF)
- Common digital thread across companies, institutions and ministries of defense

Observations

- Navantia products have longer lifecycle (~40 years), with heavy configuration changes over the life cycle - which makes it a valuable case for implementing MBSE
- Document-based SE approach is not suitable to cover operation, and sustainment needs as far as deliverables are product oriented and information is siloed
- Model Based SE provides the tools, methodology and functionalities to cover sustainment needs by providing a common and accessible data configuration that can be much more easily exploited
- Beyond concept & development, MBSE offers equal if not more value in the operations phase of the life cycle
- Implementation of MBSE requires tools, methodology and a change of culture of the team

Acknowledgement

1. Captain Juan Manuel Torrijos Colado (Spanish Navy Program Manager of S80 Submarine Through Life Support)
2. Adolfo García Alcaraz (Navantia Program Manager of S80 Submarine Through Life Support)
3. Olimpia Gómez García (ISDEFE Engineering Chief of S80 Submarine Through Life Support)
4. Julio Elias Sánchez, Gastón Mercado Roasso, Salvador Delgado Franco & Pedro Bueno Enciso (Accenture)
5. Juan Aranda, Hugues Bertrand, Josu Zaballa, Monil Chheta, Zoran Petrovic, Henning Brohm, Albino Teixeira Pereira & Mike Nicolai (Siemens)

Thank you!



35th Annual **INCOSE**
international symposium
hybrid event

Ottawa, Canada
July 26 - 31, 2025

 **Navantia**  **accenture**  **SIEMENS**