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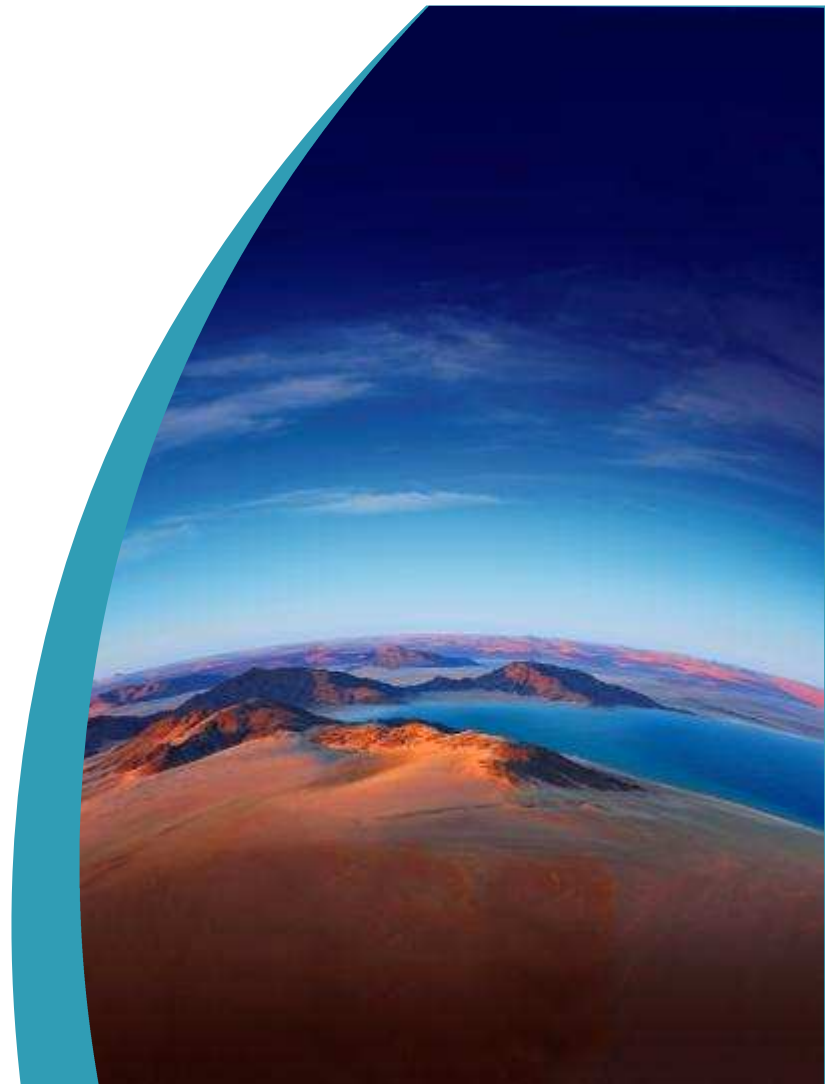


ATL2 modernization When MBSE keeps its promises

Guillaume JOURNAUX
Tony SOQUET

Capella Day
June 20th, 2017

www.thalesgroup.com



RenoATL2 - Context



Maritime Patrol Aircraft (MPA) renovation program

- Led by DGA for French Navy
- TSA as a co-contractor with Dassault Aviation

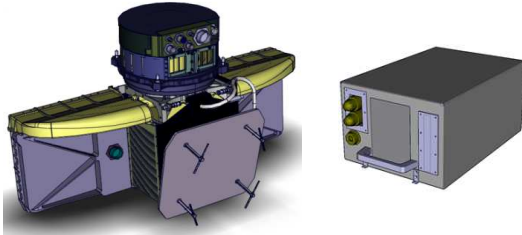
TSA perimeter = SSRI / Sub-System Radar & IFF

TUS perimeter = STAN / Acoustic Processing System

RenoATL2 – SSRI breakdown

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Radar Search Master (TSA)

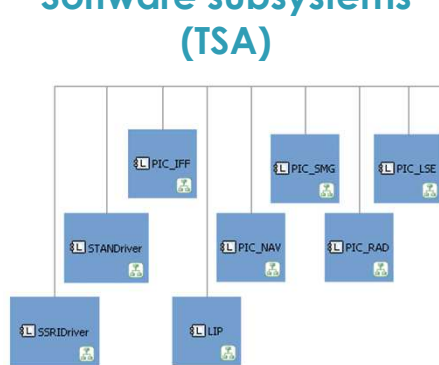


IFF TSA2542 (TCS)

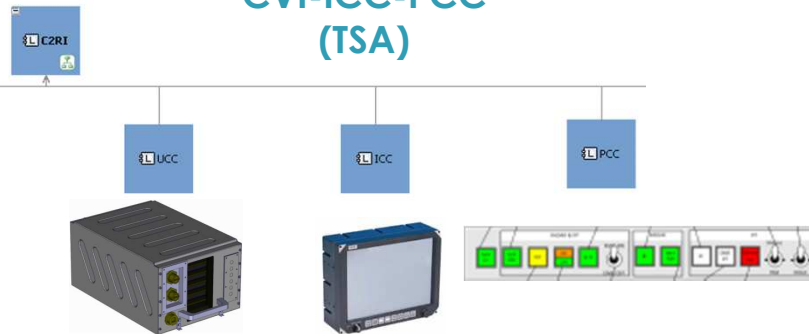


Control & Command

Software subsystems (TSA)

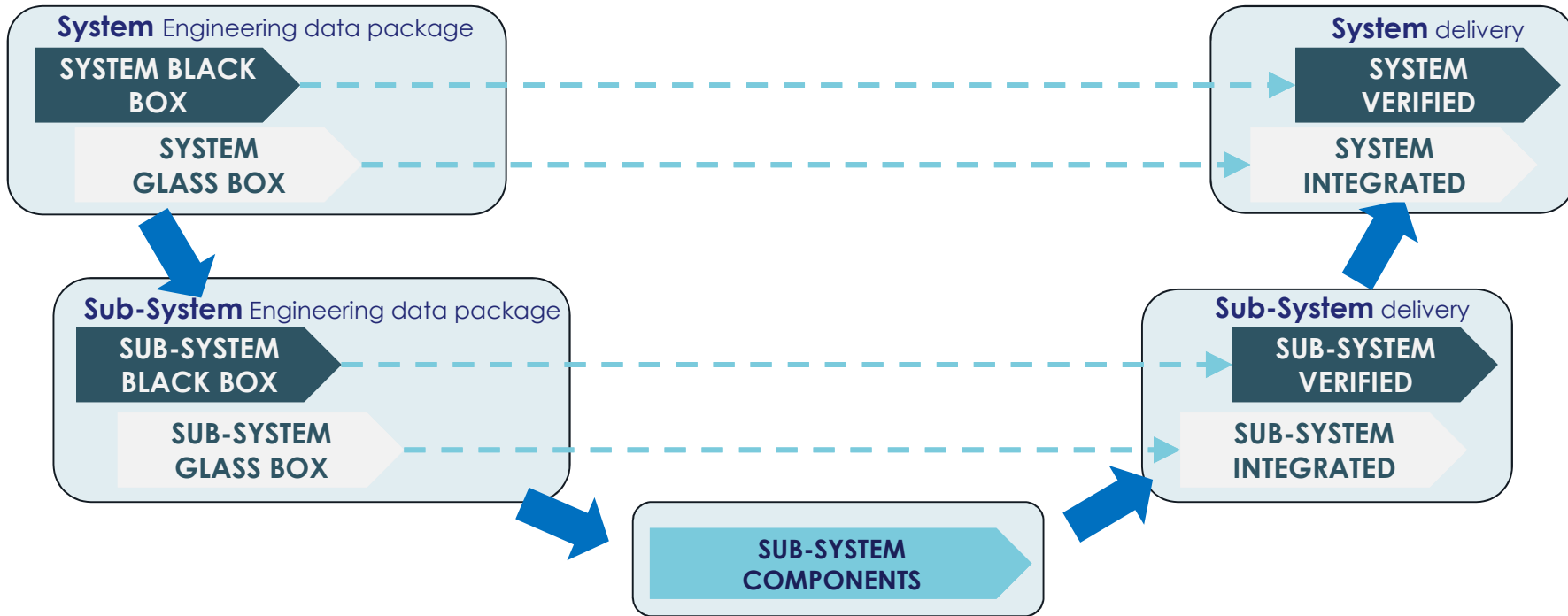


CVI-ICC-PCC (TSA)



RenoATL2 Model Based System Engineering Story line

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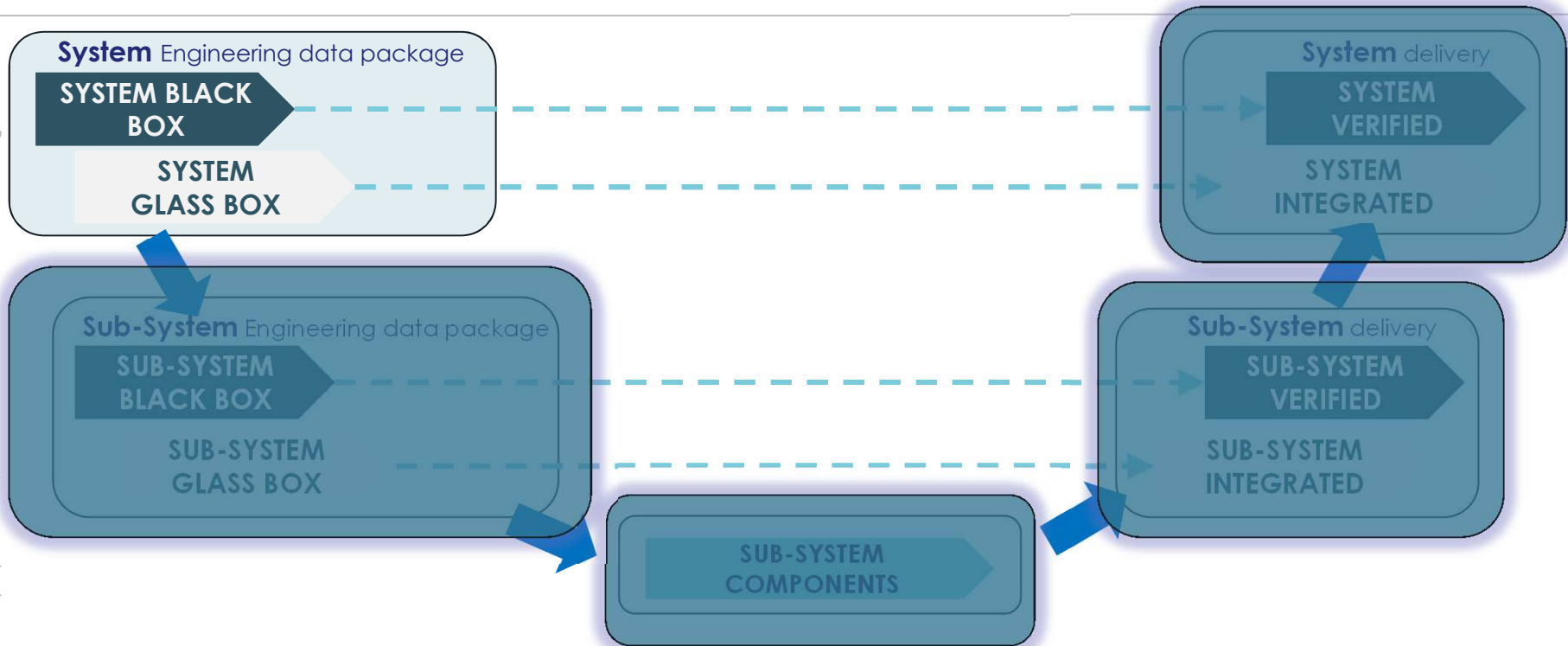


A classic process rolled out by increments

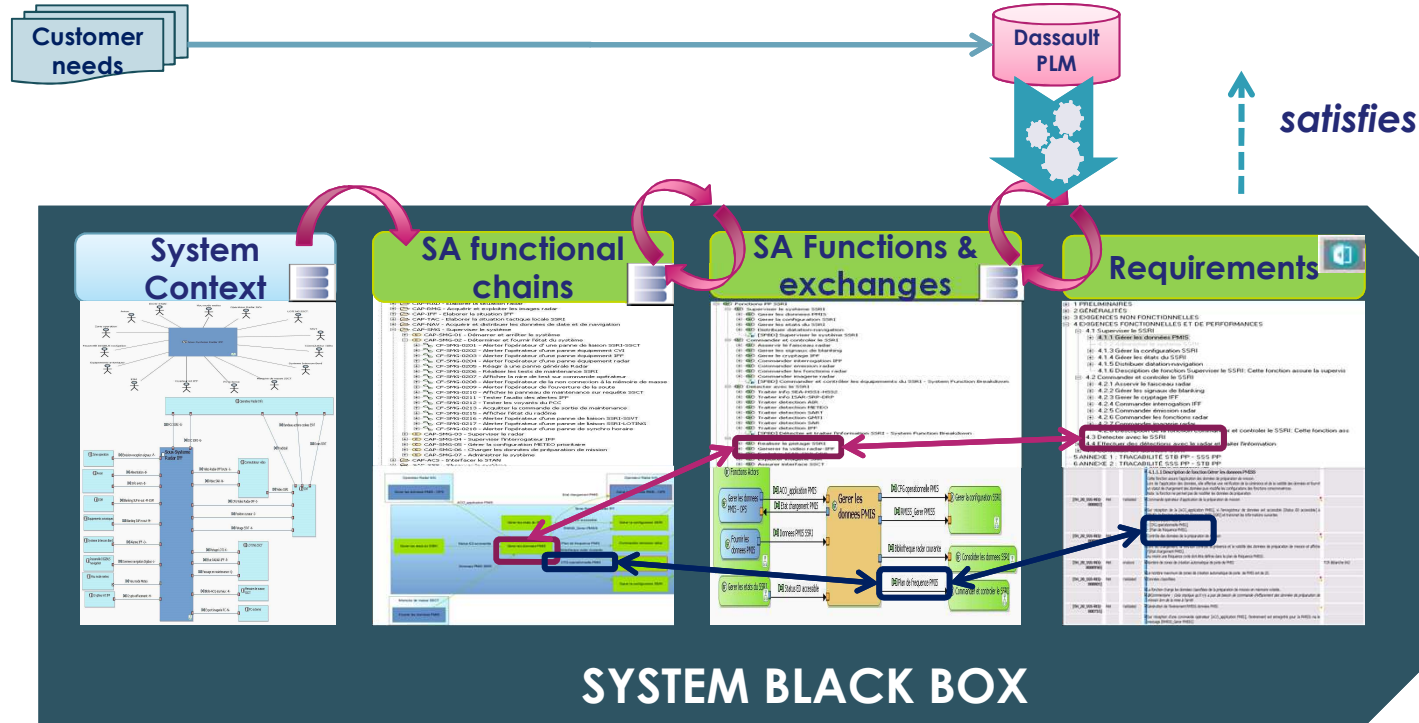
RenoATL2 Model Based System Engineering Story line



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From functional chains to requirements



- 6 capabilities
- 198 funct. Chains
- 24 leaf-functions
- 458 funct. exchanges
- 641 requirements

An efficient functional threesome for a complete and consistent specification

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From functional chains to IVV procedures



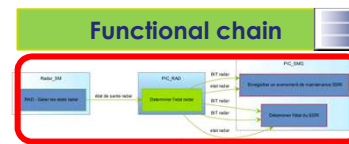
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Functional Chains list

- CF-5MG-0201 - Alerter l'opérateur d'une panne de liaison SSRI-SSCT
- CF-5MG-0202 - Alerter l'opérateur d'une panne équipement CVI
- CF-5MG-0203 - Alerter l'opérateur d'une panne équipement IFF
- CF-5MG-0204 - Alerter l'opérateur d'une panne équipement radar
- CF-5MG-0205 - Réagir à une panne générale Radar

Functional Chains release definition

Version	Date	Components	Composites	Previous	Following	Needs Prev
ATL2 - SSRI						
Other						
SSRI_V0				SSRI_ABE	SSRI_V1	
SSRI_V1				SSRI_V0	SSRI_V2	
SSRI_V2				SSRI_V1	SSRI_V3	
SSRI_ABE				SSRI_V0	SSRI_V3	
SSRI_V3				SSRI_V2	SSRI_V0	



Requirements

- 4.5.5 Assurer interface SSCT
- 4.5.5.1 Gestion de l'état et navigation
- 4.5.5.2 Gestion des états

[TH_20_S55-REQ-000471] Fonction émet à la fréquence de 1Hz le message [SSRI_LOTI_Etat_Systeme_SSR1].

[TH_20_S55-REQ-000471] Fonction élabore [SSRI_LOTI_Etat_Systeme_SSR1] à partir de [Etat_Systeme_SSR1].



IVV Test Suite Repository

Allocate writers in TSR

Refresh from TSR

Orchestra IVV Management Test Suite Repository Dashboard version 3.3.2

THALES

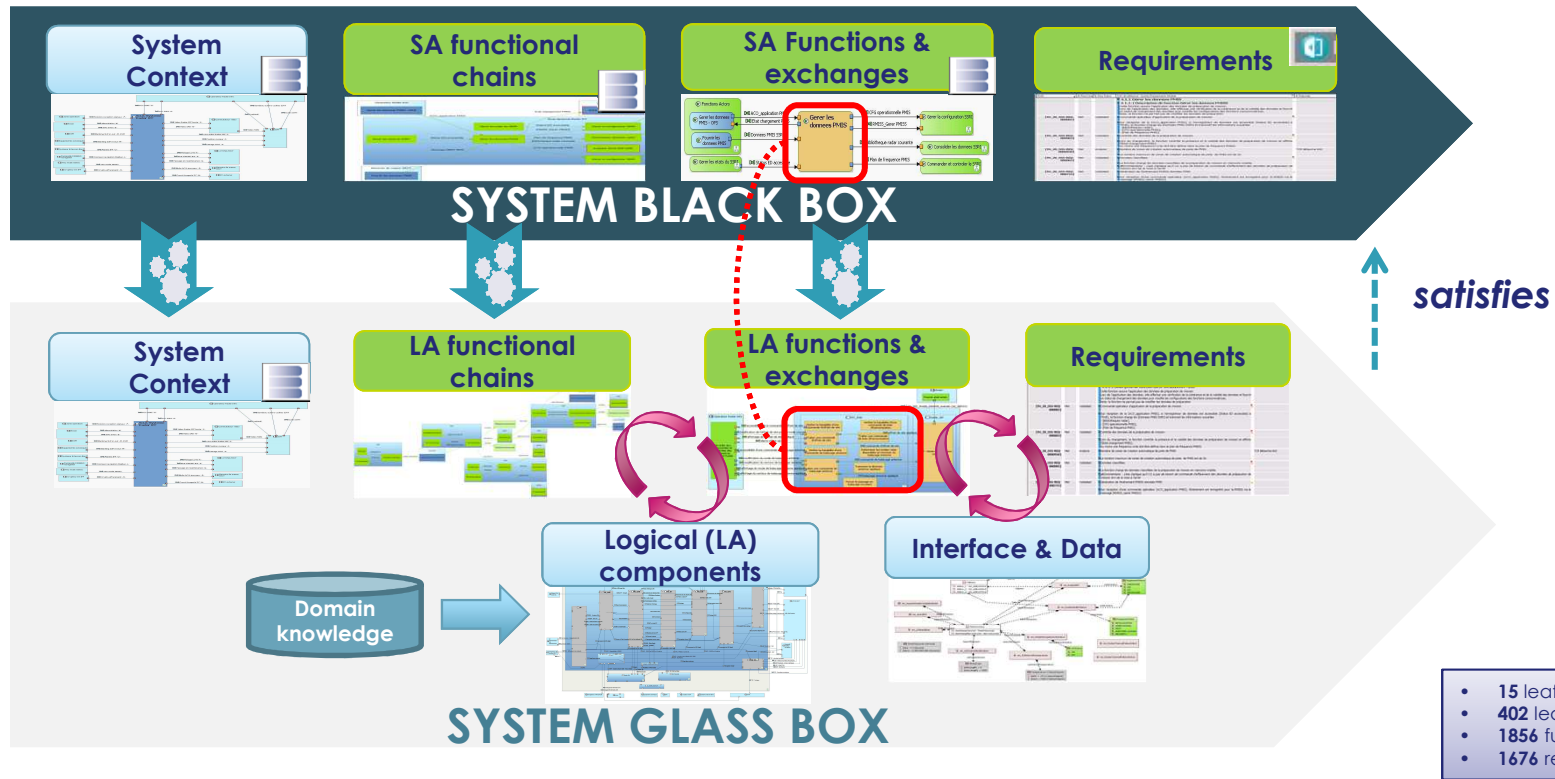
ID	Title	Associated Campaigns
SSRI-VAP-000001	CF-BAD-0101 - Configurer et activer des secteurs d'inhibition d'émission radar (radar seul et	SSRI_V0,SSRI_V1,SSRI_ABE,SSRI_V2,SSRI_V3,SSRI_VBETA
SSRI-VAP-000002	CF-BAD-0102 - Activer l'émission RADAR	SSRI_V0,SSRI_V1,SSRI_ABE,SSRI_V2,SSRI_V3,SSRI_VBETA
SSRI-VAP-000003	CF-BAD-0103 - Inhiber l'émission radar par la plateforme avion	SSRI_V0,SSRI_V1,SSRI_ABE,SSRI_V2,SSRI_V3,SSRI_VBETA
SSRI-VAP-000004	CF-BAD-0104 - Inhiber l'émission radar sur demande opérateur	SSRI_V0,SSRI_V1,SSRI_ABE,SSRI_V2,SSRI_V3,SSRI_VBETA
SSRI-VAP-000005	CF-BAD-0120 - Modifier l'offset de site antenne	SSRI_V0,SSRI_V1,SSRI_V2,SSRI_V3,SSRI_VBETA
SSRI-VAP-000007	CF-BAD-0121 - Modifier l'offset de site antenne lors d'un changement de mode balayé	SSRI_V0,SSRI_V1,SSRI_V2,SSRI_V3,SSRI_VBETA
SSRI-VAP-000008	CF-BAD-0122 - Modifier le balayage antenne radar	SSRI_V0,SSRI_V1,SSRI_V2,SSRI_V3,SSRI_VBETA
SSRI-VAP-000009	CF-BAD-0130 - Modifier le plan de fréquence radar	SSRI_V0,SSRI_V1,SSRI_V2,SSRI_V3
SSRI-VAP-000009	CF-BAD-0131 - Appliquer un décalage de plan de fréquence	SSRI_V0,SSRI_V1,SSRI_V2,SSRI_V3

IVV procedure

	Back to summary	Legends	To be filled	Append test case(s)
3	Positionner l'axe de fin du même secteur à 15°	RI_HMS_OC_ARQ_230: Le bouton "Appliquer" est disponible	Automatically filled	
4	Vérifier que le secteur de blanking est affiché dans la vidéo radar-FF en mode édition	RI_HMS_OC_ARQ_230: Le bouton "Actif" du secteur n°1 est activé. Le nombre de secteurs actifs est de 1.	Context	TH_20_S55-REQ-000397 (-3)
5	Appliquer le secteur de blanking défini.	RI_HMS_OC_ARQ_230: Le bouton "Actif" du secteur n°1 est activé. Le nombre de secteurs actifs est de 1.	Phase	TH_20_S55-REQ-000397 (-3)
6	Activer le secteur de blanking n°1	RI_HMS_OC_ARQ_230: Le bouton "Actif" du secteur n°1 est activé. Le nombre de secteurs actifs est de 1.		TH_20_S55-REQ-000179 (-2)
7	Vérifier que le secteur de blanking n°1 est affiché dans la vidéo radar-FF	RI_HMS_OC_ARQ_230: Le bouton "Actif" du secteur n°1 est activé. Le nombre de secteurs actifs est de 1.		TH_20_S55-REQ-000397 (-3)

The functional chain as a starting point of IVV activities

Functional Chains through System Architecture



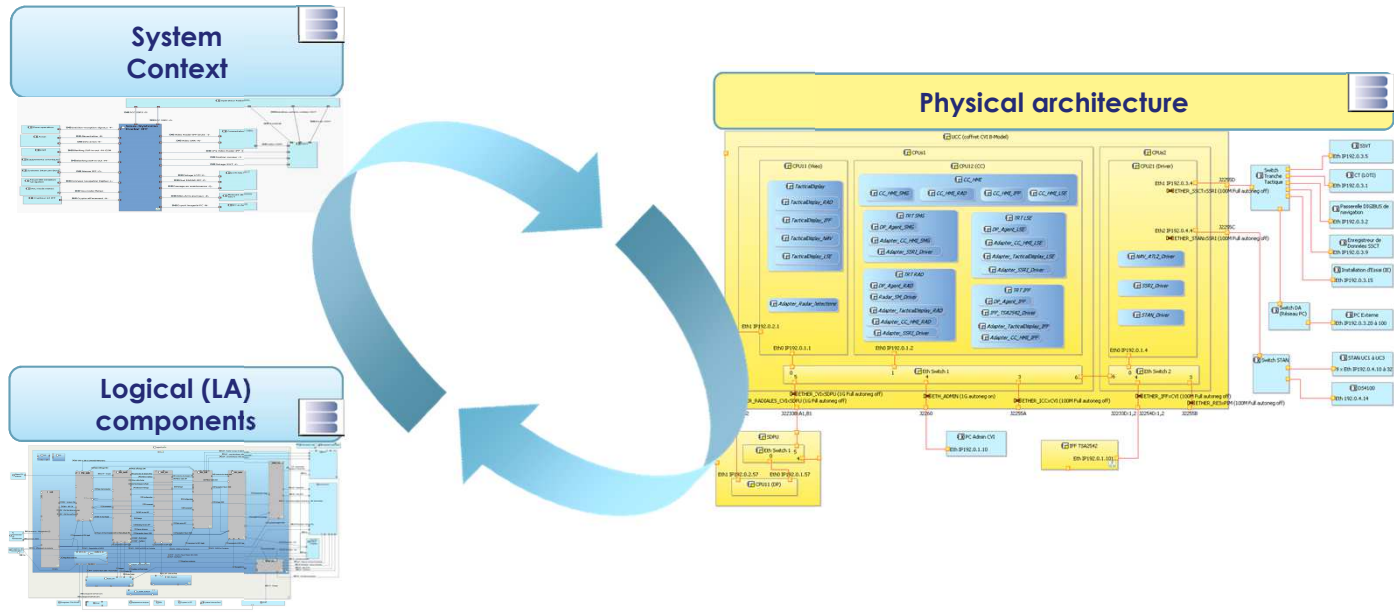
When the functional threesome has to comply with the architecture...

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Physical Architecture

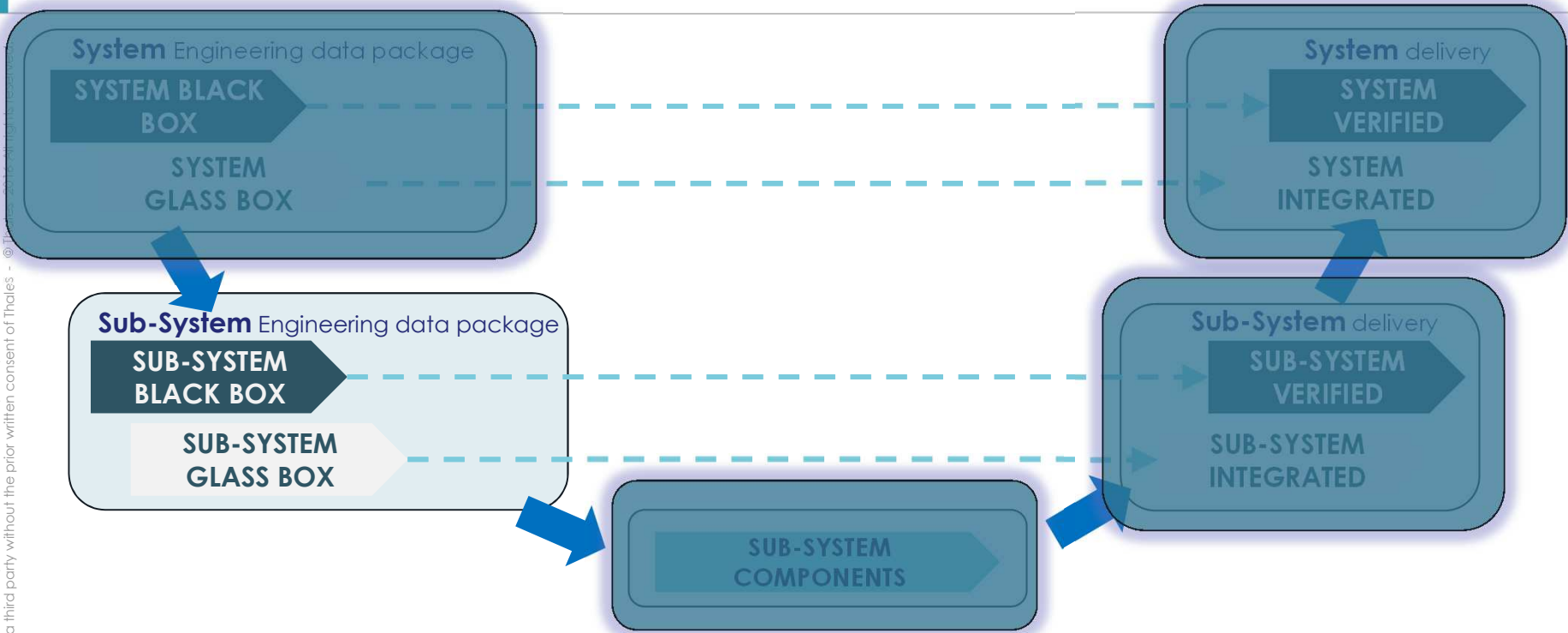


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Let's talk about wiring and network !

RenoATL2 Model Based System Engineering Story line



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System engineering data validation (1/2)



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System Logical Architecture

LA functional chains

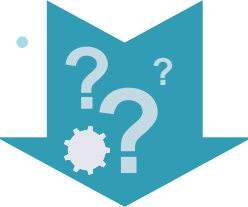
System Internal Data

Requirements

- 4.5.5 Assurer interface SSCT
- 4.5.5.1 Gestion-état-et-navigation
- 4.5.5.2 Gestion des états
- Transmission de état SSRI
- [TH_20_S55-REQ-000471] La fonction émet à la fréquence de 1Hz le message [SSRI_LOTT_Etat_Systeme_S55RI]
- [TH_20_S55-REQ-000474] La fonction émet à la fréquence de 1Hz le message [SSRI_LOTT_Etat_Systeme_S55RI]
- [TH_20_S55-REQ-000474] La fonction élabore [SSRI_LOTT_Etat_Systeme_S55RI] à partir de [Etat système SSRI]

SYSTEM GLASS BOX

All functional exchanges are involved in a functional chain ?



Is there a function not allocated to a sub-system ?

Sub-system interfaces allow to develop its functions at the edge ?

Query Tool Result

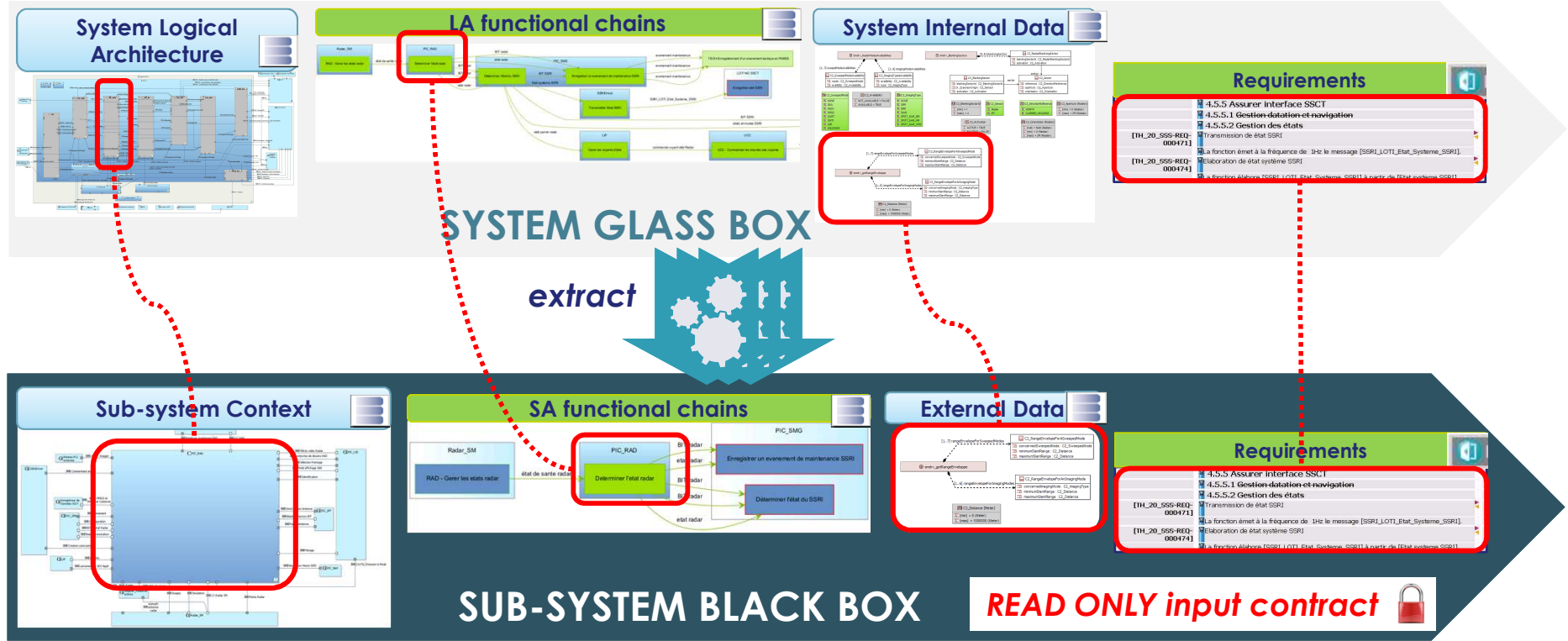
C	r	pc	ksnd	External	External
Adaptateur_RadarDetections	Emetteur signaux de vie Adaptateur_Radar...	signaux de vie Adaptateur_RadarDetections	OUTPUT	Genere les signaux de vie CVI	LP
Adaptateur_SSRI	Adaptateur Interface PCC_LSE vers le SSR...	Etat des postes SSRI	INPUT	Mettre à jour les postes SSRI	EP_Agent_LSE
Adaptateur_SSRI	Adaptateur Interface PCC_LSE vers le SSR...	acquisition creation de poste SSRI	OUTPUT	Ajouter les commandes postes	SSRI_Driver
Adaptateur_SSRI	Adaptateur Interface PCC_LSE vers le SSR...	acquisition repositionnement de post...	INPUT	Repositionner une poste SSRI par ant...	EP_Agent_LSE
Adaptateur_SSRI	Adaptateur Interface PCC_LSE vers le SSR...	poste SSRI	OUTPUT	Transmettre les postes SSRI	SSRI_Driver
Adaptateur_SSRI	Adaptateur Interface PCC_LSE vers le SSR...	nouvelle position de poste SSRI	OUTPUT	Repositionner une poste SSRI par ant...	EP_Agent_LSE
Adaptateur_SSRI	Adaptateur Interface PCC_LSE vers le SSR...	nouvelle position de poste SSRI	INPUT	Ajouter les commandes postes	SSRI_Driver
Adaptateur_SSRI	Adaptateur Interface PCC_LSE vers le SSR...	poste SSRI à supprimer	OUTPUT	Annuler les postes SSRI en cours de su...	EP_Agent_LSE
Adaptateur_SSRI	Adaptateur Interface PCC_LSE vers le SSR...	acquisition creation de poste SSRI	INPUT	Creer une poste SSRI manuelle par ant...	EP_Agent_LSE
Adaptateur_SSRI	Adaptateur Interface PCC_LSE vers le SSR...	acquisition repositionnement de post...	OUTPUT	Ajouter les commandes postes	SSRI_Driver
Adaptateur_SSRI	Adaptateur Interface PCC_LSE vers le SSR...	parametres de creation de poste SSRI	OUTPUT	Creer une poste SSRI manuelle par ant...	EP_Agent_LSE
Adaptateur_SSRI	Adaptateur Interface PCC_LSE vers le SSR...	parametres de creation de poste SSRI	INPUT	Ajouter les commandes postes	SSRI_Driver
Adaptateur_SSRI	Adaptateur Interface PCC_LSE vers le SSR...	poste SSRI à supprimer	INPUT	Ajouter les commandes postes	SSRI_Driver
EP_C_PCC_LSE	OUTPU Assurer l'interconnexion pour ch...	parametres de creation de poste SSRI	OUTPUT	Creer une poste SSRI manuelle par ant...	EP_Agent_LSE

Start System Integration before its development !

Transition From System to Sub-Systems engineering



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A tooling up and iterative extraction

From functional chains to IVV procedures



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- CF-5MG-0204 - Alerter l'opérateur d'une panne équipement radar
- CF-5MG-0205 - Réagir à une panne générale Radar

Functional Chains release definition

Version	Date	Components	Composites	Previous	Following	Needs Prev
ATL2 - SSRI						
Other						
SSRI_V0				SSRI_ABE	SSRI_V1	
SSRI_V1				SSRI_V0	SSRI_V2	
SSRI_V2				SSRI_V1	SSRI_V3	
SSRI_ABE				SSRI_V2		
SSRI_V3						
SSRI_V4						
SSRI_V5						
SSRI_V6						



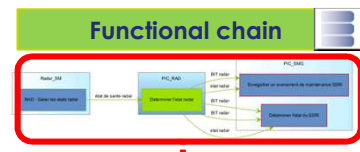
IVV Test Suite Repository

Allocate writers in TSR | Refresh from TSR

Orchestra IVV Management Test Suite Repository Dashboard version 3.3.2

THALES

ID	Title	Associated Campaigns
SSRI-VAP-000001	CF-RAD-0101 - Configurer et activer des secteurs d'inhibition d'émission radar (radar seul et	SSRI_V0,SSRI_V1,SSRI_V2,SSRI_V3,SSRI_V4,SSRI_V5,SSRI_V6,SSRI_V7,SSRI_V8,SSRI_V9,SSRI_VBETA
SSRI-VAP-000002	CF-RAD-0102 - Activer l'émission RADAR	SSRI_V0,SSRI_V1,SSRI_V2,SSRI_V3,SSRI_V4,SSRI_V5,SSRI_V6,SSRI_V7,SSRI_V8,SSRI_V9,SSRI_VBETA
SSRI-VAP-000003	CF-RAD-0103 - Inhiber l'émission radar par la plateforme avion	SSRI_V0,SSRI_V1,SSRI_V2,SSRI_V3,SSRI_V4,SSRI_V5,SSRI_V6,SSRI_V7,SSRI_V8,SSRI_V9,SSRI_VBETA
SSRI-VAP-000004	CF-RAD-0104 - Inhiber l'émission radar sur demande opérateur	SSRI_V0,SSRI_V1,SSRI_V2,SSRI_V3,SSRI_V4,SSRI_V5,SSRI_V6,SSRI_V7,SSRI_V8,SSRI_V9,SSRI_VBETA
SSRI-VAP-000005	CF-RAD-0120 - Modifier l'offset de site antenne	SSRI_V0,SSRI_V1,SSRI_V2,SSRI_V3,SSRI_V4,SSRI_V5,SSRI_V6,SSRI_V7,SSRI_V8,SSRI_V9,SSRI_VBETA
SSRI-VAP-000006	CF-RAD-0121 - Modifier l'offset de site antenne lors d'un changement de mode balayé	SSRI_V0,SSRI_V1,SSRI_V2,SSRI_V3,SSRI_V4,SSRI_V5,SSRI_V6,SSRI_V7,SSRI_V8,SSRI_V9,SSRI_VBETA
SSRI-VAP-000007	CF-RAD-0122 - Modifier le balayage antenne radar	SSRI_V0,SSRI_V1,SSRI_V2,SSRI_V3,SSRI_V4,SSRI_V5,SSRI_V6,SSRI_V7,SSRI_V8,SSRI_V9,SSRI_VBETA
SSRI-VAP-000008	CF-RAD-0130 - Modifier le plan de fréquence radar	SSRI_V0,SSRI_V1,SSRI_V2,SSRI_V3,SSRI_V4,SSRI_V5,SSRI_V6,SSRI_V7,SSRI_V8,SSRI_V9,SSRI_VBETA
SSRI-VAP-000009	CF-RAD-0131 - Appeler un décalage de plan de fréquence	SSRI_V0,SSRI_V1,SSRI_V2,SSRI_V3,SSRI_V4,SSRI_V5,SSRI_V6,SSRI_V7,SSRI_V8,SSRI_V9,SSRI_VBETA



Requirements

- 4.5.5 Assurer interface SSCT
- 4.5.5.1 Gestion d'activation et navigation
- 4.5.5.2 Gestion des états

[TH_20_S55-REQ-000471] Fonction émet à la fréquence de 1Hz le message [SSRI_LOTT_Etat_Systeme_SSRI].

[TH_20_S55-REQ-000471] Fonction élabore [SSRI_LOTT_Etat_Systeme_SSRI] à partir de [Etat_Systeme_SSRI].

IVV procedure

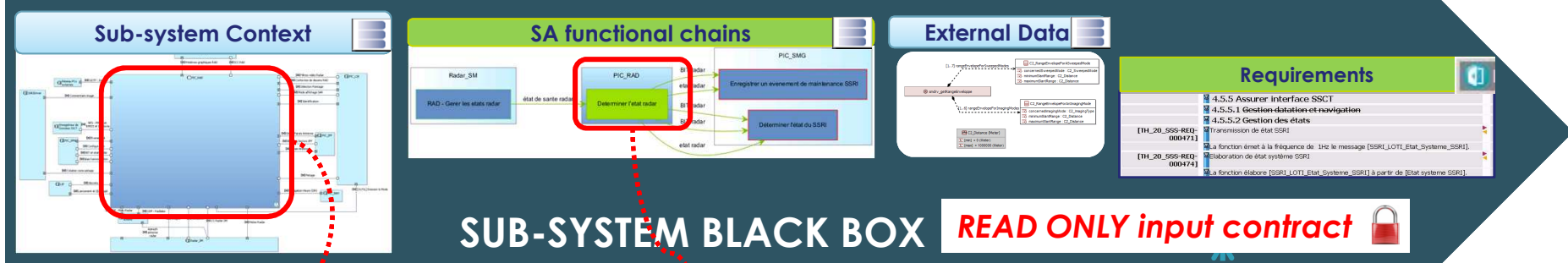
	Back to summary	Legends	To be filled	Append test case(s)
3	Positionner l'axe de fin du même secteur à 15°	RI_JMS_OC_ARQ_230: Le bouton "Appliquer" est disponible	TH_20_S55-REQ-000397 (-3)	
4	Vérifier que le secteur de blanking est affiché dans la vidéo radar-FF en mode édition	RI_JMS_OC_ARQ_230: Le bouton "Actif" du secteur n°1 est activé. Le nombre de secteurs actifs est de 1.	TH_20_S55-REQ-000397 (-3)	
5	Appliquer le secteur de blanking défini.	RI_JMS_OC_ARQ_230: Le bouton "Actif" du secteur n°1 est activé. Le nombre de secteurs actifs est de 1.	TH_20_S55-REQ-000179 (-2)	
6	Activer le secteur de blanking n°1	RI_JMS_OC_ARQ_230: Le bouton "Actif" du secteur n°1 est activé. Le nombre de secteurs actifs est de 1.	TH_20_S55-REQ-000397 (-3)	
7	Vérifier que le secteur de blanking n°1 est affiché dans la vidéo radar-FF	RI_JMS_OC_ARQ_230: Le bouton "Actif" du secteur n°1 est activé. Le nombre de secteurs actifs est de 1.	TH_20_S55-REQ-000397 (-3)	

Same process than System one : writing IVV procedures is a piece of cake !

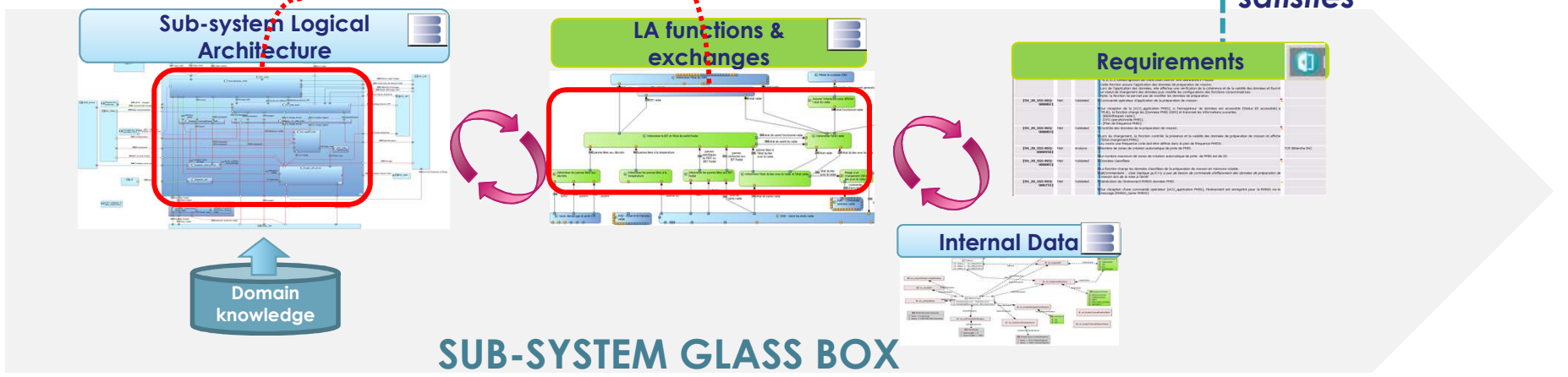
From need to solution



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SUB-SYSTEM BLACK BOX **READ ONLY input contract**

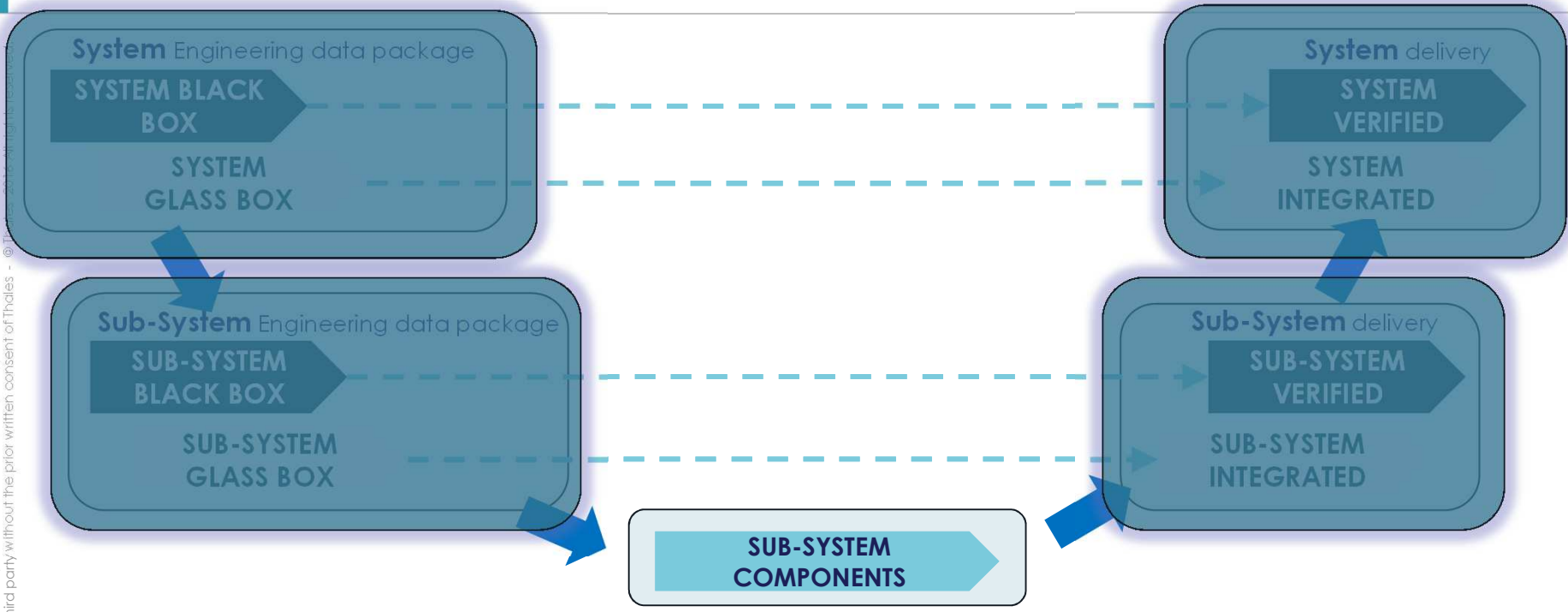


SUB-SYSTEM GLASS BOX

Same process than System one : refine and iterate !

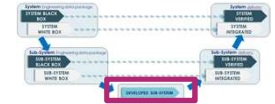


RenoATL2 Model Based System Engineering Story line

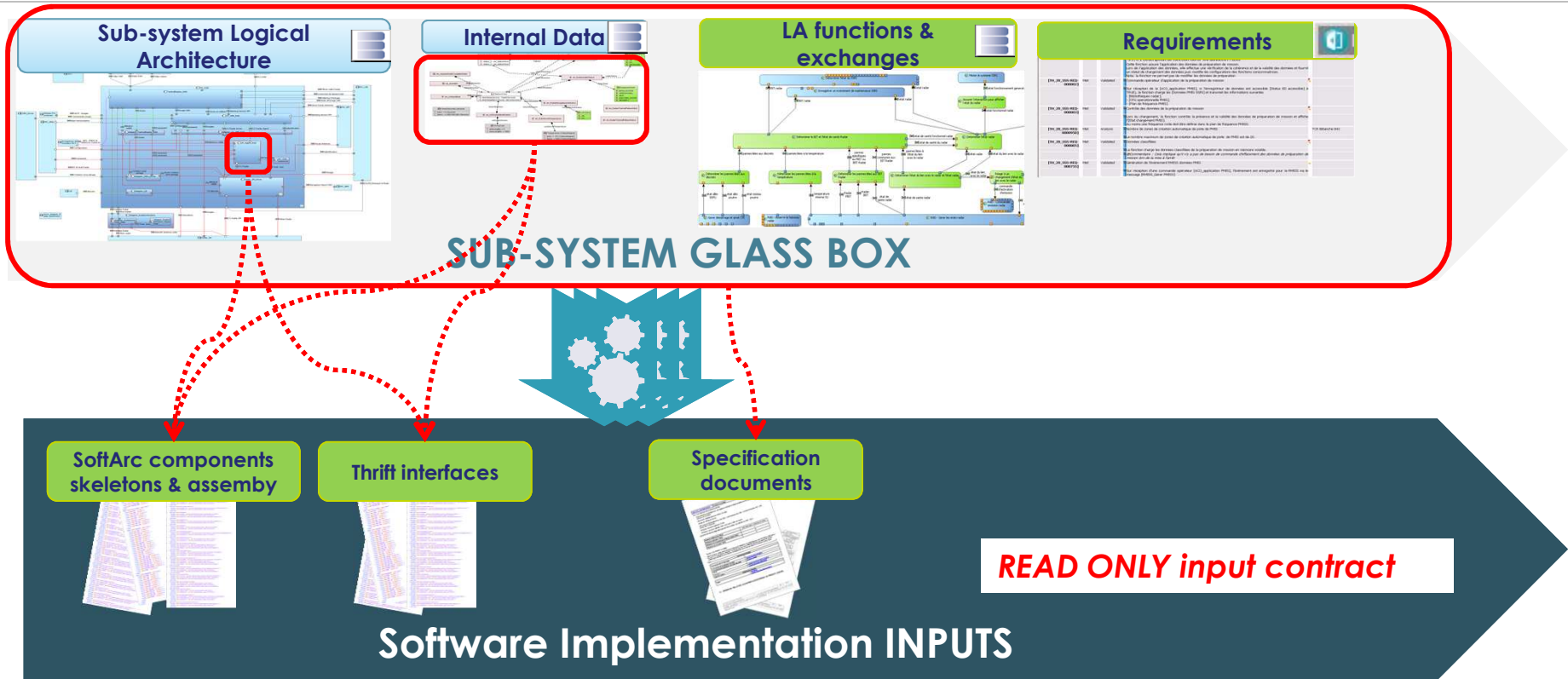


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Transition From Sub-System engineering to development

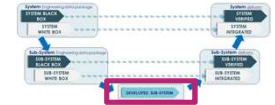


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Tooled up extraction for a strongly consistent set !

Software components implementation and test

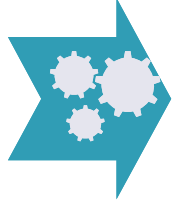


Software Implementation INPUTS



SW component implementation

SW component unitary tests

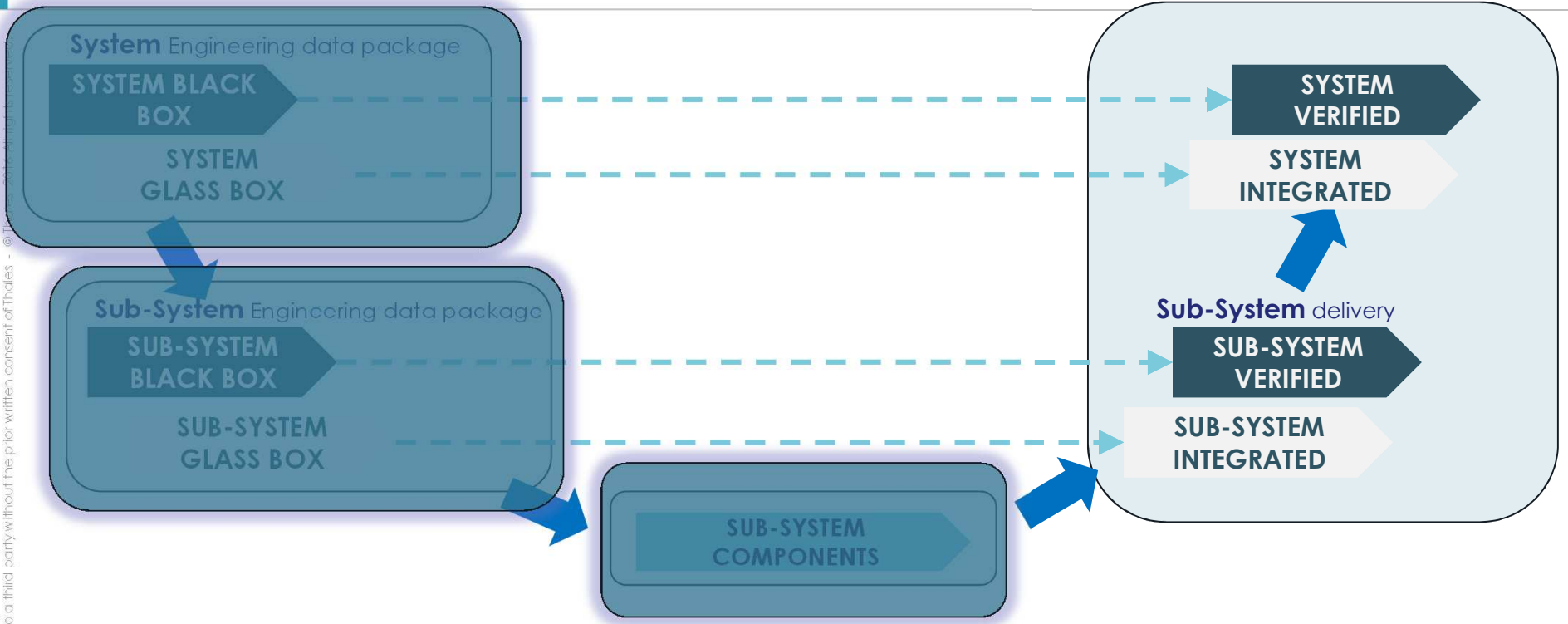



Conformity Matrix

Modeling facilitates automation

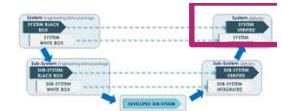
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RenoATL2 Model Based System Engineering Story line

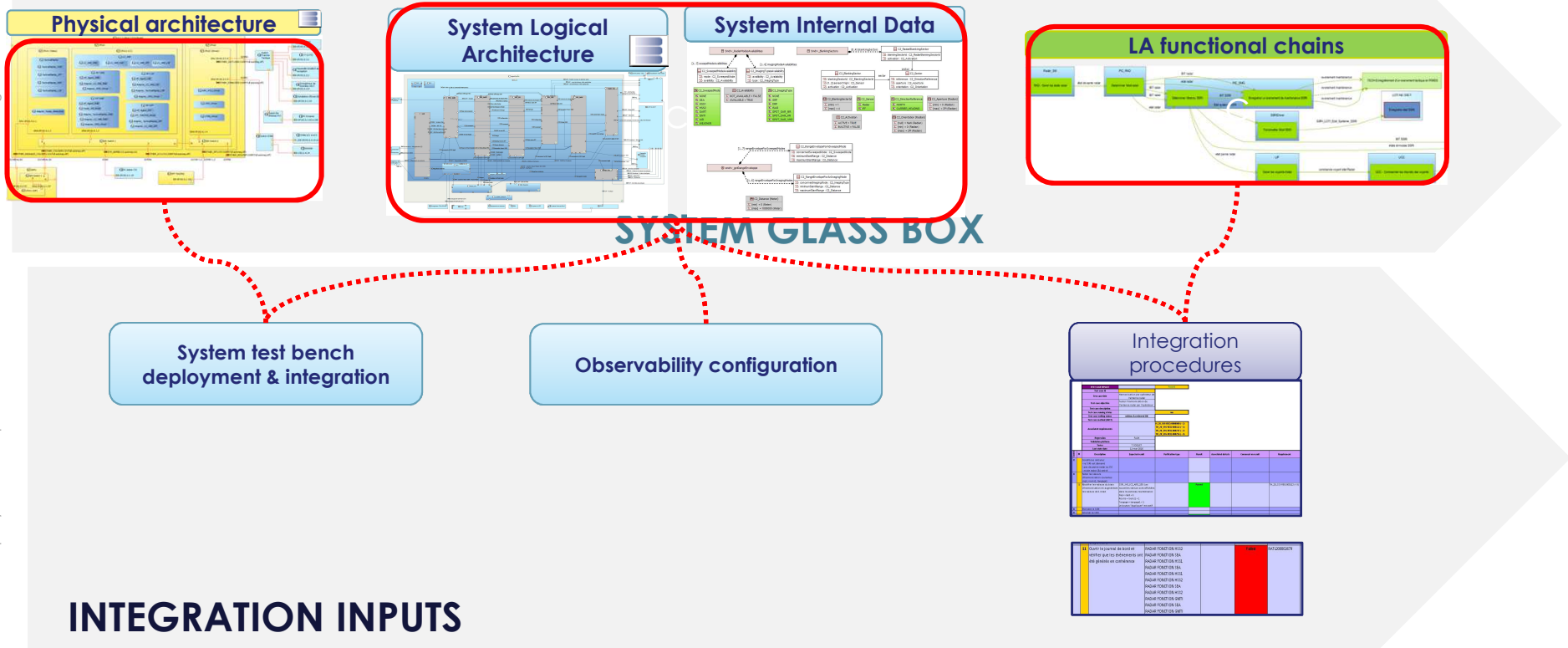


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System integration

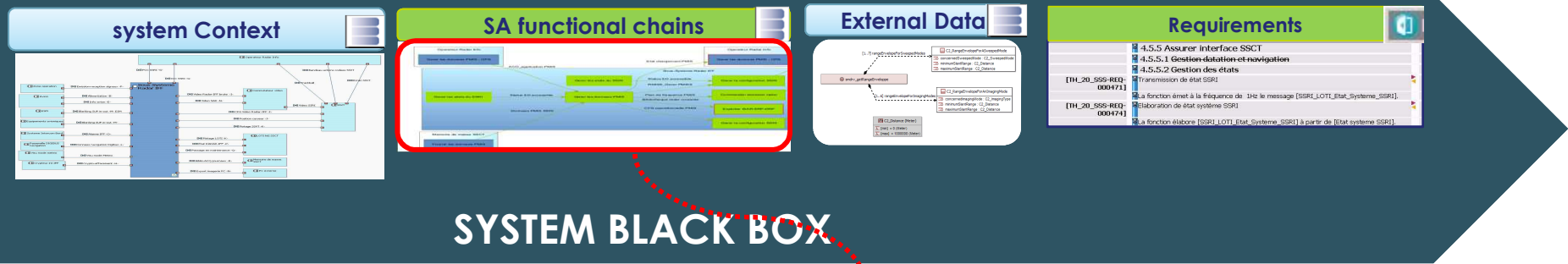
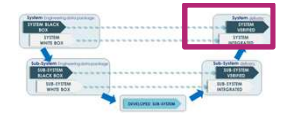


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Modeling facilitates test bench deployment, integration and observability

System verification



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system + test bench

Test suites

Back to summary	Issues	Appart test case(s)
1. Fonctionnalité de base de données de l'ETI	RMG_0101_00001	RMG_0101_00001
2. Fonctionnalité de base de données de l'ETI	RMG_0101_00002	RMG_0101_00002
3. Fonctionnalité de base de données de l'ETI	RMG_0101_00003	RMG_0101_00003
4. Fonctionnalité de base de données de l'ETI	RMG_0101_00004	RMG_0101_00004

Test results

Issue	Severity	Test	Pass	Fail	Not run	Blocked
RMG_0101_00001	High	RMG_0101_00001	1	0	0	0
RMG_0101_00002	High	RMG_0101_00002	1	0	0	0
RMG_0101_00003	High	RMG_0101_00003	1	0	0	0
RMG_0101_00004	High	RMG_0101_00004	1	0	0	0

Defects

Vue Defect RATL200001363 (T0012865,CHARM_BRE@RATL2)

Submission | Analysis | Decision | Realisation | Verification | Closure | Hierarchical Links | Clone Link

Capacité : RMG-Acquérir et exploiter les images radar
(Free_Field_choice_03)

Sous-Capacité : RMG-04-Lancer et afficher une acquisition ISAR
(Free_Field_choice_04)

Chaîne Fonctionnelle : RMG-0101 Lancer l'acquisition d'une image ISA

FUNCTIONAL CHAIN OBSERVABILITY

VERIFICATION INPUTS

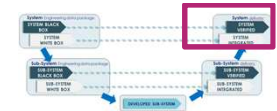
System FC status

Conformity Matrix

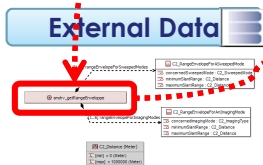
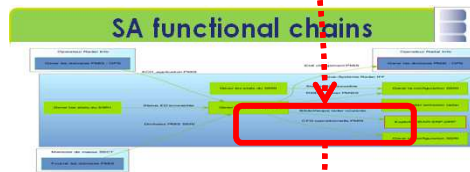
Modeling facilitates work organisation and reporting

Technical event analysis

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Test suites	
Back to summary	Appel test case(s)
1. Test suite de vérification de la configuration de l'application	1. Vérification de la configuration de l'application
2. Test suite de vérification de la configuration de l'application	2. Vérification de la configuration de l'application
3. Test suite de vérification de la configuration de l'application	3. Vérification de la configuration de l'application
4. Test suite de vérification de la configuration de l'application	4. Vérification de la configuration de l'application



Check of consistency with specification

Requirements

- 4.5.5 Assurer Interface SSCT
- 4.5.5.1 Gestion de l'état de navigation
- 4.5.5.2 Gestion des états

LA functions & exchanges

Observability Configuration & analysis

Specification Defects

Vue Defect RATL200001363 (10012865,CHARM_BRE@RATL2)

Submission | Analysis | Decision | Realisation | Verification | Closure | Hierarchical Links | Clone Link

Capacité (free_field_choice_03) : RMG-Acquiere et exploiter les images radar

Sous-Capacité (free_field_choice_04) : RMG-04-Lancer et afficher une acquisition ISAR

Chaîne Fonctionnelle : RMG-0101 Lancer l'acquisition d'une image ISA

Component Defects

Vue Defect RATL200001363 (10012865,CHARM_BRE@RATL2)

Submission | Analysis | Decision | Realisation | Verification | Closure | Hierarchical Links | Clone Link

Capacité (free_field_choice_03) : RMG-Acquiere et exploiter les images radar

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Component Evolution

Vue Defect RATL200001363 (10012865,CHARM_BRE@RATL2)

Submission | Analysis | Decision | Realisation | Verification | Closure | Hierarchical Links | Clone Link

Capacité (free_field_choice_03) : RMG-Acquiere et exploiter les images radar

Sous-Capacité (free_field_choice_04) : RMG-04-Lancer et afficher une acquisition ISAR

Chaîne Fonctionnelle : RMG-0101 Lancer l'acquisition d'une image ISA

VERIFICATION INPUTS

Modeling facilitates defects analysis

Lessons learnt (1/2)

What are the keys for success ?

- Model shall be at the heart of engineering activities
- Functional chains shall be the keystone of technical activities monitoring
- Transitions between engineering phases / development shall be defined and toolled up
- Do not under estimate activities for process and tools definition
- Integrated coaching
- Trust and Resilience !

Lessons learnt (2/2)

Benefits

- A shared feeling of getting engineering activities under control
- Engineering data is easy to share and ready for reuse
- Efficient and natural fight against silos
- Mastering activities brings real serenity
- Modelling can be an easy and cost saving way to work

Way forward

- Share our experience
- Challenge and improve process and tools

Questions



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