THALES

ATL2 modernization
When MBSE keeps its promises

Guillaume JOURNAUX
Tony SOQUET

Capella Day
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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

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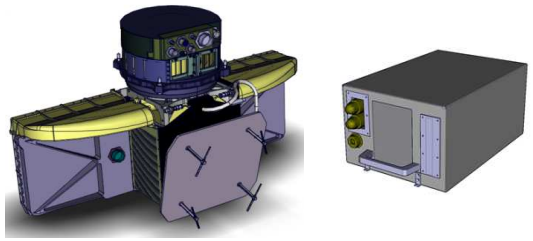
RenoATL2 – SSRI breakdown

Radar Search Master (TSA)



IFF TSA2542 (TCS)

Control & Command

Software subsystems (TSA)

CVI-ICC-PCC (TSA)

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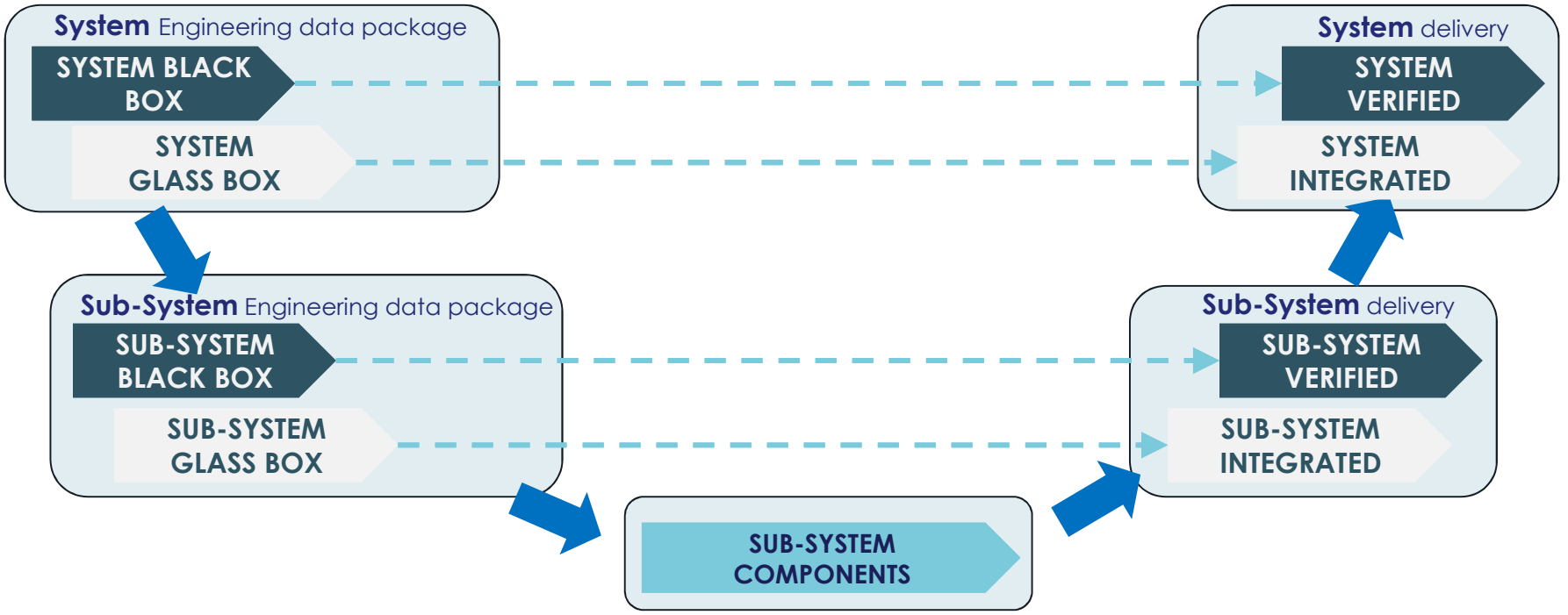
RenoATL2 Model Based System Engineering Story line



A classic process rolled out by increments

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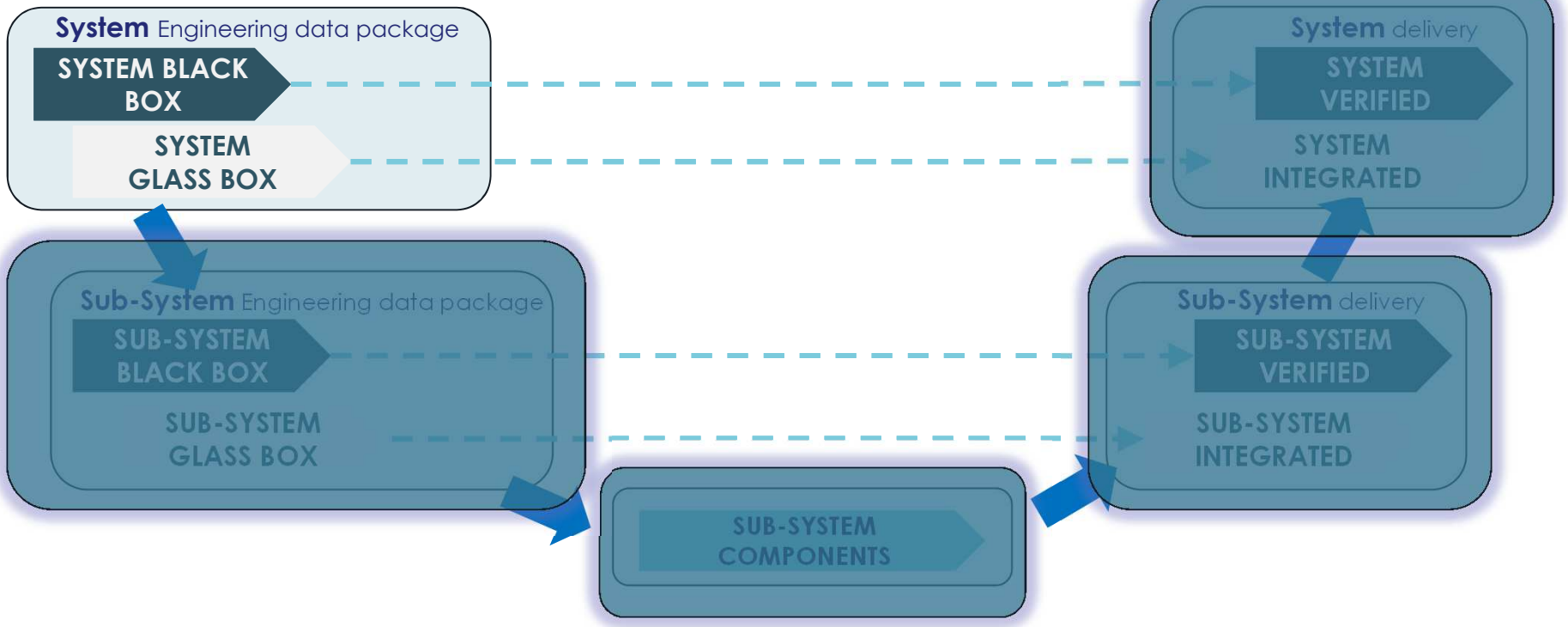
RenoATL2 Model Based System Engineering Story line



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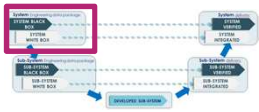
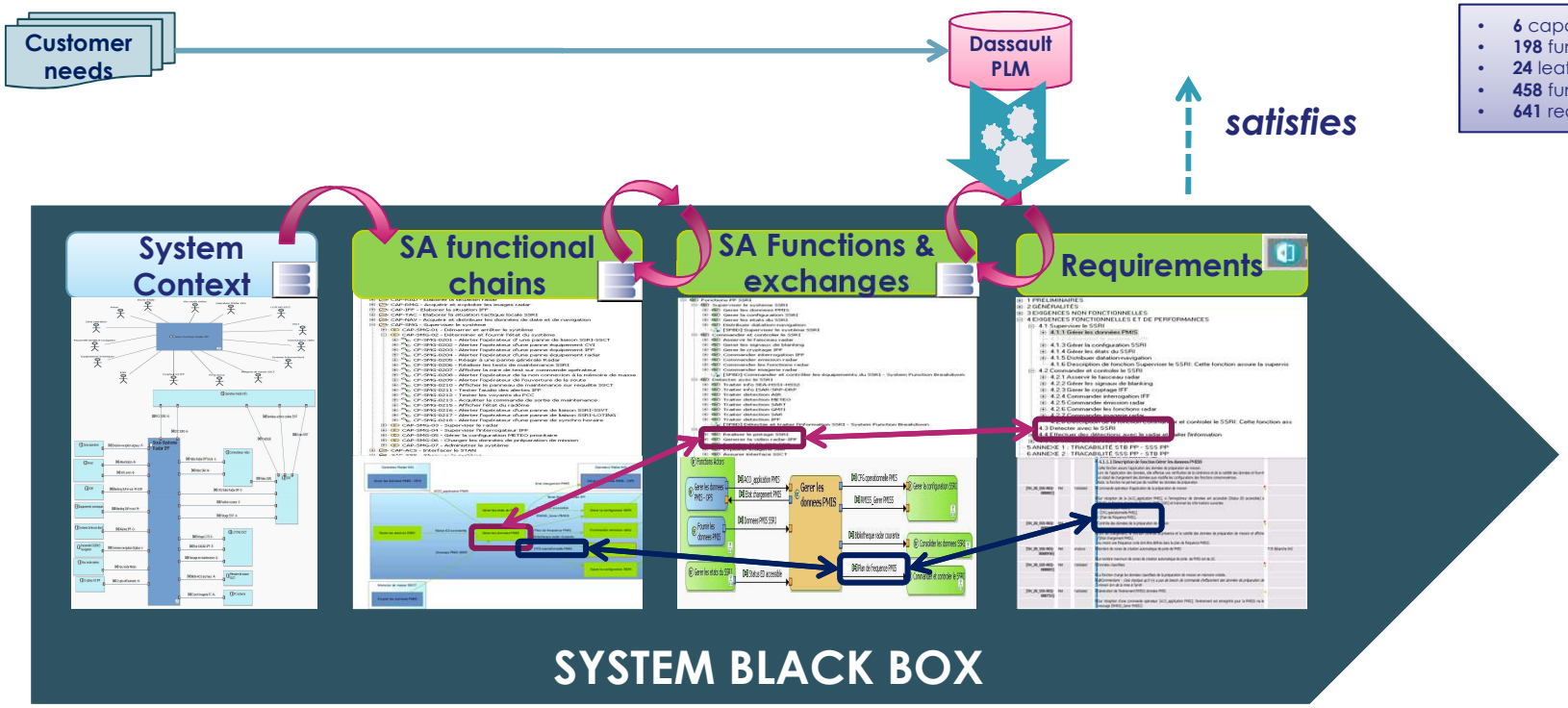
From functional chains to requirements





- **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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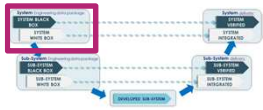
From functional chains to IVV procedures



Functional Chains list

CAP-SMG-02 - Déterminer et fournir l'état du système
- CF-SMG-0201 - Alerter l'opérateur d' une panne de liaison SSRI-SSCT
- CF-SMG-0202 - Alerter l'opérateur d'une panne équipement CVI
- CF-SMG-0203 - Alerter l'opérateur d'une panne équipement IFF
- CF-SMG-0204 - Alerter l'opérateur d'une panne équipement radar
- CF-SMG-0205 - Réagir à une panne générale Radar

Functional Chains release definition

ATL2 - SSRI

Version	Date	Components	Composites	Previous	Following	Needs Prep
REQUESTED						
Other						
SSRI_V0				SSRI_ABE	SSRI_V1	
SSRI_V1				SSRI_V0	SSRI_V2	
SSRI_V2				SSRI_V1	SSRI_V3	
SSRI_BCS						
SSRI_V3				SSRI_V2		
SSRI_ABE					SSRI_V0	
DEVELOPED						

Functional chain

Requirements

- 4.5.5 Assurer Interface SSCT
- 4.5.5.1 ~~Gestion datation et navigation~~
- 4.5.5.2 Gestion des états

[TH_20_SSS-REQ-000471]	Transmission de état SSRI
	La fonction émet à la fréquence de 1Hz le message [SSRI_LOTI_Etat_Systeme_SSRI].
[TH_20_SSS-REQ-000474]	Elaboration de état système SSRI
	La fonction élabore [SSRI_LOTI_Etat_Systeme_SSRI] à partir de [Etat systeme SSRI].

IVV Test Suite Repository

ID	Title	Associated Campaigns
SSRI-IVVP-000001	CF-RAD-0101 - Configurer et activer des secteurs d'inhibition d'émission radar (radar seul et	$SRI_V0,$SRI_V1,$SRI_ABE,$SRI_V2,$SRI_V3,$SRI_VBETA
SSRI-IVVP-000002	CF-RAD-0102 - Activer l'emission RADAR	$SRI_V0,$SRI_V1,$SRI_ABE,$SRI_V2,$SRI_V3,$SRI_VBETA
SSRI-IVVP-000003	CF-RAD-0103 - Inhiber l'émission radar par la plateforme avion	$SRI_V0,$SRI_V1,$SRI_ABE,$SRI_V2,$SRI_V3,$SRI_VBETA
SSRI-IVVP-000004	CF-RAD-0104 - Inhiber l'émission radar sur demande opérateur	$SRI_V0,$SRI_V1,$SRI_ABE,$SRI_V2,$SRI_V3,$SRI_VBETA
SSRI-IVVP-000005	CF-RAD-0120 - Modifier l'offset de site antenne	$SRI_V0,$SRI_V1,$SRI_V2,$SRI_V3,$SRI_VBETA
	CF-RAD-0121 - Modifier l'offset de site antenne lors d'un changement de mode balayé	
SSRI-IVVP-000007	CF-RAD-0122 - Modifier le balayage antenne radar	$SRI_V0,$SRI_V1,$SRI_V2,$SRI_V3,$SRI_VBETA
SSRI-IVVP-000008	CF-RAD-0130 - Modifier le plan de fréquence radar	$SRI_V0,$SRI_V1,$SRI_V2,$SRI_V3
SSRI-IVVP-000009	CF-RAD-0131 - Appliquer un décalage de plan de fréquence	$SRI_V0,$SRI_V1,$SRI_V2,$SRI_V3

IVV procedure

Back to summary | Append test case(s)

Legends: To be filled | Automatically filled | Context | Phase

3	Positionner l'axe de fin du même secteur à 15°	$SRI_IHS_ICC_ARO_230: Le bouton "Appliquer" est disponible.		
4	Vérifier que le secteur de blanking est affiché dans la video radar-FF en mode édition	\\hrtfs01\vdisque (\AFF_Reno_ATL2_Allier\PP_SSRI\Artefacts\V\Vmngt\IVV\TSRITestSuites\Common\Blanking_radar.jpg		TH_20_SSS-REQ-000397 (--3)
5	Appliquer le secteur de blanking défini	$SRI_IHS_ICC_ARO_230: Le secteur de blanking N°1 est défini en cohérence et le bouton actif est disponible Le secteur de blanking en édition n'est plus affiché dans la video radar-IFF		TH_20_SSS-REQ-000397 (--3)
6	Activer le secteur de blanking n°1	$SRI_IHS_ICC_ARO_230: Le bouton "Actif" du secteur n°1 est activé. Le nombre de secteurs activés est de 1		TH_20_SSS-REQ-000179 (--2)
7	Vérifier que le secteur de blanking n°1 est affiché dans la video radar-IFF	\\hrtfs01\vdisque (\AFF_Reno_ATL2_Allier\PP_SSRI\Artefacts\V\Vmngt\IVV\TSRITestSuites\Common\Blanking_radar.jpg		TH_20_SSS-REQ-000397 (--3)

The functional chain as a starting point of IVV activities

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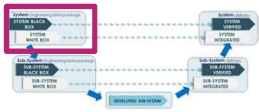
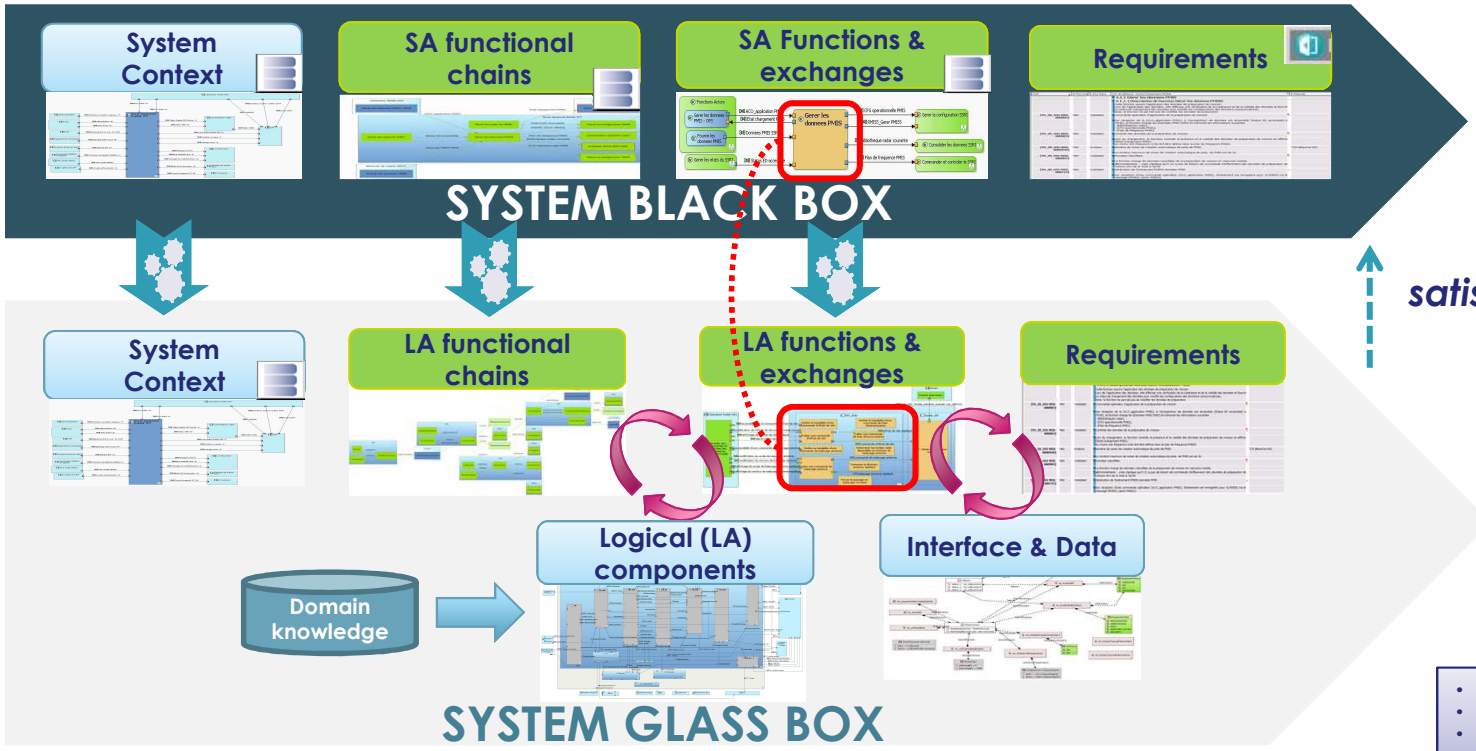
Functional Chains through System Architecture





- **15** leaf components
- **402** leaf-functions
- **1856** funct. exchanges
- **1676** requirements

When the functional threesome has to comply with the architecture…

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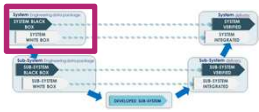
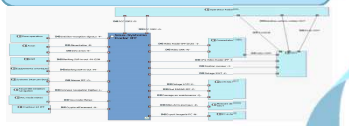
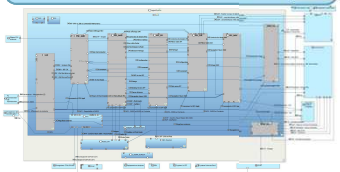
Physical Architecture



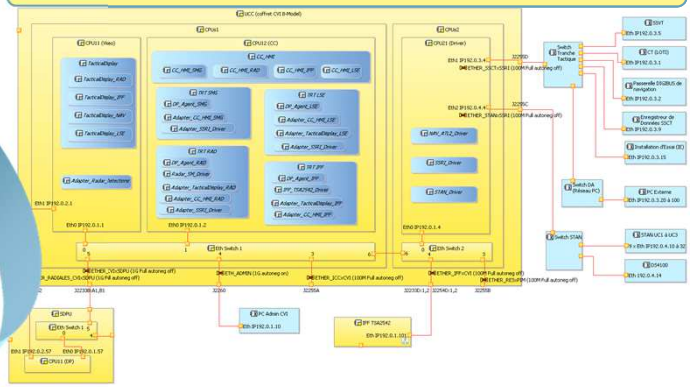
System Context



Logical (LA) components



Physical architecture



Let's talk about wiring and network !

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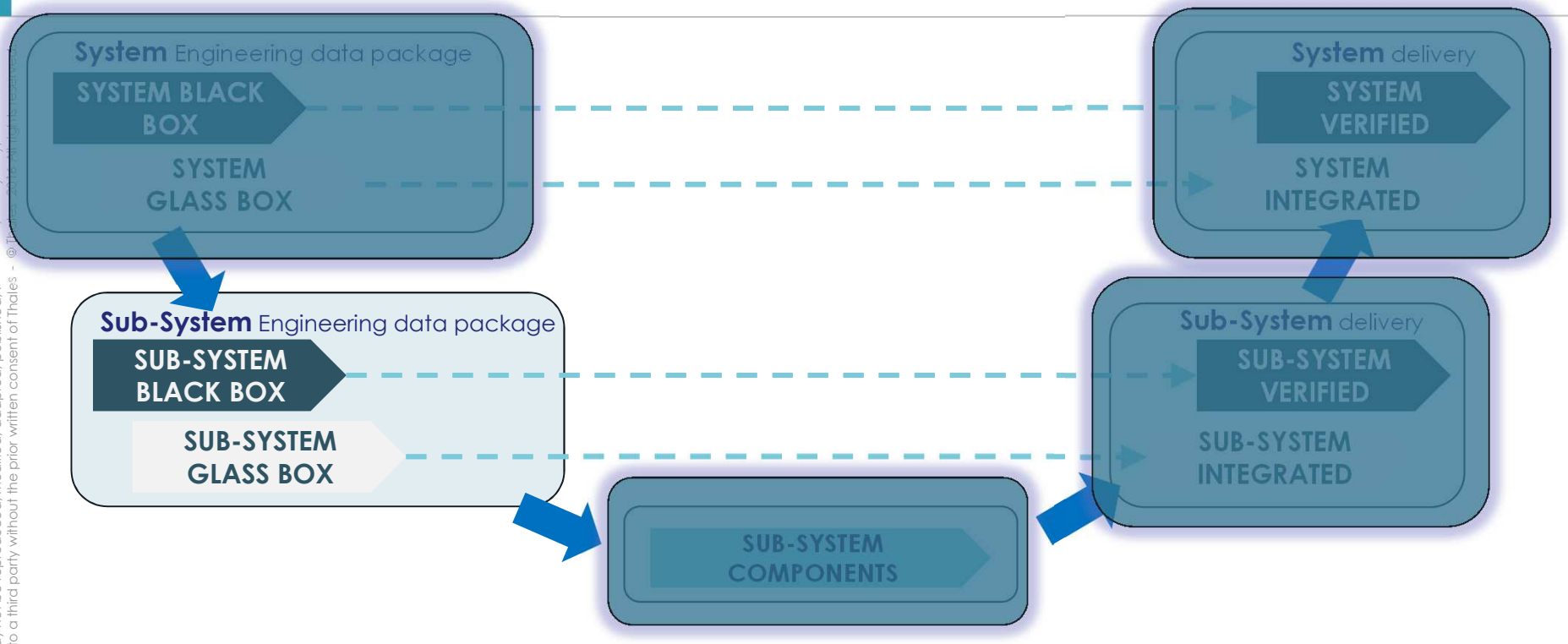
RenoATL2 Model Based System Engineering Story line



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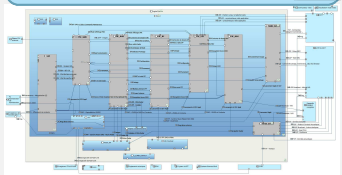
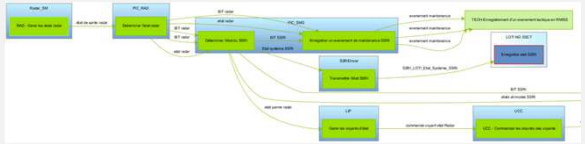
System engineering data validation (1/2)

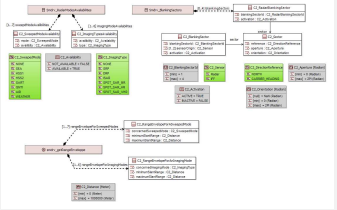
System Logical Architecture



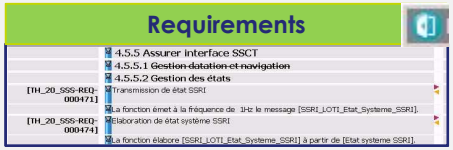
LA functional chains



System Internal Data



Requirements



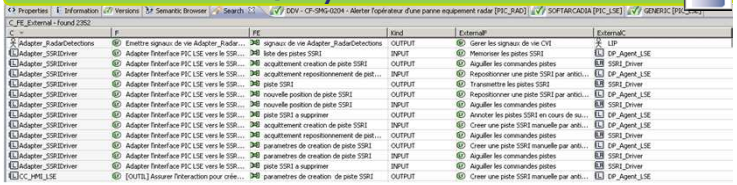
SYSTEM GLASS BOX

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



Start System Integration before its developement !

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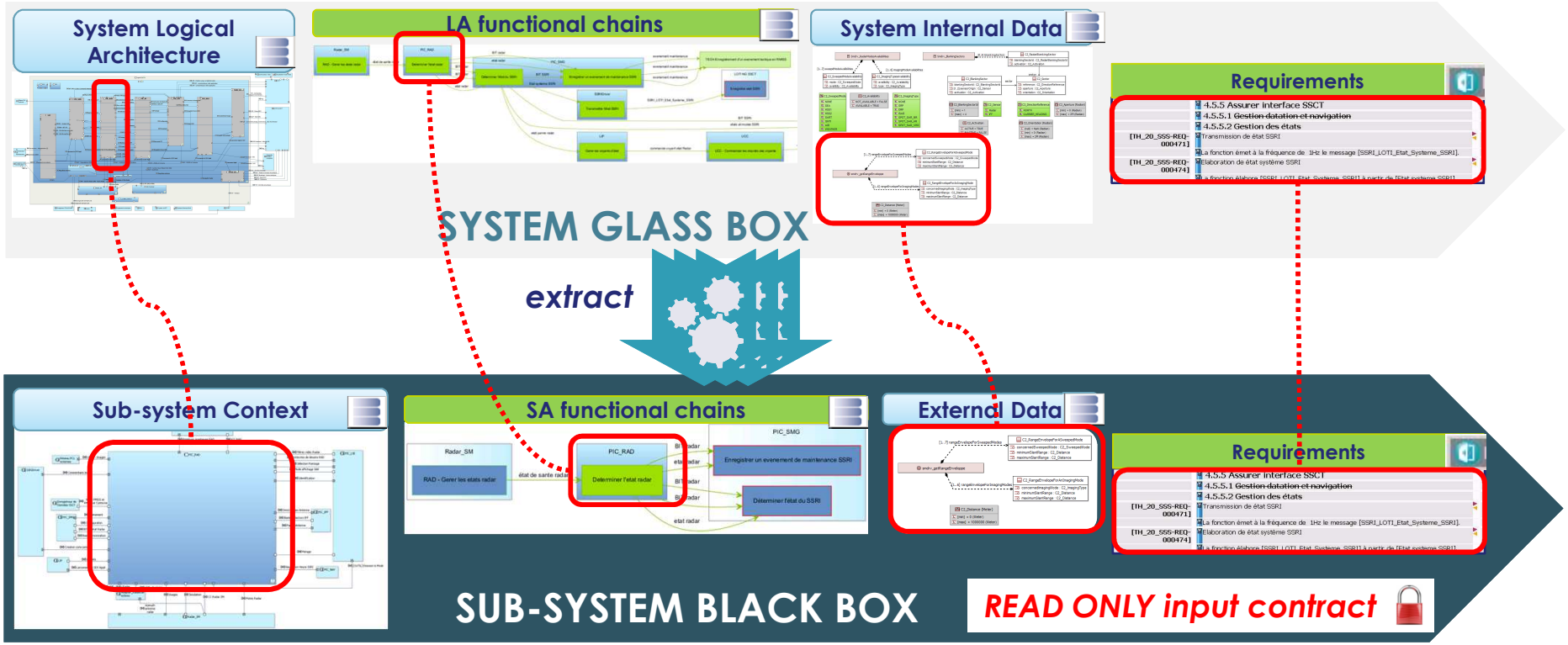
Transition From System to Sub-Systems engineering



A tooled up and iterative extraction

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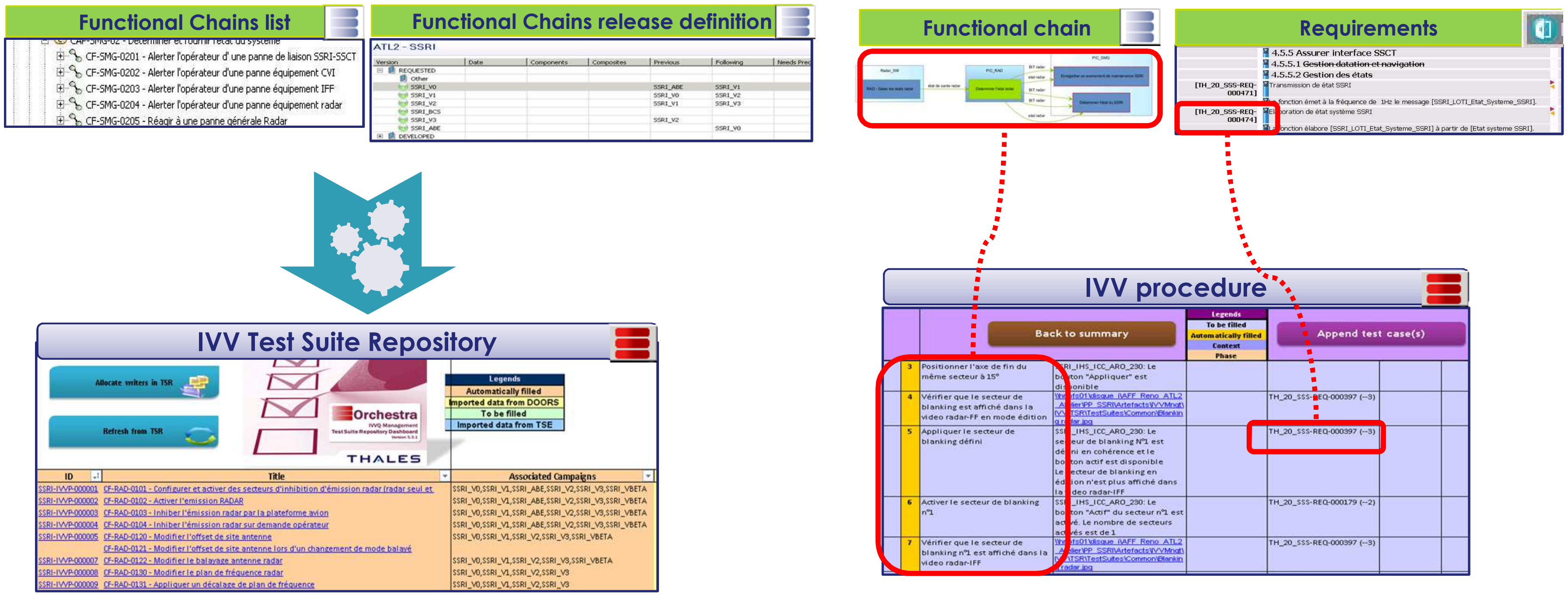
From functional chains to IVV procedures



Functional Chains list
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Functional Chains release definition
ATL2 - SSRI
Functional chain
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Vérifier que le secteur de blanking n°1 est affiché dans la video radar-IFF
TH_20_SSS-REQ-000397 (--3)
TH_20_SSS-REQ-000179 (--2)
IVV Test Suite Repository
Allocate writers in TSR
Refresh from TSR
Orchestra
THALES
Legends
Automatically filled
Imported data from DOORS
To be filled
Imported data from TSE
ID
Title
Associated Campaigns
SSRI-IVVP-000001 CF-RAD-0101 - Configurer et activer des secteurs d'inhibition d'émission radar (radar seul et
SSRI-IVVP-000002 CF-RAD-0102 - Activer l'emission RADAR
SSRI-IVVP-000003 CF-RAD-0103 - Inhiber l'émission radar par la plateforme avion
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SSRI-IVVP-000005 CF-RAD-0120 - Modifier l'offset de site antenne
CF-RAD-0121 - Modifier l'offset de site antenne lors d'un changement de mode balayé
SSRI-IVVP-000007 CF-RAD-0122 - Modifier le balayage antenne radar
SSRI-IVVP-000008 CF-RAD-0130 - Modifier le plan de fréquence radar
SSRI-IVVP-000009 CF-RAD-0131 - Appliquer un décalage de plan de fréquence

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

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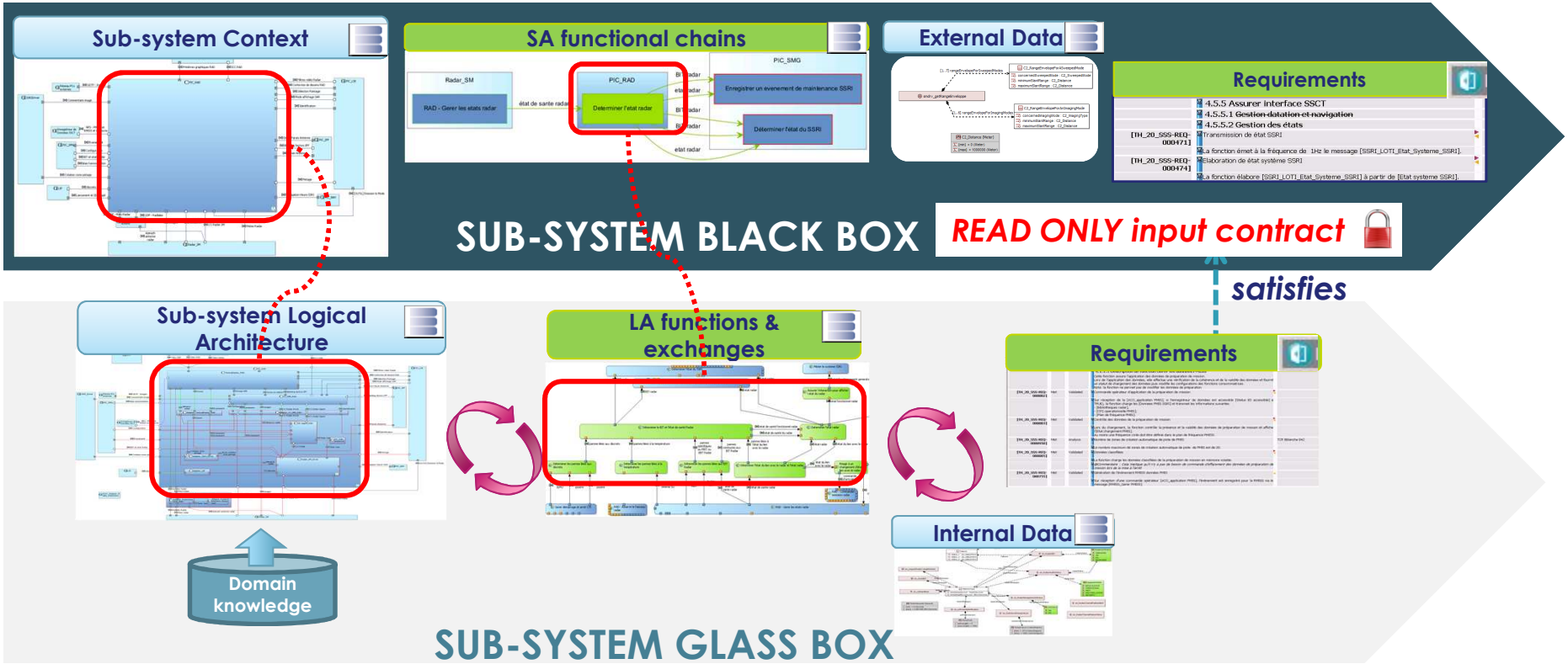
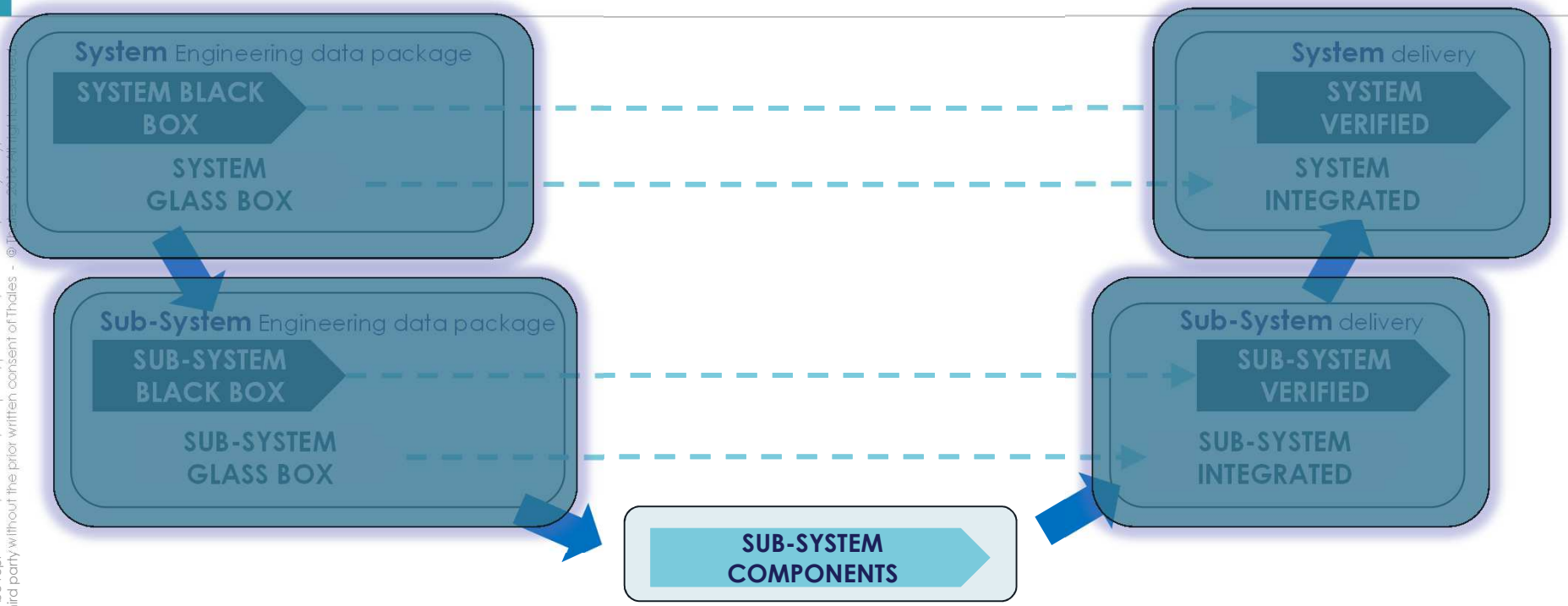
From need to solution



Same process than System one : refine and iterate !

THALES

RenoATL2 Model Based System Engineering Story line



THALES

Transition From Sub-System engineering to development

Sub-system Logical Architecture

Internal Data

LA functions & exchanges

Requirements

SUB-SYSTEM GLASS BOX

SoftArc components skeletons & assemby

Thrift interfaces

Specification documents

READ ONLY input contract

Software Implementation INPUTS

Tooled up extraction for a strongly consistent set !

THALES

Software components implementation and test

SoftArc components skeletons & assemby

Thrift interfaces

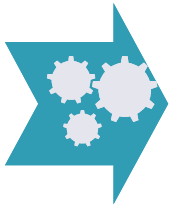
Specification documents

READ ONLY input contract

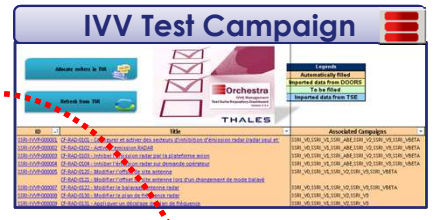
Software Implementation INPUTS

SW component implementation

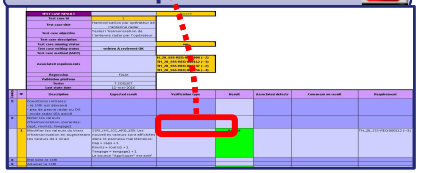
SW component unitary tests



IVV Test Campaign



IVV procedures



Conformity Matrix

Modeling facilitates automation

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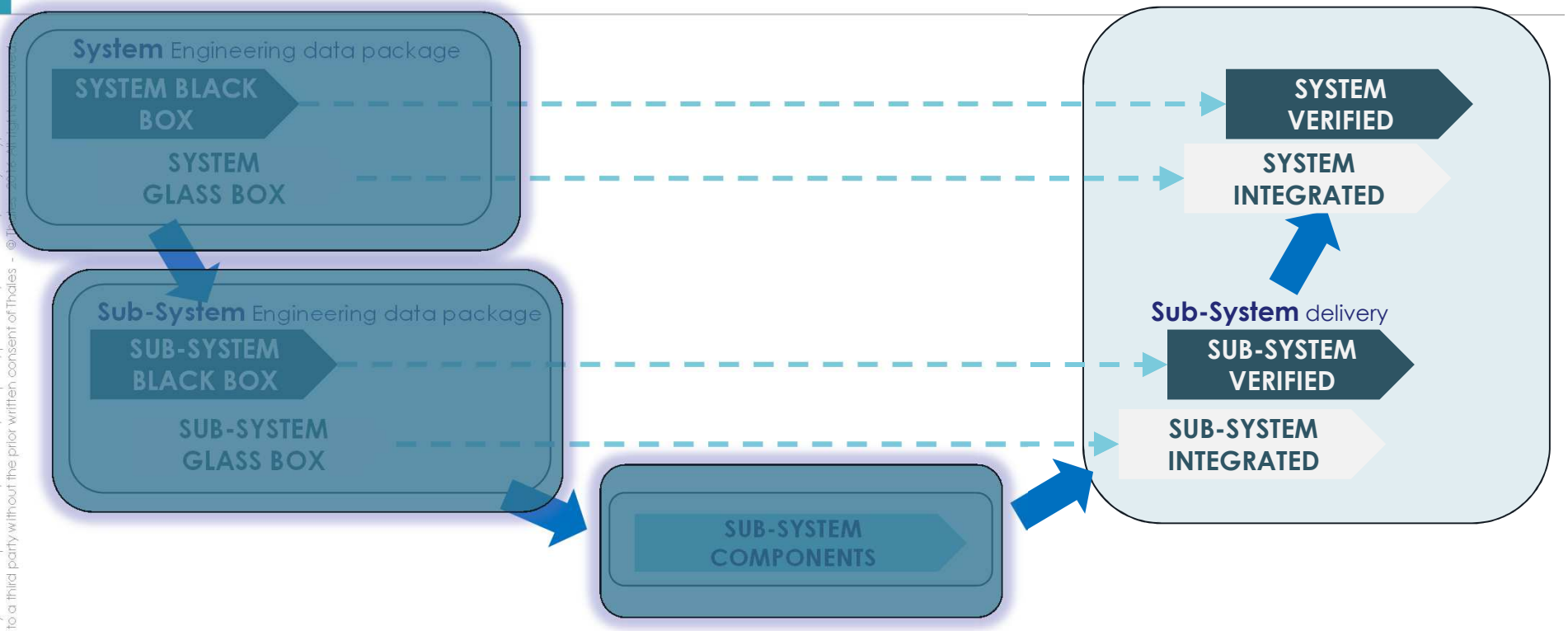
RenoATL2 Model Based System Engineering Story line



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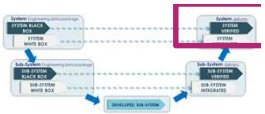
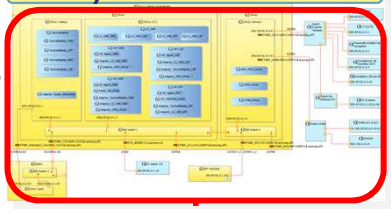
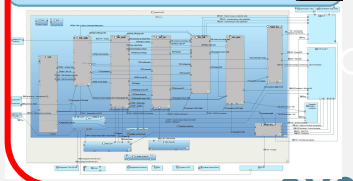
System integration



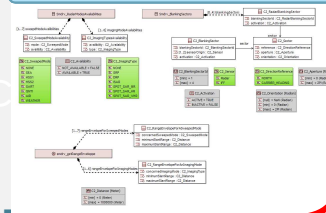
Physical architecture



System Logical Architecture



System Internal Data



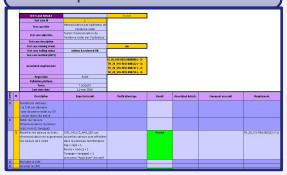
LA functional chains

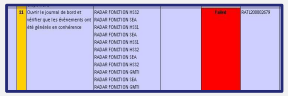
SYSTEM GLASS BOX

System test bench deployment & integration

Observability configuration

Integration procedures





INTEGRATION INPUTS

Modeling facilitates test bench deployment, integration and observability

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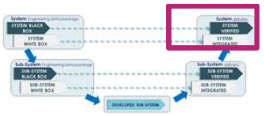
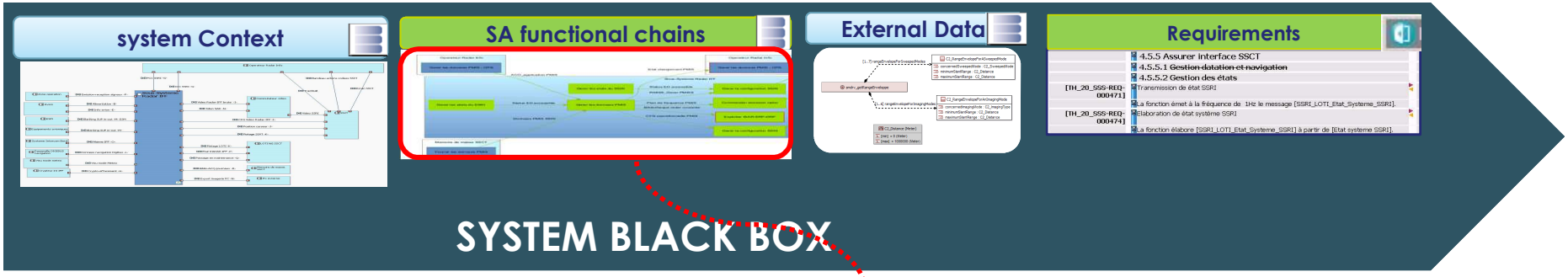
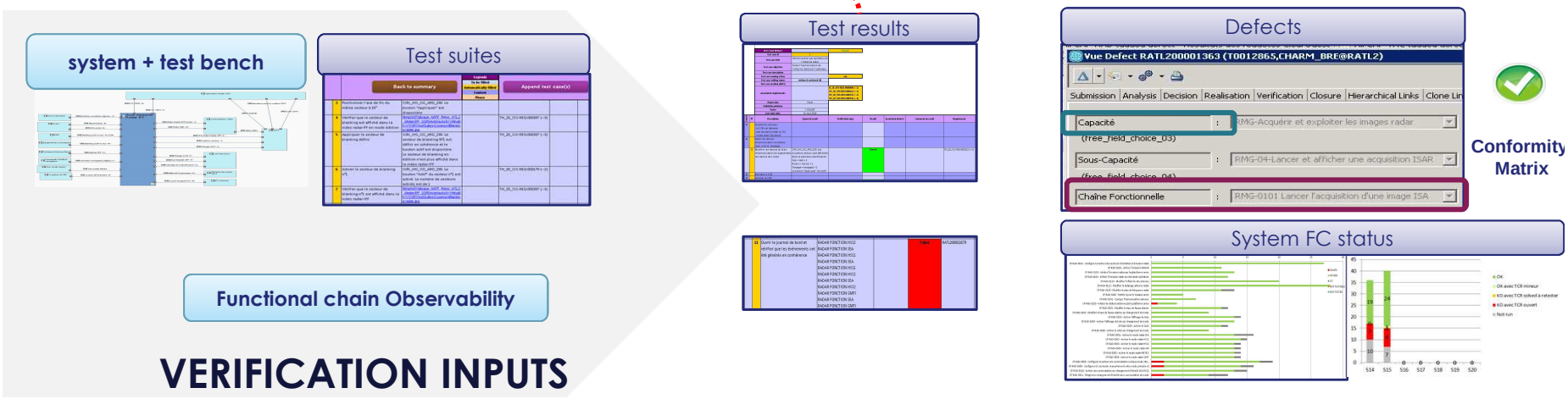
System verification







Modeling facilitates work organisation and reporting

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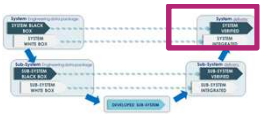
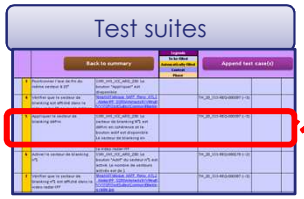
Technical event analysis



Test suites

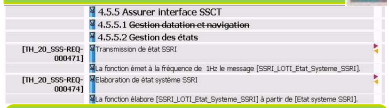


SA functional chains

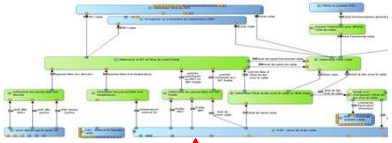
External Data

Check of consistency with specification

Requirements



LA functions & exchanges



Observability Configuration & analysis

Specification Defects

Component Defects

Component Evolution

VERIFICATION INPUTS

Modeling facilitates defects analysis

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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 tooled up
- Do not under estimate activities for process and tools definition
- Integrated coaching
- Trust and Resilience !

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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 serinity
- Modelling can be an easy and cost saving way to work

Way forward

- Share our experience
- Challenge and improve process and tools

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Questions

Guillaume JOURNAUX guillaume.journaux@fr.thalesgroup.com

Tony SOQUET tony.soquet@fr.thalesgroup.com

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