



User case of complex Programme
Planning and Scheduling:
S-80 Submarines at [Navantia](#)
Forum Safran 2023

Cristina Sancho Berlanga
S-80 Programme Planning Manager



Agenda

The company

The programme

The planning department

The tools



The company



NAVANTIA a 100% state-owned naval technology company

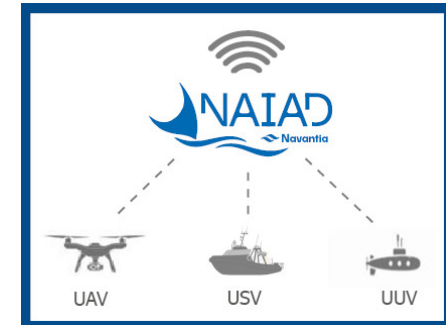
Leading company in the defence sector

More of 300 YEARS of experience

Strategic for Spanish Defence

Exports to over 25 countries

More than 5000 professionals



The company

Business areas



Shipbuilding and Ship Repairs



Systems and Services, including
Turbine and Engine factories



Green Energies, including
offshore wind, alternative fuels

The company

National: main supplier for the Spanish Navy

4 x Frigates F100



1 x Frigates F105



4 x Submarines S80



5 x Frigates F110



1 x BAM-IS



1 x AOR



4+2 x BAM



2 x LPD



1 x LHD



2000

2005

2010

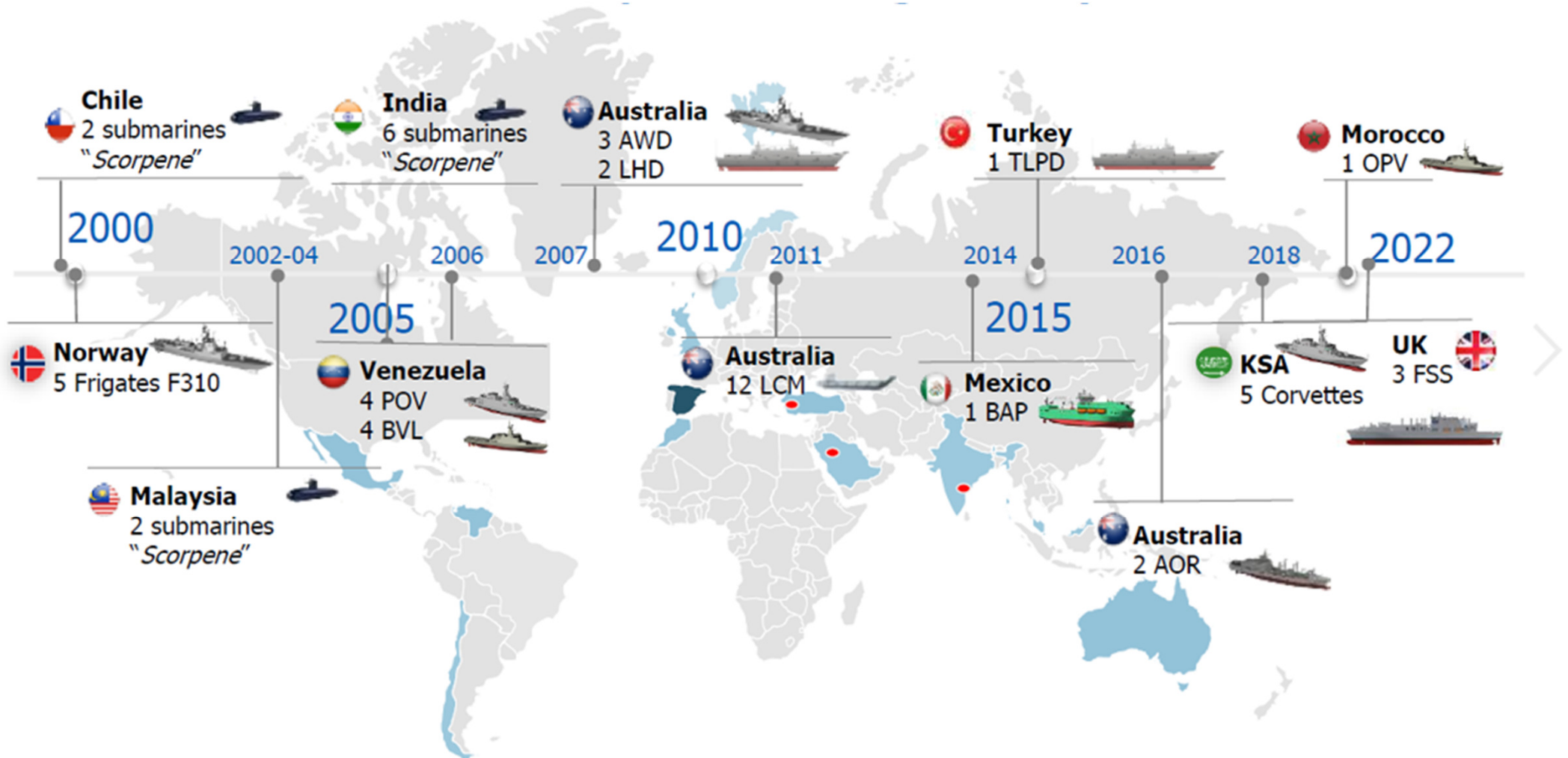
2015

2020

Naval units delivered or in process during the last 20 years

The company

International: permanently offering support to more than 25 countries



Naval units delivered or in process during the last 20 years

The company

Facilities: three locations in Spain with shipyards and other infraestructure

Navantia

Ría de Ferrol

Shipyards
Repairs
Life cycle support
Turbines factory
Wind power

Navantia

Madrid
Headquarters

Navantia

Bahía de Cádiz

Shipyards
Systems
Repairs
Life cycle support
Wind power

Navantia

Dársena de Cartagena

Shipyards → S-80 Programme Leader
Systems
Repairs
Life cycle support
Engines factory

International Offices



UK



Norway



Brussels – NATO/EU



Turkey



Middle East - KSA



Australia



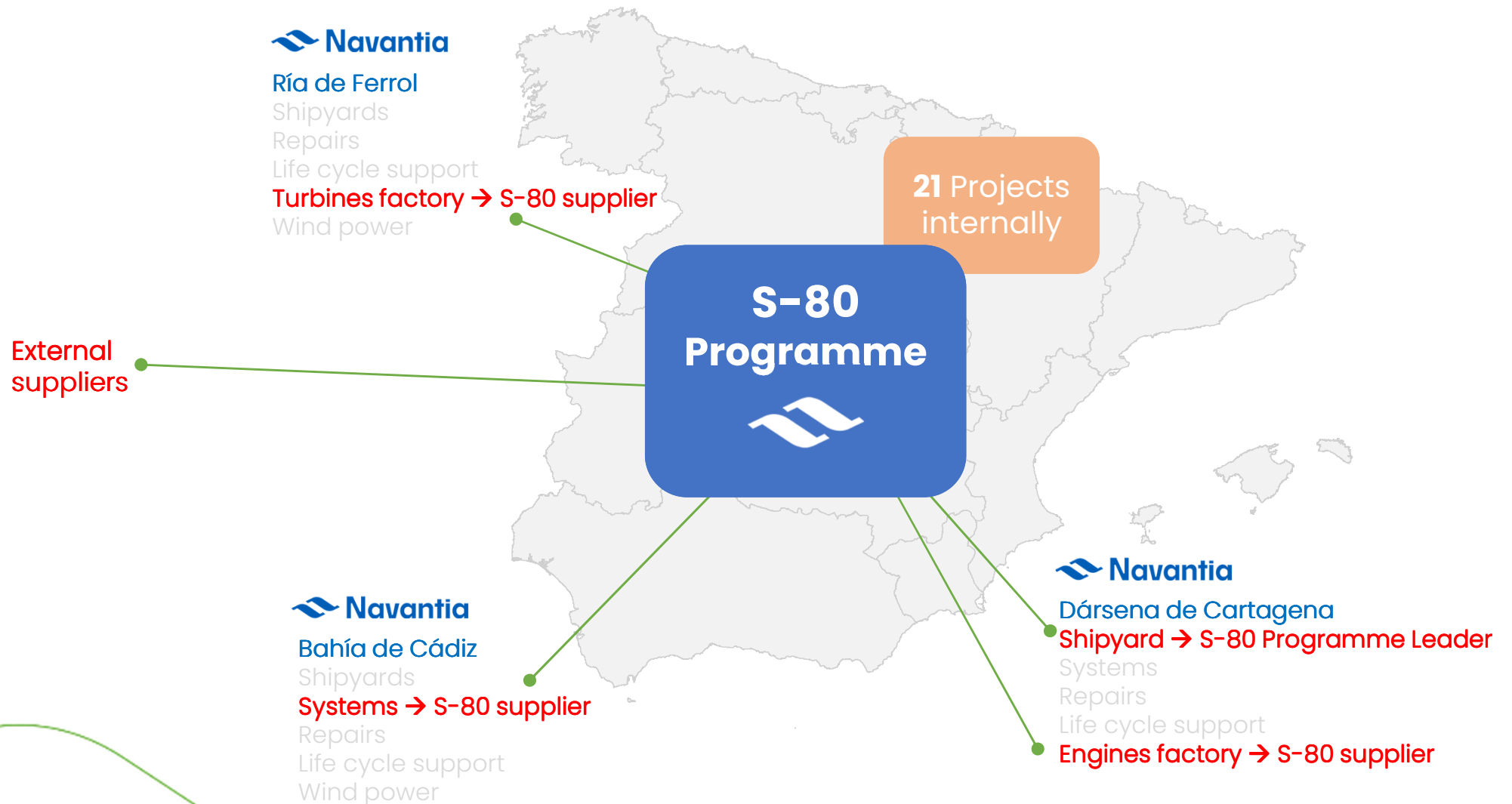
India



USA

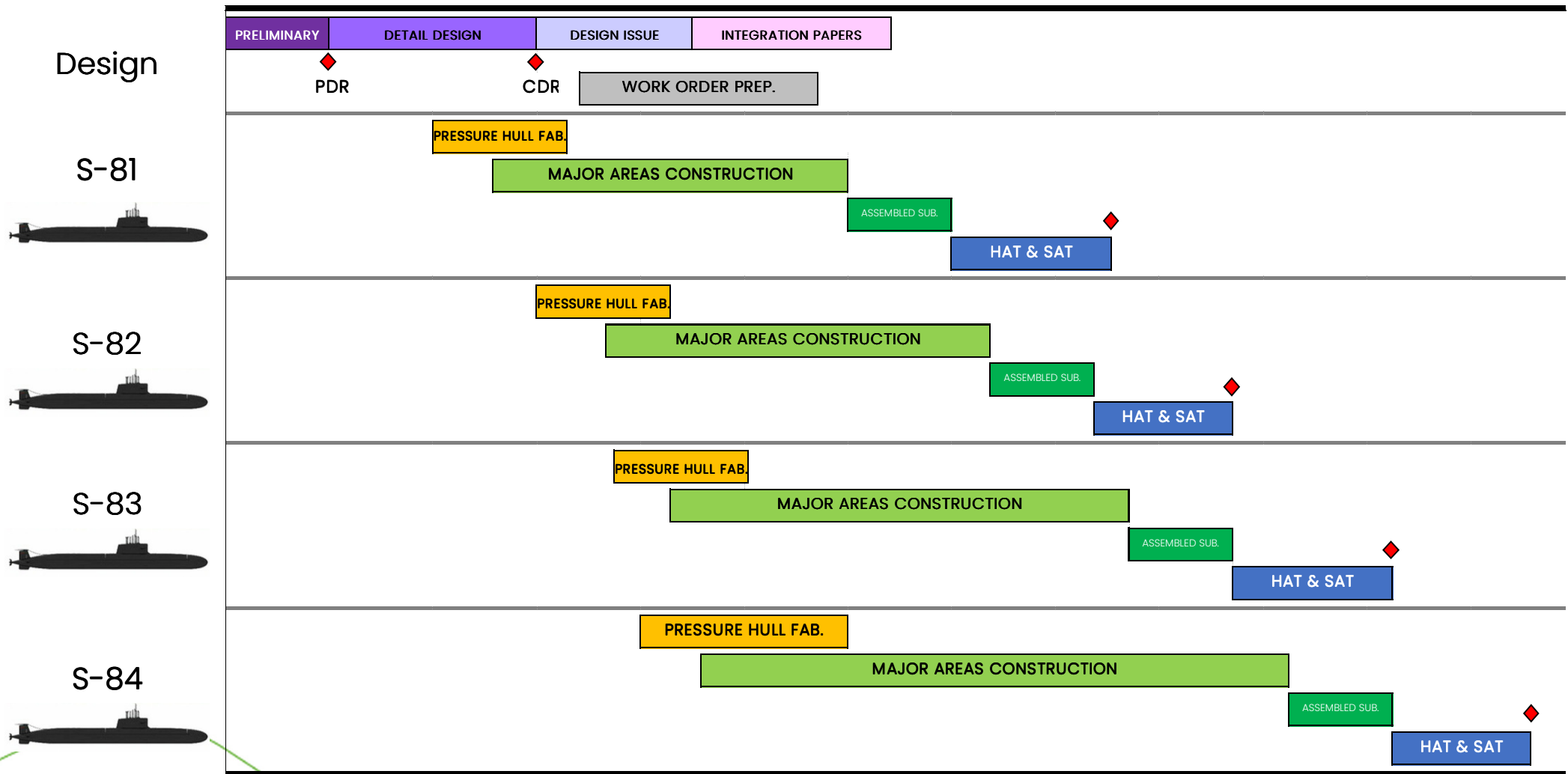
The programme

Programme S-80: interrelated multidisciplinary Projects handled by different facilities



The programme

Programme S-80: consists of the design, construction and testing of 4 submarines



The planning department

Main functions and responsibilities

Develop the Program Planning

Establish the Baseline/s to measure against and assess Projects performance

Identify and highlight risks and opportunities

Ensure that all areas involved in the process are included in the plan

Define WBS structures, assign budget and verify traceability

Monitor Project development

The planning department

Main planning areas

Engineering

Functional design
3D model and design publishing

Production Engineering and Production Management

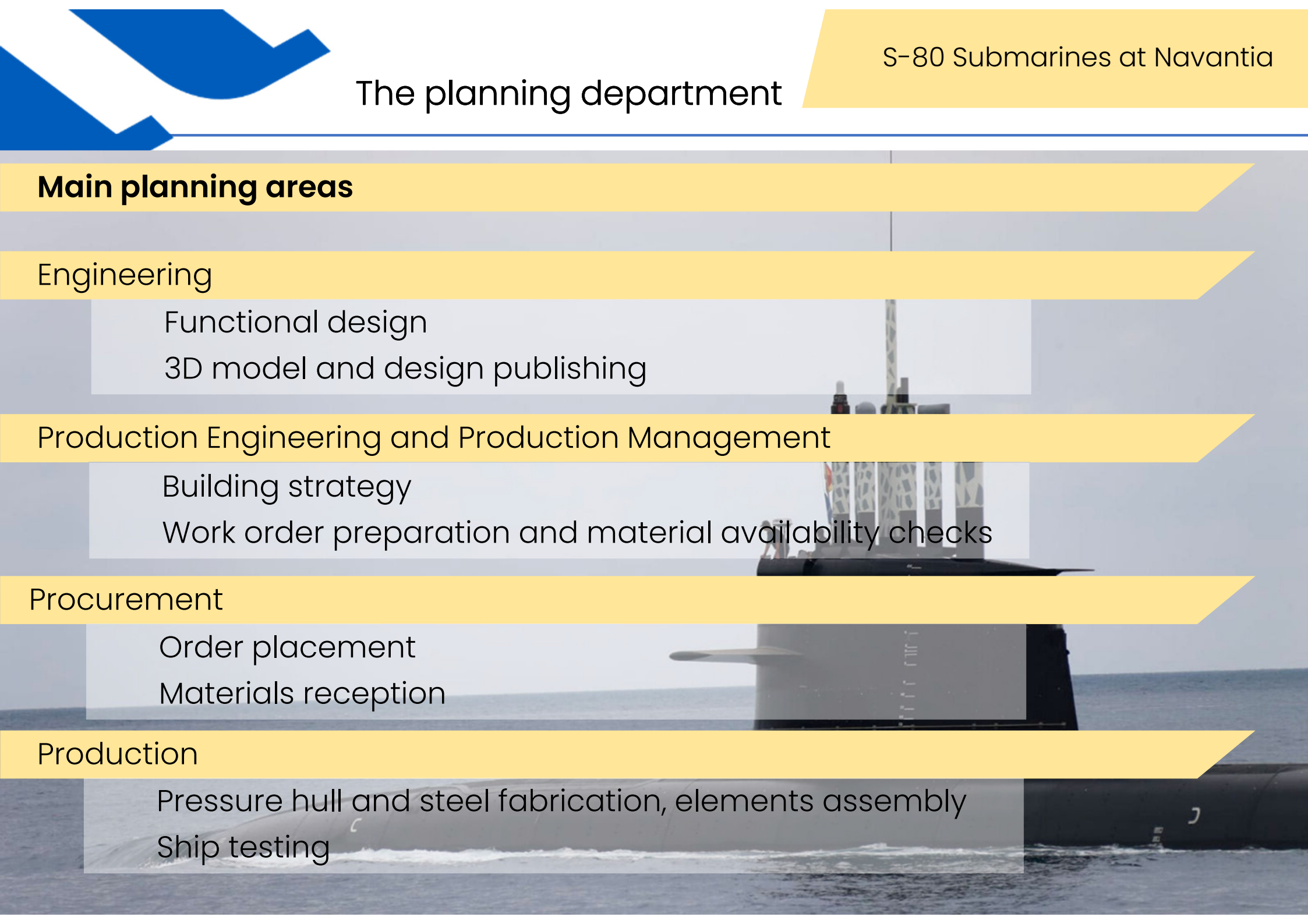
Building strategy
Work order preparation and material availability checks

Procurement

Order placement
Materials reception

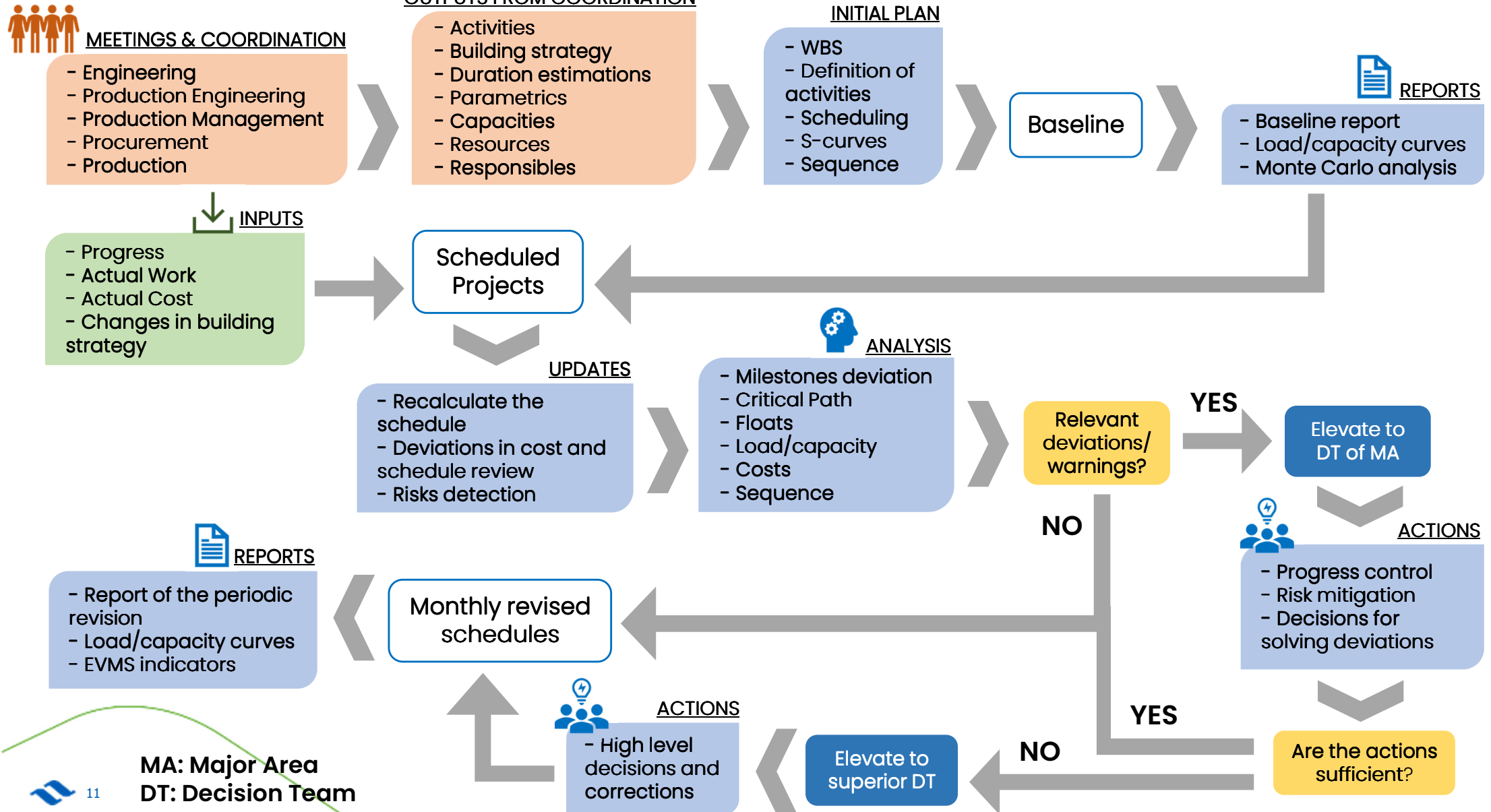
Production

Pressure hull and steel fabrication, elements assembly
Ship testing



The planning department

Our workflow



The planning department

A briefer summary of our workflow

IN

- Building Strategy
- Historic data (Budget and durations)
- Shipyard capacities & capabilities
- Actual data

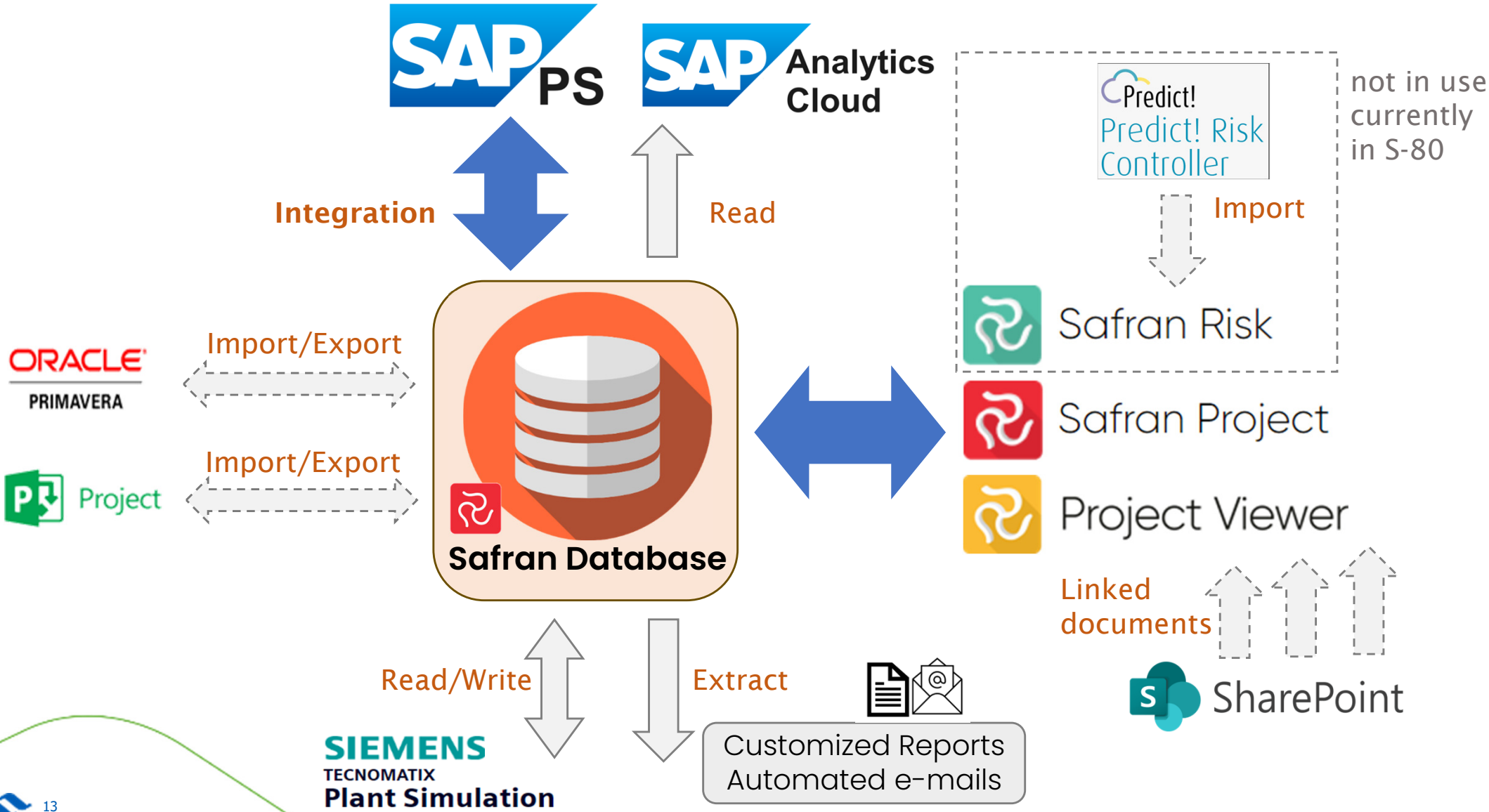


- Updated plan
- Load – capacity curves
- Need dates for materials
- Planning reliability
- Mitigation actions

OUT

The tools

Ecosystem of Safran and other tools



The tools

“Special” features used by Navantia to present today:

1. Integration SAP – Safran

2. Project Groups

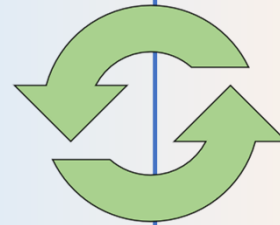
3. Database automations

The tools

1. Integration SAP PS – Safran Project

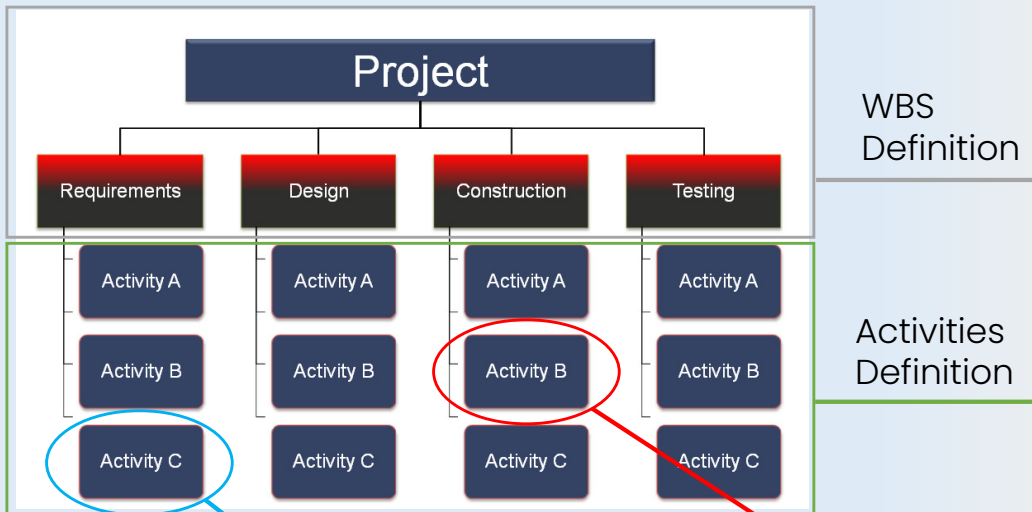


Definition of scope and structure of Projects



Safran Project

Analysis and scheduling of Projects

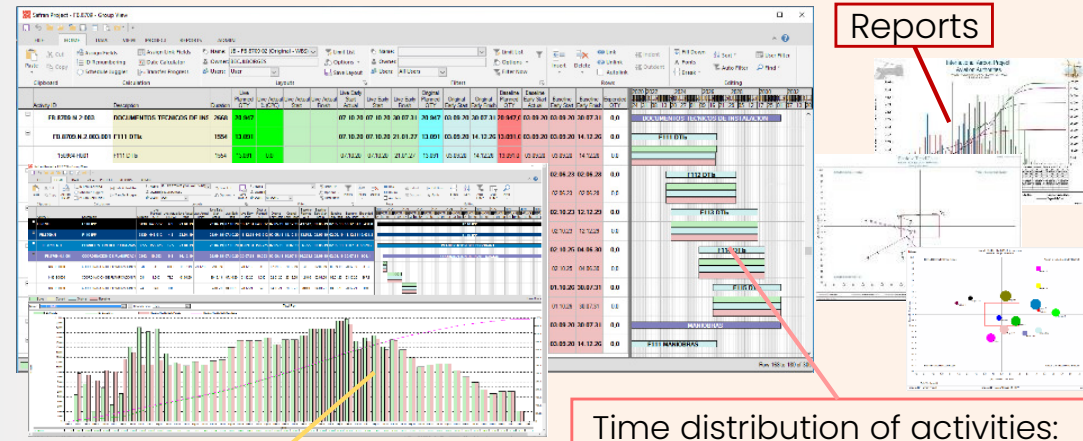


Assignments:

- Resources (Work Centres)
- Estimated budget
- Preliminar Durations

Inputs:

- Progress %
- Actual Dates
- Actual Work & Cost



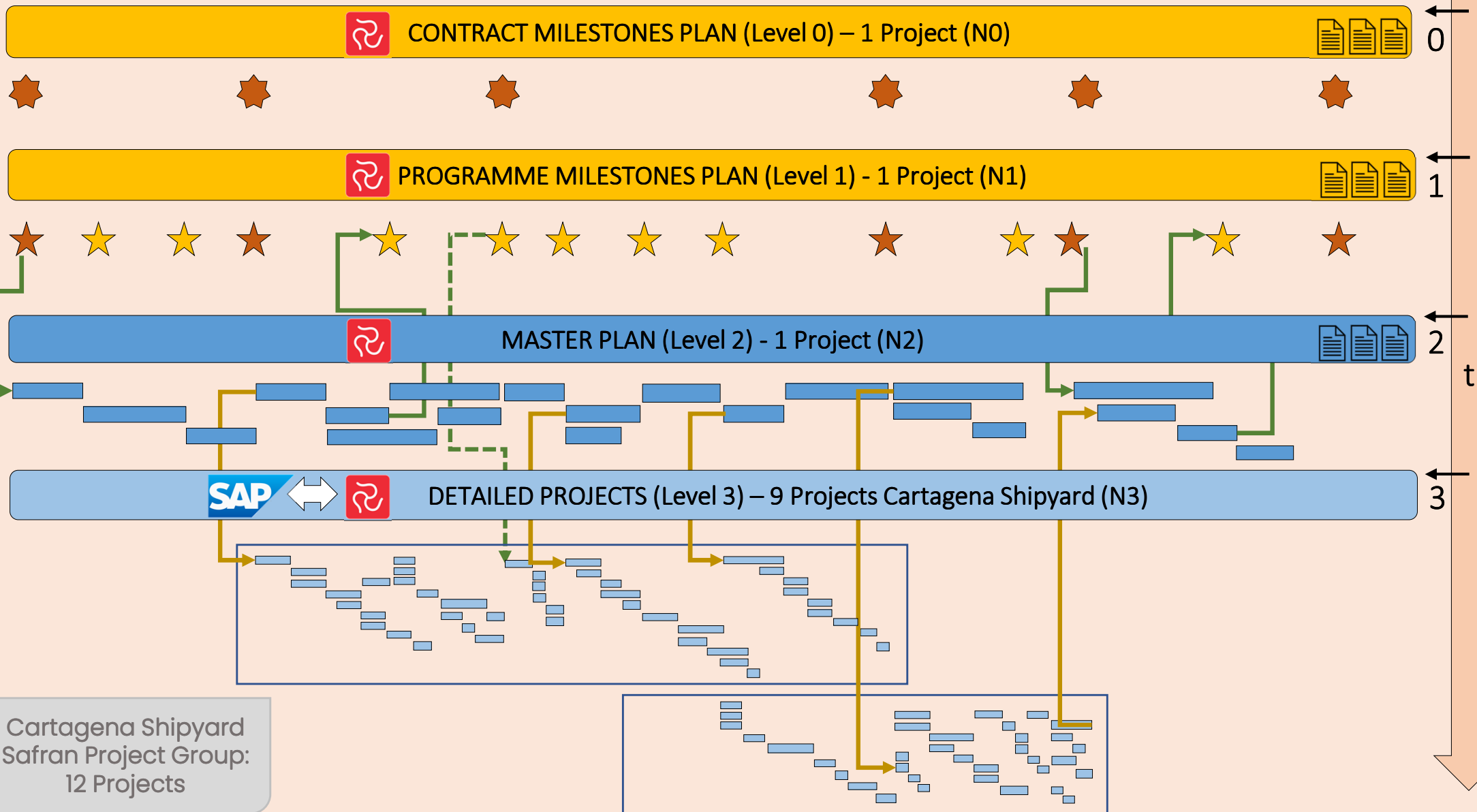
- Load-capacity distributions
- Planned use of resources
- S-Curves...

- Time distribution of activities:**
- Logic
 - Constraints
 - Durations review
 - Calendars assignments
 - ...

- Analysis and calculations:**
- Critical Path, What If, Monte Carlo, Resource Levelling...
 - Control and monitoring: updates schedule & impacts
 - Rescheduling Dates, Floats, Logic...

The tools

2. Project Groups: Integrated Programme Planning (I)

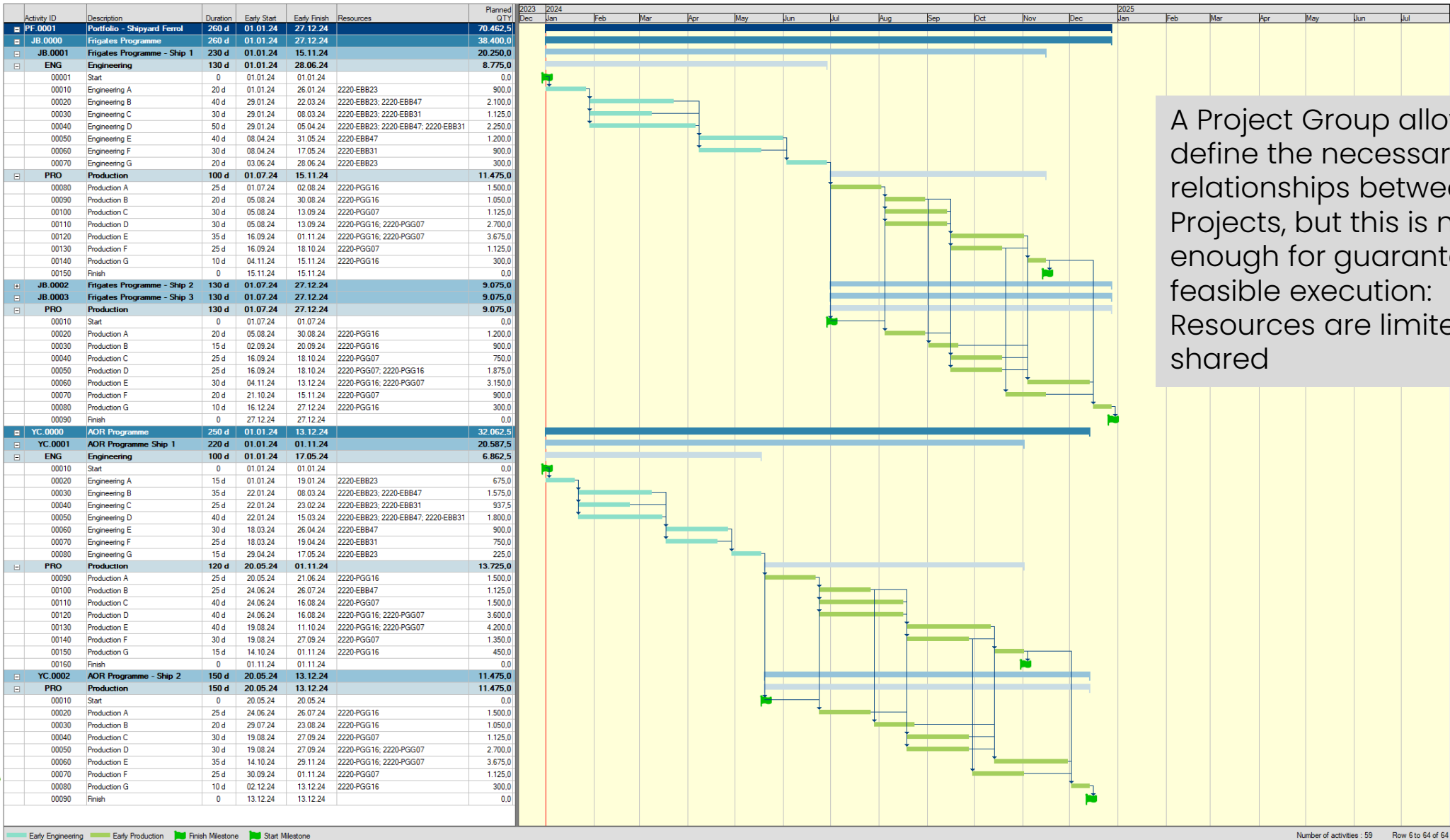


Cartagena Shipyard
Safran Project Group:
12 Projects

The tools

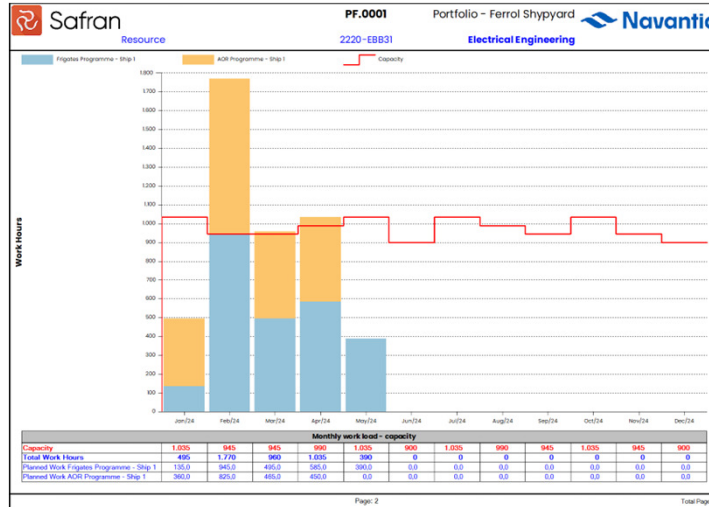
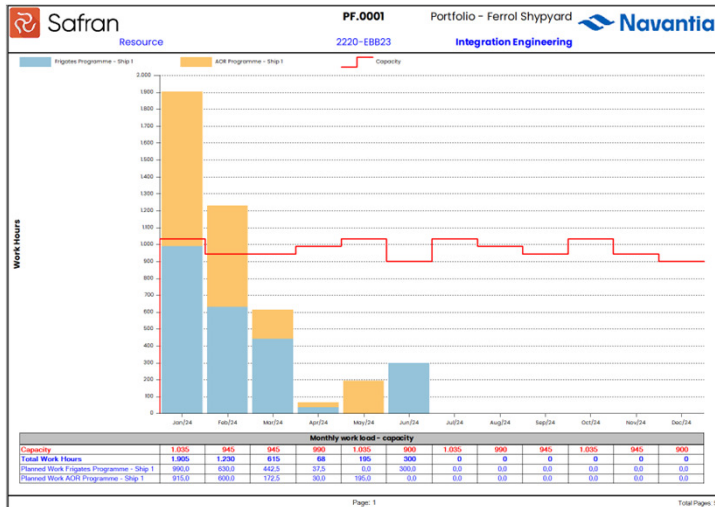
2. Project Groups: analysis of load-capacity from multiple projects using shared resources

A Project Group allows to define the necessary relationships between Projects, but this is not enough for guarantee a feasible execution: Resources are limited and shared

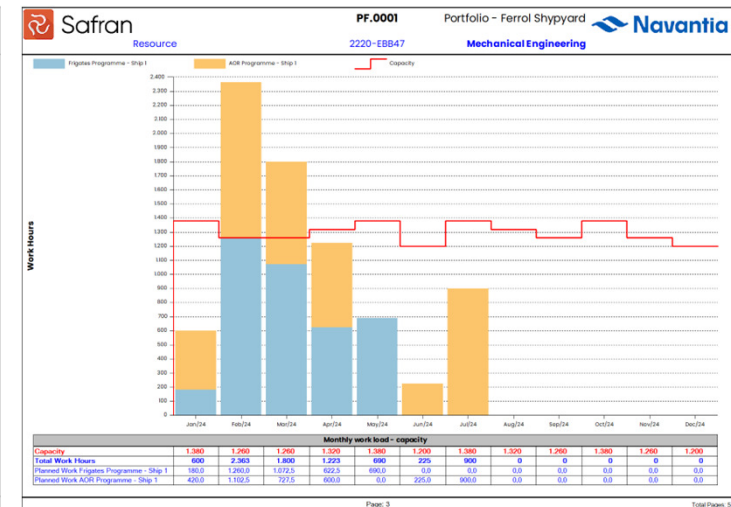
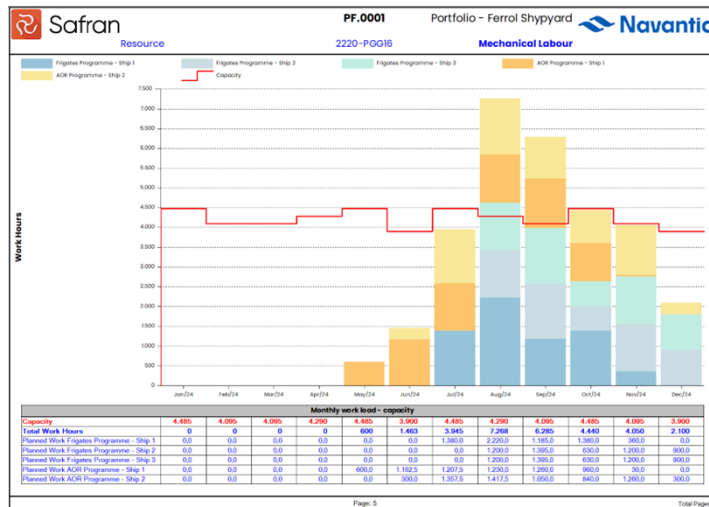
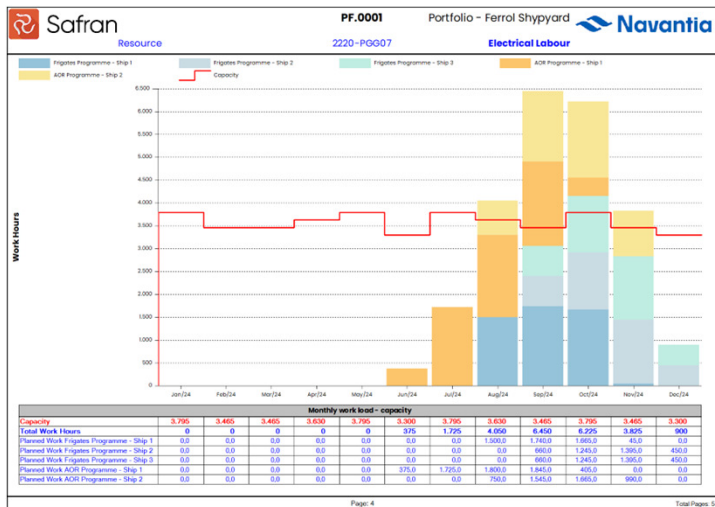


The tools

2. Project Groups: analysis of load-capacity from multiple projects using shared resources

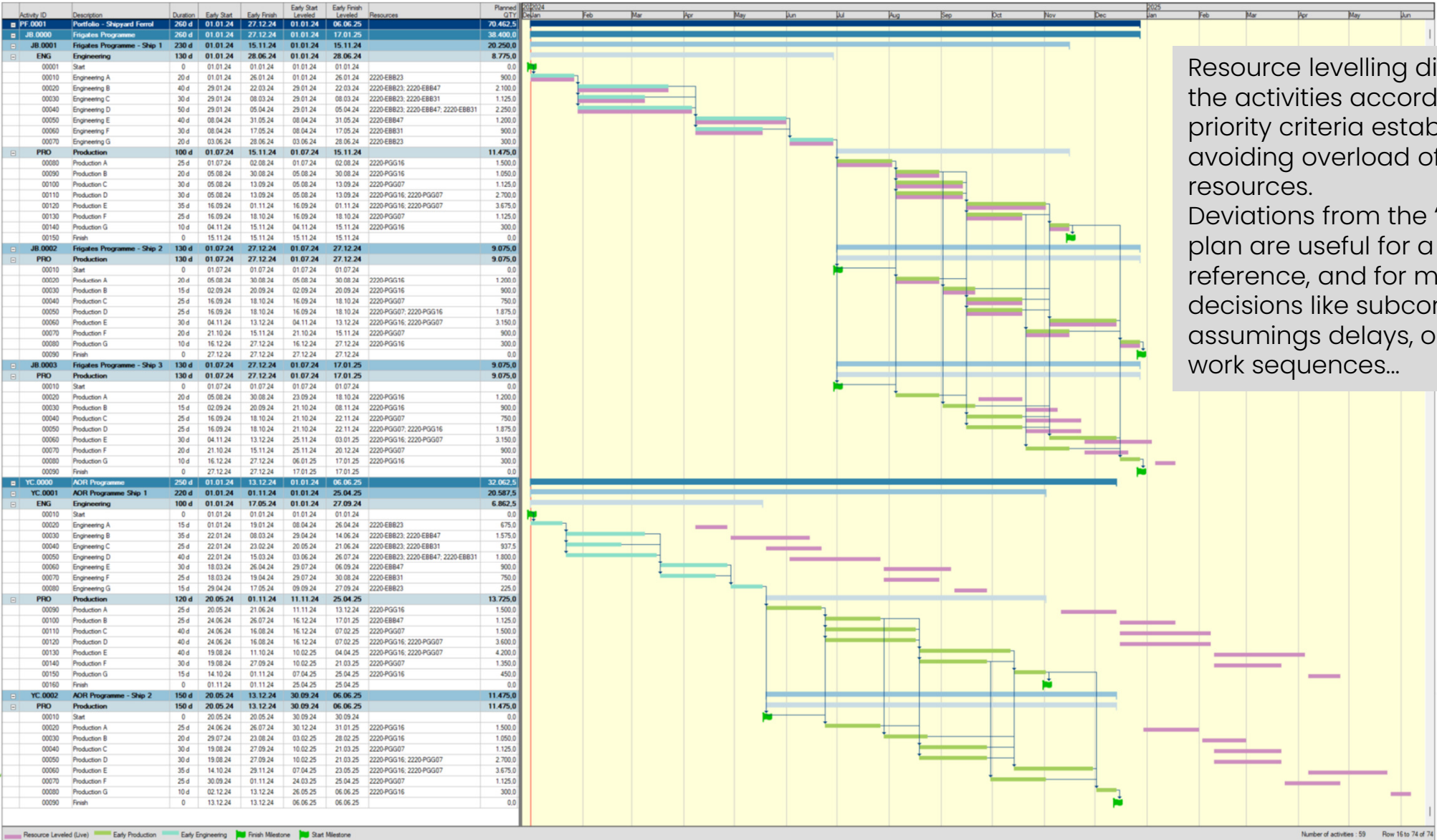


Histograms reflecting the current planned load of work for each productive resource (bars, differentiating the load in the different Projects), and the capacity of each resource (red line)



The tools

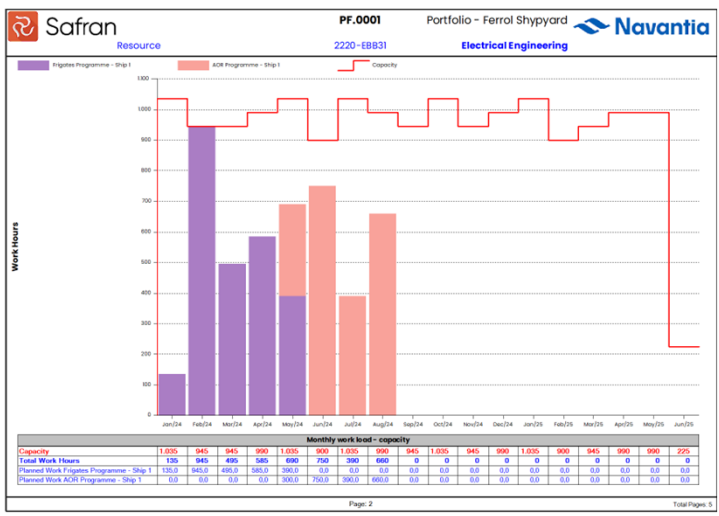
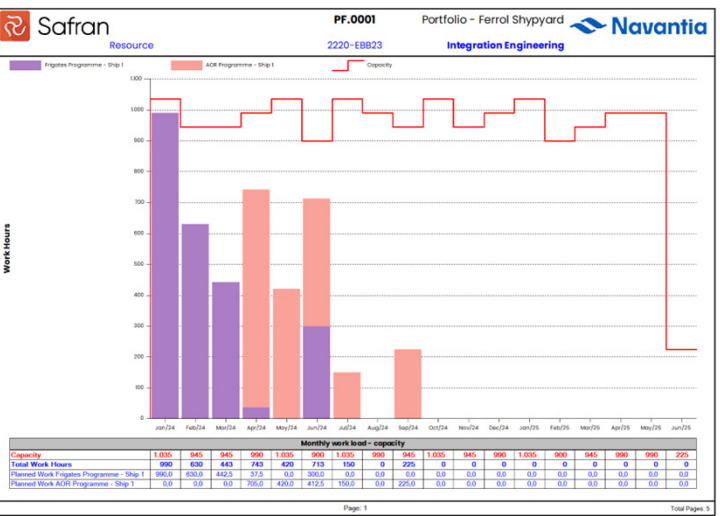
2. Project Groups: analysis of load-capacity from multiple projects using shared resources



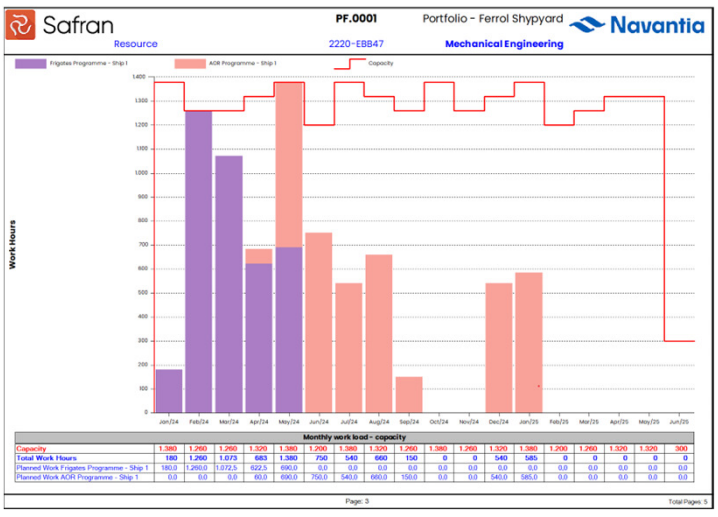
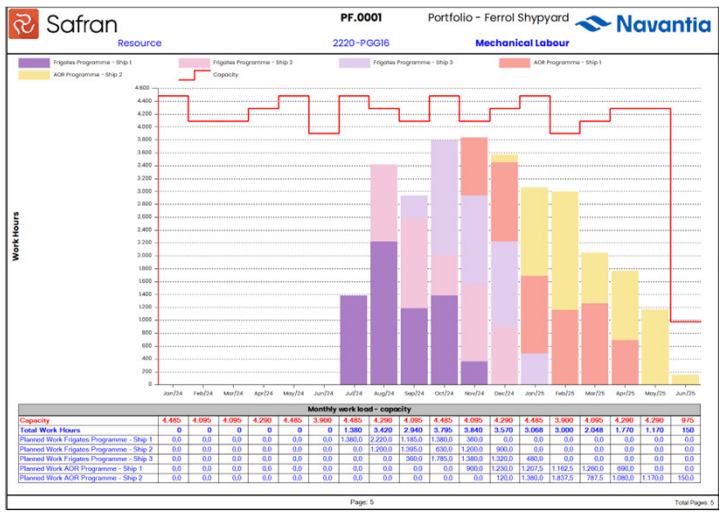
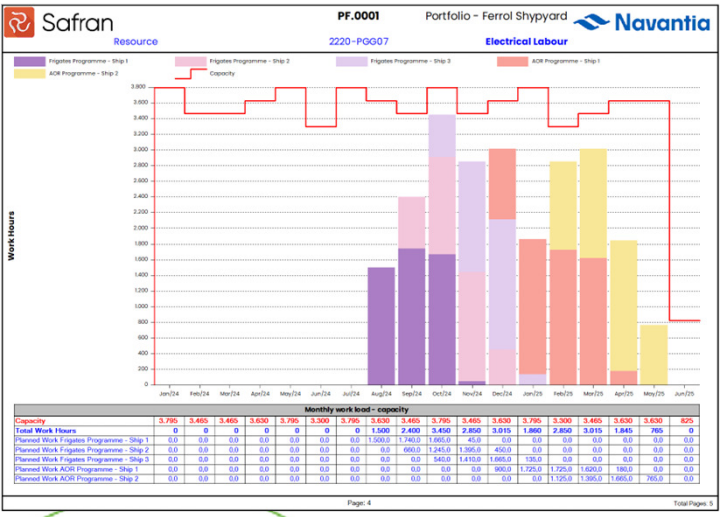
Resource levelling distributes the activities according to the priority criteria established, avoiding overload of resources. Deviations from the “logic” plan are useful for a first reference, and for making decisions like subcontracting, assumings delays, optimize work sequences...

The tools

2. Project Groups: analysis of load-capacity from multiple projects using shared resources

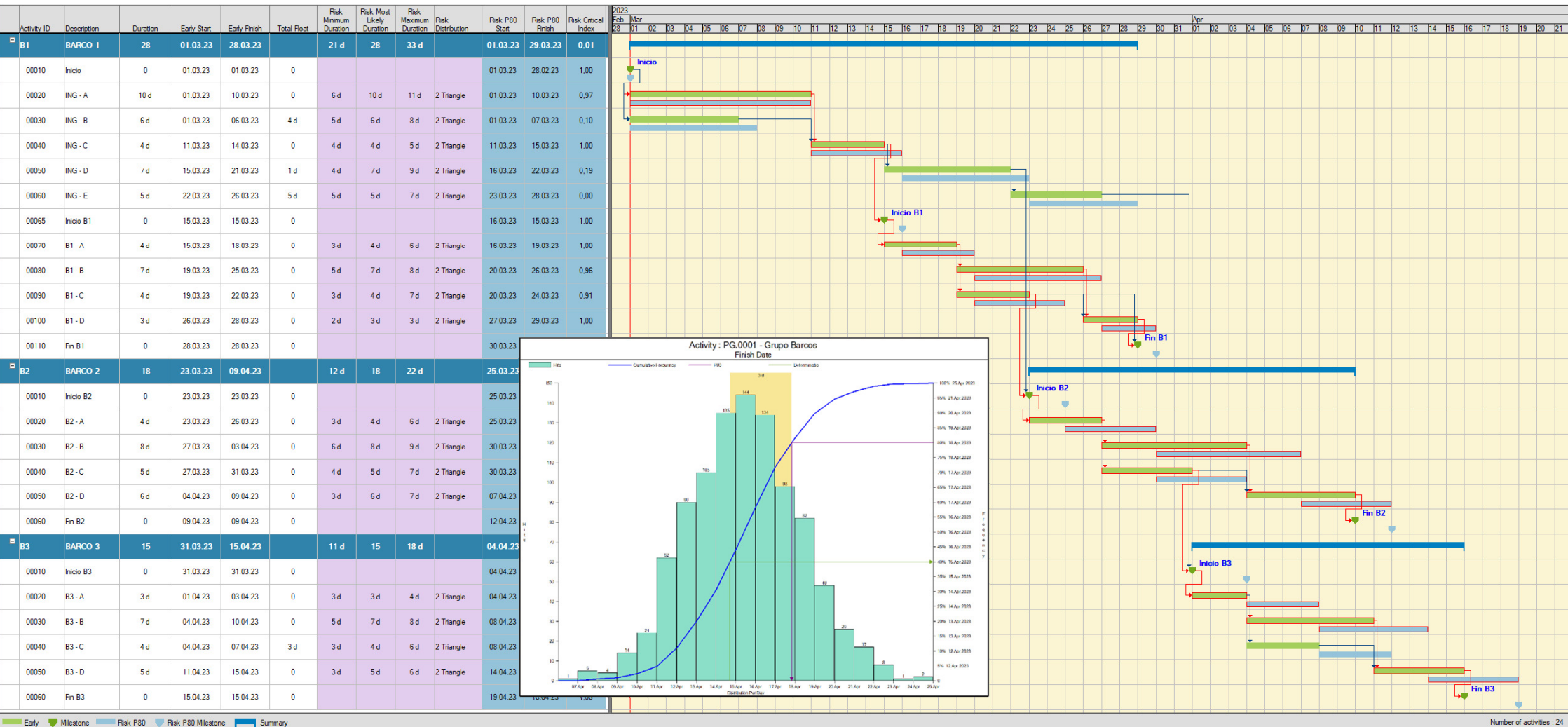


Same histograms, using the levelled dates for distributing the work load.



The tools

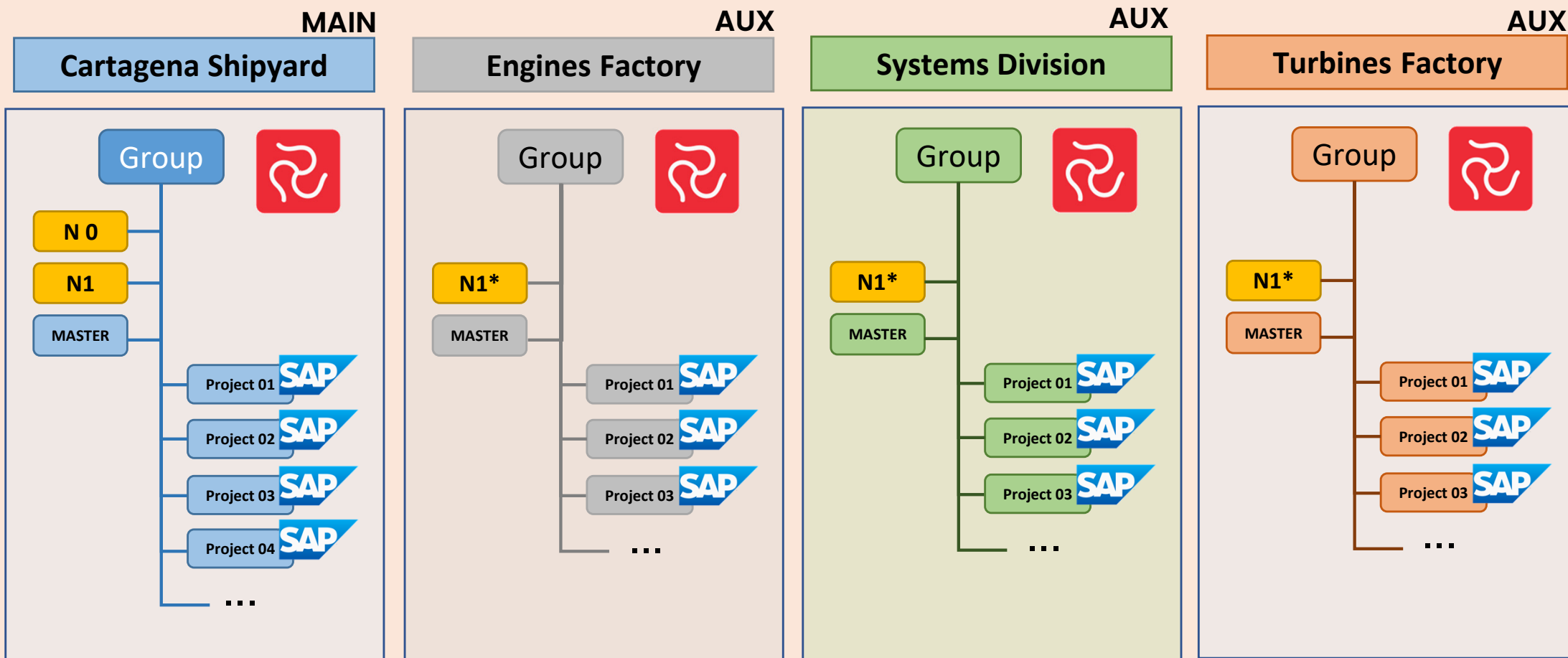
2. Project Groups: Monte Carlo, Critical Path Analysis... at Programme level



The tools

3. Database automations: Integrated Programme Planning (II)

Coordination between Business Units through N1-N1* Projects



The tools

3. Database automations: Integrated Programme Planning (II)

From NI, the main BU selects in a reference userfield which aux. BU to coordinate a milestone with

Reference	Text	Date	Flag	Decimal	Duration	Outline Codes	Computed
Field	Label	Field No.: 11					
R7	SAP R07 -	Label: PGR R11 - Unidad de Negocio					
R8	SAP R08 -	Visible: <input checked="" type="checkbox"/> Enabled: <input checked="" type="checkbox"/>					
R9	SAP R09 -	<div style="text-align: center; color: red;">↑ MAIN BUSINESS UNIT</div>					
R10	SAP R10 -						
R11	PGR R11 - Unidad de Negocio						
R12	PGR R12 - Buque						
R13	PGR R13 - Tipo Entregable						
R14	PGR R14 -						
R15	PGR R15 -						

ID	Short	Description	Sort
1	2220	Astillero Ferrol	1
2	2225	Turbinas Ferrol	2
3	2230	Astillero Cartagena	3
4	2236	Motores Cartagena	4
5	2240	Astillero Puerto Real	5
6	2241	Astillero San Fernando	6
7	2233/43	Sistemas FAB A SF/CA	7

!! ID MUST MATCH IN THE MAIN BUSINESS UNIT AND AUXILIARY BUSINESS UNITS

Reference	Text	Date	Flag	Decimal	Duration	Outline Codes	Computed
Field	Label	Field No.: 11					
R7	SAP R07 -	Label: PGR R11 - Unidad de Negocio					
R8	SAP R08 -	Visible: <input checked="" type="checkbox"/> Enabled: <input type="checkbox"/>					
R9	SAP R09 -	<div style="text-align: center; color: red;">↑ AUXILIARY BUSINESS UNITS</div>					
R10	SAP R10 -						
R11	PGR R11 - Unidad de Negocio						
R12	PGR R12 - Buque						
R13	PGR R13 - Tipo Entregable						
R14	PGR R14 -						
R15	PGR R15 -						

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A database automation is run daily, transferring data from NI to each NI* and vice versa

In the NI* project of each auxiliary BU, the corresponding milestones will be generated, inheriting some data from the main BU (ref. date, type, vessel, purchase code, comment...)

Each auxiliary BU links the milestones to the detail projects in their Project Groups as corresponds, so the date will depend on their schedule. This date, and other data will be returned to the Project NI of the main BU

Having the "need" date of the main BU in one userfield, and the "forecast" delivery date of the auxiliary BUs in another userfield, they can be compared for detecting delays, confirming deliveries...

Several userfields from different types are reserved for Programme coordination between Business Units, they must be configured properly

The tools

3. Database automations: Integrated Programme Planning (II)

Description	Fecha Local	Fecha Externa	Retraso Entrega	Hito Completado	2022		2023				2024				2025				2026				2027				2028				2029							
					Ago	Oct	Dec	Feb	Abr	Jun	Ago	Oct	Dec	Feb	Abr	Jun	Ago	Oct	Dec	Feb	Abr	Jun	Ago	Oct	Dec	Feb	Abr	Jun	Ago	Oct	Dec	Feb	Abr	Jun	Ago	Oct	Dec	Feb
Submarino S82			Yes		[Timeline bar]																																	
Astillero Cartagena			No		[Timeline bar]																																	
Referencia de UN Principal	18.11.22	26.03.26	No		[Timeline bar]																																	
Milestone 1	18.11.22	18.11.22	No	Yes	[Timeline bar]																																	
Milestone 2	06.06.23	06.06.23	No	Yes	[Timeline bar]																																	
Milestone 3	07.02.24	07.02.24	No	No	[Timeline bar]																																	
Milestone 4	13.02.24	13.02.24	No	No	[Timeline bar]																																	
Milestone 5	11.02.25	11.02.25	No	No	[Timeline bar]																																	
Milestone 6	14.07.25	14.07.25	No	No	[Timeline bar]																																	
Milestone 7	26.03.26	26.03.26	No	No	[Timeline bar]																																	
Sistemas FAB A SF/CA			Yes		[Timeline bar]																																	
Equipos - Sistemas - Software	01.10.23	10.02.27	Yes		[Timeline bar]																																	
Milestone 23	01.10.23	02.10.23	No	Yes	[Timeline bar]																																	
Milestone 24	01.10.23	16.10.23	No	Yes	[Timeline bar]																																	
Milestone 25	15.10.23	16.10.23	No	Yes	[Timeline bar]																																	
Milestone 26	14.01.24	13.06.24	No	No	[Timeline bar]																																	
Milestone 27	22.06.24	25.11.24	No	No	[Timeline bar]																																	
Milestone 28	10.05.24	29.11.24	No	No	[Timeline bar]																																	
Milestone 29	19.11.24	29.11.24	No	No	[Timeline bar]																																	
Milestone 30	14.07.25	06.06.25	Yes	No	[Timeline bar]																																	
Milestone 31	14.02.25	10.07.25	No	No	[Timeline bar]																																	
Milestone 32	03.07.26	11.02.26	Yes	No	[Timeline bar]																																	
Milestone 33	31.01.27	10.02.27	No	No	[Timeline bar]																																	
Documentación	29.10.23	19.03.25	No		[Timeline bar]																																	
Pruebas	28.09.23	11.03.25	No		[Timeline bar]																																	
Trabajos in-situ	15.11.23	15.11.23	No		[Timeline bar]																																	
Submarino S83			No		[Timeline bar]																																	
Astillero Cartagena			No		[Timeline bar]																																	
Sistemas FAB A SF/CA			No		[Timeline bar]																																	
Submarino S84			No		[Timeline bar]																																	

A corporative Layout has been prepared, so everybody sees the same, independently if they are looking from NI or one of the NI* projects (NI* projects will not display milestones from other aux. BU)

The tools

3. Database automations: automated reports by e-mail

[Safran Project] Proyectos Eva Vázquez - Incidencias en la Planificación (2023.10.23)

Comunicaciones Safran Project <comunicaciones_...>
 To: jvarela@navantia.es
 Cc: Borges, Jorge
 Mon 23/10/2023 13:39

Attachments: EvaVazquez_incidenciasPlanificacion_2023.10.23.csv (827 KB)

Hola.

Se ha generado el informe "Proyectos Eva Vázquez - Incidencias en la Planificación" a fecha 2023.10.23. Se envía adjunto el resultado de su ejecución y, a continuación, un listado con el número de incidencias de cada tipo.

Proyectos Eva Vázquez - Incidencias en la Planificación	
Incidencia	Nº de Activi
[Check 01] Total Float negativo	0
[Check 02] Total Float > 150	393
[Check 03] Fechas Early anteriores al Timenow	411
[Check 04] Restricciones "duras"	739
[Check 05.1] Out of Sequence	144
[Check 07.2] Sin Calendario o con Calendario diferente al 10	0
[Check 09] Descripción de más de 40 caracteres	0
[Check 11] Descripción "ANULAD@" sin "No Existente"	0

A	B	C	D	E	F	G
Incidencia	Project Name	WBS - F1	Activity ID	Description	Lenght Description	Total Float
[Check 02] Total Float > 150	FB.8728	FB.8728.N.A.BCO.002	156230-0100	Activity 01		449
[Check 02] Total Float > 150	FB.8728	FB.8728.N.A.BCO.002	156230-0110	Activity 02	22	449
[Check 02] Total Float > 150	FB.8728	FB.8728.N.A.BCO.002	156230-0120	Activity 03	28	449
[Check 02] Total Float > 150	FB.8728	FB.8728.N.A.BCO.002	156230-0130	Activity 04	29	449
[Check 02] Total Float > 150	FB.8728	FB.8728.N.A.BCO.002	156230-0140	Activity 05	20	449
[Check 02] Total Float > 150	FB.8728	FB.8728.N.A.BCO.002	156230-0150	Activity 06	34	449
[Check 02] Total Float > 150	FB.8728	FB.8728.N.A.BCO.002	156230-0160	Activity 07	27	449
[Check 02] Total Float > 150	FB.8728	FB.8728.N.A.BCO.002	156230-0170	Activity 08	30	453
[Check 02] Total Float > 150	FB.8728	FB.8728.N.A.BCO.002	156230-0180	Activity 09	27	449
[Check 02] Total Float > 150	FB.8728	FB.8728.N.A.BCO.002	156230-0190	Activity 10	24	453
[Check 02] Total Float > 150	FB.8728	FB.8728.N.A.BCO.002	156420-0030	Activity 11	16	2502
[Check 02] Total Float > 150	FB.8728	FB.8728.N.A.BCO.002	156420-0040	Activity 11	18	2509

Each planner, group of planners, planning manager... receives a weekly customized report by e-mail automatically, extracting data from Safran Database according to the incidences or metrics they want to check.

The tools

3. Database automations: different operations in userfields and standard fields, not possible using formulas from the application. Some examples:

The recently “All predecessors completed” (with some variations) was automated in a flag userfield

After each integration from SAP to Safran, a database automation adjusts the progress of non-SAP resources (used sometimes exclusively in Safran for particular levelings), so when executing an Status Update, the aggregated progress depends only on SAP resources

Another automation calculates the aggregated cost progress at activity level in an userfield, based on each resource progress and the cost budget (since the application only calculates the progress based on qty)

Some flags are automated for identifying activities with some particularities, which are not easy or not possible to identify using standard filters such as activities with at least one SS/FF/SF link with a successor, activities with inconsistent progress and actuals, activities having resources integrated from SAP without budget...

Limitations: these automations are executed periodically (daily, weekly...) or triggered by an integration SAP – Safran, so they don't respond to changes in the schedule, and it is necessary to execute them manually for an immediate update, or wait.

