

Integration reviews

a creation of a reality check, consistency check and alignment between
engineering documentation vs. design solutions

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Agenda

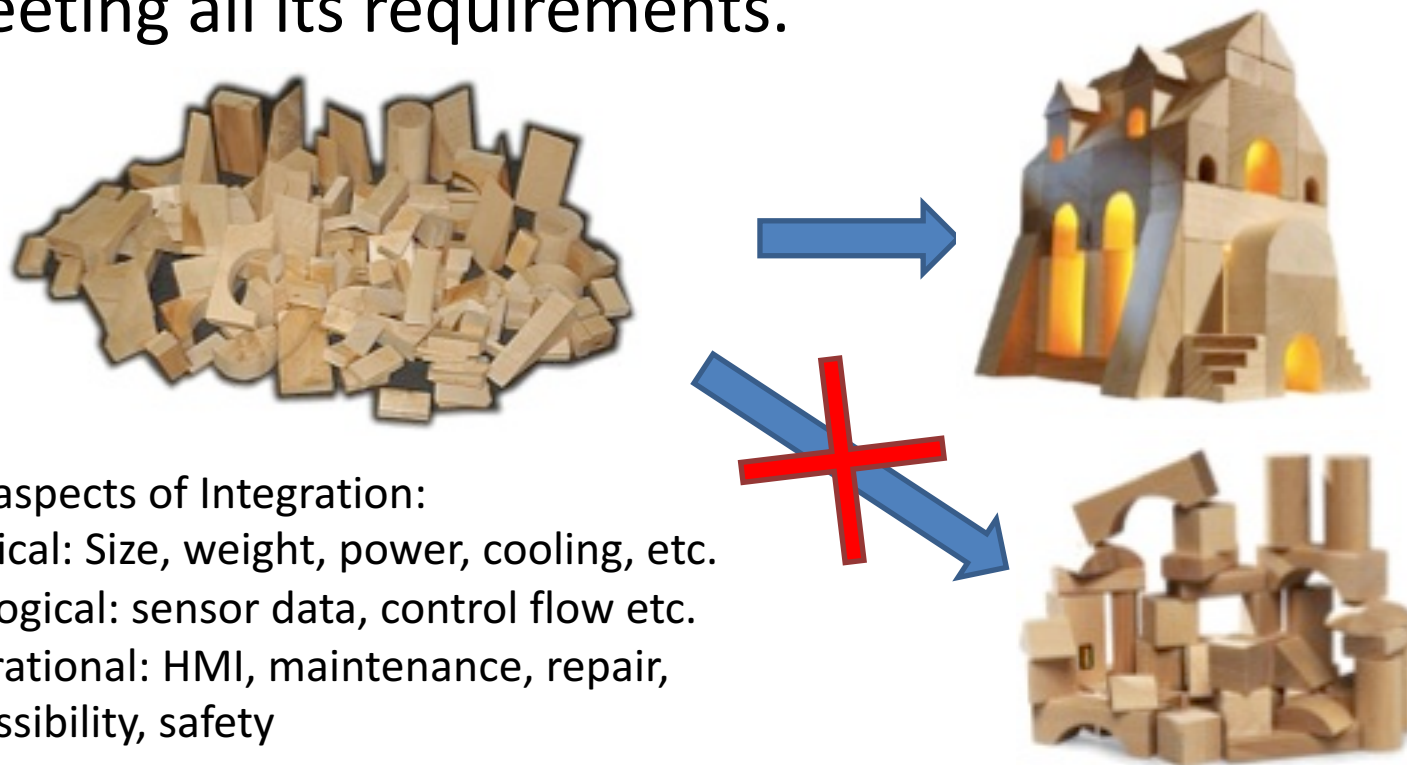
- Short introduction
- Integration – a definition
- Facilitating integration – some thoughts
- Integration reviews – rationale and setup
- Conclusions

About me

- MSc Engineering Physics
- 20+ years experience of systems engineering and project management. Mainly from Submarine Design and Construction:
 - Roles/Positions
 - Systems Engineer for Hydroacoustical Systems and Combat Systems Infrastructure (Technical Project Leader roles)
 - Design Authority Representative for Combat Systems Integration; Australia's Collins Class Submarine
 - Project Manager Combat Systems Integration; two classes of submarines
 - Submarine Integration Manager/Chief Project Engineer; Next Generation Submarine in Sweden (numbers now published; about 950 M€ - responsible for 30% directly)
 - Propulsion System Integration Advisor – Frigate program
 - Project Manager – Mine Warfare System
 - Involved in Implementation of Systems Engineering
 - Product Experience
 - 4 Different submarine Classes in Sweden
 - 3 Different Submarine Classes for export customers
 - 3 Different Submarine Rescue Vehicle classes; domestic and export

Integration – “a definition”

- Is the work performed to realise a system by bringing together the component sub-systems into one entity – meeting all its requirements.



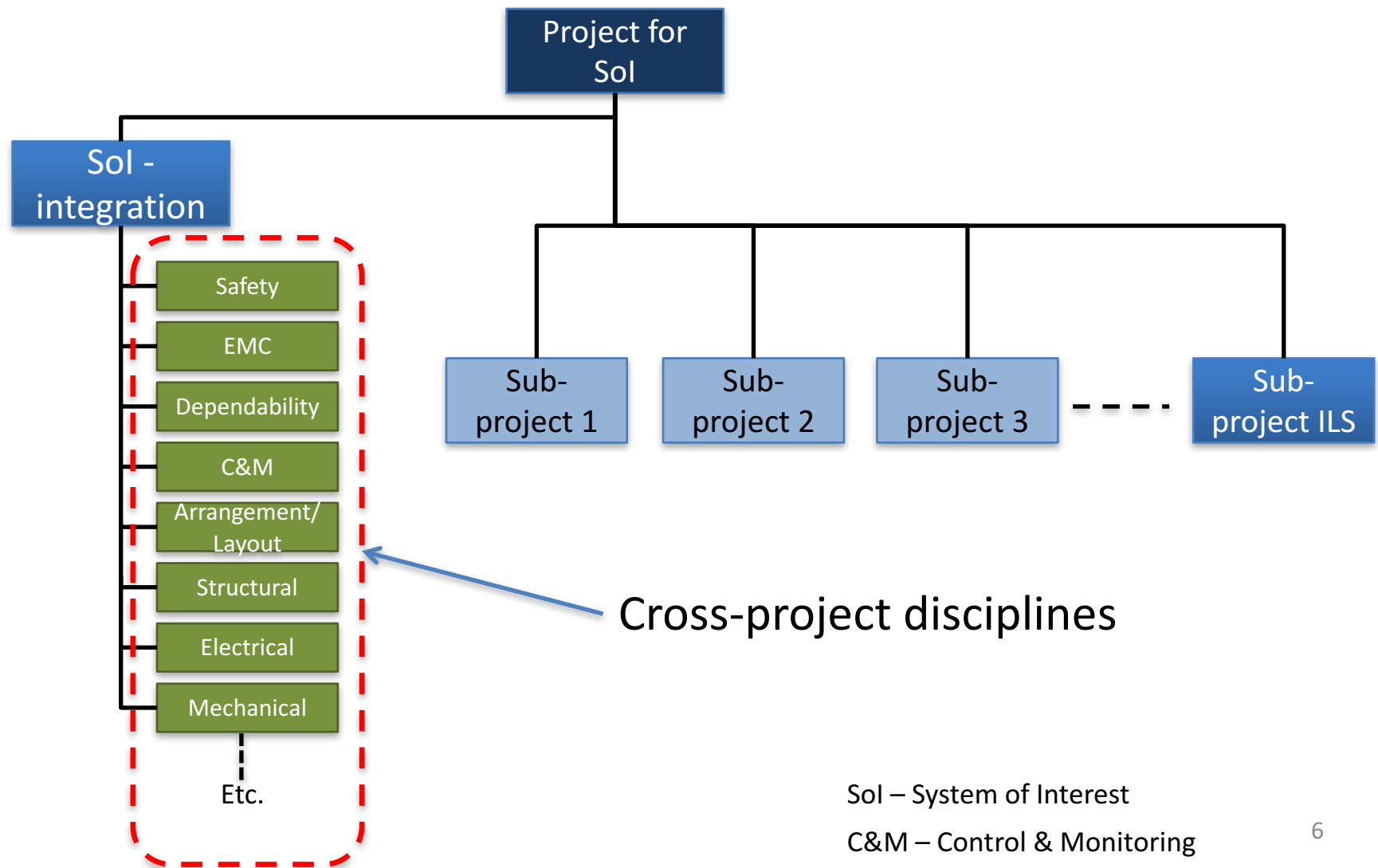
Typical aspects of Integration:

- Physical: Size, weight, power, cooling, etc.
- Infological: sensor data, control flow etc.
- Operational: HMI, maintenance, repair, accessibility, safety

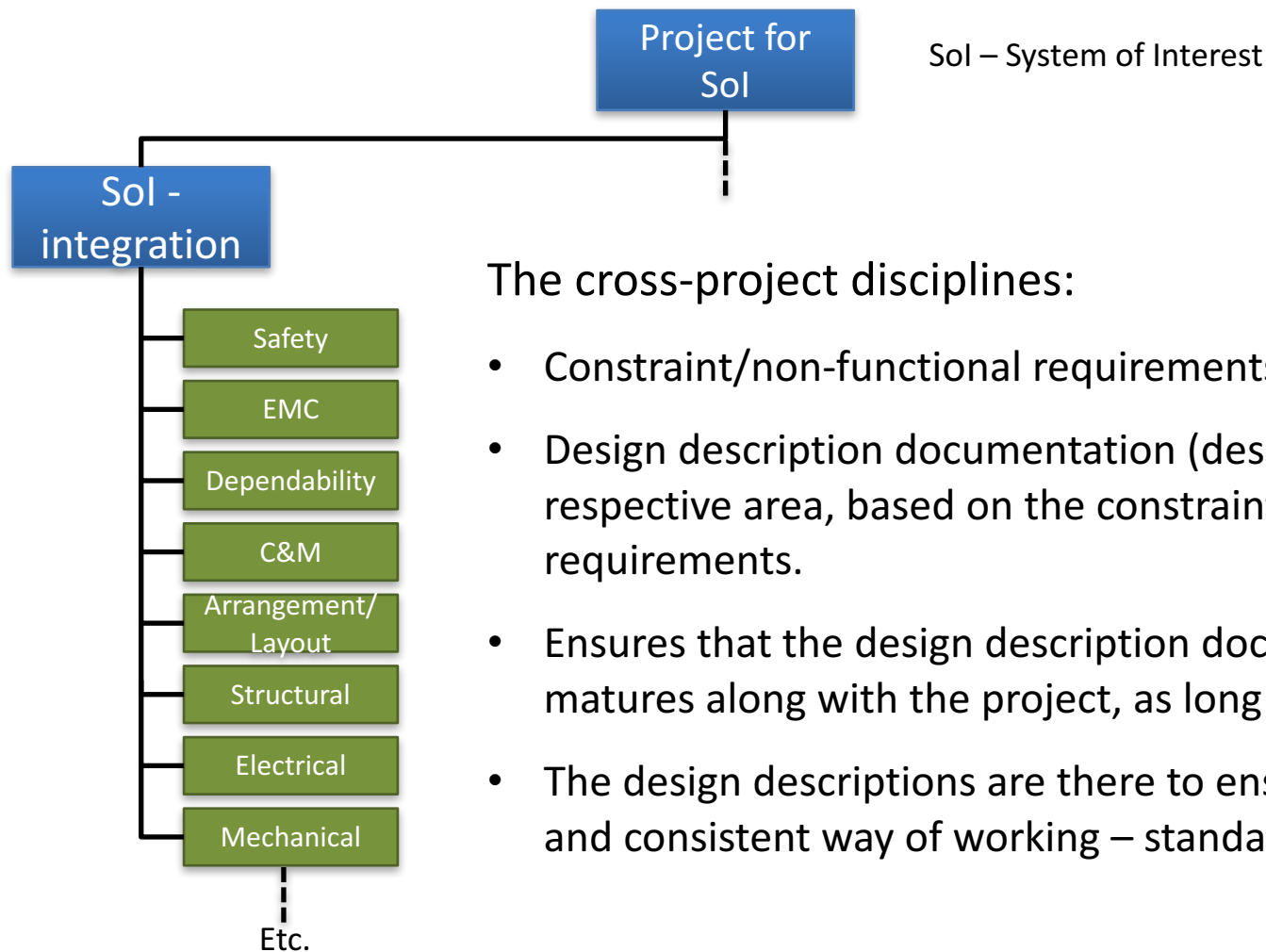
Facilitating Integration – Some thoughts on Requirements

- Frontloading – think ahead w.r.t training, operations (incl. RAMI) and decommissioning etc.
- Defined requirements; further refined and propagated to lower level systems.
- Freezing of requirements at certain juncture points early in the project.
- Constraint/non-functional requirements to be identified as early as possible
- Clearly identifying interfaces and accompanying requirements

Facilitating Integration – Some thoughts on Project setup



Facilitating Integration – Some thoughts on consistent work approach



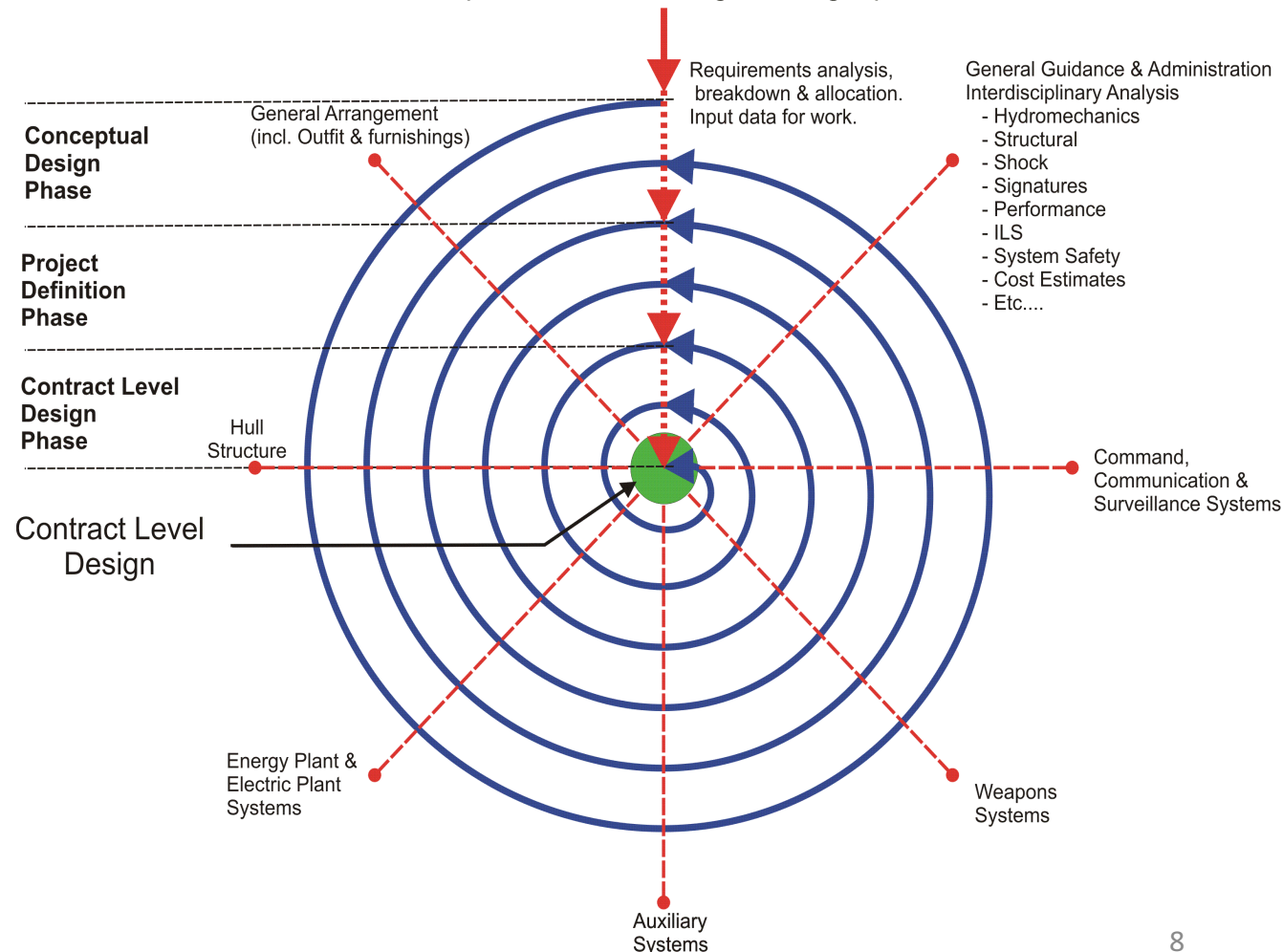
The cross-project disciplines:

- Constraint/non-functional requirements.
- Design description documentation (design rules) for respective area, based on the constraint requirements.
- Ensures that the design description documentation matures along with the project, as long as needed.
- The design descriptions are there to ensure a unified and consistent way of working – standardization

Facilitating Integration – Some thoughts on iterative development

Example: Typical submarine design process (part of)

Requirements & other governing input



Detailed Design Phase and Construction Phase follows

Iterative development:

- Allows for parallel activities – under control.
- Achieve incremental progress - balanced Sol.
- Allows for the gradual increase of maturity of design description documentation.
- Suitable for selective systems development (major, mid-size, small systems)

Integration Reviews - Key Objective

The Key Objective of Integration Reviews is to have a:

Reality Check, Consistency Check and Alignment
between

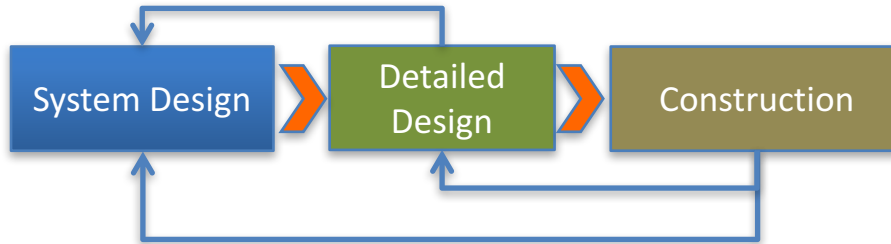
Engineering documentation

VS.

Design Solutions prepared for Construction
together with accompanying Installation
Management

Integration Reviews – Rationale

Preferred and ideal way to ensure outcome:

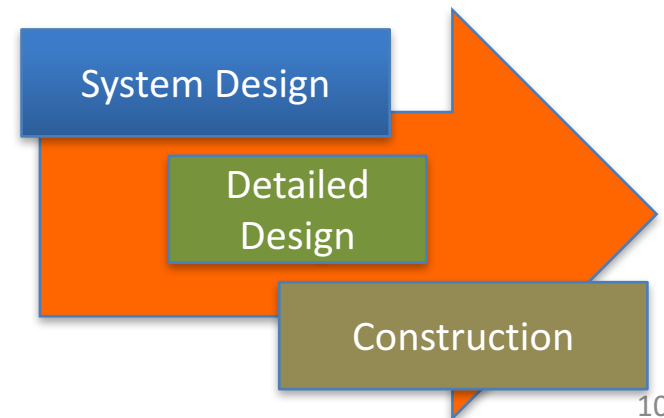


Integration work required, but easily managed.

However this could be a reality:

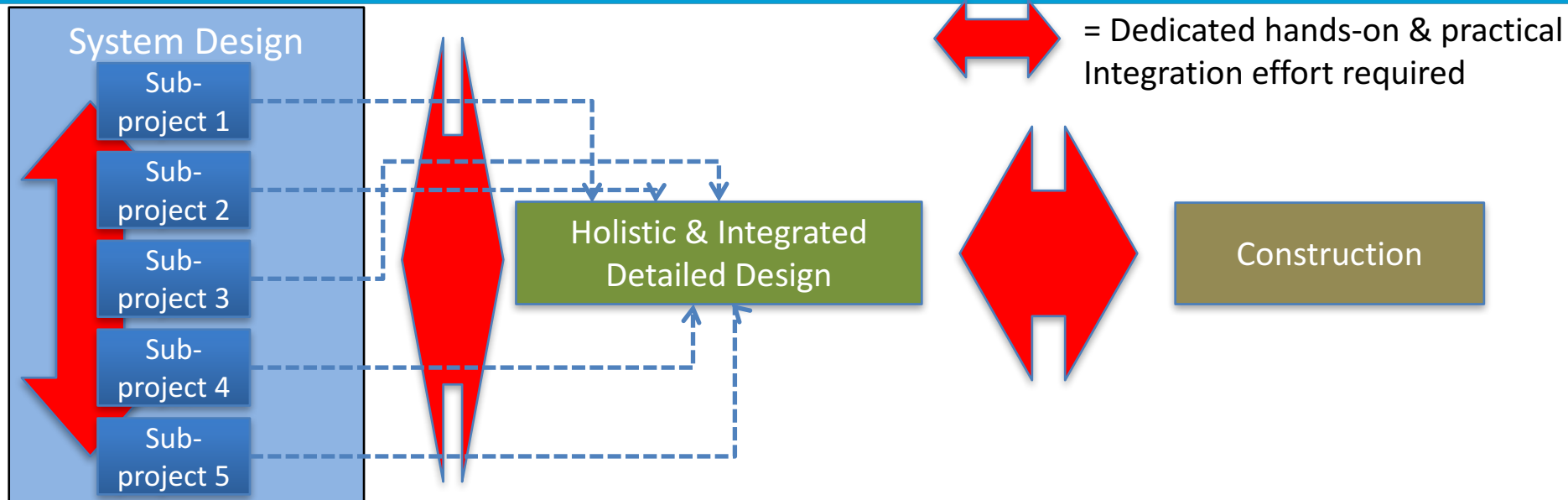
Where:

- Integration requires a hands-on and practical approach on a day-to-day basis



Integration Reviews – Rationale, cont.

Multidimensional Integration



System Documentation

- is prepared according to the Development Process control document
- Multiple Juncture points.
- Gradually increased maturity of system designs.
- The different Systems are in different stages of maturity.
- Systems do not generally share delivery times

Prepared Design Solutions

- 3D Models (Clash detection!)
 - Systems from all Sub-Projects
 - “Structural Enclosure” items: doors, walls etc.
 - Main services: piping, cable trays, ventilation and cooling systems etc.
- Detailed Design drawings for construction
- Installation sequence planning (when, order, required equipment (cranes, personnel, tools, forklifts etc.))

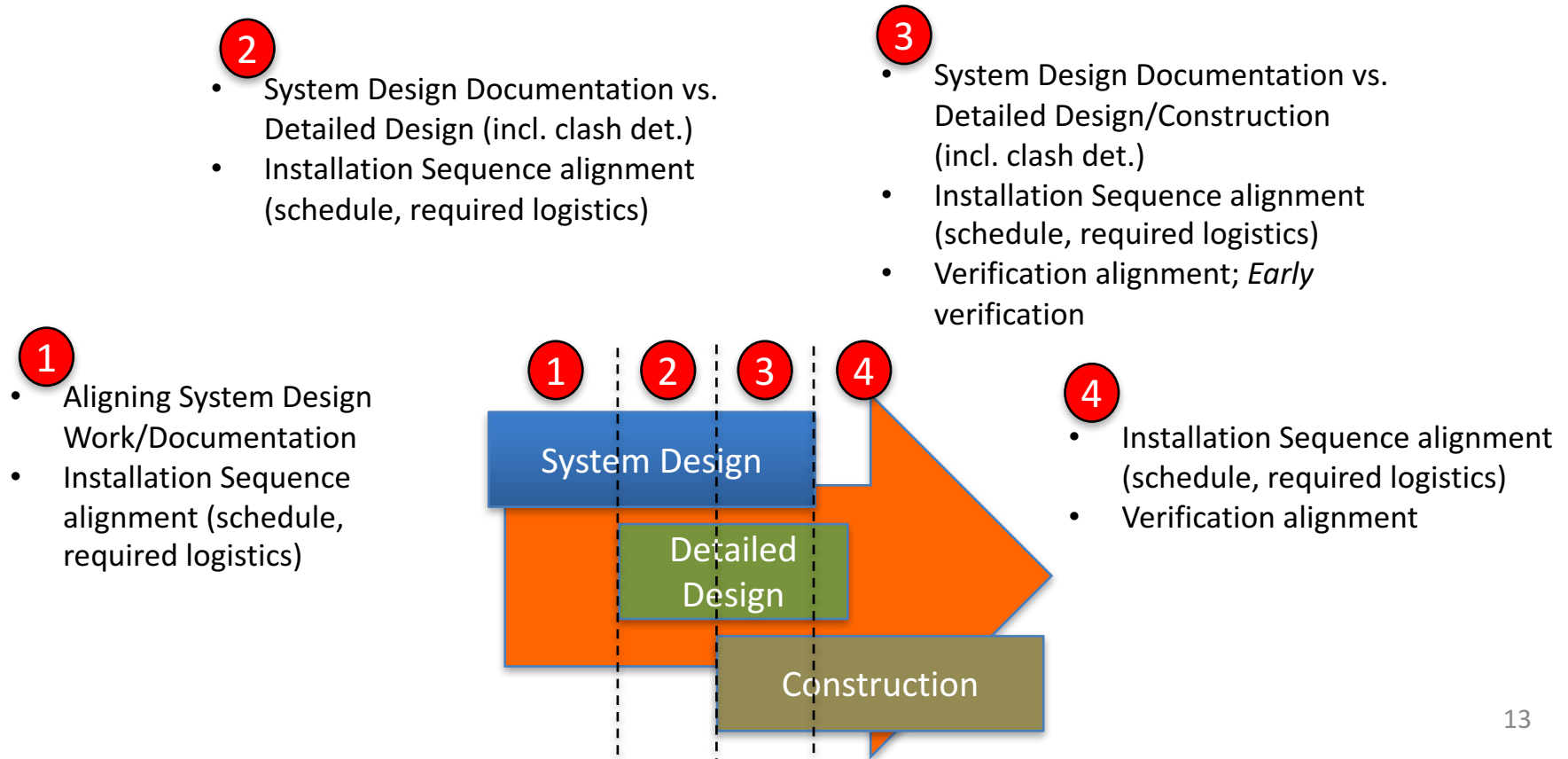
- Structural work (piling, concrete)
- Walls & roofs
- Rooms/zones
- Outfitting Conventional (substations, pumps, motors)
- Outfitting facility specific
- Pipe/vent/cable routing
- Etc.

Integration Reviews – Rationale, cont.

- Integration reviews should be conducted to align and harmonize a Project/System of Interest.
 - One critical driver of the IRs is the alignment and consistency between design solutions provided for construction, from an project wide perspective (i.e. holistic and balanced) and the engineering documentation that is the basis for them.
 - Another is the Installation sequence planning that benefit from IRs and that has an impact on required resources and schedule.
- Integration Reviews should be based on actual maturity of the development of a Project – It is a practical and hands-on effort and NO POWERPOINT or other DOCUMENTATION ENGINEERING exercise.

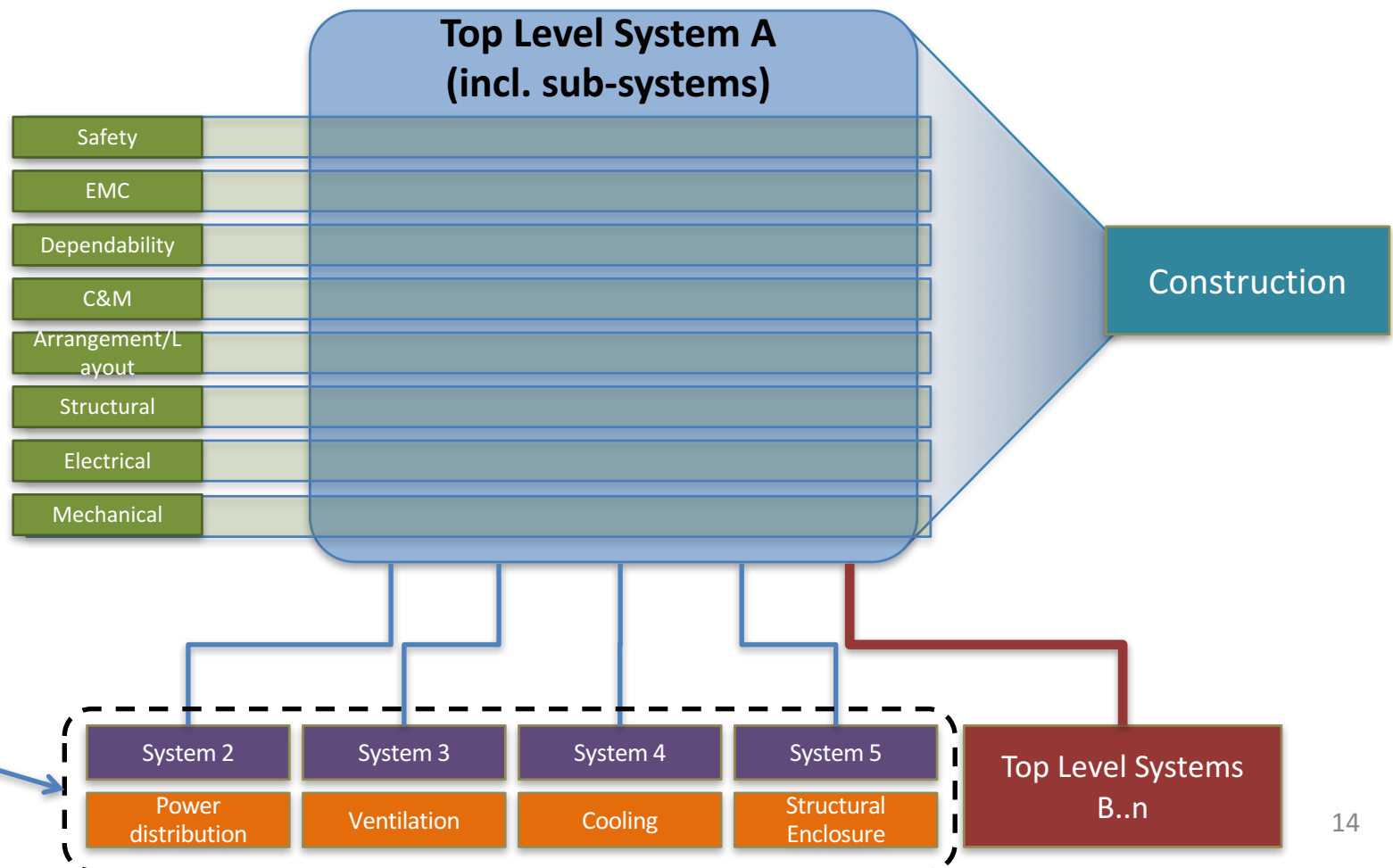
Integration Reviews – Possible Setup

- Type of setup depends on the phase of the project
 - Different focus areas (examples)



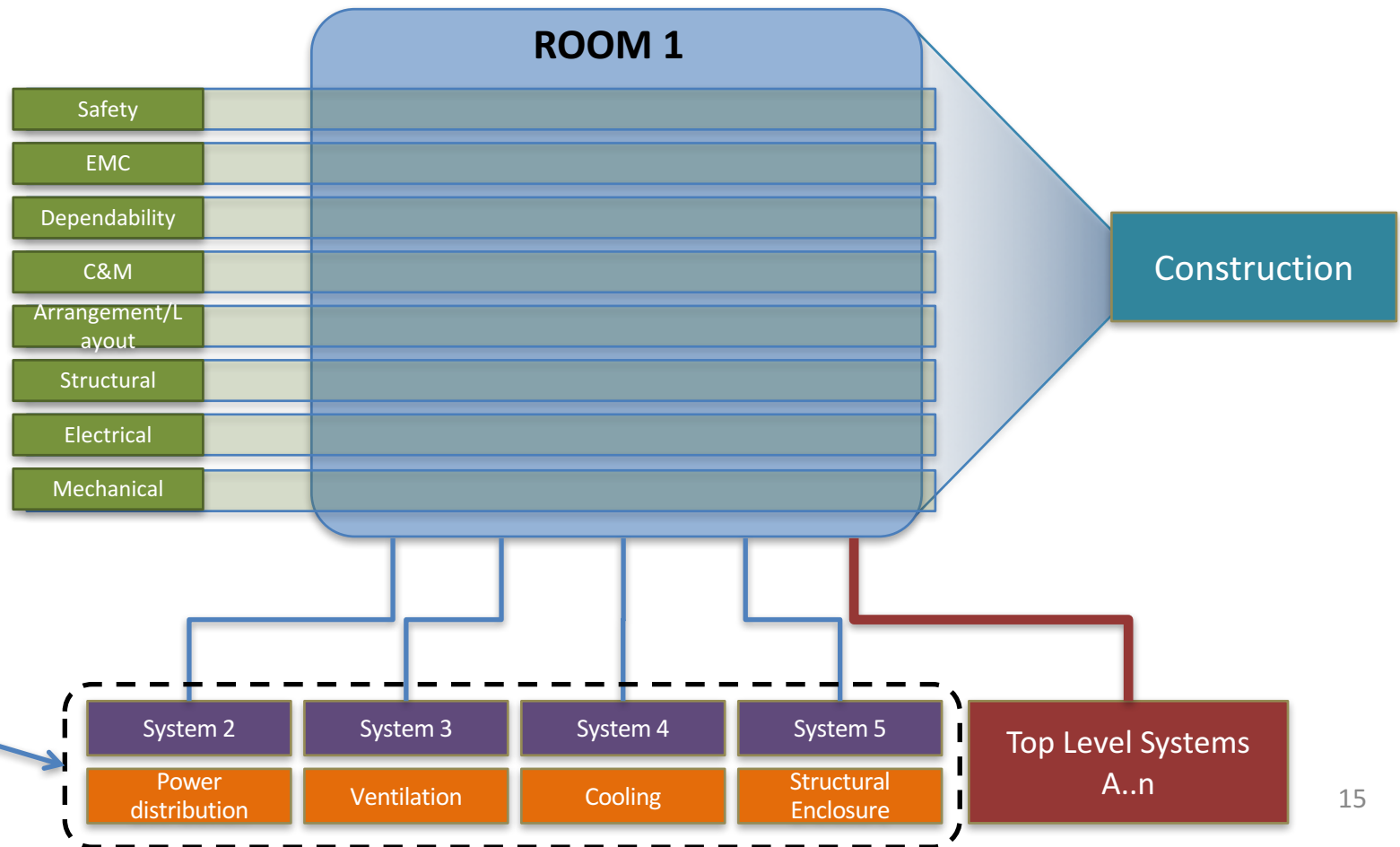
Integration Reviews – Possible Setup; Conduction of Integration Reviews

Top-Level System perspective:



Integration Reviews – Possible Setup; Conduction of Integration Reviews

Top-Level “Room” Perspective:



Integration Reviews – A separate Coordination Office

- As Integration Reviews are the culmination of a hands-on day to day work it makes sense to have a separate entity to handle this – e.g. a Coordination Office (or eqv.).

A Coordination Office should be:

- An independent entity
- Charged with preparing and leading Integration reviews
- Reporting to the PM/PMO
- Consisting of one or more full time staff plus representatives from other project areas.
- Have the authority to be the arbiter of **issues** of minor impact (e.g. issues that could be disputed by affected parties but does not imply overall project scope, cost and/or schedule changes)

Integration Reviews – Conclusion

Integration reviews benefit greatly from:

- A verified process (applies to both a “sequential” as well as a “parallel” project) - that is truly enforced by management.
- A facilitating project structure/set-up
- A full time Integration Coordination Office both working with day-to-day issues as well as conducting the reviews themselves