Total Ship Process Modeling

"Ship Design Project Management; can we improve?"

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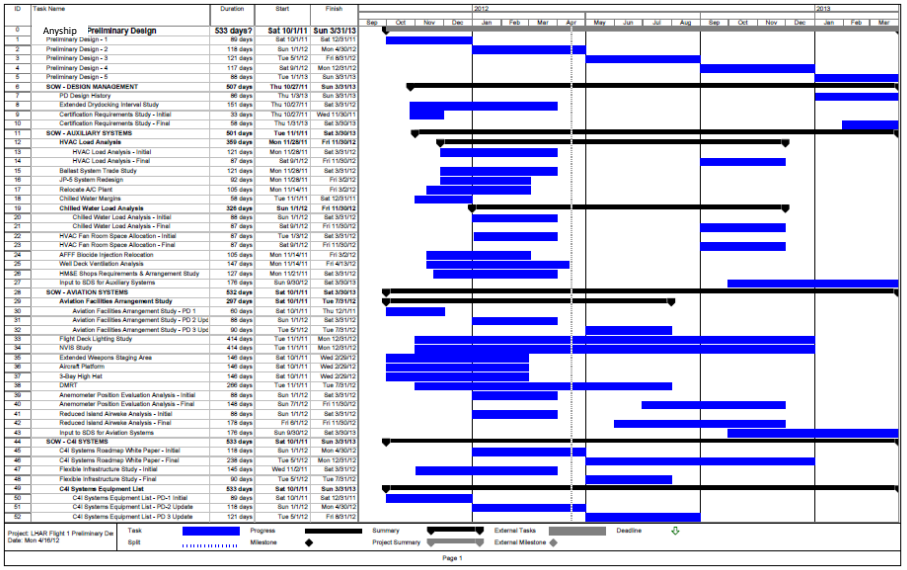
Some questions:

- Have you ever been involved in a project that was completed late?
- Have you ever been delayed by someone else not providing you the input you needed?
- Has anyone expected you to provide something without letting you know?
- Have you ever had a beneficial suggestion, but no means of demonstrating its value?

Notice:
Bad planning on your part does not constitute an emergency on my part.

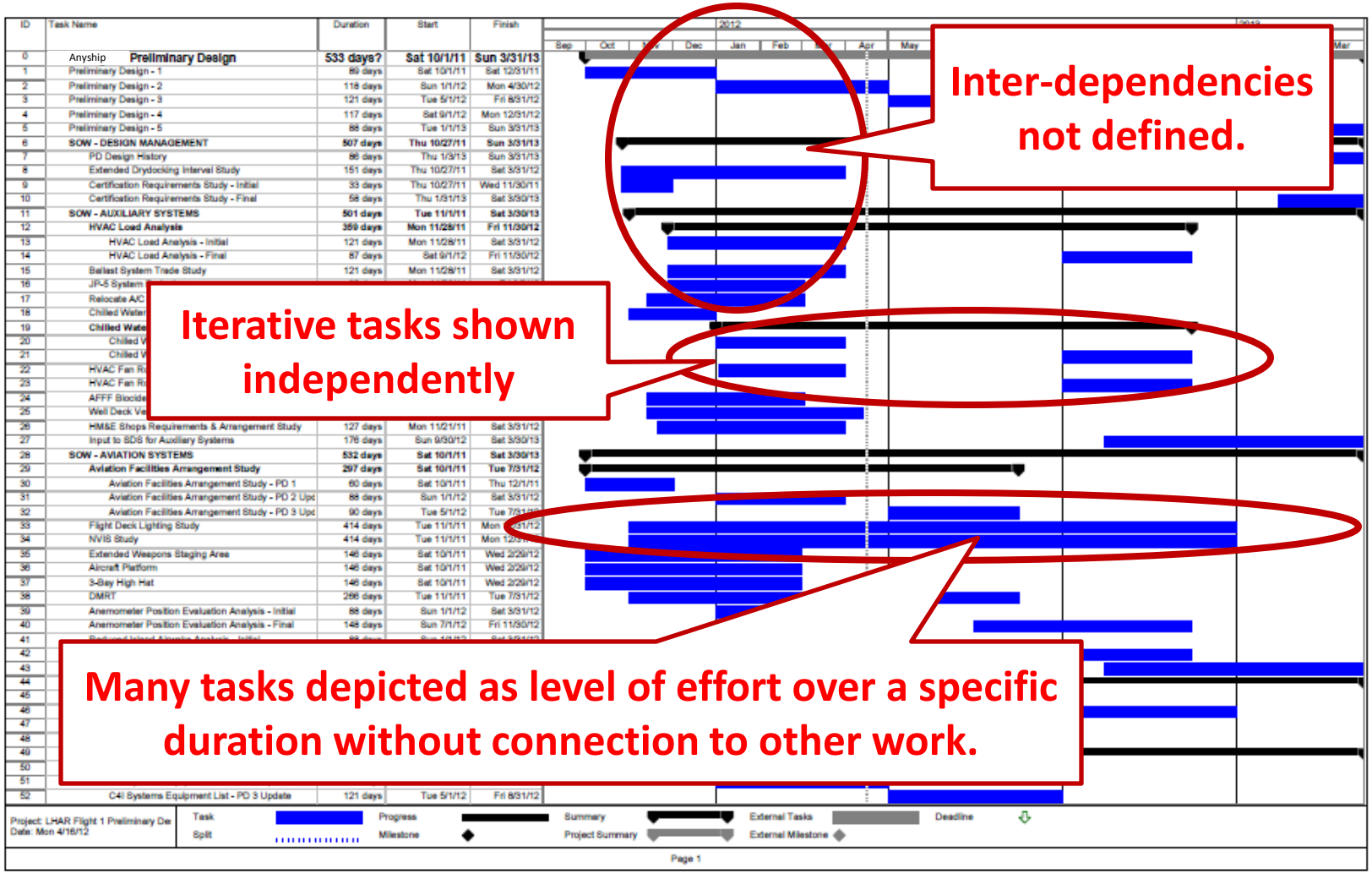
Typical Preliminary Design Schedule

- Tasks described in Microsoft Project®
- Collocated HM&E resources (to extent possible)
- Multiple Commands involved
  - Aviation Systems
  - Combat Systems
  - Integrated Warfare Systems



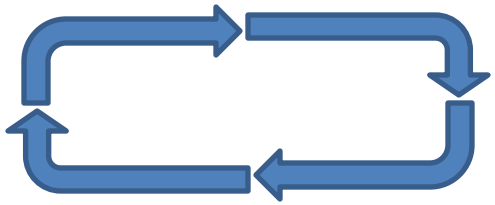
ID	Task Name	Duration	Start	Finish
0	Anyship Preliminary Design	533 days?	Sat 10/1/11	Sun 3/31/13
1	Preliminary Design - 1	89 days	Sat 10/1/11	Sat 12/31/11
2	Preliminary Design - 2	118 days	Sun 1/1/12	Mon 4/30/12
3	Preliminary Design - 3	121 days	Tue 5/1/12	Fri 8/31/12
4	Preliminary Design - 4	117 days	Sat 9/1/12	Mon 12/31/12
5	Preliminary Design - 5	88 days	Tue 1/1/13	Sun 3/31/13
6	SOW - DESIGN MANAGEMENT	507 days	Thu 10/27/11	Sun 3/31/13
7	PD Design History	96 days	Thu 1/3/13	Sun 3/31/13
8	Extended Drydocking Interval Study	151 days	Thu 10/27/11	Sat 3/31/12
9	Certification Requirements Study - Initial	33 days	Thu 10/27/11	Wed 11/30/11
10	Certification Requirements Study - Final	58 days	Thu 1/3/13	Sat 3/30/13
11	SOW - AUXILIARY SYSTEMS	501 days	Tue 1/1/11	Sat 3/30/13
12	HVAC Load Analysis	359 days	Mon 11/28/11	Fri 11/30/12
13	HVAC Load Analysis - Initial	121 days	Mon 11/28/11	Sat 3/31/12
14	HVAC Load Analysis - Final	87 days	Sat 9/1/12	Fri 11/30/12
15	Ballast System Trade Study	121 days	Mon 11/28/11	Sat 3/31/12
16	JP-5 System Redesign	92 days	Mon 11/28/11	Fri 3/2/12
17	Relocate A/C Plant	105 days	Mon 11/14/11	Fri 3/2/12
18	Chilled Water Margins	58 days	Tue 1/1/11	Sat 12/31/11
19	Chilled Water Load Analysis	326 days	Sun 1/1/12	Fri 11/30/12
20	Chilled Water Load Analysis - Initial	88 days	Sun 1/1/12	Sat 3/31/12
21	Chilled Water Load Analysis - Final	87 days	Sat 9/1/12	Fri 11/30/12
22	HVAC Fan Room Space Allocation - Initial	87 days	Tue 1/3/12	Sat 3/31/12
23	HVAC Fan Room Space Allocation - Final	87 days	Sat 9/1/12	Fri 11/30/12
24	AFFF Biocide Injection Relocation	105 days	Mon 11/14/11	Fri 3/2/12
25	Well Deck Ventilation Analysis	147 days	Mon 11/14/11	Fri 4/13/12
26	HM&E Shops Requirements & Arrangement Study	127 days	Mon 11/21/11	Sat 3/31/12
27	Input to SDS for Auxiliary Systems	176 days	Sun 8/30/12	Sat 3/30/13
28	SOW - AVIATION SYSTEMS	532 days	Sat 10/1/11	Sat 3/30/13
29	Aviation Facilities Arrangement Study	297 days	Sat 10/1/11	Tue 7/31/12
30	Aviation Facilities Arrangement Study - PD 1	60 days	Sat 10/1/11	Thu 12/1/11
31	Aviation Facilities Arrangement Study - PD 2 Upd	88 days	Sun 1/1/12	Sat 3/31/12
32	Aviation Facilities Arrangement Study - PD 3 Upd	90 days	Tue 5/1/12	Tue 7/31/12
33	Flight Deck Lighting Study	414 days	Tue 11/1/11	Mon 12/31/12
34	NWS Study	414 days	Tue 11/1/11	Mon 12/31/12
35	Extended Weapons Staging Area	146 days	Sat 10/1/11	Wed 2/29/12
36	Aircraft Platform	146 days	Sat 10/1/11	Wed 2/29/12
37	3-Bay High Hat	146 days	Sat 10/1/11	Wed 2/29/12
38	DMRT	266 days	Tue 11/1/11	Tue 7/31/12
39	Anemometer Position Evaluation Analysis - Initial	88 days	Sun 1/1/12	Sat 3/31/12
40	Anemometer Position Evaluation Analysis - Final	148 days	Sun 7/1/12	Fri 11/30/12
41	Reduced Island Airwake Analysis - Initial	88 days	Sun 1/1/12	Sat 3/31/12
42	Reduced Island Airwake Analysis - Final	178 days	Fri 6/1/12	Fri 11/30/12
43	Input to SDS for Aviation Systems	176 days	Sun 8/30/12	Sat 3/30/13
44	SOW - C4I SYSTEMS	533 days	Sat 10/1/11	Sun 3/31/13
45	C4I Systems Roadmap White Paper - Initial	118 days	Sun 1/1/12	Mon 4/30/12
46	C4I Systems Roadmap White Paper - Final	238 days	Tue 5/1/12	Mon 12/31/12
47	Flexible Infrastructure Study - Initial	146 days	Wed 11/2/11	Sat 3/31/12
48	Flexible Infrastructure Study - Final	90 days	Tue 5/1/12	Tue 7/31/12
49	C4I Systems Equipment List	533 days	Sat 10/1/11	Sun 3/31/13
50	C4I Systems Equipment List - PD-1 Initial	89 days	Sat 10/1/11	Sat 12/31/11
51	C4I Systems Equipment List - PD-2 Update	118 days	Sun 1/1/12	Mon 4/30/12
52	C4I Systems Equipment List - PD 3 Update	121 days	Tue 5/1/12	Fri 8/31/12

Level of Effort vs. Detailed Process



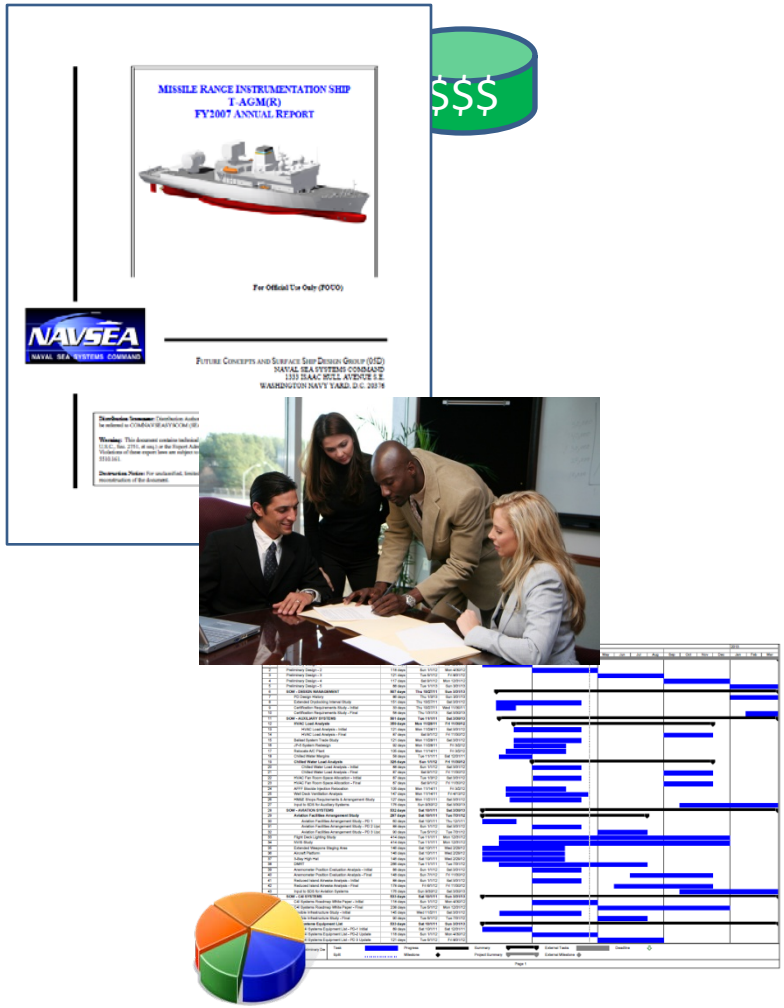
Dynamic Management

- Requirements and Program Office direction can change.
- Weekly stand-up meetings provide this week's priorities and "30 day look" (cadence.)
- The on-site team is cohesive; remote team elements may be less well integrated.
- Design Reviews are key to integration; solutions to issues examined in next cycle.
- Success is function of Ship Design Manager (SDM) skill and intuition.



Organizational Wisdom

- Schedules are based on the experience of the community and leadership expertise.
- Past practice is captured in “Red Books” and Annual Reports.
- Technical Warrant Holder community provides domain expertise.
- Emphasis is on budget allocation.



Opportunity

- Navy budgets increasingly constrained.
- Ship design community decimated.
- Systems becoming more complex.
- Engineering and planning processes consume approximately one third of life cycle costs. (~$13B/yr)
- Scheduling with time-trusted techniques can cause:
  - Unnecessary work
  - Delays
  - Engineering errors; missing data

Can we do better?
Yes, we can!

The Ship Design Process Model

- Since 2008 the Navy has been developing a model of the ship design process.
- Initial objective was to quantify the benefits of new software.
- The team has identified some new tools and techniques that help us capture the expertise of the community and apply it towards effective project planning.
- The Technical Warrant Holder Community has contributed its expertise.
- We are in the pilot stage on real acquisition programs to validate anticipated benefits.

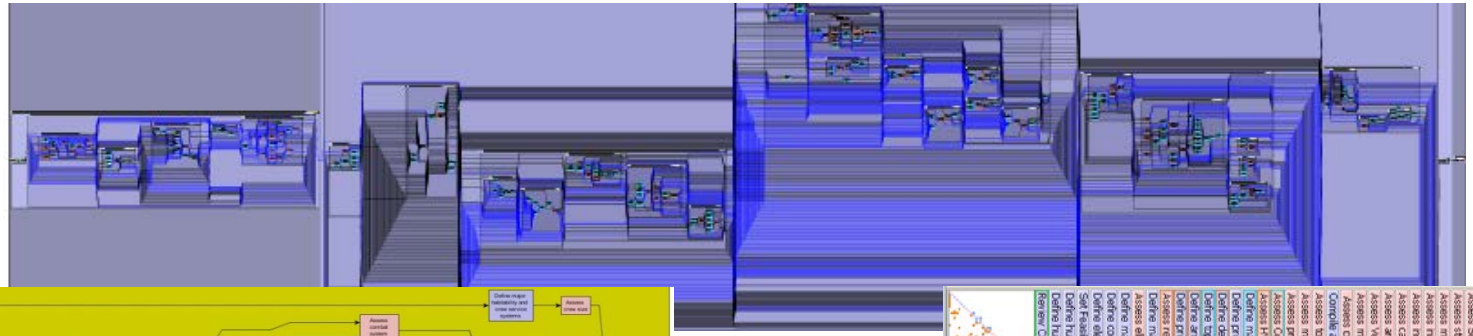
Data-Centric Approach

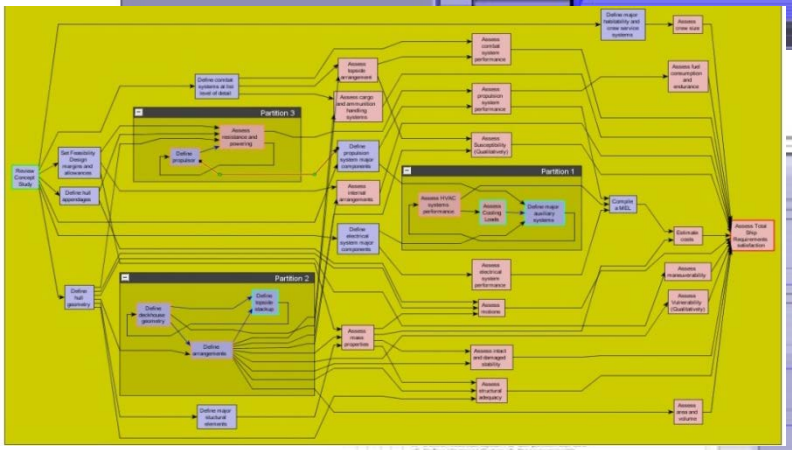
- The Ship Design Process Model (SDPM) is a database that captures the activities and transactions within the ship design process.
- The Ship Design Process Reference Model (SDPRM) represents a typical surface combatant design process.
- The SDPRM data was gathered primarily during the ONR Ship Design Workshops.
- The SDPRM is a starting point for planning other ship design processes; unique models generated.
- The SDPRM includes a representative range of activities and reminds the SDM of activities to consider when planning a new project, of any type.
- Commercial software enables rapid editing to tailor the process and supports simulations to explore alternatives.

The SDPRM has been modeled using the PLEXUS® software from Plexus Planning, Ltd. This commercial product has proven to be intuitive and capable of meeting our modeling needs. Used by Rolls Royce, GE, Boeing, & Raytheon.

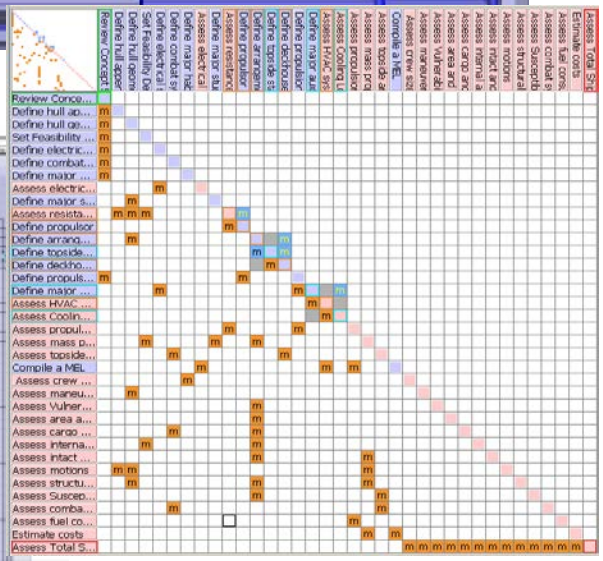
Multiple Views of Same Data

Process Diagrams "Boxes and Arrows"



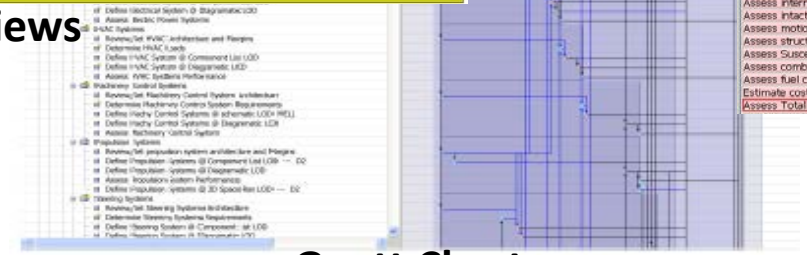


Alternate WBS Views



Design Structure Matrix

Spreadsheets

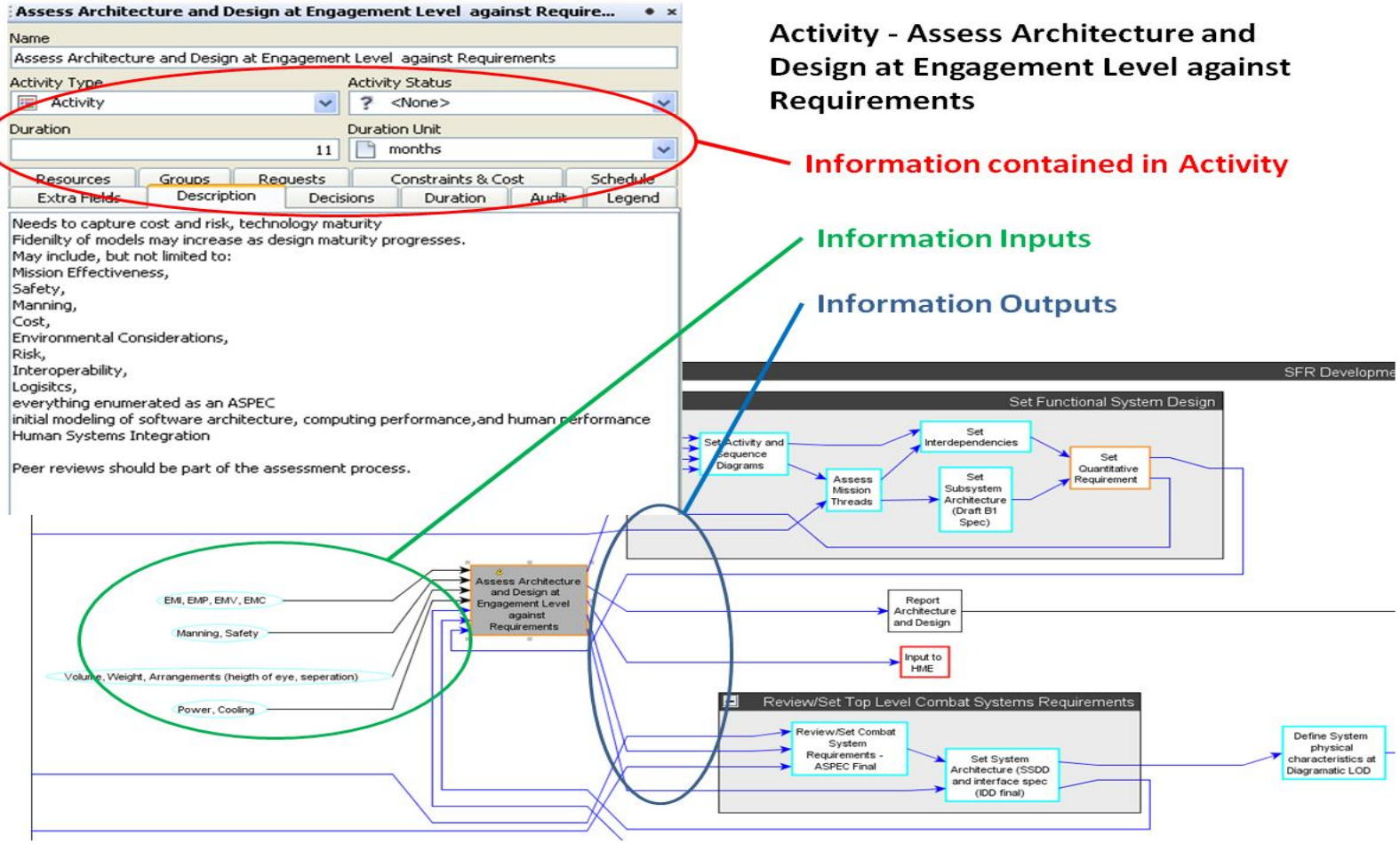


Gantt Chart

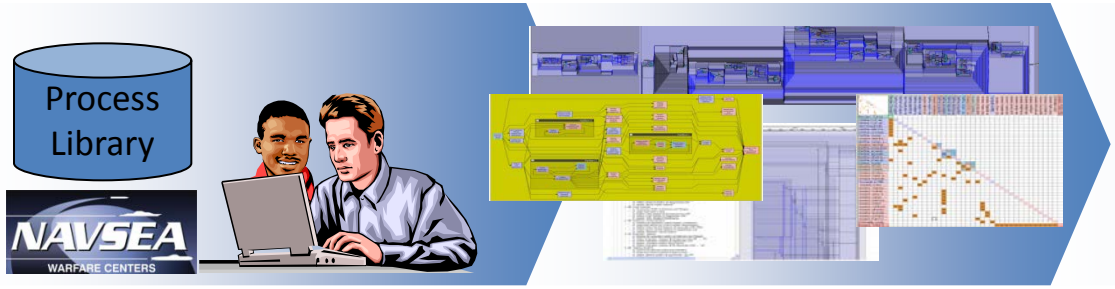
Process Data

- The SDPM captures data on activities and their interdependence.
- The SDPM clearly defines inter-organizational relationships and responsibilities.
- Activity data can include the typical content of tasking statements such as:
  - Organizational Assignments
  - Expected Deliverables
  - Resources Required
  - Expected Duration
  - User-defined data

Process Data

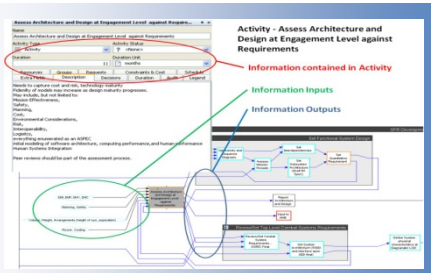


SDPRM Business Processes

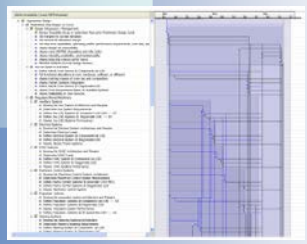


1. SDM consults process model library to begin planning process.

2. Process visualization, rapid assessment of alternatives, and optimization.

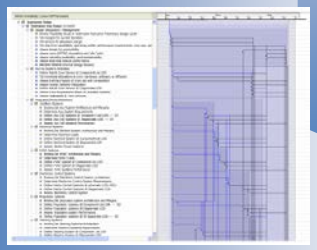


3. Data captured regarding team commitments and dependencies.



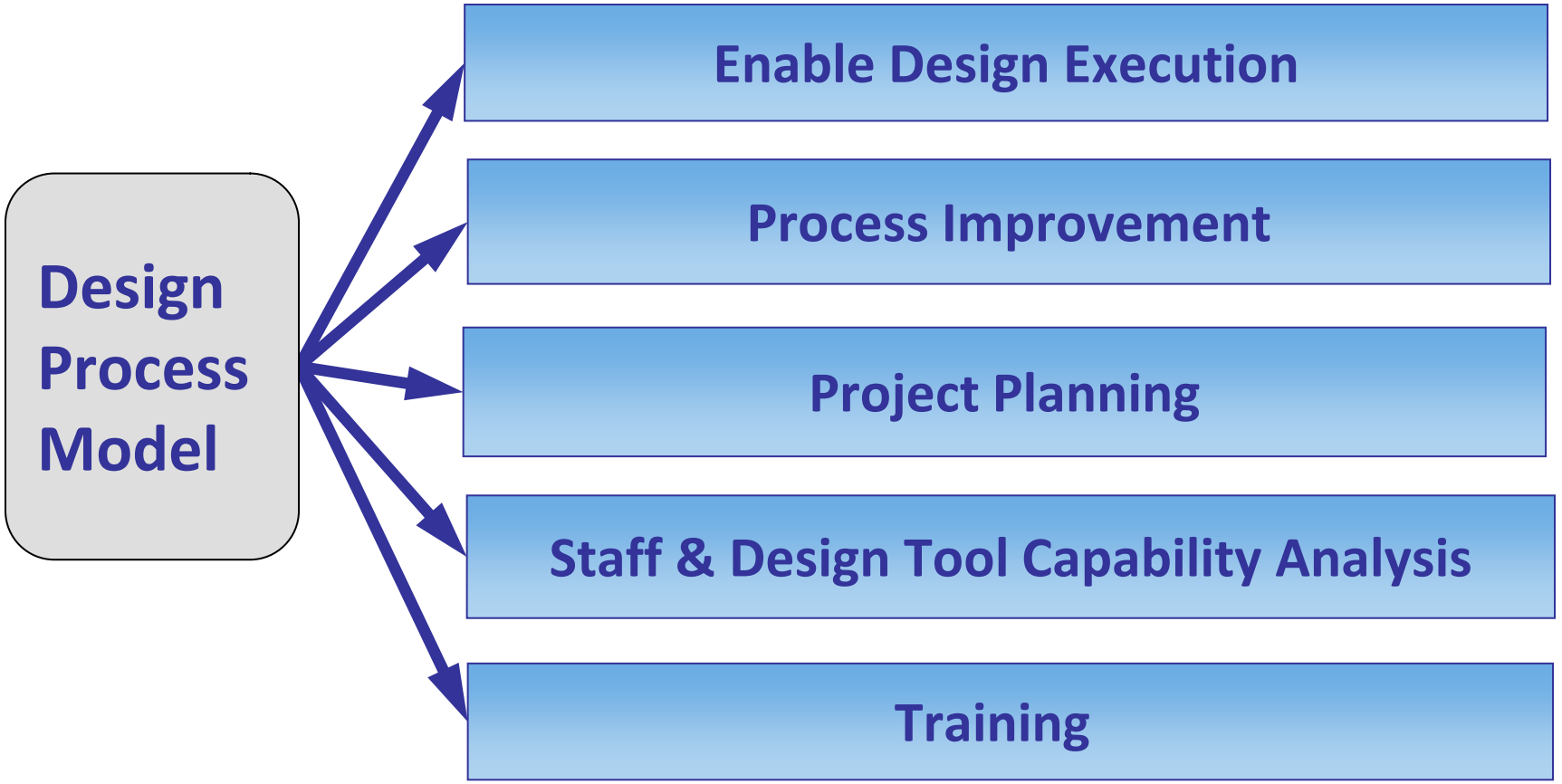
6. Actual results imported back in to the model.

5. Program management



4. Preferred process exported to MS Project.

SDPRM Applications



Summary

1. The ship acquisition community spends $Billions per year on engineering and planning processes.
2. Contemporary modeling tools and techniques are available to understand and assess processes.
3. Effective process execution requires the processes to be defined.
4. Process improvement requires well defined processes.
5. Process modeling supports training.

The SDPRM enables more effective ship design management - *leading to a more cost effective Fleet.*

Need more info?

- NSWCCD Process Model website:
  - http://www.navasea.navy.mil/nswc/carderock/pub/who/departments/ship_design/aspx
- 11th &13th DSM Conferences
  - http://www.dsmweb.org
  - http://129.187.108.94/dsmweb/en/dsm-community/dsm-conference.html
- Vendor data:
  - http://www.plexusplanning.com/