SYM-AM-25-333

Excerpt from the Proceedings

of the

Twenty-Second Annual Acquisition Research Symposium and Innovation Summit

Wednesday, May 7, 2025 Sessions
Volume I

Using Data Analytics and Dashboards in a Research Organization Environment for Project Management

Published: May 5, 2025

The research presented in this report was supported by the Acquisition Research Program at the Naval Postgraduate School.

To request defense acquisition research, to become a research sponsor, or to print additional copies of reports, please contact any of the staff listed on the Acquisition Research Program website (www.acquisitionresearch.net).

ACQUISITION RESEARCH PROGRAM
DEPARTMENT OF DEFENSE MANAGEMENT
NAVAL POSTGRADUATE SCHOOL

Using Data Analytics and Dashboards in a Research Organization Environment for Project Management

David A. Lechner, PhD—is a senior scientist at the Naval Research Laboratory with over 40 years of experience in program management and defense program research. He spent 15 years managing EW and Sonar programs at NAVSEA, then over two decades in private industry developing technology and managing programs. He received his PhD in 2019 from the Catholic University of America in Mechanical Engineering and Acoustics, is a former Washington chapter President of the Acoustical Society of America, and has taught Physics as an Adjunct Professor at Anne Arundel Community college. [David.A.Lechner.Civ@US.Navy.mil]

Austin Tamez—is a Senior Project Manager at Envisioneering Inc with over 10 years of management experience. He is a former U.S. Navy Lieutenant and served on the ballistic missile submarine SSBN 735 USS Pennsylvania and taught as a submarine tactics instructor for several years. He received a BS in Operations Research from the Unites States Naval Academy and was certified as a Nuclear Engineering Officer by Naval Reactors. He currently works with Naval Research Laboratory Code 5720 helping to manage advanced R&D programs, and helped implement and improve the Power BI PM Tool designed at NRL. [Austin.R.Tamez.ctr@US.Navy.mil]

Abstract

The use of data analytics tools offers significant new opportunities for acquisition programs in the Department of Defense (DoD). In particular, the use of modern tools like Power BI and Tableau provide data platforms to organize, visualize, and track program data. This paper will review how data dashboards built on the Navy's Flank-speed platform were developed for experimental use by one particular section of a research organization, Code 5720 within the U.S. Naval Research Laboratory (NRL). The results are largely transferrable across the DoD, as the tools use Microsoft's Power BI and the dashboard modules are instantly replicable. We review the motivation for building the platform, review its capabilities in tracking technical goal alignment with "north star" objectives, how it tracks expenses and estimated costs at completion, and how the visual schedule data is easily updated and understood. We will review how long it took our team to build the dashboard, what it takes to instantly copy it onto other platforms, and what we do to maintain the data using simple MS Excel files. We will show how a potential organizational management dashboard might look, and review how the use of dashboards is improving our branch's operations and a potential data analytics framework that crosses the full acquisition life cycle.

Note: This work reflects an experimental use of data tools in one specific branch of NRL and does not reflect the views or usage by the entire organization.

Research Issue/Problem Statement

Defense program management requires management of financial, schedule, technical, and quality status and progress. Historically programs were planned by writing lengthy documents. Those documents were then approved by senior management as stand-alone volumes, using the knowledge and experience (and limitations and bias) of the approver. Typical attempts to improve program oversight have included adding more reporting, typically via added documents and reporting of schedule and financial data in greater detail. Without tracking (good and bad) project data, there is no way to compare the planning data and results metrics as the plans and technical specifications are contained in static documents. It should be possible to prevent project failure if we are able to look backwards and determine common elements in failed projects. NRL 5720 has been developing a set of tools that convert plans, presentations, and tables of financial data into an integrated planning and program management tool. Although designed for R&D projects, it is generally extendable to the development, engineering, and production phases of a program. This paper presents the motivation, design, and development history of the planning tool.

Motivation for Building a Data Analytics Tool for Project Management

NRL 5720 is a branch at NRL with about 30 projects, and we wanted to improve management of our technical planning, schedules, financial status, and staffing. We built the early version of this prototype in 2023 using PowerPoint slides to design and storyboard the tool, and used the format from decade-old quarterly program reviews as our starting point. We started using the prototype in 2024 for one project, then recently expanded it to all of our projects in 2025. Starting with effectively zero institutional knowledge about how to construct a Power BI dashboard, a total of about 6 staff months of effort have been invested in the tool so far, reflecting how easy these tools are to use. Over time the expectation is that the data will accumulate, allowing new uses in comparative and predictive analytics.

There were several questions we wanted the tool to answer, primarily:

- What are the strategic technical objectives of our research?
- Are the projects on track to meet technical objectives?
- Are the projects on track to complete on promised schedules?
- Is our cashflow OK? Will we run out? Are we fully spent for expiring funds?
- Do we have enough work for our staff?
- Do we have enough staff? Do we need to hire? When? How many?
- How do the sections of our branch compare in metrics? Which needs help?
- Who are our current sponsors? Who are the future sponsors?

Project Management Tool Capabilities

The project management (PM) tool we developed shows project managers and organizational leadership data as a series of tabs on a web page, but is designed to show the health of our projects and our organization in a dashboard style, just like the dashboard of a car shows its health while driving. Just like a car, the data is color coded when possible, with green lights for good data and yellow and red for bad. This does focus the viewer on problem areas, and allows faster review of good projects and data.

The dashboards are designed to replace the typical PowerPoint slides that dominated staff meetings in the past, and allow instant viewing of data without having to enter data, copy graphics, and paste them on a slide. The data is always available, and the visual data can be refreshed as often as 5 times a day. This does not eliminate the need to have data updated, but by pulling the data from Excel files we provided a simple and commonly-known tool for users to edit the data. We estimate that a project leader can update the data for their project in about 10 minutes would use a monthly refresh cycle. A second paper included in this panel discusses the ability to pull data from the Navy's Enterprise Resource Program (ERP) into Power BI, which allows a team to develop their own financial data tools with even less need for manual data entry.

The tool also has several other dashboards that were developed to mimic tables that we used to show for new projects. One showed which other projects preceded or were related to the new project. The second summarizes the credentials of the people that will be working on the projects.

The following figures are provided, along with a brief explanation, to illustrate the capabilities of this tool. Note that the data shown was created for illustration only, and does not represent any actual research projects at NRL (at least not yet!).

Branch Overview Dashboards

The organizational data dashboards are intended to show the current and primary technical objectives of the organization and how well it is doing in the metrics that we set for branch. This includes metrics as how well are we meeting the technical objectives, are we delivering our projects in a timely manner, how are our finances, and describe the key attributes of the branch such as staffing levels and financial health.

The "Branch Overview" dashboard (Figure 1) provides a report on multiple aspects of a research branch's "health" for senior leadership. It shows status on metrics important in an R&D organization and financial data. The data is "sliceable" by sponsor type, section code, and even by individual project.

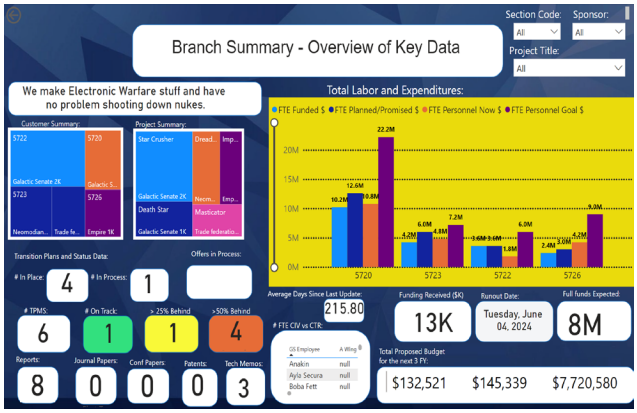

Figure 1: Branch Overview Dashboard, provides an overview of key metrics on one page

Note: It summarizes our customers with a box chart, our three sections with a bar chart, and key organizational metrics including financial health

The data entry for the dashboard is done with simple Excel files, as shown in Table 1. We will not show these tables for the other dashboards, as they duplicate the visual information in the dashboard. Users simply open the Excel file and updating the data, and within a scheduled time the dashboards will show the new data (we set the updates as 5x per day, at time periods 8,10,12,2, and 4).

Table 1 and 2: Examples of Excel Data Used for Branch Overview Data

Work Unit	TPM	Percentage of TPM Metric Met	Met or Exceeded	Greater than 25% behind	Greater than 50% behind	Has a TPM(1 for yes 0 for n
57X002	Decrease mold buildup in the	110	1	0	0	1
57X003	Pcc Improves by 0.25	50	0	0	1	1
57X004	Decrease time needed for ta	0	0	0	1	1
57X001	Laser color will be greener by	75	0	1	0	1
57X003	Floatiness of the struts will i	10	0	0	1	1
57X005	Shield strength increased by	33	0	0	1	1

Branch Code	FTE Goal	FTE Now	FTE Planned	FTE Funded	FTE Goal $	FTE Now $	FTE Planned $	FTE Funded $	Full FTE Funds Expe
5723	12	8	10	7	$ 7,200,000	$ 4,800,000	$ 6,000,000	$ 4,200,000	$ 10,200,000
5726	15	7	5	4	$ 9,000,000	$ 4,200,000	$ 3,000,000	$ 2,400,000	$ 5,400,000
5722	10	3	6	6	$ 6,000,000	$ 1,800,000	$ 3,600,000	$ 3,600,000	$ 7,200,000
5720	37	18	21	17	$ 22,200,000	$ 10,800,000	$ 12,600,000	$ 10,200,000	$ 22,800,000

Note: The data for the dashboards are maintained by users using simple Excel spreadsheets that are easily updated by users. Once the files are updated and closed, the changes are automatic.

Technical Performance Metrics Dashboard

The Technical Performance Metrics (TPM) dashboard (Figure 2) is designed to reflect the key technical goals of the organization, which can then be used to flow-down to and be

referenced by projects at a lower level. This may be a dashboard developed by a strategic planning process. It would be useful during management reviews to understand how a group is doing in achieving and underachieving its goals. Some goals may be secretive, thus may use code-names. Some metrics may be secretive, and thus may use relative percentage values. The goals are sometimes referred to as the "North Stars" of the team, and allow everyone to see whether the progress is good or not and work towards those goals.

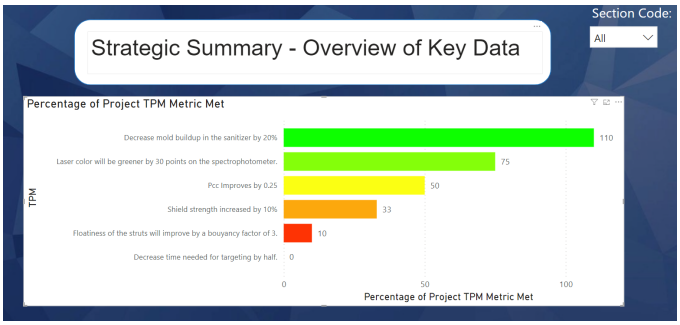

Figure 2: Technical Performance Dashboard Example

Note: This dashboard allowed tracking of our "North Star" technical objectives.

Staff Planning

The staff planning dashboard (Figure 3) was developed to allow us to manage our people, as their time is truly our most valuable asset. They allow a planner, project lead, or individual to see the staff loading over a planning time (1 year for our branch). The data is shown in four bar-graphs, which show whether a project is fully staffed or not and whether people are fully tasked or not. This is a key tool for task and staff planning.

In our branch we try to be sure that each project has more than one person assigned to it, and each person has a primary and secondary project that they support. This dashboard allows proactive workload planning. By graphically displaying an individual's workload next to a project's necessary workload, a planner can better coordinate how to plan researcher's time when they work on more than one project.

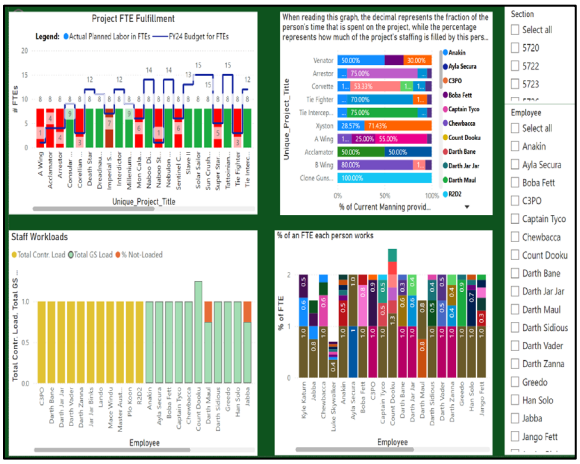

Figure 3: Staffing Plan Dashboards

Note: These dashboards helped show that we had enough work for all of our people, and enough people for all of our projects.

Each of the four staff planning views can also be viewed individually, simply by clicking a button in the corner, as shown in Figure 4. By showing this data, we see which staff members need work and which are over-tasked. We also can see which projects are under-staffed. In the future a similar graphic will be built showing how actual staff labor charging rates in the last 30 or 60 days compare to planned allocations, thus identifying problems where costs will over-run or work will under-run.

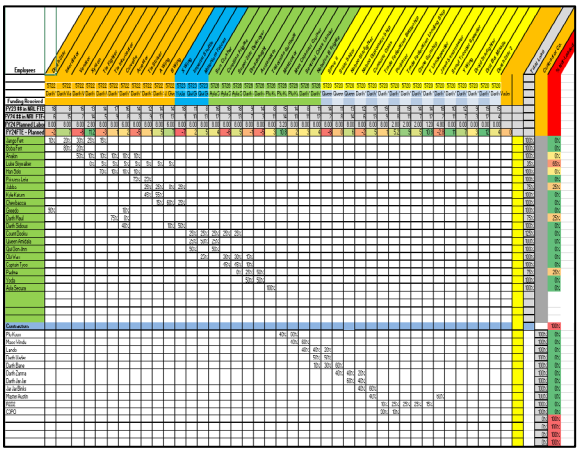

Figure 4: Staffing Summary Dashboard

Note: This one provides an overview of how all the staff is allocated between every project.

Project-Specific Dashboards

The project-level dashboards show data specific to a single project, but in a consistent format. They are organized to provide a consistent view of data across projects, explain them to management and visitors, and track the health in project management terms (technical, cost, schedule, and quality metrics).

In the first and summary level view of a project we recreated the common “Quad Chart,” showing a graphic illustration of the project, technical summary, schedules, and financial data (Figure 5). It can be used to review and compare new project proposals or projects that were approved and funded. On a monthly basis the project lead is asked to update the technical issues and schedule elements. The financial data should be retrievable from an enterprise financial tool with little or no effort. In the future, a semi-automated link to enterprise tools should enable daily data updates, but getting good data is often harder than getting the latest data. The Power BI software tool will automatically pull data elements from individual fields in the Excel file, and uses a single project number as a “key” that identifies the data for that project.

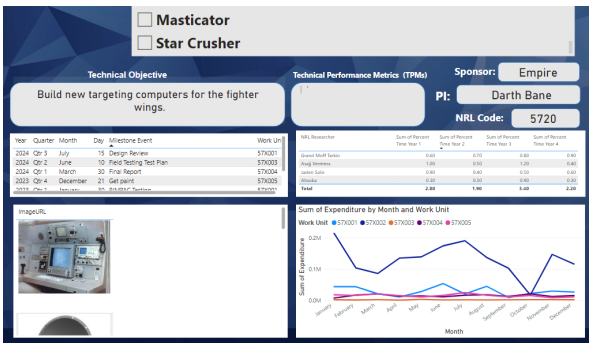

Figure 5: Project Summary Dashboard based on the Common Quad Chart

Note: This one provides a project specific view for each project.

Project Schedule Dashboard

This dashboard provides a classic Gantt chart to visualize the project schedule (Figure 6). This is based on David Bacci's Deneb script, which is available online. It allows a project lead to plan start and stop dates for each task, task dependencies, and the percentage completion for each reporting interval. This view shows the team's progress on a project and the inter-dependencies between tasks (Bacci, 2023; Payton, 2024). The data is entered using an Excel spreadsheet, shown in Table 2.

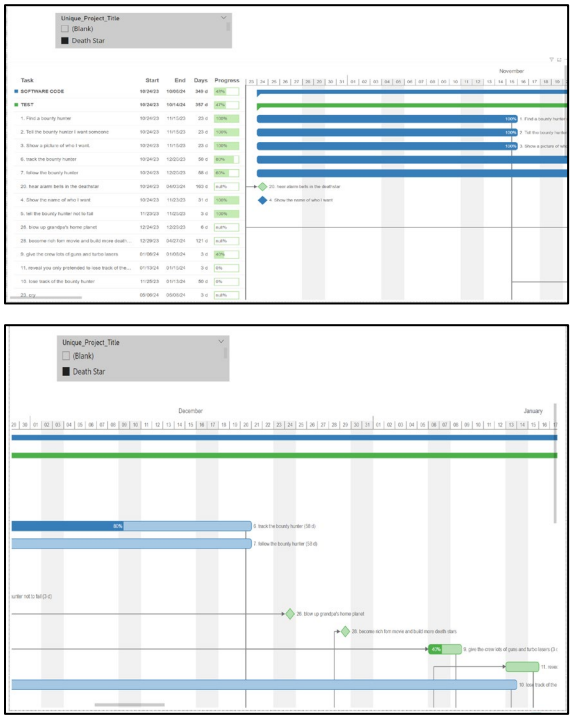

Figure 6: Project Schedule Dashboard

Note: This provides the classic Gantt view of a schedule and allows relatively easy visualization of progress on each task.

Table 1: Data Entry File for a Project Schedule

#	task	Progress	phase	milestone	Assigned_t	start	end	completion	dependenc	Work Unit
1	1. Find a bounty hunter	1	Software Code		Jar Jar Binks	10/24/2023	11/15/2023	100		57X001
2	2. Tell the bounty hunter I want someone	1	Software Code		Jar Jar Binks	10/24/2023	11/15/2023	100		57X001
3	3. Show a picture of who I want	1	Software Code		Jar Jar Binks	10/24/2023	11/15/2023	100		57X001
4	4. Show the name of who I want	1	Software Code	TRUE	Phi Koon	10/24/2023	11/24/2023	100		57X001
5	5. tell the bounty hunter not to fail	1	Test		Yoda	11/23/2023	11/26/2023	100		57X001
6	6. track the bounty hunter	1	Software Code		Phi Koon	10/24/2023	12/28/2023	80		57X001
7	7. follow the bounty hunter	0.1	Software Code		Yoda	10/24/2023	12/28/2023	60		57X001
8	8. ensure men are trained on how to fight bounty hunters	0.1	Software Code	TRUE	Yoda	11/25/2023	1/4/2024	40	1,2,3,4	57X001
9	9. give the crew lots of guns and turbo lasers	0.3	Test		Anakin	1/4/2024	1/8/2024	40	6,6,7	57X001
10	10. lose track of the bounty hunter	0	Software Code		Yoda	11/25/2023	1/13/2024	0	1,2,3,4	57X001
11	11. reveal you only pretended to lose track of the bounty hunte	0	Test		Anakin	1/13/2024	1/13/2024	0	8	57X001
12	12. show up unannounced at critical moment in fight	0	Software Code		Anakin	1/4/2024	2/10/2024	0	6,6,7	57X001
13	13. attempt to take prize from bounty hunter	0	Documentation		Anakin	2/10/2024	2/12/2024	0	9	57X001
14	14. lose prize to bounty hunter	0	Documentation	TRUE	Anakin	2/12/2024	3/11/2024	0	9	57X001
15	15. pay the bounty hunter	0	Documentation		Anakin	2/12/2024	3/11/2024	0	9	57X001
16	16. accept the hostage from the bounty hunter.	0	Software Code		Anakin	3/11/2024	3/13/2024	0	11	57X001
17	17. kill the bounty hunter and take your money back.	0	Software Code		Anakin	2/10/2024	3/30/2024	0	9	57X001
18	18. find out the hostage has escaped the garbage sector	0	Software Code	TRUE	Anakin	2/10/2024	3/30/2024	0	9	57X001
19	19. look for the hostage again	0	Software Code		Anakin	3/30/2024	4/1/2024		14	57X001
20	20. hear alarm bells in the deathstar	0	Test	TRUE	Anakin	10/24/2023	4/1/2024	Basic Date		57X001
21	21. evacuate the death star	0	Software Code		Anakin	4/1/2024	4/5/2024		15	57X001
22	22. discover the hostage is your mom	0	Software Code		Anakin	3/11/2024	5/6/2024		10,11	57X001
23	23. cry	0	Test	TRUE	Anakin	5/6/2024	5/8/2024		16	57X001
24	24. ask your grandpa if he wants to rule the galaxy together	0	Software Code		Anakin	5/11/2024	5/11/2024		10,11	57X001
25	25. find out she would rather spend time with people who beat	0	Software Code		Anakin	5/13/2024	5/15/2024		17	57X001
26	26. blow up grandpa's home planet	0	Test	TRUE	Anakin	12/24/2023	12/28/2023		Basic Date	57X001
27	27. sell tickets to a movie titled "how I blew up my grandpa's h	0	Software Code		Anakin	12/24/2023	12/28/2023		Basic Date	57X001
28	28. become rich fom movie and build more death stars	0	Test	TRUE	Anakin	12/25/2023	4/27/2024		18	57X001
29	29. blow up all the suns in the galaxy	0	Software Code		Anakin	5/15/2024	6/3/2024		19	57X001
30	30. start a flashlight company	0	Test	TRUE	Anakin	6/3/2024	6/18/2024		20	57X001
31	31. get even richer on flashlight company	0	Software Code		Anakin	6/24/2024	7/10/2024		MST10	57X001
32	32. miss your grandpa	0	Test	TRUE	Anakin	7/10/2024	8/9/2024		21	57X001
33	33. hire bounty hunter to see if your grandpa was on his home	0	Management		Anakin	8/9/2024	9/8/2024		MST11	57X001
34	34. find out he wasn't	0	Management		Anakin	9/8/2024	9/15/2024		MST12	57X001
35	35. bounty hunter returns and reveals they are your grandpa	0	Software Code		Anakin	9/15/2024	10/8/2024		MST13	57X001
36	36. make movie about your life	0	Integration		Anakin	10/8/2024	10/12/2024		19	57X001
37	37. Profit	0	Test	TRUE		10/12/2024	10/14/2024		20	57X001

Note: The schedule data is maintained in an Excel file.

An additional dashboard was created that tracks task schedules in a table and project summary data in summary quad-chart format (Figure 7). The dates in this table are the same as those used in the Gantt graphical view, but provides more detailed schedule data along with some basic project data.

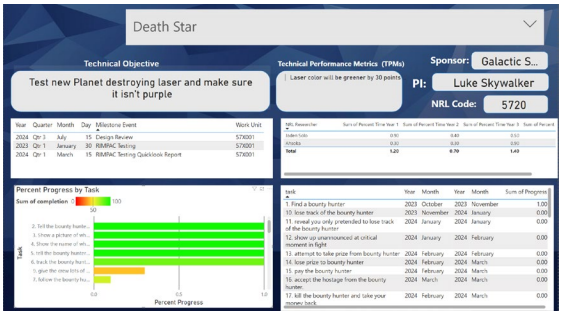

Figure 7: Quad-Chart Summary with Detailed Schedule Table

Note: This provides project summary data along with detailed schedule data, useful for detailed schedule planning meetings.

Contract Management Dashboard

Another dashboard (Figure 8) was created to help manage work by a contracted partner, and provides project leads an idea of what projects are using the contract, how long current funding will last, and when added funding should be put on a contract to ensure work continuity.

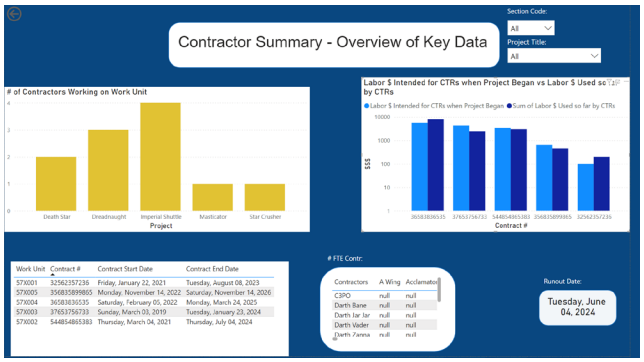

Figure 8: Contract Management Dashboard

Note: Provides an overview of contract work and funding status.

Proposal Review Dashboards

The PM Tool also includes several other data dashboards built to recreate several standard slides used in the annual NRL proposal process, including the project summary, team credentials, and related projects dashboards. Examples of these are shown in Figure 9, Figure 10, and Figure 11.

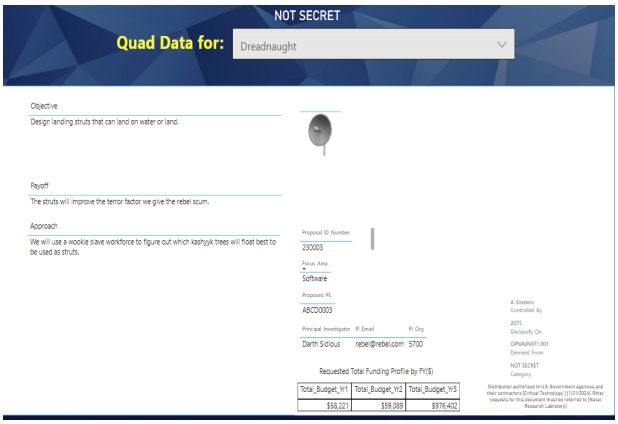

Figure 9: Proposal Summary Dashboard

Note: This provides project summary data on a proposed project.

Figure 10: Related Work Units Summary

Note: Shows what other projects are related to the proposed effort.

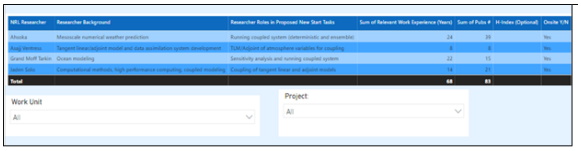

Figure 11: Team Credentials Dashboard

Note: Provides information on the proposing team to consider their credentials and experience.

Project Financial Dashboard

The last group of data dashboards we are experimenting with are financial data dashboards (Figure 12). These are meant to show how a project is spending money versus allocated funds, whether it will meet a budget or not, and compare several different metrics on financial health. It also provides overall branch financial data, and calculates cashflow and runout dates.

Figure 12: Financial Summary Dashboard

Note: Provides additional details on project and branch financial data to assess the work backlog and funding status.

A Potential Organizational Management Dashboard

Our project focused on what our branch needed, which was a tool to manage multiple research projects. As a part of the initial project we also prototyped a data dashboard that might be used to manage an organization of many branches at the leadership level. This would not necessarily involve just aggregating the lower level data, although some data fields may use that approach to compile summary statistics. At the organization level other factors are also important, such as performance metrics for functional support teams. The result is shown in Figure 12, which is also another example of the prototyping method using a power-point slide.

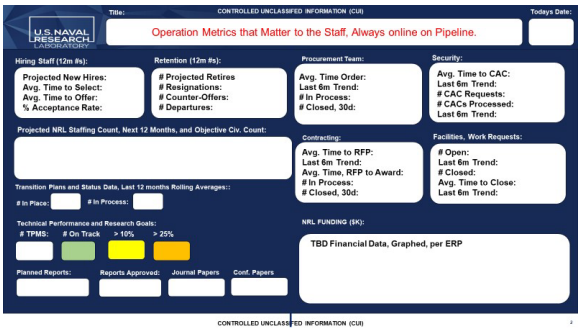

Figure 13: Hypothetical Organizational Dashboard

Note: shows potential organizational and functional performance metrics in one glance.

The command level dashboard could be used to provide the full organization insight into the metrics in each part of the organization, including all of the functional support departments. In some areas, pulling data from programs such as the docflow system would enable automated data input. It could be used to motivate the organization to improve their metrics via public awareness, and provide project teams critical data to enable planning efforts (e.g., procurement lead times or hiring timelines). Ultimately the choice of metrics and data content would be customized for each organization, and negotiated with the leadership team to show both current performance metrics and aspirational performance behaviors.

Data Security

One of the concerns we had in creating these dashboards was the overall data security, as the platform was hosted on Flankspeed and our division plans and project data would be stored there. Power BI and Flankspeed have security controls that limit who can see the dashboards and who can edit the data files. We also had to ensure that the site was properly marked, as it had Controlled Unclassified Information on it, and did not contain Personal Identifiable Information on individuals.

Building the Dashboard

To build the dashboards we started first by examining the data that is currently briefed to track project status, data obtained for new proposals, prior management data requests, then conducted online research for best practices in tracking project status and progress. We used senior staff members with both industry and academia experience to review recommended project management strategies and data visualization methods. Then the dashboards were prototyped using simple PowerPoint tools. These were then reviewed in a briefing mode with other managers. This design activity took about 2 months. After this the dashboards were prototyped in Power BI as that license was already included in our Microsoft Office toolset. The prototyping process took several months, and the only tricky part was the display of images and integration of certain graphical widgets. Overall it only took us about 6 months to build several

working dashboards and iterate the design once. Power BI is a 5th-generation style environment and easily learned by any programmer or technical staff member. Conventional wisdom is that these projects are not technically difficult, and once completed the problem is getting users to accept and use a new business practice ("20% Technical, 80% Social" is how one senior staff member described these efforts). The harder part of designing a tool like this is leveraging useful senior managers to direct the content, and not generate too much detail so that the tool remains simple to use and focuses on important data.

Replication on Other Platforms

One of the strengths of building a tool like this is that it is easily replicated and modified for other organizations. The files generated at NRL can be copied into a small zip file and shared on any other licensed Power BI server (which covers most of the Navy and DoD). NRL is able to share the basic PM-Tool files on request and is seeking internal approvals to post them on a shared server. In some cases, an organization may benefit by hiring a contractor that has experience in building Power BI dashboards, in particular if a whole new set of dashboards is being developed. Besides building the tool however, the social problems start once it is introduced. To overcome these NRL hosted an overview briefing on the project and why the tool was being used, then had short individual training sessions with the primary users, one on one. We then built a how-to manual and posted it as a web page on our SharePoint site, right next to the PM Tool page. An online video is also planned. Even with all of this, the introduction of such a tool across a large organization is a significant effort. For a single branch of 32 engineers the planning was modest. Generally, such projects start with a single team, like ours, as a beta site. Then the introduction starts to scale up to a division of hundreds, a full site, and then the full organization. At least 6 months for each phase is recommended, possibly more.

Maintaining the Data Using Excel

The problem that some teams have reported in using data dashboards is that the creation effort is too easy, and multiple complex dashboards are created that then must be maintained and fed with data. This can be a problem. In the long-term maintaining data sets is an expensive proposition. In an organization with 2,000 staff members, if each update takes even 10 minutes per month that is 333 staff hours, and at a nominal $200 per hour becomes almost $800,000 for the staff time. This author has seen tools that take an hour per month to update, which would clearly be a huge expense in a large organization.

This tool was designed to take about 10 minutes per month, but save more than that in avoiding time spent developing typical program review slides. Some modest engineering project will spend several days of effort every quarter for program reviews, typically involving senior technical staff to prepare and dry-run the material. Maintenance effort must also be simple, so that staff does not become frustrated.

Any requirement to retype data from one table into another must be avoided at all costs, as that is not only prone to error but also extremely costly in staff time. Power BI includes tools to massage data from one format into another, making the ingest of data from an enterprise tool relatively simple if the right reports are available. When used, that allows relatively simple data update cycles and staff can focus on interpreting the data which is the higher value use of their time.

Improvements in Organizational Efficiency

This is a work in process, but preliminary results to date are promising. PM Team Tool users are reporting that the tool is providing a simple method to organize tasks and keep track of progress. Section managers reported typical difficulty in starting to use the tool, even in the

case where the tool designer had to use it, but increased ease once the how-to pages were posted. One noted that for a small project it was important to create project schedules with about a dozen tasks at a time, and not get too detailed.

Initially usage of this tool spread slowly, with about one project per month being added in the first few months, but this also allowed the development engineer time to debug the tool and refine the data base. Use for project reviews has just started. A follow-up article is planned to discuss additional metrics in usage, acceptance, changes, and quality rates, but the primary metric for success is that projects are more clearly attaining technical objectives and delivery results on time and within budgets.

The use of dashboards and metrics are also ideal complements to six-sigma type efforts to improve organizational performance. The steps in a six-sigma or process improvement cycle are to a) establish performance metrics for the organizational team, b) monitor the metrics, c) set improvement goals jointly with the team leads, d) implement strategies to improve the performance levels, e) measure the new performance, and then f) repeat the process in cycles and over time.

Examples of methods for improving performance are:

a) Identifying bottlenecks and either enable parallelism, add staff, or automate activity with better information support to approvers and improve the throughput rate
b) Tracking organizational error rates, and enable low-error teams to bypass approvals
c) Monitoring approval actions with no value (i.e., very low correction or rejection rates) and eliminate those approval points
d) Invest capital for new tools or equipment
e) Restructuring a team
f) Changing the business processes, or
g) Delegating authority for activities

Use supplier quality certification strategies, where error rates are monitored after the fact, and authority increased to lower-level managers with low error rates, and taken away if errors go up.

Sharing Status Data with Customers

One aspect of this tool is that it could be used to replace monthly project status reporting. Instead of receiving a monthly report or briefing, the tool allows any (and only) registered site members to log-in and view the data. It is also relatively easy to do briefings using the data dashboards. Customers reported positive experiences after this approach was used in briefing status. It is also relatively easy to create special dashboards that use the same data, but provide outward-facing views of the project status for customers to see at any time. Another approach might be to package the data files on a regular basis and email them to the customer. In general, this approach should reduce project management and reporting costs for federal contracts. To enable this, a new DD-1423 Data Item Description would be needed, along with an easy to download set of Power BI and Excel files. This is a logical extension of this type of tool.

Other Lessons Learned

Be careful what data is being collected—data is not free, and collection has a cost. Know and understand the cost of collection. Maintaining data over the long term is expensive. Focus on key strategic metrics and maintain those well. Do not go metric-crazy and create a complex system. Simpler is better in this domain.

Behavior adapts based on data collected, and people are creative. Sometimes this resembles whack-a-mole. As an example, software testing metrics are collected to show error rates during final tests, so teams create an additional step for testing before the final test to detect errors earlier. The final test rate falls, but this is now taking longer as there are two steps.

Monitor metrics for maturity and utility, and discard those that are no longer needed or show constant levels of performance. Some metrics reflect fundamental business rules or the result of capital systems productivity, and do not change.

Understand quality performance methods—start out with frequent measurement of new projects or teams, and if performance remains consistently good back-off the measurement rates to a random audit or eliminate it.

Use color wisely—green is good and above a goal or within acceptable tolerance. Red is bad, outside of a defined tolerance limit or below acceptable limits. Define metrics so that "up" is good and "down" is bad. Be consistent in how data is displayed. As an example, use test success rates (99% is "good") instead of error rates (going "up" from 1% to 8% is actually "bad").

Understand statistical sample methods, confidence levels, and long-term averaging of data. In some cases, a small sample focus may be a problem, such as measuring costs on a daily basis and a large amount of procurement orders are placed in one day. Similarly, if the measurement for cost is monthly on a large project, a small error rate could seem hidden or portend a large change in final estimated cost.

R&D Data Analytics Within the Overall Acquisition Process

The PM Tool in use at NRL 5720 is just a portion of the overall data set needed to define, research, develop, produce, test, field, and support a program or capability within the DoD. The location of the research project PM Tool within the overall defense acquisition system is shown in Figure 14, marked with the red outline, but elements of it could be used in the requirements and budgeting phase, material acquisition phase, and even by sustainment organizations. Each aspect of this system is important, and could benefit in its own way from similar application of data dashboards, metrics, six-sigma improvement, and comparative and predictive data analytics.

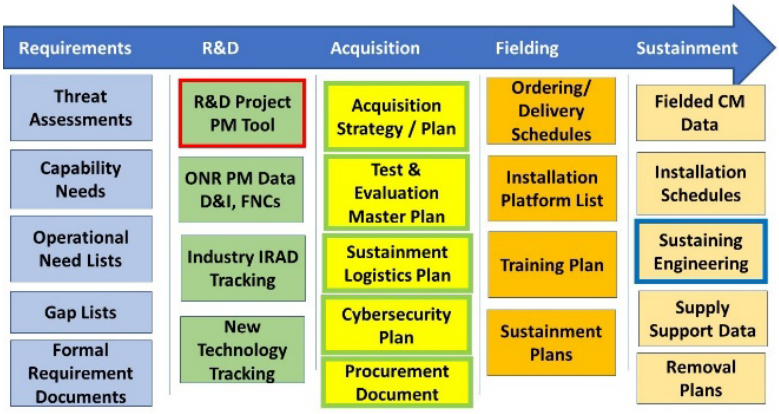

Figure 14: An Integrated Framework for Data Base Acquisition Analytics that Spans the DoD Acquisition Life Cycle

Note: The box outlined in Red indicates the PM tool for research projects discussed in this paper. A data schema for several of the acquisition functions (in yellow) was developed for Sharepoint Lists in prior work by this author (Lechner). Sustaining Engineering financial data (blue border) is the subject of another paper on this panel (Dunn).

This figure is also material-centric, and possibly the application of data dashboards for other parts of the doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) structure have already started in other DoD organizations. This will be an ongoing process for the DoD, but their use could be very pervasive within the next several years with some modest leadership encouragement, low-level advocacy, and organizational sharing.

Although the PM Tool in use at NRL 5720 is of general use in managing many types of technical projects there or in other warfare centers and development commands, it is easily modifiable to suit individual needs of other types of organizations. On a grander scale, it would be extremely useful to the overall DoD if the data analytics used across multiple programs and organizations used a common data schema and hierarchical structure.

A common data schema could allow the DoD to compare performance metrics between organizations, then leverage improvement ideas from the best organization. It would allow after-action analysis of projects that succeed and those that had problems, and eventual use of artificial intelligence tools to recognize leading indicators using predictive analytics and prevent problems as they occur or before it becomes too late.

An example of a common data structure used for the material acquisition phase of a program and was developed by this author for a project using SharePoint and Excel in 2018. That schema was designed to replace the Acquisition Plan document with an online data set, and similar schema were created for the Test and Evaluation Master Plan, Acquisition Strategy, Logistics Sustainment Plan, Cybersecurity Plan, and Installation planning documents (Lechner, 2018).

The 2018 demonstration aimed to create data entry forms like TurboTax for creating programs, and views like Amazon shopping for comparative analytics and program approvals. Initial testing indicated that it took a program team less than a day to fill in the data and allowed the AP data for a sample data set of a program to be reviewed and approved within 2 weeks. Those types of metrics, if extended and successfully scaled, could allow the programs to be created in months not years, and the elimination of hundreds of support jobs at each acquisition command. The data schema was built as a flat-file however, and the prototype used SharePoint forms, and thus would need to be reorganized into a star format and rehosted to allow use with a modern business intelligence tool.

Table 2: A Portion of the 2018 Acquisition Plan Schema

Title	Data Type
AP Appendix #	Text
Project Title	Text
Document Date	Date
Acquisiton Category Level (ACAT)	Number
Technical Project Manager (PM)	Name
Approval Date, Technical Manager	Date
Local Warfare Center Project Office Manager	Name
Approval Date, Local Contracting Officer	Date
Approval by HCA, PEO, or DRPM	Name
Approval Date, HCA, PEO, or DRPM	Date
Approved, Chief of Contracting Office	Name
Approval Date, Chief of Contracting Office	Date
Approval, Contracting Officer	Name
Approval Date, Contracting Officer	Date
Approval, Program Manager	Name
Approval Date, Program Manager	Date
1a. Prototype Status?	Yes/No
1c. MDAP Status	Yes/No
2. Technology Focus Area	Pull Down
3. DOD Product of Services Descriptive Code	Number
4. Program Office (Code)	Text
5. Lead Contracting Office (Code)	Text
6.1 Statement of Need	Text
6.2a Historical Summary, Background	Text
6.2b Historical Summary, Requirement	Text
6.3a Previous Contract	Text
6.3b Previous Contractor	Text
6.3c Previous Contract Type	Text
6.3d Previous Contract Code	Text
6.3e Prev. Contract, Quantity	Number
6.3f Prev Contract Award Date	Date
6.f Prev Contract, PoP End Date	Date
6.3g Prev Contract, Total Value	Currency
6.3h Prev Contract, Competitive?	Yes/No
6.4a RTI or FAST-Lane Rationale	Text
6.4b Govt. Resources Needed	Text
6.4c Collaborating Integrator	Text
6.4d Integrator Funding, RTI Ph.1	Currency
6.4e Integrator Funds, RTI Ph.2	Currency
6.4f Integration Funding PMO Contact	Name
7.1 RTI Project Description	Text
7.2 Likely Quantity	Currency
7.2a Estimated Unit Cost	Currency
7.3a Primary EMP Name	Text
7.3b P-EMP Objective	Number
7.4a Secondary EMP Name	Text
7.4b S-EMP Objective Value	Number
7.5 EMP Tradeoffs	Text
8a Relevant Patents	Text

Title	Data Type
8b Relevant Copyrights	Text
9.1a Funding Years (List 5 Years)	Currency
9.2a RDT&E Funding, Year 1	Currency
9.2b RDT&E Funding, Year 2	Currency
9.2c RDT&E Funding, Year 3	Currency
9.2d RDT&E Funding, Year 4	Currency
9.2e RDT&E Funding, Year 5	Currency
9.3a Procurement Funding, Year 1	Currency
9.3b Procurement Funding, Year 2	Currency
9.3c Procurement Funding, Year 3	Currency
9.3d Procurement Funding, Year 4	Currency
9.3e Procurement Funding, Year 5	Currency
9.4a Construction Funding, Year 3	Currency
9.4b Construction Funding, Year 4	Currency
9.4c Construction Funding, Year 5	Currency
9.5a Maintenance Funding, Year 3	Currency
9.5b Maintenance Funding, Year 4	Currency
9.5c Maintenance Funding, Year 5	Currency
9.6 Total Funding, All Types & Years	Currency
9.7a RTI Phase 1 Est. Cost	Currency
9.7b RTI Phase 2 Assment Cost	Currency
9.7c T&E Services Cost	Currency
9.7d Production Costs, All Years	Currency
9.7d Procurement Profile, by Year	Currency
9.7e RTI Eng. Services Costs, All years	Currency
10a CPARS Contact	Name
10b Email of DPARS Contact	Email
10c CPARS Contact Phone #	Phone
11a MDA TDS Approval Date	Date
11b MDA Acquisition Strategy	Date
11d MDA Peer Review Date	Date
11e Purchase Request Receipt Date	Date
11h White Paper & Draft RFP Release Date	Date
11j Full RFP Date	Date
11l Proposal Due Date	Date
11m Contract Award Date	Date
11o RTI Phase 1 Completion Date	Date
11p MS-B Requirements Complete	Date
11g Pre-EMD Peer Review Complete	Date
11c Actual AS approval	Date
11f Actual PR Receipt Date	Date
11i Actual WP Release Date	Date
11k Actual Proposal Receipt Date	Date
11n Actual Contract Award Date	Date
12a Prospective Sources	Text
12b Other Considered contracts	Text
12c Small business Set-Aside Only?	Yes/No
13 Risks	Text
14 GFP	Text
15 GFI	Text

Note: This is a part of the data set the author tested in 2018 to replace an AP document with a data set for a program in EMD phase. The test showed that the data set could be created in less than a day.

Summary and Conclusions

NRL Code 5723 has developed a data dashboard on Power BI that can be easily adapted by other DoD users for project management. The data is maintained in simple MS Excel files and easily updated. Creating project instances takes a few hours, one time. Maintaining the data is less, projected at less than 10 minutes per month, or perhaps a quarter hour. The research project data views are also useful for procurement offices and easily adapted to show contract planning, project execution, schedules, and technical success (or not!). The approach is scalable to organizational metrics and management (e.g., procurement office, hiring, and financial execution).

We found that, similar to most data analytics projects, the technical development was the simple part of the problem, whereas the user adoption, training, and follow-up was the challenging part. Another finding was that the Power BI tools are very scalable and easily replicated to other organizations and programs. Finally, we found that the Power BI tools provide a simple method to track ongoing program status and organize project data across an organization, allowing comparison of program metrics and easier and real-time visualization of program data. This positive experience reinforces projections made by many advocates that

using data analytics will provide significantly better tools for project management in the DoD, and that their use allows an evolving Acquisition Data Analytics approach that could effectively replace the bulk of the paper and briefings that make up the current DoD Instruction 5000.02 Defense Acquisition System.

References

Bacci, D. (2023). *A collection of advanced dataviz examples using Vega, Vega-Lite, Deneb and Power BI.* Github Site. https://github.com/PBI-David?tab=repositories

Dunn, K. (n.d.). *Streamlining financial reporting at NUWC Keyport: A centralized Sharepoint and Power Suite System for improved data access and analysis, Naval Undersea Warfare Center*.

Lechner D. (2018). *Using database and workflow methods for statutory and regulatory acquisition documents*. The MITRE Corporation.

Payton, C. (2024). *How to use David Bacci's Deneb template: Power BI Gantt w/ milestones, dependencies, and phases*. Youtube https://www.youtube.com/watch?v=tOhAxulPAoc

Acquisition Research Program
Department of Defense Management
Naval Postgraduate School
555 Dyer Road, Ingersoll Hall
Monterey, CA 93943

www.acquisitionresearch.net