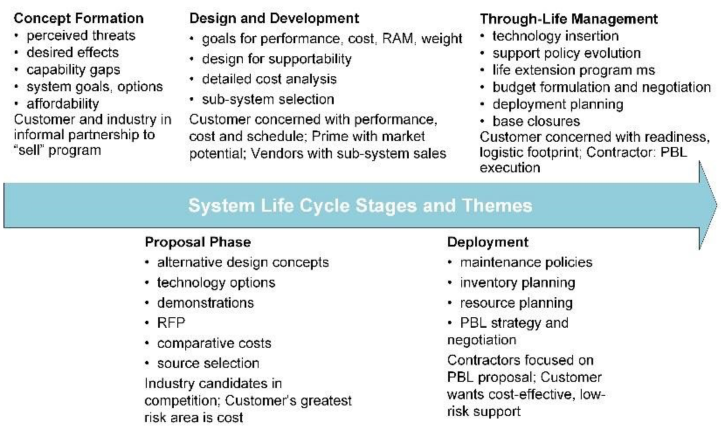
Affordable Capability – TFD Global and the Art of the Possible

Emerging Environment

The clear importance to military capability of an ability to deploy a variety of sufficiently numerous and effective weapon systems ensures that operational availability, mission reliability and affordability will always be matters of significant concern to governments around the world. Evolution of the methods favored by acquisition and logistic staffs to achieve affordable capability has given rise in the early years of the 20th century to a sustainment paradigm typified by Total Life Cycle System Management (TLCSM) staffs applying a Performance Based Logistics (PBL)[1] approach to the pursuit of capability goals.

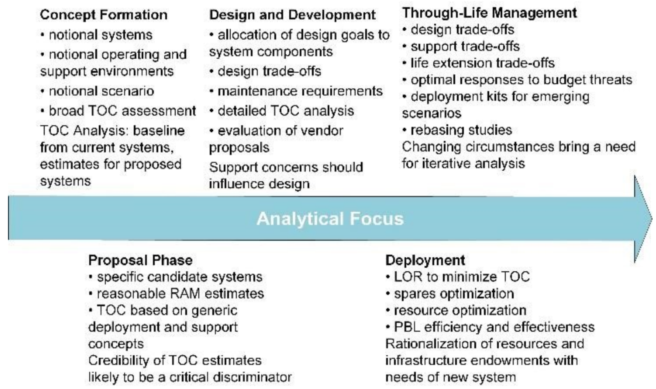
TLCSM is a strategy for ensuring, above all, that acquisition and upgrade programs start with the end in mind – at any stage in the life cycle, the knowledge that it will have to live with the consequences of its decisions gives the TLCSM team a powerful incentive to make good ones. The diagram at left portrays the most important life cycle themes. Seeking to attain in-service performance goals at minimum cost, PBL, the second distinguishing feature of the new sustainment paradigm, links incentives to capability outcomes to shape and integrate the contributions of weapon system support providers PBL, the second distinguishing feature of the new sustainment paradigm, links incentives to capability outcomes to shape and integrate the contributions of weapon system support providers.



[1] While the terms TLSCM and PBL gained currency in the US, the concepts and principles that set the approaches apart recognize no borders. In the UK, Integrated Process Teams (IPTs) foster Privately Financed Initiatives (PFIs). A PFI might fairly be described as PBL on steroids. The Defence Materiel Organisation (DMO) in Australia provides another good example of the TLCSM orientation.

Analytical Implications

The viability of TLCSM hinges on integration of analytical effort across the life cycle. In early stages the emphasis tends to be on front-end methods that tolerate paucity of data. Later analysis tends to be highly data-intensive.



The first step may involve rapid generation of candidate system architectures, convergence to a baseline comparison system (BCS) that would satisfy the operational requirement, and creation of plausible alternative architectures that outperform the BCS in one way or another. Once the broad outline is settled in this way, the focus shifts to source selection of major components, necessitating comparative analysis of vendor offerings in terms of operational performance, reliability, maintainability and cost. Next come analysis of support strategies (leading to selection of a preferred set of support arrangements), determination of resource requirements in the light of these arrangements, and verification (e.g. through simulation) that the resource solution will be adequate to cater for all envisaged scenarios.

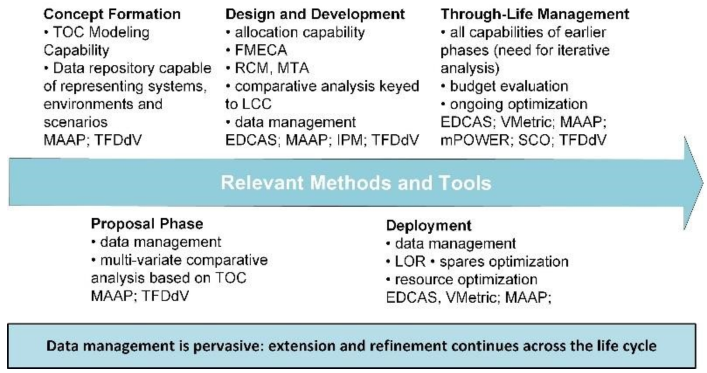
The input dataset for each successive stage of analysis is heavily dependent on the outputs of its predecessor stages. Degrees of freedom tend to disappear and datasets become more specific and detailed. But there is a clear need for consistency of approach and traceability throughout.

Another plank in the case for integration of analytical effort over the life cycle is the fact that fundamental assumptions and other data values (e.g. operating scenarios, budgetary limits, hardware and software configurations, demand forecasts, support arrangements, prices and the like) are subject to never-ending change. If consequent resource mismatches are not addressed then system performance deteriorates and costs increase. But without a data resource that can portray the unfolding situation at the level of detail required by relevant forms of analysis, corrective action becomes hit-ormiss.

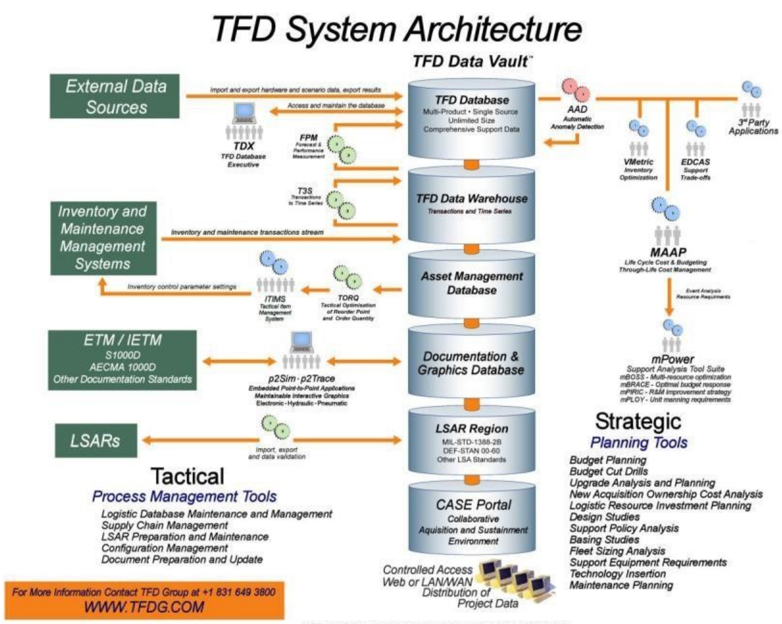
PBL has brought a further need for a viable method, applicable across the spectrum of weapon systems and operational scenarios, for determining the relative importance of relevant performance metrics, specifying appropriate performance targets, and evaluating the quanta of incentives needed to induce attainment of the targets. For such a method to make a significant difference it needs to be accessible to program managers and prospective support providers alike when engaged in early, high-leverage, context setting activities such as business case analysis, bidding, source selection and contract negotiation. Needless to say, prospects for success in execution of contracts shaped by application of such a method will be enhanced to the extent there is consistency between the planning approach and ongoing tactical decision support.

The TFD Solution

For Forty years the TFD Global has worked to equip organizations engaged in design, acquisition and sustainment of complex hardware systems with the tools and services they need for success. Today TFD is unmatched in its ability to deliver appropriate analytical solutions from offices in the US, the UK, Europe, South Africa and Australia.



The TFD Analytical Software Suite rises to the integration challenge by combining the first successful implementation of a common core database for logistics with an unmatched array of strategic planning and execution tools. The backbone of the suite, the TFD Data Vault (TFDdV), incorporates (primarily in the TFD Database – TFDdB) a carefully organized and rationalized compilation of the analytically-useful data found in LSARs and other logistic data collections. The TFDdB also accommodates additional data elements required by a variety of analytical models. There is no limit to the number and variety of hardware systems that can be represented, and the level of detail and realism in portraying deployment and operating scenarios is unsurpassed. TDX, the TFD Database Executive, features powerful yet highly intuitive data creation and maintenance tools, designed to minimize specialist training. TDX makes it possible to achieve a cost-effective division of labor between skilled analysts and a larger team of less highly trained staff assigned to data preparation. To serve the needs of ongoing analysis, provision has also been made (by means of the TFD Data Warehouse and FPM) for analysis of transactional data from the field, enabling regular update of key values, such as demand forecasts, lead time estimates and prices.



The TFD Database serves as a permanent source of reusable, maintainable data for the many forms of analysis that can add value in supporting management decisions over the life cycle. To exploit this priceless resource to the full, TFD provides an unmatched range of analytical tools. The TFD Database can also support the use of third-party tools. The most significant components of the TFD analytical toolkit include:

- **EDCAS**. Hardware design choices and system support strategies go hand in hand. And getting them right the first time makes a big difference to cost, performance and the bottom line. With more than 600 government and industry users in more than 20 countries, EDCAS has become the de facto international standard for front-end analysis. The model has been applied successfully to the task of optimizing the design and support of a wide variety of weapon systems produced over the past two decades.

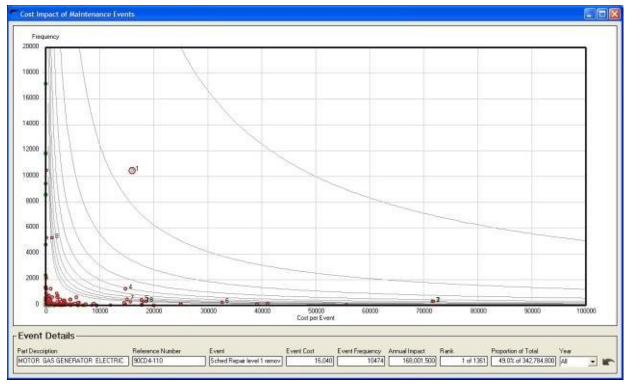
- **VMetric.** Keeping expensive systems running takes significant resources. Many of the resources needed, such as shops, trained people and special support equipment, take a long time to develop and put in operation. However, unlike other resources, stocks of spare parts are more readily adjustable and equally crucial to sustainment. For that reason a disproportionate amount of attention tends to be focused on how to build and maintain the supply chain. Recently, the emphasis placed on achieving a given level of support effectiveness – whether it plays out as the system operator's desire for readiness or as the sustainment contractor's responsibility to earn a fee through performance – has underscored the need for optimization; that is, for achieving the desired outcome, but at the lowest cost possible. Whether this is called readiness based sparing, sparing to availability, spares optimization or common sense, it requires a good tool, a bit of science and a modest investment in data. VMetric is the preeminent spares optimization tool in the world. The answers it provides, quickly and with a minimal investment in data, are capable of saving as much as half your contemplated investment in spare parts when it really counts – before you ever spend the money.
- **MAAP**. Over the past decade the Monterey Activity-based Analytical Platform (MAAP) has staked a strong claim for recognition as the most complete, versatile and effective software tool available anywhere in the world to answer questions about ownership costs of complex, evolving systems in dynamic operating scenarios. Most leading Aerospace and Defense companies now rely heavily on MAAP in formulating winning strategies for the capture and fulfillment of large performancebased sustainment contracts, while military services in several countries look to MAAP to determine whether proposals from these and other companies, viewed from the other side of the table, represent value for money. MAAP's power to deal effectively with hardware platforms capable of absorbing many cycles of so-called spiral development stems from its own design as an analytical platform, capable of supporting a wide range of analytical tasks (and of absorbing its own cycles of spiral development). That is, a MAAP model grows in relevance over the life cycle of a capital investment by passing data from one analytical exercise to the next with no need for re-interpretation, transformation or re-entry into other decision models or databases, assuring continuity of decision support across a range of settings: source selection, operational planning, support planning, resource management, and capability planning.
- ***mPOWER.*** Achieving a satisfactory level of performance at an affordable cost over the life cycle entails identification and quantification both of the resources consumed in operations and support activities, and of the additional capital investment in resources (over and above the quantities consumed) needed to meet performance goals. While the resource consumption aspect is straightforward, the required capital investment is a function not only of the pattern of events but also of the required performance level, typically expressed as an operational availability (A_o) target.

Access to an array of practical multi-resource optimization methods is essential if the issue of the day happens to be formulation of a PBL strategy, or some kind of disruption like a budget cut or directive to reduce the logistic footprint. *mPOWER*, the MAAP Performance Optimization Workbench for Enhanced Readiness, is an extensible suite of advanced analytical tools designed to exploit the extensive output of MAAP to deal properly, for the first time, with the more problematic investment aspects of performance optimization. The *mPOWER* tools include:

- ***mBOSS*** (MAAP Budget Optimized System Support). *mBOSS* overcomes conceptual and computational ***difficulties*** of earlier times to generate optimal multi-resource support solutions, producing year by year curves of A_o versus Cost in similar vein to VMetric, except that the resource selections represented by the points on the curves encompass not only parts but also tools, facilities and skills. Accordingly, the set of resources that can least harmfully be “done without” is identified simply by retracing the optimal sequence of resource additions.

- ***mBRACE*** (MAAP Budget Response to Avoid Capability Erosion). The purpose of *mBRACE* is to facilitate a coherent approach to budget cuts by identifying options for short-run avoidance of expenditure (***or*** conversion of resources to cash) and making visible the likely capability impacts of executing various cost-reduction strategies. A further potential purpose is to prioritize candidates for additional funding in expansionary circumstances (e.g. build-up to war).

- ***mPIRIC*** (MAAP Progressive Investment in R&M Improvement Candidates). A particularly useful MAAP output is a scatter plot of maintenance events against frequency and cost axes, as shown at right. *Distance* from the origin (calibrated by isoquants drawn in the background) indicates a given ME’s relative *standing* in terms of impact on the support portion of TOC. *mPIRIC* brings this display to life, supporting system engineering efforts to develop coherent R&M improvement programs, and also enabling evaluation of prospective changes in maintenance capabilities, maintenance policies or operating procedures. Selection of a particular maintenance event from the scatter plot provides access to a planning tableau enabling a user to portray the investment profiles and expected benefit streams associated with projects competing for inclusion in an overall improvement program.

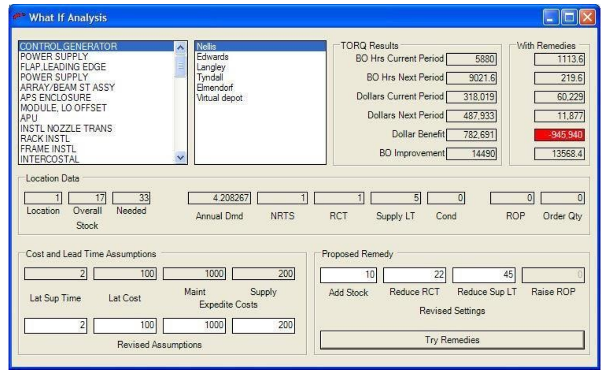


- ***mPLOY*** (MAAP Manpower Planning Tool). While MAAP quantifies the requirement for direct labor (and *mBOSS*/*mBRACE* can provide refined assessments) the overall manpower bill includes command and supervisory structures, as well as medics, cooks, etc. Overhead numbers are derived from the direct labor requirement via relationships that are seldom linear and are likely to include step functions. The idea of *mPLOY* is to elicit the overall commitment by applying an organization’s manpower planning policies/rules to the direct component.

- **SCO.** Mission capability is lost when the supply chain is unable immediately to replace an unserviceable component required for performance of one or more of a weapon system’s approved missions. In a PBL setting, accumulation of such losses beyond contractually-set thresholds drags down a support contractor’s performance rating, reducing incentive fees and threatening follow-on business. The Support Chain Optimization system (SCO), through its main components, *TORQ* (Tactical Optimization of Response Times and Quantities) and *ITIMS* (Integrated Tactical Information Management System), provides Supply Chain Managers (SCMs) with timely and defensible answers to the question: *which of the many remedies that might be initiated today, either to ameliorate a crisis already in being or to reduce the risk that looming problems will turn into crises, promise sufficient net benefit to warrant expenditure of the time and money required to implement them*?

- ***TORQ.*** Because the long-term, steady-state pipeline assumptions of traditional Readiness Based Sparing models are inapplicable inside the tactical planning horizon, *TORQ* uses Monte Carlo simulation to produce reliable estimates of backorder hours over the remainder of the current evaluation period, taking into account anticipated part deliveries and so forth. *TORQ* bases its quantification of the costs and benefits associated with plausible SCM interventions (e.g. buy more spares, speed up maintenance or procurement, relocate parts) on a comprehensive understanding of the context: the nature of the supported system, its deployment and operating profile, the current states of buffers and repair or reprocurement queues, apparent demand, performance requirements, and contract terms actually in force.

- ***ITIMS.*** *ITIMS* provides a rich user interface for viewing the outputs of overnight *TORQ* runs, and performing budget management, what-if and execution functions, by means of which SCMs can make timely and assured midcourse corrections necessary for achievement of optimal performance and profit. On opening *ITIMS* displays a list of parts sorted in descending order of recoverable profit potential". The status and location of every instance of a given part is available, along with all relevant part characteristics, such as current price, demand forecast by location, demand history by location, fitment to systems, repair cycle time, repair fractions, repair cost, and so on. Maps, graphs and color coding are used where appropriate to draw attention to key information.



- **CASE** (Collaborative Acquisition and Sustainment Environment)**.** In many circumstances it will not be cost-effective for organizations needing access to TFD database infrastructure and analytical tools to acquire and maintain extensive analytical capabilities. The CASE Portal has been developed to extend services to such organizations on a pay-for-use basis over the internet.

The TFD Global also provides:

- the services of skilled analysts at client sites (whether as self-contained project teams or as consultants to client organizations),
- practical training for clients' analytical staff, either in TFD training facilities or at client sites, and
- seminars or workshops on subjects of enduring importance (current offerings include Analytical Methods for the Logistics Professional, Decision Making and Failure Avoidance, PBL Solutions, and Spares Management and Modeling).

Notable Engagements

The TFD Global's long involvement as a leading source of analytical products and expertise has led to the existence today of a community of more than 10,000 skilled users working for more than 800 organizations in 20 countries. In recent times TFD has entered into close relationships with a number of large organizations seeking exceptional analytical performance to mitigate the risks of failure in a range of significant programs where the stakes are exceptionally high. Some of the company's more significant current engagements are described below.

- **MTU.** MTU Aero Engines GmbH, located in Munich, is one of four engine companies included in the Eurojet consortium, engaged in design, manufacture and through-life support of the EJ200 engine powering the Eurofighter Typhoon. MTU is responsible (on behalf of all members of the consortium) for development of the modeling component (known as the Simulation Model, or SIM) of the EJ200 In-Service Support System. MTU accepted the TFD Global's proposal to base SIM on the existing capabilities of MAAP and VMetric, complemented by an array of powerful new features. TFD is on contract to deliver SIM by the middle of 2007.
- **RAF – LARO, MRA4 and the VFMC.** The Royal Air Force was the launch customer for the TFDdB. For 10 years the Logistic Analysis and Research Organisation (LARO) at RAF Wyton near Cambridge has used the TFDdB to maintain logistic data relating to more than 1.5 million significant components of RAF aircraft types. Shortly after LARO's reconstitution as a tri-Service organization in the early part of the 21st Century, a second instance of the TFDdB was installed, this time for the British Army. In its role as custodian of logistics modeling standards for the UK Ministry of Defence, LARO, after an exhaustive Verification and Validation effort, certified MAAP as an acceptable tool for Total Ownership Cost (TOC) analysis. As no other TOC tool has gained such certification, MAAP was the natural choice for the Nimrod MRA4 Integrated Project Team, faced with the challenge of demonstrating value for money in the life cycle sustainment package to be proposed along PBL lines by a prime contractor unburdened by the discipline of competition. TFD is presently on contract to implement a Value For Money Comparator (VFMC) based on MAAP, with such additional features as may prove necessary. This engagement involves a permanent TFD presence alongside the IPT for at least the next two years.
- **NGC – JSTARS, B-2, Global Hawk.** Northrop Grumman Corporation's Integrated Systems Sector enjoys Total System Support Responsibility (TSSR) for the E-8C Joint Surveillance Target Attack Radar System (JSTARS) aircraft fleet under a longterm contract. With its emphasis on availability, mission reliability and TOC, the JSTARS TSSR arrangement ranks as one of the more important early PBL initiatives. NGC's commitment to implement what the company called the JSTARS Cost and Performance System (JCAPS) was a significant factor in closing the TSSR deal with the US DoD. MAAP and VMetric are major components of JCAPS, and NGC's need to optimize resources was the spur for the development of *mBOSS*. When NGC later contracted for participation in a Total System Support Partnership (TSSP) as parts supplier for the B-2 bomber, also along PBL lines, TFD's contribution was the first implementation of SCO. Other NGC programs, of which Global Hawk is a highly visible example, will be supported with the full range of TFD analytical software.

- **AAR – Sentry.** NGC also recently won a contract for life cycle support of the RAF's Sentry AWACS aircraft fleet. AAR Corporation is a key member of the NGC team. AAR's task as supply chain manager is to orchestrate the contributions of a network of repair venues and suppliers to provide the serviceable components needed for achievement of a challenging availability goal within a fixed price per flying hour. AAR used VMetric to rebalance the Sentry spares inventory at the inception of the contract, and is now implementing SCO to ensure continuity of performance and profit.
- **LMAC – F-35 and F-22.** When the Lockheed Martin Aeronautics Company was selected to develop the Joint Strike Fighter (JSF), now designated the F-35 Lightning II, EDCAS came into extensive use for design trade-offs, while the LMAC Affordability Group adopted MAAP as its primary weapon in a concerted struggle to avoid disappointing the USAF's expectation of an affordable fighter program. LMAC subsequently enlisted TFD's assistance in designing and implementing a highly innovative PBL solution for sustainment of the F-22 Raptor fleet, at the time about halfway through initial deployment. The F-22 engagement has given rise to a flurry of software development, yielding new capabilities such as CASE, a sparing to availability routine for MAAP, a widening of the scope of *TORQ* to encompass repairables, and a utility to steer PBL contract negotiations in near real time (this utility does double duty as a means of ascribing dollar values to part delays – a.k.a. backorders – to facilitate *TORQ*'s ranking of SCM interventions).

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