Aspîre - Analyse. Optimise. Deliver.

Evolving a Support Solution

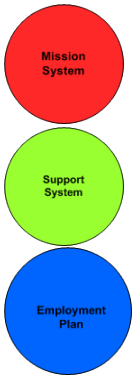
The application of an elegant systems approach can transform the effectiveness of an ILS programme.

Evolution not revolution, how the application of a simple systems approach can transform the effectiveness of an ILS programme.

The Support Solution

In my articles "What is ILS" and "What is LSA" I revisited the very basics of ILS and LSA, to explore the questions, what are ILS and LSA, what are they for, what is it we're "Integrating" what is the difference between LSA and a series of disparate analyses?

As a result of those articles a number of people pointed out that we need to address the design of the equipment, the platform etc, the "Mission System" in Aspire parlance. Now in part this was a misconception, because I spent more time illustrating my points by discussing the "Support System" than I did talking about the Mission System, and in part because of the semantics I used. So for the absence of any doubt, in this article I will use the term "Support Solution" and in this context this includes:



The support aspects of the Mission System, this is the ship, the tank or the aircraft; it is comprised of hardware, software and people.

The Support System is comprised of the entire Support Infrastructure, and the associated support processes and resources.

The Employment Plan defines the manner in which the Mission System will be employed, where, when, in what environment, how often, and by whom. The Support Solution must take cognisance of the Employment Plan and vice versa.

This "Systems thinking" is a characteristic of Aspire's approach to Support Engineering.

Too Soon, Too Soon…Too Late!

There is a perennial problem that most ILS Managers, LSA Managers and Support Engineers will recognise. When they try to conduct support analyses, to carry out Through Life Cost predictions for example, in the earlier stages of a system's life cycle, they will often be told that it is too soon for such activities. The argument being that the design is not mature and hence there simply is no appropriate data available. Which seems reasonable enough…

The problem is that "**Too Soon**" can become "**Too Late**", with no apparent intervening interval. The Support Engineer can suddenly find that the system design is pretty much fixed, and that it is now too late to influence that design, and because the trials have not begun, we still have no data!

The need for Data…

The Support Engineering community faces a lot of problems, both technical and political, but this issue, the need for data, and the seeming unavailability of that data, is one of the commonest and possibly the most critical. The result is that effective analyses are often not carried out, system modelling does not occur, trade-offs are not conducted, the Mission System is not optimised, Through Life Cost [TLC] is not estimated and so on.

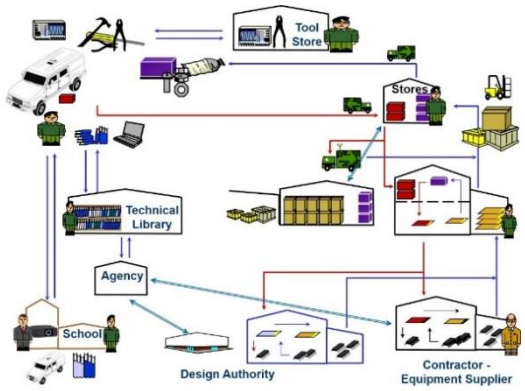
Now if you cannot estimate TLC you cannot conduct effective investment appraisals and if you cannot conduct investment appraisals how can you evaluate alternative design options or alternative strategies for support? How can you influence the design? How can you do Level of Repair Analyses? How can you prepare a cost effective Through Life Management Plan? This problem can sometimes seem insuperable, but it can be overcome if the appropriate Systems Thinking and Systems Engineering approaches are applied.

What are these approaches, how do we define them? The start point is to recognise that many Support Engineering problems are "**Wicked Problems**", problems which involve so many interacting variables and probabilistic measures such as Mean Time To Repair, [MTTR] and Mean Time Between Failure [MTBF], that we will never know if, or when, the optimal solution has been achieved. In these circumstances, we seek to achieve relative improvements rather than absolute performance targets. We need to apply a large dash of common sense and we aim for **Better** rather than the **Best**.

These probabilistic metrics are wholly dependent on the availability of some form of historical data, they are derived from field or test data. In most instances, we cannot determine the support parameters associated with a Mission System design by analysing the design per se; more radical approaches are required.

But how reliant are we on these metrics, this data, do we need quantitative data associated with our Mission System design? The answer is that this depends on the question that we are asking.

If our task is to design a new improved Support System we will need to capture, and to understand, the "design" of our proposed solution, we would need to understand how it was likely to behave, how it was likely to perform - relative to the extant 'design'.



To achieve this, we need realistic representative data in order to test the 'structure' of our proposed new system, in order to determine if it is better or worse than the extant system, in a given scenario. (E.g. we may wish determine the ultimate effect of enemy action which is targeting the support elements of a Strike Bde).

We can model the present system and the future system (or systems) to identify any "marginal" gains or losses.
If, having finalised the design of our Support System, we wanted to know precisely how many spares we would require, then we would of course prefer precise, rather than representative, arising rate data.

The Support System – An organisation, a structure, processes and embedded resources

Consider now, how would you go about developing or designing a Support System, e.g. for an operationally critical fleet of vehicles, an element of a "Strike Force" - an offensive column that will penetrate deep into enemy territory. Some items will be maintained in theatre, others will be returned to a "Strategic Base" either in the UK or perhaps to a "Floating Task Force Base", depending on the location and the nature of the operation.

This is a very complex task, the Support System for a fleet of vehicles is not a stand-alone system, many elements will be shared with a wide range of other Mission Systems. The only feasible approach is to take the existing system and use that as a start point.

Baselines – a Critical Concept

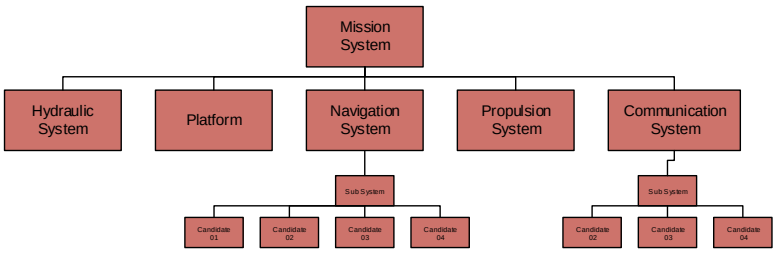
We capture the definition of the extant Support System, this is our "Baseline" or "Present System", then we initiate an iterative development process. We retain those aspect of the extant system that are that are good and we eliminate or improve those that are not, we deploy new technologies, new methods and new materials as appropriate.

This is the basis of a highly structured development process, applying the principle of evolutionary development, evolving a solution (the "Future System") from a known baseline by applying a systems engineering process, a form of spiral development. This concept is as applicable to the Mission System as it is to the Support System.

Hence, when implementing an ILS programme, we need to create a series of baselines, derived from one or more existing systems; because the Support Solution is comprised of the Mission System, the Support System and the Employment Plan, we need to establish and to simultaneously evolve three separate baselines. If we create these three baselines we will have the data that we need to "Prime the Pumps" of the ILS and LSA processes.

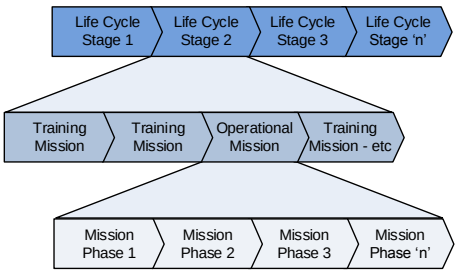
We need some mechanisms and tools for capturing and evolving these baselines. There are a lot of options for capturing a Mission System definition, including the LSAR, but there are other choices. The same is not true for the Support System or the Employment Plan however, there are no 'off the shelf' tools, here we tend to find the default tool is Word!

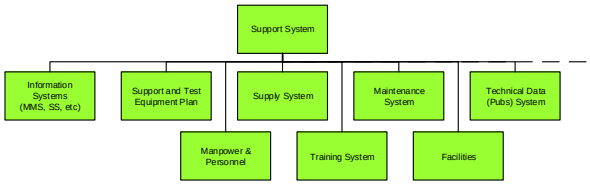
Capturing the Baselines



Tools for capturing and managing Mission System data tend to be organised hierarchically.

Employment Plans can be represented in the form of a simple hierarchy





The Support System defined in the form of a simple hierarchy

The Cost…?

Creating and then evolving such baselines does require investment, but it is not significant, not when compared with what is traditionally spent, and certainly not when compared to the benefits of such an approach. The approach is likely to pay for itself in terms of improved programme efficiency alone.

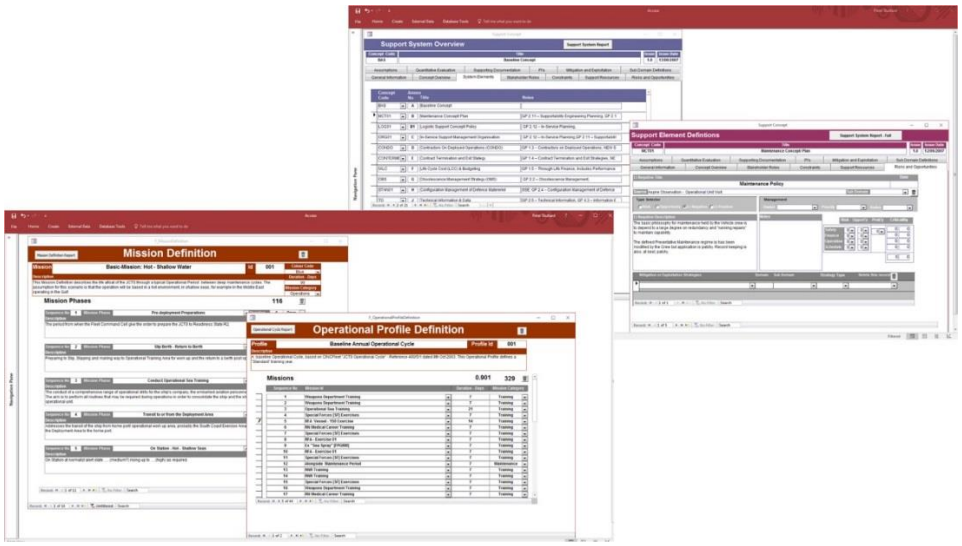
The first attempts will of course be the most challenging, but consider the amount of overlap and duplication that exists between different programmes. Consider the similarities between two RFA vessels, or even those between an RFA and an RN vessel, the degree of commonality can be significant. Hence much of the work could not only be reused, but such an approach would also facilitate much needed coherence across a range of systems and their support arrangements.

Utilising the Baselines

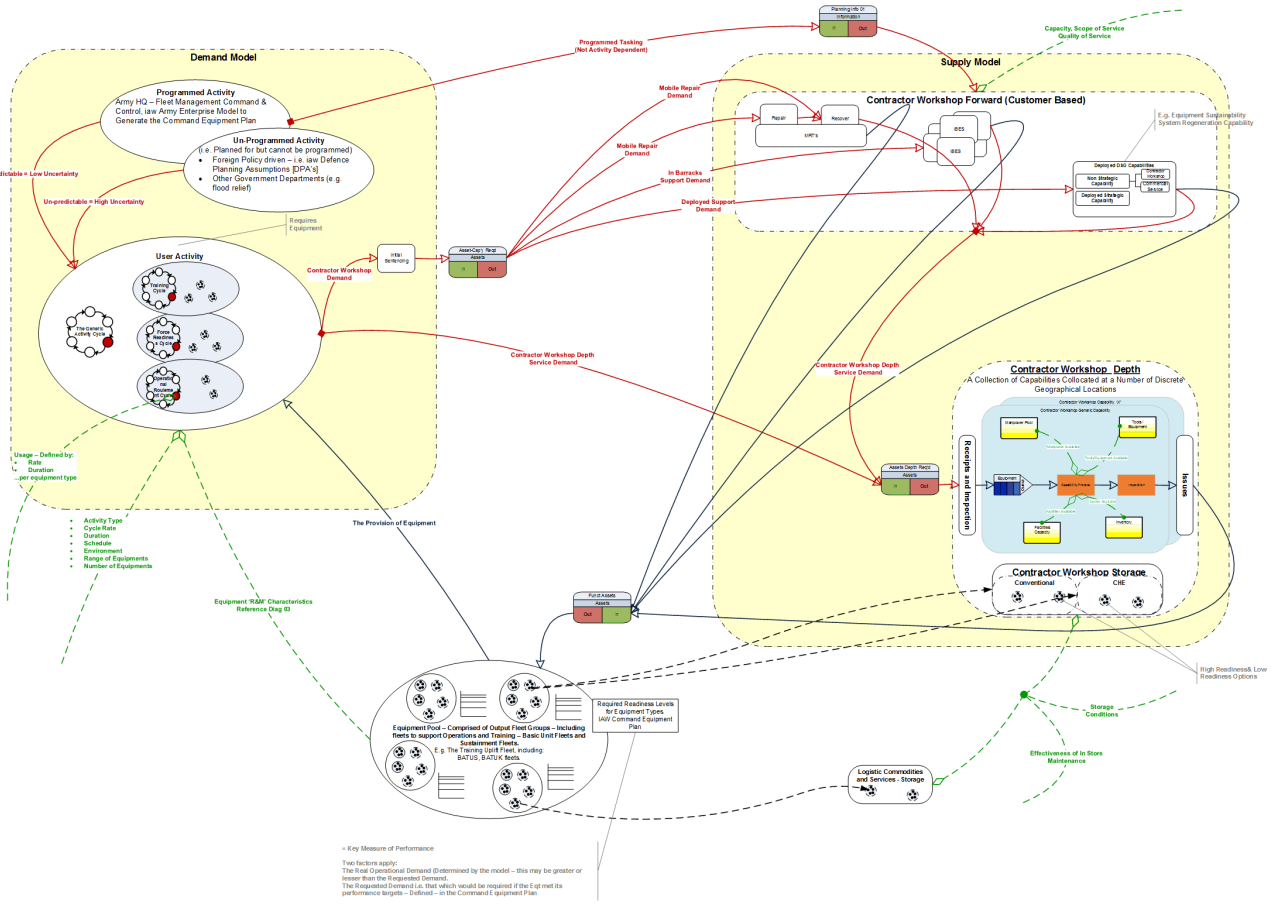
But both can be treated as simple hierarchies and such hierarchical approaches are amenable to the use of databases. Such hierarchical approaches are amenable to the use of databases, and the use of hierarchies in such databases means that we can use these structures to 'hang' all sorts of data and information on, information such as:

- Lessons Identified – Both positive and negative – a deceptively simple, a very powerful tool in our armoury – these are a backward-looking variant of →
- Risks and Opportunities – which are forward looking
- Interfaces – which applies to all three elements. Consider the Support System, we can identify the interfaces between the Customer and the Contractor, these may be the points at which physical items transfer from one organisation to the other, where information is transferred, or even where responsibility or ownership is transferred. This is important because it is to such interfaces that we need to apply appropriate
- PI's and KPI's – which will form the basis of Contracts and SLA's etc
- Assumptions, constraints, etc.
- Etc

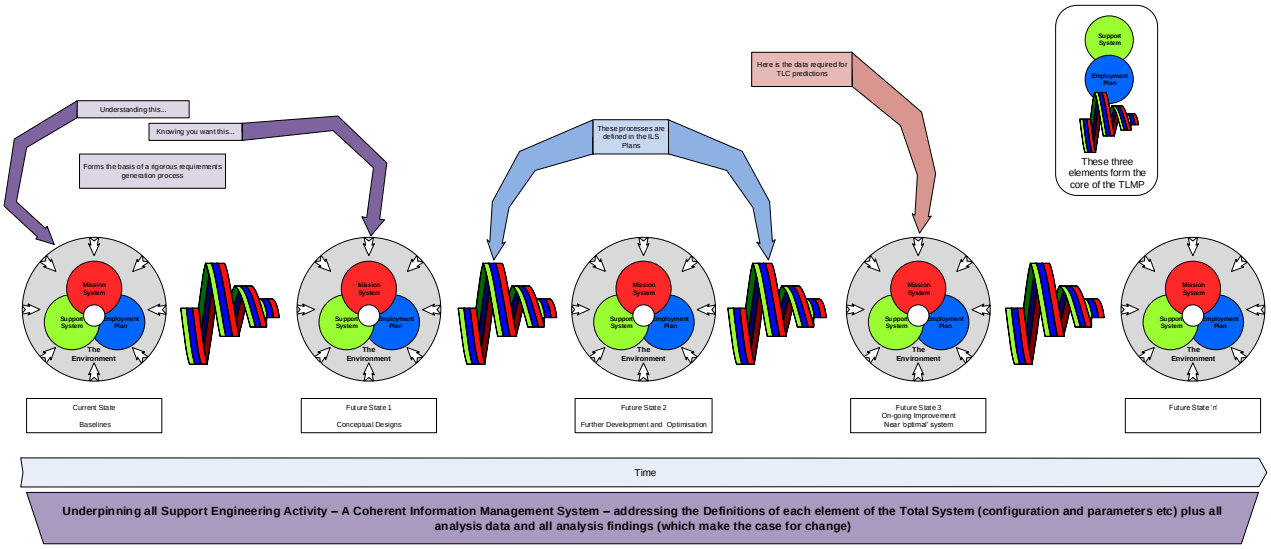
Aspire's tools for capturing Employment Plans and Support Systems – the Employment Plan Definition Environment [EPDE] and the Support System Definition Environment [SSDE]



Aspire supplements such databases with other information capture techniques, such as process flow diagrams, rich pictures, influence diagrams etc.



Once the Log Jam is Broken …



Many other benefits accrue as a result of this approach…

These tools facilitate the evolutionary process; the benefits of this approach are profound, consider:

- ❑ The data from the Baselines is used to populate Through Life Cost [TLC] and Availability models, providing a "Benchmark" for future improvements.
- ❑ As the baselines evolve the new definitions, the databases and the schematics, are used as a source of data to populate TLC and Availability models, hence we monitor progress.
- ❑ The method provides the foundation for a robust requirements generation process.
- ❑ The processes required to evolve from one state the next are defined in the ILS plan set.
- ❑ The Support System Definition, the Employment Plan Definition and the Programme Plans collectively form the core of a Through Life Management Plan [TLMP].
- ❑ There is considerable overlap and duplication between the support solutions of different platforms, hence much of the work invested in generating one baseline can be reused when generating others, this approach also facilitates the achievement of support coherence between platforms.

Baselines and the Digital Twin Concept

Such baselines are in effect a form of "Digital Twin" of our Mission System, the Support System and Employment Plan.

It is time we gave serious consideration to applying the concept of a "Digital Twin" not only to assets such as gas turbine engines, but to all platforms, wheeled and tracked vehicles, ships and aircraft and their associated Support Systems and Employment Plans. Such an approach would deliver significant benefits, not only during the development of a new system, but also during the management of extant In-Service systems, and today's technologies render this feasible, with relatively low levels of investment.

This does beg a question; which is "how good is the historical data ?" … and there is no doubt that a lot of our in-service data collection systems do need to be improved, as does the quality of the data they collect. But this is more likely to happen if, when, that data is effectively exploited.

In summary

Applying System and Systems Engineering approaches to ILS will reduce ILS programme costs; effective ILS programmes should be, can be, "save to save".

The creation of baselines, then the evolving of those baselines, via a series of stages, until a formal Support Solution is achieved, will address the issue of the apparent lack of available data.

We are dealing with "Wicked Problems" hence we seek **RELATIVE** improvements rather that **ABSOLUTE** performance

targets.

The approach is elegant, readily achievable, it will deliver very significant benefits.

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Aspire: Aspire Consulting Ltd are a private and independent company who have provided expert Supportability Engineering services for over 20 years. Our Support Engineering services, our training and our software have been deployed across the Defence and commercial sectors to optimise the operational performance and through life cost of complex systems.

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