KNOWLEDGE MANAGEMENT FOR THROUGH LIFE SUPPORT

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Abstract

The effective use of knowledge to deliver outcomes is a key tenet in successful Through Life Support of aircraft. This paper outlines a vision for TLS, describes the mindset associated with TLS, identifies how effective knowledge management can help deliver on that vision, and outlines potential strategies for success.

1 Introduction

Over the lifecycle of an aircraft program (i.e., 'cradle to grave'), literally thousands of people will interact with an aircraft type in some way or form. They might be a pilot, a technician, a mechanic, a design engineer, a support engineer, a project manager, a contract administrator, a fleet planner, or one of many other roles that might bring a person into some form of contact with an aircraft.

It's likely that each one of these individuals will have some level of a unique experience associated with that aircraft type, and hence will have varying degrees of "tacit knowledge" – unique knowledge which resides in the minds of each individual, and isn't necessarily captured by some formal process.

Much of what is known about an aircraft type is documented and/or captured in some form (often referred to as "explicit knowledge"). There still exists, however, significant scope to understand how to leverage the tacit knowledge that resides within the individuals associated with an aircraft system, whether it is from the early design phases, to the support/in-service phase, right through to system retirement. Perhaps this knowledge can be used to improve the capability of the aircraft system (and ultimately its safety), as well as improve and make more efficient the processes used to support that aircraft.

This paper will outline some of the work and the emerging conclusions associated with a project that is investigating the interesting paradigm of "knowledge management" in the context of aircraft support. The project is a collaboration between BAE Systems Australia and RMIT University, and is especially interested in how the management of knowledge can contribute to improving the outcomes associated with performance-based Through Life Support (or "TLS") – a contracting vehicle that is gaining increased popularity within aerospace and defense.

It appears there is currently little research into the area of Through Life Support, although the concept is considered to be very important to aerospace and defense contractors around the world, with successful implementation potentially doubling the business of some contractors! The performance-driven approach is going to have (and has had) significant ramifications for industry, and with a number of contractors already 'doing TLS', the concept is now viewed as being an important field for research.

It's important to note that the research project goes far beyond simply 'knowledge retention' or applying existing knowledge management practices to the TLS context. Rather, it's considering how knowledge can be better managed to deliver Through Life Support excellence. Hence, the research is seeking to identify what TLS excellence might look like, how TLS really works, and to develop a vision of the true nature of Through Life Support. It's

from this basis that knowledge management strategies will be devised and implemented.

The paper begins by outlining and loosely defining the Through Life Support concept, and identifying some of the drivers for the concept. It then begins to construct a vision for TLS, outlining its essence, and identifying the mentality that's associated with it. The role of knowledge management in achieving this vision is discussed, and is followed by a vision for how knowledge management will enable the higher-level Through Life Support vision. A preliminary strategy development pathway (that the project will use) is described, along with some early thoughts on actual strategies to be used in the TLS context. Finally, prior to some concluding thoughts, some ideas are presented to help readers lead change in their respective domains to help make the TLS concept a success.

2 An Introduction to the Through Life Support Concept

The term Through Life Support, in some contexts, can be loosely used to describe the integrated, performance-driven approach and activities associated with supporting a product during the operational phase of that product's lifecycle. There is, however, a certain level of ambiguity about the term, and there seems to be no universally accepted definition for TLS – in some contexts it refers only to 'after-sales support', whereas in other contexts it's a full transfer of technical risk to a contractor (which is known in the United States as "Performance Based Logistics", or PBL). To further this ambiguity, the concept is used to describe the support of components, major sub-systems, and entire airframe systems. The term "Through Life Support" appears to be somewhat unique to Australia, with similar terms such as "Through Life Capability Management" somewhat unique to the United Kingdom. For the purposes of this paper, it's assumed "Through Life Support" refers to the performance-based support of the entire aircraft/airframe-system, by the system manufacturer or approved partner.

The concept of 'support' in the aerospace context can encapsulate a wide range of activities. These include (but are not limited to) deeper aircraft vehicle maintenance/repair/overhaul, major capability upgrades, engineering support, management of spare-parts (including sourcing, tracking, overhauling and replacing of components), obsolescence management, reliability and availability analysis, access and use of Intellectual Property such as design drawings and data, training support, and the provision of other products and services which enable an operator to conduct efficient and effective operations. In essence, it could be argued that TLS is actually about 'capability delivery' – enabling an operations-focused customer to successfully achieve their mission.

In both defense & airline circles, the maintenance and support of aircraft platforms has traditionally been carried out mostly in-house. Over time, these arrangements have been supplemented by the outsourcing of some or all of these support activities. Generally, this outsourced work has been undertaken using "Time and Materials" (T&M) contracts, whereby the operator pays simply for the level of work undertaken by the contractor (i.e., hours worked), plus the materials used (such as new parts). This arrangement would seem to be steadily been replaced by performance-based support concepts, which are now very popular in the United States.

The TLS concept is best seen in terms of performance-based servicing arrangements, such as the "Power-by-the-Hour" (PBTH) and Performance-Based-Logistics contract vehicles. In each case, a contractor is not paid by the level of activity performed (such as hours spent on maintenance), but rather on the level of defined system availability. PBTH involves a fee paid to a service provider/contractor on an hourly operational basis (i.e., the number of flight hours, multiplied by a per-hour fee). Other such performance-based contracts may stipulate minimum system flight-hour availability over a time period, or the provision of a minimum number of aircraft to a daily operational 'pool' – all for which a fee is paid to the service provider

for delivery, with penalties for not achieving the availability/delivery targets.

It follows that customers are ultimately not paying for activities, but for outcomes – outcomes which ultimately manifest themselves into a capability that the customer can use to perform a given mission (such as commercial transport, air defense, strike, or all weather rescue, as some examples). The customer is more concerned about having the capability to achieve their specific mission, and is less concerned with the means of how that capability is provided. Contracts are thus constructed in such a way to deliver, among other things, greater levels of defined system availability.

This new contractual arrangement is now driving support contractors (an increasing number who are the system manufacturers) to better integrate all the various support activities, in order to deliver better outcomes at a lower cost. Under T&M arrangements, there are incentives to keep an aircraft in the hangar as long as possible, as payments are tied to hours worked. However, Through Life Support concepts dictate 'pushing' the aircraft out of the hangar as quick and as long as possible in order to make the operation as profitable for the contractor as possible. This is driving the need for a much more intelligent approach to support.

Clearly, with new business opportunities presented by TLS, there is considerable interest in the Through Life Support concept within the aerospace manufacturing/service industry and aircraft operators.[1], [2] This is particularly so, because traditional aircraft manufacturers are seeing the support phase of an aircraft's lifecycle as being particularly lucrative (due to the longevity of aircraft operational lives), and through repositioning themselves as 'through-life capability providers', are increasingly taking on the role of supporting and maintaining the platforms that they manufacture.

In a previous paper [3], it was observed that other drivers for Through Life Support included the desire by customers for "mission-focused capability-delivery", the desire by customers to partner with an the "intelligent supplier", the importance of availability/utilization, and the push by governments to adopt a policy of performance-based contracting in department/agency procurement practices. It's interesting to note that the mission-focused capability-delivery concept has been driving some interesting platform changes, such as the extension of a baseline aircraft's range to meet an operator-specific route.

There are, however, significant challenges for the move towards this more integrated approach. Questions, such as 'what does it mean for us' have to be addressed by aerospace companies, independent service providers, and by operators alike. Issues such as organizational culture, and even the mindsets of the diverse stakeholder groups, will likely be the biggest impediment to the successful, wide-scale adoption of the Through Life Support methodology – whatever TLS definition is applied.

3 A Vision for a Through Life Support Mentality

In order to grasp of the essence of TLS, and to catch the vision of its essence, it is important to first consider what the drivers for this paradigm will likely bring about.

An undergraduate study [4] from RMIT University in 2006 discusses the topic of Through Life Support, particularly in relation to the commercial aircraft industry. It defines some of the key tenets of Through Life Support, including:

- Risk transfer
- Predictable costs
- Higher fleet utilization
- Reduced Lifecycle costs
- Effective use of knowledge to achieve outcomes
- Delivery of capability through outcomes, not just delivery of activities (application of 'systems thinking')
- Win-win mentality

The same study identified three likely major outcomes of a TLS program:

- Continuous airworthiness (i.e., safe to fly)
- Continuous product improvement

- Continuous process improvement

Traditionally, support/maintenance operations have often been seen as an after-thought to aircraft program planning, which would seem to be mostly concerned with the design and manufacturing phases of the program/system lifecycle. To that end, aircraft maintenance has become a management mechanism – where the implied definition of 'management' is that of 'stopping things from getting worse'. Its function seems to have been simply to prevent aircraft from falling out of the sky, and to ensure people don't get killed or injured as a result of an un-airworthy aircraft.

Whilst maintenance is a key activity of Through Life Support, the outcome-based nature of the TLS concept yields the opportunity to deliver far more than just an airworthy fleet. Instead of simply preventing negative events from happening, the TLS concept has significant scope to focus on maintaining, and even improving, capability. In essence, Through Life Support presents the opportunity for an intelligent & clever capability-delivery operation that goes beyond the 'fire-fighting'.

Table 1 illustrates some of the attitudes/mentalities that are held about the nature of 'maintenance management', and contrasts them with the service-focused mentalities of Through Life Support. These attitudes associated with maintenance management seem to typify how maintenance/support operations are viewed, as in the experience of the authors.

Maintenance Management	**Through Life Support**
A focus on simply preventing failure (A 'fire-fighting' mentality; striving to ensure nothing happens that would jeopardize safety)	A focus on contributing 'our bit' to customer mission success (which requires a good understand of one's customer and what they are trying to achieve)
Activities are centered on restoring an aircraft, as close as feasible, to its original condition (and managing gradual loss of capability due to aging)	Activities are centered on delivering an aircraft that meets the capability needs of the operator (customer)
Nature of operation dictates strict adherence to procedures	Nature of operation provides substantial scope for innovation and creativity (due to continuous improvement drive)
Knowledge used to prevent failure (in the technical, commercial, and operation/business-objectives dimensions); used in an ad-hoc way simply to keep things under control, and; used to 'feel in the dark' (particularly of airworthiness and technical issues)	Knowledge used to deliver capability and bring about improvements (to product, process, capability, safety, project, commercial, etc); used in an intelligent, organized and efficient manner; used to 'turn on the light' (support organization is very aware of airworthiness/technical issues and status)
'Keeping a lid on things'	'Skies the limit'
Working harder	Working smarter
Fear-based (trying to prevent 'oops')	Excellence-driven (strives for 'that's fantastic!')
A 'looking down' mentality – just trying to keep one's activities under control. Is quite an inward-focused attitude, concerned with own internal issues.	A 'looking up' mentality – pursuing positive outcomes for stakeholders. Attitude is outward-focused, centered on serving others.
Emphasis on activities and doing	Emphasis on outcomes and delivery
A transactional business relationship	A partnership
Maintenance as a 'cost centre'	TLS as a vital element of value generation
Maintenance as a 'dirty trade'	TLS as a professional discipline
Platform 'management'	Service 'leadership'

Table 1: Contrast of maintenance management and TLS attitudes

It's very important to emphasize that Through Life Support doesn't do away with the basis of the 'negative' connotations of maintenance management – it, by all means, does absorb them. Through Life Support still incorporates the 'management' aspects of aircraft support. However, it goes beyond just trying to keep pulling a fleet up to a baseline ('good enough') and 'keeping a lid on things', and is about taking a fleet to meet and exceed customer expectations. It combines continuous sustainment (platform 'management', including

the strict rules and processes) with continuous improvement (platform 'leadership' accompanied with innovation).

An example of how the TLS mentality absorbs the basis of the maintenance management mentality is that of a safety focus, and trying to prevent things going wrong. Clearly, ensuring an aircraft platform is safe to fly is paramount to providing a capability (and is reflected as one of the three outcomes of a TLS program). A Through Life Support mentality recognizes that an airworthy platform is a key ingredient of capability. However, it also realizes that the whole point of undertaking a TLS program is also keenly intent on tailoring and preparing platforms to specific missions, and continuously improving that platform to deliver the required capability. Of course, managing the conflicting requirements between firepower (for example) and safety is essential, and TLS programs must be structured in such a way to ensure that safety is always put first. However, the TLS attitude realizes the vital importance of safety, and understands that a balanced approach is required (with safety as the priority).

TLS also yields the opportunity to develop new attitudes to what has been seen traditionally as a pure cost-centre. Maintenance has been seen as a necessary task, but one that brings no value to an operator – it incurs a financial loss to an airline, and is seen as a loss of an ability to defend the nation in the case of militaries. However, the 'capability-delivery' concept starts to bring about the idea that TLS is actually an investment – that putting money into the TLS operation actually yields to an operator the ability to go an perform their value-generating mission.

The availability driven nature of the performance-based contracts are also driving process improvements. It is in a contractor's best interests to have no aircraft in the hangers and rather have them all in active operator service – it means they are actually getting paid because the system is available. There is an inferred pressure on contractors to 'push' the aircraft out of the hanger as quick as possible, and for as long as possible. This business-driver will help bring about the objective for higher fleet availability, and thus utilization.

The Through Life Support mentality also has other implications for the whole program lifecycle (i.e., Market Research> Conceptual Design> Preliminary Design> Detailed Design> Validation, Verification, Test & Certification> Manufacture> In-service/Support> Retirement). It sees such a program lifecycle as about developing and delivering an ongoing capability, that is manifested though the aircraft product. It's a bit like the lifecycle is turned on its head – whereas previously the manufacturer's emphasis has been on design, it should now be that the in-service and support phase be the main focus and driver of the aircraft program. The main aim is *capability* – the product is simply the means.

This means that new aircraft need to be designed to meet operator capability needs, with scope for through-life modification and continual improvement, especially as the operator's environment changes over time. Such aircraft also should be 'TLS friendly' (meaning supportable, maintainable, and reliable).

For 'legacy platforms' (i.e., existing aircraft that are being supported in a TLS-manner, that have not been specifically designed with TLS considerations in mind), extra effort may well be required to achieve these objectives, with an implied need for the support organization to continuously learn more about such platforms to efficiently support them (something which links into knowledge management practices, especially the concept of "the learning organization").

Having the ability to adapt an aircraft platform to meet operator needs as they arise implies that any TLS program provider must have an intimate understanding of their customer's constantly evolving operational environment and requirements. In the military context, this might mean new weapons and sensors. In the commercial arena, it might mean better cabin experiences, improved fuel-burn performance, and/or increased navigational performance, such as incorporating new technologies that enable the "open skies" concept. Managing this evolution will be a challenge.

In essence, the Through Life Support mentality is about having a passionate culture that seeks to serve customers, by providing capability through continuous innovation.

4 The Role of Knowledge Management in Enabling the Vision

The above vision for Through Life Support might be somewhat aspiration, but how can it be achieved in reality? What are some of the enablers to that vision?

Interestingly, there is an increasing level of reference in research and industry practice literature that supports the idea that the greatest impediment in the move towards TLS-like concepts is not technical, but relates to culture and mindsets [2],[5]. Traditional manufacturers (such as aircraft producers) have been struggling in their transition to offering services alongside their products, and it would appear the greatest struggle is in the way that people in the manufacturing organization think.

An additional challenge that the TLS concept presents is that payment arrangements tend to oppose traditional business thinking. Normally, payment has been tied to activity, but under TLS, they are now linked to outcomes. Also, the concept of also having to 'give money away' (for a penalty payment) contradicts the way a business would think (whose main aim is to make a profit). These issues have been identified with talks with industry.

Aside from changing mindsets, there are other enablers that should contribute to the successful implementation of the TLS concept:

- 'TLS friendly' aircraft design (interestingly, industry has commented a fair amount about how aircraft design offices have not, until recently, been TLS friendly)
- A partnership approach
- Use of environmental scanning (anticipating productive and disruptive changes before they happen)
- The open communication of needs (of both operator and TLS provider)
- Effective data management (including data use, to generate an accurate and clear picture of the TLS operation)
- 'Knowledge management' in order to create a smart and professional TLS operation with the 'knowledge-edge'

Interestingly, as one attempts to develop a list of such enablers, it appears such a list continually points to people and to knowledge (which is ultimately used by people). An addition, considering the characteristics in Table 1, one can pick up on a theme suggesting that knowledge is a critical ingredient to Through Life Support success. This would be especially so, considering that aircraft are very complex and knowledge intensive systems.

When considering the field of "asset management", "logistics support", or Through Life Support, one finds an increasing reference to the importance of 'knowledge management'. Research papers make it clear how a complex system, such as an aircraft, have the potential for long lifecycles, in which significant levels of knowledge can be generated regarding that system [6]. The complexities of such systems led to a study into knowledge management in the field of systems acquisition by the Defense Systems Management College in the United States [7]. Other research confirms an increasing realization by industry (as observed by these authors) that knowledge in the logistics domain has often been underutilized and is subsequently wasted [8].

However, it's not just within academic research that there are calls for improved knowledge management. There are a number of real-life examples that demonstrate the need for the effective use and management of knowledge:

- It was observed by the lead author during work experience that a maintenance engineer in the heavy-structures repair shop identified that over a period of time, a specific component corroded faster than similar components. Whilst this mechanic perceived this as 'fascinating', there was no process in place to extract that knowledge from that worker in order to improve the

product/process. The scheduled maintenance requirement (i.e., flight-hours between inspections) for that component was dictated by the design & certification phase of the aircraft development, but could be more accurately improved with the knowledge of this worker (and others like him).

- An interesting story from the jet-engine support industry describes how British Airways noted that its 747s assigned to operate out the hot, high & sandy port of Phoenix, Arizona, have higher engine degradation rates than aircraft that don't operate out of that port (due to localized environmental factors). It's difficult to capture data that can be used to predict the variability of global environmental conditions; however, using this head-knowledge, a scheduler can use their judgement to pull an aircraft from the flight-line at the most opportune time. This example reinforces the important of understanding the localized operating environment of their customers – even the physical/atmospheric environment.
- During the Boeing 777 design effort, the use of "Design-Build Teams" (an excellent knowledge-use strategy, which sees staff of varying professional disciplines work together on the aircraft design, versus a 'siloed' approach) saved approximately $60m on the design of the passenger doors alone [9]

As the 2006 RMIT University study identified, TLS is about the effective use of knowledge to achieve outcomes. Ultimately the benefits of improved knowledge use and management potentially extend to safety/airworthiness, cost savings, availability rates, profit, and even staff satisfaction and motivation. Obviously, it also extends to enabling the TLS service provider to deliver a program that satisfies and exceeds customer expectations, as well as company goals. It is the clever use of knowledge that is a significant foundation to achieving the vision of a resilient, intelligent and smart support operation.

The knowledge management concept is also vital due to the very-long timeframes associated with aircraft programs, with some lifecycles up to 50 years in length. It's little surprise then, that when the authors have been talking with industry, the importance of effective 'knowledge management' strategies (in the TLS context) have been very clearly articulated by engineers and managers.

5 A Vision for Knowledge Management in the Through Life Support Domain

It's interesting to note the responses of engineers and project managers when one discusses the concept of 'knowledge management'. Often, the response includes terms such as 'databases' and 'data management', with some seeing "KM" as being about knowledge retention (i.e., capturing all the knowledge within an organization, often "in some sort of database"). Whilst the application of technologies such as intranets, "wikis", and other knowledge-management-type databases are valid, there is a considerable amount of research material that is now focusing on the people and culture within an organization or social context [10],[11].

As has been previously described, the Through Life Support concept yields the opportunity to deliver an intelligent, smart and sharp operation. What, then, might a TLS operation that successfully manages knowledge, look like? The following are some potential characteristics:

- Innovation & capitalizing on opportunities: The organization doesn't stand still, but pursues continuous improvement, and always looks for new opportunities to develop their business, sales, and of course, to enhance their success of their customers
- Detailed understanding of customer: The TLS provider goes beyond just delivering what the customer specifically asks for (for example, by following a Statement of Work), but seeks to add value to their customer's operation in an innovative way. This includes having a very deep

understanding of customer operations and needs, and suggesting improvements and changes that will ultimately help the customer achieve their mission more effectively. The authors have seen this approach successfully used outside of the aerospace domain – with a business taking a customer requirement, studying it, and developing a proposal that doesn't necessarily conform to the original specification, but one that does better meet the needs of the client. This unique approach has been instrumental in winning contracts, even against formidable competitors. Ultimately, caring for the customer yields financial benefits.

- 'One company' mentality: being on the same page, and unified in operations
- Intelligent action: Making informed decisions and taking informed action – no 'stab in the dark' approach, but very precise actions to deliver a 'win-win' situation
- Working smarter, not harder: Using resources efficiently, and using knowledge (both tacit and explicit) to make things work smoother, more efficiently, and more effectively
- Detailed understanding of system, and environment: Able to anticipate and quickly adapt to change.

It's likely that effective knowledge management will be a significant enabler of TLS. Interestingly, bringing the two emerging concepts of 'knowledge management' and 'Through Life Support' together presents some intriguing avenues of thought. As has been discussed, attitude, mindsets and culture alone are going to play a key part in bringing about success in TLS operations. At the same time, knowledge management (on its own) has strong links to culture and organizational resilience. When one brings these two concepts together, there is a strong link between the two – both have significant overlap in the area of culture and excellence.

It's important, though, to understand where TLS organizational culture should head – hence the vision that has been shared in this paper. Clearly stating the vision of TLS opens the way for the culture of an organization to be changed and adapted to suit TLS-focused operations. This vision gives people a clear purpose and an understanding of their role in 'the bigger picture'. However, because of the substantial role culture plays in knowledge management, it's essential that both the TLS mentality and knowledge management factors are incorporated into organizational culture development initiatives.

6 Knowledge Management Strategy Development

A significant part of the research project is to develop implement-able strategies to enable effective knowledge management in the Through Life Support domain. To date, little work has been undertaken on detailed strategy development. However, what follows is a draft strategy development pathway:

- Context identification: define the context, the organizations, influences, nature of customers, behaviors, attitudes, culture, business & political environment
- Situational Analysis: Identification of major processes, the fundamental business objectives within each stakeholder organization, consideration of airworthiness regulations, contractual requirements, distinguish the potential differences that exist between contexts (for example, commercial airline TLS versus military-customer TLS operations)
- Define what TLS looks like (as has been touched upon in this paper)
- Define how KM can contribute to that vision (also touched upon in this paper)
- Strategy development: actual detailing of strategies to achieve the vision
- Strategy deployment & refinement

In essence, at the end of the research project, it will answer:

- Where are we?

- Where do we want to go?
- How are we going to get there?
- How do we make sure we get there?

Further work is to be undertaken to enhance this approach. This approach will be further refined, including identifying evidence to back up each strategy (such as academic research, industry advice, or case studies).

Some 'free-thought' ideas have been considered, and are in the early stages of development. Of course, these are only preliminary thoughts (which the authors would be pleased to receive feedback upon), and many other strategies are to follow. These preliminary strategies are described below:

- Create leaders: leaders don't necessarily have to be in a position of authority, but often act as people who point out a pathway to others. Creating leaders at all levels of an organization will potentially lead the entire workforce to adopt a TLS mindset, incorporating behaviors conducive to effective knowledge sharing and knowledge using. This strategy is especially useful to develop people who are on the 'same level' within the organization.
- Creating the right culture and environment: Formally recognizing behaviors that benefit the knowledge management vision (such as bonus pay, or other rewards) and even physically rearranging the office to be more conducive to people-flow and communication
- Strengthening relationships: from personal experience and observation, as human beings, we are more likely to share detailed knowledge with someone with whom we have some form of a relationship. A relationship is a bit like a bridge that connects people, and fosters communication (and hence the sharing of knowledge).
- Engraining processes into an organization to enhance learning: for example, at regular business reviews, undertake a formal environmental scan, compare it with that of the previous month (to gain an understanding of how things are changing), and then relaying this knowledge around the organization
- Scenario simulations: undertake 'role-plays', especially linked to issues of major concern, identified in risk management processes. Seeing and being involved in such role-plays may be an effective platform for knowledge-sharing in context (basically, 'doing', rather than just talking).

Papers and articles at a later date are expected to detail some of these strategies, especially in the Through Life Support context.

7 Leading Change

Throughout this paper, it has been highlighted that one of the greatest impediments to Though Life Support success is organizational attitudes and culture. Hence the authors would like to encourage readers to start thinking how they might apply, to their own work and field of influence, the vision described in this paper.

Readers are encouraged to question their mindsets with regards to their work, and how that might affect their work. How might one adjust their thinking to adopt a service-orientated worldview?

Even the language one might use can reinforce attitudes that may create a stumbling block to adopting a Through Life Support mentality (for example, referring to a TLS operation has being a "cost and liability" versus "a great help").

Readers are also encouraged to share the vision for Through Life Support throughout their domain. A strong, clear and well communicated vision is important to debunk old thinking, and establish a right culture. Such new attitudes can act as a lubricant to enable Through Life Support success.

There is a strong likelihood that attitudes will need to change, even to guarantee the long-term viability of aircraft support. There has been

a perception, especially among young people, that "maintenance" is a 'dirty', unprofessional trade, which only leads to a career dead-end [12]. Adopting the TLS attitude will be important to demonstrate that Through Life Support is a professional discipline, one that young people can thrive in (this will be especially important to long-term recruitment).

Finally, the observations and thoughts presented in this paper are not just simply for senior managers and leaders within the aerospace and defense industry – it's for everyone who has some sort of contact with an aircraft system (similar to the context described in the introduction to this paper). It's hoped that readers will be able to take something from these ideas, and apply them in their everyday work.

8 Concluding Remarks

The aerospace business is changing from a traditionally product driven environment to a more capability driven environment. As a consequence, the product supplier must take responsibility of the serviceability of the product from design, manufacture, operations, and right through to disposal. This change is significant as contractual capability/serviceability guarantees can be costly if they cannot be met.

It could be argued that the Through Life Support concept is not just a phase in an aircraft's lifecycle, but rather it is a driver of change that will redefine the way entire aircraft programs are planned, executed, and managed. The majority of aerospace manufacturer/integrator effort might be more concentrated on the operational phase of the platform's lifecycle, with the design/manufacturing phase really about developing, as part of a capability system, a flexible platform to deliver the outcomes necessary to supply the right capability at the right time to the right customer.

Achieving the vision will, however, be a challenge. The authors have observed by talking to industry that the 'soft', people-related issues are probably the greatest impediments to successfully moving towards the TLS concept.

The authors believe that the increased interest in knowledge management is in response to a growing realization that *people* are the users (and often holders) of knowledge within a company. Furthermore, the authors feel that there is a growing realization that people are not the "number one asset" in a company – rather, *people are the company*! The legal definition of a company as a legal entity really only holds true in the eyes of the law. But to consider a company at its fundamental and simple essence is to realize that people *are* the organization.

With this in mind, it's important to remember that a Through Life Support operation is made up of people, who sensibly adhere to processes, and using technology/tools to achieve a common purpose – a service-orientated purpose!

To enable the vision described in this paper, there is a need to manage knowledge very effectively. There is significant opportunity in that mindset and culture change can deliver TLS excellence alone – but extending such change efforts to affect the energizing of the management of knowledge will yield an even greater likelihood of Through Life Support success.

Finally, it's important to realize that there is a continuum to knowledge management – it isn't a matter of 'doing it' or not. Likewise, it would be fair to say that the contrast between maintenance management and TLS mentalities isn't completely clear-cut, and that maintenance isn't as negative as perhaps is often perceived. However, the performance-driven nature of TLS is going to require the energizing of knowledge management initiatives and processes, as well as an increase in efforts to change organizational attitudes and culture towards Through Life Support in order for the concept to be truly successful.

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