

Can you LEAN an Aircraft Carrier?

John Hardwick (FIOM)

Can you LEAN an Aircraft Carrier? This is the question that Commander Alan Martyn asked in early 2004, but he was not thinking about the angle of the mast to the perpendicular! He was asking himself whether you could apply the lean tools and principles to a ship of war? The (maybe) surprising answer is a resounding YES! So if you can apply it in this scenario, don't tell me that lean doesn't have something to offer in the operation you manage.

BACKGROUND

It was in 2002 that Commander Martyn first came across lean whilst working for Air Marshal Barry Thornton, who was responsible for the support of all military aircraft.

Lean was being introduced at RAF Cottesmore post success with the tools in the US Air Force and US suppliers like Lockheed and Boeing.

The tools were first applied to the deep maintenance of the Harrier GR7 "Jump Jet" and delivered results almost immediately. Through a combination of value stream mapping, flow solutions, reduction of non-value added activities and revised scheduling they achieved a 100% increase in throughput and saved the airforce £56 million a year in maintenance costs.

In some ways this was not surprising. Maintaining an aircraft as complex as the Harrier is a lengthy process, and in many ways similar to a production line. The activities were by and large predictable and repetitive. Certainly the degree of maintenance depended on what was

found during inspection, however the maintenance itself was carried out to a set of standard procedures and to the same exacting quality standards for each aircraft.

How did the decision get made to have a look at an aircraft carrier? Believe it or not it was the result of a bar room discussion between Commander Martyn and Air Marshal Thornton. In late 2003 Commander Martyn had been assigned to HMS ILLUSTRIOUS as Commander Air Engineer, and Air Marshal Thornton was concerned that Alan would "get bored". It was here that the plan was hatched! How about seeing what lean could do for a war ship?

Commander Martyn had no formal Lean training, but he had seen enough at RAF Cottesmore to know that he had to start with a Value Stream Map. But what is the 'Value Stream' for an aircraft carrier? First principle, start with the 'customer'. In this case it was the Pilots of the Harriers that were identified as the main customers, and the key measure for them was "Sortie Generation Rate" which translates to civilians as "How many plane launches per day".

So the first activity was to map the process, from landing of the Harrier on deck, through manoeuvring, maintenance and

pre-flight checks, to re-launch as a refuelled and re-armed fighting machine. "Even just carrying out the mapping exercise brought some immediate insights" commented Commander Martyn. "The lift between the deck and the service bay was an obvious bottle neck. If that lift is out of action, everything just stops!".

Another insight from the value stream mapping was the amount of time that planes sat around flight-worthy but idle. It was a bit more tricky to find the root causes for that one though!



Creating the "Current State" value stream map

Initially the ratings were a bit sceptical, they were concerned that this was just a cost cutting exercise. "It is true that wherever we looked there was waste. Wasted time, wasted movement, wasted spares, wasted fuel." Says Commander Martyn. "Most critical however, was the wasted time. In a war situation, that means flying fewer sorties and lives lost! It was important that this message

was put across. This was not a cost cutting exercise, this was about being more efficient within the constraints we have.”

GETTING STARTED

This was not a top down initiative from the top of the house, this was just two people with a vision and belief. This meant there was no cadre of Lean Experts or Sigma Black Belts to draw on, just enthusiastic amateurs. “We decided to use a consultant to give us a jump start. They helped us to clarify the outcomes of our first ‘Baseline’ activity, and also helped us run the event.”

The focus was very much on ‘learning by doing’, and while it is still all on paper there is no risk. (They did however find out later that making changes to an aircraft carrier, even relatively minor ones, can lead to a lot of bureaucracy!)

They started off by drawing a flow diagram of every step of the process. Even that gave them some really good insights, it had simply never been done before. Everyone around the board was asking, “Why do we do it that way, it doesn’t make sense”.

The next step was to go and do some observations. “Although this was very time consuming, it was a vital step” says Commander Martyn. “While many people thought they knew the answers, only by observing everyone in action could you really see the waste and opportunities”

With this data, they could now construct the value stream map. “It’s a bit like a process flow chart, but it requires more detailed information to be added”. The team measured start times, end times, idle time & rework time. They also measured how many people were involved in an activity, and how long they actually spent doing ‘value added’ work.

‘Value added’ is an important concept in any value stream mapping activity, and it is worth spending some time getting everyone to agree on some definitions. The Navy was looking at this from an ‘aircraft turnaround’ point of view. So anything that was diagnosing faults

or fixing them was a ‘value’ part of their value stream, although strictly speaking repair can be looked on as waste due to something breaking down.

Typical examples of non-value adding work they found were; searching for tools, waiting for spares, moving planes more than once due to congestion, waiting for the lift etc.

DEFINING THE FUTURE

This was where the fun really started. “We have some very innovative men in our team, but I would hasten to add so do all teams!” says Commander Martyn. “We wanted to give them a chance to do some ‘blue-sky’ thinking on what they had found from the current state mapping. We decided to try and define an ‘ideal state’. What could we achieve if we had no constraints?”

This resulted in some very interesting concepts. The team decided that in an ideal world, each plane would self diagnose its service requirements through appropriate instruments, transmit these to the ship and be directed to the correct service areas immediately after landing. To get to the service bay, there would be no lift, simply a set of ramps that extended beyond the landing deck. In the service areas, pre-assembled replacement parts would be fitted with secure but quick release fittings.

“Many of the concepts were completely impossible to implement with our current ship and aircraft” commented Commander Martyn. “However, it helped us set some really stretch targets, and break out of old style thinking”.

Coming back to earth, the team still found they had plenty of opportunities to improve. Breaking the whole process down into sub-steps, and then looking at your best ever times for each step is a good way to start looking at what can be achieved. Even without making radical changes, they should be able to halve their turnaround time if they could consistently achieve their best times in all steps.

The next step was a ‘future

state map’. This is similar to the current state map, but should have unnecessary steps removed, steps that were on the critical path but can be done before or after the key activities, should be moved, and new targets for each of the remaining steps should be shown.

The last step is to prioritise. Every organisation has limited resources, and selecting the important changes to make is a balance between the benefit they will bring and the time, money and resources required.

“There is never one ‘single fix’ for challenges like this” says Commander Martyn. “We identified 26 further ‘events’ that would be required to get us where we wanted to be. However, by the end of the first one we knew exactly, which order they should be done in, who was required to be there, and what the objectives were.”

THIS AIN’T ROCKET SCIENCE!

Commander Martyn is passionate that Lean has something to offer virtually every operations management situation. “The great thing about Lean is that it just turns common sense into common practice for you”.

‘Do the right things, and then do them right’ is another good mantra. At a practical level, the changes proposed were not earth shattering, but some of them did challenge long held beliefs and ways of working.

One of the bottle-necks was around the number of sorties that pilots could fly due to their shifts. In the ‘current state’ all pilots attended the pre-flight briefing, of which much was mundane or routine. By distilling out the key operational information and only getting a few pilots to attend and then brief the others, the overall flying hours were dramatically increased.

Another example was around the ‘recovery’ routine for planes. (To a layman ‘recovery’ means landing and parking!). In the current state, the correct positioning and securing of planes on the deck was an ‘art’ not a science, and depended on the skills of a particular crewmember. One of the workshops held brought together the experts from the various shifts

and identified the best way to do this. Having defined this, markings were put on the deck and the securing chains were shortened so that they only fit if the planes are in the right place.



A place for everything, and everything in its place

Bomb storage was another opportunity. Current practice was to assemble a number of payloads before each sortie, and store them on the deck. This gave them safety issues, as well as interfering with flow. Through leaning the assembly process, they are now so slick that they can assemble them on a just in time basis. This vastly reduces storage, and also reduces risk.

IMPLEMENTATION

It's all very well defining it on paper but what about doing it in practice? "Some of it was really easy" says Commander Martyn. "If it could be done by the team, with no reference needed to the 'high ups', then we just got on with it."

Commander Martyn believes the involvement of the ratings and engineers was key to this. "You may think that in the Navy we say 'jump' and they say 'how high?' but it's not really like that. You can get compliance for a short while, but only when they are really bought in to the change do you get the support needed."

This is a common theme with change management, and particularly Lean. You are asking people to change their behaviours at the end of the day, and just telling people to change won't do it, not even in the armed forces.

There were some frustrations along the way though. "Getting the markings painted on the deck took nearly 6 months!" explained Commander Martyn. "Deck markings are particularly tricky for safety

reasons. They can distract the pilots or confuse them on approach, so we have to go through several trials and consultations with pilots, safety advisers and engineers before making any changes. This is not easy when the ship is at sea for a large proportion of the time."

"We got a bit of resistance from the pilots about the briefings (interestingly they were less involved in the workshops) however after a few trials they have settled into it."

There were some other real gems. "When it came to lift down-time, 92% of the time this was caused by operator error, because there was no indication of which way you should move the lift operation lever. Simply placing an arrow and a sign reduced lift downtime by nearly 40%!"

RESULTS

One of the things that Commander Martyn and the team did early on was to look at some top-level measures for what they were trying to achieve. LEAN made us look at productivity (cost/output) as well as output and here we discovered we were three times more productive than a big US carrier.

The programme saw improvement from 16 to 30 aircraft launches per day. Other improvements included cutting the weapon assembly time from 1 in 2.5hrs to 3 in 27 minutes, reducing plane parking times from 7 minutes to 23 seconds and increasing aircraft lift availability by 60%. Very importantly to any tax payer these improvements were delivered together with a saving of almost £20M.

CONCLUSIONS

Operations management is a very broad discipline. Most people think about manufacturing or perhaps service industries when thinking about operations management, but this example clearly shows the benefits of good operations management principles in a wide range of situations. The important thing is to remain focussed on your mission, not on cost cutting. The Navy has a mission to serve and protect, and they are finding ways of doing this in a more effective and efficient way. Whilst doing this, they are finding ways to improve safety, reduce costs and make life a little easier for the ratings and engineers.

Perhaps you work in another part of the armed forces, in a hospital, in a government department or in project management. What examples of good operations management practice can you share?

About the author

John Hardwick (FIOM) wrote this article, based on conversations with Commander Alan Martyn during June 2006.

John has worked in the Pharmaceutical industry for 24 years and currently works as an Internal Consultant for GlaxoSmithKline. His work focuses on using Lean and 6-Sigma tools in non-manufacturing environments.

John has a degree in Chemical Engineering and an MBA from Cranfield School of Management.

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