From Turbulence to Tranquillity

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Abstract

For those who thrive on a challenge, the management of obsolescence through a prolonged economic down-turn certainly provides the right environment. The underlying assumptions of most obsolescence plans; equipment strategies, product life cycles, maintenance policies and even equipment manufacture processes are being thrown into disarray as both suppliers and customers look to best meet the present challenges.

This paper will look at the revised operating models within both suppliers and customers and highlight the challenges these present to Obsolescence Managers and the options which are open to them to navigate their way successfully through this current minefield.

Introduction

I can remember times like this before. Just when you thought it was safe to go back in the water someone announces that another shark has been spotted. It does not matter that you are doubting whether the report is actually true, the damage has been done and panic has set in amongst the upper echelons of the company. To reinforce their concerns all departments have been tasked with demonstrating where savings can be made both within their own organizations and, more worrying, to suggest ways where revised working practices across the company can reduce costs. Everybody knows that these processes must produce the desired result or ultimate panic measure from the board room will be un-leashed – consultants!

All is well in departments which have been able to build fat into their processes over the years for just this type of activity. Or those departments who are secured by firm contracts which will continue regardless the pressures of economics, and of course those departments which are the present flagship providers.

But if you are a small(ish) department, recently established – well recent within the timescales of the company, with a large budget, which does not make or sell anything and is considered by most of other departments as an oversubscribed insurance policy. Beware! They were all happy to let you be established during the bid phases of the new generation of support contracts or equipment supply which has imbedded through life support. But today with the banks retracting everything, except their own bonuses, the provision of expensive insurance policies which probably will not be used for a number of years, or if ever, if you believe some voices in the board room; is not the flavour of the month any more.

More over, this process is not just taking place within manufacturing companies or their supply chain. End users are also having to justify every penny of expenditure and exploring creative ways to save money. Many are looking at ways to negotiate their way out of long term all encompassing support contracts or at least find ways where the scope of these contacts can be reduced so that, to them, a more cost effective solution can be arrived at. And anyway who knows what is likely to be happening in five years time; everything would have been recovered by then and the boom times will be back and…….. Before you know it –

The obsolescence department is just on the brink of being made

OBSOLETE.

But hold on there, who is that who is going to save us - no I cannot believe it is the Marketing Department.

Induced Turbulence

Strange times result in strange bed fellows, alliances and allegiances which would never have been considered in the past are suddenly fashionable. I am not trying to get political here but we only have to look to Parliament in Westminster to illustrate. So the Marketing department have come up with a brainchild to help all their cash strapped customers to find a way through this current economic minefield.

And of course, to provide a strategy which will give their own company the boost it needs to survive itself.

What they have come to realise is that the cost of new equipment is not just the capital cost of the equipment itself. In main this can be considered as only a small part of the near and through life costs of the acquisition process. Remember past studies on the introduction of obsolescence solution have shown that the cost of producing the engineering solution is only approx. 33% of the overall cost.

So where are those major costs? Well, they tend to lie in five distinct areas; documentation, training, support, host modification and of course testing. If the cost of these areas can be significantly reduced or in the best scenario eliminated altogether then what was an unacceptably priced project now becomes reality. This becomes not only a survival strategy for the manufacturing company but also for the end user of the equipment. So the strategy is simple buy more of the same and not the enhanced equipment that has been talked about since the introduction of the original equipment onto the platform. Quite a bitter pill to swallow in some departments within the customer's company, especially engineering, who were looking to the upgrade to solve some problems, or "features" as they are called in the software department and also the manufacturing facility who were looking forward to a platform modification programme. Oh yes I forgot the stress department who were looking forward to approximately 7 man years of work to re-calculate the stresses on the platform because the overall weight was proposed to increase by 0.0001%!!!

But what does this strategy mean to the manufacturer? Well this was one of those projects where everything was done correctly. Not only was a full through life plan produced during the initial design and development phase but this was fully integrated with the Obsolescence Management plan and strategies which were generated at the same time. (Honestly this **has** happened!!) But whether this was fully documented or not it can be guaranteed that central to both the through life plan and the obsolescence plan was the concept of planned upgrades and the that short term obsolescence solution which have been necessary since the introduction of the equipment have assumed that these upgrades would happen. In addition it was a firm assumption that, this far into the life of the equipment, a second batch would not be ordered and planned to go down the production line. Only those items which would be needed for product support would require to be built and all life time buys stock holdings etc, have so far reflected this.

So in summary the Marketing department have miraculously saved the company while at the same time saved their customer.

The obsolescence department is just on the brink of having a

Nervous Breakdown

In Search of Tranquillity

I can remember, as an obsolescence Manager, coming out of a long and protracted negotiation with the customer over the obsolescence costing to be included within the next generation whole life support contract, and the product support director saying "well done – but now is the time to get clever I want a lot of that as profit!" So clever is something the obsolescence department has become very use to over its years of existence. But have no illusion if we thought we had been

clever in the past moving forward would be a totally different ball game.

First of all we need to examine the constraints which will be imposed on any solution which is generated. So what have the marketing department promised the customer. Well not only can he offer them a cut price item, made possible by the realisation that reduced profits were still profits and profits would mean the continuation of the workforce and subsequently the company, and importantly no further, or at worst very little, cost the customer in introducing the new equipment into his current systems. To achieve this later criteria, certain factors would have to be adhered to:

Form Fit and Function

Any solution which does not fit into the same physical space, interface in precisely the same way with the other equipments and humans which are required to either communicate with it or operate it will not produce the desired solution. However there are also a number of other factors which are forgotten when endeavouring to generate a form fit and function solution. Operating temperature, environmental conditions, EMC and radiation tolerance are just some. However one which is commonly forgotten is the speed of operation. Most circuits operate far quicker today than when the initial products were initially released. In most cases this will not present a problem, and if the design has been carried out correctly it will not present a problem interfacing with other equipment; but what about the operator? I can imagine the confusion created if the cash point machine started asking my wife questions at a quicker rate: I would probably be bankrupt!! And so it is with system operators; ask the members of the human interface team and they will tell you – quick is good but quicker can be disastrous.

Maintenance Policy

Again we do not want any thing to change. This means that the processes which are adhered to today to repair the equipment must remain the same. On a practical level this will increase in difficulty if the customer himself is repairing the unit. If the customer undertakes LRU replacement then the new LRU must fit into exactly the same place as the old unit and include within its design exactly the same functions as the old unit. Problems become severe if the customer repairs LRUs.

Cosmetics

If it does not look the same then it cannot be the same! You know that this is rubbish and so do I but the number of times that I have heard this is unbelievable. Therefore if we can make the unit look the same as the original and unbelievably delivery it in the same packaging then it will prove to be more acceptable to the user

The obsolescence department is now in Melt Down.

Calming the Waves

To recap then, not only has the obsolescence management department got to solve the problems of obsolescence so that an ageing design can be re-produced and then supported for a large number of years but considerable constraints have been placed on any forthcoming solution. This is going to tax even the best of clever and creative thinking. However three items do come immediately to mind which can assist this process and all of these come with little or very little cost overhead. The three which are to be examined are Component Usage, Adaptation and Re-engineering. There are a number of other areas where oblique think can be applied but from experience the following three can produce a high return.

Component Usage

I do not know how many times I have heard the question asked – why did he do that or more commonly these days why did he use that. It is very rare that we are able to confront the original design engineer to ask these questions. They have either flown the nest, holding an elevated position somewhere or in most cases are now too senile! Therefore we are left with engineering deduction. During this process of deduction we are going to be up against a number of factors which will probably have very little direct influence in finding a replacement for the original component. Some of these factors apply more to mechanical problems and some more to electrical or electronic.

The first influence on what has been used is pure favouritism. As engineers we know what we like and we like what we know. I can remember coming out of University with the total belief that only Texas Instruments made logic circuits. I am still guilty today of when I am looking for a component only using certain websites to assist me making my choice. Therefore if those people do not stock a range of components then they will not be considered. If we think that we have it bad then consider the same job in the future. Many companies now have computerised preferred component selection systems, most probably where the software was written by someone who could not spell engineer! There would have been so many influences on the choice of the component that the task is almost impossible. But electrical / electronic is easy!

I can remember asking a mechanical design engineer why a certain bearing had been used and his response went something like this. “Well in the beginning we used one whose strength was xx but it broke in test so we upped the strength. When this passed test we replaced that with one which was 25% better to be sure.” When asked what the strength of the bearing should be he replied. “Well better than the original and probably less than the one we fitted!” Fortunately we were able to find a stock of the original component somewhere in darkest America.

So is this re-examination possible? Most definitely yes and it is, in most cases, a lot easier than it sounds. The simple questions like “What does it do?” Why do we need to do it?” “What constraints are there?” Produce not limited but in most cases, multiple answers to the solution. Yes there may need to be other work done to ensure that the new component is satisfactory and this may be the only major constraint to the selection, but there will always be a solution. Even where the only solution is the cloning of the original component this process must be gone through to at least define the new item. But as I have said answering the simple questions tend to broaden choice not narrow it.

Take the example of IC memory. Back in the mists of time when the circuit was originally designed the engineer probably put in the largest memory he could get at the time (“in case we need a bit more”). Nowadays that size of memory is almost impossible to purchase. Why? Because today it is too small! Voltage levels can be changed, both supply and interface, response time are better, packaging is much smaller – where is the problem. With a small amount of lateral think solutions will be aplenty.

Just remember though what the question should be

What did they want the component to do?

NOT

What did the component do.

Adaption

Where do I start? Although this should be one of the central policies in the obsolescence managers tool-kit it does appear to be unfashionable when resources are plentiful and money is not the driving factor. However it always has been and remains one of the most effective solutions to component obsolescence. From the simple footprint converter to ASIC replacement this solution will save you money in the areas of re-design, regression testing, re-qualification. Yes I know and I can hear some of you whispering, it is my expertise and we have heard it all before, but it is a technique that needs to be talked about on a regular basis as it is a technique which can solve many more problems than can be seen on face value. I think that this needs illustrating with three examples all from the high reliability and all illustrating what can be done if lateral think can be applied and for one reason or the other re-design of the LRU / equipment is not an option.

The first case is what, nowadays we consider as the normal use of adapters – the ASIC replacement. Today's FPGA's and PLC are ideally suited for this purpose. Fortunately their small size also allows the other requirements which surround this type of replacement – Boot Chip, Power Supply, Control Logic, JTAG connector and in some cases case more de-coupling capacitors than you can ever imagine. Containing all of this within the original space envelope proved challenging but not overly taxing. In this case only a single board some 1" square was needed to solve the problem.

The second case takes us back to the days when integrated circuits were in their infancy and the vogue at the time was for hybrids. The problem we were given was could we emulate an integrated circuit display and control logic using discrete components and still keep it with the same footprint. Well today it is surprising how many of the latest discrete component can be accommodated per square inch! Not only could the actually 20 segment display be re-constructed but its logic and current control circuitry could also be placed although in this case both sides of the adapter were used. The mother system for this project started to go obsolete some 10 years ago but with a little creative think its life is still being extended.

The third case, for a military end user, required two solutions to meet his requirement to have enough devices to build of another batch of equipment and the life time support of his current and future support requirements. The original design used an 80 I/O electronic cross point switch based in a BGA package. The differential I/O standard used for the original design, were LVDS or Low Voltage Differential Signalling. The control circuitry for the device, were standard CMOS levels. Following a full analysis of what was required of the replacement two options were defined as solutions, unfortunately neither in sufficient quantities to satisfy the customers projected usage. Therefore it was decided that both solutions would be developed in parallel. The first involved using an IC with 128 I/Os but with the same differential I/O standard. Although on face value this seemed to be straight forward solution, this up-issued IC had included some more features and it was found necessary to introduce control logic into some of the control signals to ensure correct operation. So the solution ended up with the larger cross point switch and a few micro single gate devices. For the second solution it was found that the original IC could be sourced but with LVPECL differential I/Os. Whereas the inputs to the new IC would be compatible, all of the outputs would present too high a level and would thus need to be attenuated. So although the replacement IC would be the same size there was a need to accommodate some 228 x 0402 resistors, oh yes and a step up PSU to drive the I/Os at the higher level. A challenge but with adapter technology, achievable.

The days of simple footprint conversion, you would think, are long gone and that all adaptive solution are like the three examples above. They were there to illustrate what can be done. The change of package still presents the biggest problems which has to be solved and of course is ideally suited to the adapter solution.

Re-Engineering

There comes a time when the pill has to be swallowed and re-design is the only option. But there are techniques within this process which can considerably reduced cost both in development and during the life of the equipment. The first and obvious decision that most be made is what needs to be re-designed. If this can be limited then the better and cheaper the solution; it sounds obvious but is very rarely followed. However because of the constraints to maintain form fit and function and especially with design with a consistent maintenance policy re-designs tend to happen at LRU level. I do however question how much thought is given to the actual process of re-design to ensure that a cost effective solution is achieved.

Most sub-systems or LRUs consist of three distinct parts, the intelligent circuitry, interface circuitry and finally ancillary circuitry. The function of the intelligent circuitry is obvious; it is the engine of the sub-system design. These days highly complex applications can be performed in very small areas and with the use of modern electronics like PLC and FPGA the original functionality can be replicated with ease. However the use of such new devices will mean that the interface circuitry which provides the barrier between the central core and the outside world will need to be re-designed as well but this is a simple un-complicated low risk activity. This can also be said for the ancillary circuitry which is there to provide correct power levels, clock etc to the central core.

Of these only the core of the board, the intelligent circuitry tends to be complex and require multi-level PCB to enable efficient interconnects and routing, especially these days with the use of high ball count BGA packages. The rest of the board, which tends to be by far the larger volume, can easily be accommodated using low layer count PCBs. So why not design the new board such that a small area high layer PCB containing the complex circuitry can be separately interfaced onto the main board which is of low layer count. We have been using this technique, called Matrics, successfully for a number of years. It is in effect an adapter by a different name but its use warrants it's re-branding. Testing using this concept can also be considerably easier as the complex module can be separated and tested stand-alone before being introduced to the of designs on the main board.

In Reflection

Two years ago when I presented "Mitigating around the Recession in the Supply Chain" I do not believe that anybody at that time believed that it would be as severe as it has been and the consequences it would have on our industry. I do not think I am over exaggerating when I say that basic operating models in End Users, Customers and Suppliers have been to the most part re-written. I said that we were looking at money being rare but did not consider at that time it would be non-existent. However within the Obsolescence community, we have got quite used to financial challenges. The use of "More of the same" operating model is quite common when times are hard. Although there are immediate consequences and of course those stored for the future it can be the saviour for suppliers and users alike. I have highlighted three areas which if followed can returned a high yield but there are many more which have been talked about in other forums. The most obvious is the policy of Software protection. But is this operational code or firmware? And what is the impact on PLC and FPGA's. You may have to wait another two years for that to be discussed.

References

1. Alan Baker, "Mitigating Around the Recession in the Supply Chain"