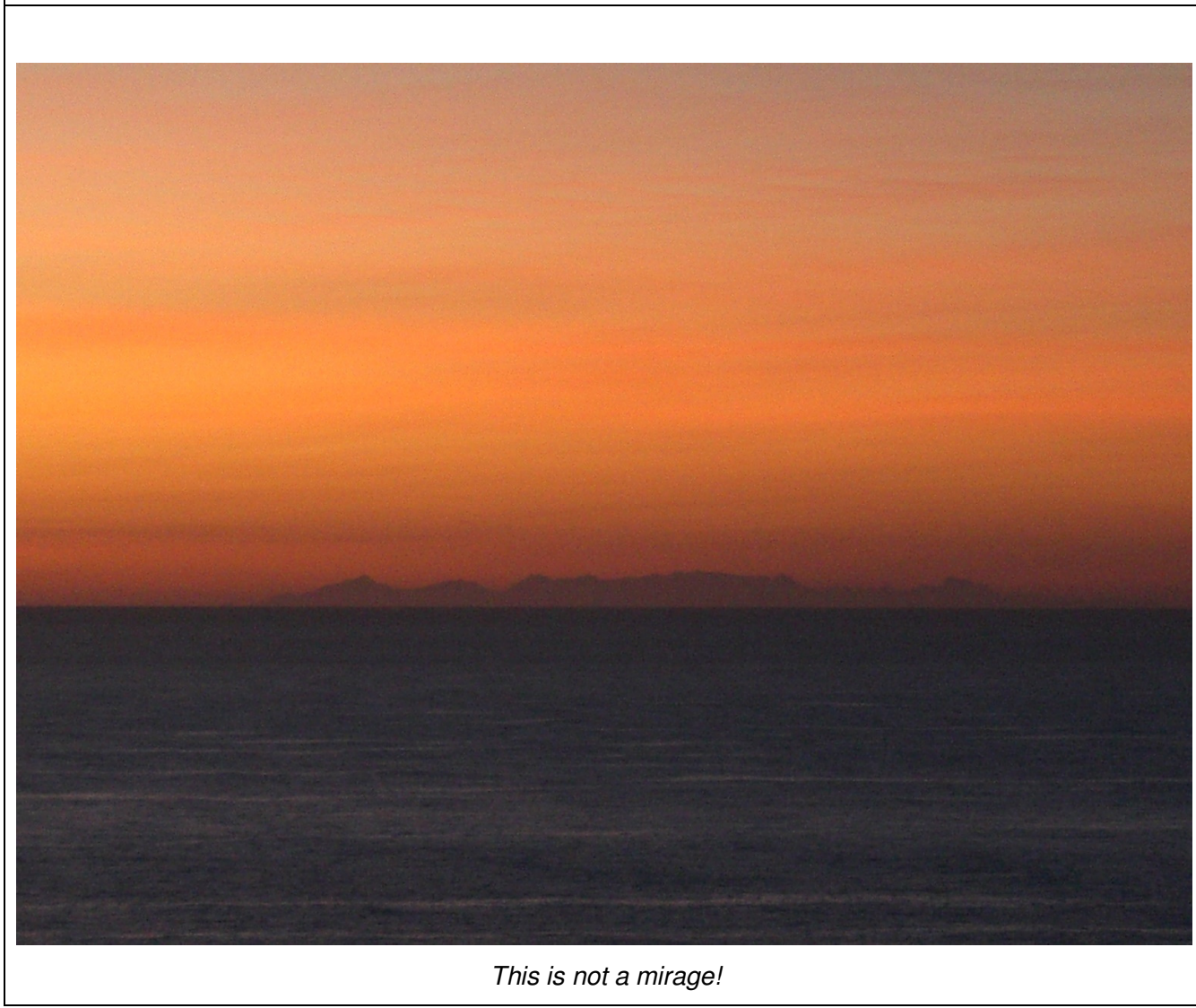



 <p><b>Calm</b> IMR Value from technology and experience</p>	<p><b>CASE STUDY</b></p>	<p><b>IMPROVING VALUE OF PERIODIC INSPECTIONS</b></p>
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**IMPROVING THE VALUE OF A CALM BUOY'S PERIODIC INSPECTION**



<p><b>REVISION DESCRIPTION:</b></p>	<p>2015/11/01</p>
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	<b>CASE STUDY</b>	<b>IMPROVING VALUE OF PERIODIC INSPECTIONS</b>
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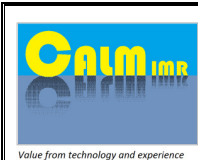
## 1. INTRODUCTION

This case study looks, through the lens of “lean thinking”, at a simple activity – the Yearly inspection of a CALM buoy – analyses the client’s value stream and the provider’s value stream and proposes a different approach to the activity itself in order to improve its efficiency and provide a better work satisfaction to those involved in the activity. In order to present this line of thinking a fictitious story has been put together with simplified processes involved in the inspection of a CALM buoy (a CALM buoy is a fairly rugged piece of equipment which allows a tanker to on-load or off-load the products it is transporting through the equipment itself while at the same time moor to the equipment and thereby allowing the tanker to freely rotate around the buoy so as to always be orientated in the direction in which the weather and current generate the least forces on the tanker – for more information on CALM buoys type “calm buoy” in an internet search engine). The story is only inspired by reality – names, monetary sums and events come from the imagination of the author.

## 2. THE STORY:

### 2.1. Pre-project

Patrick is the onshore support manager of a petroleum terminal (PT&Co) comprising among other important equipment a CALM buoy. On December 11<sup>th</sup>, 2012 Patrick receives an alert from the CMMS (Computerized Maintenance Management System) informing that the “Yearly Inspection” of the CALM buoy will be due in 2 months’ time and that a representative of the Original Equipment Manufacturer (OEM) is to be mobilized to assist in “General inspection of the CALM buoy including a full rotation of the turntable and a tension check of the Main Roller Bearing”. Upon receiving this alert, Patrick sends an email to his colleague Tom, who works in the purchase department, requesting the mobilization of an inspector from OEM. Tom knows the OEM quite well as he was involved during the procurement of the equipment 5 years ago and because last year he placed a purchase order for an identical inspection. Tom decides to prepare a purchase order (value 19,000 USD) using the same information as for last year’s inspection. On December 12<sup>th</sup>, 2012, Tom sends the PO to Lucas, who is the area sales manager of the OEM for this region, asking him to make the necessary arrangements to have an inspector ready for mobilization on February 11<sup>th</sup>, 2013. On December 13<sup>th</sup>, 2012, Lucas answers the email by thanking Tom for sending it and by explaining that the PO cannot be processed as is because the OEM’s internal procedures requires that an offer be made before an order from a client can be accepted. Lucas further explains to Tom that the PO he has sent will be treated for the time being as a request for quotation, that Lucas will come back to Tom as soon as possible with a commercial and technical offer and that the PO can then be amended to suit the offer. On the same day Lucas sends an email to Pieter, Services department manager, asking him to prepare a technical offer for the inspection and to prepare for the mobilization on February 11<sup>th</sup>, 2013 of one of his service technicians. Lucas also sends an email to Audrey, the proposal engineer, asking her to assemble all costs involved and prepare a management summary including all the usual charges and margins. Pieter requests one of his project engineers to prepare the technical offer. On January 4<sup>th</sup>, 2013, Pieter sends the technical offer to Audrey (who is still on vacation). On January 15<sup>th</sup>, 2013, Tom sends an email to Lucas asking when he can expect to receive the offer from the OEM. Lucas calls Audrey and asks where the proposal is, Audrey promises to have it ready by end of day, works expeditiously over the lunch, gets the management summary signed off by all required internal authorities, and by the end of the day sends the proposal to Lucas. Lucas goes through the documents, makes some last adjustments asks Audrey to reissue it with the small corrections. On January 16<sup>th</sup>, 2013, Lucas sends the technical and commercial (21,500 USD + international flight @cost + 15%) offers to Tom. On January 17<sup>th</sup>, 2013, Tom sends the offers to Patrick asking him to advise. Patrick forwards the offers to Roger, a senior technical superintendent. On January 25<sup>th</sup>, 2013, Roger



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sends an email to Lucas (copying Tom and Patrick), confirming that the offers are accepted but that the mobilization date now can only be on the 9<sup>th</sup>, of April. On January 27<sup>th</sup>, 2013, Lucas sends an email to Roger (copying Tom), confirming good receipt and thanking him for the PO confirmation, Lucas further points out that for administrative reasons there is a need for a formal PO amendment to be issued in line with the offers and that the handover to the project management team will take place only when this amendment has been received. On January 28<sup>th</sup>, 2013, Tom sends an email to Lucas with the formal PO amendment attached.

### 2.2. Project

#### 2.2.1. Preparation phase

On February 7<sup>th</sup>, 2013, Lucas hands over the project to Pieter who nominates Jacob as the project engineer in charge of the project. On February 14<sup>th</sup>, 2013 Pieter decides that Paul will be the service technician who will perform the inspection. On the same day Jacob contacts Roger to confirm the mobilization date and to ask him to provide him with an invitation letter for the visa that will be required for Paul when entering the country. On February 15<sup>th</sup>, 2013, Roger sends the letter to Jacob who forwards this to Lucie (the services department's secretary) asking her to organize the visa for Paul as well as to start booking the flights and accommodation for Paul's mission. Lucie contacts Paul asking him to send her his passport, Paul says that this is not possible at the moment because he will be going on vacation in the coming days and requires his passport during the duration of his vacation (10 days). Lucie calls Jacob to inform him of the passport issue and in his turn Jacob calls Paul to get a clear picture of the situation (the visa usually takes 4 weeks to obtain), Jacob and Paul agree that upon Paul's return from vacation end of February he will immediately send his passport to Lucie which will leave them with a one week buffer in order to obtain the visa. On February 28<sup>th</sup>, 2013, Paul couriers his passport to Lucie, who, on March 1<sup>st</sup>, 2013, couriers it together with the letter of invitation to the Embassy. On March 29<sup>th</sup>, 2013, Lucie receives the passport of Paul with the required visa and informs Jacob of this good news. On April 1<sup>st</sup>, 2013, Jacob calls Roger at PT&Co to ensure that the mobilization date of April 9<sup>th</sup>, 2013 still stands, and, when obtaining this confirmation, he then calls Paul to arrange for Paul to come to the office on April 5<sup>th</sup>, to prepare the documents for his inspection. Lucie arranges the flights (500 USD) of Paul to come to the office. Lucie arranges the flights (4,500 USD) and accommodation (800 USD) for Paul's mission. Paul comes to the home office on April 5<sup>th</sup>, and prepares for the mission.

#### 2.2.2. Execution phase

Paul boards his flight to site on April 9<sup>th</sup>, 2013 and disembarks on April 10<sup>th</sup>, 2013, checks in at the hotel and takes a taxi to PT&Co where he meets up with Patrick and Roger. Roger expresses his surprise to Paul that he arrives on April 10<sup>th</sup> instead of April 9<sup>th</sup>, he explains that a tanker is incoming and is now planned to moor at the buoy on April 12<sup>th</sup>, and that if all inspection cannot be completed on April 11<sup>th</sup> then Paul will have to extend his stay. Paul, Patrick and Roger call Jacob on the phone to explain the situation. After a few exchanges of opinions, they all agree that Paul is to do his best on April 11<sup>th</sup> and that if he cannot complete the inspection that day then he will audit the spare parts inventory on April 12<sup>th</sup> and finish the inspection of the buoy as soon as possible. On April 11<sup>th</sup> Paul boards the crew vessel that will take him to the buoy together with John, the maintenance superintendent, 2 mechanical helpers and a watchman, after one hour of travel they board the buoy and start its inspection. After 10 hours onboard the buoy they decide that it is indeed time to call it a day and board the crew vessel again for a one hour trip back to shore. On April 12<sup>th</sup> the buoy is occupied by a tanker that has started to discharge its cargo, the operation is planned to take 36 hours so Paul performs the spare parts inventory check in PT&co's warehouse. On April 13<sup>th</sup> Paul is stranded onshore, he decides to counter check all that is required to do the next day and notices that he has misplaced the document including some target values he needs for the final phase of the inspection, he calls the home office to get hold of Jacob but this is Saturday and the home office is closed. Paul decides to call Jacob on his mobile phone, Jacob gives him a telling for not having thought of this before and tells him to call back in 2 hours so that he can get hold a




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mechanical engineer who might be able to sort this out. Paul calls Jacob back who has been able to get the required target values – but that this will cost him a lunch to the mechanical engineer. On April 14<sup>th</sup> Paul can board the buoy again with the same crew as on April 11<sup>th</sup> and performs the tension check of the Main Roller Bearing’s bolting and the grease sampling of the same. The inspection takes a full day to complete and the crew returns to shore in the beginning of the evening. Paul calls Jacob on April 15<sup>th</sup> in the morning to provide an update and to ask him to let Lucie organize his trip back to the home office as soon as possible. Paul meets up with Patrick, Roger and John at PT&Co, he does a full debriefing on the findings, asks them to send the grease samples to their laboratory, thanks for the support and promises to write the full report once he is back in the home office.

### 2.2.3. Reporting phase

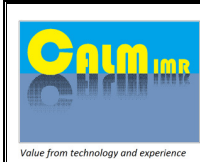
On April 16<sup>th</sup> Paul flies back home. On April 17<sup>th</sup> Paul calls Jacob at the office and asks when he should come to the office, Jacob has already booked a flight for Paul the same afternoon so that he can write the report as soon as possible. Pieter calls Jacob and tells him that there is a major issue with a piece of equipment which is stopping the production of an oil field and that the only personnel available with the adequate skills and experience in the team is Paul, so when Paul arrives he will need to go and see Pieter straight away. When Paul arrives on April 17<sup>th</sup> in the late afternoon he meets up with Pieter who tells him that he will be boarding a flight the next morning for an intervention that will take approximately 10 days, and that the CALM buoy inspection report will have to be finished afterwards as this intervention takes priority, Jacob will have to sort it out with the client. So Paul grabs all technical information that he can for the intervention and on April 18<sup>th</sup> he boards a flight for an unspecified period of time.

On April 22<sup>nd</sup> Patrick sends an email to Jacob to enquire about the status of the inspection report and to provide the results for the grease samples PT&Co has just received from the laboratory. Jacob contacts Paul via email asking him to try to finish the report at night when he is not intervening on the faulty equipment, Paul who by then has traveled over 10 time zones in the last two weeks and who has not had much rest sends the photos he has taken during the inspection and tells Jacob to make do with this material. On April 23<sup>rd</sup> Jacob responds to Patrick saying that Paul had to leave but that the material is at hand and that the report should not take more than a couple of weeks to complete. On April 29<sup>th</sup>, Paul has successfully finished his “firefighter” intervention and returns home. On April 30<sup>th</sup>, Jacob calls Paul and asks him when he can return to the office to finish the report, Paul answers that he will come when he has taken his rest and recuperation. On May 6<sup>th</sup>, Paul arrives at the office and starts to reluctantly write the CALM buoy inspection report. On May 8<sup>th</sup> the report is forwarded to Jacob who reviews it rapidly before sending it to the engineering department for comments. On May 10<sup>th</sup> Patrick sends an email of complaint to Pieter for not having received the report yet. Pieter calls Jacob and enquires about the status of the report and asks why he is not putting more effort in getting it out to the client. Jacob calls engineering to see what the status is and gets the answer that the report he is referring to resembles a trip report with plenty of photographs but little text and that for sure it is not a priority in the engineering workflow at the moment (considering the 150 million project that have just been awarded). Jacob asks Pieter for help who contacts the engineering department manager (an old friend of his) and asks him for a favor to get this report through his department’s workflow. Pieter responds to Patrick saying that the report will be sent to PT&co by May 17<sup>th</sup> at the latest. Jacob expedites the engineering department on May 13<sup>th</sup> and on May 14<sup>th</sup> the comments and recommendations from the engineering department are received and incorporated into the report. The report is then reissued for final review by Lucas, the area sales manager. On May 15<sup>th</sup> the document is finally approved. Jacob transmits the report to Patrick and Tom. On May 16<sup>th</sup>, Jacob sends the final invoice of 21,500 USD + 5175 USD (4,500 USD + 15% for flight tickets) to Tom. On May 17<sup>th</sup>, Lucas contacts Patrick to discuss the possibility of offering the spare parts which were identified as missing during the inventory inspection of the warehouse. On May 24<sup>th</sup>, Jacob contacts Tom to enquire about the status on the payment of the invoice. On May 29<sup>th</sup> the invoice is settled and Jacob can close out the inspection project, while Patrick and Tom wonder if they really should request an offer for the supply of spare parts to Lucas.

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#### 2.2.4. Questioning phase

Two months later Patrick is called by David, the Terminal manager, who informs him that due to the economic environment savings are required: he needs to cut down on the external costs by at least 50% and he needs to do this fast. Patrick reviews all the external expenditures together with Tom and with Roger in order to see what activities are essential and only keep these. When the review comes to the Yearly Inspection activity of the CALM buoy, all agree that they want/need the outside assessment of the buoy's condition but that the current cost is too steep. Patrick contacts Lucas and explains the situation to him and asks propose something. Lucas knows that there is no way that he can reduce the selling price by 50%, the margin is not very good on this activity and the costs are easily substantiated, so Lucas proposes to meet with Patrick and go through an open book exercise taking the last yearly inspection as a basis. Patrick agrees to this meeting and when they meet they systematically go through all the steps of the last yearly inspection.



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### 3. ANALYSIS

Before starting the analysis it is important to clarify that the main objective of the Yearly CALM buoy inspection is: "to assess the general status of the buoy, report on the actual condition and advise on adequate corrective actions (if any)". In the analysis, the only activities that are considered Added Value Work are: information gathering, analysis, recommendations and reporting.

#### 3.1. Initial situation

##### 3.1.1. Chronological steps of the story

Below table presents in a synthetic manner the various activities the Client and OEM have performed in order to have the inspection performed and reported. Each step is allocated an activity type:

NAV	Non Added Value	The client should not have to pay for this
NNAV	Necessary Non Added Value	The step is not adding value but the organization of the activities makes it necessary to include it
AV	Added Value	This is really what the client is expecting to pay for.

Item	Date	Who	Activity description	Cycle (hr)	Activity Type
<b>Pre-project</b>					
1	11/12 -12	Client	Patrick asks Tom to organize OEM mobilization	0.1	NAV
2	12/12 -12	Client	Tom sends PO to Lucas	0.5	NNAV
3	13/12 -12	OEM	Lucas explains how it works at the OEM to Tom	0.4	NNAV
4	13/12 -12	OEM	Lucas requests input from Pieter	0.3	NNAV
5	13/12 -12	OEM	Lucas requests proposal from Audrey	0.1	NNAV
6	4/1 -13	OEM	Pieter sends technical offer Audrey	8	NNAV
7	15/1 -13	Client	Tom expedites Lucas	0.1	NAV
8	15/1 -13	OEM	Lucas expedites Audrey	0.2	NAV
9	15/1 -13	OEM	Audrey sends proposal to Lucas	6	NNAV
10	15/1 -13	OEM	Lucas sends adjustments	1	NNAV
11	16/1 -13	OEM	Audrey incorporates adjustments and reissues the proposal to Lucas	2	NNAV
12	16/1 -13	OEM	Lucas sends proposal to Tom	0.2	NNAV
13	17/1 -13	Client	Tom forwards proposal to Patrick	0.5	NAV
14	17/1 -13	Client	Patrick forwards proposal to Roger	0.5	NAV
15	25/1 -13	Client	Roger gives go ahead to Lucas	3	NNAV
16	27/1 -13	OEM	Lucas requests formal PO amendment to Roger and Tom	0.5	NAV
<b>Project starts</b>					
17	28/1 -13	Client	Tom issues ammended PO	2	NNAV
18	7/2 -13	OEM	Lucas hands over the project to Pieter	2	NNAV
19	7/2 -13	OEM	Pieter nominates Jacob as Project engineer	1	NNAV
20	14/2 -13	OEM	Pieter nominates Paul as service technician	1	NNAV
21	14/2 -13	OEM	Jacob confirms to Roger the inspection dates	0.5	NAV
22	15/2 -13	Client	Roger sends invitation letter	1	NNAV
23	15/2 -13	OEM	Jacob forwards letter to Lucie	0.1	NAV
24	15/2 -13	OEM	Lucie contacts Paul and prebooks flights	1	NNAV
25	15/2 -13	OEM	Lucie calls Jacob about passport problem	0.3	NAV
26	15/2 -13	OEM	Jacob calls Paul about passport problem	0.5	NAV
27	28/2 -13	OEM	Paul couriers his passport to Lucie	1	NNAV
28	1/3 -13	OEM	Lucie couriers passport to embassy	0.5	NNAV
29	29/3 -13	OEM	Lucie receives passport from embassy	0.1	NNAV
30	29/3 -13	OEM	Lucie informs Jacob of good receipt of passport	0.3	NAV
31	1/4 -13	OEM	Jacob calls Roger to ensure mobilization date	0.2	NAV
32	1/4 -13	OEM	Jacob calls Paul to arrange for trip	0.4	NNAV
33	1/4 -13	OEM	Jacob calls Lucie to organize trip	0.2	NNAV
34	1/4 -13	OEM	Lucie books flights to office and confirms pre-booked flights	0.5	NNAV
35	5/4 -13	OEM	Paul takes flight to office	2	NAV
36	5/4 -13	OEM	Paul prepares his mission	8	NNAV
37	5/4 -13	OEM	Paul returns home	2	NAV
38	9/4 -13	OEM	Paul takes flight to site	10	NNAV
39	10/4 -13	OEM	Paul checks in at hotel	4	NNAV
40	10/4 -13	OEM	Paul takes taxi to PT&co	1	NNAV
41	10/4 -13	C + O	Heated discussion between PT&co and OEM	1	NAV



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42	10/4 -13	OEM	Paul takes taxi to hotel	1	NNAV
43	11/4 -13	OEM	Paul takes taxi to PT&co	1	NNAV
44	11/4 -13	C + O	Paul, John and co take crew vessel	1	NNAV
45	11/4 -13	C + O	Paul, John and co inspect buoy	10	AV
46	11/4 -13	C + O	Paul, John and co take crew vessel	1	NNAV
47	11/4 -13	OEM	Paul takes taxi to hotel	1	NNAV
48	12/4 -13	OEM	Paul takes taxi to PT&co	1	NNAV
49	12/4 -13	C + O	Inventory of spare parts	8	AV
50	12/4 -13	OEM	Paul takes taxi to hotel	1	NNAV
51	13/4 -13	OEM	Paul works from hotel calls Jacob	2	NNAV
52	13/4 -13	OEM	Jacob calls engineer	0.5	NNAV
53	13/4 -13	OEM	Engineer calls Jacob	0.5	NNAV
54	13/4 -13	OEM	Jacob calls Paul	0.5	NNAV
55	14/4 -13	OEM	Paul takes taxi to PT&co	1	NNAV
56	14/4 -13	C + O	Paul, John and co take crew vessel	1	NNAV
57	14/4 -13	C + O	Paul, John and co inspect buoy	10	AV
58	14/4 -13	C + O	Paul, John and co take crew vessel	1	NNAV
59	14/4 -13	OEM	Paul takes taxi to hotel	1	NNAV
60	15/4 -13	OEM	Paul calls home office to report back and to arrange for flight back	0.5	NAV
61	15/4 -13	OEM	Paul takes taxi to PT&co	1	NNAV
62	15/4 -13	C + O	Paul debriefs with Roger, Patrick and John, and hands over the grease samples	1.5	NNAV
63	15/4 -13	Client	Patrick couriers grease samples to the laboratory	1	NNAV
64	15/4 -13	OEM	Paul takes taxi to hotel	1	NNAV
65	16/4 -13	OEM	Paul takes taxi to airport	1	NNAV
66	16/4 -13	OEM	Paul takes flight to home	10	NNAV
67	17/4 -13	OEM	Paul calls Jacob	0.5	NNAV
68	17/4 -13	OEM	Paul takes flight to office	2	NAV
69	17/4 -13	OEM	Pieter informs Paul that he will have to leave	1	NAV
70	22/4 -13	Client	Patrick enquires about status of report and provides result of grease samples	0.2	NAV
71	22/4 -13	OEM	Jacob asks Paul to work on report while away	0.3	NAV
72	22/4 -13	OEM	Paul sends photos to Jacob and tells him to make do with this	1	NAV
73	23/4 -13	OEM	Jacob informs Patrick that it should not be long now	2	NAV
74	30/4 -13	OEM	Jacob calls Paul about his return to office	0.3	NAV
75	6/5 -13	OEM	Paul takes flight to office	2	NAV
76	6/5 -13	OEM	Paul works on report	4	AV
77	7/5 -13	OEM	Paul works on report	10	AV
78	8/5 -13	OEM	Paul works on report	4	AV
79	8/5 -13	OEM	Paul sends report to Jacob	0.3	NNAV
80	8/5 -13	OEM	Jacob reviews report and forwards to engineering	2	NNAV
81	10/5 -13	Client	Patrick sends complaint to Pieter	0.5	NAV
82	10/5 -13	OEM	Pieter calls Jacob regarding complaint	0.5	NAV
83	10/5 -13	OEM	Jacob calls engineering to expedite	0.5	NAV
84	10/5 -13	OEM	Jacob asks support from Pieter	0.5	NAV
85	10/5 -13	OEM	Pieter calls engineering manager	0.5	NAV
86	10/5 -13	OEM	Pieter responds to Patrick's email	0.5	NAV
87	13/5 -13	OEM	Jacob expedites engineering	0.2	NAV
88	13/5 -13	OEM	Engineering makes comments and sends them to Jacob	10	AV
88	14/5 -13	OEM	Jacob incorporates comments received from engineering	4	AV
89	14/5 -13	OEM	Jacob sends final report to Lucas	0.1	NAV
90	15/5 -13	OEM	Lucas approves report	3	NNAV
91	15/5 -13	OEM	Jacob transmits report to Patrick and Tom	0.1	AV
92	16/5 -13	OEM	Jacob transmits final invoice to Tom	3	NNAV
93	17/5 -13	OEM	Lucas contacts Patrick to offer spare parts	1	NNAV
94	24/5 -13	OEM	Jacob contacts Tom regarding invoice payment	0.3	NAV
95	29/5 -13	Client	Tom settles payment of invoice	2	NNAV
96	29/5 -13	OEM	Jacob closes the inspection project	3	NNAV



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### 3.1.2. Leadtimes and cycle times

Before looking at the spread of the different activities, an Industrial Engineering point of view would be to start to look at the overall leadtimes and cycle times:

Period	Leadtime (days)	Cycle time (hrs)	Cycle time (days)	Idle time (days)
Pre-project	48	23.4	3	45
Project	121	158.4	20	101
Overall	169	181.8	23	146

Why are these figures interesting? If we concentrate on the project figures, what this means for the OEM is that without improving the productivity of any activity (Client or OEM), the time from order to getting paid by client could theoretically be reduced from 121 days to 20 days just by removing idle time (in Industrial Engineering this would be the equivalent of removing all inventories from work in progress).

### 3.1.3. Project cycle times

Feeding the step by step information into a spreadsheet we can extract the following distribution of activities for the project phase:

Sum of Cycles (hr)	AV	NAV	NNAV	Totals
C + O	28	1	5.5	34.5
Client		0.7	6	6.7
OEM	32.1	18.1	67	117.2
<b>Totals</b>	<b>60.1</b>	<b>19.8</b>	<b>78.5</b>	<b>158.4</b>
Process Efficiency: AV/Totals				38%

If we look at the totals, we see that NAV cycle times (i.e. waste) represent 12.5% of the total cycle times, which means that costs can be reduced by 12.5% just by eliminating these activities (This is a good improvement but it is nowhere near the 50% reduction that PT&Co is looking for).

### 3.1.4. Scrutiny of the Project NNAV activities

If we turn our attention to the AV cycle times (38%) and the NNAV cycle times (49.5%). Typically in a lean approach what you attempt is to optimize and standardize the AV activities and to question and reduce the NNAV activities.

Sum of Cycles (hr)	Adm	Prep	T&L	Totals
C + O		1.5	4	5.5
Client	4	1	1	6
OEM	13.3	14	38.7	66
<b>Totals</b>	<b>17.3</b>	<b>16.5</b>	<b>43.7</b>	<b>77.5</b>

Note: the sending of spare parts offer has been place outside of the project hence the 1 hour.

If we first look at the NNAV activities and further categorize them we can see that of the 78.5 cycle time hours, 43.7 hours (55%) are connected to transportation & logistics issues. The rest is evenly distributed between administration and preparation and execution work.

### 3.1.5. Scrutiny of the Project AV activities

Sum of Cycles (hr)	Admin	Assessment	Gathering	Reporting	Totals
C + O			28		28
OEM	0.1	10		22	32.1
<b>Totals</b>	<b>0.1</b>	<b>10</b>	<b>28</b>	<b>22</b>	<b>60.1</b>

When we look at the AV activities and further categorize them we can see that of the 60.1 cycle time hours, 28 hours (46.7%) are for gathering information (which by the way is performed jointly by the OEM and the Client), 22 hours (36.6%) in reporting, 10 hours (16.7%) in engineering assessment.

What jumps out is that the activity which counts for the largest sum of cycle time, information gathering, is one that is shared between the Client and the OEM; and that the only reason there is so much travel time is in order to make it possible for the OEM to perform the information gathering. What would be the consequence if the information gathering activity is left to the Client entirely (as it stands right now, out of the five persons performing this activity four are from the client and only one from the OEM)?

### 3.2. Intermediary situation

In order to facilitate the overall process the Client places an order to the OEM for the assessment work only which the OEM is to invoice once the work is done. Both Client and OEM recognize that it is really important that the information flows to the correct person and that the information is in an adequate format so that it is easily exploited – so clear communication procedures are set up for this work.

#### 3.2.1. Chronological steps

Item	Date	Who	Activity description	Cycle (hr)	Activity Type
1	11/12 -13	Client	John receives message from CMMS	0.1	NNAV
2	11/12 -13	Client	John organizes information gathering inspections	3	NNAV
3	16/12 -13	Client	John and Co take crew vessel	1	NNAV
4	16/12 -13	Client	John and co inspect buoy	10	AV
5	16/12 -13	Client	John and Co take crew vessel	1	NNAV
6	23/12 -13	Client	John and Co take crew vessel	1	NNAV
7	23/12 -13	Client	John and co inspect buoy	10	AV
8	23/12 -13	Client	John and Co take crew vessel	1	NNAV
9	24/12 -13	Client	John writes report	5	AV
10	25/12 -13	Client	John writes report	5	AV
11	25/12 -13	Client	John sends report to OEM	0.1	NNAV
12	4/1 -14	OEM	OEM requests clarifications on certain details of the report	4	NNAV
13	7/1 -14	Client	John provides requested clarifications	2	NNAV
14	8/1 -14	OEM	Engineering and operations make recommendations	10	AV
15	8/1 -14	OEM	OEM sends comments and recommendations to PT&co	0.1	NNAV
16	9/1 -14	Client	John incorporates comments and recommendations and issues the Yearly	5	NNAV
17	9/1 -14	OEM	OEM issues and sends invoice	0.5	NNAV
18	10/1 -14	Client	John, Roger and Patrick meet to plan the actions based on the recommendations	2	AV
19	24/1 -14	Client	PT&Co settles the invoice	2	NNAV
20	24/1 -14	OEM	Lucas contacts Patrick to offer spare parts	1	NNAV

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### 3.2.2. Leadtime and cycle times

Period	Leadtime (days)	Cycle time (hrs)	Cycle time (days)	Idle time (days)
Project	44	63.8	8	36

Sum of Cycle (hr)	AV	NNAV	Totals
Client	32	16.2	48.2
OEM	10	5.6	15.6
<b>Totals</b>	<b>42</b>	<b>21.8</b>	<b>63.8</b>
Process Efficiency: AV/Totals			66%

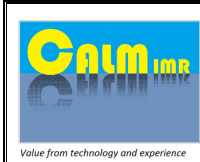
The reshuffling of the process has provided great reductions in leadtimes and cycle times, but activities and processes can probably be further improved.

### 3.3. Current situation (story continued)

Assessing the change made in the overall process that have brought great benefits, the Client and the OEM meet and agree that there could still be improvements made in order to reduce the work on the report writing (both NNAV and AV tasks) by introducing recent inspection software applications. What the adopted software boils down to is that the inspector makes use of a digital tablet or smartphone to take photos in a predefined and structured way, complementing the photos with either generic comments when all is well, and with more detailed comments when issues are identified. When the inspector has finished the inspection the digital tablet or smartphone is connected via cloud or on the client's internal network to the report generator. The report is then available for editing to predefined users. When the report is adequately filled up it is made available to the OEM who is automatically notified, the OEM makes recommendations in the report, when that task is finished, the report with recommendations is made available to the Client who is also automatically notified. The client then goes through the recommendations, "approves" the report and starts to act on recommendations.

#### 3.3.1. Chronological steps

Item	Date	Who	Activity description	Cycle (hr)	Activity Type
1	11/12 -14	Client	John receives message from CMMS	0.1	NNAV
2	11/12 -14	Client	John organizes information gathering inspections	3	NNAV
3	16/12 -14	Client	John and Co take crew vessel	1	NNAV
4	16/12 -14	Client	John and co inspect buoy	10	AV
5	16/12 -14	Client	John and Co take crew vessel	1	NNAV
6	23/12 -14	Client	John and Co take crew vessel	1	NNAV
7	23/12 -14	Client	John and co inspect buoy	10	AV
8	23/12 -14	Client	John and Co take crew vessel	1	NNAV
9	25/12 -14	Client	John loads up data and sends report to OEM	0.1	NNAV
10	4/1 -15	OEM	Engineering and operations make recommendations	8	AV
11	4/1 -15	OEM	OEM sends comments and recommendations to PT&co	0.1	NNAV
12	7/1 -15	Client	John incorporates comments and recommendations and issues the Yearly	0.5	NNAV
13	7/1 -15	OEM	OEM issues and sends invoice	0.5	NNAV
14	8/1 -15	Client	John, Roger and Patrick meet to plan the actions based on the recommendations	2	AV
15	21/1 -15	Client	PT&Co settles the invoice	2	NNAV
16	21/1 -15	OEM	Lucas contacts Patrick to offer spare parts	1	NNAV



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3.3.2. Leadtimes and cycle times

Period	Leadtime (days)	Cycle time (hrs)	Cycle time (days)	Idle time (days)
Project	41	41.3	5.5	35.5

Sums of Cycle (hr)	AV	NNAV	Totals
Client	22	9.7	31.7
OEM	8	1.6	9.6
<b>Totals</b>	<b>30</b>	<b>11.3</b>	<b>41.3</b>
Process Efficiency: AV/Totals			73%

The improvement has enabled the reduction of the cycle times by 35% compared to the year before. What is important is to keep trying to continue the improving the process to avoid the installation of complacency. But it is important to recognize that personnel having developed good process and lean thinking start focusing on other improvement areas in the company where the cost benefits could be greater.

3.4. Year on year evolution


Project data	2013	2014	2015
Leadtime	121	44	41
<b>Y-Y evolution</b>	-	<b>-64%</b>	<b>-7%</b>
Cycle time	158.4	63.8	41.3
<b>Y-Y evolution</b>	-	<b>-60%</b>	<b>-35%</b>
Efficiency	38%	66%	73%
<b>Y-Y evolution</b>	-	<b>74%</b>	<b>11%</b>

The greatest improvements take place when the process is shaken up and revisited. Continued effort in improving the process is important because it makes the process better and by continuing these efforts it guarantees that the process does not regress whereby people would return to old habits.

External costs	2013	2014	2015
Inspection	\$ 21,500	\$ -	\$ -
Travel expenses	\$ 5,175	\$ -	\$ -
Recommendations	\$ -	\$ 5,600	\$ 3,200
Software	\$ -	\$ -	\$ 2,000
Grease analyses	\$ 1,000	\$ 2,000	\$ 2,000
<b>External costs</b>	<b>\$ 27,675</b>	<b>\$ 7,600</b>	<b>\$ 7,200</b>
<b>Y-Y Evolution</b>		<b>-73%</b>	<b>-5%</b>

The external costs for the Client decrease dramatically when the process is completely reshuffled. We can notice an increase in cost for the grease analyses – this is due to the sound decision to doubling the frequency in the grease sampling which has the advantage speeding up the building of the trend of the bearings condition evolutions and thereby more rapidly detect an anomaly. This also improves the know-how of the crew taking the samples.

The cost reduction between 2014 and 2015 is typical of small improvements in the process which are also linked to improved work conditions for the personnel doing the reporting.

 <p>Value from technology and experience</p>	<b>CASE STUDY</b>	<b>IMPROVING VALUE OF PERIODIC INSPECTIONS</b>
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### 3.5. Key success factors

- There was a sense of urgency which forced both parties to really analyze what they wanted out of the process and which required dramatic changes rapidly.
- Both parties had a common cause – keep the relation between the companies and improve it – even if the reasons for this common cause are different.
- Concentrating on what brings value to the client, both parties were looking at value streams instead of being locked into the department silos point of view.



	<p><b>CASE STUDY</b></p>	<p><b>IMPROVING VALUE OF PERIODIC INSPECTIONS</b></p>
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## 4. CONCLUSION

### 4.1. Overall

- The process efficiency has improved. Leadtimes and cycle times have been greatly reduced.
- By having worked together on improving a process that spans over both companies, the relationship evolves into one of trust (this started with the open book approach and the recognition that both companies need each other to some extent).

### 4.2. Client perspective

- The overall cost for the client has decreased by 74% while at the same time the overall hassle has decreased.
- The personnel who are regularly on the buoy and who have the responsibility of maintaining it do no longer feel that they are being audited, the yearly inspection becomes a good tool for trying to improve the process that are not working adequately.
- Condition data of the bearings become more reliable.

### 4.3. OEM perspective

- The service technicians can now be employed on more value added activities, such as intervening on equipment which have degraded, training client personnel on the best maintenance practices, or upgrading equipment.
- The revenue initially decreases dramatically for the inspection activity, but with this remodeled concept of the inspection activity, the OEM is able to increase the number of involvement in buoy inspection (out of the 360 buoys that the OEM has sold and are still active, in 2013 only 4% (14) were being inspected yearly by the OEM, whereas by the end of 2016 this has increased to 35% (126)).
- The domino effect of the increase in the number of inspected buoys is that the involvement of the OEM in the supply of spare parts soars, the number of engineering studies increases dramatically, the number of refurbishment and upgrading projects increases, the sales of new system increase.