

Improve OCE-Overall Craft Effectiveness Because Craft Labor is a Terrible Thing to Waste

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Improving Overall Craft Effectiveness (OCE) is about improving craft productivity. Getting maximum value from craft labor resources and higher craft productivity requires measurement and knowing where you are now. Maintenance operations that continue to operate in a reactive, run-to-failure, fire-fighting mode and disregard implementation of today's best practices will continue to waste their most valuable asset and very costly resource - craft time.

Typically, due to no fault of the craft work force, surveys and baseline measurements consistently show that only about 30 to 40 percent of an eight-hour day is devoted to actual, hands-on wrench time. It is very important to understand; "How your valuable craft time can slip away" as illustrated below in Figure 1.



Figure 1: How Your Valuable Craft Time Can Slip Away



Best practices such as effective maintenance planning/scheduling, preventive/predictive maintenance, more effective storerooms and parts support all contribute to proactive, planned maintenance and more productive hands on, “wrench time”.

Measuring and improving Overall Craft Effectiveness (OCE) must be one of many components to continuous reliability improvement process and total asset management. OCE includes three key elements very closely related to the three elements of the OEE Factor (Figure 2) which we will discuss next in more detail...

Overall Craft Effectiveness (OCE)	Overall Equipment Effectiveness (OEE)	Elements of OEE and OCE
1. Craft Utilization or Wrench Time (CU)	Asset Availability/Utilization (A)	Effectiveness
2. Craft Performance (CP)	Asset Performance (P)	Efficiency
3. Craft Service Quality (CSQ)	Quality of Asset's Output (Q)	Quality

Figure 2: The Three Elements of OCE

Craft Utilization

Craft Utilization (CU): The first element of the OCE Factor is Craft Utilization or pure wrench time. This element of OCE relates to measuring how effective we are in planning and scheduling craft resources so that these assets are doing value-added, productive work (wrench time). Effective planning/scheduling within a proactive maintenance process is one important key to increased wrench time and craft utilization. It is also about having an effective storeroom with the right part, at the right place in time to do scheduled work with minimal non-productive time on the part of the crafts person or crew assigned to the job. Your valuable craft time can just slip away to a level of 30-40% or below when crafts service a large geographic area; a large plant, refinery or facilities complex.

Pure wrench time is hands on time at the job site doing the repair with the right parts and does not include time caused by the following;

1. Running/traveling from emergency to emergency in a reactive, fire fighting mode
2. Waiting on parts issue, actually finding parts or getting parts information
3. Waiting on other asset info, asset drawings, repair instructions, documentation etc.
4. Waiting for the equipment or asset to be shut down to begin work
5. Waiting on rental equipment or contractor support to arrive at job site
6. Waiting on other crafts to finish their part of the job
7. Traveling to/from job site
8. All other make-ready, put away or shop clean up time
9. Meetings, normal breaks, training time and excessive troubleshooting due to lack of technical skills
10. Lack of effective planning and scheduling

Craft Utilization (or wrench time) can be measured and expressed simply as the ratio of:

$$CU\% = \frac{\text{Total Productive (Wrench Time)}}{\text{Total Craft Hours Available \& Paid}} \times 100$$



Improve Wrench Time First: Go on the attack to increase wrench time in your operation even if you do nothing to improve the other two OCE Factors; Craft Performance (CP) and the Craft Service Quality (CSQ) level. As we will see in the following examples, very dramatic and significant tangible benefits can be realized with just focusing on increasing wrench time. Improvement of from 10 to 30 percentage points from your current baseline of wrench time can typically be expected. In addition, often this can be achieved, just from more effective maintenance planning and scheduling. Let's now look at several examples showing the value of craft utilization improvement within a 20-person work force with an average hourly rate of \$18.00 and see the significant benefits that a 10 percent increase in craft utilization can provide.

Gained Value of 10% in Wrench Time: What if through better planning and scheduling, good parts availability and having equipment available to fix it on a scheduled basis, we are able to increase actual wrench time by just 10 percent from a baseline of 40%? What is the gained value to us if we get wrench time increase across the board for a 20- person crew being paid an average hourly rate of \$18 per hour? First, let's look at what it is really costing us at various levels of wrench time

Total Craft Hours Available and Annual Craft Labor Costs for Crew of 20 Crafts

$$20 \text{ Crafts} \times 40 \text{ Hrs. wk.} \times 52 \text{ wks./yr.} = 41,600 \text{ Craft Hours Available}$$

41,600 Craft Hours @ \$18/hr. = \$748,800 Craft Labor Cost/Year

Wrench Time and Actual Costs Per Hour at Various Levels of Craft Utilization

Level of Craft Utilization	Total Wrench Time (Hours)	Actual Hands On Cost Per Hour	Average Wrench Time Hours Per Craft Position
30%	12,480	\$60.00	624
40%	16,640	\$45.00	832
50%	20,800	\$36.00	1040
60%	24,960	\$30.00	1248
70%	29,120	\$25.71	1456
80%	49,920	\$22.50	1664
*85%	35,360	\$21.18	1768
90%	37,440	\$20.00	1872
100%	41,600	\$18.00	2080

Figure 3: Actual Cost Per Hour at Various Levels of Wrench Time

Note: Maximum possible Craft Utilization is 85 percent (as shown in Figure 3 above and in Figure 1 considering paid holidays, vacation time, breaks, clean up, employees meetings, craft training, etc.

Example A: What If Baseline for Wrench Time is 40%? With effective planning and scheduling, we can achieve at a minimum a 10-point improvement in craft utilization from our current baseline. Starting from a baseline of 40 percent and increasing wrench time up to a level of 50 percent, we in effect get a 25 percent increase in craft capacity for doing actual work.



Total Hours Gained in Wrench Time: 4,160 hours gained
 20,800 hours @ 50% - 16,640 hours @40% = 4,160 hours gained
 Total Gain in Equivalent Number of Crafts Positions: 5 craft positions

4,160 Hours Gained
 832 Average Wrench Time Hours @ 40% = 5 Equivalent Craft Positions

Total Gained Value of 5 Equivalent Positions: \$187,200

	Hrs.		Wks		\$18.00	
5 equivalents x 40	wk.	x 52	yr.	x	hr.	= \$187,200 Gained Value

Valuable Craft Time Can Be Regained: For the 20-person craft work force, just a 10% improvement up to 50% wrench time is 4,160 hours of added wrench time. This gain represents a 25 percent increase in overall craft labor capacity. The maintenance best practice for planning and scheduling requires a dedicated planner(s). An effective maintenance planner can support and plan for 20 to 30 crafts positions. With only a 10 percent increase in craft utilization for a 20-person craft work force, we can get more than a 5 to 1 return to offset a maintenance planner position.

Example B: What if Wrench Time is 30%? For many operations, wrench time is only about 30% and sometimes below 30%. Again, with effective planning and scheduling, good PM/PdM and parts availability we can eliminate excessive non-wrench time. An improvement of at least 20 points in craft utilization is very realistic. If we begin from a baseline of 30% up to a level of 50%, we are in effect getting a 67% percent increase in craft capacity for actual hands on work.

The gained value of going from 30% up to 50% wrench time.
 Total Hours Gained in Wrench Time: 8,320 Hours Gained
 20,800 hours @ 50% - 12,480 hours @30% = 8,320 hours gained
 Total Gain in Equivalent Number of Crafts Positions: 13
 8,320 Hours Gained
 624 Average Wrench Time Hours @ 30% = 13.3 Equivalent Craft Positions

Total Gained Value of 13.3 Equivalent Positions: \$497,952

	Hrs.		Wks		\$18.00	
13.3 equivalents x 40	wk.	x 52	yr.	x	hr.	= \$497,952 Gained Value

Valuable Craft Time Can Be Regained: Tremendous opportunities are available for the 20-person craft work force with wrench time currently in the 30% to 40% range. Just a 10% to 20% improvement up to 50% wrench time can be from 4,000 to 8,000 hours of added wrench time. This gain represents a 25% to 67% increase in overall craft labor capacity. There are a number of best practices to help you regain valuable craft resources. The maintenance best practice for planning and scheduling requires a dedicated planner(s). An effective maintenance planner can support and plan for 20 to 30 crafts positions.

Use your CMMS/EAM as a mission-essential information technology tool that supports planning and scheduling, better MRO materials management and effective preventive/predictive maintenance. They are three best practices for improving craft wrench time. Bottom line results that give us 5 to 13 more



equivalent craft positions and up to \$500,000 in gained value of more wrench time with existing staff, can be dramatic proof that internal maintenance operations can be profit centered.

Craft Performance

Craft Performance (CP): The second key element affecting Overall Craft Effectiveness is craft performance. This element relates to how efficient we are in actually doing hands-on craftwork when compared to an established planned time or performance standard. Craft performance (CP) is expressed as the ratio of:

$$CP\% = \frac{\text{Total Planned Time (Hours)}}{\text{Total Actual Craft Hours Required}} \times 100$$

Craft performance is directly related to the level of individual craft skills and overall trades experience as well as the personal motivation and effort of each craftsperson or crew. Effective craft skills training and technical development contribute to a high level of craft performance.

Craft Performance Calculation: The planned time for a minor overhaul or PM procedure is 10 hours based on a standard procedure with parts list, special tools, permits required, etc.

If the job is completed in 12 hours, then Craft Performance = $(10 \div 12) \times 100 = 83\%$

If the job is completed in 9 hours, then Craft Performance = $(10 \div 9) \times 100 = 111\%$

An effective planning and scheduling function requires that reasonable repair estimates. It is what I call reliable planning times and they should be established for as much maintenance work as possible. Because maintenance work is not highly repetitive, the task of developing reliable planning times is more difficult. However, there are a number of methods for establishing planning times for maintenance work including:

Reasonable estimates: A knowledgeable person either a supervisor or planner uses their experience to provide their best estimate of the time required. This approach does not scope out the job in much detail to determine method or special equipment needed.

Historical data: The results of past experience are captured via the CMMS or other means to get average times to do a specific task. Overtime, a database of estimated time is developed which can be updated with a running average time computed for the tasks.

Predetermined standard data: Standard data tables for a wide range of small maintenance tasks have been developed. Standard data represents the building blocks that can then be used to estimate larger, more complex jobs. Each standard data table provides what the operation is, what is included in the time value and the table of standard data time for the variables that are included. The Universal Maintenance Standards (UMS) method used back in the 1970s and developed by H. B. Maynard Inc. represents a predetermined standard data method.

The ACE Team Benchmarking Process: As a means to overcome many of the inherent difficulties associated with developing maintenance performance standards, the ACE (A Consensus of Experts) Team Benchmarking Process was developed. This method is based upon principles of the Delphi Technique. It relies primarily on the combined experience and estimating and methods improvement



ability of a group of skilled crafts personnel, planners, and foreman. The objective is to determine reliable planning times for a number of selected “benchmark” jobs. This team-based process which uses skilled craft people places a high emphasis on continuous maintenance improvement to reflect improvements in performance and repair methods and repair quality as they occur.

Generally, the ACE Team Benchmarking Process parallels the UMS (Universal Maintenance Standards) approach in that the “range of time concept” and the “slotting” technique is used once the work content times for a representative number of “benchmark jobs” have been established. The ACE Team Benchmarking Process focuses primarily two key areas; a) repair methods improvement and b) on the development of work content times for representative “benchmark jobs” that are typical of the craftwork performed by the various craftwork areas.

Once a number of benchmark job times have been established, these jobs are then categorized onto spreadsheets by craft and task area and according to work groups which represent various ranges of times. Spreadsheets are then set up with 4 work groups/sheet with each work group having a time slots or “range of time”. For example, work group E would be for benchmark jobs ranging from 0.9 hours up to 1.5 hours and assigned a standard time (slot time) of 1.2 hours. Likewise, work group F would be for benchmark jobs ranging from 1.5 hours up to 2.5 hours and assigned a standard time of 2.0 hours. Spreadsheets include brief descriptions of the benchmark jobs and represent pure wrench time. Work content comparison is then done by an experience person, typically a trained planner to establish planning times within the 95% confidence range. By using a relatively small sample of benchmark jobs, a planner can establish work content for a large number of repair jobs. More about certification in using the ACE Team Benchmarking Process is available at www.PRIDE-in-Maintenance.com .

Planning Times Are Essential: Planning times provide a number of key benefits for the planning/scheduling process. First, they provide a means to determine existing workloads for scheduling by craft areas and backlog of work in each area. Planning times allow the maintenance planner to balance repair priorities against available craft hours and to realistically establish repair schedules that can be accomplished as promised. Secondly, planning times provide a target or goal for each job that allows for measurement of Craft Performance. Due to the variability of maintenance type work and the inherent sensitivity toward measurement, the objective is not so much the measurement of individual craft performance. The real objective is measurement of the overall performance of the craft work force as a whole. While measurement of the individual crafts person is possible, Craft Performance measurement is intended to be for the maintenance craft labor resources (Figure 14.8) doing skilled type work.

Craft Service Quality

Craft Service Quality (CSQ): The third element affecting Overall Craft Effectiveness relates to the relative quality of the repair work. This element includes quality of the actual work, where certain jobs possibly require a call back to the initial repair thus requiring another trip to fix it right the second time. Recall the last time you had to call back a repair person to your home for a job not performed to your satisfaction. This is not a good thing for a real profit-centered maintenance company! However, Craft Service Quality can be negatively impacted within a plant or facility complex due to no fault of the crafts person when hasty repairs, patch jobs or inferior repair parts/materials create the need for a call back

We can measure callbacks via the CMMS with special coding of callback work orders. Typically, the CSQ element of OCE is a more subjective value and therefore it must be viewed accordingly in each operation. However, the Craft Service Quality level does affect overall craft labor productivity and the



bottom line results of the entire maintenance process. When reliable data is present for all three elements of OCE, then the Overall Craft Effectiveness Factor can be determined by multiplying each of these three elements:

OCE =	CU%	x	CP%	x	CSQ%
	Craft	x	Craft	x	Craft Service Quality
	Utilization		Performance		Quality
			e		

All Three Elements of OCE are Important: Maintenance craft labor may be very efficient with 100 percent craft performance and still not be effective if craft utilization is low and craft service quality are poor.

The Impact of Improving Both Craft Utilization and Performance: Improved craft utilization through more effective planning of all resources will increase available wrench time. Improved performance results from the fact that work is planned and the right tools, equipment, and parts are available made by planning the right craftsman or crew for the job with the type of skills needed. Improving craft performance is a continuous process with a program for craft skills training and methods improvement to do the job right the first time in a safe and efficient manner. The ACE Team Benchmarking Process mentioned earlier provides reliable planning times based upon “a consensus of experts” and a tremendous repair methods improvement effort as benchmark jobs are analyzed.

Example C: What if We Increase Wrench Time from 30% to 50% and Craft Performance from 80% to 90%

When we look at the combination of improving both craft utilization and performance, we see an even greater opportunity for a return on investment. Let’s now look at a very realistic 20 point improvement in Craft Utilization and a 10 point increase in Craft Performance for the same 20-person craft work force shown back in Table 3 and having an average hourly rate of \$18.00.

Example C Details:

Baseline Cost Per Direct Maintenance Hour @ 30% Utilization and 80% Performance

$$20 \text{ crafts} \times 40 \text{ hours/week} \times 52 \text{ weeks/year} \times .30 \text{ (CU)} \times .80 \text{ (CP)} = 9,984 \text{ Direct Craft Hours/Year}$$

$$= 499 \text{ Direct Hours/Craft Position}$$

Baseline Cost: \$748,800 ÷ 9,984 Direct Hours = \$75 Cost Per Direct Craft Hour

Improved Cost Per Hour With 50% Craft Utilization and 90% Craft Performance

$$20 \text{ crafts} \times 40 \text{ hours/week} \times 52 \text{ weeks/year} \times .50 \text{ (CU)} \times .90 \text{ (CP)} = 18,720 \text{ Direct Craft Hours/Year}$$

$$= 936 \text{ Direct Hours/Craft Position}$$

Cost Per Direct Craft Hour @ 50% Craft Utilization and 90% Craft Performance = \$40

$$\$748,800 \div 18,720 \text{ Direct Hours} = \$40 \text{ Cost Per Direct Hour}$$

Total Direct Craft Hours Gained = 8,736 Total Direct Hours Gained (87% Increase)

$$18,720 \text{ Hours} - 9,984 \text{ Hours @ Baseline} = 8,736 \text{ Direct Craft Hours Gained}$$

$$8,736 \text{ Hours Gained} \div 9,984 \text{ Hours @ Baseline} = .875 \times 100 = 87\% \text{ Gain in Direct Craft Hours}$$

Total Gain in Equivalent Number of Craft Position: 17 Equivalent Craft Positions

$$20 \text{ crafts} \times .87 \text{ (%Hours Gained)} = 17.4 \text{ Equivalent Craft Positions}$$

$$8,736 \text{ Hours Gained} \div 499 \text{ Hours/Craft Baseline Average} = 17.4 \text{ Equivalent Craft Positions}$$



Total Gained Value = \$655,200

Gain of 8,736 Direct Craft Hours x \$75 Baseline Cost/Direct Hour = \$655,200 Gained Value
 \$655,200 ÷ \$748,800 = 87 % Gain from a Baseline of 30% Wrench Time and 80% Craft Performance

Summary of Our Previous Examples: The previous examples have illustrated that increasing OCE provides greater craft capacity and gained value from increased wrench time. Improving Craft Performance in combination with improving Craft Utilization simply compounds our return on investment; an astronomical amount of 87% as shown in Figure 14.10.

Examples	Baseline	Improve To:	Craft Labor Gain	Gained Value
A	CU @40%	CU@50%	5	\$187,200
B	CU@30%	CU@50%	13	\$497,952
C	CU@30% & CP@80%	CU@50% & CP@90%	17	\$655,200

Figure 4: Summary Comparisons of Previous Examples

Where Can We Apply OCE Gained Value: Maintenance operations that continually fight fires and react to emergency repairs never have enough time to cover all the work (core requirements) that needs to be done. Overtime, more crafts people or more contracted services typically seem to be the only answers. Improving craft utilization provides additional craft capacity in terms of total productive craft hours available. In relation to OEE, OCE is increased people asset availability and capacity. It is gained value that can be calculated, estimated, and then measured. The additional equivalent craft hours can then be used to reduce overtime, devote to PM/PdM, reduce the current backlog, and attack deferred maintenance which doesn't go away. Figure 2 shows; "How your valuable craft time can just slip away".

Indiscriminate Cutting of Maintenance is Blood Letting: Typically, operations that gain productive craft hours desperately need to invest the time elsewhere. Likewise, we cannot automatically and indiscriminately reduce head count when we improve overall craft effectiveness. Indiscriminate cutting of maintenance is killing the goose that lays the golden egg. If an organization is not achieving core requirements for maintenance the cutting of craft positions to meet budget is like using bloodletting as a new cure for a heart attack. It just will not work.

Just like the high cost of low bid buying, gambling with maintenance costs can be fatal. Long-term stabilization and reduction of head count can occur. Attrition can absorb valid staff reductions that may result over the long-term. We also may regain our competitive edge and get back some of the contract work we lost previously to low performance and productivity. We cannot indiscriminately cut craft labor resources when we increase OCE.

Think Profit-Centered: Today's maintenance leaders and crafts people must develop the "maintenance-for-profit" mindset that the competition uses to stay in business. Measuring and improving Overall Craft Effectiveness and the value received from improving our craft assets is an important part of total asset management. Profit-centered in-house maintenance in combination with the wise use of high quality contract maintenance services will be the key to the final evolution that occurs. There will be revolution within organizations that do not fully recognize maintenance as a core business requirement and establish the necessary core competencies for the maintenance.



The bill will come due for those operations that have subscribed to the “pay me later syndrome” for deferred maintenance. It will be revolution within those operations that have gambled with maintenance and have lost with no time left before profit-centered contract maintenance provides the best financial option for a real solution.

Maintenance is Forever: Contract maintenance will be an even greater option and business opportunity in the future. Again, we must remember - Maintenance is Forever! Some organizations today have neglected maintaining core competencies in maintenance to the point that they have lost complete control. The core requirement for maintenance still remains but the core competency is missing. In some cases, the best and often only solution may be value-added outsourcing. Maintenance is a core requirement for profitable survival and total operations success. If the internal core competency for maintenance is not present, it must be regained. Neglect of the past must be overcome. It will be overcome with a growing number of profit-centered maintenance providers that clearly understand Overall Craft Effectiveness and providing value added maintenance service at a profit.



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