Labor Rate and Productivity Calculations
For Commercial Aircraft Maintenance

Effective January 2013
DISCLAIMER

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NOTICE

This paper presents an attempt to provide common understanding to labor productivity and rate calculations around the world. It is derived from industry best practices from airline technical operations and MROs. It is based on principles of management accounting that differ significantly from the strict financial accounting standards. It is important to note that labor rate calculations may differ from one company to another depending on internal policies. We welcome your comments at mctf@iata.org
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1 INTRODUCTION

In general, labor is the second cost driver in the airline industry, after fuel expenses; however, calculating labor cost and labor rate can be a challenge as there is no standard way to do so. Capturing all benefits, properly assigning overhead cost and assessing productivity are amongst the main difficulties. The objective of this document is to provide best practices on calculating labor rate in a consistent way thus determining trends and drivers.

Rather than an accounting paper, this is a practitioner’s guide for people working in an airline’s technical operations finance department or an MRO organization (from line maintenance to a full service MRO provider) to determine the actual labor rate as it applies to specific cases. It will give a better understanding of how labor rate should be calculated in order to be used for:

- “Make vs. Buy” decisions; whether work should be done in-house or contracted out
- Evaluation of profitability
- Benchmarking purposes

First, this article presents the three main components of direct labor cost: gross salary, overtime and company’s contributions. The sum of these costs represents how much a mechanic will cost to the organization. Then, we introduce the notion of productivity, and provide a methodology to calculate the adjusted labor rate. Finally, we address the various elements of all indirect costs in order to allocate the appropriate overhead to the direct adjusted labor rate.

Note: Labor cost vs. labor rate? Labor cost is an amount of money that can range from the cost of labor related a specific maintenance event to the cost of the entire technical division, usually on an annual basis. Labor rate is a unit cost (e.g. an amount of money per hour).

2 COST OF AN EMPLOYEE TO AN AIRLINE

When trying to determine the cost of an employee to an airline, there are 3 important aspects to be considered: employee’s gross salary, the employee’s overtime pay, and the company’s contributions for the employee’s benefits. In many instances, an employee is also referred to as an FTE (Full Time Equivalent); human resource departments may use the term “headcount” for the number of employees/FTEs.

Note: It is important to distinguish between headcount and FTE. Headcount is simple payroll style accounting for human resources. It shows only that an individual or group of individuals work for the company. It does not generally say how they spend their time in productivity terms. FTE is a measure of workload based on an aggregate of 1, or 100% productive. Employees who work part time or, for some reason, are less than 100% productive are factored accordingly e.g. 0.75, 0.5, 0.25 FTE. This kind of measure is very important for planning, as it provides a level of detail, with which to measure available resource.
In the case of aircraft (and components) maintenance, direct labor refers to the labor performed by the employees that specifically and consistently work on aircraft and their parts. Depending on regulatory, legal and union requirements, these employees “mechanics” may be holders of a specific license.

2.1 Mechanic’s Gross Salary

The mechanic’s gross salary is the employee’s salary before any deductions. These deductions include, but are not limited to, employee’s contributions for retirement, health, government taxes, etc. (applicable per local & company policies). For illustration purposes, an example will be given in Table 1, using the average gross salary for all manual labor. A proper way to calculate the average gross salary of employees is by adding all the salaries and dividing by the total number of workers. This can also be done per activity; for example, line maintenance, base maintenance, components maintenance, etc.

2.2 Overtime

Overtime consists of additional hours worked by the employee or any time the employee works during a weekend or a holiday, and is paid in addition to their base salary. Average overtime costs per employee can be calculated in a similar way to average gross salary. Overtime varies depending on the employee and the airline but a general example is used in Table 1 for illustration purposes.

2.3 Company’s Contributions

The company’s contributions consist of payments made by the airline for the employee’s benefits. These contributions include, but are not limited to, retirement/pension, healthcare, taxes, uniforms, training, tools, transportation, meals, allowances, etc. (applicable per local laws, company policies and applicable union agreements).
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<table>
<thead>
<tr>
<th></th>
<th>Annual</th>
<th>Hourly (assume 2 080 hours/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Gross Salary</td>
<td>$32,000.00</td>
<td>$15.38</td>
</tr>
<tr>
<td>Company’s Contributions- Benefits</td>
<td>$10,000.00</td>
<td>$4.80</td>
</tr>
<tr>
<td>Overtime Allocation² (if applicable)</td>
<td>–</td>
<td>$0.00</td>
</tr>
<tr>
<td><strong>Total Hourly Cost of Employee</strong></td>
<td></td>
<td><strong>$20.18</strong></td>
</tr>
</tbody>
</table>

Table 1 – Total Hourly Cost of Employee

If a company estimates that overtime is expected, then the budgeted number of overtime hours should be added to the number of scheduled hours per year. The total cost of the employee (including overtime pay) will be divided by the total number of hours (scheduled and overtime) for that year. This is illustrated in Tables 2 and 3 with an example. Please note that for the rest of the article, overtime will not be considered and calculations made in Tables 2 and 3 will not carry through the rest of the article.

<table>
<thead>
<tr>
<th></th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Gross Salary</td>
<td>$32,000.00</td>
</tr>
<tr>
<td>Company’s Contributions- Benefits</td>
<td>$10,000.00</td>
</tr>
<tr>
<td>Overtime Allocation² (if applicable)</td>
<td>$2,307.70</td>
</tr>
<tr>
<td><strong>Total Cost of Employee for the Year</strong></td>
<td><strong>$44,307.70</strong></td>
</tr>
</tbody>
</table>

Table 2 – Total Cost of Employee for the Year

In order to determine the total cost of the employee for the year, on an hourly basis, the total cost must be divided by the total number of hours worked during the year, including overtime. This calculation is illustrated in Table 3.

<table>
<thead>
<tr>
<th></th>
<th>Annual</th>
<th>Hourly (2,180 hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cost of Employee for the Year</td>
<td><strong>$44,307.70</strong></td>
<td><strong>$20.33</strong></td>
</tr>
</tbody>
</table>

Table 3 – Total Cost of Employee for the Year (Hourly)

¹ Local laws determine the number of hours an employee should be working per year. In this case, for simplicity reasons, the employee works 40 hours a week, 52 weeks a year (40 x 52 = 2,080). In reality, there is an additional day in a year or 2,088 working hours.

² Company policy will dictate whether or not employees typically work overtime. In the example in Table 2, overtime was not included, and will not be included for the rest of the article, except for the simple illustration in Tables 2 and 3.
3 EMPLOYEE PRODUCTIVITY

It is important to be able to determine the productivity of employees as this will help determine how much maintenance employees are costing an airline (or maintenance entity) relative to the work that they are performing. Productivity is also used to estimate the number of employees required to perform certain tasks.

Productivity is determined by the number of hours that an employee is working directly on his/her duties (i.e. “hands-on” labor). There are times throughout the year when employees are not performing direct labor however are still being paid. There are 2 scenarios where this occurs:

A. Employee is physically absent from the workplace (i.e. weekends, vacation, public holidays, sick leave, etc.)
B. Employee is physically present but performs other tasks (i.e. training, meeting, morning briefings, breaks, etc.)

3.1 Case A: Employee is physically absent from the workplace

If an employee is hired to work full time it is assumed that he/she should be working 2,080 hours a year (as per calculation above). An employer, however, must account for days when employees are not physically present at work but are still getting paid, as this will affect productivity. Paid time off typically consists of statutory holidays, vacation days, as well as sick days. If, for example, an employee is entitled to 10 statutory holidays, 20 vacation days, and 5 sick days per year they end up working 35 days less than originally calculated. This means that the original calculation of 2,080 hours of work per year ends up becoming 1,800 available working hours per year. This is illustrated in Table 4.

<table>
<thead>
<tr>
<th>Days</th>
<th>Total Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Paid Time</td>
<td>260</td>
</tr>
<tr>
<td>Statutory Holidays</td>
<td>(10)</td>
</tr>
<tr>
<td>Vacation Days</td>
<td>(20)</td>
</tr>
<tr>
<td>Sick Days (on average)</td>
<td>(5)</td>
</tr>
<tr>
<td>Total Available Time</td>
<td>225</td>
</tr>
<tr>
<td></td>
<td>1,800</td>
</tr>
</tbody>
</table>

Table 4 – Employee’s Total Available Time

3.2 Case B: Employee is physically present but performs other tasks

An employer must also account for times when employees are physically present at work but are performing other tasks. Other tasks can include meetings, training, conference calls, waiting for parts, company travel time, etc. The amount of time taken up by these tasks should be subtracted from the employee’s available time since that time is not spent directly on labor. In addition, this is time that third party customers would not be willing to pay for because the employee is not working directly on maintenance.
Certain activities are easier to account for than others. For example, training and meetings are usually scheduled therefore it is relatively simple to determine the amount of time spent on them. The majority of these activities are essential in order for employees to perform their duties. For instance, training may be mandatory and meetings might be necessary to plan and clarify the tasks that need to be performed.

Other activities, such as waiting for parts, are more challenging to calculate, since they are not scheduled. They will not be included in this write-up but should be taken into consideration depending on the airline, its needs, and its processes. It is a best practice to monitor the time spent on these types of activities and find ways to minimize most of these activities as well as the associated time that is being wasted as a result.

If, for instance, an employee spends one hour per business day in meetings, and 5 days a year in training, he is spending 260 hours a year on activities that are not considered to be direct labor. The 1,800 available working hours end up becoming 1,540 hours spent on direct labor.

Note: It is important to consider that training and meetings only take place during available working hours therefore the one hour per day of meetings should only be multiplied by 225 days rather than the 260 scheduled workdays. In addition, meetings will not take place when employees are in training or are traveling therefore it is important to calculate the amount of hours spent in meetings after the training days have been subtracted from the available working hours.

<table>
<thead>
<tr>
<th></th>
<th>Days</th>
<th>Total Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available Hours</td>
<td>225</td>
<td>1,800</td>
</tr>
<tr>
<td>Training</td>
<td>(5)</td>
<td>(40)</td>
</tr>
<tr>
<td>Meetings</td>
<td>(27.5)³</td>
<td>(220)</td>
</tr>
<tr>
<td>Total Productive Time</td>
<td>192.5</td>
<td>1,540</td>
</tr>
</tbody>
</table>

Table 5 – Total Productive Time

4 PRODUCTIVITY ADJUSTMENT CALCULATIONS

It is important to note that third parties will typically pay for services by the hour and they will only pay for time when the employees are physically working on maintenance tasks, (i.e. during the “productive time”). Since third parties will only be paying for productive time, it is crucial to be able to adjust for that and determine how much the employee is costing the employer during non-productive time. The extra costs that are incurred during non-productive time will be allocated to the productive hours in order to come up with an adjusted cost per productive hour that takes into account the hours that the employee is getting paid, but not working directly on maintenance activities.

There are two key reasons for airlines to determine the adjusted labor rate of their employees. First, they can compare the cost of performing maintenance in-house versus outsourcing the tasks. For example, if an airline can negotiate to have a third party perform work for them below their

³ 27.5 = 1 hour/day x 220 days/year
⁴ Does not include time waiting for parts, making calls, etc.
adjusted labor cost\(^5\) then they may want to consider outsourcing as it will be more cost effective. The
second reason they should determine the adjusted labor cost is if they have unused capacity and are
interested performing services for third parties. By charging a rate equal to the adjusted labor cost
they will break even, and any charge above that will be profit.

A two-step calculation is required to determine the adjusted labor rate. First, one must determine the
productivity adjustment factor. This factor is the fraction of total scheduled working time over total
productive time. Following the previous example, 2,080 hours would be divided by 1,540 hours to
obtain a productivity factor of 1.35. This number will now be multiplied by the cost per hour, per
employee, that was previously determined to figure out the adjusted cost per employee (per hour).
If $20.18 is multiplied by 1.35 the result will be 27.24 which is the adjusted labor cost per hour (per
employee). This cost is important as it will be crucial in determining the break-even point if ever an
airline would like to sell their technical services to third parties. Using the previous example, an airline
would have to charge at least $27.24 per hour if they would like to break even.

<table>
<thead>
<tr>
<th>Productivity Adjustment Factor</th>
<th>2,080/1,540 = 1.35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted Hourly Labor Rate</td>
<td>$20.18 x 1.35 = $27.24</td>
</tr>
</tbody>
</table>

Table 6 – Adjusted Hourly Labor Cost

**Note:** There is always the argument that once the cost has been paid off (e.g. facilities, laborer’s
annual salaries, etc.) all additional revenues are pure margin. These arguments should be addressed
and resolved between the finance department and the business units, including sales and
maintenance operations so that a common understanding is established.

**Note:** Another issue that arises when calculating labor productivity is labor efficiency. The same job
might take different people different amounts of time to complete. Labor efficiency varies between
personnel within the same company but is more prominent when personnel from different
countries/cultures are being considered. Training and experience are some factors that significantly
alter labor efficiency. Labor efficiency has not been addressed in this article.

5 **OVERHEAD ALLOCATION**

Allocating overhead using the activity based costing approach is a logical way to allocate overhead as
maintenance activities fall into different categories based on their nature. The main activity cost pools
should be categories such as line maintenance, base maintenance, component maintenance, engine
maintenance, power plant systems maintenance, spares & inventory maintenance, etc. Each of these
major categories entails different types and amounts of overhead therefore they should be accounted
for separately. Overhead costs include electricity, utilities, rent, etc. Management salaries are also
considered overhead, especially if they are not directly related to the maintenance that is being
performed. Since these costs are not directly related to maintenance but are required in order for
maintenance to be performed, it is important to allocate these costs to the maintenance activities.

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\(^5\) Hourly labor cost x total hours
5.1 Line Maintenance

Calculating line maintenance labor cost is relatively straightforward. Mechanics are working directly on specific aircraft for certain amounts of time therefore it is easy to allocate their time to specific jobs. Additionally, idle time and overhead may become important depending on airline schedules.

Assume there are 6 licensed mechanics and 1 supervisor. In this example, no hangar is used. In many cases, line maintenance is performed in a hangar therefore the facility cost related to the hangar should be properly allocated and added to the overhead cost. The same benefits & productivity rates will be used as in the previous example.

<table>
<thead>
<tr>
<th>Indirect Cost Driver</th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervisor Salary (including benefits at 30%)</td>
<td>$60,000.00</td>
</tr>
<tr>
<td>Facility Rent (including insurance, maintenance, etc.)</td>
<td>$10,000.00</td>
</tr>
<tr>
<td>Utilities (including power, telecom, etc.)</td>
<td>$30,000.00</td>
</tr>
<tr>
<td><strong>Total Annual Overhead Expense</strong></td>
<td><strong>$100,000.00</strong></td>
</tr>
</tbody>
</table>

Table 7 – Total Annual Overhead Expense

The $100,000.00 annual overhead expense must be allocated amongst the 6 licensed mechanics since they are the ones performing the direct labor. When a third party is involved they only pay for direct labor therefore it is important to be able to determine how much the overhead is costing and how that should be allocated to ensure that the cost per hour for direct labor is adjusted to take into account a certain amount of overhead.

<table>
<thead>
<tr>
<th>Steps for Calculating the Adjusted Labor Cost after Overhead Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Overhead per mechanic ($100,000.00 / 6 mechanics)</td>
</tr>
<tr>
<td>Step 2: Overhead per mechanic per hour ($16,666.67 / 1,540(^7) hours)</td>
</tr>
<tr>
<td>Step 3: Adjusted Labor Cost before Overhead Allocation (Table 6)</td>
</tr>
<tr>
<td>Step 4: Adjusted Labor Cost After Overhead Allocation ($27.24 + $10.82)</td>
</tr>
</tbody>
</table>

Table 8 – Steps for Calculating the Adjusted Labor Cost after Overhead Allocation

If an airline has long turnaround times in a particular station, it might be beneficial to allocate maintenance staff there so that line maintenance can be performed while the aircraft is on the ground. This is especially true in countries with lower labor costs. If airlines determine that they can obtain lower maintenance costs in a particular country, they might be in a position to set up a maintenance station over there and optimize their flight schedules, to ensure that aircraft spend more time on the ground in that country so that maintenance could be performed. Excellent understanding of local labor regulations is essential for such decisions.

**Note:** If an entity is offering line maintenance services as a core activity, the cost of management overhead, up to the head of line maintenance operations, should be allocated to overhead.

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6 Supervisor salary will also include the supervisor’s bonus (if applicable)
7 1,540 was obtained from Table 3
5.2 Base Maintenance

Base maintenance will occur in a hangar environment where there are several overhead costs involved. The fixed costs include electricity, utilities, rent, etc. and are not directly related to the maintenance that is being performed. These costs must be allocated to the cost of the direct labor so that the true cost of the task can be calculated.

Assume there is 1 hangar with 2 bays, 2 shifts, occupied 5 days per week, and each bay has 60 mechanics.

<table>
<thead>
<tr>
<th>Indirect Cost Driver</th>
<th>Case 1</th>
<th>Case 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leasing Cost of Facility</td>
<td>$4,000,000.00</td>
<td>$1,600,000.00</td>
</tr>
<tr>
<td>Insurance (Facility)</td>
<td>$35,000.00</td>
<td>$15,000.00</td>
</tr>
<tr>
<td>Insurance (Aircraft)</td>
<td>$200,000.00</td>
<td>$75,000.00</td>
</tr>
<tr>
<td>Cleaning Services</td>
<td>$200,000.00</td>
<td>$80,000.00</td>
</tr>
<tr>
<td>Overhead/Salaries*</td>
<td>$300,000.00</td>
<td>$115,000.00</td>
</tr>
<tr>
<td>Electricity</td>
<td>$400,000.00</td>
<td>$155,000.00</td>
</tr>
<tr>
<td>Heating</td>
<td>$300,000.00</td>
<td>$115,000.00</td>
</tr>
<tr>
<td>Water</td>
<td>$10,000.00</td>
<td>$4,000.00</td>
</tr>
<tr>
<td>Repair &amp; Maintenance</td>
<td>$600,000.00</td>
<td>$230,000.00</td>
</tr>
<tr>
<td>Security</td>
<td>$2,000.00</td>
<td>$1,000.00</td>
</tr>
<tr>
<td><strong>Total Annual Overhead Expense</strong></td>
<td><strong>$6,047,000.00</strong></td>
<td><strong>$2,390,000.00</strong></td>
</tr>
</tbody>
</table>

Table 9 – Total Annual Overhead Expense

The total annual overhead expense must be allocated amongst the 120 licensed mechanics since they are the ones performing the direct labor. When a third party is involved, they only pay for direct labor therefore it is important to be able to determine how much the overhead is costing and how that should be allocated to ensure that the cost per hour for direct labor is adjusted to take into account a certain amount of overhead.

<table>
<thead>
<tr>
<th>Step</th>
<th>Case 1</th>
<th>Case 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Overhead per mechanic (total overhead expense / 120 mechanics)</td>
<td>$50,391.67</td>
<td>$19,916.67</td>
</tr>
<tr>
<td>Step 2: Overhead per mechanic per hour (overhead per mechanic / 1,540)</td>
<td>$32.72</td>
<td>$12.93</td>
</tr>
<tr>
<td>Step 3: Adjusted Labor Cost before Overhead Allocation (Table 6)</td>
<td>$27.24</td>
<td>$27.24</td>
</tr>
<tr>
<td>Step 4: Adjusted Hourly Labor Cost After Overhead Allocation ($27.24 + overhead per mechanic per hour)</td>
<td>$59.96</td>
<td>$40.17</td>
</tr>
</tbody>
</table>

Table 10 – Steps for Calculating the Adjusted Labor Cost after Overhead Allocation

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* Salaries include the cost of hangar management and support functions that are related to base maintenance (hangar operations) (i.e. quality, engineering, etc.)
5.3 Engine and Component Maintenance

Similar calculations to the ones above can be used to calculate the labor rate and productivity related to engine and component maintenance functions. Activities such as parts clearing, non-destructive testing (NDT), bench testing, special processes (plasma coating, shot peening, etc.) can be either allocated directly to a product line (e.g. CFM56-7 engine maintenance) or distributed appropriately as overhead.

6 FINAL NOTE

Calculating the labor rate and labor productivity is not an exact science. Deciding on overhead costs and allocating these costs requires an in-depth understanding of the business model (especially for airlines that provide third party work). Additional complexity arises from the existing systems, processes and culture regarding identifying and allocating costs. These aspects usually serve the required financial accounting principles well but fall short of meeting the needs of managers who need to base their decisions on managerial accounting principles. As mentioned earlier, a good understanding and open discussion between the Finance and Operations departments will facilitate the process of achieving an the best possible solution for the company.
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