

# **Cost Analysis of Union Negotiations**

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## **Abstract**

Pratt & Whitney Auto-Air Inc. has hundreds of employees with different job classifications and various wages depending on seniority and skill level. The goal of this project is to create a model that calculates and projects the wages of all the employees over a period of four years. P&W management may implement this tool during any future contract negotiations with the worker's Union. This model will perform two crucial functions. First, the routine will provide management with the ability to follow each employee's progression through the job ranks while monitoring their respective hourly wage during this time period. Second, the model will enable P&W to examine the percentage increase in salary expenditures for each year over any four-year span.

Ideally, the completed routine will allow P&W management to scrutinize an array of possible contract terms before entering into the actual negotiations with the labor Union. By varying the routine's input values, which are progression rates, cost of living allowances, and raises guaranteed by contract, P&W's management will be able to determine the set of contract terms that most significantly benefit the corporation's finances. P&W management may, then, consult these figures in determining the conditions of the new workers' contract with Union officials.

## Table of Contents

Introduction.....	3
Experimental Methodology.....	5
Analysis.....	8
Assumptions.....	9
Results.....	10
Discussion.....	11
Conclusion.....	12
References.....	13
Appendix A.....	14
Appendix B.....	19
Table 1.....	3
Table 2.....	4
Table 3.....	7
Figure 1.....	10
Figure 2.....	10
Figure 3.....	11
Figure 4.....	11
Figure 5.....	11
Figure 6.....	11

## I. Introduction

Companies that employ large numbers of workers with varying wages and skill levels must perform complicated calculations in order to project future wage increases. P&W would benefit greatly from an automated tool designed to forecast employee wage increases. Such a program would facilitate the company’s negotiations with the workers’ Union, helping to create economic figures acceptable to both the corporation’s management and the Union.

The complexity of the wage computations can be attributed both to the number of variables involved in the calculation process and the diversity of wage classifications. There are three primary factors affecting all employees’ wages, namely, *cost of living allowance*, *progression rates of pay*, and *wage increases guaranteed by contract terms*, as outlined in the Union workers’ agreement [1]. For the Cost of Living Allowance, or COLA, each employee receives a predetermined wage increase of \$0.20 per hour four times per year. These wage increases occur on the third Mondays of March, June, September, and December of any given year. In addition, employees receive progression rates of pay twice per year, on the third Mondays of March and September. Depending on an individual worker’s seniority and classification, he or she receives an additional \$0.15 or \$0.20 per hour as a progression increase. Specifically, those employees within the ‘A’ sub-category of any job classification receive a \$0.20 per hour raise, while their colleagues within the ‘B’ or ‘C’ classes receive only \$0.15 per hour from progression. Finally, all workers, regardless of seniority or job classification, receive a wage increase of \$0.20 per hour once a year as a result of the specific terms within the current Union contract. These wage increases are commonly referred to as ‘Contract’ and they are distributed to employees on the third Monday of March of each year. Table 1 presents the aforementioned wage increase in a more concise manner.

**(as specified in the Union Contract Agreement)**

	<b>March</b>	<b>June</b>	<b>September</b>	<b>December</b>
<b>COLA</b>	\$0.20	\$0.20	\$0.20	\$0.20
<b>Progression</b>	‘A’-level: \$0.20 Other levels: \$0.15	‘A’-level: \$0.00 Other levels: \$0.00	‘A’-level: \$0.20 Other levels: \$0.15	‘A’-level: \$0.00 Other levels: \$0.00
<b>Contract</b>	\$0.20	\$0.00	\$0.00	\$0.00

**Table 1. Pratt & Whitney, Inc. Wage Increase Schedule**

As previously stated, COLA, Contract, and Progression are all applied to employees’ wages at designated times throughout the year. However, two of these wage increments, COLA and Contract, are also applied to the salary ranges of P&W’s various positions. This practice periodically reestablishes wage ranges and serves to keep workers

within the bounds of their job rank’s wage ranges for greater lengths of time. Without this system, employees would reach and surpass the upper wage bound associated with their position in a relatively short period of time. The problem with this lies in the fact that workers must spend a specific amount of time within one job classification before receiving promotion to a higher level. By simultaneously adding COLA and Contract to both employee salaries and wage ranges, P&W avoids this problem by greatly reducing the chance that an employee will reach the upper bound of a wage range before completing the time requirements of his or her job classification. This practice can be summarized as follows:

- COLA and Contract serve to alter wage ranges
- Progression moves employees through such wage ranges

In addition to the three wage increases presented in Table 1, a smaller percentage of P&W employees also receive a fourth type of wage increase. This additional wage increase may be one of two possible types: either a *Shift Premium* or a *wage increase associated with being a Group Leader*. Shift Premiums usually accompany working hours that, for some reason, may seem less desirable to employees. Overnight shifts or weekend hours represent examples of such shifts. The title of a Group Leader is most commonly bestowed upon senior employees who possess an exceptional knowledge of their field. These Group Leaders, in turn, assume various additional responsibilities, which often include serving as an intermediary between their coworkers and management officials. If an employee receives a Shift Premium, then this additional amount, between \$0.30 and \$1.20, bolsters their hourly wage, depending on the particular shift; and if a worker assumes the role of a Group Leader, then he or she receives an additional \$0.60. Shift Premiums and Group Leader raises differ from COLA, Contract, and Progression, however, in that they are not applied to an employee’s wage at a specific time during the year. Instead, these salary increases can be thought of as existing outside of the normal timeline associated with calculating wages. Once a worker’s hourly wage has been determined, these increments are added on to the resultant hourly total. Table 2 briefly outlines the specific facts concerning Shift Premiums and Group Leader wage increases.

	Amount (\$)	# of employees receiving raise
<b>Shift Premiums</b>	\$0.30-\$1.20	35
<b>Group Leader Wage Raises</b>	\$0.60	26

**Table 2. Shift Premiums and Group Leader Raises**

The purpose of this project is to implement in Microsoft Excel a routine that can accurately forecast future wages for each individual presently employed by P&W. Using this Excel routine, rather than distribute wage increases uniformly among the various job titles, P&W management could explore different combinations of wage increases for every position. By allowing management to alter the distribution of wage increases among job categories, using different values for progression, contract, and COLA as

inputs, the routine would enable management to determine an optimal set of wage increases that seems most beneficial to the company's finances. The model also will calculate the percent increase of employee salaries for each year of a four-year period.

In the following sections of this report, we shall present an algorithm implemented in Excel that calculates the hourly wages for P&W'S employees over a four-year period.

The *Experimental Methodology* section provides a synopsis of the complications associated with developing such a routine in Excel as well as specific information regarding the techniques employed for overcoming such obstacles. Most importantly, however, the *Experimental Methodology* portion of this report presents a detailed account of one employee's progression through P&W's job ranks and salary ranges.

The subsequent *Analysis* segment complements the *Experimental Methodology* section by serving two purposes. First, this portion of the report explains the mathematical basis for calculating the future hourly wages of P&W employees within various job categories. Second, this section identifies the numerical values utilized in carrying out the calculations.

## II. Experimental Methodology

The primary objective of this project is to create an Excel routine that can accomplish two specific tasks:

- ❶ Forecast the future hourly wages of individual employees
- ❷ Calculate the percent increases in total salary expenditure per year

Before programming in Excel, though, we must evaluate two aspects of P&W employee progression. First, we must analyze the manner in which P&W employees receive contractually guaranteed hourly pay raises over the course of one year. Second, we must investigate the relationship between these wage increases and the promotion of employees through P&W's job ranks. The best method for illustrating how P&W employees receive the various wage increases and move through the job ranks lies in following a specific employee through the ranks of his or her job category.

P&W employees are divided into two categories, referred to as *Tier I* and *Tier II*. The difference between these subgroups of employees is that all members of Tier I were originally hired by the company before March 15, 1995. It is also important to note that Tier I represents a substantially smaller group of employees than Tier II. Most P&W employees were, in fact, hired after March 15, 1995, and, thus, are members of Tier II. Employees with Assistant status represent a special type of Tier II employee. These individuals receive wage increases and progress through the ranks in manners different from P&W employees already established within a job category. For the first sixty days of their employment, all Assistants receive \$8.00 per hour. At the end of this sixty-day period, the Assistants become members of the workers Union and receive a \$0.50 wage increase. Then, after six months of receiving \$8.50 per hour, Assistants progress to an Assistant level with a \$9.25 corresponding hourly wage. Upon completing six months at this wage level, Assistants receive another wage increase of \$0.50, giving them \$9.75 per

hour. After another six months of receiving \$9.75 per hour, Assistants adopt an hourly wage of \$10.25. Finally, after four months at this level, at the end of the twenty-second month of their employment, Assistants assume the status of a regular Tier II employee, adopting the lower bound of the salary range corresponding to their job category. At first glance, this advancement process may not seem different from the route followed by other employees. However, it is important to note that, although Assistants receive Progression like other employees, they do not carry these wage increases with them as they move to the next sub-level of the Assistant category. For example, during the first six months of employment, an arbitrary Assistant may receive wage increases from COLA, Contract, and Progression. However, upon graduation to the next Assistant level, previously received Progression increases are subtracted from the employees' hourly wage. This practice is applied only to Assistant employees.

In choosing an arbitrary employee as an example of how workers progress through P&W's system, it is clearly best to focus on a Tier II employee. The reason for this is that Tier II employees have greater opportunity for advancement than Tier I members. Once Tier I employees reach the upper bound on their wage range, they only continue to receive COLA and Contract wage increases. These employees no longer receive Progression, since they cannot move any higher within the ranks. Therefore, examining a Tier II employee affords one a better perspective on the difficulties encountered in tracking employees' progress through P&W's job ranks.

The following analysis tracks an employee through the ranks of their respective job category over a four-year period. Since P&W's negotiations with the labor Union begin on March 15, the company's fiscal year extends from March 16 of one year to March 15 of the next year. Thus, for the purposes of these calculations, we shall assume that the four-year period extends from March 15, 2002 to March 15, 2005. We shall also assume that the employee's basic wage represents his or her wage as of December 31, 2001. Since P&W employees do not receive any wage increases between December 31, 2001 and March 15, 2002, this December wage will serve as the worker's salary on March 15, 2002.

In this case, we shall consider employee number 1536, a Production Molder of rank 'C' who entered this job classification August 21, 2001. The employee's basic wage, as of December 31, 2001 is \$12.68 per hour. This wage seems perfectly reasonable, as it lies within the designated wage range for a Production Molder C (\$12.23 - \$13.53). So, at the start of the first calculated year, employee 1536 is still earning \$12.68 per hour. However, on March 18, 2002, employee 1536 receives three wage raises: COLA, Contract, and Progression. This combined increase of \$0.55 boosts employee 1536's hourly wage to \$13.23. However, COLA and Contract also alter the wage range, which becomes \$12.63-\$13.93. In June, COLA is applied to both 1536's wage and the wage range of Production Molder 'C', elevating these quantities to \$13.43 and \$12.83-\$14.13, respectively. In September, 1536 receives COLA and Progression, increasing his salary to \$13.78 per hour. The wage range, in turn, becomes \$13.03-\$14.33. Finally, in December the COLA increment raises 1536's wage to an hourly \$13.98 and alters the wage range to \$13.23-\$14.53.

Thus, employee 1536 enters into the second year of consideration, which begins March 16, 2003, earning an hourly wage of \$13.98 within a range of \$13.23-\$14.53. On March 17, 1536 earns \$0.55 from the three wage increases, elevating his wage to \$14.53.

The wage range boundaries also increase by \$0.40, becoming \$13.63-\$14.93. The contribution of COLA in June raises 1536's wage to \$14.73 and increases the wage range to \$13.83-\$15.13. Thus, by the time that the next wage increases occur in September, employee 1536 already has fulfilled his time requirement as a Production Molder 'C', and has received promotion to the level of a Production Molder 'B'. Like the wage ranges corresponding to Production Molder 'C', the wage ranges associated with Production Molder 'B' also have been affected by COLA and Contract. So, upon promotion, employee 1536 assumes the lower bound of this new range, which is \$16.33. In September, upon receiving COLA and Progression, 1536 earns \$15.68 within a wage range of \$15.53-\$17.25. In December, COLA increases 1536's wage to \$15.88 and changes the wage range to \$15.73-\$17.45. However, in this case, the month of December does not present the last wage increments of the year. In March 2004, the third Monday of the month falls on March 15. So, employee 1536 receives another round of COLA, Contract, and Progression during this second year of calculation. On March 15, these additional wages raise 1536's hourly salary to \$16.43. COLA and Contract also alter the wage range, which becomes \$16.13-\$17.85.

Entering into the third year of calculations, since 1536 has already received the wage increases designated for March 2004, the first wage increments of the business year occur in June, when COLA is applied to both 1536's wage and the range. This raises 1536's hourly rate to \$16.63 and the wage range to \$16.33-\$18.05. In September 2004, 1536 receives COLA and Progression, which raise the hourly rate to \$16.98 and extends the range to \$16.53-\$18.25. In December 2004, 1536 earns \$17.18, and the range is altered to \$16.73-\$18.45.

By the fourth year of calculations, 1536 has already risen to the level of Production Molder 'B', and on March 21, 2005, he or she receives an additional \$0.55 for a total wage of \$17.43 per hour. The wage range becomes \$17.13-\$18.85. In June, COLA elevates 1536's wage to \$17.63 within a range of \$17.33-\$19.05. September's additional \$0.35 increases 1536's wage to \$17.98 and COLA alters the wage range to \$17.53-\$19.25. Finally, in December 2005, employee 1536 receives the last COLA increment for this four-year period, boosting his or her hourly wage to \$18.18 within a range of \$17.73-\$19.45. **Table 3** displays employee 1536's hourly wage and corresponding wage range for each March 15 from 2002 to 2005.

	Employee 1536's Hourly Wage	Wage Range Associated with a Production Molder
March 15, 2002	\$12.68	\$12.23-\$13.53
March 15, 2003	\$13.98	\$13.23-\$14.53
March 15, 2004	\$16.43	\$16.13-\$17.85
March 15, 2005	\$17.18	\$16.73-\$18.45

**Table 3. Employee 1536's Hourly Wage and Wage Range**

The Excel routine is designed to forecast the wages of all P&W employees over a four-year period. Since the union negotiations begin on March 15, the one-year period ends on that date. The Excel routine contains the employee's ID, the hourly wage as of December 31, and any extra income associated with being a group leader or receiving a shift premium. This data is supplied by the company. The program's output includes the four-year forecast of each employee's wage, the average wage each year, and the percent increase in P&W's total salary expenditures over the four years.

The most critical component of the routine is entitled *Tier 2*. This table contains each Tier 2 employee's current position and hourly wage. More importantly, though, this table allows the user to input values for Contract, COLA, and Progression. Once the user has entered values for these variables, the worksheet displays each employee's hourly wage after each year of the designated four-year period, the percent increase in salary expenditures between years, and the position of each employee within their job category after the four-year period. The routine also utilizes several lookup tables.

The first of these tables, entitled *MainTable*, contains the projected ranks and the amounts of Progression for all employees over the chosen four-year period. The lookup table entitled *Times* contains the designated time requirements for each position within the P&W corporation. This table enables the program to project an employee's job rank after four years. The lookup table entitled *Ranges* displays the wage ranges associated with each job rank over the four years. This represents a crucial component of the routine. As previously stated, COLA and Contract wage increases alter wage ranges as well as employee wages. Thus, this lookup table allows the program to determine whether or not an employee's hourly wage lies within the appropriate range, or whether he or she has reached the range's upper bound. The table entitled *MondayTierII* calculates the wage increases received by employees on March 15 and September 15 of each year during the four-year period, contingent upon these dates falling on a Monday. The table designated *Assistants* projects the wages and ranks for all employees within the Assistant job rank over four years. This is extremely important since the assistants progress through company ranks in a fashion very different from all other employees.

The main lookup table, *MainTable*, which contains the ranks, progression rates, and the starting date to the specific rank for each employee is calculated first so that each employee's rank is known throughout the considered four-year period. Then, the routine performs the subsequent calculations by following the procedures outlined in the previous sections.

The most significant difficulty in using Excel is not being able to control any cells other than the cell specified by the formula entered by the user. This difficulty is overcome by recalculating all the necessary information for the months, March and September, during which the progression is applied to the wages. Since the progression rate depends on an employee's rank and the starting date within a rank must be initialized every time an employee advances to a new rank, the routine's lookup tables greatly simplified the calculations in the main worksheet.

### **III. Analysis**

It is a complex task to create an Excel program that calculates the future salaries of over one hundred eighty employees. The challenge in designing such a routine lies in how to

track each employee's progress through the job ranks. The wage increases associated with advancement within the company represent a crucial component in determining both individual salaries and future payrolls.

Under Pratt & Whitney's current system for professional advancement, employees must spend a predetermined length of time within a certain job classification before progressing to the next highest level. At each level of employment, workers' wages are restricted by salary ranges. In other words, a lower bound and an upper bound serve to establish wage ranges for each job classification. Also, employees receive wage increases upon receiving promotion to the next level.

Thus, in tracking employee advancement for the purpose of wage calculation, one must consider not only the employee's starting date within a certain position, but also where that classification lies in the hierarchy of its job category. If an employee reaches the upper salary boundary for his or her job classification before he or she has fulfilled the time requirement, then he or she shall not receive any more Progression until advancing to the next highest classification. At that time, upon receiving promotion, the employee shall assume an hourly wage equal to the lower boundary of their new position's salary range. On the other hand, if an employee fulfills a position's time requirement before reaching the upper wage boundary, then he or she immediately advances to the next job category, adopting this classification's lower boundary on salary as his or her wage.

However, as previously mentioned these conditions are only of concern when dealing with Tier II employees, because Tier I workers have already reached 'AA' status and can not progress to any higher classification.

#### **IV. Assumptions**

For the purposes of this experiment's algorithm, the group must make a certain number of assumptions before beginning to design the Excel routine.

**Assumption 1:** Time is the sole factor that determines how an employee progresses through the ranks of his or her respective job category. In other words, the employee does not have to perform to some predetermined level of satisfaction or pass any sort of requirements or exams. He or she simply must invest the specified amount of time in order to receive promotion to the next level. We are basing this assumption on both the information that we have received from P&W and information that we discovered in *Union Contract Clauses* [2], a compilation of various union contract clauses.

**Assumption 2:** In the data provided by P&W, there are several examples of employees whose wages have surpassed the upper wage bound associated with their job classification. In these cases, we have attributed the inflated wage to a switch in job areas. If an employee achieves a considerable level of success in one job classification, yet, for some reason, decides to change to another job classification, then he or she must start from the bottom of the ranks once again. However, he or she does not have to accept the lower salary of their new classification's entry level. These workers may continue to earn the hourly wage of their previous job classification.

**Assumption 3:** In order to establish a reference point for our wage calculations, we shall

assume that employees' initial wages are the hourly wages as of December 31 of the year before the four-year period's first year.

**Assumption 4:** Within the Excel routine, every P&W employee is assigned a appropriate starting date to their current position within the company. Since these specific dates were not supplied by P&W, the dates must be assumed for each employee in order to follow employees through the job ranks and accurately forecast their future positions and hourly wages.

## IV. Results

Upon examining the tracking of employee 1536 through the Production Molder ranks, as presented in this report's *Experimental Methodology* section, the process of tracking employee advancement and wage changes may seem straightforward. However, implementing this in an Excel program proved to be an extremely intricate task. Some of the most challenging aspects of this problem were presented by the multitude of variables, the problem of constantly monitoring the day and date, and cases in which employees switched job categories. However, by relying on four worksheets within the Excel routine and several programming functions, we were able to develop a successful model in accordance with the requirements of P&W management officials. The complete results of this project, presented in the form of the finalized Excel routine, are given in Appendix A.

The final percentages in annual salary expenditures for the P&W corporation over a four-year period are illustrated through the following graphs. Figure 1 and Figure 2 display each year's average wage for every employee in Tier I and Tier II, respectively. Figure 3 and Figure 4 show the percent increases in annual salary expenditures for Tier I and Tier II employees, respectively. Figure 5 displays each year's average hourly wage for both Tier I employees and Tier II employees. Figure 6 shows the percent increases in hourly wages for both Tier I employees and Tier II employees for each year over a considered four-year period.

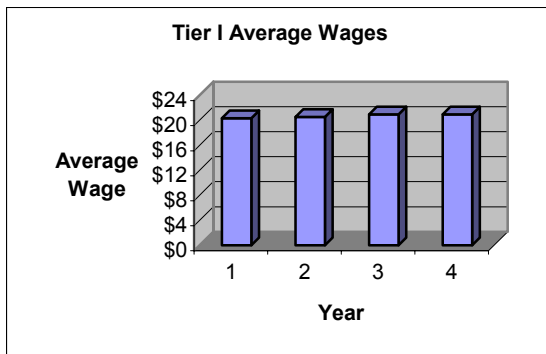


Figure 1

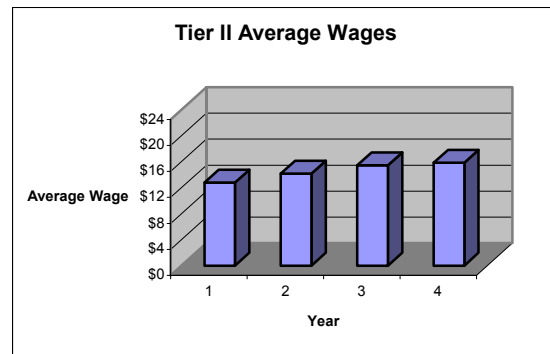
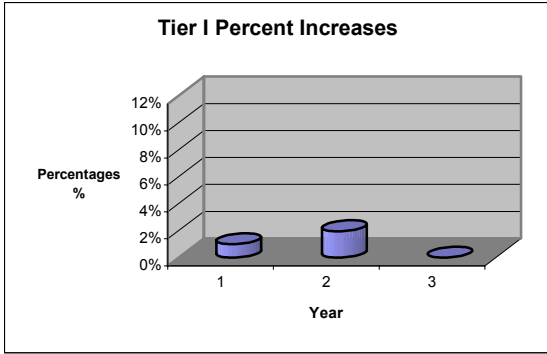
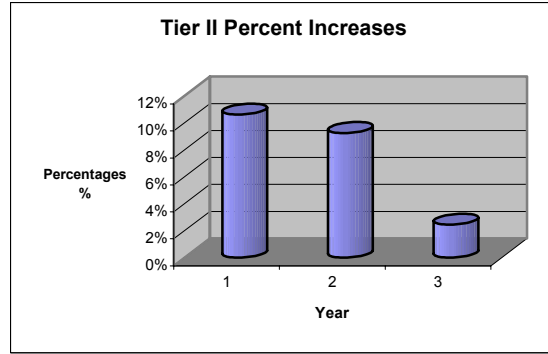


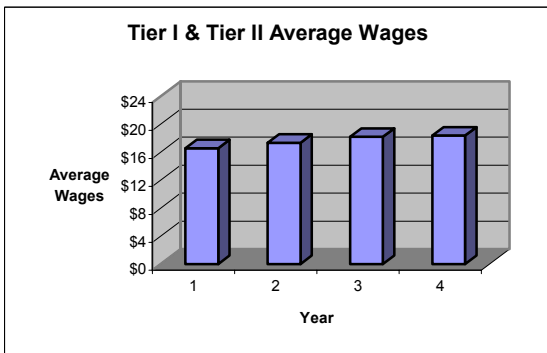
Figure 2



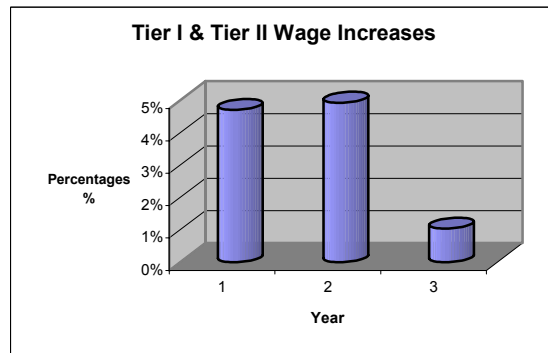
**Figure 3**



**Figure 4**



**Figure 5**



**Figure 5**

## V. Discussion

As illustrated in Appendix A of this report, the completed Excel routine accomplishes both of this projects stated objectives. First, the model accurately forecasts the wages of individual P&W employees for each year of a four-year period specified by the user. Second, the routine calculates and displays the percent difference in P&W’s total salary expenditure from one year to the next. However, the project certainly presented several formidable obstacles during the creation of the Excel routine.

In order to perform the complex calculations involved with this project, one must be able to manipulate several variables. Unfortunately, Excel limits a user’s ability to control certain cells. The user can alter the values contained only in those cells entered by the corresponding formula. Initially, this inability to control a cell from outside that cell presented a significant problem. However, by creating several worksheets and implementing them as look-up tables, we were able to overcome this difficulty. Although Excel represents a very effective program, especially in processing both input values and output values, it certainly does not provide an ideal programming environment. The calculations associated with this project could have been performed more easily with a low-level programming language, such as Visual Basic.

Before entering into the development phase of this project, the members of this group were forced to make several assumptions, as a result of a lack of specific

information. These assumptions, which are outlined in the previous ‘Assumptions’ section, convey information critical to the understanding and the utilization of the Excel routine.

In order to create a tool even more useful to P&W management officials, future programmers may choose to switch the roles of the input variables and the output variables. This would allow users to input a desired percentage increase in salary expenditure for some four-year period, so that they may determine the exact COLA , Contract, and Progression values that correspond to this percentage increase. However, as stated previously, a low-level programming language could accomplish this programming task much more effectively. Also, using a low-level programming language would allow P&W to develop a control whereby they could add and delete employees from the model. Under the given circumstances, with Excel as the preferred programming language, creating such a control was not possible.

## **VI. Conclusions**

The three following conclusions are supported by the results of this project.

- The completed Excel model accurately forecasts the hourly wages for all current P&W employees over a chosen four-year period. These hourly wage values depend on the input values, COLA, Contract, and Progression, entered by the user.
- The Excel routine also provides P&W management with the percentage increases in annual salary expenditures. P&W management officials may repeatedly alter their input values in order to determine which potential contract terms ensure a specific percentage increase.
- The most accurate percentage increases in total annual salary expenditures are achieved by omitting Cola wage increases received by employees from the final calculations.

## VII. References

- [1] “Agreement between Auto-Air Composites, Inc. of Lansing, Michigan and Lodge No.2184 International Association of Machinists”, March 1998, Articles VII, XXI, XXII, XXIII, and XXIV.
- [2] *Union Contract Clauses.* Commerce Clearing House, Inc. : Publishers of Topical Law Reports, Chicago, Illinois, 1954.
- [3] MacCluer, Charles R. *Industrial Mathematics: Modeling in Industry, Science, and Government.* Prentice Hall Publishers, Upper Saddle River, New Jersey, 2000.

## Appendix A

<b>Prog. A</b>	<b>Progression</b>
0.20	0.15

<b>Average</b>	<b>\$20.30</b>	<b>\$20.50</b>	<b>\$20.90</b>	<b>\$20.90</b>
<b>% Increase</b>		<b>0.99%</b>	<b>1.95%</b>	<b>0.00%</b>

EMPLOYEE	JOB CLASSIFICATION	TOTAL WAGES (HR.)	1st Year	2nd Year	3rd Year	4th Year
1054	AUTO-CLAVE AA	\$22.24	\$22.24	\$23.24	\$24.64	\$25.24
1063	AUTO-CLAVE AA	\$20.17	\$20.17	\$21.17	\$22.57	\$23.17
1122	AUTO-CLAVE AA	\$19.40	\$19.40	\$20.40	\$21.80	\$22.40
1024	ETCHING AA	\$19.40	\$19.40	\$20.40	\$21.80	\$22.40
1206	INSPECTOR AA	\$21.94	\$21.94	\$22.94	\$24.34	\$24.94
1117	INSPECTOR AA	\$22.00	\$22.00	\$23.00	\$24.40	\$25.00
1134	INSPECTOR AA	\$21.19	\$21.19	\$22.19	\$23.59	\$24.19
1154	INSPECTOR AA	\$21.49	\$21.49	\$22.49	\$23.89	\$24.49
1174	INSPECTOR AA	\$20.98	\$20.98	\$21.98	\$23.38	\$23.98
1068	INSPECTOR AA	\$21.40	\$21.40	\$22.40	\$23.80	\$24.40
1071	INSPECTOR AA	\$20.59	\$20.59	\$21.59	\$22.99	\$23.59
1098	INSPECTOR A	\$20.33	\$20.33	\$21.33	\$22.73	\$23.33
1180	JIG & FIXTURE AA	\$21.09	\$21.09	\$22.09	\$23.49	\$24.09
1007	JIG & FIXTURE AA	\$21.58	\$21.58	\$22.58	\$23.98	\$24.58
1173	JIG & FIXTURE AA	\$20.59	\$20.59	\$21.59	\$22.99	\$23.59
1013	JIG & FIXTURE AA	\$20.98	\$20.98	\$21.98	\$23.38	\$23.98
1216	JIG & FIXTURE AA	\$21.24	\$21.24	\$22.24	\$23.64	\$24.24
1207	JIG & FIXTURE AA	\$20.19	\$20.19	\$21.19	\$22.59	\$23.19
1177	JIG & FIXTURE AA	\$20.98	\$20.98	\$21.98	\$23.38	\$23.98
1037	JIG & FIXTURE AA	\$20.64	\$20.64	\$21.64	\$23.04	\$23.64
1041	JIG & FIXTURE AA	\$21.58	\$21.58	\$22.58	\$23.98	\$24.58
1128	JIG & FIXTURE AA	\$21.09	\$21.09	\$22.09	\$23.49	\$24.09
1250	JIG & FIXTURE AA	\$20.29	\$20.29	\$21.29	\$22.69	\$23.29
1224	JIG & FIXTURE AA	\$20.69	\$20.69	\$21.69	\$23.09	\$23.69
1581	JIG & FIXTURE AA	\$20.98	\$20.98	\$21.98	\$23.38	\$23.98
1223	JIG & FIXTURE AA	\$20.19	\$20.19	\$21.19	\$22.59	\$23.19
1058	JIG & FIXTURE AA	\$20.98	\$20.98	\$21.98	\$23.38	\$23.98
1060	JIG & FIXTURE AA	\$21.58	\$21.58	\$22.58	\$23.98	\$24.58
1129	JIG & FIXTURE AA	\$20.44	\$20.44	\$21.44	\$22.84	\$23.44
1075	JIG & FIXTURE AA	\$20.98	\$20.98	\$21.98	\$23.38	\$23.98
1252	JIG & FIXTURE A	\$19.84	\$19.84	\$20.84	\$22.24	\$22.84
1150	JIG & FIXTURE B	\$21.34	\$21.34	\$22.34	\$23.74	\$24.34
1244	LAB ASSISTANT AA	\$18.84	\$18.84	\$19.84	\$21.24	\$21.84
1203	MACHINIST AA	\$20.28	\$20.28	\$21.28	\$22.68	\$23.28
1197	MACHINIST AA	\$20.98	\$20.98	\$21.98	\$23.38	\$23.98

1161	MACHINIST AA	\$20.98	\$20.98	\$21.98	\$23.38	\$23.98	
1586	MACHINIST AA	\$20.29	\$20.29	\$21.29	\$22.69	\$23.29	
1064	MACHINIST AA	\$21.58	\$21.58	\$22.58	\$23.98	\$24.58	
1066	MACHINIST AA	\$20.22	\$20.22	\$21.22	\$22.62	\$23.22	
1190	MACHINIST AA	\$20.69	\$20.69	\$21.69	\$23.09	\$23.69	
1123	MACHINIST B	\$17.76	\$17.76	\$18.76	\$20.16	\$20.76	
1000	MAINTENANCE AA	\$20.98	\$20.98	\$21.98	\$23.38	\$23.98	
1116	MAINTENANCE AA	\$20.98	\$20.98	\$21.98	\$23.38	\$23.98	
1663	MAINTENANCE AA	\$20.98	\$20.98	\$21.98	\$23.38	\$23.98	
1008	MAINTENANCE A	\$19.96	\$19.96	\$20.96	\$22.36	\$22.96	
1153	MAINTENANCE B	\$19.48	\$19.48	\$20.48	\$21.88	\$22.48	
1661	PRODUCTION MOLDER AA	\$19.39	\$19.39	\$20.39	\$21.79	\$22.39	
1005	PRODUCTION MOLDER AA	\$20.00	\$20.00	\$21.00	\$22.40	\$23.00	
1215	PRODUCTION MOLDER AA	\$19.40	\$19.40	\$20.40	\$21.80	\$22.40	
1010	PRODUCTION MOLDER AA	\$20.15	\$20.15	\$21.15	\$22.55	\$23.15	
1242	PRODUCTION MOLDER AA	\$18.89	\$18.89	\$19.89	\$21.29	\$21.89	
1245	PRODUCTION MOLDER AA	\$18.79	\$18.79	\$19.79	\$21.19	\$21.79	
1074	PRODUCTION MOLDER AA	\$20.39	\$20.39	\$21.39	\$22.79	\$23.39	
1107	PRODUCTION MOLDER AA	\$20.00	\$20.00	\$21.00	\$22.40	\$23.00	
1159	PRODUCTION MOLDER AA	\$19.40	\$19.40	\$20.40	\$21.80	\$22.40	
1200	PRODUCTION MOLDER AA	\$19.34	\$19.34	\$20.34	\$21.74	\$22.34	
1145	PRODUCTION MOLDER AA	\$20.60	\$20.60	\$21.60	\$23.00	\$23.60	
1028	PRODUCTION MOLDER AA	\$19.40	\$19.40	\$20.40	\$21.80	\$22.40	
1160	PRODUCTION MOLDER AA	\$20.00	\$20.00	\$21.00	\$22.40	\$23.00	
1155	PRODUCTION MOLDER AA	\$19.40	\$19.40	\$20.40	\$21.80	\$22.40	
1036	PRODUCTION MOLDER AA	\$20.00	\$20.00	\$21.00	\$22.40	\$23.00	
1157	PRODUCTION MOLDER AA	\$21.20	\$21.20	\$22.20	\$23.60	\$24.20	
1545	PRODUCTION MOLDER AA	\$19.40	\$19.40	\$20.40	\$21.80	\$22.40	
1178	PRODUCTION MOLDER AA	\$20.00	\$20.00	\$21.00	\$22.40	\$23.00	
1046	PRODUCTION MOLDER AA	\$19.40	\$19.40	\$20.40	\$21.80	\$22.40	
1049	PRODUCTION MOLDER AA	\$19.47	\$19.47	\$20.47	\$21.87	\$22.47	
1144	PRODUCTION MOLDER AA	\$18.89	\$18.89	\$19.89	\$21.29	\$21.89	
1256	PRODUCTION MOLDER AA	\$18.79	\$18.79	\$19.79	\$21.19	\$21.79	
1184	PRODUCTION MOLDER AA	\$19.24	\$19.24	\$20.24	\$21.64	\$22.24	
1052	PRODUCTION MOLDER AA	\$19.40	\$19.40	\$20.40	\$21.80	\$22.40	
1067	PRODUCTION MOLDER AA	\$22.62	\$22.62	\$23.62	\$25.02	\$25.62	
1106	PRODUCTION MOLDER AA	\$19.40	\$19.40	\$20.40	\$21.80	\$22.40	
1255	PRODUCTION MOLDER AA	\$18.79	\$18.79	\$19.79	\$21.19	\$21.79	
1548	PRODUCTION MOLDER AA	\$20.00	\$20.00	\$21.00	\$22.40	\$23.00	
1099	PRODUCTION MOLDER C	\$21.64	\$21.64	\$22.64	\$24.04	\$24.64	
1104	TOOL CRIB ATTENDANT AA	\$19.40	\$19.40	\$20.40	\$21.80	\$22.40	
1040	TOOL CRIB ATTENDANT AA	\$19.40	\$19.40	\$20.40	\$21.80	\$22.40	
1044	TOOL CRIB ATTENDANT AA	\$19.40	\$19.40	\$20.40	\$21.80	\$22.40	
1076	TOOL CRIB ATTENDANT AA	\$19.40	\$19.40	\$20.40	\$21.80	\$22.40	

Progression A		Progression		Average	\$12.80	\$14.16	\$15.46	\$15.84
0.20	0.15			% Increase		10.60%	9.24%	2.44%
EMPLOYEE	JOB CLASSIFICATION	TOTAL WAGES (HR.)	Start. D.	1st Year	2nd Year	3rd Year	4th Year	
1671	ETCHING ASSISTANT	\$9.75	04/06/2001	\$9.75	\$13.53	\$15.38	\$16.63	
1420	INSPECTOR B	\$17.54	01/01/2001	\$17.54	\$18.54	\$20.54	\$21.34	
1439	INSPECTOR B	\$15.53	02/21/2000	\$16.49	\$17.89	\$19.89	\$20.69	
1589	JIG & FIXTURE A	\$16.89	02/12/2000	\$16.89	\$18.29	\$20.29	\$21.09	
1430	JIG & FIXTURE A	\$16.89	02/04/2001	\$16.89	\$18.29	\$20.29	\$21.09	
1449	JIG & FIXTURE A	\$17.48	01/02/2001	\$17.48	\$18.88	\$20.88	\$21.68	
1433	JIG & FIXTURE A	\$17.39	08/21/1999	\$17.39	\$18.79	\$20.79	\$21.59	
1484	JIG & FIXTURE A	\$16.99	02/21/1999	\$16.99	\$18.39	\$20.39	\$21.19	
1444	JIG & FIXTURE A	\$17.78	02/12/1999	\$17.78	\$19.18	\$21.18	\$21.98	
1480	JIG & FIXTURE A	\$16.99	02/04/2001	\$16.99	\$18.39	\$20.39	\$21.19	
1487	JIG & FIXTURE A	\$17.29	01/02/2001	\$17.29	\$18.69	\$20.69	\$21.49	
1472	JIG & FIXTURE A	\$17.99	08/21/1999	\$17.99	\$19.39	\$21.39	\$22.19	
1427	JIG & FIXTURE A	\$17.29	02/21/1999	\$17.29	\$18.69	\$20.69	\$21.49	
1423	JIG & FIXTURE B	\$15.83	02/12/1999	\$17.19	\$18.59	\$20.59	\$21.39	
1600	JIG & FIXTURE B	\$15.13	02/04/2001	\$15.13	\$17.19	\$19.19	\$19.99	
1465	JIG & FIXTURE B	\$15.23	01/02/2001	\$15.23	\$17.19	\$19.19	\$19.99	
1607	JIG & FIXTURE B	\$15.13	08/21/2001	\$15.13	\$16.43	\$19.39	\$20.19	
1554	JIG & FIXTURE B	\$15.43	02/21/1999	\$16.89	\$18.29	\$20.29	\$21.09	
1612	JIG & FIXTURE B	\$15.13	02/12/1999	\$16.59	\$17.99	\$19.99	\$20.79	
1511	JIG & FIXTURE B	\$15.13	02/04/2001	\$15.13	\$17.19	\$19.19	\$19.99	
1535	JIG & FIXTURE B	\$15.13	01/02/2001	\$15.13	\$17.19	\$19.19	\$19.99	
1551	JIG & FIXTURE B	\$14.98	08/21/1999	\$16.59	\$17.99	\$19.99	\$20.79	
1463	JIG & FIXTURE B	\$15.23	02/21/1999	\$16.59	\$17.99	\$19.99	\$20.79	
1497	JIG & FIXTURE B	\$15.23	02/12/2000	\$16.19	\$17.59	\$19.59	\$20.39	
1452	JIG & FIXTURE B	\$16.32	02/04/2001	\$16.32	\$17.32	\$19.32	\$20.12	
1398	LAMINATOR A	\$15.95	02/04/2001	\$15.95	\$17.35	\$19.35	\$20.15	
1500	LAMINATOR B	\$13.98	01/02/2001	\$13.98	\$16.25	\$18.25	\$19.05	
1476	MACHINIST B	\$15.37	08/21/2001	\$15.37	\$16.67	\$19.69	\$20.49	
1675	MACHINIST B	\$16.05	02/21/1999	\$16.89	\$18.29	\$20.29	\$21.09	
1495	MACHINIST TRAINEE	\$12.68	02/12/1999	\$13.38	\$16.13	\$19.19	\$19.99	
1466	MAINTENANCE A	\$16.89	02/04/2001	\$16.89	\$18.29	\$20.29	\$21.09	
1419	MAINTENANCE B	\$15.73	01/02/2001	\$15.73	\$17.49	\$19.49	\$20.29	
1664	PRODUCTION MOLDER A	\$16.55	08/21/1999	\$16.55	\$17.95	\$19.95	\$20.75	
1544	PRODUCTION MOLDER A	\$15.95	02/21/1999	\$15.95	\$17.35	\$19.35	\$20.15	
1402	PRODUCTION MOLDER A	\$16.65	02/12/1999	\$16.65	\$18.05	\$20.05	\$20.85	
1395	PRODUCTION MOLDER A	\$16.25	02/04/2001	\$16.25	\$17.65	\$19.65	\$20.45	
1400	PRODUCTION MOLDER B	\$15.33	01/02/2001	\$15.33	\$16.33	\$18.33	\$19.13	
1397	PRODUCTION MOLDER B	\$13.83	08/21/2001	\$13.83	\$15.13	\$18.45	\$19.25	
1432	PRODUCTION MOLDER B	\$14.78	02/21/1999	\$16.25	\$17.65	\$19.65	\$20.45	

1547	PRODUCTION MOLDER C	\$12.68	02/12/1999	\$13.73	\$16.25	\$18.25	\$19.05
1510	PRODUCTION MOLDER C	\$12.68	02/04/2001	\$12.68	\$14.33	\$16.18	\$18.25
1549	PRODUCTION MOLDER C	\$13.28	02/04/2001	\$13.28	\$14.93	\$16.78	\$18.85
1606	PRODUCTION MOLDER C	\$12.53	01/02/2001	\$12.53	\$14.33	\$16.18	\$18.25
1569	PRODUCTION MOLDER C	\$12.83	08/21/1999	\$14.03	\$15.33	\$18.75	\$19.55
1534	PRODUCTION MOLDER C	\$12.68	02/21/1999	\$13.73	\$16.25	\$18.25	\$19.05
1540	PRODUCTION MOLDER C	\$12.68	02/12/1999	\$13.73	\$16.25	\$18.25	\$19.05
1451	PRODUCTION MOLDER C	\$13.27	02/04/2001	\$13.27	\$14.42	\$16.27	\$18.25
1410	PRODUCTION MOLDER C	\$13.53	01/02/2001	\$13.53	\$14.53	\$16.38	\$18.25
1188	PRODUCTION MOLDER C	\$12.98	08/21/2001	\$12.98	\$14.28	\$16.73	\$17.48
1537	PRODUCTION MOLDER C	\$13.28	02/21/2000	\$13.93	\$15.23	\$18.85	\$19.65
1604	PRODUCTION MOLDER C	\$12.38	02/12/1999	\$13.73	\$16.25	\$18.25	\$19.05
1733	PRODUCTION MOLDER C	\$12.38	02/04/2001	\$12.38	\$14.33	\$16.18	\$18.25
1621	PRODUCTION MOLDER C	\$12.53	01/02/2001	\$12.53	\$14.33	\$16.18	\$18.25
1536	PRODUCTION MOLDER C	\$12.68	08/21/2001	\$12.68	\$13.98	\$16.43	\$17.18
1587	PRODUCTION MOLDER C	\$13.33	02/21/1999	\$13.73	\$16.25	\$18.25	\$19.05
1602	PRODUCTION MOLDER C	\$12.53	02/12/2001	\$12.53	\$14.33	\$16.18	\$18.25
1488	PRODUCTION MOLDER C	\$13.06	02/04/2001	\$13.06	\$14.33	\$16.18	\$18.25
1519	PRODUCTION MOLDER C	\$12.98	02/04/2001	\$12.98	\$14.63	\$16.48	\$18.55
1187	PRODUCTION MOLDER C	\$12.68	01/02/2001	\$12.68	\$14.33	\$16.18	\$18.25
1568	PRODUCTION MOLDER C	\$12.83	08/21/2000	\$12.83	\$14.98	\$16.83	\$18.95
1562	PRODUCTION MOLDER C	\$12.53	02/21/2001	\$12.53	\$14.33	\$16.18	\$18.25
1731	PRODUCTION MOLDER ASSISTANT	\$8.00	12/12/2001	\$8.50	\$12.00	\$14.63	\$15.38
1696	PRODUCTION MOLDER ASSISTANT	\$8.83	08/08/2001	\$9.78	\$11.98	\$15.08	\$15.83
1685	PRODUCTION MOLDER ASSISTANT	\$8.68	08/18/2001	\$9.63	\$12.88	\$14.78	\$15.53
1710	PRODUCTION MOLDER ASSISTANT	\$8.51	07/07/2001	\$9.46	\$11.66	\$14.78	\$15.53
1727	PRODUCTION MOLDER ASSISTANT	\$8.01	12/10/2001	\$8.50	\$12.00	\$14.63	\$15.38
1722	PRODUCTION MOLDER ASSISTANT	\$8.31	12/12/2001	\$8.80	\$12.30	\$14.93	\$15.68
1698	PRODUCTION MOLDER ASSISTANT	\$9.28	04/24/2001	\$9.28	\$13.23	\$15.08	\$16.33
1692	PRODUCTION MOLDER ASSISTANT	\$8.93	09/08/2001	\$9.88	\$13.13	\$15.18	\$15.93
1678	PRODUCTION MOLDER ASSISTANT	\$8.00	12/21/2001	\$8.00	\$10.95	\$14.63	\$15.38
1735	PRODUCTION MOLDER ASSISTANT	\$8.85	07/21/2001	\$9.80	\$12.00	\$14.78	\$15.53
1697	PRODUCTION MOLDER ASSISTANT	\$8.30	12/01/2001	\$8.80	\$12.30	\$14.93	\$15.68
1723	PRODUCTION MOLDER ASSISTANT	\$8.51	07/07/2001	\$9.46	\$11.66	\$14.78	\$15.53
1704	PRODUCTION MOLDER ASSISTANT	\$8.83	07/07/2001	\$9.78	\$11.98	\$15.08	\$15.83
1693	PRODUCTION MOLDER ASSISTANT	\$8.53	09/08/2001	\$9.48	\$12.73	\$14.78	\$15.53
1709	PRODUCTION MOLDER ASSISTANT	\$8.83	09/08/2001	\$9.78	\$13.03	\$15.08	\$15.83
1688	PRODUCTION MOLDER ASSISTANT	\$8.01	12/21/2001	\$8.01	\$10.95	\$14.63	\$15.38
1734	PRODUCTION MOLDER ASSISTANT	\$8.83	07/07/2001	\$9.78	\$11.98	\$15.08	\$15.83
1683	PRODUCTION MOLDER ASSISTANT	\$8.68	07/06/2001	\$9.63	\$11.83	\$14.78	\$15.53
1700	PRODUCTION MOLDER ASSISTANT	\$8.93	07/07/2001	\$9.88	\$12.08	\$15.18	\$15.93
1713	PRODUCTION MOLDER ASSISTANT	\$8.01	11/21/2001	\$8.50	\$12.00	\$14.63	\$15.38
1676	PRODUCTION MOLDER ASSISTANT	\$9.45	03/24/2001	\$9.45	\$13.23	\$15.08	\$16.33
1673	PRODUCTION MOLDER ASSISTANT	\$9.45	04/24/2001	\$9.45	\$13.23	\$15.08	\$16.33
1686	PRODUCTION MOLDER ASSISTANT	\$8.93	07/07/2001	\$9.88	\$12.08	\$15.18	\$15.93
1669	PRODUCTION MOLDER ASSISTANT	\$9.45	04/22/2001	\$9.45	\$13.23	\$15.08	\$16.33
1732	PRODUCTION MOLDER ASSISTANT	\$8.00	12/10/2001	\$8.50	\$12.00	\$14.63	\$15.38
1705	PRODUCTION MOLDER ASSISTANT	\$8.53	09/08/2001	\$9.48	\$12.73	\$14.78	\$15.53

1712	PRODUCTION MOLDER ASSISTANT	\$8.41	12/10/2001	\$8.90	\$12.40	\$15.03	\$15.78
1674	PRODUCTION MOLDER ASSISTANT	\$9.45	04/22/2001	\$9.45	\$13.23	\$15.08	\$16.33
1725	PRODUCTION MOLDER ASSISTANT	\$8.51	07/07/2001	\$9.46	\$11.66	\$14.78	\$15.53
1614	PRODUCTION MOLDER ASSISTANT	\$8.00	12/21/2001	\$8.00	\$10.95	\$14.63	\$15.38
1730	PRODUCTION MOLDER ASSISTANT	\$8.00	12/21/2001	\$8.00	\$10.95	\$14.63	\$15.38
1706	PRODUCTION MOLDER ASSISTANT	\$8.53	07/07/2001	\$9.48	\$11.68	\$14.78	\$15.53
1687	PRODUCTION MOLDER ASSISTANT	\$8.53	07/14/2001	\$9.48	\$11.68	\$14.78	\$15.53
1679	PRODUCTION MOLDER ASSISTANT	\$8.85	05/04/2001	\$8.85	\$13.23	\$15.08	\$16.33
1694	PRODUCTION MOLDER ASSISTANT	\$8.83	07/07/2001	\$9.78	\$11.98	\$15.08	\$15.83
1667	PRODUCTION MOLDER ASSISTANT	\$9.45	05/12/2001	\$9.45	\$13.23	\$15.08	\$16.33
1695	PRODUCTION MOLDER ASSISTANT	\$8.53	07/14/2001	\$9.48	\$11.68	\$14.78	\$15.53
1726	SHIPPING & RECEIVING ASSISTANT	\$8.31	12/10/2001	\$8.80	\$12.30	\$14.93	\$15.68
1670	SHIPPING & RECEIVING ASSISTANT	\$9.70	02/04/2001	\$10.40	\$13.23	\$15.08	\$16.33
1680	SHIPPING & RECEIVING ASSISTANT	\$8.85	05/04/2001	\$8.85	\$13.23	\$15.08	\$16.33
1611	TOOL CRIB C	\$12.68	08/09/2001	\$12.68	\$13.98	\$16.73	\$17.48
1411	TOOL CRIB C	\$14.18	01/11/2000	\$14.18	\$15.48	\$18.25	\$19.05
1470	TRUCK DRIVER	\$13.01	02/12/1999	\$13.01	\$14.14	\$15.54	\$16.14
1426	WELDER B	\$15.23	02/04/2001	\$15.23	\$17.19	\$19.19	\$19.99
1613	WELDER B	\$15.28	02/04/2001	\$15.28	\$17.19	\$19.19	\$19.99

## Appendix B

This document is created to answer some common questions for the project done for Pratt & Whitney by MSU Math 844 team.

### How to use the program?

Change the Progression, COLA and Contract values for Tier I and Tier II by using the arrows. The output is contained in columns labeled *year 1*, *year 2*, *year 3*, and *year 4*. The percent increases are given in the upper left corner of the appropriate worksheet. The graphs for the results can be found in the *graphs* worksheet.

### How to perform some common operations?

#### 1) Adding a Job Category

- Go to *Times* worksheet.
- Add the job category to the first column. (The job category should be inserted to the proper row alphabetically).
- Add the time requirement to the second column.
- The job category for the next promotion should be added to the third column
- Add the progression rate for that job category to the fourth column.
- The time requirement for the *assistants* is represented by “\*”.
- Go to *ranges* worksheet and insert the job category to the proper row. Add the minimum and maximum values for that job category to the second and third columns. Select the rest of the columns and by using the *fill* command to fill the rest of the fields in the new row. You can find the *fill* command in the *edit* menu.

#### 2) Changing the time requirements

- Go to *Times* worksheet and change the second column for every job category.
- Remember that the time requirement for the *assistants* is a “\*”.

#### 3) Deleting an employee

- Go to *tier i* or *tier ii* worksheet depending on where the employee is located.
- Find the employee by the employee number and delete the row.
- Go to *monthpay* worksheet and delete the row with that employee.
- Go to *asisstants* worksheet and delete the row with that employee.
- Go to *mondaytierii* or *mondaytieri* worksheet and delete the row with that employee.
- Go to *maintable* worksheet and delete the row with that employee.

#### 4) Adding an employee

- If the new employee has a job category that is not listed in the *times* worksheet follow the steps in 1).

- If the employee is a Tier I employee then go to *tier i* and insert the values for the first 6 columns to the end of the list.
  - a) Go to *mondaytieri* worksheet and fill the last row by using the *fill* command from the *edit* menu ( as explained in **1** ).
  - b) Go back to the *tier i* worksheet and fill the rest of the fields for the row inserted by the *fill* command from the *edit* menu.
- If the employee is a Tier ii then go to *tier ii* worksheet and insert the values for the first 7 columns to the end of the list.
  - a) Go to *maintable* worksheet and by using the *fill* command from the *edit* menu fill the last row.
  - b) Go to *mondaytierii* worksheet and by using the *fill* command from the *edit* menu fill the last row.
  - c) Go to *assistants* worksheet and by using the *fill* command from the *edit* menu fill the last row.
  - d) Go to *monthpay* worksheet and by using the *fill* command from the *edit* menu fill the last row.
  - e) Go back to *tier ii* worksheet and fill the rest of the fields for the inserted row using the *fill* command from the *edit* menu.