**Mini Case #1: Capital Budgeting at Rio Negro, Inc.**

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Julissa Limon

# Introduction

In this annual cost analysis of Rio Negro, Inc. (RNI), a transportation cargo business, the costs between overhauling an already-owned small dry-cargo ship (the *Maracas*) with and without the installation of a brand-new engine and control system and acquiring a new vessel will be compared. To help RNI make the best decision on the future use of its capital investment funds, the present value and the equivalent annual costs of all options were calculated. Calculations such as operating costs, revenue, additional expenses, depreciation, and taxes were made based on the tables and additional information provided by the case and can be found in the attached Excel workbook.

# Analysis

## Present Value of the Proposed Overhaul of the Maracas

Rio Negro, Inc. (RNI) has the option to overhaul the Maracas, either with or without adding a new engine and control system. If they do not add the new engine and control system, the total cost of the overhaul expenditures will be $820,000 with an estimated annual operating cost of $1,181,000, expected to increase by the annual inflation rate of 1.25%. On the other hand, if the new engine and control system are part of the overhaul, the total initial expenditure will be $1,420,000 with estimated annual operating costs of $1,020,000, again expected to increase annually at the same 1.25% rate of inflation. In either case, the initial expenditure amount would be due immediately, the overhaul would take one year to complete, and the maintenance costs would not begin until one year after the vessel is put back in service. Either overhaul option would be depreciated accounting to the 7-year MACRS class.

To calculate the correct operating cost for each year, the rate of inflation was multiplied by the prior year’s operating costs. The operating cost at year zero is given, but since operating costs do not occur until one year after the vessel is back in service, the given cost is increased by the inflation rate twice to determine the operating cost in year two. From there, the operating cost can be increased by 1.25% each year thereafter. Similarly, depreciation does not begin until year two and was calculated by multiplying the total cost of the overhaul of each alternative by the corresponding 7-year MACRS percentages. Adding the operating cost and the depreciation gives the earnings before taxes (EBT) for each year. The tax rate can then be calculated off that amount at the given 35%. Subtracting the tax from the EBT results in the net income for each year.

The depreciation was then added back into the net income amount to calculate the operating cash flows for each year since there is not an actual cash outflow with depreciation. In year zero, the only cash flow is the stated cost of the overhaul. There are no cash flows in year one since the vessel is not put back in service until year one. The present value of all the cash flows can be calculated using the NPV function in Excel and adding the cash flow at year zero to the result (see Exhibit 1 for calculations).

After calculating the present value of the total cash flows of the overhaul options, the overhaul including the new engine and control system nets a lower total present value of the cash flows and therefore should be the chosen option when considering the two overhaul alternatives. The total present value of the initial cost for the overhaul with the new engine and control system, combined with the present value of the maintenance costs for 12 years after the vessel is returned to service, is equal to ($5,946,740.88), which is less than the present value of the initial overhaul without the new engine and control system of ($6,261,849.33). Though the initial cost of the overhaul with the new engine and control system is more expensive, the decrease in annual maintenance costs causes the total present value of the option to be less expensive when considered over 12 years.

## Present Value of Buying and Operating the New Vessel and Missing Information

As a third alternative, RNI was considering purchasing a new $3,000,000 vessel from a Colorado shipyard, Racette & Sons, with an estimated 20-year useful life. Similarly to the other two alternatives, the net present value (NPV) of the total cash flows was calculated to make a more accurate cost analysis to help the company choose the best option. To begin, half of the price of the new vessel is expected to be paid immediately, or at year zero. The machinery will not be delivered until a year later, during which the other half of the price must be paid and $100,000 will be received from selling the old machinery at book value. The operating cost provided in the case will increase from $885,000 to $907,263.28 in year two due to the 1.25% inflation rate and will continue to increase at such a rate for the rest of the machinery’s useful life years. With this alternative, however, there will also be a $50,000 one-time training expense that will reflect in year two along with a $175,000 revenue that will continue to increase every year thereafter. The company will also pay a depreciation expense for 8 years according to the corresponding rates on the given depreciation schedule (7-year MACRS).

Once earnings before taxes are calculated, a tax rate of 35% is multiplied to and subtracted from EBT each year to compute net income. Depreciation expenses are then added back to calculate operating cash flows (OCF) because it is included for accounting purposes and is not an actual cash flow. The nominal interest rate of 8.5% and OCF from years one to twenty-one were then used to calculate their present value of $5,121,071.28. To find the total present value of this alternative, the present value from years one to twenty-one was added to the $1,500,000 amount paid for the new vessel at year zero (as seen in Exhibit 2). Therefore, the total present value of buying and operating a new vessel is ($6,621,071.28), higher than the other two overhaul alternatives.

With this alternative, it was assumed that the *Maracas* would be sold for a book value of $100,000. This means that the old machine was used in the year it would take to receive the new machinery. Therefore, additional information that would have been useful in this analysis would have been the associated revenue generated, operating costs, and depreciation expenses for that year. Having this additional information would have contributed to a more accurate cost analysis as it could significantly impact the total present value and equivalent annual cost (EAC) found for this alternative and ultimately impact the company’s final decision.

## Equivalent Annual Costs

In order to make an annual cost comparison of the overhaul with and without a new engine against the purchase of a new vessel, it is best to calculate each alternative’s equivalent annual cost. First, the real discount rate was calculated to compute accurate EAC values because it does not include inflation. The real discount rate was calculated with a variation of the Fisher Equation (((1+nominal rate)/(1+inflation rate)) –1) to get 7.16% as shown in Exhibit 3. Then, the EAC of each of the alternatives was found using the real discount rate of 7.16% and their corresponding present values, and periods by using the PMT function in Excel. The EAC of an overhaul without a new engine is $756,065.82, with a new engine is $718,019.12, and with a new vessel is $618,955.41. According to these calculations alone, RNI should move forward with purchasing the new vessel since it has the lowest annual costs of the three alternatives.

## Importance of Equivalent Annual Cost Method

The equivalent annual cost method puts costs of ownership, operation, and maintenance on a per-year basis. It is useful in decision-making in this case because the overhaul of the Maracas’ remaining useful life is approximately 12 years and the new vessel will have approximately 20 years of life. Due to having unequal lives, solely relying on other methods such as NPV would be a mistake because the vessels would need to be replaced at different times. Additionally, as previously mentioned, the real discount rate is used to compute the EAC because it provides a more accurate calculation as it is the difference between the nominal interest and inflation rates.

Problems that may impact decision-making while using the EAC method include a significant change in the cost of maintenance, materials, inflation, faulty equipment, or early replacement in the future. In addition, EAC factors in indefinite replacement, so if either vessel manufacturer halted production, then this method would need to be reconsidered. Furthermore, EAC can be misleading as such values reflect the cost per year throughout the different lifespans of the alternatives. For example, the annual cost for the new vessel is $618,955.41, lower than the other alternatives, however, it must be paid for a span of 21 periods as opposed to $756,065.82 or $718,019.12 for 13 periods.

## Conclusion

The analysis of the calculated present value and equivalent annual costs of the proposed overhaul of the *Maracas*, the suggested installation of a brand-new engine, and the buying and operating of the new vessel shows the following: When using present value, the calculations yield to choose the alternative with the overhaul with the installation of a new engine and control system because it has the lower total cost. On the other hand, when using equivalent annual cost, the capital budget should be used in buying a new vessel. Furthermore, the EAC between the two cost methods was used since this allows for the comparison between the cost-effectiveness of the assets and their unequal lifespans. In conclusion, it is advised that RNI buy and operate a new vessel as it is the most cost-efficient alternative per year in the long run.