Contingency Analysis Rules for NOνA

March 27, 2006

1.0 Definitions

Cost contingencies are an essential part of Total Cost Management. A contingency is an amount added to a cost estimate to compensate for unexpected expenses resulting from incomplete design, unforeseen and unpredictable conditions, or uncertainties in the project scope. This may be derived either through statistical analysis of past project costs, or by applying experience gained on similar projects.

We define contingency for NOνA as the amount of money, D, that needs to be added to a realistic cost estimate, C, to produce a cost, C+D, that is likely to have some confidence level (95%) that the project will be completed for less than C+D.

Contingency allowances are applied to each WBS element and are expressed as percentages of estimated cost and improve cost estimates by accounting for uncertainties. The contingency allowance is large at the beginning of a project because there are more uncertainties, but as a project develops, the allowance shrinks to adjust for costs already incurred. Ideally, the total estimated cost remains the same throughout a project. *Contingency is not to be used to avoid making an accurate assessment of the expected cost*. Contingency does not cover major changes in scope or schedule, Acts-of-God, or other Force Majeure situations.

Scope contingency is the ability to adjust the "deliverable" without significantly impacting the ability of the project to achieve its goals. For example, eliminating a detector station, layer or ring that, relative to other stations, doesn't contribute much.

Schedule contingency is defined as the time between when something must be ready (the need-by date) and when something is scheduled to be ready (the ready-by date). An example where schedule contingency would be required is a tight schedule that might require extra shifts in order to finish a task by the need-by date. A schedule with lots of flexibility and float will not require significant schedule contingency.

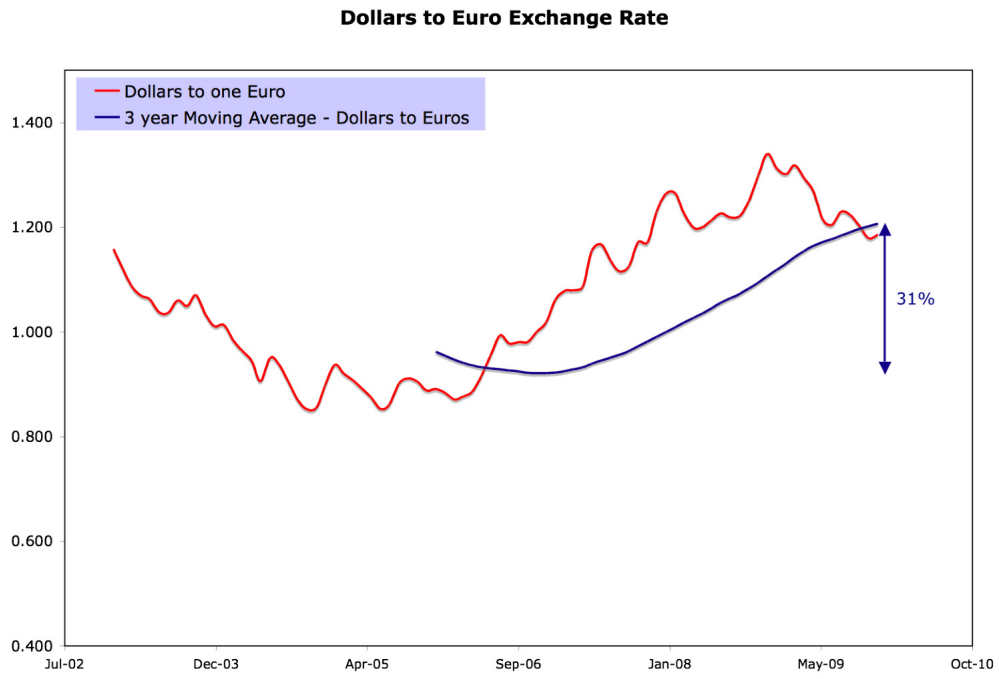
2.0 Contingency for NOνA

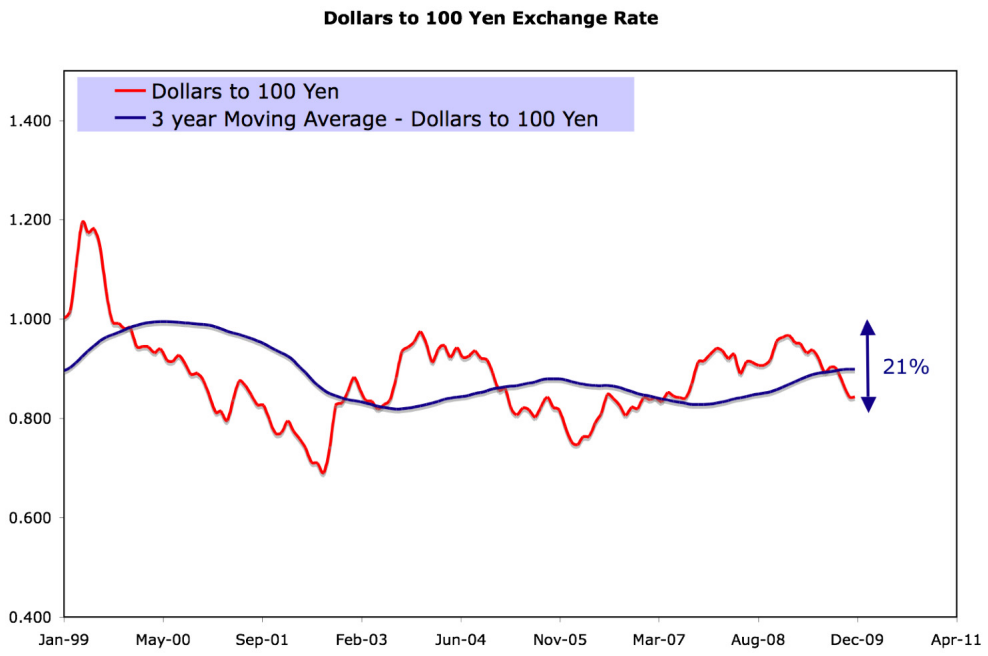
Although all NOνA tasks present challenges, some are similar to tasks done many times before, while some have never been done before or are at a larger scale than has been attempted in the past. Some tasks have had rather complete R&D, while others still have outstanding issues. As a result, the various deliverables that comprise the NOνA Project will have a wide range of contingencies. The contingency rules below do not apply to the conventional construction part of the project. Contingency rules governing conventional construction are described in DOE order 430.1, the DOE Cost Estimating Guide.

2.1 Additional Contingency Due to Foreign Currency Fluctuations

Fluctuations between foreign currencies and the US dollar (USD) are inevitable over the lifetime of NOνA and can increase or decrease the cost estimate. The following prescription will be used to translate quotes submitted in Euros or Yen to USD. The exchange rate on January 5, 2006 will be used. Those rates are 1 Euro = 1.211 USD and 100 Japanese Yen = 0.863 USD. Historical data demonstrating the relationship of the Euro and Yen to the US dollar over time are shown in the plots below.

If the most likely (or only) source of procurement involves a foreign currency, the contingency will be increased to account for possible (upward) currency fluctuations. The Project Office will determine the amount of the increase. If there are viable US domestic options, it may not be necessary to make an adjustment to the contingency. Here it will be necessary to use one's best judgment and to document the rationale for whatever action is taken.





2.2 The NOνA Contingency Rules

We now give explicit guidance on how to estimate M&S and Labor contingencies. These comprise the "base" contingency. However, if any of these items has an increased **Risk**, extra contingency must be applied. For example, if the cost of a particular item has a strong dependence on the cost of crude oil, known to be a volatile commodity, the Level 2 Manager would have identified it as having some associated cost risk. The contingency necessary to account for this risk must be evaluated. For particularly high-risk items, the Level 2 Manager will consult with the Project Manager to arrive at an appropriate risk-based contingency. Once the base contingency estimate and the additional estimate due to the risk have been determined, the two contingency estimates will be combined using the Monte Carlo method described in the Risk Management section of DOE Order 413.3.

2.3 M&S Contingency Rules

1) 0% on items that have been completed

2) 10-15% on items that have already been purchased at least once (perhaps in small quantities) or items for which there is a very firm quote and for which there is more than one potential vendor.

3) 15-25% on items that have already been purchased at least once (perhaps in small quantities) or items for which there is a very firm quote but for which there is likely to be only one vendor.

4) 25-50% on items that can be readily estimated from a reasonably detailed design or for which there exists a very close "analogous system", with well understood costs.

5) 50-70% on items for which only a conceptual design exists.

6) 50-70% for items that have unproven yields or for which there are unique issues (e.g. an uncertain cost and a single vendor).

7) 70-100% for items that do not yet have a detailed conceptual design.

2.4 Labor Contingency Rules

1) 0% on items that have been completed.

2) 15-25% for a project that has been done before and has a reasonably good estimate based on actual time durations.

3) 25-50% for a project that is conventional and well defined but is not supported by actual time durations.

4) 50-70% for a project with only a time and motion type study derived from a limited-scale test.

5) 100% for a project of uncertain labor requirements. In such cases, the schedule must allow for additional shifts to be added so that the cost contingency covers the schedule risk, i.e. the 100% contingency pays for the addition of a second shift so that the base schedule remains intact.

2.5 Schedule Contingency

Our procedure for establishing schedule contingency is:

1) Estimate nominal task durations as well as possible.

2) Do not attach fake contingency tasks to artificially stretch the schedule. We want to use the schedule to properly understand critical paths.

3) The Project Office will take note of naturally occurring float times in the schedule.

4) The Project Office will generate additional milestones with float relative to the scheduled date in Open Plan so that slippage can be easily monitored. Examples would include Beneficial Occupancy of the building + 3 months, End of project +

6 months, etc. If the available float shrinks to less than half of the original slack then action by the project office is triggered.