



AVOIDING A **DOOMED** SOFTWARE PROJECT BY CHECKING THE **STAFF BUILD-UP PLAN**

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The **STAFF BUILD-UP PLAN** defines how many, what kind, and when staff are needed for the entire project. Too many or too few, bringing them on too early or late, employing the wrong mix of expertise or experience—**avoiding all these pitfalls** with a staff build-up plan will ensure a **SUCCESSFULLY STAFFED PROJECT**.

REVIEWING PROPOSALS FOR A COMPLEX PROJECT, SUCH AS MAJOR SOFTWARE DEVELOPMENT OR SUPPORT, IS A CHALLENGING ACTIVITY. SINCE LABOR IS THE MAJOR COST AND FEASIBILITY DETERMINANT FOR SUCH PROJECTS, REQUIRING THE SUBMISSION OF A "STAFF BUILD-UP PLAN" AND VERIFYING ITS REALISM IS CRUCIAL IN DETERMINING WHETHER A PROPOSED PROJECT CAN REALISTICALLY SUCCEED.

The staff build-up plan defines how many, what kind, and when staff are needed for the entire project. Too many or too few, bringing them on too early or late, or employing the wrong mix of expertise or experience are red flags. Doomed projects can be avoided by rejecting proposals with unrealistic staff build-up plans.

CHECK THE STAFF BUILD-UP PLAN

So let's assume you've asked to review proposals responding to a big expensive contract your organization put out for bid. It's a multiyear effort involving outsourcing the development of a major new software application, and it is a major investment for your organization. You carefully read the eight proposals received in response to the solicitation. In deciding which proposal will win, you consider a number of factors, including, but not limited to:

- Does the bidder understand the scope and technical complexity of the work?
- Is the proposed solution feasible?

- Is it as good as or better than the other proposals?
- Is their proposed project manager capable and experienced?
- Does the project manager—and organization—have a track record for success on projects like this?
- Are they proposing a team with appropriate skill sets?
- Will they meet your desired schedule?
- Is their price reasonable?

After reviewing the eight proposals, you manage to identify the best one that you believe answered the foregoing factors positively and its price is within your budget. On your recommendation, your organization awards the contract to that bidder. As reward for your hard and careful work, you're given the job of overseeing the outsourced contract—and the responsibility for ensuring delivery of the promised software application.

THE REAL WORK BEGINS

Fast-forward three months. The winning company has begun work. You hold weekly meetings with their management team to review project status. You notice that you've received three monthly invoices covering a team that's been fully staffed since the second week. You also notice that they're still working on finalizing requirements and making early design decisions. You note that at this rate, you'll exhaust your budget before the software is completed and are on course for a cost-overflow.

Change the above scenario slightly. After three months of status reviews you notice that, while costs appear to be in line with the planned budget, product development is behind schedule. The contract project manager tells you the team is working hard and making progress, but it seems certain they won't be able to deliver the product on time. You review team staffing and discover they appear to have one-third fewer staff than needed to do the work. At this rate, the product will be late or you may be forced to increase the budget to add more contract staff. In all likelihood, both will occur and you'll have a late and over-budget project.

Change the scenario slightly again. Instead of software development, the contract calls for maintenance support of a major application. After three months, you notice a buildup of unanswered or unresolved trouble tickets resulting in a large backlog. Complaints from your user community have increased markedly. You review team staffing and it appears they have one-half the staff needed to provide the support. Your choices are either add budget so the contractor can add the appropriate number of staff or tolerate deteriorating support.

WHAT WENT WRONG?

In reviewing the proposals, you did your due diligence. The winner's proposal described the work to be done in enough detail to convince you that they understood the requirement. They have a track record in this particular area, and proposed an experienced project manager. Other proposed staff covered the needed skills. Why are you seeing problems after just a few months?

Evaluating one additional piece of information could have avoided these problems: A detailed staff build-up plan. The Project Management Institute's *Project Management Body of Knowledge* calls for a "staffing management plan" as part of the overall "project management plan," which is where this staff build-up plan would be found. Software development efforts, as well as many other types of IT projects, are service-oriented. Performing the work involves human labor, which is usually the major cost-driver of such projects. Too small a team risks late or poor delivery. Too large risks over-staffing, which can lead to cost-overruns, increased defects, and unexpectedly late delivery. How would you use such a plan to avoid these problems?

PREPARATION IS KEY

Prior to awarding a contract that mostly involves services, a staff build-up plan for the proposed work needs to be reviewed. To do that, the following must be considered:

internal estimate (i.e., cost, labor, and schedule) that includes a staff build-up plan for the work to be contracted. Note that bidders should not see this estimate and it should not be included in the solicitation.

- 2 | The solicitation needs to require that proposals include a detailed staff build-up plan.
- 3 | When reviewing proposals, the soliciting organization must compare its internal estimate with those in the proposals to ensure the proposal isn't over- or under-staffing the resulting project.
- 4 | The soliciting organization's evaluation team must have some understanding of the work to be done. The more expert they are the better. Also, they must have access to and understand the estimate and its relation to the proposed work.

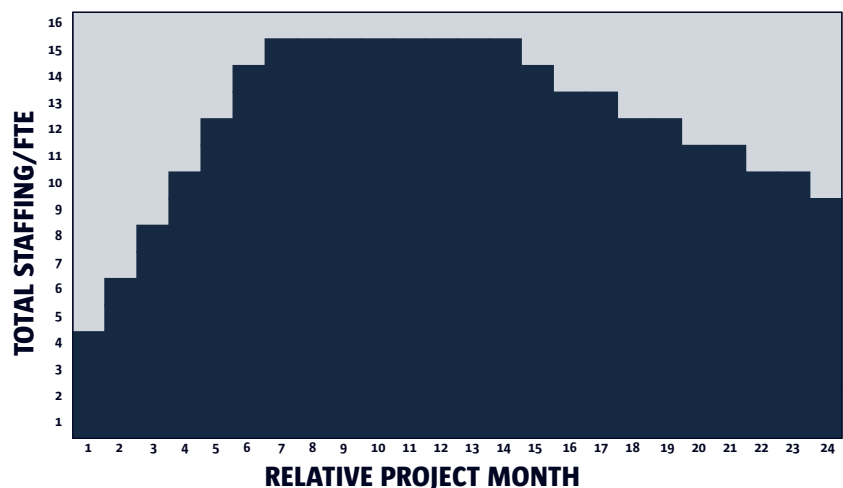
WHAT DOES A STAFF BUILD-UP PLAN LOOK LIKE?

FIGURE 1 below shows the minimum content of a staff build-up plan for a 24-month effort. It can be part of a larger staffing management plan and presented in a number of different ways, but this one is in the form of a resource histogram, where the resource shown is staff time. The x-axis is a time period—days, weeks, or months (in this case, months). The y-axis is the

staffing level—typically total number of staff, positions, or full-time equivalents. In **FIGURE 1**, the staffing level starts out at four in month one, then slowly climbs to its peak of 15 in month seven. The level begins to decrease in month 15, presumably because the work will begin to taper off, and ends with nine staff at the end of the period in month 24.

The time period covered along the x-axis should be for the entire contract period, or a representative time period such as one year that is repeated for future year-long periods. The y-axis can be just the number of staff or full-time equivalents working in each month, as shown in **FIGURE 1**, or it can be stratified by type of labor. **FIGURE 2** on page 22 shows a more detailed chart with stratification by junior-, intermediate-, and senior-level staff. The distinction can be by skill level, cost, labor type, or other qualification that makes sense for the contract. In **FIGURE 2**, a project manager is shown for each of the 24 months in the bottom row. Two senior-level staff are shown through month 15, then only one thereafter. One intermediate staff is shown in month one, three in month two, and then varying numbers for the remainder of the schedule. Whether or not it's part of a larger staffing management plan, there should be some written description that relates the plan to the needs of the contract's work.

FIGURE 1. BASIC STAFF BUILD-UP PLAN



- 1 | The organization putting out the contract solicitation must do its own

WHAT DOES A STAFF BUILD-UP PLAN TELL US?

Item three in the numbered list earlier in this article compares proposal staff build-up plans with the solicitor's internal estimate. What should proposal evaluators look for, and why? The following are several scenarios that could indicate one or more problems.

PROPOSAL STAFFING LEVEL IS SIGNIFICANTLY LOWER THAN THE ESTIMATE.

Unless the proposal makes a convincing argument for a lower-than-expected staffing level, it probably indicates one of two things:

- The bidder doesn't understand the full scope or complexity of the work, or
- They're deliberately trying to low-ball the bid.

If the first is true, the bidder shouldn't be awarded the contract. In the case of the second, the bidder may be trying to win by undercutting the competition's price with the expectation that, once they win, they can convince the soliciting organization to increase the contract budget.

Contracting processes can be long and difficult, especially in government settings. Once awarded, the solicitor may prefer to "bite the bullet" and increase the budget rather than ending the just-started contract, wasting a substantial amount of internal work, and starting over. At a minimum, this is unfair to the other bidders and, worse, the soliciting organization may end up paying more than if someone else had won. Unfortunately, this too often plays out in practice.

In highly structured evaluation situations, as is usually the case in U.S. federal government contracting, technical and cost proposal evaluations are often split between two separate teams:

- The technical team, and
- The cost team.

The technical team might not have access to costs and, if no detailed staffing plan is evaluated, may declare an under-staffed proposal to be technically acceptable. Later, that proposal may end up as the cost winner and win the award because the price is low and the technical part was deemed acceptable. This practice—i.e., "lowest price technically acceptable" (LPTA)—is not a good model for high-complexity work

like software development or support, but is often used in practice. LPTA errors can be avoided if the technical team spots the under-staffed proposal during its review and declares it "not acceptable." In that case, it won't win the award no matter how low its cost because the staffing was found to be completely inadequate for the job.

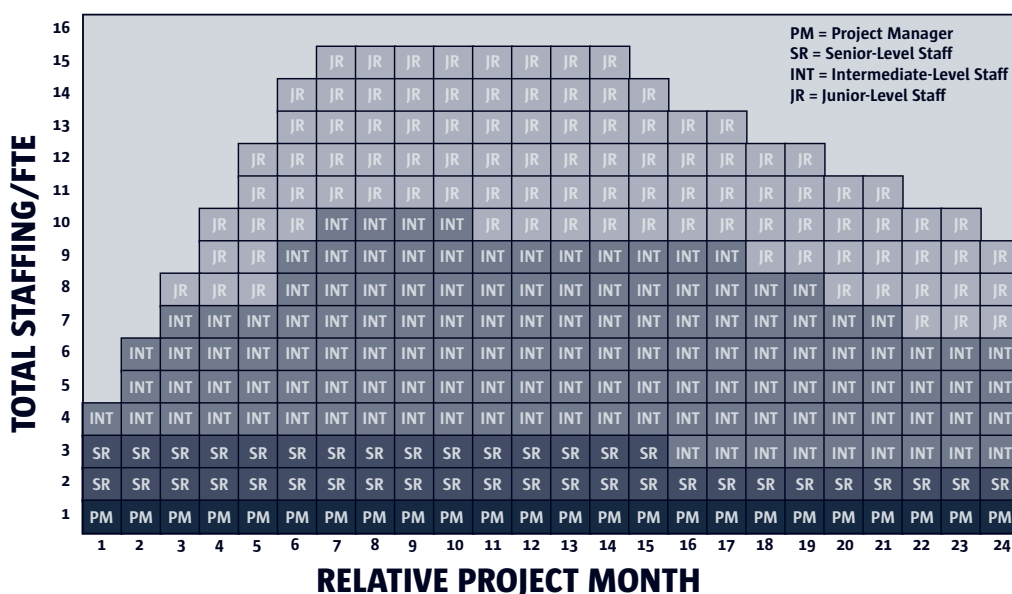
PROPOSAL STAFFING LEVEL IS SIGNIFICANTLY HIGHER THAN THE ESTIMATE

As with the low staffing scenario, unless the proposal provides a strong justification for a larger-than-expected staff, it should be rejected. As before, either the bidder doesn't understand the requirement or they're padding the proposal. In practice, this case is easy to reject since the cost will be in the higher range. Projects with high complexity may call for a "best value" type award in which a higher cost can be justified by a truly superior proposal. This must be carefully considered and the technical evaluation team thoroughly convinced of its superiority if it declares such a proposal as "acceptable." In such cases, the evaluation team must make a strong justification for award on technical merits since the proposal's cost will very likely be high.

PROPOSAL STAFFING LEVEL IS CLOSE TO THE ESTIMATE, BUT THE SKILL MIX IS BIASED TOWARD JUNIOR OR SENIOR STAFF

If provided in the proposal, does the skill mix match the solicitor's estimate or the technical evaluation team's assessment of the project's need? The mix could be junior/senior or a specific labor category breakdown (e.g., systems analyst, lead developer, database expert, etc.). Proposing the right skill mix is another clue as to the bidder's understanding of the required work. Also, a mix consisting of too many senior staff could indicate price padding, while

FIGURE 2. STAFF BUILD-UP PLAN STRATIFIED BY STAFF LEVEL



too many junior staff indicates an attempt to low-ball the price.

PROPOSAL STAFFING LEVEL DOES NOT MATCH THE RHYTHM AND PACE OF THE WORK

The staff build-up plan shows not just “how many,” but also “when” staff is needed. Support contracts tend to be operational and call for the provision of a certain number of staff for the project’s duration. In this case, rapid staff build-up would be expected almost immediately upon contract award. For software development projects, however, a lot of front-end analysis may be needed in the early stages and a more modest and gradual staff build-up pace would be expected. One potential trouble scenario is where the full staff is quickly brought onto a project in which front-end work will dominate the early going. For example, a full team of 20 staff is brought on board by the end of month one, but only five will be engaged in planning, requirements, and analysis until the end of month six. The soliciting organization would be paying the vendor for up to 75 staff months of low- or no-value effort in month two through six for the excess staff.

PROPOSAL STAFFING LEVEL AND SKILL MIX IS CLOSE TO THE ESTIMATE

This is the hoped-for scenario. Proposals that match the estimated staff build-up levels and pace with the right skill mix (when provided and evaluated) indicate an acceptable proposal, at least for this evaluation factor (other factors are also evaluated).

By matching the estimate, we mean the proposed staff build-up is not significantly above or below it. But what does “significantly above or below” mean? The answer to this question should be based on both a trend line of historical data and the evaluation team’s judgment. The trend line of historical data should show size of the software functionality versus effort and/or staffing levels. If the proposed staffing is more than a standard deviation above or below average, the evaluation team

should consider rejecting the proposal. The evaluation team should also apply some expert judgment. Does anything else in the proposal clearly justify why fewer staff than expected can do the job or that more are needed? Perhaps the bidder has some kind of process, tool, or other “secret sauce” that allows them to be more efficient than expected, leading to lean staffing. Or perhaps the complexity of the work or high quality of the proposed solution justifies more than the estimated number of staff? Having a highly expert evaluation team will help sort out these issues and lead to a good award decision.

STAFFING MODEL FOR ENGINEERING PROJECTS

In the early 1960s, Peter Norden of IBM discovered that engineering project staffing tended to follow a statistical pattern called the “Rayleigh Curve,” which is part of the family of Weibull distributions. **FIGURE 3** below shows a typical Rayleigh Curve—a skewed-left version of the normal or bell curve. In the early going of a project, staff is added gradually to keep the team small since only a relatively small team is required for planning and analysis activities. As work picks up, staff is added fairly rapidly until a peak is reached. The peak staffing continues until most of the work is accomplished, followed by a gradual decrease in staffing while the project is implemented and supported in production.

In the 1970s, Lawrence Putnam Sr. discovered that the curve also appeared in software development projects. He developed the “Software Lifecycle Management” (SLIM) estimation tool, which uses the Rayleigh Curve to model an estimated staffing curve. The SLIM tool is calibrated with over 12,000 industry and government projects and has been refined since then to accommodate innovations in development practices, such as agile acquisition. SLIM can be used to estimate project cost, schedule, and defects. It can also show

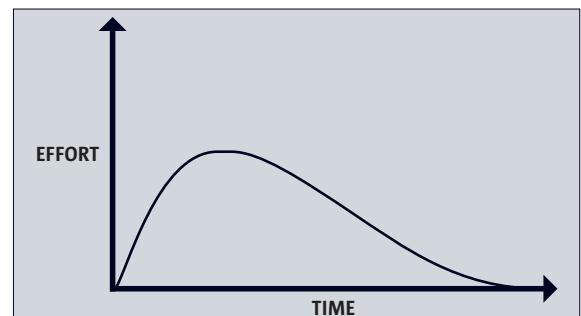
how a proposal’s estimate compares with a historical trend line and whether that estimate is more than a standard deviation above or below, as previously described. It can model various cost/schedule tradeoffs, showing the impact of staffing level on the schedule, or, conversely, of shortening or lengthening the schedule on needed staff. The relationship among those factors in engineering projects is not linear, as in the case of manual labor projects, but is more complicated. The SLIM model captures the interplay and allows for reasonably accurate estimates of such projects.

When evaluating proposal staff build-up plans for software development projects, ask how closely the plan follows the Rayleigh Curve. Is there a gradual staff build-up to a peak, sustained for a period of time, then a more gradual reduction? If yes, the plan is consistent with this well-known staffing model. If not, why not? **FIGURE 4** on page 24 shows a Rayleigh Curve superimposed on the staff build-up histogram from **FIGURE 2**. Here, the histogram shows the curve’s characteristic shape and is an indicator of a valid staff build-up plan.

EVALUATING PROPOSALS—ART AND SCIENCE

As described in this article, reviewing the staff build-up plan gives the evaluation team an objective way of evaluating a service-oriented project proposal—whether it’s part of a contract bid, a proposed internal project, or a project review. Comparing the number of staff, their mix, and when they’re needed to an internal estimate helps the evaluator decide whether or not the proposing company understands the work

FIGURE 3. TYPICAL RAYLEIGH CURVE



and is making a good-faith bid. It can help weed out low-ball proposals and avoid cost overruns and failed or cancelled projects. Staffing that significantly differs from the estimate is a red flag and needs to be examined closely. Significant differences that aren't credibly explained in the proposal should lead to rejecting the proposal, even if its price is low.

Staff build-up, however, is only one of a number of factors to be evaluated. In software development projects, for example, other factors to evaluate include the following:

- Are the proposed solution's architecture, feature set, and nonfunctional requirements consistent with what the contract calls for?
- Does the bidding company have a history of successfully performing this type of work?
- Are the project manager and named team members experienced in this type of work, available, and capable

of delivering the required product or service?

These factors are interrelated in various ways, and improving upon some can mean weakening others. Judging them requires that each not only be assessed on its own, but also their relationship to each other and what kinds of tradeoffs can and should be made.

This is a complex process and is as much art as science. While objective measures can inform these kinds of complex decisions, in the end the evaluators need to use their own expertise and judgment to get a complete picture and make a sound decision. **CM**

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FIGURE 4. RAYLEIGH CURVE SUPERIMPOSED ON STAFF BUILD-UP HISTOGRAM

