**Perspectives** QuantitativeSoftwareManagement® QSM®

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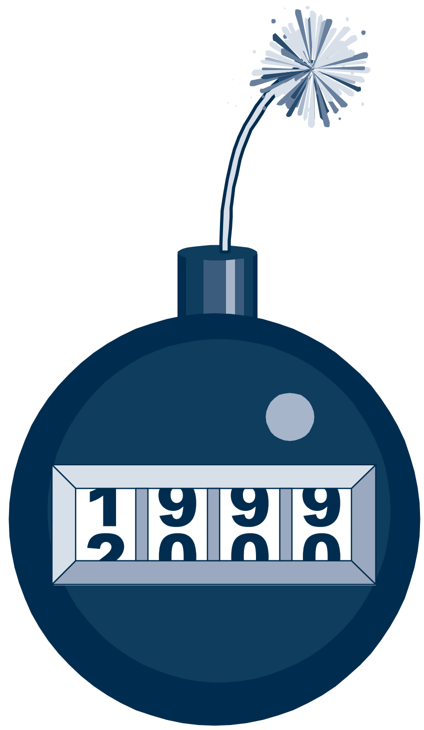
# Estimating Millennium Resources

**by Jim Greene**

*What will happen to your date-dependent software when the year rolls from 1999 to 2000?*




There is no doubt that the millennium date change problem is ***huge***. Thus according to Gartner Group's strategic planning assumptions:

- Addressing the date change through 1999 will cost information technology (IT) between $300 and $600 billion globally. The U.S. portion of the cost for date redesign is thought to be in the $200 billion range.
- By 1999, without corrective measures, 90 percent of all applications and systems will be affected, producing unknown or erroneous results.

Given these figures, a major issue facing companies is to estimate the resources needed to convert their systems to year 2000 compliance. The work consists of finding, fixing, and testing date dependencies.

**Five to ten percent of organizations will likely have big problems and go out of business.**

## *A Substantial Effort*

In quantifying the associated resource required, Quantitative Software Management (QSM) has determined that the effort will be substantial. ***Thus for major organizations, date conversion will require 200 to 400 person years of effort, assuming no delay in starting the effort.***

QSM's expertise is directed at quantifying the effort and time to do these changes, based on:

- categorizing the size of the system portfolio in terms of the density of changes;
- quantifying these changes by sizing the modified and new code required; and
- determining the process productivity of the conversion teams carrying out the work.

These key factors are used as inputs to generate estimates of typical scenarios of conversion time and effort.

## *Sizing the Problem*

Key to estimating a date change effort is determining how much code must be changed and added to the organization's existing systems. This is best done by conducting representative pilot evaluations.

Specialized tools are available that scan the pilot systems' source code, identifying date-dependent statements and fields. In this way, the date dependency of an organization's systems is determined, as well as the density of these items.

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## In This Issue

## Things to Do for Millennium

- ☑ Start as soon as possible
- ☑ Inventory your systems
- ☑ Determine the systems' size and date-related characteristics
- ☑ Produce initial estimates of the effort and time for average systems in each size category
- ☑ Estimate the consolidated effort, and the implications for the team size required
- ☑ Decide on a strategy for outsourcing part of the work
- ☑ Present the results for final management awareness and acceptance
- ☑ Refine initial figures by doing pilots from the main size categories
- ☑ Update the estimates based on the findings from the pilot projects in relation to modified and new code required, and the pilots' process productivity
- ☑ Compute the potential costs and time scales for outsourced and in-house work
- ☑ Establish and plan the total staffing required for the millennium work
- ☑ Estimate and allocate each individual system conversion, considering specific characteristics and staff availability
- ☑ Track and control every project

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Each date-dependent item is then examined to indicate date sensitivity. Existing date-sensitive statements must be modified, and new statements must be added where necessary. So the pilot analysis quantifies date-sensitive items in terms of the logical statements that must be modified, and those that are to be added as new statements.

Since the total size of the full system is known, the percentage of modified and new logical statements can be calculated.

## Process Productivity

The QSM measure of process productivity is the Productivity Index (PI), which captures all the factors in the conversion process. These include technology, tools, methods, and people-related factors. Other elements that influence the process efficiency include the difficulty of conversion of these old, fragile systems; and the complexities involved.

Process productivity ranges from 1, low productivity, to 40, high productivity. Business systems typically have PI values between 17 and 20.

Conducting pilot system conversions as above also provides data with which to calculate the process productivity of the teams doing the work. This is computed from three input values: the size of the modified and new logical statements, the effort in person months, and the time in months to carry out the conversion.

The effort and time cover *all* the work performed in the pilot conversions. This includes setting up the pilot, performing the analysis to identify date-related statements, investigating all the code to detect and confirm the date-sensitive items, making the modifications, and adding in new statements. Also included is unit testing of the altered programs, as well as the subsequent regression and system testing.

If pilots are not yet available to provide process productivity measures, organizations can use reference measures from the QSM data base of past projects to immediately generate general estimates. However, these default process productivity measures should only be used temporarily, before the company conducts pilots. They must be qualified and updated once real conversion work is begun.

## As Time Goes By

Research at QSM is providing clear evidence of exponentially increasing effort and hence cost as development time is compressed. Adding staff to compress the schedule results in communication "noise," and poor communication gives rise to more errors.

In an example scenario, a modest time reduction from 7 months to 6 months was found to result in expensive penalties from increased effort. Effort increased from 35 person months to 65 person months, a near doubling of effort and hence cost.

***The consequence of delay is an enormous increase in effort, staffing levels, and cost for each system to be converted.***

## Conclusion

A significant investment is required to deal with millennium projects. This is especially true for large organizations with an inventory of legacy systems that are highly date dependent. Companies with smaller inventories require lower investments, which are nevertheless substantial.

Although QSM's results are not surprising, and, indeed, confirm others' figures, many companies have not yet woken up to the great size of the millennium challenge. Therefore QSM's quantification of the estimates can serve to focus management attention on the year 2000 problem, and, more importantly, stimulate management action.

The longer an organization delays in getting started, the greater the costs and risks. As time runs out, the pressure increases, and more people will be needed to do the conversion, at enormously increased cost. There will also be fewer resources available, particularly in terms of outsourcing.

Most companies will fix a high percentage of their systems, although 1-2% will undoubtedly slip through the cracks. Five to 10% of organizations will likely have big problems, and go out of business. How early and how fast companies jump on the problem will determine how credible a repair job they do.

More information about millennium issues can be obtained from the following Internet sites:

http://www.qsm.com

http://www.system2000.com

*This article is a condensed version of Greene, J.W.E., "How to Estimate the Resources Required to Modify Software for the Millennium." The original paper can be found at http://www.qsm.com or by contacting the author. Ed.*

# Software Project Office at Honeywell Air Transport Systems

**by Mike Ross**

*Here is a way to get control of your development projects while satisfying three of the SEI CMM KPAs for Level 2*

In 1989 Honeywell Air Transport Systems (ATS) in Phoenix, Arizona embarked on a program of Continuous Quality Improvement (CQIP) in order to perpetuate their viability as a world leader in the development and production of commercial avionics. One result of this program was the establishment of overall cost, cycle time, and quality objectives.

Concurrent with the formation of CQIP, an outside evaluation of Honeywell ATS software development was performed. This evaluation was done within the framework of the SEI CMM and Honeywell ATS was evaluated at Level 1.

Following the evaluation, Honeywell ATS redesigned its organization to meet the challenges posed by the above-mentioned activities. Part of this reorganization included the formation of an Integrated Product Development (IPD) directorate with subordinate Processes and Tools departments. The Processes department eventually evolved into the Systems and Software Engineering Process Group (SSEPG).

Activity within the SSEPG is currently centered around achieving SEI CMM Level 2. This effort and the lessons learned from the Boeing 777 Aircraft Information Management System program (1990 through 1995) have together illuminated a critical need for a systematic software project management process. ***Honeywell ATS is addressing this need through the implementation of a Software Project Office.***

## *Description*

The Software Project Office at Honeywell ATS (see adjacent figure) is a ***process*** (methods, tools, training, and activity flow). It provides an ***archive*** (history repository) for the organization's past performance. It provides history-based ***estimates*** of product ***size***. It provides a viable project ***plan*** based on these estimates and past performance. It provides project ***control*** (tracking, forecasting, and correcting) by comparing measured actual results to the project plan, predicting the project outcome based on to-date trends, triggering corrective action when actuals deviate significantly from the plan, and ***archiving*** the final results in the organization's history repository.

## *Justification*

One of the keys to advancing from SEI CMM Level 1 to Level 2, is software project management. Two of the five Level 2 Key Process Areas (KPAs) are directly related to software project management. One is ***Software Project Planning***. The other is ***Software Project Tracking & Oversight***; also referred to as "control". Additionally, a third KPA associated with Level 2, ***Software Subcontract Management***, draws from an organization's planning and

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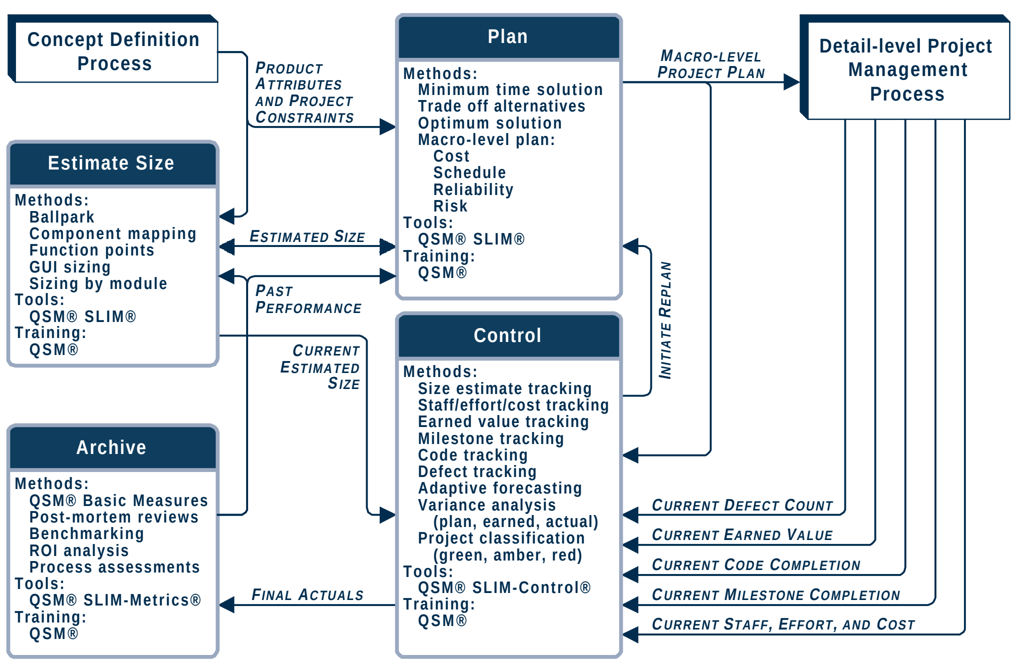


**New Clients and Old Clients with New Needs**

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US Army DMLSS

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control approach.

The Software Project Office concept provides ***dedicated***, ***centralized***, and ***independent*** execution of the ***planning*** and ***control*** aspects of an organization's software project management process. Comprehensive project management includes much more than planning and control (e.g., recruiting, organizing, training, equipping, and terminating). Therefore, it is important to note that the Software Project Office is ***not*** intended as a replacement for traditional software project management but rather as an enhancement to two traditional software project management activities.

## *Need for Dedication*

Planning and control expertise is experience driven. Skills must be developed over time and with much practice. Line engineers are primarily concerned with getting products "out-the-door" and have neither time nor opportunity to practice these skills [DeMarco, 1982]. Because planning and control activities are the primary concern of the Software Project Office analysts, they ***do*** have time and opportunity to practice.

## *Need for Centralization*

A centralized approach to planning and control is good for the following reasons:

While the primary goal of planning and control is to support individual projects, it must also provide aggregate information to organization-level management to support the strategic decision-making process. A centralized approach can support this goal more efficiently and consistently than can a distributed approach.

Economies related to tools procurement, tools development, tools and methods training, consulting, and interfaces with industry and academia can be realized with a centralized approach.

A centralized approach can better support the creation and maintenance of an organization-wide historical data repository.

## *Need for Independence*

An independent approach to planning and control (one that minimizes adverse political influence from product-line organizations) is good for the following reasons:

It is a conflict of interest to have the same people responsible for planning and control also be responsible for the work itself. While the planning and control processes must rely heavily on product-line personnel to ***collect*** data, the ***analysis*** of that data is best left to those not involved in the project being measured. The dispassionate judgment required to analyze the data and to make reasonable projections is compromised by ego involvement in performance when the same people do both [DeMarco, 1982].

The value of planning and control outputs will suffer if, due to reporting relationships, they can be influenced by people with a stake in the outcome [DeMarco, 1982].

The product development and Software Project Office processes have different goals and, therefore, should have different evaluation criteria. Developers should be evaluated on project performance. Software Project Office analysts should be evaluated on how quickly their projections converge with actuals and should have no stake in project performance. It should be possible for Software Project Office analysts to be successful even though the project turns out to be a failure if that failure has been predicted in a timely fashion [DeMarco, 1982].