I. OVERVIEW

This paper suggests that improving an organization's software project measurement function is both necessary and economically effective in raising that organization's maturity level.

Measurement and measurement-related activities can provide a foundation on which organizations achieve higher process maturity levels, as defined by the Software Engineering Institute (SEI). No software development organization can progress to higher levels of process maturity until its measurement program is institutionalized. Many requirements for higher maturity levels implicitly rely on functioning measurement systems to measure properties of the software products and the software development process, derive metrics from those measurements, and support effective action based on the results (Humphrey and Sweet 1987).

The paper describes highlights of the SEI capability maturity model, demonstrates that effective measurement is essential in successful implementation of a maturity growth program, and that software measurement helps produce higher quality, more useful software products and processes, while improving the level of both process and capability maturity.

II. RAISING MATURITY LEVELS IS NECESSARY

Suppliers of systems containing software must attain higher process maturity levels to remain competitive. Recent trends in U.S. Government procurements of systems containing software make this essential. For example, prospective vendors are considered high-risk suppliers if their software process maturity is below level 2. To be responsive to procurements now in process, developers must demonstrate that their software development process meets requirements of SEI levels 2 or 3. It has been
suggested that U.S. Government acquisition organizations require aggressive action to encourage suppliers who now have level 1 software processes to improve to level 2, and require level 2 organizations to dedicate resources to improve their process to reach level 3.

An organization's "software process" is considered here to be that set of activities, methods, tools, and practices that guide its people in the production of software. It is useful to think of "process" in terms of its interaction with people, methods, and technology.

Senior management's legitimate concerns about costs are met by observing that overhead cost for a measurement program—two to four percent of cost for software development—is minor compared to the improvements in project performance.

III. SEI AND THE CONCEPT OF PROCESS MATURITY LEVEL

The Software Engineering Institute has developed two models of how organizations develop software. The first "process maturity model" (Humphrey and Sweet, 1987) gave the preliminary version of a process maturity questionnaire. This preliminary version was intended to provide "a simple tool for identifying areas where an organization's software process needed improvement. Unfortunately, the questionnaire was too often regarded as the 'model' rather than as a vehicle for exploring process maturity issues" (Paulk, 1991, vii).

In the next four years SEI, working with industry and government, evolved the software process maturity framework into a fully defined product, the capability maturity model for software (CMM). The CMM emphasizes the key practices that evidence an organization's commitment and ability to perform software development, and "...provides organizations with more effective guidance for establishing process improvement programs than was offered by the [preliminary process] maturity questionnaire." (ibid.)

The CMM model serves three operational needs. It provides: (1) an underlying structure for consistent, reliable assessments of software processes; (2) a vehicle for applying process management and quality improvement concepts to software development and maintenance; and (3) a guide for organizations to use in planning their evolution toward a culture of engineering excellence. In this latter role, the CMM is designed to help software organizations:

- characterize the state of their current software practice (the state of their art) in terms of "process"