An industry/university collaboration to upgrade software engineering knowledge and skills in industry

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Abstract

This paper describes an ongoing collaboration between Boeing Australia Limited and the University of Queensland to develop and deliver an introductory course on software engineering. The aims of the course are to provide a common understanding of the nature of software engineering for all Boeing Australia's engineering staff, and to ensure they understand the practices used throughout the company. The course is designed so that it can be presented to people with varying backgrounds, such as recent software engineering graduates, systems engineers, quality assurance personnel, etc. The paper describes the structure and content of the course, and the evaluation techniques used to collect feedback from the participants and the corresponding results. The immediate feedback on the course indicates that it has been well received by the participants, but also indicates a need for more advanced courses in specific areas. The long-term feedback from participants is less positive, and the long-term feedback from the managers of the course participants indicates a need to expand on the coverage of the Boeing-specific processes and methods.
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1. Introduction

When Boeing Australia Limited (BAL) moved its corporate headquarters to Brisbane in 1998, Boeing management made it clear to the local universities that they were keen to establish collaborative partnerships. At the beginning of 2000, BAL asked the University of Queensland for assistance to create an in-house course that provided an overview of software engineering. At this time, BAL was revising its Software Process Manual and introducing an intranet facility known as EngNET, which provides uniform access to information for engineering staff. BAL wanted all technical staff to have a common base of knowledge about software engineering and its corporate best practice. Because the course was intended to be broad in scope, it was given the title "Software Engineering Fundamentals".

BAL is a wholly owned subsidiary of the Boeing Company, and specialises in the design, installation and support of defence systems, and the development and application of complex systems support and communications solutions for commercial markets. The Boeing Company has been involved in Australian aircraft and defence businesses for more than 60 years. BAL conducts operations at 13 locations throughout Australia and employs more than 1400 Australians. Like most enterprises, BAL recognises the strategic importance of software to its business, and it is keen to identify ways to enhance the skills of its staff.

BAL's Central Engineering department maintains overall control of all engineering activities across the company. As well as providing technical advice for all BAL projects, Central Engineering is responsible for maintaining all engineering processes and providing an interface to external organisations such as the Australian Department of Defence, universities and the Boeing Company's research organisation. The department is also responsible for all aspects of technical staff development, from engineering fundamentals training to the management of Technical Excellence programs.

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The University of Queensland established its Bachelor of Engineering (Software) program in 1997 and produced its first graduates in December 2000. It is one of four engineering majors offered by the School of information Technology and Electrical Engineering. The B.E. (Software) received full accreditation from the Institution of Engineers, Australia (I.E. Aust) in 2002.

The course described in this paper is not related to the undergraduate software engineering program offered by the University. Rather, this in-house course is an overview of software engineering designed to establish a common core of knowledge in BAL's technical staff. No academic credit is available for the course because it is introductory and broad in coverage.

The remainder of the paper is organised as follows: Section 2 describes the aims and expected outcomes of the course and Section 3 explains the way in which the course was developed. The content and structure of the course are presented in Section 4, while Section 5 discusses how the course is delivered. Section 6 explains the feedback mechanisms that have been used to gather information from the course participants, the types of feedback received and how this feedback has been used to improve the course. Section 7 discusses related work on collaborations between industry and universities to improve software engineering education and training.

2. Course aims and expected outcomes

The aims of the Software Engineering Fundamentals course are introduced in the first session of the course, and they are to:

- Provide a working understanding of Software Engineering principles.
- Introduce all software engineers to accepted software engineering practice within BAL.
- Demonstrate the role of the BAL Software Process Manual and EngNET in supporting software engineering at BAL.

We stress that this course is only introductory and that it is not meant to produce experts in any of the areas that are covered in the course. Although the second aim is phrased in terms of software engineers, the course is actually intended for a much wider audience, including systems engineers, quality assurance personnel, and even some of BAL's customers. As such, we expect that different people will value different aspects of the course. For example, for recent software engineering graduates employed by BAL, the most valuable parts of the course are most likely to be the Boeing-specific aspects of the course, such as the BAL Software Process Manual and EngNET. For a systems engineer, it is more likely to be a general understanding of the software

engineering discipline and how this is put in to practice at BAL. For others, it might be some of the specific techniques that we teach in the course.

3. Development history

When the software engineering fundamentals course was originally proposed by BAL's technical director early in 2000, BAL already had a successful in-house systems engineering course. An objective was to duplicate the success of that course in the software engineering domain. The intention was that all technical staff would take both courses.

The first author spent several months part-time during his sabbatical in the middle of 2000 at BAL helping to prepare the course, working with Central Engineering's software engineering and process managers. The initial phase was deciding on the structure and scope of the course, which was achieved by reviewing software engineering texts, proposed and actual software engineering curricula, and early versions of the SWEBOK guide (Abran et al., 2001). Decisions about topics were guided by practical experience within BAL as well as by acceptance within the software engineering community. The duration of the course was set at a maximum of 4 days since prior experience suggested that longer courses were generally considered excessive by participants (and their managers!). This initial phase was undertaken in May and June 2000 and took about 20 person days of effort.

The second phase was the detailed development of the course materials, which was performed in July and August 2000 immediately prior to the first offering of the course in September. The list of topics was allocated to sessions within the course and these sessions were distributed to individual members of the course development team. The Boeing Company has an extensive library of in-depth courses that provide an excellent starting point for many sessions. Team reviews were then used to check and guide the development and refinement of each session. The second phase took about 100 person days of effort.

An early decision was to involve both academic and BAL presenters so the participants receive both theoretical and practical viewpoints of software engineering. Another was to make the course as practical as possible so participants have opportunities to experiment with their new knowledge. A particular challenge is that the course is intended for a wide audience; as a result, most practical work is organised as workshops to be done in groups.

4. Course content and structure

The structure of the course has changed since it was first delivered in September 2000. In this section, we