Development of Integrated Computer Modelling systems at Forest Research

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Summary

A new software development project called ATLAS has been initiated at Forest Research to modernise and integrate its suite of computer modelling and database tools. A step-change has occurred in the software development process that includes commitment to a modern software architecture, which will allow flexibility and full integration. Computer programming resources have been aggregated into a sizeable team and leading edge technologies have been adopted with the help of a senior software consultant.

An outline is given of potential business areas where software may be developed by this project in the future and a description is given on how these could be fully integrated into a mega-system.

This is planned as a multi-staged project that will begin with the development of inventory and harvest scheduling software tools. New features and functionality provided by these tools is listed.

Background

Forest Research has a 20-year history of developing software tools for the forestry sector. These tools have predominantly been in the forest planning area but have also included tools that assist with sawmilling and timber drying. The major tools that are in current use are:

- **TFM** - "The Forest Master" a stand record system, the new generation of this system, TFM2, has just been released.
- **STANDPAK** - Modular stand modelling system used to schedule silvicultural operations and predict yields, log and timber quality, and stand economics.
- **MARVL** - Resource assessment system, providing data capture, inventory design, yield analysis, and database management.
- **AEM** - The "Agroforestry Estate Model" provides for farm or regional planning of physical and financial yields.
- **IFS** - The "Interactive Forest Simulator" simulates the consequences of adopting alternative strategies when managing the forest estate.
- **FOLPI** - An estate planning tool that uses optimisation techniques to meet yield and financial objectives.
- **AUTOSAW** - A sawing simulation system using 3D log descriptions, that can be used to evaluate log quality and improve sawing systems.
- **TreeMAPS** - A sawing and peeling simulator (based on some AUTOSAW capability), with 3D graphic rendering of log characteristics.
- **DRYSPEC** - A supervisory control and data acquisition package for centralised control of a battery of timber drying kilns.
- **DRYLine** - An endpoint detector for controlling drying to a target moisture content.
- **Mcontent** - A tool that stores and analyses moisture content readings from dry timber.

Most of the above products have 30–50 customers (including overseas companies) and have been in commercial use for at least 10 years, in some cases more than 15 years. Although these products have served the forest industry well, they have largely been developed as "stand alone" products with limited linkages and integration designed only at the conceptual level. Some of the products are mature DOS applications that require significant redesign, other products require upgrading and modernisation.

Software Developments

A key driver behind the development of software at Forest Research is that it provides an essential synthesis of research results, data, and knowledge via computer modelling, into easy to use decision support tools or models of a specific business practice. This technology transfer role has become increasingly important as clients seek packaged computer-based solutions rather than written reports.

Forest Research has undertaken a rigorous review of its software business and has restructured to provide quicker delivery, superior products, and better product integration on a sustainable basis. Computer programming resources have been aggregated into a project team that has begun to develop a new and modern system called the ATLAS project. To assist with this project, a senior software engineer has been engaged as a consultant for 1 year. His recommendations on integration methods and modernisation of operational practices have been key in creating a step-change in the software development process at Forest Research. His first task has been to develop a modern open architecture that is flexible and allows for the true integration of a large suite of products.

To model the business processes in a powerful and rich way, modern programming techniques are required. Object Orientated technology has been chosen to fulfil these needs and represents a paradigm shift in the approach taken for software design. This will include the use of an object orientated database (i.e. not a relational database).

Many software projects fail or under-achieve because of the large number of unknowns and the...
complexity of the tasks. To achieve delivery of software, risks need to be managed by the use of considerable process and structure. To achieve this, the Rational Unified Process with an iterative development process has been adopted. This process also includes other useful techniques such as “Use cases” and emphasises management of user requirements.

**Components**

The aim of the ATLAS project is to develop new software tools within an integrated structure over a 4 - 6 year period. These tools will include forest management and wood processing aspects of the value chain and also could provide decision support in the areas of risk management and environmental impacts.

The system will operate at a range of levels of detail (e.g. support for estate, stand, tree, log, and wood products), and include operational, tactical, and strategic planning software tools. However, ATLAS does not include all software developed at Forest Research. For example, software used to control processing or operations may not require linkages to other systems.

Potential business areas that could be part of the system include:
- Genotype selection
- Site selection and management
- Stand management and scheduling silvicultural operations
- Risk management
- Inventory and yield prediction
- Estate planning
- Harvest scheduling
- Forest Engineering
- Supply chain management
- Wood processing planning
- Product performance
- Environmental planning and Carbon sequestration

Figure 1 gives a schematic of how these may be integrated into a mega system and of the potential data flows and linkages may be required. Names of existing Forest Research tools are given in italics. Although not shown each product will be modular and will have links to existing systems within client organisations.

By providing a comprehensive integrated mega system Forest Research products will have better connectivity, a common interface and hence ease of use.

**Development in Year One**

Considerable effort has been put into selecting the business area for the first year of development. At the May meeting of Software Users a brief poll was taken of clients’ interests. A later telephone survey of clients has indicated the business areas where new software maybe needed. Follow up visits have occurred to achieve an understanding of the business processes of potential clients.

Inventory and harvest scheduling tools were generally identified as important products that were needed to assist with achieving maximum value at harvest. They will be needed to provide information for both short term and longer term planning. Links to existing tools (e.g. Timber Tech LOGGER and MANAGER), will be essential to complement existing decision support systems in this phase of the forestry cycle.

In the first year the project team will develop inventory (resource assessment) and harvest scheduling tools with the working title of ATLAS One.

Some of the new features in ATLAS One that will provide better inventory results are:
- Extended tree description
- Input/output links to GIS
- Tree level sampling
- Individual tree growth and quality modelling
- Capture and analysis wood properties
- Compatibility with Timber Tech Manager
- Reporting capability for supply chain reconciliations
- Input & output in imperial units

Some of the new features in ATLAS One that will improve short term harvest scheduling will be:
- Use of an mixed integer linear programming optimiser
- Multiple time period analysis
- Links to supply chain inventory to provide real time “what if?” analysis
- Links to GIS for derivation of transport costs

To date, the development of ATLAS One is progressing very well and is expected to be completed in the third quarter of 2000.

What will be in stage two, three, or four of ATLAS has not been decided. Client demand and the strategic direction of Forest Research will determine this.