Session 5
Paper d

"BUCK ROGERS" TECHNOLOGY IN THE FOREST - FACT OR FICTION?

Richard Parker
Liro, Rotorua

INTRODUCTION

"Tough Times" are a stimulus for innovation which provides flexibility and new opportunities. The problems that result from tough times are often too great to be solved by conventional means. Many of the major technological (and social/economic) advances of the twentieth century are the result of extreme political or economic conditions. For example, the Great Depression of the 1930s resulted in radical economic initiatives such as Roosevelts "New Deal". Periods of war resulted in extreme levels of research and innovative activity. Radar, a concept of the 1930s, was developed and refined under the pressure of war. Political rivalry between the great super-powers of the Cold War, USA and USSR resulted in the arms and space races of the latter half of this century. Common objects of today were great super-power advances of the 1960s. For example, velcro - allowed astronauts to stick to the walls of space ships (both sides had plans for manned orbiting "observation posts"), disposable nappies – another product to enhance astronaut comfort.

This paper takes some of the technological advances that have come from the military, aviation and space industries and looks at potential uses in forestry.

Buck Rogers

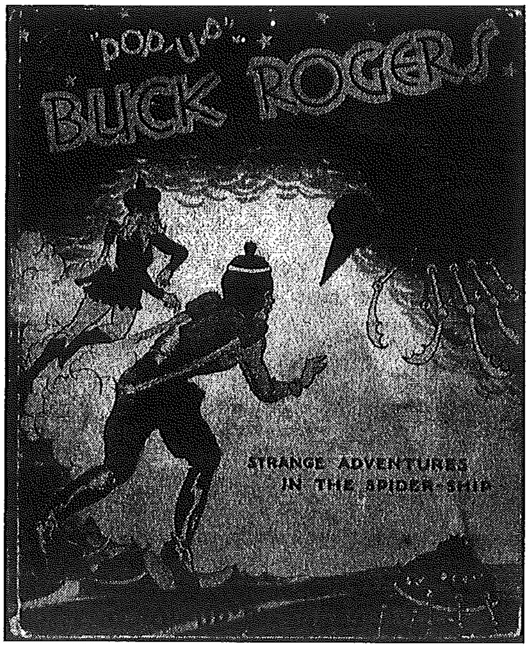

Figure 1 - Buck Rogers cartoon series from 1929 (Source: Century 25 Web Site)

Buck Rogers (Figure 1) was a science fiction character who featured in a newspaper comic strip titled "Buck Rogers in the 25th century" which started in 1929. His name has become synonymous with seemingly improbable high technology.

Fact or fiction?
All of the technologies presented in this paper are FACT, they exist. But their uses in forestry are purely fictional. If they can be proven to complete the task more efficiently, fiction will become fact.

EXAMPLES

Aircraft

Aerial imaging of forests is a fast but expensive way to collect information. Military demands for autonomous (completely self controlled) and semi-autonomous (remote controlled) aircraft have resulted in new technology which could be used to image forests.

At the high technology end are "DarkStar" - a stealthy high performance completely autonomous aircraft and "Global Hawk" which has a range of 13,500 miles, up to 65,000 feet, staying aloft for 40 hours and using sensors on board to provide near-real-time imagery back to base (DefenseLink, 1998). This is probably overkill for forestry purposes.

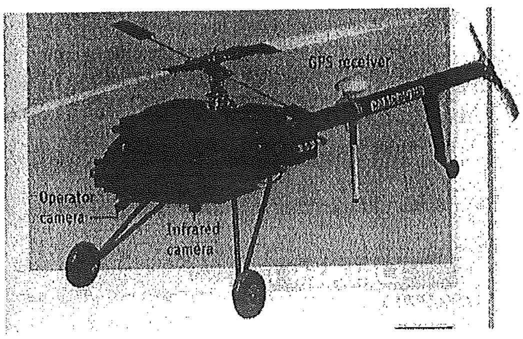

Figure 2 - Small (2 m long) remote controlled reconnaissance helicopter
(Source: Popular Science)

Lower tech solutions exist. The US Naval Research laboratory have a surveillance aircraft that weighs three kilograms and fits in a suitcase. The US Army (What's New, 1998) are currently trialing a small pilotless helicopter with a range of 70 km for reconnaissance and land mine detection (Figure 2). Smaller still are Micro Air Vehicles (MAV). These are very small aeroplanes (less than 15 cm in any dimension) developed for reconnaissance and using on board GPS for navigation (McMichael & Francis, 1997).

Many types of sensors have been miniaturised to be carried by small pilotless aircraft. The small relatively cheap aircraft could be fitted with a camera for aerial photography of a single compartment at frequent intervals. Stereo digital video cameras could be used while flying above the canopy to record upper mid-crown yellowing in radiata pine trees (Firth, Brownlie & Olykan, 1997). MAVs could even fly among the trees if a useful purpose could be found!

Virtual reality workbench

The US Marine Corps and the US Naval Research Laboratory have developed a battle planning and management system which provides an interactive 3D representation of a battle field. The VR workbench displays computer-generated stereoscopic images on a table (Figure 3). The images are viewed with stereo shutter glasses and appear to rise up out of the table.

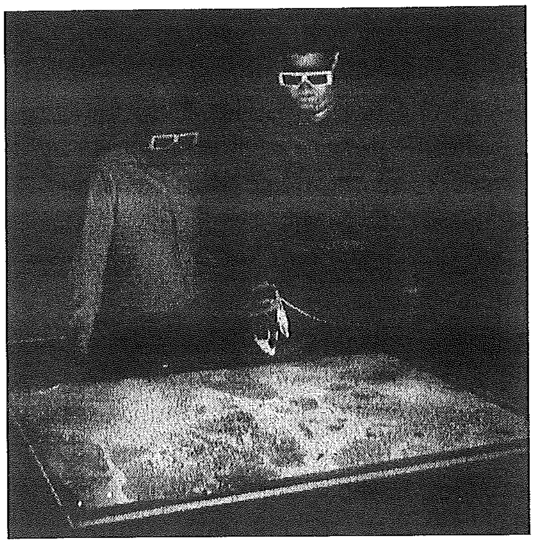

Figure 3 - Naval Research Laboratory virtual reality workbench
(Source: Naval Research Laboratory)

This technology could be used in harvest planning and roading. Giving the planner a greater appreciation of the terrain and the opportunity to try alternatives at no cost. The military use the VR Workbench to visualise terrain masking effects such as where radar will not reach. Could the harvest planner visualise where the hauler will not reach if it is set up in a particular position? The information gathered by flights of small relatively cheap surveillance aircraft could be added to the terrain map to update it.

Robots

Robots (autonomous machines) have often been considered in any discussion of future technology for forestry. Traditionally they have been portrayed as human-like; with arms and legs, or as autonomous versions of existing machines controlled by complex microprocessors. However, complexity costs money. To get a linear increase in robot ability needs an exponential increase in computing power. For example "to make a robot that makes you toast costs $20,000. To get it to butter your toast costs an additional $300,000" (Tilden, 1998).

To get around this problem work is being done at Los Alamos National Laboratories on small (hold in your hand size) robots which do only one task and simply react to the environment like an insect. These robots have been trialed clearing minefields. When they stand on a mine a leg gets blown off - they have many legs, so can stand on many mines before they no longer function. In forestry we should consider robots, not just from the perspective of complex harvesters doing many tasks but of more smaller, simpler robots performing only one task. Perhaps these simple robots will do more complex tasks by working together. Bay (1998) discusses the design of the "Army-Ant" cooperative lifting robot. A future scenario could be a swarm of small cheap identical machines, much like ants, pruning standing trees or delimbing felled trees. They could be used to collect economically valuable information about standing trees such as stiffness, diameter and so on.

Human amplification

It is unlikely that the forests of the future will be devoid of people. Humans can make decisions on the spot and develop innovative solutions to problems that arise. People are very mobile on two legs. A logger can walk to almost every tree in a forest, no matter how loose the soil or steep the slope. But a person is not strong.

To combine the mobility of a person with the strength of a hydraulic machine a powered "exoskeleton" was developed by the General Electric Corporation in the 1960s. It enabled a person to lift 800 kg using only 25 kg of force. However problems with joint dexterity and hydraulic control caused the work to be shelved.

More recent work by NASA and military researchers is investigating "artificial muscles" which can be embedded in the clothing of soldiers (or astronauts) to enhance to power of tired muscles (Best of the New, 1998). Perhaps the loggers trousers of the future will be "powered"?

Stiffness determination

Wood stiffness and density are vital measures for the forest industry. The space industry also have a vital interest in stiffness and density. Prolonged periods in space result in a loss of bone strength and stiffness. The traditional methods used to determine bone mineral loss during spaceflight were by painful biopsy or complex medical scanners. Using a simple acoustic method (Stüssi & Lawson, 1996) the stiffness of the tibia between knee and ankle has been measured on astronauts (Figure 4).

This same technology, with modification, could be applied to tree stem stiffness determination.

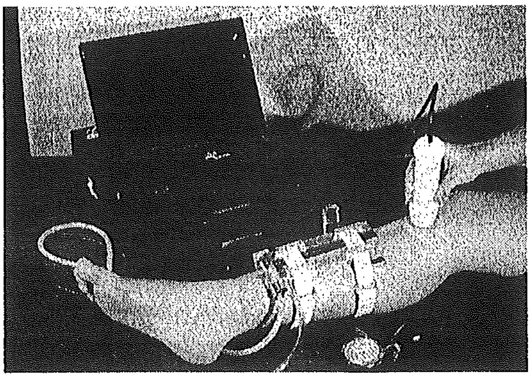

Figure 4 - Acoustic bone stiffness measurement
(Source: European Space Agency)

The Airship
Since the Hindenburg disaster in 1937 the technically naïve have viewed airships as fantasy vehicles with no commercial future. However a renaissance in airship development is occurring. The Zeppelin Company in Germany have launched their Zeppelin NT (New Technology) airship and sold six already. Cargolifter AG is building a 242 m long airship with a lifting capacity of 160 tonnes (Cargolifter, 1998).

The most obvious use of an airship in forestry is the elimination of roads and their environmental and economic costs. The airship could move machinery into an isolated block and move the logs out to the nearest road or railhead.

SEDUCTION

Technology is seductive. Highly capable systems developed for use on the modern battlefield or for in orbit around the earth have a certain appeal for the technophile. The technology-rich Buck Rogers system must be an economically viable alternative for the current system it replaces. Also, technology cannot eliminate the need for skilled people in the workplace. Often the technology requires more skills of the operators. The Australian Army found that high technology on the battlefield (helmet mounted displays and thermal imaging) complimented but did not replace basic soldier skills. They ended up with a double training bill (Coleby, 1997).

CONCLUSIONS

Buck Rogers technology does exist, in fact, in the miliary, aviation and space industries. Some of this technology, if economic, will be used by the forest industry in the future. However, we must introduce the technology cautiously and ensure the people who use the technology have the resources to be trained effectively in its use.

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