SHOOTING FROM THE STARS

If we want to enjoy products made of wood, we have to find out just how much high-quality timber there is in our State forests and how quickly it grows. Then we need to estimate how much we should use. Amongst other things, forest measurement means knowing how tall a tree is, whether it's growing straight, what blemishes there are in the outer layers, what imperfections there may be in the heart of the wood, and so on.

But first we have to find our tree.

THERE'S a worn old image of the forester as an earthbound rustic, a bloke who sleeps on his axe amongst the tree-roots and sizes up his charges with a measuring tape. This quaint notion should have been put to rest two decades ago when, in 1972, the first magnificent LANDSAT photographs gave forest inventory a quantum leap forward. If the old image still lingers, recent developments within CALM ought to shatter it forever.

The very latest technology is being used by forest scientists to measure the amount of timber in the State's jarrah forests. Using a specially modified helicopter, forestry staff fly up and down pre-determined flight lines and photograph the forest below. Their equipment includes a computer that taps in to a precise satellite-based navigation system, known as a Global Positioning System (GPS).

ORBITING EYES

The helicopter's GPS receiver calculates its position on the earth's surface from a constellation of NAVSTAR satellites, launched by the US Defense Department. Signals are transmitted from the satellites, which orbit about 20 000 kilometres above the earth's surface. The

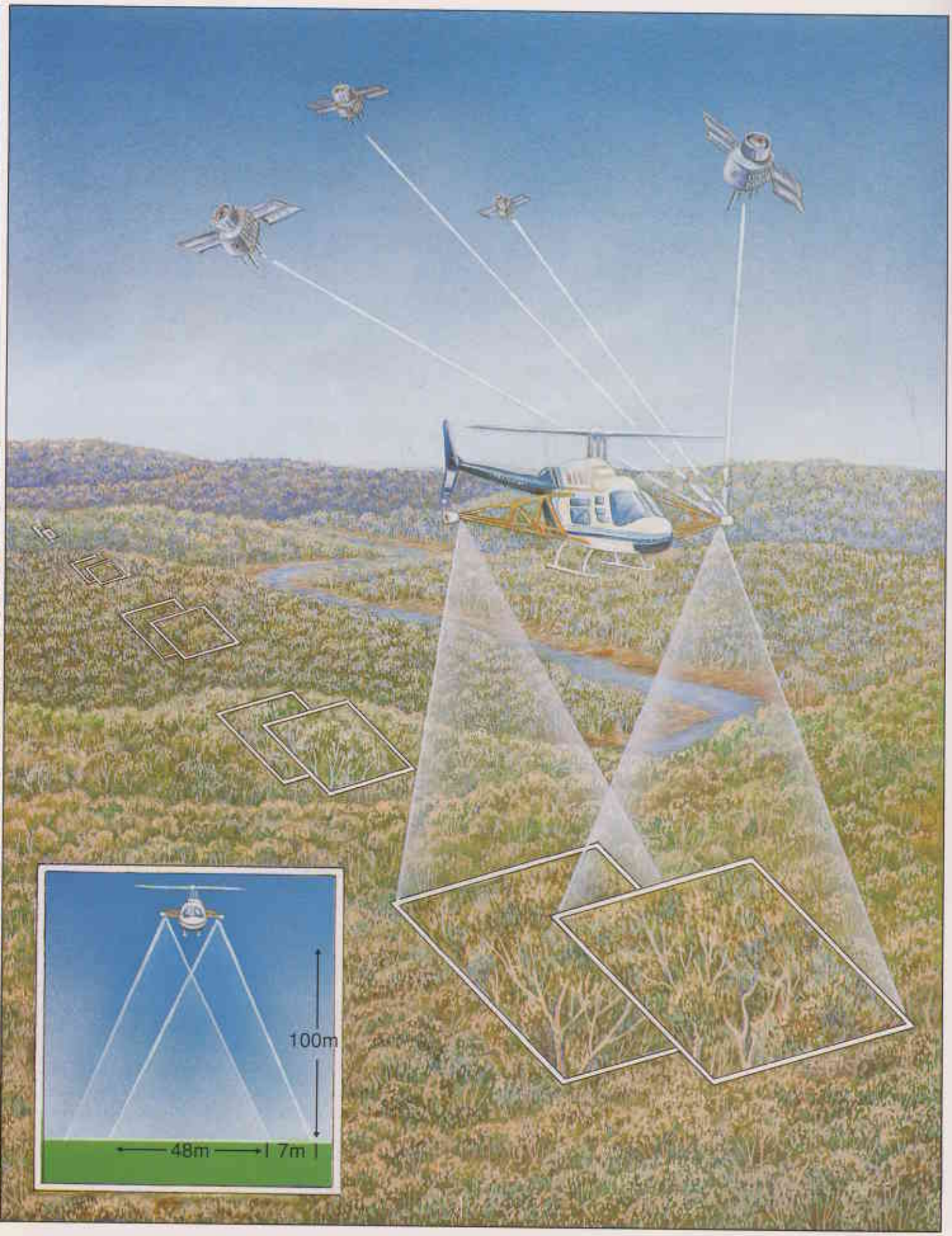
Technology ascends while the forest waits.
Photo - Jiri Lochman ▲

GPS unit in the helicopter receives the signals and fixes its position once every second by measuring the time each signal takes to reach the receiver.

At least four satellites must be visible above the horizon for observers to get a three-dimensional fix, and if the satellites are well distributed about the sky, the helicopter's position can be determined to within 25 metres. A full constellation of 18 satellites is needed for 24-hour coverage of the planet, but at present only seven are in orbit. As a result, a helicopter flying over Western Australia in the middle of the day can currently exploit the system only from November to February.

Large-scale stereo photographs are taken on a sample grid while the helicopter flies at a constant height of 100 metres. Two photo pairs are taken for each square kilometre of forest. Cameras are mounted on either side of the helicopter at each end of a 7.5 metre boom, and are aimed so that their images overlap at a spot 100 metres below - the 'plot'. The result is a regular sampling of the forest by a series of precisely positioned photographs, from which tree species can be identified and tree heights estimated.

Because of this technology, CALM foresters can find a plot a lot more easily than ever before - not only from the air, but on the ground. At the heart of the photography system is a laptop computer, connected ('interfaced') not only to the Global Positioning System, but also to a radar altimeter and the stereo camera control unit. Before a flight begins, the latitude and longitude of each of a series of parallel flight lines, spaced one kilometre apart, are read into the computer from a floppy disk, and are then transferred to the GPS unit. Through his GPS receiver, these coordinates enable the pilot to navigate accurately along the required



The helicopter flies at 100 m above the trees and takes a pair of photographs every 500 m. A GPS satellite navigation system is used to direct the helicopter along the correct line and to determine the exact location of each pair of photographs. ▲

INSET: The photographs are at a scale of 1:1000 and each covers an area 55 x 55 m². Any tree in the area where the photographs overlap can be measured stereoscopically.
Illustration - Yeon Hee Kim

Loading the camera in the starboard pod.
Photo - Jiri Lochman ▲

This article was written in consultation with staff of the Inventory branch and the Land Information branch of CALM.

flight paths. A map showing the position of the flight paths and the sequence of plots along them is used later to direct ground staff to the scene.

A FIX FROM THE STARS

The computer gets its position once every second from the Global Positioning System, then sends a signal that triggers the cameras every 500 metres along the flight line. The computer knows from the GPS which satellites are sending the signals, and how accurate the positional fix is; it takes its altitude from the radar altimeter, and also generates a frame number for the photographs. All this information, plus the location coordinates, is written to a disk when each photograph is taken. The computer also displays information continuously to the cameraman, who can stop or pause the photography, or alter parameters if necessary.

While this is in progress, pilot and navigator are reading navigational information supplied by the Global Positioning System, displayed separately above the pilot's instrument panel. For each flight line, it displays the direction and distance to the destination point, the true direction of travel, the speed, and the amount of deviation to the right or left of the required line.

When the flight is over, the information written to disk is transferred to CALM's mainframe computer and translated into a map. Other staff can use this information to locate particular plots on the ground, after which they can measure any individual tree selected from each plot and assess the quality and potential use of its timber.

With the help of this and other new technology, foresters expect to complete the inventory of the jarrah forest by 1991. It will be the first time that such a detailed picture of the forest and its timber has become available. The information will be more than a huge help - it will be utterly essential to CALM's foresters in managing and conserving the State's forests well into the next century. ▣

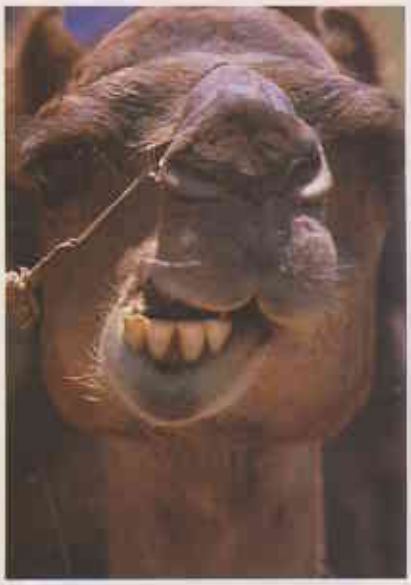
RAY BAILEY

LANDSCOPE

VOLUME 5 NO 2 SUMMER EDITION 1989/1990

Dolphins, whales and seals frequently strand along the WA coast. Find out who helps them and what they do on p. 10.

Powerful forces have formed the rocks and land surface of WA over billions of years. See p. 48.



Why are the thousands of feral camels that roam inland Australia the scourge of the desert? Turn to p. 22.

Explore the fascinating subterranean worlds deep beneath the earth on p. 28.

Inlets and rivers, towering karri and tingle forests, rugged coastline and remote wilderness areas - Walpole-Nornalup National Park has it all. See p. 15.

C O V E R

Australian sea-lion (Neophoca cinerea). *Photo - Nick Gales*

F E A T U R E S

R E G U L A R S

Managing Editor: Ron Kawalilak
Editor: Carolyn Thomson
Designers: Louise Burch/Robyn Mundy
Production: Karen Addison/Margaret Wilke
Maps: Project Mapping, CALM
Advertising: Tim Langford-Smith ☎ (09) 389 8644 Fax: 389 8266

Colour Separations by The Colour Set
Printed in Western Australia by Kaleidoscope

Published by Dr S Shea, Executive Director,
Department of Conservation and Land Management,
50 Hayman Road, Como, Western Australia 6152.