Precision viticulture

Raise a glass to GPS planting

Australia is a world leader in precision agriculture, with its winemakers at the forefront of those using sophisticated information to create great wine. **Mark Eggleton** *reports*

AARON FRANCIS

Terroir terrific: CEO of Treasury Wine Estates David Dearie toasts the company's use of satellite images in its winemaking

WINEMAKERS often talk about the "terroir" of their wines and occasionally mouth Yoda-like mantras such as "made in the vineyard, wine is". They're right, as wine is a reflection of the geography, climate and geology of where its grapes are grown, unless it's a cheap, multi-regional hotchpotch of styles or in a silver bag.

Nowadays, with precision viticulture, winemakers are able to uncover so much more about their vineyards, as technology and science combine to meet with the centuries-old philosophy behind the creation of great wine.

According to CSIRO's Principal research scientist, Dr Rob Bramley, Australia leads in the area of precision agriculture and its application extends right across agriculture into broad-acre farming as well.

Dr Bramley says Australian farmers have generally been early adopters of the technologies associated with the technique, which involves numerous technologies including satellite.

Global Positioning Systems (GPS) are used for mapping land variability as well as in the areas of machine-guided planting and spraying.

Dr Bramley says many farmers are already using GPS technology when it comes to machine-guided planting – especially in broad-acre farming – and it's "just a step up to precision agriculture as it disposes the grower to using other technologies".

"Out on a large farm, a grower can work the fields all night using GPS technology and know where they are in the field and what they've covered to a distance of a couple of centimetres," he says.

Back in the vineyard, Dr Bramley says satellite technology has numerous applications, ranging from laying out new vineyards using GPS, to potentially yield mapping a vineyard's variability. "GPS is a key enabling technology, but when it comes to mapping a vineyard from above, it's better to use regular aircraft as the imagery needed has to be more detailed than can usually be obtained from a satellite.

"A satellite image might show five to 10 metres in area, whereas the row spacing in a vineyard might be two to three metres. You need higher resolution imagery and an airborne system can provide this over a smaller area without being prohibitively expensive," Dr Bramley says.

"With satellite imagery, you have to buy a whole scene, which can be perceived to be quite expensive if you're just looking at a vineyard's small footprint."

The national viticulturist for Treasury Wine Estates, Paul Petrie, says the company has been actively involved in precision viticulture since the late '90s and says the technologies are mostly applied to the company's premium and ultra-premium blocks of fruit.

He says while satellite images would primarily be used over a large area, the company does tend to use an aeroplane to photograph vineyards of about two to 3 hectares. The infrared and colour images taken help the company and its winemakers measure plant cell density and get a better idea of potential yields.

It's from these images that a winemaker can then decide how to manage the vineyard as the fruit further develops. Moreover, the yield maps created from these images can be used at harvest time and this is where GPS satellite technology comes into play again.

"With GPS technology, we can target really good parcels of fruit out of a block as there's always variation in one block as soils differ," Petrie says. "For example, in the Coonawarra, there might be a limestone ridge running through the block, while at our Penfolds Robe vineyard there are sand dunes in the vineyard.

> "Many farmers are already using GPS technology when it comes to machine-guided planting"
>
> **DR ROB BRAMLEY,** Principal research scientist, CSIRO

"When we're picking, we have lights on the harvesters, which indicate different parts of the vineyard and different fruit quality. The fruit is assigned to a bin according to the light, which works off a computer-generated map that is all run off a GPS system. In fact, we probably take GPS technology for granted nowadays as it's integral to the whole process," Petrie says.

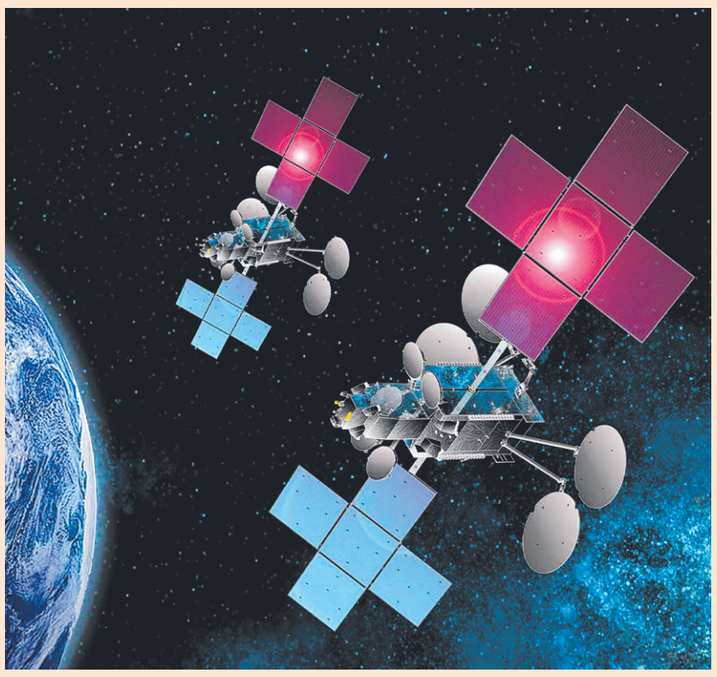
And while GPS technology is now taken for granted in broad-acre farming and viticulture, the next use for satellite could be to find and map specific chemical signatures. At present, the airborne platforms taking multispectral infrared images typically are confined to four wave bands at once, which identify the health of the canopy, among other things. A step up would be satellite imagery taking hyper-spectral images that collect more than 100 wavelengths at once.

"There might be a chemical signature that can be worked out from there," Dr Bramley says. "So far, we've found nothing, but even if we do identify a chemical signature, we don't know whether it will be something worth knowing about."

Telecommunications

Heads turn as billions blast off

By **JAMES DUNN**



Into space: Artist's impression of the two NBN satellites in orbit

IN a $40 billion-spending program, $2 billion is barely noticeable. But NBN Co spending that amount on a satellite network for Australia is certainly noticeable in the satellite industry.

The spend marks Australia's first foray into nationally owned satellites since the government got its fingers burned in Aussat in the 1980s.

Earlier this year, NBN signed a US$620 million ($608 million) contract with Space Systems/Loral – formerly the aerospace division of Ford Motor Company – of Palo Alto, California, to build two dedicated communications satellites, to be launched in 2015.

NBN says the satellites will service about 3 per cent of homes and business premises outside the reach of its fibre optic and fixed-wireless services, including outback areas and Australia's external territories such as Norfolk Island, Christmas Island, Macquarie Island and the Cocos Islands.

The rest of the $2 billion will be spent on the telemetry, tracking and command (TT&C) system, building 10 Earth stations across the country, equipping them with the latest in Ka-band technology, and integrating the network with the rest of the NBN.

The NBN satellites will be completely dedicated satellites, just hosting NBN traffic. To that end, they need to be "Among the biggest broadband satellites ever put into space," says Matt Dawson, NBN Co's satellite project director. "Not only are they next-generation Ka-band satellites, they are at the very heavy end of satellite engineering. They are massive, 6300-kg units, which is reaching the limit of how big you can build these satellites.

"That's necessary because they have to be dedicated in terms of their payload: it is specific to delivering high-speed broadband to very targeted areas of demand over Australia and its outlying islands. They're not built for any other purpose. We need every inch of capacity and kilogram of mass on the satellite to be dedicated to that purpose," Dawson says.

Australians living and working in remote areas have had satellite communications access since Optus took over the first three Aussat satellites in the 1990s – and subsequently both added to its fleet and retired some satellites into "junk orbit" – and through satellites launched by other countries, such as Thaicom of Thailand's IPSTAR satellite and the Thuraya Satellite Network, operated by the UAE-based satellite services provider Thuraya.

> "It is specific to delivering high-speed broadband to very targeted areas of demand over Australia"
>
> **MATT DAWSON,** Satellite project director, NBN Co

Under the Australian Broadband Guarantee (ABG), the Federal Government leased capacity on the IPSTAR and Optus satellites and offered subsidised services to homes and small business premises unable to access commercial broadband services comparable to those available in metropolitan areas. But that scheme was retired in June 2011, replaced by NBN's "interim service guarantee," under which NBN leased capacity on the same satellites to provide service to customers until its own satellites are deployed.

"We invested quite a bit of money to upgrade all the infrastructure at the Optus and IPSTAR earth stations, the antenna systems and modems – the network termination device that goes into homes. It's a much-improved service – it offers a 6 Mbps (megabit-per-second) peak download speed, which is orders of magnitude better than people experienced on the old ABG, where they would have been lucky to get 1 Mbps.

"But our own satellites have been designed to deliver initial peak speeds of 12/1 Mbps at the wholesale level for the same wholesale access price as similar fibre services," Dawson says. "We have more than 17,000 users currently enjoying our interim satellite service, but it has capacity limitations, because it doesn't use dedicated satellites."

Paul Budde, principal at independent telecommunications research and consultancy company BuddeComm, says satellite is the only economically viable solution for the delivery of telecommunications to remote areas – but even satellite is not viable enough at the speeds NBN proposes to deliver.

"The new technology that NBN Co is using is state-of-the-art – they have basically over-engineered the satellite to get over the 'latency' problem, which affects interactivity – but it is still not economically viable in a household sense. It wasn't until the NBN came along that, within the total package of $40 billion, a couple of billion dollars for satellites barely shows up.

"That was one of the reasons why the government wanted to utilise the whole NBN, have it considered as one big project, because if you start to split out individual elements, you could ask, 'is it economically viable to give those people in remote areas such an expensive technology?' The government wanted to provide remote services as comparable as possible to the services it was delivering to metropolitan areas through fibre."

Budde uses the example of an Aboriginal community being connected to the NBN satellite service. "Say that costs $200,000. But if that community can now have remote access to healthcare and to education, the social and economic benefits generated are likely to outweigh the $200,000," he says.