The C-ITS revolution and how the new technology is being tested

Many people assume Cooperative ITS (C-ITS) is simply the addition of communication with cars to 'traditional' ITS. However, although it brings together intelligent vehicles and infrastructure, that perception fails to grasp the shift in ways of working. C-ITS involves moving all ITS applications onto a common platform, each communicating using a standardized set of protocols.

To date we have used separate systems for intersection control, parking management, traffic counting and profiling, weather and pollution monitoring, tolling/road user charging and enforcement. Each requires its own power, communication, sensors, boxes, operations, management and maintenance contracts.

Maximizing the space

Incorporating as many applications as possible onto a single platform therefore makes budgetary and operational sense, but this mitigation will take time, due to many factors. These include the relative lifespans of deployed systems; the time taken for procurers and users to realize the extent of change; and the vested interests of some product manufacturers keen to preserve market share. Nevertheless, in the coming years we will see the plethora of solutions currently marketed and deployed shrink into single, universal alternatives.

In Australia, Q-Free is engaged in a series of projects that support national and state-driven initiatives designed to prove and facilitate the deployment of next-generation traffic management to improve safety and reduce emissions.

Australia has a very active program of research and
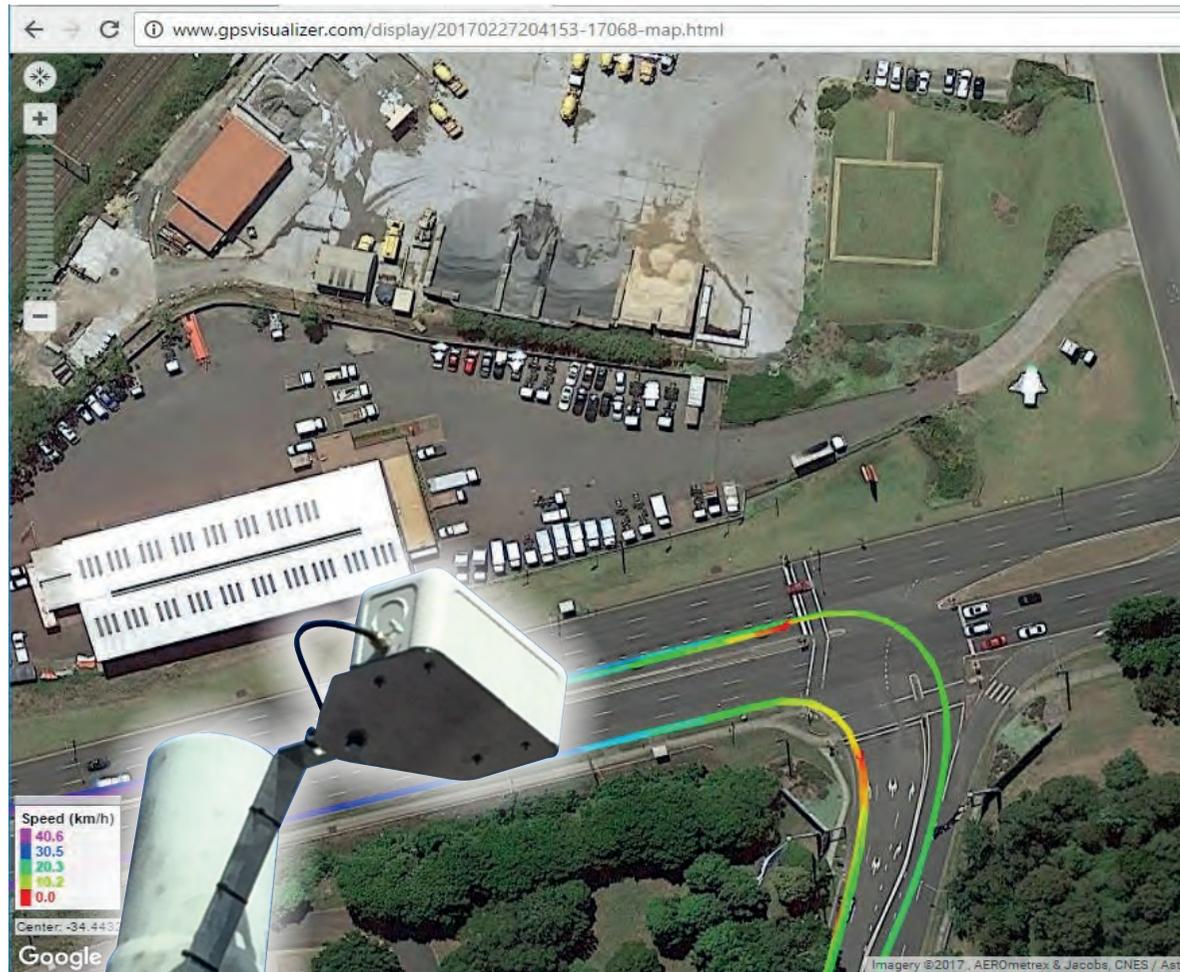
Above: **Q-Free's U-ITS solution can accurately map vehicle location, speed and heading down to the individual lane level**

Inset: **One roadside unit is able to perform multiple functions**

development. It has also committed considerable finances, with the iMOVE Cooperative Research Centre being the principal funding vehicle. It has been awarded A$55m (US$43.4m) in federal government funding for the next 10 years. In total over A$107m (US$84.6m) has been committed to the country's C-ITS effort by industry and government partners.

Q-Free's Universal ITS (U-ITS) Station is a compact, comprehensive C-ITS solution providing full hybrid, ETSI/ISO-standard communications. It is available in roadside and in-vehicle versions that use many of the same components and its conformity with internationally agreed C-ITS standards enables ready interfacing with other manufacturers' technologies.

During the 2016 ITS World Congress in Melbourne, C-ITS Station-equipped coaches traveling to and from the outdoor demonstration area passed through a series of intersections. The roadside U-ITS Stations broadcast standard messages including intersection map and traffic signal status (SPaT/MAP),

roadside awareness messages (CAM) and service announcements. A central ITS station provided open web access, enabling smartphone, tablet and PC users to follow the demonstration live.

Government backed
Following expressions of interest from several World Congress exhibitors, including major automotive companies, the systems will remain in place in Melbourne and will potentially form a part of the National Connected Multimodal

Testbed. Meanwhile, the government of New South Wales has acquired its own set of Q-Free Universal ITS Stations with which to further C-ITS development work taking place in the state.

In November 2016 the country's largest C-ITS trial to date was announced, part of the Connected and Automated Vehicle Initiative (CAVI). It will take place in Ipswich, a town near the Queensland state capital, Brisbane. The trial will involve some 500 vehicles in the testing of seven Day One applications. These include: emergency brake light, stopped/slow-vehicle warning, red-light warning, road-works warning, back-of-freeway-queue warning, and in-vehicle speed warning (an application dealing with the delivery of variable message sign-type information directly into the vehicle). Another application will look at using connectivity to provide

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warnings of pedestrians' and cyclists' presence and intentions. Although the future ideal is that all individuals will carry some form of connected device, this is still some way off, so information from pressed crossing call buttons will be used initially.

Size does matter
Australia is also home to the largest C-ITS test facility currently in operation in the southern hemisphere. The Cooperative Intelligent Transport Initiative (CITI) is based in the Illawarra region, to the south of Sydney in New South Wales.

The testbed includes three C-ITS-equipped intersections that provide signal-status information, as well as a roadside station that broadcasts speed-limit information to heavy vehicles. Almost 60 trucks and 11 buses have been fitted with C-ITS systems, and drivers in participating vehicles can see information on speed limits and signal phases, and receive warnings of intersection collisions and heavy braking ahead. CITI is to be expanded to include 55 cars from the Wollongong area.

In March 2017 Q-Free Australia demonstrated the GNSS positioning capabilities of its vehicle ITS Station at the CITI test facility.

The tests involved 34 maneuvers at three intersections, with each maneuver repeated twice. The unit's latitude, longitude, speed and heading were recorded every second, then plotted on satellite images.

Conclusive results
The results proved that the Q-Free station accurately recorded the position of the test vehicle, with consistent results across repeated tests. The plotted

tracks appeared at the center of the lane in which the vehicle actually traveled, proving a ±2.0m positioning accuracy and showing the Q-Free hardware's ability to be used for applications where positioning down to lane level is critical.

The company has also demonstrated its hybrid communications capabilities. The U-ITS Station is capable of hosting a wide range of protocols, including the ETSI ITS G-5 and IEEE WAVE protocol stacks. It can also host Bluetooth, wi-fi and 5.8GHz-based tolling if desired. 5G cellular is presumed by many to be the complementing technology to G-5/WAVE, but Q-Free has also already shown the ability to use 3G/4G on ISO CALM (communications access for land mobiles) standards. This has great potential given Australia's sheer size, but is also highly relevant where other deployments may be required to cover a very large area.

Although G-5/WAVE are the presumption for safety applications, and 5G the preference for non-safety applications, the delivery of ITS/C-ITS services via multiple generations of cellular has merit because it would enable quick, interoperable C-ITS deployment with greatly reduced numbers of roadside units. Given that 5G is still at the definition phase, this is a major plus, and confers a distinct advantage both to Q-Free as a technology supplier and to its potential customers and partners. ○