

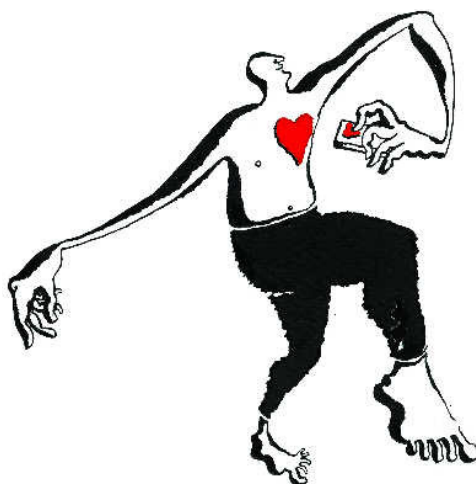
► first tests the speed was pushed up to 70kph, and this summer the first multiple-vehicle tests will begin with up to three cars and two lorries. The researchers will then be ready to leave the test track, says Erik Coelingh, head of active-safety functions for Volvo, a carmaker that is one of the SARTRE members. "During the autumn and winter we will refine the controls, and if we succeed we would like to test the same system on public roads in Spain during summer 2012," he says.

Platooning is not a new idea. In the 1990s a project in San Diego called PATH carried out small-scale tests of a system that involved placing induction loops in the road which acted as electromagnetic rails to guide vehicles along the highway. The idea never took off because it was prohibitively expensive. But SARTRE is different, says Mr Robinson, because it does not require any changes to the road infrastructure.

Moreover, aside from the wireless-communication system, SARTRE works by taking advantage of the actuators and sensors that already exist in many modern cars, such as adaptive cruise control, automatic braking and lane-departure systems, which use radar, infra-red sensors and cameras. "We reuse the sensors and part of the control system, but add new algorithms," says Mr Coelingh. So once a car has joined a platoon these systems make it relatively easy to stay in line. The driver at the front would be trained, licensed and paid to lead. As well as steering, he would have to take account of the platoon's impact on other traffic when changing lanes or turning. The rest would be taken care of by software.

The technology is not quite there yet, concedes Mr Coelingh. Strategies still need to be precisely worked out to enable vehicles to join or leave safely, even if they are in the middle of the platoon. Similarly, methods will be needed to allow the lead vehicle to dissolve the platoon on reaching its destination or to allow another lead vehicle to take over. The researchers must also determine how closely packed together the cars should be to get the best fuel savings and highest level of safety.

Mr Robinson and Mr Coelingh accept that the success of platoons is more than just a question of whether or not the technology can be made to work. The real question is whether drivers really want it. Driver attitudes towards automation are softening, Mr Coelingh believes. And there are occasions, such as during a daily commute, when motorists might welcome not having to drive. However, drivers are currently required to be in control of their vehicles at all times, and in many places it is illegal to use a mobile phone when at the wheel. So laws will also have to be changed, says Mr Robinson, which could take a decade or so. ■



## A wireless heart

**Biomedicine: Better artificial pumps, powered wirelessly by induction, offer hope to those who cannot get transplants**

DICK CHENEY has no heartbeat. That might sound like the punchline to a political joke, but for the former American vice-president it is deadly serious. Mr Cheney is one of thousands of people around the world who have a "left ventricular assist device" (LVAD) implanted in their hearts. LVADs—mechanical pumps that take the stress away from a failing heart by moving blood smoothly around the body without generating a pulse—have become smaller and more reliable over the years since their introduction in 1994. They were originally designed as a stopgap to keep a patient alive for a few extra months while a suitable transplantable heart could be found. But improvements in the technology, and a lack of donor organs, mean they are increasingly used on a long-term basis.

One area in which they have not improved, though, is their power supply. The pump requires an electric cable, called a driveline, that runs through the abdominal wall to a battery pack in a harness. This device, which must be worn all the time, hampers mobility, makes it awkward for the wearer to shower (and impossible to swim) and makes driving impossible because even a minor accident that dislodged the driveline could be fatal.

Most importantly, though, it is a constant source of infection. With most medical implants, such as pacemakers and hip replacements, the risk of infection decreases over time. But the driveline collects bugs from the outside world, and the

LVAD then introduces them directly into the bloodstream, allowing them to spread quickly. As a result, the driveline must be redressed every day using sterile gloves and gauze. Even so, virtually everyone fitted with an LVAD experiences an infection every 12 to 18 months. Many such infections are serious. Some are deadly.

Joshua Smith, an engineer at the University of Washington, and Pramod Bonde, a heart surgeon at the University of Pittsburgh, hope to change that. Between them they have developed the world's first wireless-powered, driveline-free heart pump. It was formally announced at the American Association for Thoracic Surgery's annual meeting in May.

The Free-Range Resonant Electrical Energy Delivery System, or FREE-D, is powered by induction. Specifically, it exploits a phenomenon called resonant coupling, in which metal coils that resonate at the same electrical frequency can exchange energy particularly efficiently. A transmitter coil, 26cm in diameter, can beam up to 15 watts of power to a receiver coil just 4.3cm across. The transmitter coil can thus be worn in a vest that also holds a battery pack, while the receiver tucks neatly into the patient's chest.

Dr Smith's design can compensate for changes in the angle or position of the coils, allowing a user to move around freely. He envisages beds with built-in transmitter coils, letting people sleep without a vest on, and even entire hospital rooms (or houses) that have coils hidden in the walls and ceilings.

Such improvements cannot come a moment too soon. America's National Heart, Lung and Blood Institute estimates that more than 50,000 Americans a year need a heart transplant or an LVAD. Even so, fewer than 2,500 heart transplants are performed in the country every year and the number of LVAD implants is even smaller. As the supply of donor hearts is unlikely to increase, the need for better LVAD technology is clear.

The wireless heart pump developed by Dr Bonde and Dr Smith will not be available for a few years, however. Technical challenges remain, including integrating a leakproof backup battery into the device and miniaturising the FREE-D's control electronics. And even when those problems are solved, the device will still have to undergo extensive clinical trials before it can be licensed for sale.

If the history of medical research teaches anything, though, it is that conditions which affect wealthy and powerful men like Mr Cheney have little difficulty attracting the money needed to develop and refine new treatments. In just a few years, then, the world could be full of thousands more healthy, active ex-politicians without a heartbeat. Insert your own punchline here. ■