

**Response to Law Commissions' second consultation on Automated Vehicles
(Law Commission Consultation Paper 245; Scottish Law Commission Discussion Paper 169)**

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What is your name?

Richard Sarginson

What is the name of your organisation?

Retired

Are you responding to this consultation in a personal capacity or on behalf of your organisation?

[Respondents chose from the following options: Personal response; Response on behalf of your organisation; Other.]

Personal response

CHAPTER 3: OPERATOR LICENSING – A SINGLE NATIONAL SYSTEM

A single national scheme

Consultation Question 1 (Paragraph 3.82): Do you agree that Highly Automated Road Passenger Services (HARPS) should be subject to a single national system of operator licensing?

[Respondents chose from the following options: yes; no; other.]

Yes

With the advent of HARPS, it would be a nonsense to have anything other than a national system system of regulation. I am however concerned that our system may diverge from that developed and used in Europe. It is possible to see that, if we are not aligned with EU regulations, difficulties may arise in the long term. I comment more fully on this in the final section on other issues/points.

Is 'National' inclusive of all parts of the UK? Will these regulations apply in The Channel Islands, Isle of Man etc

Consultation Question 2 (Paragraph 3.86): Do you agree that there should be a national scheme of basic safety standards for operating a HARPS?

[Respondents chose from the following options: yes; no; other.]

Yes

In the future, there will be accidents and any variability allowed in safety standards would become key areas that would be explored in Court cases. In my mind, it would not be helpful for legal argument to explore which standards were applicable.

I would suggest that all standards relating to safety should apply nationally unless there is a compelling case to do otherwise. However, at the moment, I cannot think of an example where an exception would be (or seem to be) justified. Clarity is essential.

CHAPTER 4: OPERATOR LICENSING –SCOPE AND CONTENT

Scope of the new scheme

Consultation Question 3 (Paragraph 4.33): Do you agree that a HARPS operator licence should be required by any business which: (1) carries passengers for hire or reward; (2) using highly automated vehicles; (3) on a road; (4) without a human driver or user-in-charge in the vehicle (or in line of sight of the vehicle)?

[Respondents chose from the following options: yes; no; other.]

Other

I am assuming that points 1-4 in the question will all need to apply.

My simple answer is YES, but I have a problem with the question's wording.

At point 1: What if a charity were to offer a free service to passengers? For example, they might provide a service to take patients to a hospital in a city from a the suburbs but not require payment due to the deprivation in that local area.

This point would then no longer apply.

The operator licence should, I suggest, be required for offering a service, irrespective of whether there is any kind of of payment.

At point 3: I note that car parks are not legally roads. (para 4.20) So, where will passengers alight safely if being taken on a journey from say Exeter to Carlisle via the motorway? No Stops??? It cannot park without blocking the roads within the service station! Not a journey I would buy.

Where could privately owned HARPS stop legally?

Refuelling/recharging also seems to me to be problematic as a garage forecourt or plug-in point does not seem to be a road.

This also implies that a HARPS vehicle will need to be able to be driven by a driver to take it into a service facility or overnight parking. So all the controls, seats etc needed will need to be present, unless it is towed by a tractor unit like an aircraft - would this be possible at a motorway service area or at an hotel for an overnight stop? I very much doubt it.

Is there the thought that HARPS will have to be restricted to a very limited number of the roads, as many roads may not suit the control system algorithms (particularly in the early days after initial release on to the market? If so, it opens up many more regulation and licensing issues.

If not and HARPS can be used on any road, then I would have severe doubts about the use of HARPS on single track Devon country roads!

I suggest that, initially, HARPS will not be allowed on all roads; certainly not until the technology has matured at some time in the future. Thus there will be a linkage between the licence for HARPS and the roads on which they may be used. This will open up the need for identifying roads that can be used by HARPS. More regulations and laws will then be required.

The HARPS control software and systems will have been developed for use on some sort of road surface and for roads meeting a certain standard. I would expect that this would be defined and the licence could require that any particular type of HARPS can only use the roads for which the software and hardware system has been designed and tested. Who will decide and authorise roads for HARPS use? What knowledge and skills will that person need to do the job competently (exams, testing of roads with a trials vehicle)?

This line of thought leads me to the point that HARPS, as a system, is the roads system as well, together with the complete electromagnetic environment (EME) that it uses. You can licence the vehicle and the operators, but who controls the physical environment and EME in which the system exists? If that changes outside what has been allowed for in the system development (or is different in some way* -discussed below), then there will be foreseeable failures and accidents. This implies that the physical environment of the roads, signage, and the verges will perhaps need to meet a certain standard. This will also apply to the EME. Does this then mean that the EME will require to be monitored; if so by who and with what permission/ laws authorising signals intercept? Regulation of Investigatory Powers Act 2000 may well apply; if it does, then exemptions will be needed and this will require to be controlled to ensure there is no misuse.

Thus, the roads, their build and maintenance standards also have a significant bearing on the safety of HARPS. The EME also needs to be considered. For example, for a period twice a year there are times of the day when I drive out of the road in which I live. On cloudless days, the sun, which is at a very low angle, shines straight in my eyes and it is difficult to move away safely. As far as I can, however, I can shield my eyes. As a driver I have to make the decision about when to drive on. But what will HARPS do, if there are conditions which take any of the sensors outside their specified operating range? Currently, there is a driver who has to decide what actions to take, and basically it's his neck on the line. Where does the responsibility now lie and, perhaps, the answer to this will have a bearing on the operator licence conditions?

*Consider a road on which HARPS are in use. There may well be an accident or road repair work in progress requiring all vehicles to follow a specific route. HARPS will need to cope with this. What if the indicated diversion uses roads on which HARPS are not allowed?

Consultation Question 4 (Paragraph 4.34): Is the concept of “carrying passengers for hire or reward” sufficiently clear?

No

Please see my response to question 3 as well.

Many passengers will also wish to carry/ take other items on board with them. What is intended as the limit that a passenger can carry on board? What storage for luggage will there be?

For example, it might be allowed to have a suitcase, but up to what size?

If a suitcase is allowed, could a passenger carry a similar sized IKEA flatpack on-board, or would this be considered to be breaking the licence?

In this area there will be a need for regulation and possibly laws too. How they will be enforced also needs to be considered. Will there be items that passengers cannot carry on board? Should this be a criminal offence? My specific concern is if a passenger had something that had the potential to interfere with the sensors or any of the other electronic systems on board - even if they were not activated. The potential for a serious incident would still be there in the event of accidental activation. (This will also be highly relevant for the goods version of HARPS. Hopefully, this will never be needed, as I see it as a backstop regulation and law that provides a 'boundary' to the allowed loads on HARPS.

In my view, an overloaded vehicle should mean that the licence conditions have been broken. This, as a concept, should be contained within the licence conditions.

At present, the driver can monitor what is carried on-board his vehicle by passengers. The driver also has responsibility for controlling the numbers of passengers. For example, when I travel by bus, there will often be a mother with a pushchair on-board in the designated space. Sometimes there is more than one. The driver controls the numbers and there is clearly a trade-off between numbers of passengers and pushchairs (or wheel-chairs). Licencing carriage of a specific maximum number does not mean that the HARPS cannot be overloaded.

Without the driver being present, there needs to be a means to assign that responsibility elsewhere as I suggest the responsibility will still need to rest somewhere with the operator/owner and the ADSE.

Exemptions

Consultation Question 5 (Paragraph 4.46): We seek views on whether there should be exemptions for community or other services which would otherwise be within the scope of HARPS operator licensing.

Safety must be the prime concern. I have great difficulty in imagining what exemptions might be suggested that can definitively have no safety impact. Current exemptions seem to me to place responsibility on the driver. As there will be no driver, this suggests no exemptions.

But perhaps I have missed something

Consultation Question 6 (Paragraph 4.54): We seek views on whether there should be statutory provisions to enable the Secretary of State to exempt specified trials from the need for a HARPS operator licence (or to modify licence provisions for such trials).

No, the Secretary of State should not be able to exempt any trials from an operator licence nor modify the provisions.

Operator requirements

Consultation Question 7 (Paragraph 4.72): Do you agree that applicants for a HARPS operator licence should show that they: (1) are of good repute; (2) have appropriate financial standing; (3) have suitable premises, including a stable establishment in Great Britain; and (4) have a suitable transport manager to oversee operations?

[Respondents chose from the following options: yes; no; other.]

Yes

However, I have a few points

Item 3:

Suitable Premises - Suitable needs definition. The vehicle will contain complex and sensitive sensors, communications and computer equipment. I see security as all important. I doubt that a yard with just a security fence around it will suffice. The system manufacturer should define the other aspects of storage that will need to be controlled. My concerns centre around the way bad weather might cause system degradation and increase the likelihood of component failure; eg periods of excessively high or low temperature. (Would I expect my computer to work for a long time, reliably, if it were alternately frozen to -5 (or lower) and then heated to +40 degrees C? - No.)

The type of premises that are suitable should be regulated by inspection. Re-visits (without warning) should also occur to ensure the HARPS cannot be tampered with. Storage of HARPS in unsuitable premises should be covered by regulation with laws as a final resort. This will be relevant for HARPS stored prior to sale.

Will the company selling HARPS need an Operator Licence?

The degradation would be very difficult to identify immediately, the effects may be revealed due to an increase in failure rate of safety critical sub-systems. Therefore, loss of licence should be the ultimate sanction.

However, I do recognise that there may be occasions when a HARPS may have no option but to store the HARPS in less than ideal conditions (eg problems that make the proper storage unavailable). The data on this should be recorded and the regulatory authority informed of such events. This information could then be useful should there be on-going reliability or maintenance issues.

The system manufacturers will know what components and their quality that have used and should be able to specify the conditions under which they should be stored. Compliance with these requirements need to be a licence condition.

I would expect them to need to be garaged with the consequent increase in security. The nearest analogy I can think of are military aircraft; they are kept in hangars, often in a temperature controlled environment.

The sensors are like the eyes of the driver; they need to be looked after. Cleanliness of the window through which they receive information/data (particularly for any optical sensors) will be all important and likely to need daily attention.

Thus I would expect suitable premises to look very different from that seen now and would suggest a significant degree of environmental protection may well need to be mandated to ensure safety standards are met and maintained.

Consultation Question 8 (Paragraph 4.73): How should a transport manager demonstrate professional competence in running an automated service?

With the driver disappearing from the cab, it seems to me that all their duties and responsibilities land on the Transport Manager (TM) role. However, the problem I foresee is that the TM will need to demonstrate an understanding of the mechanical systems, sensors and the control electronics together with significant knowledge of how they interact with those functions undertaken at the home base.

A driver, while driving and using a vehicle, and as a competent person, learns to recognise the signs and sounds of a vehicle that has problems. It is far from clear to me how responsibilities that used to be in the province of the driver will be coped with by a TM.

I would expect there to be a need for formal training and exams (under control of an external exam board) would be essential. Also, earlier in his career, a TM may well have done some/all of the tasks carried out within the transport business involving HARPS.

Further, I suggest that the TM job would be a board level role.

Perhaps a better idea and to provide a starting point about the required range of knowledge needed, might be to brainstorm what would happen at an inquiry into a range of fictitious accidents. This might then show what sorts of issues need to be covered and known about by someone in that role. From that, it would be possible to evaluate the knowledge that the Transport Manager would be expected to have and how he should be ensuring all staff are doing their jobs correctly.

Adequate arrangements for maintenance

Consultation Question 9 (Paragraph 4.89): Do you agree that HARPS operators should: (1) be under a legal obligation to ensure roadworthiness; and (2) demonstrate “adequate facilities or arrangements” for maintaining vehicles and operating systems “in a fit and serviceable condition”?

[Respondents chose from the following options: yes; no; other.]

Yes

YES

Whilst I cannot quote any figures in detail, I am aware that sensors and computer-based systems need to be looked after. They do not like temperature extremes or thermal shocks - reliability suffers and the mean time between failure decreases. Dust can also create problems. It is also well known that new electronic systems have a higher failure rate than those that have got through an initial 'burn in' period. I have no reason to think that HARPS will be any different. Thus, newness does not confer reliability on a system as suggested in para 4.79. It is going to be more complex if safety is not to be compromised.

At (2)

The wording is very non-specific and I would guess that as such, what will actually be required would be determined by court cases after incidents involving HARPS.

Para 4.83 in main document - Record Keeping

Not sure where to respond to this paragraph, so I have included a comment here.

Many of the checks and updates will be in the software systems. It should be possible for all this information to be stored electronically within the vehicle and also to be reported automatically to the HARPS home base. For example the software build standard of each subsystem could be automatically reported each time the system is started. Details of all journeys could be reported automatically, as could the operational status of all the sensors and other sub-systems.

It would also be possible to stop use of the vehicle if a needed update or repair was not completed in a timely way. I suspect that this type of over-sight might be considered to be too 'big-brotherish' by some, but safety and public confidence will depend on a very low level of accidents due to the automated system.

With passenger aircraft, blind landing systems are employed but the passengers only find out after the landing has been successfully completed; with HARPS we will all know that, at all times, the vehicle is on automatic pilot. Even minor hiccups will be noteworthy to passengers.

Consultation Question 10 (Paragraph 4.90): Do you agree that legislation should be amended to clarify that HARPS operators are “users” for the purposes of insurance and roadworthiness offences?

[Respondents chose from the following options: yes; no; other.]

Yes

All HARPS operations will, in my view, need to be licensed. Having insurance valid at all times needs to be an essential licence condition. NO insurance = loss of HARPS licence. [I note that for a car driver the penalty can include loss of the vehicle].

BUT, where does liability lie?

The operator will not be competent to do very much to the Command and Control software and the sensor systems. If there is a fault here that causes an insurable loss, surely the liability will be with the HARPS system supplier? In a bus now, the driver is responsible for accidents; after all he is controlling when and where the HARPS goes. As he is now replaced by the software, it would be logical that liability rests with the software developer, as that is the component that controls HARPS. However, almost all software (that I have used) is sold on a no liability basis if it is used by me and a loss occurs. Surely, the regulatory authority will need to have powers to demand where the liability will lie, particularly as passenger safety may well be an issue. As these powers are quite likely to need to apply to foreign companies, will there be issues?

In the final analysis, the regulatory authorities must be able to force change they see as necessary to ensure safety. A way of doing this needs to be determined with the necessary framework of regulations and legal powers. A means for adjudicating in the case of disagreement will also be needed.

The point that also needs to be clear is that any passengers must be compensated quickly and fully as soon as possible after an incident. Payment of compensation should not wait until the 'ownership of liability' is determined in the courts.

Compliance with the law

Consultation Question 11 (Paragraph 4.124): Do you agree that HARPS operators should have a legal duty to: (1) insure vehicles; (2) supervise vehicles; (3) report accidents; and (4) take reasonable steps to safeguard passengers from assault, abuse or harassment?

[Respondents chose from the following options: yes; no; other.]

Yes

Yes, is the simple answer, but the interior of HARPS will be an unsupervised space except for any CCTV or other remote surveillance provided. Such systems need to provide high quality images and sound from multiple cameras and microphones to provide an evidential quality system. Quick action to control a developing, potentially hazardous situation will not be as possible as there is no UiC physically present.

Would there be any value in the person who is monitoring a HARPS journey, being able to divert the HARPS to the nearest police station, or for a medical emergency to a hospital or ambulance station?

It would be useful for all HARPS to have a large and unique ID painted on the roof and sides. Although the GPS will know where the HARPS is, humans need visual evidence they have the correct one. I would include this as a legal duty.

Consultation Question 12 (Paragraph 4.125): Do you agree that HARPS operators should be subject to additional duties to report untoward events, together with background information about miles travelled (to put these events in context)?

[Respondents chose from the following options: yes; no; other.]

Other

Again the simple answer is YES

as it is information like that mentioned in the question (and near misses) from all the vehicles of a same build standard and containing the same sensor systems which may allow problems to be spotted in advanced and thus save lives. This becomes possible because the manufacturers could use these multiple reports to spot similar reports of anomalous behaviour that needs investigating.

This information needs to be provided to both the regulatory authorities and to system manufacturer.

It should be more than a duty, as this is so involved with safety. It should be a criminal offence to interfere in any way with this type of information flow. Penalties need to be significant and have a large deterrent effect.

The HARPS supplier would be required to agree to confidentiality. Reports on incidents published for public consumption would be allowed to contain this type of information to satisfy the need for public confidence and transparency.

Consultation Question 13 (Paragraph 4.128): Do you agree that the legislation should set out broad duties, with a power to issue statutory guidance to supplement these obligations?

[Respondents chose from the following options: yes; no; other.]

Yes

Yes, but what is written, I see as being a minimum set of standards, particularly where cybersecurity is concerned. HARPS would be such an obvious target once it comes into service. Appropriate government departments need to be setting standards to be met for an operator licence to be granted. System suppliers would need to have passed these standards prior to any operator being allowed to purchase HARPS.

Consultation Question 14 (Paragraph 4.133): We invite views on whether the HARPS operator licensing agency should have powers to ensure that operators provide price information about their services. In particular, should the agency have powers to: (1) issue guidance about how to provide clear and comparable price information?

[Respondents chose from the following options: yes; no; other.]

Yes

I think it should go further than is implied in the question. The price information should be for the whole journey requested, even where a number of operators would need to be involved to provide the journey. A breakdown of costs should also be available to show the cost of each part of a journey. It must also be possible to save and/or print the information provided. Options that might lower the cost should also be presented to the potential passenger.

Any and all other fees should be presented at the same time.

And/or (2) withdraw the licence of an operator who failed to give price information?

[Respondents chose from the following options: yes; no; other.]

Yes

Continued failure to meet a requested standard should be subjected to penalties initially and then quickly escalating to withdrawal of licence.

Who should administer the system?

Consultation Question 15 (Paragraph 4.138): Who should administer the system of HARPS operator licensing?

As background, I can see that HARPS will potentially require significant infrastructure expenditure. As such it will need to be the responsibility of a government minister to have delivery responsibility for that infrastructure.

The administration of HARPS needs to be within the public sector only staffed by people who are not part of the transport industry. It would be wrong to allow individuals to circulate between government departments with relevant responsibility and firms working in that industrial sector.

NOTE

In my comments, I have followed the questions as written and tried to provide helpful answers. The line taken in the paper is that as HARPS is a road system, the existing road system has

then been used as a template for the future. This may well be the best way forward, but I wish to offer an alternative.

Throughout, I have noticed that HARPS will be a system that is similar to passenger aircraft from the point of view of the operators. OK, it doesn't fly and they do have a pilot/driver (but blind landing has been developed), but apart from that the development, design, requirements and safety assurance aspects have much in common with aircraft development. Particularly noteworthy is the extent to which HARPS Command and Control systems, (ie the sensors, and software) will be proprietary to the manufacturer. They will have the detailed information and have been responsible for ensuring correct and safe operation. They will be responsible for all updates and fault rectification. Only they will be able to install new or improved sensors and ensure proper integration. The aircraft industry seem to have a working model for their industry and, by using it in a suitably adapted form, HARPS may well avoid having to re-learn things that are already solved.

Thus, I wonder to what extent the regulation of airlines and aircraft has been considered as a template on which to base HARPS.

The safety record, with some exceptions, is now notable. They have learnt many lessons over the decades to ensure that they provide a safe service to passengers. It would be remiss to ignore their achievements.

Freight Transport

Consultation Question 16 (Paragraph 4.140): We welcome observations on how far our provisional proposals may be relevant to transport of freight.

I see freight transport as needing many of the issues discussed so far.

For example, I see an on-going necessity for road transport to deliver flammable products. I can see great benefit in those vehicles having driver aids; but removing the driver from the cab should never even be suggested. A human UiC I believe is essential for dangerous loads.

CHAPTER 5: PRIVATELY-OWNED PASSENGER-ONLY VEHICLES

Setting a boundary between HARPS and private leasing

Consultation Question 17 (Paragraph 5.12): Do you agree that those making “passenger-only” vehicles available to the public should be licensed as HARPS operators unless the arrangement provides a vehicle for exclusive use for an initial period of at least six months?

[Respondents chose from the following options: yes; no; other.]

Yes

I agree that an arrangement of this type should be possible, but ... and here I cannot make up my mind.

The problem is that I wonder if this type of arrangement might allow loop-holes for someone to avoid being a HARP operator.

The arrangement then relies on the contract wording to ensure that vehicle use is appropriately regulated.

So I wonder about the words 'exclusive use'. Is this, in legal terms, definitive enough to cover all eventualities? Could the vehicle still be used in a way that, without this leasing arrangement, have usually attracted the need for HARPS operator status?

I am assuming that there will be review and approval process of contract wording [operated by the regulatory authority] for such arrangements.

This question also shows that there is a need for regulation and laws to ensure that HARPS hire/lease terms and conditions of hire are not in some way getting around the need for a HARPS operator licence. I suggest that if this is found to be happening, then a criminal offence will have been committed.

Allocating responsibility for a privately-owned passenger-only vehicle: placing responsibilities on keepers

Consultation Question 18 (Paragraph 5.40): Do you agree that where a passenger-only vehicle is not operated as a HARPS, the person who keeps the vehicle should be responsible for: (1) insuring the vehicle; (2) keeping the vehicle roadworthy; (3) installing safety-critical updates; (4) reporting accidents; and (5) removing the vehicle if it causes an obstruction or is left in a prohibited place?

[Respondents chose from the following options: yes; no; other.]

Other

With HARPS available for exclusive use to an individual, I can foresee a problem with the responsibilities assigned to that person should that person be disabled and unable to discharge those responsibilities listed. There needs to be a way for the owner/lessee to assign the legal responsibilities to another individual or organisation. (In fact, I suspect that there reason for wishing to assign the responsibilities elsewhere may well need to be wider in scope than just disability. It might well be that people who could carry out the tasks just wish to reassign them elsewhere).

For item 3, I assume that it is not intended that the registered keeper should personally install safety-critical updates' but that is how it reads. I am assuming that such a task will require a certain level of skill and that, should it be done incorrectly, there is a chance of safety being compromised. Therefore installation of updates should, in my view only be done by trained personnel who are certified to carry out the process.

If, in the design and development process, such updates can be made automatic and foolproof (guaranteed), then I would see no reason why the registered keeper should not do it. However, I would point out that upgrades to my Windows based laptop are often not trouble free.

It needs to be made clear in the system specification what actions can be performed by the registered keeper and what actions need trained/skilled personnel to carry them out. This requirement could usefully be included in the licence conditions for the vehicle.

Consultation Question 19 (Paragraph 5.41): Do you agree that there should be a statutory presumption that the registered keeper is the person who keeps the vehicle?

No

Given my response to question 18, I suspect that such a statutory assumption will lead to unfairness.

There does need to be a registered keeper, but I would suggest that this person or organisation is agreed on sale/lease. Without this being agreed, then the sale documentation would be invalid. It would be up to others to determine if this should be sanctionable in some way.

Consultation Question 20 (Paragraph 5.42): We seek views on whether: (1) a lessor should be responsible for the obligations listed in Question 18 unless they inform the lessee that the duties have been transferred?

In general yes. But active, provable agreement is essential - see next part.

It should be possible to show that the lessee actually accepted AND understood his responsibilities.

(2) a lessor who is registered as the keeper of a passenger-only vehicle should only be able to transfer the obligations to a lessee who is not a HARPS operator if the duties are clearly explained to the lessee and the lessee signs a statement accepting responsibility?

I would like to see that the lessor has to provide clear proof that the lessee was aware and had agreed to the arrangement. Ideally, this needs to be a clear and separate document so that it was not agreed to by being amongst many other terms and conditions. ie please make it a stand alone document. All conditions attached to such a responsibility transfer should be clearly stated. If a condition is not stated, then it does not apply.

What happens if someone who is a registered HARPS operator but wishes to lease a HARPS on his own account and not as part of his business? (It won't happen often, if at all; but is it theoretically possible?)

From my own experience, I know that the paperwork is seen as just being a boring, but necessary, hurdle. Many may see this as the same as getting in a taxi that drives itself. Somehow, this a type of attitude needs to be overcome.

Will consumers require technical help?

Consultation Question 21 (Paragraph 5.47): Do you agree that for passenger-only vehicles which are not operated as HARPS, the legislation should include a regulation-making power to require registered keepers to have in place a contract for supervision and maintenance services with a licensed provider?

Yes

Yes and given a valid contract, this arrangement should transfer the legal responsibility too.

Additional note from paragraph in main document just before this question:

(for your information and I am not sure where else to cover this)

Para 5.45 mentions cyber attacks. I believe that HARPS (and any other automated vehicle) will be vulnerable to attack from more than just cyber attacks.

From <https://www.techopedia.com/definition/24748/cyberattack> (choosing just one website after Googling the term)

A cyberattack is deliberate exploitation of computer systems, technology-dependent enterprises and networks. Cyberattacks use malicious code to alter computer code, logic or data, resulting in disruptive consequences that can compromise data and lead to cybercrimes, such as information and identity theft.

Cyberattack is also known as a computer network attack (CNA).

I know little of the actual detail of the modern technology used for the sensor systems themselves for automated vehicles which HARPS will use to determine where it is and what is happening in the immediate environment around the vehicle; but, depending on design, techniques may well exist to damage or degrade those sensor systems. HARPS operators' knowledge needs in this type of area do not seem to be defined, but whatever they are, won't an individual owner, or lessee, also need at least an awareness.

Peer-to-peer lending

Consultation Question 22 (Paragraph 5.53): We welcome views on whether peer-to-peer lending and group arrangements relating to passenger-only vehicles might create any loopholes in our proposed system of regulation.

Other

Peer to peer lending creates opportunities for responsibilities to become poorly defined, as do group arrangements. If either of these are to be allowed, I would like it to be possible only under terms and conditions set by the Regulatory Authority.

As time passes and there is more clarity about exactly what the capabilities and costs of HARPS will be, I would expect new ownership models will be found and loopholes will be created. It is in this area that there perhaps could be a need for the regulating authority to introduce new regulations. This would need to be subject to political oversight, but perhaps might just need authorisation from a Minister.

Thinking about this, I started to wonder what happens if a registered keeper keep is not around to discharge his duties for a significant period (perhaps any period over ?4 weeks?; select your own time...)

Events that may cause this might be:

- 1 Illness
- 2 Accident and hospitalisation
- 3 Long period of travel for business or a holiday
- 4 Being sent to gaol

.....

Who needs to recognise that there is a problem in this area.

What actions should they perform to ensure that the HARPS, for which there is no available registered keeper, is actually maintained to the required standard and safe to use.

Perhaps, I worry about a non-issue

Protecting consumers from high ongoing costs

Consultation Question 23 (Paragraph 5.60): We seek views on whether the safety assurance agency proposed in Consultation Paper 1 should be under a duty to ensure that consumers are given the information they need to take informed decisions about the ongoing costs of owning automated vehicles.

Yes, the Safety Assurance Agency should have this duty. I would anticipate that this will be a significant education effort and costs will not be small.

HARPS will be familiar in the sense that they are road vehicles, but will work in a very different way to the vehicles that we are currently used to. I suspect that many will just see HARPS as a driverless car without understanding the need for professional maintenance or the way in which technology is actually enabling the driverless car to work.

Even if the information is provided, I wonder if it will be read and Understood. Will the general public recognise anomalous vehicle behaviour?

CHAPTER 6: ACCESSIBILITY

What we want to achieve

Consultation Question 24 (Paragraph 6.11): We seek views on how regulation can best promote the accessibility of Highly Automated Road Passenger Services (HARPS)? In particular, we seek views on the key benefits and concerns that regulation should address.

The provided documentation seems to me to cover a very wide range of issues and I thank you for that. The document does highlight many of the advantages I can see as there will be travel freedoms that are simply not available now for many, provided they can pay.

Cost of use does concern me. The vehicles and the ancillary services needed to own and use any HARPS vehicle will be significant and this will be paid for by customers. This leads me to wonder about the extent to which the whole population will be able to afford to use the services provided. Fare regulation may well become an issue.

Another concern is that HARPS will be a moving space for vehicles designed to be the equivalent of buses with no figure of authority who can oversee and control what is happening. Video and audio links will not give the deterrence effect of a human being. Passengers cannot simply walk away should problems arise and, if there are problems, any miscreants will be first off the vehicle once it comes to a stop. Thus, I can see that there could be confidence issues for users that they will be entering a safe domain.

How will behaviour in the HARPS domain be regulated and enforced?

How will offenders be identified and held to account?

I can see a case for some types of behaviour, that would be treated with at most a caution anywhere else, might need to be treated more seriously if done on a HARPS. This is simply because the intended victim cannot get away and there is no person in authority immediately present.

Core obligations under equality legislation

Consultation Question 25 (Paragraph 6.31): We provisionally propose that the protections against discrimination and duties to make reasonable adjustments that apply to land transport service providers under section 29 of the Equality Act 2010 should be extended to operators of HARPS. Do you agree?

[Respondents chose from the following options: yes; no; other.]

Yes

The devil will be in the detail. It is difficult at this stage, I believe, to be explicit until far more is known about exactly what HARPS will need in the way of its own infrastructure. Whilst I hate to see discrimination, I can think of some disabilities where the cost of making HARPS (as used by the general public) accessible would be disproportionate to the benefit.

There is an arguable case for a person needing a permanent carer, that carer should be able to travel free.

Specific accessibility outcomes

Consultation Question 26 (Paragraph 6.106): We seek views on how regulation could address the challenges posed by the absence of a driver, and the crucial role drivers play in order to deliver safe and accessible journeys. For example, should provision be made for:

(1) Ensuring passengers can board and alight vehicles?

[Respondents chose from the following options: yes; no; other.]

Yes

I envisage the need for regulation that currently exists for current bus designs to be transferred to the HARPS vehicle.

It might be thought necessary to have a non-driving member of staff (not classed as a UiC, but perhaps as a guard) on board, but I recognise the counter to this that this negates some of the cost savings.

The regulatory authority might wish to have the power to insist on a guard being carried if there is persistent trouble. That guard would need to have powers that would enable him to demand ID and address. Any violence offered to the guard would attract a far more severe sentence on conviction. He would have the body mounted cameras that the police do, but it is debatable about how far towards police power he should go. As a fight on a moving vehicle would be a disaster, it would be better for the guard to let the vehicle stop and allow the miscreant to escape.

(2) Requiring reassurance when there is disruption and accessible information?

[Respondents chose from the following options: yes; no; other.]

Yes

Knowing what is happening and when the next bus will arrive is important to me when I use a bus. The information will be available to the operator and it should be passed on to the users.

For me, at some places, I can see a limited amount of information which has altered my planned journey. (But it wasn't available on the net, I had to be at the bus stop).

The system should be designed to have this type of information permanently available.

(3) Expansion of support at designated points of departure and arrival?

[Respondents chose from the following options: yes; no; other.]

Other

This may well be necessary, but it would take away some of the benefits of there being no driver, particularly if this required a person to be physically present.

For example: At present, the driver can see if his pull-off at a bus stop is occupied and decide what to do and where to stop. For HARPS, would it be intended that for ANY vehicle under ANY circumstances to occupy a designated stopping places to be made illegal and a criminal offence?

Developing national minimum accessibility standards for HARPS

Consultation Question 27 (Paragraph 6.109): We seek views on whether national minimum standards of accessibility for HARPS should be developed and what such standards should cover.

Yes there should be minimum standards that fall into categories dependent on intended use.

But if a capability is provided, it must meet the standard required by regulation.

All aspects of accessibility offered by currently available, land-based transport should be read across to HARPS.

Charities could be approached to identify areas for improvement as there is no real standard for HARPS set yet. However, I am concerned that HARPS accessibility standards should offer a very real improvement of that currently in use.

Enforcement mechanisms and feedback loops

Consultation Question 28 (Paragraph 6.124): We seek views on whether operators of HARPS should have data reporting requirements regarding usage by older and disabled people, and what type of data may be required.

[Respondents chose from the following options: yes; no; other.]

Other

Yes I can see some advantages, but there will be problems. Disabled covers a very wide range of conditions. Elderly, well it's obvious with some, but I have also met people who are under 60 but quite honestly look at least 10 years older.

Not all people wish to be identified as disabled. Also I count as disabled, I'm deaf, but often will not be wearing hearing aids. So all that can be said about me is that I'm elderly. I do use

buses when I can and would use them more if they came according to the timetabled time. But they don't. So I use my car if my own schedule is tight.

The point is how can reliable data be collected. If the data is not reliable, its useless, misleading and potentially dangerous.

But you can get data on the number of journeys for which a bus pass is used. Also you could count the number of journeys where the passengers have a push-chair, a stick, a wheel-chair etc or perhaps have a companion who is obviously helping another passenger. But it won't be complete nor can any deductions be made about demand.

I also have a concern that any data collected might be used to justify a service degradation by arguing that as a service is not benefiting a particular section of society as intended, therefore it should be cut.

Also, survey data of this type doesn't really tell you if there is a demand for any other services that are currently not on offer.

So, whilst I would not object to data collection, PROVIDING it is totally anonymous, I have doubts about its value and its interpretability. However, I can see that the press, in particular, would see the no-availability of such data as a sign of incompetence. But then, the press don't carry any responsibility, do they?

CHAPTER 7: REGULATORY TOOLS TO CONTROL CONGESTION AND CRUISING

Traffic regulation orders

Consultation Question 29 (Paragraph 7.23): We seek views on whether the law on traffic regulation orders needs specific changes to respond to the challenges of HARPS.

I have mixed views. I can certainly see why they might be thought to be needed. Using bus lanes as an example; buses were being delayed and so they were provided with bus lanes so they could have a far speedier journey. The buses benefited at the expense of all other road users.

So HARPS being used as a bus - I have no problem with their use of existing infrastructure. However, I suspect that HARPS may well need more than a little modification to existing roads and infrastructure. This then might detrimentally affect existing services. For example, they will need to be provided with places for passengers to board and alight. These will be fixed and immovable. Where I live the buses more often than not cannot actually stop at the bus stop, time after time, in the same place. Some other vehicle or activity prevents it; so the bus stop is more of an area marker; they do their best to be as near as possible. No-one is really inconvenienced.

But with HARPS, I suspect that the bus stop will need to be a fixed place. HARPS will take priority. All other needs will not be met and inconvenience for everyone else (at best) will become the order of the day. I don't see HARPS for bus services as having such a high priority that it justifies significantly increased problems for others. Sensible negotiation and planning will be needed, rather than diktat.

Similar considerations will also apply to other uses for HARPS. Many roads in the town where I live will be unsuitable for HARPS. One reason is the age of the housing and the lack of parking except on the street. Householders have nowhere else for their personal transport and this is essential for many to get to their work. Public transport is simply not an option. A TRO on any road that increased the ban on street parking would cause enormous problems. New housing estates have often allowed for only one vehicle per house, any others have to be in the road. The other problem is that the roads have been allowed to be built with a relatively narrow width. All this is coped with by drivers in their vehicles today. Could HARPS in any form cope? There's no centre line marking, just 2 kerbs and lots of parked cars. Will HARPS have been trained for such situations? The regulatory authorities will need to know before allowing the vehicles into such places.

Given the above, you will, I hope, see why I suggest that the RTRA is currently far too powerful and difficult to challenge, particularly by the ordinary citizen. HARPS operators should not be able to simply ask for and get any facilities provided just so that they can provide a given service (that many might not need or be able to afford). For example: This will be the case where land available to meet HARPS requirements are in limited supply. (eg for parking, refuelling and provision of stops etc). Whilst I can see that HARPS has uses, I do not believe it should be given any preferential treatment that helps it to see other forms of transport that need drivers put in a disadvantageous position.

Paragraph 7.7 in the main consultation paper, says to me that arguments are being made that effectively make HARPS the preferred, and eventually, the only vehicle of choice for the average citizen. This I must reject absolutely. It will not meet the needs of a large proportion of the working population.

I do accept the points made about having a standardised procedure and the digital aspects that are discussed.

The title to this section includes the word cruising, but his word is not used explicitly in any of the questions in this section. So I will provide my views here as cruising is likely to be a particular challenge of HARPS. I agree that cruising will need to be controlled.

However, I can see no easy way to explicitly identify when cruising is definitely taking place without using 'Big Brother' techniques. If the HARPS is not cruising, the Operator will be able to show from his records, the destination for each journey what the purpose is, the money collected and also it will be clear how many passengers there are. Other journeys (the route taken having been recorded), with no passengers, may be classed as cruising. It might be though that passengers and journeys are made up. If that is tried, the accounts should show that no money has been collected that can be correlated with the journey. Thus they are cruising or returning to base.

But where should the HARPS go to await the next use of its services? This is far from obvious and I have no immediate solution.

Regulating use of the kerbside

Consultation Question 30 (Paragraph 7.59): We welcome views on possible barriers to adapting existing parking provisions and charges to deal with the introduction of HARPS.

In particular, should section 112 of the Road Traffic Regulation Act 1984 be amended to expressly allow traffic authorities to take account of a wider range of considerations when setting parking charges for HARPS vehicles?

[Respondents chose from the following options: yes; no; other.]

No

In many places there is not an adequate provision of parking now. More is going to be needed for re-charging EVs. To convert parking that is used for UiC vehicles for the exclusive use of HARPS would, I suggest, be wrong. Parking is a resource in very limited supply, the price would go up, those who can, even now, only just afford transport to meet their essential travel needs would be placed into an impossible situation.

This question is only asking about some aspects of all the topics and issues raised in the paragraphs prior to 7.59 of the consultation paper. For the last 10 years, Central Government has squeezed Local Authorities finances and just left it to them to make impossible choices of what to sacrifice in view of too low a funding level.

Forcing vehicle sharing in place of family-owned transport will reduce economic activity as a whole. I see this as a retrograde step. The thrust behind this seems to be the wish to use the advent of HARPS to assist in social engineering of our society.

I cannot support that.

HARPS is not yet a proven technology for general use able to go everywhere that cars and buses currently go. It has yet to be shown to be affordable nor is it clear that the technology will meet the real day to day needs of our society. Society as a whole may know the term 'automated vehicle' but I suspect they do not understand the implications that are appearing from my reading of this paper.

Road pricing

Consultation Question 31 (Paragraph 7.86): We seek views on the appropriate balance between road pricing and parking charges to ensure the successful deployment of HARPS.

I see both road pricing and parking charges as a tax on travelling for business or pleasure. If road pricing charges are too high, then people will just not travel, or for business, overheads will rise causing prices to rise for both home consumption and exports. Parking charges are a tax that from which destinations get more income, but this also increases the cost of living for residents in the area.

The question itself makes the assumption that HARPS needs to succeed and presupposes that significant infrastructure costs will be socialised. I don't accept this view. It is a new technology that is being developed and will need to succeed or fail on its own merits.

Whilst I can agree that HARPS will provide advantages, there will be downsides too; the most obvious being the loss of jobs as drivers. The rebalancing that HARPS will cause only works

if ALL sections of society do benefit. At present, I do not see that there will necessarily be a general benefit. Vehicles, with a UiC, can go where there are roads, but I see little chance that HARPS will be useable over many roads in country areas, eg single track roads in Devon, Cornwall and Wales. In country areas, in particular, HARPS will be a long way off, if it ever appears.

Of the two options presented, I see road pricing as the most economically damaging to the country as a whole. Parking charges would thus be the least bad of the two bad options.

However, I would like to note that private industry and the shareholders will make a lot of money from HARPS, and I would prefer to see that taxes fall on those who hold beneficial ownership of the technology. I do not see why the public purse should be expected to pay, unless of course, the transport systems using HARPS is only in public ownership. - but then that isn't going to happen.

Consultation Question 32 (Paragraph 7.87): Should transport authorities have new statutory powers to establish road pricing schemes specifically for HARPS?

If so, we welcome views on:

- (1) the procedure for establishing such schemes;
- (2) the permitted purposes of such schemes; and
- (3) what limits should be placed on how the funds are used.

[Respondents chose from the following options: yes; no; other.]

Other

Whilst I can broadly agree, I do have concerns that such powers may be poorly applied and lead to a distorted marketplace or anomalies may be introduced into what is essentially a tax.

It also occurs to me that HARPS is currently being seen largely in the context of replacing existing services. Whilst that will certainly happen initially, any charging scheme may inhibit innovation of different types of service that would benefit the public. This will be relevant as and when the use of HARPS replaces personal car journeys to a significant extent. If the public do take to using HARPS for many more journeys, the sums of money raised may be large and exceed any sum thought likely based on current usage patterns. (I am also aware that well populated areas will raise far more than country dominated areas). Thus, what may seem reasonable now and in the immediate future could become clearly unfair in the way the money is distributed across the population as a whole.

The 'Statutory powers may, in the long term, prove to be too inflexible. I see it as important that any money raised should be distributed fairly across the country so that there is effectively an equality of service and capability for all. It should be used to satisfy the transportation needs of all sections of the general public. If those living in country areas do not have access to HARPS, or just very limited access, how will they be able to replace their need for their own personal transport?

I believe this document states that this replacement of personal transport is one of the eventual goals, so the use of the funds raised should go in part towards that aim. To achieve this, it

may well be necessary for collected tax to be used in areas other than where the tax was collected.

Quantity restrictions

Consultation Question 33 (Paragraph 7.97): Do you agree that the agency that licenses HARPS operators should have flexible powers to limit the number of vehicles any given operator can use within a given operational design domain for an initial period? If so, how long should the period be?

[Respondents chose from the following options: yes; no; other.]

Yes

I see this as essential. HARPS will be replacing, and in direct competition with existing services. How it pans out will depend entirely on user reaction, reliability, and a non-existent accident rate. (Accidents may well always be blamed on the lack of a driver in the press, at least initially.)

HARPS operators will all want to offer the services in the most popular and lowest cost areas. This could rapidly kill off the supply of a manned-driver alternative. The public, should it have an adverse reaction to HARPS, will then be left with nothing, at least for a time.

I would suggest that the period should be a minimum of 10 - 15 years. I am not saying that an operator has to be limited to the number in his initial proposal for that whole period. It can be increased by the Agency if they believe there is an under-supply of transport. However, there needs to be a significant period to allow other operators in an area to enter the marketplace.

I believe that the Agency should have a legal duty to ensure, if at all possible, that there is a diversity of suppliers. Actions, by the Agency that do not support diversity should be challengeable and reversible. What is needed is a regulatory framework that supports diversity, innovation, and actively discourages any tendency to private monopoly.

Consultation Question 34 (Paragraph 7.120): Do you agree that there should be no powers to impose quality restrictions on the total number of HARPS operating in a given area?

[Respondents chose from the following options: yes; no; other.]

No

My answer to Q.33 really explains why I believe that HARPS services offered by one supplier may well need to be limited.

That argument can be extended to all HARPS in an area. I suggest that HARPS will not be able to offer all the services that are now provided by human-driven cars. The taxi driver, in particular, offers help and assistance to the elderly and infirm to load and unload their baggage (eg food from the supermarket etc.).

If numbers of HARPS are not restricted, I can see that, in many areas, our taxi driver will likely disappear completely because services of this type alone will not provide a living. There needs to be a way having both HARPS and human-driven vehicles. This may well mean that the supply of HARPS may need to be limited to ensure that there will be an on-going supply of

human-driven.

vehicles.

The whole legal and regulatory framework needs to ensure that ALL in the population have their needs met. To do otherwise is to set up a system biased towards discrimination and exclusion.

CHAPTER 8: INTEGRATING HARPS WITH PUBLIC TRANSPORT

The current system of bus regulation: HARPS as mass transit

Consultation Question 35 (Paragraph 8.92): Do you agree that a HARPS vehicle should only be subject to bus regulation if it:

(1) can transport more than eight passengers at a time and charges separate fares?

[Respondents chose from the following options: yes; no; other.]

Other

This is, in effect, picking up the current situation and simply extending it to cover HARPS. I can see why this way forward is obvious and makes a lot of sense.

My problem is with the fact that HARPS is going to be different from current UiC services. I cannot anticipate the future well enough to suggest a change to '8' to a different number. It serves a purpose and may well need to continue, but I would like to explain why I would suggest that this definition may well not be adequate, or suitable, to cope with HARPS and the way uses will develop in the future.

In towns and cities where there are enough bus travellers for a route to pay, this number may well be appropriate. But what about other places out in the country, where there may well be potential customers, but there are too few to warrant a regular bus service. Also, consider those villages, hamlet and perhaps even the isolated cottage etc that has no bus service now, because the costs do not justify it and the need to pay a driver makes it uneconomic. Small HARPS vehicles, carrying fewer passengers, could well provide a way of providing such a bus service.

As I write, it occurs to me that what I am suggesting is that the introduction of HARPS has the potential, in the future, to change our ideas and perceptions are about what a 'bus' is. This perhaps suggests that the existing definition based on the number of passengers needs to be extended, or altered, so that it is based on function as well.

I suggest that the first edition of the regulations should allow for the definition to be changed. I would add that the definition should be re-written to reflect the function of a 'bus', rather than the number of passengers carried.

(2) does not fall within an exemption applying to group arrangements, school buses, rail replacement bus services, excursions or community groups?

[Respondents chose from the following options: yes; no; other.]

Other

Please see my comments to part 1

I would add that school buses have a unique downside if there are problems that might not have happened had there been an adult, with authority, present.

I suggest this topic needs to be re-visited.

Existing bus drivers might usefully be asked what might happen if school buses were driverless? It's not the well-behaved that will give problems, its those children who will always exploit any adult free environment.

Teachers and parents, in particular, will have views that I hope will be given a lot of weight in considering what should happen on this topic. Any survey should cover a wide range of locations across the country. It would be interesting to see, as I expect, that the views expressed will be very different, north to south and east to west.

Consultation Question 36 (Paragraph 8.94): We welcome views on whether any particular issues would arise from applying bus regulation to any HARPS which transports more than eight passengers, charges separate fares and does not fall within a specific exemption.

At present, the driver controls who boards a bus. It seems that this responsibility will be transferred to a remote person, operating over a video link. I cannot see this working.

Eg. A drunk cantankerous person may be refused permission by a driver to board a bus. With HARPS, what will that operator do, - all he will be able to do is stop the bus from moving off and call the police, leaving it to them to sort out the problem. So part of the costs of running the service have now been socialised to the police allowing the HARPS operator to save money. Will the police have the manpower? I very much doubt it.

So yes, I can see problems, but suspect that reality will be far worse than any imagining of future possible situations.

Consultation Question 37 (Paragraph 8.95): We welcome views on whether a HARPS vehicle should only be treated as a local bus service if it:

- (1) runs a route with at least two fixed points; and/or
- (2) runs with some degree of regularity.

I would like to think that this definition of a bus service will become inadequate due to the introduction of HARPS and the development of new, differently organised services.

However if HARPS is a driverless clone of the present system, then yes, this definition will do.

The regulations though, perhaps could be allowed to be changed in the light of new services that might be offered using HARPS.

Consultation Question 38 (Paragraph 8.109): We seek views on a new statutory scheme by which a transport authority that provides facilities for HARPS vehicles could place requirements on operators to participate in joint marketing, ticketing and information platforms.

The aim of all transport authorities should be to provide interconnected services provided by all suppliers working together. Part of that will be that passengers can plan a journey and know that it can be completed.

Thus, a journey that needed to use a number of different suppliers should be easily planned and the total costs, and the breakdown of the cost of each section must be available. Any options, particularly where it results in a lower fare, must be visible.

I would therefore expect this to be a mandatory requirement on all operators.

However, I would like to postulate a passenger, with baggage acquired at the last moment, needing to travel using HARPS operators A,B, and C.

A and C can allow the passenger to travel, but B says his regulations don't allow it and the passenger only finds out when attempting to board B's bus. An intolerable situation. What will the regulatory authority do?

From the HARPS operator (B) point of view, he is stuck as there had been no indication in the booking that the passenger would present this problem.

At the very least, the passenger should have a guaranteed claim for the taxi (if that will suffice) to the final destination. It would in fact be far preferable if the Regulatory Authority could make this a 'never happen' event.

Consultation Question 39: [Is there any other issue within our terms of reference which we should be considering in the course of this review?](#)

OTHER HARPS ISSUES

Thank you for the opportunity to comment on these issues.

I would like to add a number of additional points. These are in no particular order. However, I need to give a little background information which, I hope, will aid understanding some of the views expressed below.

HARPS uses AI systems. These are being developed using neural network technology. As I understand the process used by the software engineers and developers, the end result provides a very powerful and capable system. The process uses vast amounts of training data about the roads upon which the system will be driven. At the end, however, no-one actually knows exactly how the systems reach the decisions made when a vehicle is being driven with no human driver present. Thus, the training data and the subsequent testing becomes all important. The eventual system performance is predicated on the training data and subsequent testing as having been adequate and that it is fit for purpose for the country(ies) in which the AV will be sold and then used. This, for me, raises a number of issues.

At present, our transport system uses human drivers. All perform differently and will have had different experiences contributing to their standard of driving. With HARPS, 1000 vehicles of the same type, with the same software, are analogous to just one of those drivers driving all those vehicles. A fault in one is replicated 1000 times. Thus, as sales grow, it will become more and more important to be able to understand deviant behaviour. displayed by a vehicle.

Driving on left or right hand side of the road is an obvious example. Road signs may differ as might the rules of the road. Although a road in any country will have identifiable characteristics, in detail, they will differ. I just don't know how important those difference will be to underlying neural networks that control the vehicle. Even if the difference seems small to humans, what will the importance in training the system actually have been? Assuming my understanding is correct, I would like to see that HARPS has to be loaded with a system that has been developed using UK road data.

Sensors of various types have their output data processed and combined to make decisions that control a vehicle's behaviour. Inevitably, there will be uncertainty, at times, in the output from the sensors. It is important to see that, when uncertainty occurs, there is a safety first behaviour programmed. To have a vehicle ignoring uncertainty would be highly dangerous. Thus, I suggest that the regulatory authorities need to be able to test the systems reaction when it faces uncertainty in interpreting a scene. It needs the power to stop the use of what will be an unsafe system.

XX TRAINING DATA

Autonomous vehicles are being developed by a number of manufacturers around the world. Given the centrality of the training data, I would have expect that the regulatory authorities would have wanted information to be deposited with them at the time of licence application.

For example, I would suggest that all trials would be enumerated with information about each one's purpose; its success or otherwise; problems encountered and whether or not a solution had been implemented; details of retrial etc. The purpose would be to know the extent of the testing, problems encountered and solved, knowing that the problem rate of arrival at the time of application for a licence was essentially zero and had been for some time; ie it was a stable operational system. If not, no licence granted.

Further I would want to be convinced that all training data was appropriate to all aspects of the UK road environment and conditions.

I would point out that, at present, all training data is collected from roads that are filled with cars being driven by humans and reacting as humans will. Over time and with increasing HARPS sales, the environment will change to one in which a particular HARP will sense and have to operate alongside many other HARPS. Will this be a sufficiently different environment to require different software? I suspect it may well be. Thus, I would expect that the regulatory authority would have regulations requiring on-going data gathering and testing to ensure that the control software is up to date as far as the operational environment is concerned. Perhaps my concern here is based on incorrect assumptions, making this a point for the system designers to argue. I would simply point out that our roads are very different now from what they were 20-30 years ago; so would the manufacturers be implying that 20-30 year old training data would still be appropriate and safe?

To allow training of the system for what are rare events, I understand that simulated scenes are used. The inference must be made that the test data is also simulated. I suggest that it is essential for the genesis of both sets of data to be shown to be totally independent. If they are not independent, then will there be a risk that the answers obtained in tests might be unreliable? This may be an area you would wish to cover in regulations and it would, hopefully, be based on significantly more knowledge than I have.

XX VEHICLE TO VEHICLE DATA TRANSFER

It has been suggested that HARPS may send data to other vehicles. If that data is inaccurate, could this raise liability issues? Should there be restrictions on the type of data that is passed? How would this be regulated? Should all inter-vehicle exchanges be covered by international agreement on protocols? If there are any incompatibilities, there may well be issues. This also may be an area you would wish to cover in regulations and possibly laws. Just a thought

XX ACCIDENTS

At <https://www.gov.uk/government/statistical-data-sets/ras20-drivers-riders-and-vehicles-in-reported-road-accidents> tables are shown for data that is collected. (There may well be other relevant databases. I am just using the first tables I found that seemed to be relevant.) I note that RAS20005 provides a breakdown into vehicle types. In this table and all others, I suggest that regulations are needed to ensure that HARPS involvement is a separately identifiable category. (At present, I suspect that HARPS data will be lost, subsumed into the categories shown in the table). I believe that the breakdown of the data needs to go down to much lower levels so that models and makes can be ranked for safety performance. This type of detailed level data may well be needed to ensure the level of regulation of a new technology is actually adequate.

Accident rates are also identified. It is essential that HARPS involvement in an accident is separated out to see if the claims for the effect of HARPS on accident rates are actually borne out. I suggest thought is given to ensure that decisions are made on statistically valid data.

I am not quite sure how best to approach the follow-on point. Autonomous vehicles are supposed to benefit society. Given the obvious risks to individuals in society if the performance is not of a sufficiently high standard, shouldn't the trial phase continue until the statistical accident for HARPS can be seen to rival or be better than UiC vehicles? Until this point is reached, I cannot see how general approval for use can be given. If approval is given before this performance level is reached, then the Regulatory Authorities (and probably politicians) may be found to be deficient in carrying out their duties.

There are laws which cover drivers as to what actions they must take if they are involved in an accident, no matter how minor. Whilst I may have missed it, I do not believe this topic has been covered in the Consultation Document. This needs to be linked to the data collection issues discussed in the last few paragraphs.

What will happen when there is an accident? What will the various parties to the accident be required to do? A number of types of accident involving HARPS (either occupied with passengers or empty – which may alter what needs to be done) may be postulated:

a HARP on its own – eg it bumps into a wall, hits a tree, leaves the road for some reason – it may or may not be able to get back onto the road

b HARP with another vehicle with driver

c HARP with another HARP They may be from the same manufacturer or different. In this case, it will be necessary for an adjudication as to which HARP was at fault and what the problem was that needs to be rectified.

In all cases, what is the responsibility of the passengers? Will passenger actions need to be regulated?

Will the HARP be allowed to proceed with its journey if the damage seems very minor, or must the vehicle be checked by qualified engineers for correct operation? Who takes this decision and what is his liability if it later proves that the HARPS was more badly damaged than he thought?

But there is a basic issue for any accident involving HARP: Who do the other parties to the accident talk to to get the fundamental basic information needed for insurance, repair and potentially prosecution? Will any HARP related incident, no matter how small and whether or not anyone is injured, have to involve the police to ensure the necessary information is available to all parties? (After all the passengers are just witnesses, but only if they were actually paying attention to the road may they have useful information; are they going to be required to give their names and addresses to a totally unknown member of the public? If they refuse to do this, where is the power of compulsion [if this is seen to be appropriate], and then what?)

If the police always have to be involved, and as the use of HARP builds up, will the police have the resources to attend every single incident immediately before passengers get fed up and seek alternative transport? What is a reasonable time to wait for the police to arrive? If the passengers do leave, will they be subject to any form of sanction? Currently, witnesses to accidents on the high street can choose to just walk on; so do passengers in a vehicle have a different status? I suspect any law compelling passengers and by-standers to a course of action would not be popular.

Initially, as HARP appears on the market, the work load on the police may be tolerable, but what happens when many transport services are also based on HARP? This will be further exacerbated once goods HARPS transport is in general use.

Does HARP have the ability to detect that it has been in an accident of any type, no matter how minor? Is it possible that HARP could fail to detect it has actually been in a very minor accident? Is this part of the testing regime?

(I assume that there will be thresholds set in the sensor systems and that failure to detect might be possible. If the sensors' threshold are set to be too sensitive, then just going over a bump could be mistaken for a minor collision.)

If HARP does not stop when involved in an accident it will have committed a serious criminal offence and, by implication, the responsibility will lie with the ADSE. From the rest of the document, it seems that there would usually be a fine. How severe would an accident have to be to warrant withdrawal of approval? Would this ultimate sanction be for a single incident that, if committed by a human driver, would involve any length of prison sentence; or would it need multiple offences? Fairness in the pursuit of prosecuting offenders is, to me, essential. How can it be right that for an accident caused by a HARP result in a fine paid by a company; whilst for a UiC there is a prison sentence?

There seems to be a lack of clarity in this area in the document. To summarise my view, I would like to ask a question. If a human driver can go to gaol for a driving offence, why should the ADSE keep his licence, and should that company and the staff associated with it ever be allowed to be involved in the industry again? If this is considered to be too harsh a view, how

would a softer, more relaxed view be justified to the general public as it seems to me that the treatment is not equitable?

XX REPORTING OF ANY PROBLEMS OR DEFECTS TO THE AUTHORITIES

I would assume that any accident will have to be classified, initially, as a reportable potential system failure. Also, I would suggest that if any passenger is concerned about the behaviour of the HARPS vehicle they are in, they should have an easy, quick way to report the incident to the regulatory body. I would also like to see any other person who observes what appears to be unsafe behaviour also to be able to report an incident. These types of issues need to be covered as absolute requirements within the licence. Failures in these areas would be subject to sanction. Repeated failure lead would to licence withdrawal.

XX ASSIGNING FAULT AND LIABILITY

My starting point is that in law, I believe that a general statement may be made along the lines of:

Liability is based on fault; thus fault needs to be proven so that liability can then be justly assigned; but, if fault cannot be proven, then liability cannot be assigned.

At the start of this, I wrote very briefly about the difficulties with neural networks in knowing how they reached a decision. I can best illustrate my concerns by using examples to show various aspects. I hope my problems in this area can easily be answered by software engineers who know far more than I do. However, I suggest that the problems I am discussing will, in some form or other, come before a judge who will be looking for proof.

Example 1 A HARPS vehicle is in a collision and it is clear that the fault lies with that HARPS vehicle and the way in which it was controlled. An improvement notice is issued. However, as I understand the situation, the exact details of how the fault occurred in the controlling neural network will not be precisely known to the software engineers. Will the detailed analysis after the incident show exactly how and where in the controlling software the fault occurred? If not, liability cannot be determined and this would be unfair to anyone who has suffered loss from a HARPS errant behaviour.

It seems from the technical literature that broad statements may be made, but the exact details may well not be known. In some cases, such as the system not recognising a specific hazard, it would be possible to provide new training data that allowed the system to react properly. Can it then be demonstrated that ALL possible future occurrences have been catered for by that retraining? Also, there will inevitably incidents where post event scene analysis will be unable to provide definitive information about the causes and decisions made by control system. If the analysis of the AI system is also unable to provide definitive information about the sequence of events, then I believe there are problems. These need to be thought through to see where there may be gaps in the law and regulatory regime.

If a fault cannot be identified with certainty, how can it be fixed with certainty; then how can the regulation authority accept that the fault has definitely been fixed?

One approach, mentioned above, might be that new training data used that SEEMS to mimic the event and then to retrain the system, but I cannot see that this can be done AND TESTED with any certainty as the original scenario cannot be reproduced EXACTLY to allow it to be

shown that the original problem has really been fixed. (Anyway, this would also imply that training data and test data were the same, and isn't this forbidden?)

One possibility that might be suggested is to record everything during a journey in sufficient detail for replay and analysis to overcome the problems I have postulated. But would this be possible? (Test vehicles can be instrumented to do this, but is it feasible for production models).

I also see a consequential effect: Should a rectification measure be accepted (ie effectively accepted as adequate, and the problem (or one that seems very similar) occurs again, won't the reputation of the regulatory authority suffer? Their process will at the very least be called into question; but what different procedures can be used to provide more certainty? If that question can be answered, why were those new procedures not used in the first place?

The solution used in aircraft

In aircraft, for safety critical functions, multiple systems are used and are polled to see if they agree, or if just two agree, then that answer is taken. Such systems are developed independently by three different teams. An expensive, but apparently necessary solution in a different, but similar high-tech transport area. Thankfully few planes now crash, but when they do the implications are wide-ranging. (See Boeing 737 Max) Could it be done economically in HARPS? Should it be required to ensure safety? If single control systems are allowed and the accident rate becomes publicly unacceptable, then you will have had your answer, but possibly at the cost of many spoiled and destroyed lives.

So, a conundrum? I would love to know how this will be resolved.

Example 2 There is a collision between two HARPS. From what happened and from all investigations at the scene after the accident, it is not possible to determine which vehicle was to blame, or if both were.

Both system developers have a vested interest in rejecting any assertion that they were to blame. Whichever was responsible they are likely to face significant rectification and restitution costs.

What are they being asked to improve if a specific fault cannot be shown to exist?

What could be tested to show that an improvement order has been successfully completed?

If no specific fault can be found, what will the regulation authority then want to do to progress the situation and what powers will it need?

Does it require specific regulation and laws to maintain safety standards and provide an acceptable dispute resolution mechanism?

Harm to passengers and third parties may be likely as well. It would be iniquitous for them to have to wait until liability has been assigned for them to receive compensation. I would suggest that in this case and any similar where there are queries over liability, that liability payments needed should be split equally between HARPS operators so that the consumer and others

affected do not have to wait. Acceptance of this would be a condition of having a licence. I believe this point has already been covered in the Consultation document.

Example 3 HARPS and a driven vehicle/pedestrian

What will the driver, user-in-charge, or pedestrian be required to do if they are involved with a HARPS? He has no-one to talk to at the incident as required by law.

Will he, and his insurers have ALL the data available within the HARPS system provided to them?

Will it be in a form suitable for interpretation and human understanding?

In the event of an incident, will the HARPS drive off or will its system know to stop? What severity of collision is necessary to ensure that the automatic system would actually stop the vehicle?

I suggest that this whole topic needs to be thought through from scratch to work out what new regulations will be required to ensure fairness and full visibility of all information to all parties. Should all incidents be reported to the regulator for a decision about whether any HARPS system improvements are necessary? I suggest they should.

Should an incident occur, a percentage are likely to come to court that will require firm proof to convince a judge of where blame lies if there is an accident, and this may be difficult if the supposition about the lack of ability to analyse a neural network is correct.

I suggest that to proceed to licencing the use of HARPS, until at least the means by which disputes can be settled has been fully identified, would be a serious error. It would seem to be possible, if not probable, that the regulatory framework would be found to be seriously wanting, and consequently companies and individuals would be left in a legal no-man's land.

However, most of all, I am concerned that when incidents happen, it may not be possible to identify the fault and then show that the cause has been rectified. No licenced HARPS should be allowed on the road all the while this statement is true. At the moment, the responsibility still lies with the human in the cab.

XX THE NEED TO CONTROL TRAFFIC AFTER AN INCIDENT

The police, other emergency services and the general public in the immediate aftermath of an accident will currently try to control the traffic to prevent further accidents happening. As an example, consider the first policeman at an accident needing to stop the traffic and that first vehicle is a HARPS. How can he safely do this? The policeman will give the usual hand signal to a human and he knows to stop and remain stationary until told he can move and in what direction. What will HARPS do? (It may not be a uniformed policeman). Will it recognise the universal stop signal given by a policeman or anyone else?

Also moving off may not be in line with the original direction of travel – the policeman may need to indicate to a UiC by arm waving alone what to do (and this could be to reverse). Would this be understood by HARPS?

What will the HARPS system actually be capable of doing in this type of a really uncontrolled environment? Is there a need for additional regulation or laws? In my mind, this type of situation will be a test that HARPS must pass before being allowed on the road.

XX CONSTRUCTION AND REPAIR WORK ON ROADS

Following on from the previous item, HARPS may well need to find its way through a maze of cones and signs when there is road construction or repair underway. At times, the route will change almost daily and it certainly won't be on any maps. Frequently, on motorways, there are regions of contraflow. Will HARPS need some form of constant reassurance that, yes it's alright, it can travel on the wrong carriageway of a dual carriageway against the normal flow of traffic?

There is often no uniformity of signs at road works, less still is there uniformity of wording. Cones and the types of barrier are often very different. Indeed, in some places it is clear that currently, the contractors have used whatever is available to mark off carriageway restrictions, but humans usually know exactly what to do. It seems to me that HARPS will impose a need for certain (yet to be defined) standards to be met in how normal traffic flows are controlled through construction and repair periods, thus requiring new regulations and standards for those carrying out road construction and repair. Who will have the power to enforce things like this, should it be mandated? Will laws have been broken, or just regulations if there is an accident ?

Will HARPS, as currently envisaged be able to cope with this type of situation and how will it be trained and subsequently tested to prove this? Where will the training data come from here in the UK.

Regulations should demand that tests on this topic can be passed.

I suggest that this will need to be thought through to define the necessary standards and regulations needed to ensure safety of all.

It also makes me wonder about how, in normal circumstances, roads change as bushes grow, in particular how signposts etc then get obscured. Also roads decay (particularly along the verge, where the edge of roads often gets overgrown), also potholes appear. Will these types of change be important to HARPS? If so, will mandatory regulation for maintenance be required and presumably this will be a responsibility of, and a cost to, local authorities?

XX WEATHER EVENTS

As well as vegetation, roads and their edges get obscured by snow and floods. Pools of water collect in dips in the road (or perhaps due to blocked drains) to a depth that could be too great for the vehicle to get through, even if it can stay on the road. Snow covering all the bushes and trees along a road can totally change its appearance. How susceptible will the vehicles be to high wind? Could these types of environmental change cause problems to the HARPS control system? Are sufficient and varied adverse condition data sets in the training data? How and when will operation in adverse conditions be tested?

I realise that my human view in the visible spectrum may well not be the same as that provided by sensors using different frequency bands but will the testing in adverse conditions such as these be enough to show that the system is safe and acceptable to the regulatory authority?

If there are conditions which it is recognised that use of HARPS would be unsafe, how will operators and passengers know when those conditions, perhaps suddenly, exist? The information will need to be known for the whole intended route. How will individuals with exclusive use of a HARPS know that it is unsafe to use their vehicle? Will travel in HARPS, once told not to, be made illegal? Perhaps a HARPS operator will be sanctioned for continuing to use HARPS in extreme environmental conditions for which HARPS use is not licenced.

This seems to be an area needing rules, regulation and probably laws to provide a safe environment for HARPS passengers and other road users.

XX CROSS-BORDER USE OF HARPS

As far as I can see, the report does not cover this topic at all. I suggest that there will be a need for both regulation and laws that ensure that all command and control systems appropriate for use in the UK are active and foreign systems are totally deactivated when HARPS crosses a border.

What will happen at the Northern Ireland / Eire border?

[As an example, look at the route of the N53 in Ireland just south of the border. Using that road you drive into the UK and then back out again. } It seems unlikely that the UK will follow the same rules as the EU, as doing that, means ECJ control.

Should Scotland cede from the UK, what then? It may never happen, but it could and the newly independent Scotland could wish to rejoin the EU.

It would seem sensible to develop ideas and understand the implications now before there are time pressures; ie be prepared.

There are likely to be significant issues in cross-border use, if it is to be permitted. I assume that, even if there were international agreements in this area, there would be a UK-based ADSE.

Further, I would expect that a UK based HARPS operator licence would be mandated, together with all that is implied by that.

I cannot see how it can be otherwise, so the regulations and law need to be developed, written, and then enacted.

However, it is in the area of personal HARPS and hired/leased HARPS that I have the most difficulty. I simply do not have the knowledge or experience to suggest a valid, safe way forward.

If there is an unresolvable incompatibility in standards and requirements, for passenger HARPS, the most obvious way is to transfer to a vehicle that is designed for the country to be visited; at least going across the Channel. However, looking to the future and freight HARPS, I can see that cross border use will be wanted. Trucks will be able to travel throughout Europe and NI and then, if this particular topic is neglected, it will be all stop, if the UK will have different requirements.

The UK needs to have thought this through so that its laws and regulations can be consistent and require the minimum or no adaption to allow cross border use. By thinking this through

now and having an agreed way forward, you would have the requirements and constraints for international operation already built in to our system.

The UK and mainland Europe drive on opposite sides of the road. Their signage can be very different. So, I suspect it is highly likely that different software loads will be required; but could the wrong software load be used by accident? It really should be that the system design makes the use of the wrong algorithms impossible – it needs to be a “never happens” event. But NI/Ireland border makes this difficult.

To make it impossible to have more than one system command and control software loaded at any one time, what is loaded must be clearly visible within the vehicle cabin at all times (if the display has to be switched on, then it might be forgotten), showing the country in which it is intended to be used, and that it is the current, up to date load. Regulations to this effect will be required, and I would suggest that, if breached, should result in loss of operator licence given the very serious consequence of a mistake.

So the question is: “How will the use of AVs and the regulations to which they are subject, be controlled when a vehicle moves from one country to another, or from one geographical region to another if a group of countries can all use the identical system.”

The issues of the way in which fault and liability are handled across borders also needs to be thoroughly investigated. One initial thought: a UK based HARPS is travelling in France and there is an incident. As a result, the French system requires an improvement notice to be issued by the British authorities. A system for handling this and any potential disputes needs to be thought about; new regulations and laws may well be needed.

But what if that incident is severe and the French are demanding the HARPS operators licence be rescinded?

Again, ideally, this whole area requires international standards, agreements, and requirements.

XX THE NEEDS OF PASSENGERS

Passengers in this document are large seen as passive individuals who want to get from A to B. However, there are events where a passenger may need to be able to take action. For example: a HARPS owner allows other members of his family to use his vehicle for a pleasure trip. During the journey, one of the passengers has a possible heart attack. How will they be able to stop / redirect the vehicle to get help? Would there need to be regulations to cover any actions passengers may take whilst in the HARPS?

I'm sure that other possible situations can be thought of. Is this a topic needing regulation, if only to ensure that passengers in HARPS can exert some control in an immediate way? (This might be of particular relevance for leased and owned HARPS,)

XX FACIAL RECOGNITION AND INFORMATION PRIVACY

Will HARPS be allowed to have facial recognition technology in use within the passenger cabin or at the point of boarding?

I can see both pros and cons, but suggest there needs to be a much wider discussion on this point. I would suggest it will either need to be banned or, if allowed, subject to very tight regulation and control. It will also need to be consistent with other privacy laws.

The consultation mentions privacy in the opening section, but there seems to be little about what will happen to all the information collected about passengers in sharing data between HARPS or using a personal vehicle (bought or leased). We should all be aware by now that a lot can be determined about an individual by using the power of the computer to find and combine small snippets of information, leading to information about our private lives being revealed. (I excluded from these comments law enforcement activities, but suggest there still needs to be regulation to ensure that an individual's privacy is maintained.)

Has anything been done to identify all the issues and determine exactly how HARPS will affect everyone's privacy? There is the obvious, but a personal HARPS may well be telling other vehicles where I am. Although that data may be for just a few moments, across the databases there will be a lot about me and what if even one database is hacked to reveal private information? Will this be an offence? Is this type of situation already covered in our privacy laws? Should this topic be considered as needing additional regulation or change to the law?

XX ETHICS

In my first submission I discussed some ethical aspects in answer to question 44. These are highly relevant here. There is a need for knowledge of the ethical basis of decisions made by the system when unpalatable choices are all that's left. Eg. when there is clearly going to be an accident and the HARPS has to choose between hitting a pedestrian with a pram to save the passengers or injuring those passengers.

Regulation on this topic will be required to ensure that any software meets the ethical standards expected by the UK general public. Please refer to that first response for details and associated references.

Even if the designers assert that the control system would not have actively made a particular decision, when harm has been done, it will always be valid to ask, "why did that happen" and expect to get a provable answer. If there is no answer, it would be very disturbing and confidence destroying, to the extent that the deployment of the system should be in doubt.

XX TRANSPORTING PASSENGERS WHO ARE ALL MINORS AND MORE

One significant use for HARPS as a personal vehicle or taxi might well be to take children to and from school. If this is allowed, what age must those children be to travel unaccompanied by an adult? How will they be controlled, and if they do cause damage where will the liability lie?

The same issues would occur on the familiar 56 seater school bus run that is the bread and butter for many coach companies. But here there is a UiC who is responsible and he can use his authority to stop child misbehaviour. With HARPS, it will be an adult free environment, at least for the duration of the journey.

What facilities would need to be at the school to ensure safety as children board and alight from the vehicle? Would this need to be the subject of regulation?

Children are unpredictable and do not necessarily have any sense of danger. Will HARPS have been trained in such an environment where there are significant concentrations of minors, some supervised, but many not? I suggest the high concentration of minors around any school is a common, but unique environment. If it has not been included in the training and test data, how can the regulatory authority, in all conscience, sign off and agree to the use of HARPS? How can this testing and approval be achieved safely? If it is thought this can be done, exactly how will the training data be collected and how will the testing be achieved? (In my view, simulations would be stylised and biased towards an adult view of childhood and children's reactions. It would be unrealistic). It would be totally unethical to use children in the tests (Imagine the furore if a child were even touched by a vehicle under test). Also, it would be obvious to the children that there was a strange vehicle on the road, driving up and down to collect the training data, and their behaviour would change as they watched. So would the test be valid with the children possibly behaving in any abnormal way?

Thus, I can see a potential need for banning any HARPS from going to within a certain distance of a school; say 250 m. This is to give them a chance to disperse. The problem is, in my mind, that around a school, the numbers and density of children will be very high, this giving rise to a much higher probability of accident – and if one occurred, it would be highly controversial that HARPS had even been allowed into the area.

This then has the result that all people occupying houses, or businesses in that area cannot use any HARPS or accept deliveries using HARPS if they are within the set radius. Is this fair and sustainable, particularly as the use of HARPS grows and perhaps becomes the only available road transport for many services.

(Taking as an example, my very local secondary school – there are, apparently, over 1500 pupils and the main access is from both ends of one suburban type street. From one end, it is over 500m to the school. There is a small industrial estate next to the school. This road opens out at the end remote from the school into a shopping area. The other end of the road opens on to a well used B road some 250m away from the school entrance. This road is the only access to the school. Particularly at the end of the school day, but also in the morning, the place is thick with children walking or cycling to school. Parents deliver by car and there are also a number of coaches. It's chaos with children going everywhere in all directions. Will HARPS have been trained on this type of scene with large numbers of unsupervised minors? If not, then how could it be authorised to go into such an area? This will also be relevant to Goods HARPS later).

It might be suggested that HARPS use should be banned for a period at the beginning and end of the day and lunchtime. But at this local school, the children at the end of a lesson period need to walk to classes at a different location from the main building and across the road, using that public street that is the main access. Also, there are many school with clubs and breakfast clubs, so these 'children everywhere' occasions are not necessarily well defined

times.

It is obvious that a ban would mean that the location of car parks for HARPS, HARPS depots, etc cannot be within such a given distance from any school over a stated size (to be determined). Also, access routes would need to be defined HARPS. Delivery services to schools and the use of taxis which are HARPS will also be forbidden. (Consider goods HARPS too).

Part of the problem is that schools vary so much in size and are located in such a wide variety of locations, that I doubt there can be a 'one size, fits all' type of regulation. Thus, if there are guidelines, I would assume that after a survey, regulations would need to be enacted specific for each school.

This needs to be thought about and resolved as regulation, and probably laws, or changes to laws will be needed covering the whole country.

XX THE ENVIRONMENT NECESSARY FOR HARPS TO OPERATE

The HARPS sensor system, together with the controlling software, will need to work in a very diverse range of environments. To ensure this, HARPS is being trained with very large data sets. However, there may well be limits that need to be specified to ensure safety of passengers and all other road users.

Thus, it must be necessary for the HARPS designers and manufacturers to have a specification so that both operators, users, and the regulatory authorities know how, when, and where the systems may be safely deployed.

In my view, this information is essential to enable all involved in selecting which models to purchase for a particular application, and all responsible for regulation and safety to do their job properly, competently and with confidence.

Thus, I believe it is essential for the full and complete specification of all systems offered for sale and subsequent use in the UK (this will include systems that cross borders into the UK) should be fully open and available to all, including the general public. The general public need to know so that individuals and groups can pursue any legal claims they wish to prosecute. These specifications will form the fundamental information to determine if all the manufacturers requirements have been for safe operation have been met. They will be the starting point for Regulators to determine if operators have followed the manufacturers

requirements.

By analysing all the specifications it should be possible to determine if there may be gaps in the required regulatory regime and the laws needed to support the use of HARPS.

There is an aspect of HARPS which does concern me greatly. Everything about the operation of the system safely depends on all the sensors being able to provide information to the analysis and control system in a form as expected and defined in the specifications. But it can be expected that there will be occasions when all will not be as expected. For example, vehicles need to be kept in lane by detecting specific features of a road that the control system then will use to keep the vehicle on the correct path. But what if those features are not present (perhaps due to road repairs). I would expect a HARPS or to be able to cope for a certain time. But at some point, accurate control will be lost. Any problems won't be due to the HARPS. Some sensors use parts of the electromagnetic environment (EME). If there is interference from another source the guidance system may well fail. Who would be responsible? A lack of road markings would be visible and easy to detect, but how would it be determined that the EME had been degraded to the point where safe operation was not possible?

Which organisation will have responsibility for all external aspects of the environment in which HARPS will need to exist and for ensuring that the standards, as required by the vehicle specifications, are met?

What laws and regulations will be needed to ensure that any road maintenance, road building, and road works by the utility companies are done in a safe manner from the point of view of the existence of HARPS?

This then leads to the thought that HARPS systems now being developed, are exposed to vehicles that are controlled by human drivers only. What will happen as the number of HARPS on the road gradually increase? Could the active sensors (eg like those that use a radar-like principle of operation) actually cause interference for other HARPS? What measures are being employed to ensure they don't and cannot no matter what the traffic density?

This is largely, perhaps, reflecting a need for transparency, but that alone will not be enough. A good understanding also will be needed of the issues, in depth. This technology will need all with decision making powers to understand just what they are dealing with.

XX RETROFITTING OF CONTROL SYSTEMS TO PROVIDE AUTONOMOUS DRIVING CAPABILITY

Whilst doing some research for my reply to you, I have become aware that there are

companies who are researching autonomous control systems that would be retrofitted onto vehicles not designed from scratch for autonomous operation.

I can see many problems from the safety point of view with this approach, not least being the lack of a standardised platform. Personally, I would suggest that allowing such systems on the road would be madness. If it were allowed, it would need a raft of regulation and possibly special laws to ensure public safety. Assigning liability would be a nightmare.

But then, perhaps there is an argument in favour of this approach and I am just totally blind to it.

XX FINAL COMMENT

I'm sorry that my comments have been so verbose, and I hope you haven't found them inappropriate for your survey.

This technology could shape the lives of our descendants and it must be got right. Each time a HARPS is used, it will test the system design. Even when driven over the same route, day after day, there will be changes in the environment; and all the other vehicles present in the field of view will be different. With any different input data, there could be a different output. Assuming that this technology is used world-wide, that will be an awful lot of testing. It also means that the saying 'if it can go wrong, it will go wrong' will be tested and borne out.

The needed Laws, Regulation, and the Regulatory environment need to be designed and implemented with this in mind.

Please don't listen to the phrase 'Oh! that will never happen' particularly where it concerns events external to HARPS; ie in the environment. If said about HARPS itself, ask 'Why not? Prove it!'

The regulations and laws are needed to ensure that assurances given now will be adhered to out into the future and will still be valid in 100 years. I suggest that it must not be otherwise.