The Regulation of Autonomous Systems

Will regulation stymie the advance of autonomy? This was one of the questions posed by the SMMI- hosted meeting run jointly with the Knowledge Transfer Network on behalf of the South Coast Marine Cluster as part of its 2017 series of events in the Year of Autonomy. Participants heard from key industry speakers about progress on developing regulations, standards and codes of practice and conduct for autonomous systems in air, sea, rail and road vehicles. This was followed by a lively
panel discussion that included experts in law and ethics. The contributions by the audience of about
40 participants drawn from large and small companies, the defence sector and academics stimulated many interesting discussions. The meeting concluded that sharing experiences between sectors is vital and should be further encouraged.

Is Regulation a Barrier?

Progress within sectors has been varied. The marine sector has an international scope so for larger vessels regulatory development has to be within the International Maritime Organisation. Persuading around 170 other countries to align their thinking and action is challenging but the UK is in the vanguard of this process. Nationally governed marine autonomy test ranges are becoming established for smaller craft and for naval purposes. Demonstration exercises like Unmanned Warrior are important in showcasing developments and driving forward industrial and military collaboration. The air sector is similar with bodies at international, European and national levels having an interest in developing regulation. The burgeoning use of small, privately owned devices presents a particular challenge here. Road and rail are more nationally oriented so the process is different. In road autonomy the UK Government has a significant programme funding driverless cars and experimental areas in real world environments have been identified for trials. The rail sector is developing autonomy too, again using trials on existing tracks and within off network test areas too.

Opinion was divided on how the regulation of autonomous systems, its development and implementation, will influence the uptake of the technology. Some argued that the pace of technology and its backing by business will leave regulatory issues to catch up. Some felt that existing regulatory frameworks are capable of keeping autonomous systems in line with only minor
adjustments and our focus should be on “equivalence“ and minimising new regulations, at least until autonomous systems (vehicles or vessels) become part of the mainstream. Others felt that investment decisions in autonomous systems are more closely aligned to the risks of regulatory non- compliance so investment is already being constrained. Regardless of position though there was unanimous agreement that greater cooperation between the ways by which the different sectors (air, sea, rail, and vehicles) are developing their regulations would be very beneficial.

It's not just regulations that cooperation will support. Though regulations provide an overarching framework it is the standards, codes of practice and codes of conduct that deliver confidence in the technology and its operation and use. It was particularly striking to

hear how these industry-driven codes are already being developed, largely in isolation from each other. Clear similarities exist, particularly in broad principle, even if in detail issues specific to a particular context arise.

Risk Management, Confidence and Trust

Whether or not you are a passenger on an autonomous train, plane or ship, or the owner of an autonomous car, it is imperative that you and others around you have trust in the technology - a complex technology comprising multiple systems and components. Experience shows that public trust is vital in technological advancement. It is an essential component of social acceptance. We also know that perceptions of trust are asymmetric. One accident vastly outweighs a whole host of safe journeys. But that is the same for conventional transport too, though the impact of accidents

may not change our travel behaviours for many other reasons such as a lack of alternatives. So should we demand that autonomous systems are safer than their human controlled equivalents? The meeting considered this in some detail. Defining the equivalent standard for autonomy to meet isn't altogether straightforward. A wide range of human capabilities exists ranging from new car driver to professional driver, and from the occasional driver to the elderly.

From an ethical perspective safety is only one decision criterion. The benefits of access to autonomous transport for the elderly, vulnerable or disadvantaged (or drunk as one participant suggested) may well outweigh marginal reductions in safety. Here though it is the frame of reference that matters most. Who gets the benefit and who is exposed to the risk? Care is needed to ensure that autonomous transport systems, while bringing benefits or reducing risk for the user, don't increase risk for others.

A key point raised here is the security of data. The autonomous world relies heavily on data and we must ensure that this is handled securely. The complex array of systems covering sensors, controls and other operations within each sector's autonomous operations is already generating significant data volumes and this will only increase. Understanding who owns the data, who can have access to it and how to prevent cyber intrusion are all very important issues, the solutions to which will enhance public trust.

Assuring Safety

Consideration of risk:benefit trade-offs focused minds on justifying at the outset why autonomy is required. Safety is a key driver, though not by any means the only reason. Assuring safety through appropriate testing was a significant topic for discussion. Significant levels of funding are being directed at driverless cars where testing is happening in real world situations. The same is emerging for marine: witness for example the recent funding to establish a testing range in the Solent. Note though that as autonomy advances into intelligent, self-learning systems, underpinned by artificial intelligence, assuring safety will become more challenging. Self-certifying systems might be one way to develop confidence in advanced autonomous systems, but in the end demonstration through experience will be important.

Liability and Insurance

Linked closely to regulation and standards is the issue of liability and insurance for autonomous systems. In the vehicle sector encouraging progress is being made through cooperation between government, the major car manufacturers and the insurance industry. Managing many of the aspects of an accident involving an autonomous vehicle is already

familiar to us. For example this might involve mechanical failure or software error. The responsibility of the owner to ensure that the autonomous system is used responsibly, and that, for example, software updates are applied is new but not impossible to deal with. There may be a few instances where insurers and software companies end up in court, but this is a normal part of the existing process. Look, for example, at the recalls made periodically by car manufacturers and the ongoing issue with diesel engines.

Next Steps

The meeting concluded that sharing information and experiences was incredibly valuable, particularly at the early stage of technology development. Various codes of practice and conduct exist and comparing these in more detail may provide a mechanism to further integrate shared learning between sectors. On initial examination they contain many of the same major elements but it is clear that some sectors are moving faster than others.

There is also a need to examine the education system's response to the emergence of autonomous systems. Are the right courses available in the appropriate formats with clear career pathways visible to generate the skilled workforce that autonomy will demand? What about retraining the existing workforce?

Alongside education and skills we will need more testing, particularly to secure public confidence in the technology. All sectors reported progress in this area but more needs to be done to enable new approaches to be reach commercial reality. The significant funding for the road vehicle sector is not yet being matched in other sectors. Yet in terms of progress on regulations the marine sector can claim to be relatively advanced.

Future workshops as part of this Year of Autonomy initiative will explore in more detail some of the topics covered here. Specifically on the topic of "risks and reliability" to be held on 29 June at the University of Portsmouth, and a later one on the "social acceptance" of autonomous systems.

To access the presentations delivered at the event please use the following link:

https://www.dropbox.com/sh/qwahth0kmpwao7v/AAB7WtSZRsjJ20OhfUaFF0cva?dl=0

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