BEFORE THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION
AND
PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION

DOCKET NO. FRA-2018-0027
REQUEST FOR INFORMATION: AUTOMATION IN THE RAILROAD INDUSTRY
AND
DOCKET NO. PHMSA-2018-0001
REQUEST FOR INFORMATION ON REGULATORY CHALLENGES TO SAFELY TRANSPORTING HAZARDOUS MATERIALS BY SURFACE MODES IN AN AUTOMATED VEHICLE ENVIRONMENT

SUBMITTED BY
THE ASSOCIATION OF AMERICAN RAILROADS

The Association of American Railroads ("AAR"), on behalf of itself and its member railroads, submits these comments in response to the Federal Railroad Administration ("FRA")'s request for information ("RFI") and comments on the future of automation in the railroad industry, and the Pipeline and Hazardous Materials Safety Administration ("PHMSA")'s RFI on regulatory challenges to safely transporting hazardous materials by surface modes in an automated vehicle environment.[1] AAR member railroads constitute 83 percent of the line-haul mileage, employ 95 percent of the workers, and account for 97 percent of the freight revenues of all railroads in the United States, and thus have a significant interest in these proceedings.

Automation in the Freight Rail Industry

As the RFI notes, automation has already started to deliver on its great promise to remove or reduce the impact of human error and human limitations on railroad operations. And the explosion of automation technology comes at the perfect time for the nation's railroads. For the last few decades, the railroads have worked diligently to improve the safety and efficiency of their operations. Safety has improved dramatically: according to FRA data, U.S. railroads had the lowest train accident rate on record in 2016. The 2017 rail safety statistics continue a string of record-setting years, showing this period has been the safest ever for the rail sector. According to December 2017 FRA data per million train miles, since 2000 the

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[1] 83 Fed. Reg. 13,583 (Mar. 29, 2018) and 83 Fed. Reg. 13,464 (Mar. 29, 2018). AAR is a non-profit trade association and the freight rail industry's primary industry organization that focuses on policy, research, standard setting and technology.

train accident rate is down 44 percent, the equipment-caused accident rate is down 38 percent, the track-caused accident rate is down 55 percent to an all-time low, and the derailment rate is down 42 percent.

Similarly, on the efficiency and customer service side, railroads have delivered more and more goods without significantly increasing the size of the railroad network. In 1980, traffic density was 5.58 million ton-miles per mile of road. In 2016, the number was 16.99, approximately a 300 percent increase. Today, railroads can move one ton of freight 479 miles on one gallon of fuel – doubling the fuel efficiency from 1980. Over all, rail productivity gains have been dramatic: from 1980 through 2017, rail employee productivity (measured by ton-miles per employee) rose 467 percent; locomotive productivity (measured by ton-miles per locomotive) rose 93 percent; and average freight carried per train rose 63 percent. The most commonly used broad measure of rail industry productivity — ton-miles per constant dollar operating expense — was 159 percent higher in 2017 than in 1980. All of this has benefitted rail customers: average rail rates (measured by inflation-adjusted revenue per ton-mile) were 45 percent lower in 2016 than in 1981.

But a closer examination of the statistics shows that with increasing success, further improvements have become incremental and harder to achieve. If railroads are to continue to improve their efficiency, increase their capacity to transport their customers' freight, further reduce congestion on the highways, use less fuel to get goods to their destination, and, most importantly, make the industry even safer than it is today, a paradigm shift is required.

Automation is that paradigm shift. In the case of safety, technology already has proven effective at addressing the leading causes of accidents: human error, as well as equipment and track issues. With respect to the latter, and as the railroads have demonstrated, automated track inspections can and will reduce track defects leading to accidents. Likewise, the railroads have shown that automated inspection of rolling stock can and will reduce the occurrence of broken wheels and other mechanical problems that result in railroad accidents. But future safety gains will arise in large part from further (and in some cases, full) automation of the locomotive itself.

Fully automated trains (with or without humans on board) are certainly in the future - for at least some operations on some railroads. Given the development of automation in other more complex settings, automating locomotives is an entirely realistic endeavor. Trains' paths are constrained by their tracks, and access to the railroad rights-of-way by others is limited and controlled. Thus, in a world where the automation of millions of interacting trucks and cars is being vigorously pursued, the similar – and in many cases simpler – automation of train operations should come as no surprise. Indeed, as the RFI notes, there already are automated train operations elsewhere in the world, including fully automated freight trains in Australia. It can be done – in fact, it has already been done – and it will enhance safety.

Indeed, Congress recognized the life-saving potential of automated train operations by requiring positive train control ("PTC") in the Rail Safety Improvement Act of 2008. PTC in its current form is simply an automated backup that can overcome some categories of human error. But going forward, PTC provides a platform for further advances in automated train operations. With next generation PTC, railroads can be safer, faster, and more efficient with automated operations, and the railroads are fully committed to developing and using automation where it can improve safety and customer service. In short, PTC is the backbone for further innovation.

There is no single industry-wide "plan" or schedule for automation. Automation of rail functions will continue to be incremental and progressive, with individual railroads developing and carefully implementing technologies that make sense for their operations and their customers. Interoperability is always a consideration, and a complication (PTC being an excellent example of that challenge). AAR's Technical Advisory Group on Automated Train Operations ("ATO TAG") is devoted to staying in front of issues of interoperability in train operations. As FRA observed in the RFI, the ATO TAG has started the process of developing interchange standards, which will be necessary as locomotives with automated functions move over multiple railroads. The ATO TAG also recommends an automated rail taxonomy - a system of standards to clarify and define different levels of automation in trains – is appropriate, as neither the SAE nor the UITP taxonomies referred to in the RFI perfectly fit the U.S. rail industry.[2] The ATO TAG can also take on the evaluation of limitations in electronic sensors, cybersecurity, and other such matters.[3] But the pace – and the extent – of automated train operations will be determined by each railroad individually.

Railroads can be expected to employ rigorous risk mitigation planning and processes when rolling out a new technology. But complete elimination of risk cannot be guaranteed and should not be a barrier to achieving safety and efficiency improvements. But the long-term safety benefits automation will provide should not be impeded based on this concern. Further, railroads can take many steps – sealed corridors, test routes in low-density areas with non-hazardous materials, and pilot programs – to minimize any risk implicated by the development of automated operations. It is worth noting that many of these risk-mitigating options are only possible for railroad operations, rendering the rail space significantly less risky than testing and operating in other modes, e.g., motor vehicles and commercial trucking, where the public has significantly greater exposure to analogous technologies, both during testing and routine operation.

Importantly, even automation will not guarantee an end to all railroad accidents, especially two of the most prevalent kinds: accidents at grade crossings and trespasser accidents. Trains cannot come to an instant stop if a motorist or trespasser makes an unwise

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[2] *See* Attachment 1.

[3] The FRA Office of Research has been invited to participate with AAR's ATO TAG and is reviewing AAR submitted Project Proposals. *See* the ATO TAG list of project proposals in Attachment 2.

decision, whether there is a person in the locomotive cab operating the train or not. That being said, the greatest safety improvement for at-grade highway-rail crossings will come from autonomous technologies in automobiles and trucks, as human error is a factor in 94% of all highway accidents.[4] In fact, the DOT Office of the Inspector General attributed 94% of grade crossing accidents and 87% of grade crossing fatalities to risky driver behavior or poor judgment.[5] The railroads encourage FRA to work with the appropriate DOT offices to ensure that vehicles with automated technology are mandated to stop at grade crossings and obey crossing devices.

The bottom line is machines can detect more, respond faster, and provide a larger window for action, than a safety system that is subject to the limitations inherent in human eyes, minds, and hands. The railroads – and the public -- are already seeing the benefits of that technology in enhanced rail and rolling stock inspections and incident avoidance. Currently, according to DOT safety data, over one-third of train accidents are caused by human error. Autonomous operations will greatly reduce the level of human input and interaction required to operate a train and will improve safety through the reduction (or even elimination) of human error. From an economic perspective, autonomous technology has the potential to improve network velocity and fluidity. Increased network velocity and fluidity will enable the transport of more goods by rail, reducing the demand on highway capacity and providing fuel efficiency and air emissions benefits.

Security and Safety

Security – both physical and cyber – is a matter the railroads always take very seriously and to which they devote substantial resources. But security is a complex subject that is constantly evolving and cannot be defined strictly as a standard or process for any industry.

The PTC systems currently being deployed in the United States are an example of many railroads utilizing agreed upon standards and processes for interoperable train control. These efforts are consistent with MIL-STD-882C – Military Standard System Safety Program Requirements. These (and other) standards have been determined to be appropriate standards for process control, safety assessment, and risk mitigation for our current PTC technology and operations. With increased automation and potential autonomous functionality being introduced with improved and more capable software and algorithms, the additional implementation of MIL-STD-882E (or other appropriate standards), Section 4.4, Software Contribution to System Risk with the appropriate Software Control Categories to align with the AAR taxonomy, will allow for the implementation of safety programs to align processes and rigor of requirements, development, and testing to meet or exceed the requirements for safety.

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[4] *See* remarks from U.S. Secretary of Transportation Elaine Chao, AV 3.0 Summit Event, March 1, 2018, Washington D.C. Available at: https://www.transportation.gov/briefing-room/av-30-summit-event.

[5] Multer, Jordan and Yeh, Michelle, "Driver Behavior at Highway-Railroad Grade Crossings: A Literature Review from 1990 – 2006." DOT/FRA/ORD-08/03. Available at: https://www.fra.dot.gov/eLib/Details/L01598.

Importantly, security concerns are integrated into the design stage of new technologies, using approaches such as a consequence-based security analysis. The design of PTC, for example, controls where safety critical functions reside and the nature of the interfaces to them and the behaviors of the system while using those functions. This is similar to the techniques utilized for security purposes, where the "attack surface" is minimized to the degree possible. Some standard approaches used when automating processes include:

- Design for Minimum Risk – Design to eliminate the possibility of intrusion or cyber risk at the outset.
- Incorporate Safety Devices / Degrade or Fail-Safe – Design the system to mitigate the effect of intrusion to encapsulate or isolate the effect.
- Provide Warning Devices – Warnings and cautions provided to personnel when an intrusion or cyber risk is detected.
- Procedures and Training – Provide sufficient procedures and training to allow operators to detect and mitigate potential intrusion or cyber risk.

Addressing cybersecurity risks is incumbent upon many industries in our modern world and is a challenge, but not an obstacle, to autonomous rail operations. We are confident that cybersecurity can be addressed through proper design and constant vigilance, such as railroads currently employ. We note that conventional security approaches will remain an essential element in protecting safety and security of transportation by rail, due to the visible nature of rail operations.

Railroad safety and security risks are similar from country to country, although the degree of risk may vary based on parameters such as terrain, weather, and sealed corridors. Regarding cross-border collaboration, large U.S. and Canadian railroads essentially operate as one network and thus can be expected to address interchange issues as one group. The close ties between U.S. and Mexican railroads also ensure a collaborative approach. Information from safety and security assessments completed in Europe appears to confirm that the level of maturity of their rail operations is similar to our own, and in some instances may be greater. We believe there is a benefit in evaluating areas for global cooperation and sharing of best practices, and we suggest FRA and the industry work together to learn from existing and planned autonomous operations in Europe and elsewhere.

Infrastructure

PTC provides a good starting point for addressing the infrastructure needs of autonomous rail operations. Communications equipment, wireless data communications, and back office servers deployed for PTC can all be used in autonomous train operations. The Rio Tinto rail operation in Australia demonstrates the feasibility of building out the infrastructure required for autonomous train operations. It is relevant to note that the infrastructure needs of autonomous motor vehicles (detectors, lane markings, etc.) dwarf similar needs for railroads. And railroads pay for their own infrastructure, unlike motor vehicles. And yet the National

Highway Transportation Safety Administration's efforts to promote the development of automated motor vehicles (which include funding research) demonstrate DOT's interest in pushing the deployment of safety-enhancing automation technology even when few pieces of the needed infrastructure are in place. FRA should similarly embrace these forward-thinking ways, with the recognition that rail autonomy potentially can be achieved more simply, reliably and quickly.

Hazardous Materials

In addition to the obvious benefits flowing from automated rail and rolling stock defect detection technology, the increased efficiency of automated train operations promises to limit the time and distance hazardous materials spend in transport. To facilitate these benefits, PHMSA should evaluate its existing regulations for outdated requirements that would not work smoothly in an automated environment. For example, current regulations require that a physical shipping paper accompany hazardous materials shipments. *See* 49 CFR 174.24. Even with the current state of technology, physical shipping papers should not be required where the information could more quickly and easily be shared and transmitted electronically through applications like AskRail©. In a fully automated operating environment, requiring paper consists in the train would be nonsensical. As another example, in the event of an accidental release of hazardous materials, the hazardous materials regulations currently require a telephone call to the National Response Center under 49 CFR 171.15. Unquestionably, however, electronic reporting is faster and more reliable than requiring a person to place a telephone call. PHMSA should revise its regulations to support an operating environment where the locomotive itself can instantly and automatically notify a wide number of responders and stakeholders of an incident, with comprehensive information about location, consist, and other relevant facts.

Barriers and Impediments

The barriers and impediments that railroads face in fully exploiting the promise of automation in all its forms include: (1) the historic regulatory approach and culture; (2) labor concerns; and (3) public perception.

Historic Regulatory Approach and Culture

Intelligent regulatory reform can remove barriers to innovation.[6] Unfortunately, DOT's regulatory approach and culture has not changed since train orders were written on paper and delivered by hand, and track inspections had to rely on the naked eyes of employees walking along the right-of-way. Manual inspections are still required, even though technologies exist that can keep workers out of harm's way while eliminating human error. Waivers to test or

[6] *See* Kennedy, Joe "How Regulatory Reform Can Advance Automation in the Freight Transportation Sector." Information Technology and Innovation Foundation, June 2017. Available with ITIF's public comments at Docket # FRA-2018-0027.

demonstrate the safety or cost-savings offered by new technologies can often take years to be granted, and often come with arbitrary limitations. The agency too often seems to assume that the railroads have no interest in, nor any expertise regarding, how to operate safely, and must be distrusted, policed, and prescribed into safe practices. In fact, the industry has been regulating itself for years, in some cases requiring a higher level of safety than DOT does, and spends tremendous resources in researching, developing, and deploying safer equipment and operating approaches. Railroads have every incentive to do so, including from a business and liability perspective. The safety performance of the industry should have, by now, earned it a place as a trusted partner of the regulator.

Instead, DOT has taken action like the crew size notice of proposed rulemaking.[7] Recognizing that the railroads might start to automate train operations, the agency's reaction was not to encourage or facilitate that possible safety advancement, or even to gather data on the relationship between crew size and safety, but instead to issue a proposal that would preemptively prescribe minimum crew size at the status quo, and effectively chill movement towards increased automation in the locomotive cab. The inconsistency of this approach with the treatment of motor vehicle automation is stark.

Even more recent experience is concerning. For example, as mentioned, reducing accidents attributable to track and mechanical defects will require increasing use of automation. Yet, railroad efforts to obtain DOT approval to use track inspection vehicles more efficiently and use automated wayside defect detectors that are more effective than manual inspections, have been met with regulatory obstacles and years of delays.

The PTC regulations demonstrate that FRA has – perhaps until now – had no interest in encouraging the development and deployment of autonomous rail operations. The prescriptive, "may-I" approach reflected in these regulations is inefficient, destroys needed flexibility without also providing certainty, and has not led to a safer state. We urge FRA to look closely at performance-based regulatory schemes (where an equivalent or better level of safety is established), such as risk assessment and demonstration followed by certification of operating systems or operators. There are many examples available for further study and consideration, including the scheme adopted by the Australian government. And more narrowly, FRA must modify existing regulations that explicitly inhibit automation, such as the restriction that only a person can move a locomotive pursuant to the locomotive engineer certification requirements in 49 C.F.R. part 240, and those that implicitly inhibit automation, such as the standard delivery of mandatory directives in 49 C.F.R. part 236 and the onerous process of approval for new signal technology in subpart H to part 236. A blanket replacement or amendment to DOT regulations changing any reference to a "person" to include "technology that accomplishes the same purpose," would go a long way to opening up the ability to innovate in the near term.

[7] 81 Fed. Reg. 13,918 (Mar. 15, 2016).

As noted above, the regulatory climate railroads face has been particularly difficult to understand considering the very different approach DOT has taken with regard to automation on the highways. On the highway side, DOT has been quite vocal about the potential benefits of automating trucks and cars.[8] Yet, as noted above, automation of railroad inspection functions has been viewed with skepticism and mistrust by DOT, and automation of train operations – with the safety benefits it offers – has never even been mentioned publicly before this RFI. DOT should adjust the safety-critical systems regulatory oversight so that it provides a level playing field for all transportation modes as emerging technologies are being used for automation. Outcome-based guidelines can be domain-specific but general safety objectives should not favor one transportation mode versus another. Any legal safe harbors for one mode should apply to all – i.e. if there are limited liability protections, the same needs to be applied to rail.

FRA must recognize that safety is a *shared* goal, and that the railroads – not the regulator – have the greatest power and ability to innovate for greater railroad safety if they are not effectively discouraged from doing so. Railroads in the United States are businesses whose value is measured in part by their safety records. Unsafe railroads cannot, as a business concern, meet the expectations of their stakeholders. Safety is good business, and it is the right thing to do. We stand on our performance. We urge an “assessment and verification” approach to regulating the advent of autonomous rail operations that considers that railroads, as businesses, are highly motivated to be safe.

Labor Concerns and Public Perception

With respect to its workforce, railroads face the same challenges as other industries across the world as technology develops to improve on or replace human performance. AAR recognizes that there are many comments in the docket from current and former railroad employees who cite concerns from reducing the size of train crews – which they conclude is inevitable with the growth of autonomous technologies. We appreciate the concern these railroaders have for their jobs, and for future jobs in the railroad industry. While we anticipate that some conventional railroad jobs will change with increased automation, the extent of that change is uncertain. At this time, even fully automated trains run with humans onboard or need some sort of human interface in operating (indeed, the Rio Tinto operation currently includes one crew member in the cab). Contrary to the concerns of many commenters, technology is likely to *add* jobs to the rail industry – the development and deployment of PTC, for example, has created numerous new jobs on the railroad, and has employed and will continue to employ many people. Even fully autonomous trains will not be able to fix themselves in all instances and will require a human response. It also bears noting that the efficiency that comes from increased use of automation will allow railroads to remain

[8] “Transportation Secretary Elaine L. Chao Announces Vision for Automated Vehicle Technology, Emphasizes Safety Benefits and Consumer Education Focus.” Sept. 12, 2017. Available at: https://www.transportation.gov/briefing-room/dot7017.

competitive, ultimately saving jobs. An inability to compete with other transportation modes that are embracing autonomy – such as platooned autonomous trucks – would no doubt result in the loss of railroad jobs.

In any event, there can be little question that autonomy through the elimination of human factors will create a safer state. It will also remove some employees from potential hazards in the operating environment. As they have for years, the railroads will continue to work with their employees, through the collective bargaining process, to address workforce changes driven by technology.

The general public takes its lead, in part, from the regulator. The public does not have the context and information necessary to assess the risks and benefits of increasingly automated freight rail transportation, especially relative to other transportation options. This means that fears and misinformation about railroad operations generally, and automation in particular, can be exacerbated if not addressed. Accordingly, we urge FRA to follow the lead of its sister modal agencies and debunk any public misconceptions by vocally promoting the potential benefits of future rail automation and the safety benefits it will yield.

How DOT Can Help

The railroads are at a crossroads. DOT should take the same approach with rail it has taken with trucks and cars: provide and encourage the industry with the option to automate, enhancing the safety, efficiency, and environmental benefits the railroads offer. To do so would require DOT to shift its regulatory approach and attitudes to recognize the benefits of technology and other significant infrastructure investment made by railroads. As noted above, there are regulatory approaches and models abroad that are more conducive to innovation and investment than the historic approach used by DOT with regard to railroads. But already in place here is one tool that could bring substantial value to this effort: waivers. AAR strongly encourages DOT to create regulatory certainty regarding long-standing waivers whose value has been proven through successful implementation by making the waivers permanent via rule. Many of these existing waivers promote the use of technology to improve safety.[9] Further, FRA should issue waivers of indefinite duration and provide procedure for expedited conversion of time-limited waivers to permanent where equivalent or better level of safety is established. AAR also invites FRA to proactively engage with the industry to test new technology or operational approaches outside of the rulemaking and waiver process, through testing programs.[10]

In short, DOT can give the railroads the license and flexibility to conceive, develop, and deploy innovative technologies and practices where they are effective and efficient, and to be regulated based on our success in achieving safety goals, not by outdated, prescriptive

[9] *See, e.g.,* Docket Nos. FRA-2012-0091, FRA-2013-0040, and 2013-0077.

[10] *See* 49 C.F.R. § 211.51.

regulations.[11] Finally, DOT also can promote the benefits of automation in the railroad industry to the public, just as it does with trucks and automobiles.

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Thank you for your consideration.

Respectfully submitted,

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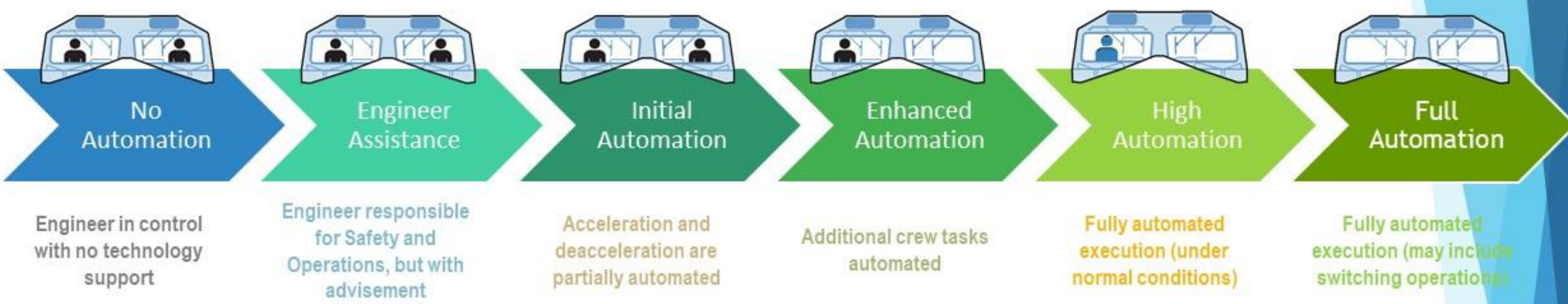
[11] *See, e.g.,* AAR's comments in Docket No. DOT-OST-2017-0069.

Automated Rail Taxonomy



Attachment 2

Association of American Railroads

Automated Train Operations Technical Advisory Group Projects

Interoperable Lifecycle Management	Specify tools and processes to support ongoing lifecycle management of PTC and operations technology, including change management, requirements management, and PTC system release management
Technology Driven Operations: ATO	Prepare concept of operations and perform preliminary hazard assessment for interoperable aspects of an automated train operation (ATO) system for freight rail operations
Automation Sensor Package	Define requirements and issue a Request for Proposal (RFP) for a proof-of-concept prototype, for a locomotive-borne sensor package to support increased levels of automation
ATO Safety Development	Define preliminary set of system level ATO safety requirements, identify level of rigor necessary in ATO functional development to satisfy safety requirements, and identify level of integrity necessary in ATO system components and segments to satisfy safety requirements
ATO Interface Definition	Develop draft interface control documents (ICDs) for high priority interfaces to support ATO system, including ATO onboard to PTC onboard, ATO onboard to ATO back office, ATO onboard to Energy Management System (EMS) onboard, and ATO onboard to ATO sensor package
Monitoring and Analysis of Integrated Network (MAIN)	Development of concepts for tools to support interoperable monitoring and analyzing PTC communications and PTC operational status
Reliability, Availability, and Maintainability Study	Development of PTC system availability analysis to include all events that result in operational impacts, enhancement of RAM and network models to support ongoing analysis as PTC and operational technology concepts evolve, develop strategic RAM growth plan to improve overall PTC availability in the long-term, implement RAM growth efforts including engaging vendors and railroads with specific actions.
PTC and Operations Technology Test Facility	Conduct an assessment of current railroad test cases to identify range of prospective testing that could be conducted at an industry test facility
Interoperable Train Control (ITC) Security Analysis	Identify and document risks and impacts of GPS and PTC 220 MHz radio network spoofing and denial of service and identify potential mitigation strategies