RAILWAY AGE – PODCAST

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TRANSCRIPT

QUESTIONS

1. You've talked about "Industry 4.0," the "Fourth Industrial Revolution." What exactly is it? More important, what does it mean for railroads?

2. The railroad "mantra" has always been "Safety First," and the industry's safety statistics, as measured by FRA and Transport Canada, have been continuously improving for at least a generation. Yet, you stress that "system safety as a formal practice" is in the very early development stages in the rail industry, indeed, across the transportation supply chain. What differentiates Safety

First from System Safety? (i.e. what is System Safety?)

3. What is the Systems of Systems level? It sounds kind of complex, almost daunting. Is it simpler than it sounds?

4. Describe the holistic view of safety. If it's a universal business concept, how does it apply specifically to a railroad.

5. Given the rapid pace of technological innovation in the rail industry, you believe that system safety "needs more support in business plans," as reactive fixes to safety problems won't work anymore. How is this accomplished?

6. Final words, wrapping up the podcast

RA INTRODUCTION

Welcome to this edition of rail group on air the podcast series brought to you by Railway Age, Railway Track and Structures, and International Railway Journal. This is Railway Age editor-in-chief William C. Vantuono. So with this podcast we are introducing a new series of three part series on System Safety, and we've chosen the title *System Safety Doesn't Happen By Accident: System Safety Comes of Age*.

I'm very pleased to welcome Sonia Bot who is well known to Railway Age now through the PSR 2.0 series and with her is Tony Zenga of the CMTIGroup just would like to add that this podcast is tied to three articles that will be in Railway Age; October, November, and December issues as well as on our website and in our digital edition.

RA QUESTION 1: You've talked about "Industry 4.0," the "Fourth Industrial Revolution." What exactly is it? More important, what does it mean for railroads?

- **RESPONSE – Sonia Bot**
    - Industry 4.0 and how we apply it to railroading quite exciting! It promises to completely revolutionize how work is done… not just improving productivity and efficiency by a little bit
    - Industry 4.0 takes automation and computerization into the future. It trends toward the automation and data exchange in processes and technologies that include the Industrial Internet of Things, cloud computing, and Artificial Intelligence.
    - Industry 4.0 was formalized by the World Economic Forum in 2016. So, we are in the early stages of it.
    - So, what does this mean for railroads?... Well… railroads, and transportation systems overall, are complex with respect to technology and operations because they involve a wide range of personnel, organizations, and technical solutions… plus… new entrant competitors

are setting new and higher expectations for origin-to-destination requirements and fueling unprecedented competition…so there is a need to apply intelligent computerized systems for the operation and control of such operating environments… and to stay ahead of the competition.

- Railroads are at the beginning of their journey to establishing true end-to-end digital continuity. For example,
    - Industrial Internet of Things (IioT): Positive Train Control and Enhanced Train Control;
    - automation: autonomous track inspection;
    - AI-based automation: expanding autonomous inspection to include predictive analytics for track data.
- So… for railroads, Industry 4.0 has benefits that include… improved productivity and efficiency… better flexibility and agility… increased profitability and competitiveness… And… it improves the customer experience!

- **RESPONSE – Tony Zenga**
    - What this also means for railroads… is that we need to align our safety practices, which means that some paradigms will shift
    - In the Industry 4.0 world, we need to ask questions such as
        - How do we know that these solutions and systems are safe – and that there are no lurking issues?
        - How do we know that the integration of multiple components from vendors, partners, and even from within meet safety objectives?
        - How do we know if safety integrity is preserved after a change is made?
        - How do we shift the paradigm where safety moves from a cost center to a value-added business driver?
    - …and, of course, design and implement safe solutions in this new world

RA QUESTION 2: The railroad "mantra" has always been "Safety First," and the industry's safety statistics, as measured by FRA and Transport Canada, have been continuously improving for at least a generation. Yet, you stress that "system safety as a formal practice" is in the very early development stages in the rail industry, indeed, across the transportation supply chain. What differentiates Safety First from System Safety? (i.e. what is System Safety?)

- **RESPONSE – Sonia Bot**
    - First of all… Safety First and System Safety are two different things… Safety First is a mantra, as you've said Bill, and goes beyond methodologies and technologies.   System Safety is a discipline, a practice, with established and emerging methodologies. The two co-exist.

- Now… It's great that safety statistics have been improving for at least a generation. I would challenge, though…
    - Are the statistics improving enough? Can we truly do better?
    - Why are unresolved safety issues perpetuating year over year?
      Is there a cultural acceptance to certain types and volumes of accidents; a form of "learned helplessness" or "cognitive dissonance"?
    - Another question… How are we addressing our industry's paradigm shift into the world of Industry 4.0 where safety is concerned?
    - Yes, we are focusing on using new technology for improving safe operations. However, the digital world continuously demands integration of systems and solutions, yet it is unforgiving to any inaccuracies or incompleteness in requirements, specifications, designs, implementations, and operations.
    - For example… As publicly reported in the news… In March 2020, there was a derailment and collision on the Tsuen Wan Line (TWL) in Hong Kong during a test in non-traffic hours. Investigation results found that the cause was software implementation errors. The recommendations pointed to practices in system safety, systems engineering, and software engineering.
      https://www.railjournal.com/signalling/contractors-responsible-hk-collision/
      There are many situations like this out there in our industry… this particular incident happened to have made it to the global newswire
    - So, what are we doing to ensure this new world, this new technology, this new way of working is safe? This is where system safety plays a critical role.

- **RESPONSE – Tony Zenga**
    - Let me tell you a bit more about system safety. By definition: System Safety is the engineering process used to prevent accidents – by identifying and eliminating or controlling hazards.
      So What's a hazard? A Hazard is a system state that, together with a set of worst-case conditions will lead to unsafe circumstances. For example Derailment or Collision, or Fire, and so on.
    - What railroads had traditionally done in the past was a reliance on accident investigation results. Much like the old aviation industry which was Fly-Fix-Fly (after a crash). But the stakes are much higher in today's rail environment. Since Today's rail systems are much more complex than in the past (for example they include:
        - Wayside controllers for controlling railway trackside devices that provide movement authority and enforce signaling interlocking functions OR
        - Onboard controllers to enforce train movement authority and safe speed limits, OR
        - As in Positive Train Control (PTC) Brake enforcement in the event that a locomotive engineer exceeds track speed limits.

    - Therefore, the systems-based approach to safety requires the application of technical, and managerial skills to hazard identification, hazard analysis for the elimination or control of hazards throughout the entire life of a rail systems.

RA QUESTION 3: What is the Systems of Systems level? It sounds kind of complex, almost daunting. Is it simpler than it sounds?

- **RESPONSE – Tony Zenga**
  - Bill let me ask you a question … "How do you eat an elephant? One bite at a time." Right! When I was first introduced to system safety engineering. The term that I heard often was "Safety in terms of the Big Picture" but there were no defined methodologies for analyzing safety in terms of the "Big Picture".
  - For the listeners who are not familiar with the term "system"… Think of it as: A set of things working together as parts of a mechanism or an interconnecting network, for example: Your Car is a system, An Aircraft is a system. A Train is a System.
  - Systems therefore decompose to lower level subsystems and their components
    - Most systems today are part of a system of systems even if they are not explicitly recognized as such.
    - In a system of systems, a collection of task-oriented or dedicated systems combine their resources and capabilities to create a new, more complex system which offers more functionality and performance than the sum of its parts.
    - A good example is Positive Train Control (PTC) which is a collection of independent and integrated systems to form a PTC system.
    - Operationally, a railroad acts as a system of systems during its daily operations to bring together a mix of functions for operations to meet mission objectives.
    - From an acquisition perspective, railroads have focused on independent systems. Most transportation systems were created and then evolved without explicit systems engineering at the systems of systems or Big Picture level.
    - Therefore, from a system safety perspective, considerations need to be applied by the transit authority or Railroad at the Big Picture level.

- Another example is this week's (September 25, 2020) Railway Age article regarding the R179 fleet. https://www.railwayage.com/passenger/rapid-transit/nyct-bombardier-r179-fleet-returning-to-service/
  One of the safety considerations highlighted in the article was the "Draft gear" failure where: two R179 cars on a 10-car train separated during revenue service. According to the report: "After parting, both sides of the train came to an immediate emergency stop. This means that a failure occurred at the "Draft gear" which is a subsystem level hazard. Mitigated at the system "train" level by applying emergency brakes to bring both parts of the train to an emergency stop. At the system of systems level "the big picture" the signaling system prevented trains from entering the zone where the parted train stopped thus preventing any cascading hazards.

RA QUESTION 4: Describe the holistic view of safety. If it's a universal business concept, how does it apply specifically to a railroad.

- **RESPONSE – Sonia Bot**
  - For me to answer this question, Bill… I need to start by making a couple of points… First… Railroads are complex with respect to technology and operations because they involve a wide range of personnel, organizations, and technical solutions.   Second… Safety is embedded in every aspect and function of the railroad
  - Let me give you an example… PTC, Positive Train Control, has introduced a new level of inter-dependencies across groups, segments, and components in the operation of a railroad. This means that when people make well-intentioned changes that are un-coordinated, un-planned, or incomplete… basically making changes outside of the change management process… and these include making design changes or making changes to the managed environment… there is a high likelihood of stopping a train or causing other catastrophic consequences that may not be immediately obvious at the time these well-intentioned people are making their changes. An example would be, powering on/off the chassis that hosts the Wayside Interface Unit (WIU) functionality without coordination of all those affected or even anyone knowing about it. So… somethings needs to be in place to safely manage these changes across all functions and at all levels… and to continuously monitor that safety objectives are met.
  - So, this takes us to the holistic view of safety. We must not view safety merely as a collection of parts… Instead, we need to view safety as a whole, where all of the parts are intimately interconnected by the reference to the whole… You may be thinking, how do we do this?
  - We start by defining a framework that holistically connects all the parts, in the context of safety… In the framework we have components such as business objectives, safety objectives, a safety management system, system safety, and so forth. With this we can see where various pieces fit in the greater connected whole… where people themselves fit in the big picture…   And by having greater clarity, there is a better sense of direction and ability to work more effectively and safely.

RA QUESTION 5: Given the rapid pace of technological innovation in the rail industry, you believe that system safety "needs more support in business plans," as reactive fixes to safety problems won't work anymore. How is this accomplished?

- **RESPONSE – Tony Zenga**
  - Benjamin Franklin supposedly once said, "If you fail to plan, you are planning to fail." Therefore every business plan must have "system safety" consideration or a dedicated "risk management plan" where system safety risks are identified, tracked and mitigated.

- The way it is accomplished is that Safety is designed upfront and built into all layers of hardware, software, systems, and processes (including real time operations).
- Railroads must also ensure that ecosystem stakeholders are just as dedicated by ensuring that: "system safety" is part of their business plans; Flow down of safety requirement to vendors/suppliers; and across the interfacing stakeholders to ensure nothing falls through the cracks for example interoperability.

- **RESPONSE – Sonia Bot**

- When I assess or develop business plans, I consider a number of things…
- Three that I'd like to mention today are…
    - First, Stop the bleeding… In railroading, oftentimes a solution is required immediately, on quick order, because the railroad must keep running, that is non-negotiable… and the time it takes to get the best solution in place may take too long… so we provision for an interim solution, to stop the bleeding…
    - however matters don't stop here…
    - Second, you need to provision to Permanently cure… to get a more effective, lower risk, and sustainable solution in place… which can take more time to develop, yet the business case for it is solid… oftentimes, "permanently cure" is in the business plan with good intent, yet falls off when other pressures arise…
    - unfortunately, in my experience, comprehensive business cases are not always done, whoever yells the loudest dominates, and poor business decisions are made
    - Third, and this is a new way of thinking for many people in our industry… How can we add more value, leverage beyond the immediate problem… How do we further monetize our safety-based investments and innovations… This is one of the topics on our next article and podcast in this series.

RA QUESTION 6: Final words, wrapping up the podcast

- **RESPONSE – Tony Zenga**
    - I would like to thank you Bill for giving us the opportunity to introduce the listeners to the system safety engineering discipline and look forward to constructive comments from your listeners. Safety is everyone's business!

- **RESPONSE – Sonia Bot**
    - I invite the listeners of this series to reach out to us with your thoughts … We'd love to hear from you as we evolve through system safety… and … the next generation of railroading together… These are really exciting times to be a railroader!

Contact

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