

WORKtoZERO

an **nsc** program

2020 Work to Zero Summit -- Executive Summary

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DAY 1

Work to Zero: The Future of Workplace Safety

Lorraine Martin – *President & CEO*, National Safety Council

Lorraine opened by stating that the National Safety Council (NSC) is focused on helping people live their fullest lives. After decades of progress, workplaces have become one of the safest places we spend our time, but our gains have plateaued. The fatal injury rate per 100,000 workers has remained steady at 3.1%. The most recent Bureau of Labor Statistics report in December reported the highest total worker fatalities in a decade. Impairment from drugs, alcohol and fatigue has become a serious workplace threat. Therefore, we must look for new solutions and new ways of keeping people safe on the job.

The goal of Work to Zero is to help employers identify proven ways to harness tech like artificial intelligence, data analytics, drones and virtual reality to keep workers safe. We have been living the tech revolution for years, so it is time we take advantage of tech in the interest of safety. Commercial applications of VR have helped people experience environments differently for games and entertainment and now has come around full circle to workplace. For example, NFL and college football teams use VR learning technology to boost training. The field of those who can benefit from VR training has expanded rapidly. Walmart is using VR to train over a 1 million employees. Verizon likewise is now training its retail employees to respond to potential workplace violence situations using VR.

Drones have also taken off in the last few years after the Federal Aviation Administration cleared commercial use. Popular imagination may have focused on the convenience of drone package delivery, but their application has promise across multiple industries, including agriculture, construction, facility inspection, filming and defense. Augmented reality is used throughout various industries to help workers apply their training on the spot and improve their work. NSC member Thyssenkrupp collaborated with Microsoft to leverage their HoloLens technology in order to safely install and repair elevators and other products.

Safety technology alone will not be sufficient; we need a robust workplace safety culture supporting it. We continue to work closely with NSC members and Campbell Institute companies who are at the leading edge of what it means to create a business that is successful, safe and sustainable. We have just begun to scratch the surface of what is out there. Imagine the first year when the number of workplace fatalities reported is zero, while businesses and communities thrive. We put the canary out of business

in the coal mines using technology – where are the next canaries we can retire and replace with lifesaving technologies.

The State of Safety Technology 2020: Work to Zero Research Report

Dr. Anthony Washburn – *Research Associate*, National Safety Council

Anthony began by discussing how far workplaces have come in reducing fatalities since the early 20th century. However, workplace fatality reduction has plateaued. The stagnant trend in workplace fatalities over the past 25 years and even slight increase over the past 10 years, especially compared to the decrease in workplace injuries over the same period, is cause for concern for many environmental, health and safety (EHS) professionals. Efforts to reduce workplace injuries do not seem to have the same impact on reducing workplace fatalities. The Council's Safety Technology 2020 report is intended to provide a starting point for thinking about how to use new technology to prevent fatalities in the workplace (www.nsc.org/WorktoZero).

The methodology for this study involved a two-pronged approach to serious injury and fatality prevention by identifying: 1) Workplace situations, or contextual factors, with the greatest potential for serious injuries and fatalities to occur, and 2) Relevant technologies for reducing risks within each of these hazardous workplace situations. Data for this paper came from four major sources of information: the Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI), qualitative phone interviews with 32 EHS professionals from large corporations, expert EHS technology opinion from technology research partners and an online survey of 113 EHS professionals from varying sizes and maturity levels of different organizations and industries.

Based on existing data, expert insight and feedback from environmental health and safety (EHS) professionals, NSC identified the top eighteen hazardous workplace situations (e.g., work at height) and associated situational risks (e.g., falls) that account for the greatest amount of workplace fatalities across different industries, job types and worker activities. Next, NSC highlighted the systemic contributing factors (e.g., lack of training) that sometimes exacerbate risk within those same hazardous situations. Finally, NSC identified a list of over one hundred relevant EHS technologies that could help mitigate both the situational and systemic risks. These technologies were then mapped to the risks in ways that the surveyed EHS professionals perceived to be most effective.

The top hazardous situations that accounted for the greatest number of workplace fatalities were work at height, workplace violence, and repair and maintenance tasks. The most used safety technologies were robotics (e.g., drones), sensors/detectors (e.g., radio-frequency ID sensors) and software (e.g., control of work software). The most important criteria for technology adoption included effectiveness of mitigating risks, relevance of technology to top organizational hazards/risks and ease of use for workers. Finally, some barriers for adopting technology included inability to adapt technology to specific organizational needs, potentially resistant workforce and limited knowledge of available technology and its capability.

Anthony ended his talk discussing some common technology examples such as computer vision and facial recognition software, robotics/drones, virtual reality/augmented reality (AR/VR) content, and wearable technology. Future Work to Zero studies will examine the effectiveness of specific EHS technologies at reducing serious injury and fatalities risk exposure. They will also develop best practices for new technology adoption and implementation for reducing workplace fatalities.

Artificial Intelligence & Worker Safety

Dr. John Howard – *Director, NIOSH*

Dr. Howard began his discussion of robotics and artificial intelligence by talking about decision-making agent capabilities like doing physical tasks, performing cognitive tasks, and engaging in emotional interaction and interpretation. In essence, robots can sense through interpretation of data (sensors and data inputs), robots can think with artificial intelligence, and robots can act through effectors or actuators and/or other decision outputs.

Sensor technology capabilities are expanding due to improvements in the quality, reliability, and efficiency of sensors (e.g., placeables, wearables, and implantables). Robots can now develop some sense of self-awareness with sensors like range finders, location sensors, proprioceptive sensors, and force/torque sensors. Indeed, sensors are the heart of the industrial internet of things because they are the main data input sources for the entire workplace and workforce. Data from sensor inputs can be stored on the cloud and used in real time with artificial intelligence/machine learning to support risk decision making. Of course, sensors have their challenges including precision calibration and data validation concerns.

Dr. Howard then defined artificial intelligence as goal-directed, adaptive behavior where the computer systems can learn and adapt without the aid of a human. True AI is adaptability where a program makes decisions and then learns whether they were good or bad decisions and adapts from there. Machine learning at its base is the practice of using algorithms to parse data, learn from it, and make a determination about something else in the world. More advanced neural networks try to imitate human neural connections and by learning through reinforcement of “correct” paths and avoiding “incorrect” paths.

The benefits of using robotics in the workplace are numerous. Robots are better than humans at routine tasks, better at finding patterns, better for dangerous work, better at managerial tasks (e.g., maintaining deadlines), and are cheaper to operate on a daily basis. The types of commercial robots include traditional industrial robots (humans and robots are separated from each other), collaborative robots (robots working together with humans), service robots (autonomous ground vehicles, unmanned aerial vehicles), social robots (companion and emotion-reading robots), and wearable robots (exoskeletons).

Robots can help improve worker safety by substituting in for humans having to do dangerous work but there are some potential concerns for robots moving forward. There is likely to be an increase in robot-related human injuries. In addition, rapid advances in robot and sensor technology will outpace national standards setting so international consensus standard setting will be required to stay on top of innovation.

Dr. Howard ended his talk discussing concerns about new technology replacing human workers in the workforce. Predictions about the pace of automation magnifies current innovations while taking for granted equally fundamental past innovations like steam, electricity, and internet. In addition, technology often makes incremental improvements to a worker’s productivity leading to higher quality output rather than to lower demand for their work. Human workers will have to shift into doing tasks that require higher cognitive and emotive complexity than robots or other technology can provide. The biggest shift in the workforce will be an unbinding of work from jobs with a redistribution of tasks between humans and machines, depending on who is best suited for the job.

Technology Roadmapping, Strategies & Stakeholder Engagement

Bill Pennington – *Senior Analyst, Verdantix*

Heiko Dahms – *Lead Director EH&S Operations Technology, The Dow Chemical Company*

Paul Wright – *Director Enterprise Workplace Safety, The Boeing Company*

Moderator: Caleb Wall – *Senior Partner, ERM*

Bill Pennington

Senior Analyst, Verdantix

Bill started his talk by defining a technology roadmap as a visual document that outlines an organization's technological needs, identified technologies, implementation timeline, and strategies. With constant advancement in digital EHS technologies, the value of developing a roadmap is becoming an important aspect of the EHS function. An effective technology roadmap ensures best-fit technology selection, reduces technology implementation time, and sets a future mindset for technology strategy. Sometimes people try technologies that fail and they are discouraged to utilize technology again. A roadmap might help keep this from happening.

There are four key questions to answer when developing an EHS technology roadmap. 1) How mature is the identified technology? Established/mature technologies are going to have a support network and supply chain, whereas new technologies might not. 2) What is the technology's proven value for EHS? Try to look for examples and case studies of the technology being used in an EHS-related application. 3) How valuable will the technology be in the future? There could be analogous technology that is innovating faster that might be a better solution. 4) What is the technology's current pace of innovation? There might have been a technological advance shaping this technology and it is worthwhile to discuss advanced capabilities with vendors.

Verdantix mapped 25 technologies along different trajectories based on maturity phase (research and development, launch, growth, maturity, and decline). Three trajectories based on high, medium, and low value generation of the technology were mapped based on demonstrated ROI, case studies, academic research, and vendor interviews. However, each company should determine their own value based on organizational interests.

Importantly, organizations should be sure to identify technologies that are currently working as well as identify potential new technologies. Do not just use new technology to replace older technology that is still working. When using a roadmap, keep the following in mind: 1) Identify EHS technology landscape. 2) Select technology that fits your firm's need. Does your firm desire mature technology? Does the tech need to have expected value? Do you want quickly moving/innovating tech? 3) Tailor roadmap to your organizational needs and outlook.

Heiko Dahms

Lead Director EH&S Operations Technology, The Dow Chemical Company

Heiko began by stating that organizations need to pick their problem/challenge to go after with technology and not just pursue technology for the sake of using new technology. Dow's innovation technology plans follow a structured process where they 1) identify risks and connect to potential solutions, 2) charter a project team and get started, 3) move through stages using stage gate review, 4) allow "fast fail" and closing of projects that are not achieving goals, 5) be able to connect to

organizational goals, 6) agree on funding with business and sites, and 7) have sub-functions together managing the project portfolio.

Dow organizes their approach to technology innovation in two broad ways: mastering the mind and mastering the machine. Mastering the mind refers to solutions designed to help workers make better decisions, understanding and managing impairments (e.g., fatigue), modernizing training, and adjusting work processes and procedures as needed. Mastering the machine refers to solutions designed to improve processes through technological advancement like robotics, hands-free high-pressure cleaning, drones for elevated inspection, heavy equipment sensors, mobile apps/data management/analytics, and exoskeleton and other wearables.

Heiko ended by stressing that connecting technology roadmapping and innovating to the strategic organizational goals is of vital importance as multiple functions and business units will have to work together to implement new solutions. Future considerations should also include data privacy and protection as more and more worker data is collected and use for prediction and risk reduction.

Paul Wright

Director Enterprise Workplace Safety, The Boeing Company

Paul began by talking about Boeing's Technology Fellowships which support business strategies by ensuring technical excellence in workers, technologies, processes, tools, and products. Technical Fellows are in-house experts for any set of technology and they assist in solving key technical challenges. The technical expert path at Boeing is an alternative to the traditional management career path where tech fellows can attain the same level leadership as traditional executives but focus solely on the technology and innovation side of the business.

Boeing's roadmapping strategy involves determining the actions, steps, and resources needed to take an initiative from vision to reality. The technology roadmap is a strategic and long-range plan to achieve short-term and long-term goals with specific technology development needs. The roadmap requires some speculation about technology needs and forecasting (unknown / unknowns). Boeing Environment Health and Safety has developed several technology roadmaps to identify technology gaps and emerging technologies to reduce ergonomic and workplace safety injuries and to help with meeting environmental targets. For example, Boeing has a specific roadmap for exoskeleton technology with different tracks based on exact ergonomic need (e.g., postural assistance, strength assistance, assembly assistance) and pace of innovation for relevant exoskeleton technology.

Paul ended with some key takeaways regarding the advantages of their approach to technology roadmapping. One key advantage is reaching an agreement about goals and the technologies needed to solve an EHS-related problem. The roadmapping strategy also integrates technology portfolio planning processes across business units and enables connectivity across business units, functions & product lifecycles. Finally, their technology roadmapping strategy shows how technologies interrelate within horizons and program opportunities for future work and innovation.

Q&A

What are some examples of fast failures that you have learned from?

- Paul: We had new technology that would identify workers in airplane wings that seemed very great but the cell phone and wifi signals wouldn't work. So we realized maybe we need to focus

on why people need to go in the wing in the first place. We've also come up with some new sanding solutions where you can just wash it off instead of having to use really abrasive materials and chemicals.

What are some successes?

- Heiko: We have had some great success with drones inside of confined spaces where we had to figure out how to operate it blindly. We've also had success with using acoustics for testing degradation of tanks without having to empty the chemical tanks.

What about new hazards with new technology?

- Paul: With exovests we had to wait to make sure that the collateral risks were sorted out before implementation. We will wait to be sure of what they are and then we will incorporate those into our training and standards. Technology readiness approach. Fail fast affects me, not operations.

Technology in Action Case Study Discussion

John Barker – *Vice President, Safety, Health & Environment, Parsons Corporation*

Dennis Vidmar – *Senior Safety Consultant, Exxon Mobil Corporation*

Michelle Garner-Janna – *Executive Director, Corporate Health, Safety & Environment, Cummins Inc.*

Aamer Shamim – *Director, Global Environment, Health, Safety & Security, AES Corporation*

Moderator: Mei-Li Lin, *Senior Vice President, Innovation, Solution & Partnership, DEKRA*

John Barker

Vice President, Safety, Health & Environment, Parsons Corporation

John started by discussing their 360 camera technology as an example of their integrated innovation approach at Parsons. Workers can do a walkthrough of a job site remotely and 360 camera technology deployment has become a cost-effective means to develop hazard identification models to train employees. The videos can be integrated into VR devices for more enhanced experiences. The 360 camera technology is a great example of just going out, buying equipment, plugging and playing. Parsons developed enterprise level training with these cost effective solutions.

Parsons is also using drones for aerial progress photos, videos, and photogrammetry. Drones now give project and site managers a way to access hard-to-reach or accessible-but-dangerous locations. These flying robots are ideal for assessing building envelopes, investigating a roof for damage or conducting inspections — eliminating the need for someone to scale up scaffolding, a telecommunication tower or climb across a rooftop.

Another area where Parsons is using new technology is with 3D /4D modeling. This technology is used to create building information modeling hazardous activity mapping. Subject matter experts offer input into activities/phases of work that elevate risk profiles. These activities and their locations are captured on the modeling application and the inputs become focus points during progress meetings, scheduling discussions, and site inspections. This process will ultimately lead to improved pre-task planning and a reduction in risk exposure.

Parsons has also introduced “Live streaming for safety,” which consists of live streaming multiple locations at once to get information to hazard team and reduce exposure. This technology has been

coupled with facial recognition software and machine learning to use for predictive analytics in the future. John ended with a personal thought about workers returning safely to their families. Don't get fixated on the next quick safety technology fix. Invest in your people and invest in your culture. Make sure people understand this is not a safety-led endeavor but that all employees contribute.

Dennis Vidmar

Senior Safety Consultant, Exxon Mobil Corporation

Dennis relayed how Exxon approaches technology applications at its sites. Ultimately, the front line workers will be the key to successful work and design. The challenge that Exxon wanted to solve was keeping workers safe around mobile equipment and vehicles. Powered vehicles and mobile equipment (non-roadway) killed 1,460 people (2012-2018). This implores us to do better.

The approach that Exxon took to implementing technology solutions for mobile equipment injuries focused on coupling technology to "work as done." In other words, using own professional resources to understand workforce needs and applying appropriate technology solution to meet their needs. No one knows the site better than those who actually work on the sites, especially not technology vendors. For example, you might be bringing a solution to a problem that does not exist. What are your pain points? What is work done successfully? How do we optimize when that work is successful? Exxon tries to focus on 98% of when things go right. Then work to understand the strengths of the sites, taking into account the workforce itself. This assessment is done before bringing in any technology and takes anywhere from 2-4 weeks at a site.

After the onsite assessment is done, then technology solutions are considered. Selection involves pursuing technology that can do the job and address the identified problems. In choosing between radio frequency identification (RFID) and vision-based proximity detection, Exxon ultimately chose RFID because it alleviated the constraints of visibility, could detect pedestrians in blind corners, and was durable.

Some immediate success helped to validate the RFID choice because the technology actually prevented a collision incident right away in the piloting stage. Employee behavior was also changing as a result of the technology being deployed. Workers were more aware of blind spots and pedestrians entering critical areas because of using the new technology.

Some key learnings from RFID implementation was thinking about how to handle new data like false positives and how to implement alarm control thinking because there are a lot of alarms that go off that are false positives. Data integration with other technology and management systems is also an important consideration moving forward.

Michelle Garner-Janna

Executive Director, Corporate Health, Safety & Environment, Cummins Inc.

Michelle started her talk by discussing Cummins' commitment to innovation and research and development. They have invested almost \$900 million in research and development and have an Industry 4.0 strategy centered around such technologies as advanced analytics, VR/AR, cyber-physical systems, 3D printing, and collaborative robots (cobots). Cobots, in particular, have come a long way in their capabilities and functionality. Most robots are designed to not come into interaction with humans

because they are fast-paced and have a large footprint. Cobots are specifically built to work alongside humans or in a shared workspace.

Michelle walked through an example of technology evolution that eventually ended with the use of a cobot in one of their turbo manufacturing plants. In 2008 Cummins had a workstation where you had to apply sealant to several parts of an engine which led to a lot of ergonomic issues. Initially, the sealant was dispensed with a bottle which caused issues when excess material sealed parts to fixtures. The first iteration to fix the problem was “Let’s use a cotton swab” to be more precise and reduce excessive messiness. They got more precision by using a cotton swab but it wasn’t really repeatable because there was still a human applying the sealant. The next iteration was an electronic fluid dispenser. The EFD improved quality but still required human interaction to move the dispensing unit which caused more ergonomic problems than there were previously. Finally, in 2016, Cummins looked into using a cobot to improve quality with exact sealant amounts and no ergonomic issues. The cobot has operated for years without downtime issues from clogging or leaks. Importantly, the new cobot did not remove an employee but instead moved them to a value-added job where they inspected and supervised the cobot and inspected the finished product.

Michelle discussed some important safety considerations for using cobots. The most important aspect of safety policy related to cobots is the risk assessment. Make sure you have thought of everything that could go wrong. Some common cobot safety features include speed and separation monitoring where the cobot will automatically detect proximity and detect safe speed of operation when a human is present. Another safety feature is hand guiding where you can train cobots to do given process by hand and a worker does not have to program cobot operations on a coordinate plane. Safety monitored stop is another key feature where the cobot will completely stop within 3 feet of person and slow down within 6 feet.

Michelle ended with some key cobot considerations moving forward. One is that employers should not assume cobots are inherently safe. They are not safe. It is up to us to make sure we design them so that we can ensure they are safe. Additionally, employers should educate their employees about the risks associated with cobots and about control measures for mitigating that risk.

Aamer Shamim

Director, Global Environment, Health, Safety & Security, AES Corporation

Aamer began his talk by discussing how AES is engaging in Smart Safety, using technology to reduce exposure, train workers more effectively, report hazardous conditions quickly, and better analyze incidents. AES has already used drones, machine learning, and other artificial intelligence technologies to improve worker safety. They have decreased high-risk exposure by 57,000 hours and saved over \$10 million in costs by using drones to do hydro facility inspections, wind turbine inspections, boiler inspections, and high-risk tree trimming.

AES has also partnered with academic researchers to study the effectiveness of body cameras for training and learning. They used body cams to record, monitor, and observe grounding process with 350 linemen randomly selected to either get feedback on safety and efficiency of their work, get feedback on safety plus a personalized video, or get feedback on safety and efficiency plus a personalized video. They wanted to know how having a body cam on impacts worker behavior. When you do a self-analysis after the activity how does that change? What happens when you’re watched by a trained instructor?

Prior to training, linemen showed large variation in efficiency and safety where workers received anywhere from 4 to 25 points out of 25 for safety. Post feedback safety scores increased from median of 18 to 20 with much smaller variation. There was also improvement in efficiency as well in time spent on task with a reduction in median time from 65 to 57 minutes. AES also reported a direct correlation between safer linemen and greater efficiency.

Interestingly, they were able to show that safety and efficiency are not necessarily trade-offs. Linemen who learn to operate more safely over time also become more efficient in their work. Additionally, adding personalized analytics (e.g., personalized video to augment training) may be helpful in improving efficiency rather than safety. Results in safety may come later, so patience and persistence is needed.

Q & A

What happens when employees rely on tech and then it doesn't work?

- Dennis: Employees in our workforce are resourceful in getting the work done. You have to put in time to understand how the work is happening. If they stop using tech they might have found a better way to do the work that we haven't thought of.
- Aamer: You have to pilot first and understand that not everything works. Buy-in has to be there. Because if it fails then you've spoiled the work you've done for the last few years.
- Michelle: Have to not rely on one size fits all.
- John: There are limitations dependent on location. Sometimes there are IT / governing limitations to work around.

Any long term effects of feedback?

- Aamer: We could prove statistically that workers are safer and more efficient. You have to be consistent to have lasting impact.
- Michelle: When you're working with innovative technologies you really have to learn as you go. It takes iteration after iteration to get to a successful and sustainable point.
- John: Have to establish proof of concept and that the tech does what it says it's going to do. We tend to develop our own resources.
- Dennis: We were primarily using RFID in PPE but now we're iterating because there is technology to have proximity sensors and gas monitors and lone-worker technologies that can be integrated at once. There are multiple solutions out there. It's about having a solution set to match facility need.

What are some unexpected benefits or consequences that you learned?

- John: We've gotten exposed to other technology from other departments where applications to safety were a second thought not the primary reason for implementing tech.
- Dennis: I got to bring home the VR set because Exxon lets employees bring home and test out equipment which gets a lot of buy-in.
- Michelle: Employees can come with an idea, work with an engineer, print the device and work with it almost in real time, which helps to spur new ideas and conversations and employee engagement.
- Aamer: We weren't expecting to get better on efficiency side with our study.

Any technology focused on human side?

- John: We piloted fatigue and distraction technology where employees have to complete cognitive assessments on their mobile phone. After a baseline is established, they can monitor for deviations from that baseline and alert supervisors to have conversations with workers.

EHS in the Changing World of Work

Julie Mason Vecchio – *VP, Corporate SH&E, AECOM*

Anthony Militello – *Director, Occupational Safety & Health, U.S. Navy*

Jim Dorris – *Advisor, Bedford Funds, LP*

Moderator: Dr. Travis Kruse, *Senior Director, Safety, Strategy & Solutions, Grainger*

What is the biggest challenge for the future of EHS given technology advances?

- Anthony: Adaptability of technology to specific organizational needs is a big challenge. We're trying to take the technology that we have and invest in our civilian workforce to make them tech savvy. We don't want technology to get ahead of the workforce that we want to use it. We have a human capital strategy to invest in training workers.
- Julie: The issue of data quality is a big concern and that is only going to increase. When we introduce new technology, we also introduce new risk. When we ask people to make observations on their phone, are they doing that in a safe way?
- Jim: I put them in two buckets. One is that there is always a chance of over-reliance on the tech. And the younger workforce does not know what working is like without technology augmenting their reality. We are going to require new literacies in the future.
- Travis: How we hire and recruit needs to change as well.

How does industry 4.0 impact how we do our jobs?

- Julie: Shiny rock syndrome. We don't want to just pursue technology because it's there. I'm trying to be the devil's advocate in a sense to figure out what the proper course of action is to take with technology. Be selective up front and really understand the problem you're trying to solve.

Anthony, you mentioned data ocean, touch on the unintended disconnects.

- Anthony: We have a thirst and hunger for data but do we have the competency and fluency to understand what to do with that data? We are changing from being just practitioners to data scientists. We may have technology that substitutes what the workforce looks like but manpower is still going to be needed.

This is an area where you really need to stay on your game. Jim, you mentioned that this is an area where you need to be a constant researcher.

- Jim: All of this technology is converging and we have to be particularly mindful of that. I think ultimately the methodologies won't change that much. The tech will change but the format and the way that we go about it won't drastically change. Some of the tried and true methodologies will continue.

How do you factor technology into operational controls? How are advances in automation considered?

- Jim: Take the hierarchy of controls, AR/VR is a form of administrative control. Automation is a form of substitution.

What have you seen changing in your organizations that you think will be a big piece of the puzzle moving forward?

- Julie: Enterprise change management is a big piece. It allowed us to leverage across the globe and across the discipline to know what are the activities that are happening and where are the gaps.
- Jim: There are some quickly shape-shifting technologies. Rate of adoption is a big piece of the puzzle. Video vision will be a key to the future of the field. Using computers to detect threats in real time.

What priorities need to shift as we move to the new frontier?

- Jim: There will be a new set of literacies that we need to refine. There will be a lot of uncertainty and vulnerability that will still need to figure out.
- Anthony: Investment in the individuals themselves. The competencies they have and that they bring organically and naturally. Different subsets of the population bring different competencies.
- Jim: The idea of reputation of brands for organizations. People are coming into the workforce with what they value (environment, treatment of workforce, etc.) and that is influencing which companies new employees are looking for.

Audience Q & A

How do you balance the process aspect of new technology? Can it really take 4-5 years?

- Julie: If it really takes 4-5 years then you probably need to do something else. We need to make sure that we are always innovating and always exploring what you can do with new analytics and data. I won't pursue new systems at the cost of what we already have that's working.

How can we better overlay safety quality, ethics, and productivity data to find needle movers that improve all?

- Travis: There is a big movement toward enterprise wide data to make strategic decisions across the organization.
- Julie: We have integrated quality into our processes even though a lot of safety professionals are not quality people they can ask the quality questions and include those in our project safety reviews. That way we get the data from that and we can weight appropriately with our safety data.

Work to Zero Initiative Strategic Plan

Emily Whitcomb – *Work to Zero Director*, National Safety Council

Emily discussed the overall strategic plan for the Work to Zero initiative. The initiative is centered around three pillars: research, education, and partnerships. Work to Zero will conduct research on the most effective technologies in reducing potential for serious injuries and fatalities and best practices for integrating technologies into the workplace. They will release education materials to increase the adoption of technology for reducing serious injuries and fatalities using NSC resources for implementation among target audiences. And the initiative will foster key partnerships with stakeholders in the field to increase NSC's visibility, credibility, and resources for Work to Zero.

DAY 2

Closing Keynote

Pablos Holman – *Technology Futurist*

Pablos provided a new perspective on problem solving using technology in new ways. Innovation and advancement takes place with out-of-the-box thinking. “Nobody’s ever invented a new technology by reading the directions.” We can attack difficult problems the way that hackers attack computer software protocols. Find the weak link in the protocol or life cycle chain and attack it. Then we can use algorithms to predict where to spend our efforts. For example, Pablos helped invent a tube to put in the water that lowers the surface temperature of the ocean and reduce size of hurricanes. He also assisted with inventing a new nuclear reactor powered by nuclear waste. We can power the world for 1,000 years with spent nuclear fuel without having to mine more uranium.

Out of the box thinking is needed to get out of the rut of common manufacturing and operational processes that stifle innovation. For example, 23% of global fresh water production is used for making clothes. Manufacturing processes are setup so that innovation is very hard to implement along the supply chain. However, iteration and innovation are normal. We don’t have to be smart. We don’t have to guess a year in advance what the market wants. We just have to get feedback and iterate. This is how software works now. We can adapt this process to other problems. What are things that we can do to become better ancestors?

Q & A

What about reliability of technology? How can we know when new tech will be reliable and when we should buy in?

- Pablos: Safety and reliability are a result of a lot of experiments. The more iteration you can get under your belt the more reliable you’ll end up.

Can you give some insight on some of your next projects? In Africa, are there new projects?

- Pablos: Anywhere kids are dying, there is a focus there.

How can we better leverage mobile technology, 5G, etc? Because we need more reliability in the field.

- Pablos: There is a limited amount of space to use in the electromagnetic spectrum. We have to use it smarter. In 5G, we created meta-antennae. We have antennae that can aim a spotlight at a user and follow them around compared to just splattering signal everywhere. That’s how you scale up the capacity of these networks. Building offline modes has less potential. It’s better to put energy into running a network than investing in non-mobile tech.