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The Official Magazine of the North American Society for Trenchless Technology



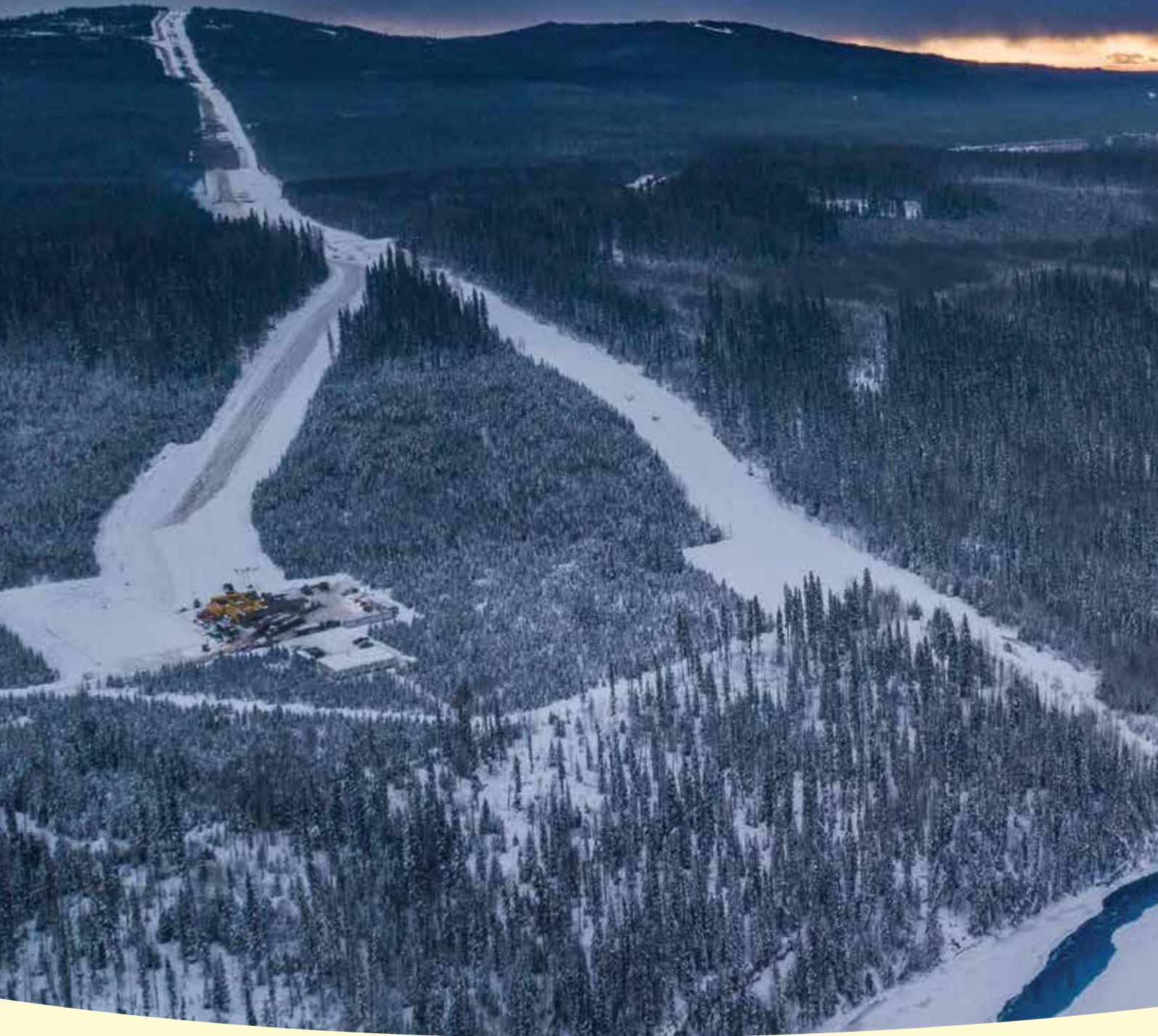
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WINTER 2021
Volume 11 • Issue 1

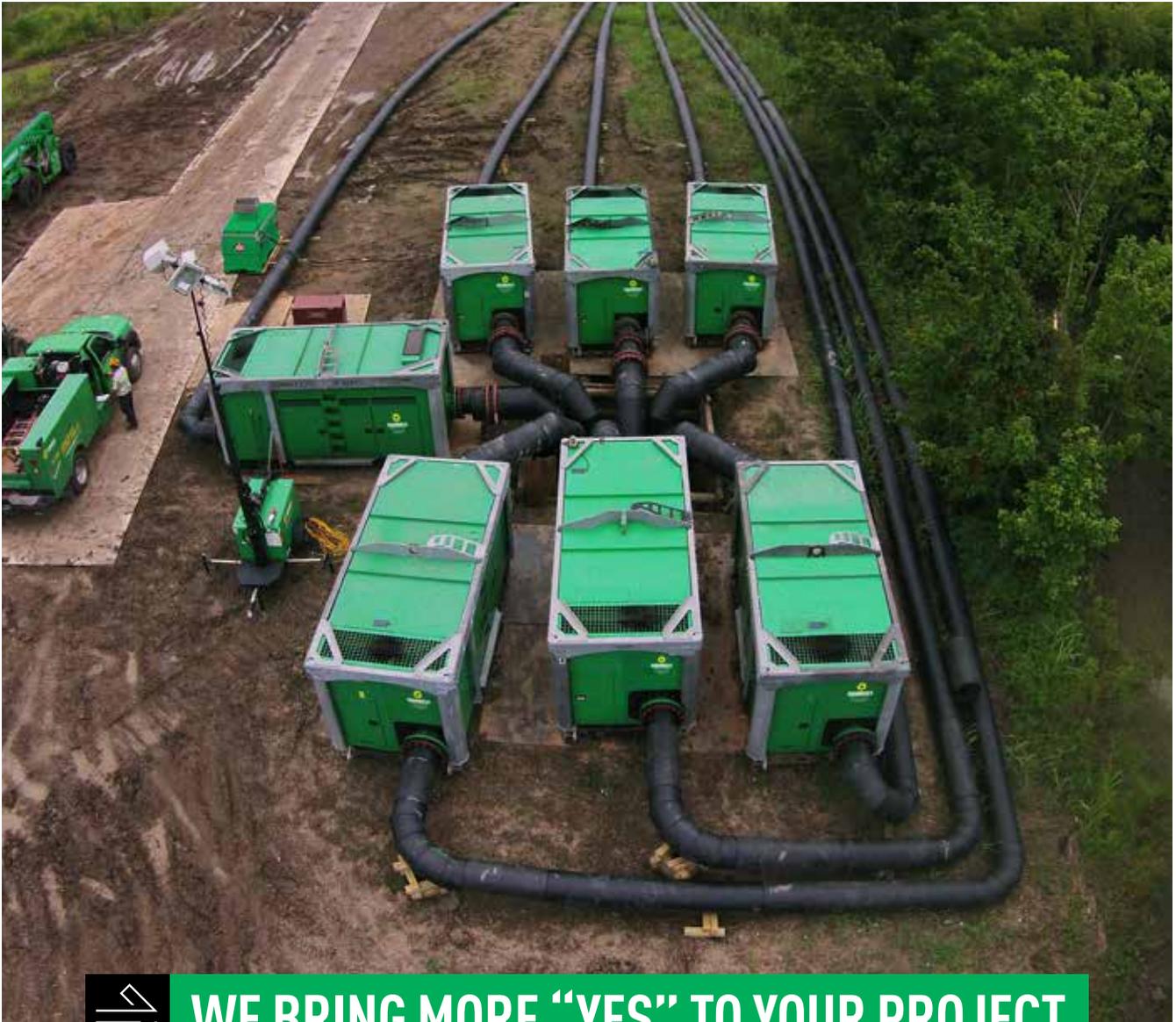
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The Official Magazine of the North American Society for Trenchless Technology

WINTER 2021 – VOLUME 11, ISSUE No. 1

NASTT 2021 NO-DIG SHOW

Returning to sunny Orlando for the first time since 2014, the NASTT No-Dig Show is a premier educational opportunity for forward-looking underground infrastructure professionals, with 6 tracks of 160 presentations, over 120 trade exhibits, and multiple networking opportunities. For the first time, an On-Demand option is available!

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A legacy of trenchless technology leadership, innovation and success. The NASTT Hall of Fame honors members who have made outstanding accomplishments and exceptional contributions to the advancement of the North American trenchless industry. A salute to the 28 Hall of Fame inductees.

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Awarded Runner-up for Most Outstanding Paper – Rehabilitation at the 2019 NASTT No-Dig Show in Chicago, this paper compares ROV and manned Inspections of 100 MGD, 3,600-foot-long, 6-foot horseshoe-shaped raw water transmission tunnel built in 1927.

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Chris Sivesind – Territory Sales Manager, Akkerman
Andrew (Drew) Sparks – Director of Engineering, Integrated Trenchless Engineering, (Laney Group, Inc.)
Jim Williams, P.E., PMP – Senior Associate, Brierley Associates

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The North American Society for Trenchless Technology (NASTT) is pleased to announce the appointment of A To B Publishing Inc. as new publishers of our highly regarded NASTT membership magazine, now in its 11th year of continuous publication.

Formerly *NASTT'S Trenchless Today*, our updated magazine will be titled *Trenchless North America* moving forwards, reflecting the NASTT mission and guiding purpose. Truly, we are all about Trenchless Technology in North America, our complete focus and dedication!

Published three times annually, *Trenchless North America* will continue to focus on the trenchless professionals working at the forefront of our industry. The people whose work demonstrates better, "greener", and more responsible ways to manage North America's underground infrastructure.

Because it reaches decision makers, important stakeholders, officials for underground infrastructure and the trenchless technology industry community, advertisements in our unique and innovative publication highlight your company. Advertising in *Trenchless North America* helps us promote your industry, associating your name with our education and awareness program as we invest back into the future people and markets for trenchless technology, developing develop the usage of trenchless technology applications to benefit the members of our industry and wider society.

Please consider pledging a portion of your marketing dollar to advertise in *Trenchless North America*. Our publication demonstrates the cost savings, social and environmental benefits of utilizing trenchless technology as the preferred method for installation and maintenance of underground infrastructure across the United States, Canada and Mexico.

Thank you for your support,

Matthew Izzard

Matthew Izzard, Executive Director

North American Society for Trenchless Technology (NASTT)

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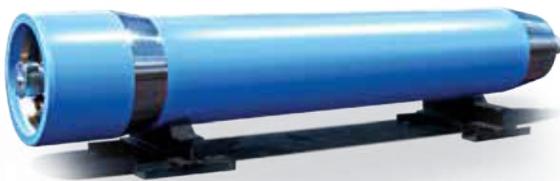


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Message from the Chair

GROWTH and RECOVERY in the NEW YEAR



This year I begin my term as Chair of NASTT's Board of Directors, and I am looking forward to seeing the continued progress and expansion of NASTT and the trenchless industry. 2020 was a year that truly was unprecedented! We've seen challenges with communication and physical meetings due to the global pandemic; however the perseverance of our membership, sponsors, and trenchless community have

enabled this society to rise above the circumstances and set our future for success. Due to unparalleled creativity and sheer effort, we will continue to experience growth and recovery as we work toward our common goals in 2021.

We are in the final days of planning the NASTT 2021 No-Dig Show being held in Orlando at the end of the month. There are currently more than 100 registered exhibitors that will be on site and ready to display their innovative trenchless products and services. Joining us in person may look a bit different as we work to ensure your health and safety, while still bringing you the value you expect from the No-Dig Show. We will ensure the proper health protocols are in place to provide a safe environment. Having attended two conferences over the last 30 days I am assured that the best efforts are being made to protect attendees at No-Dig 2021. We are also offering an On-Demand option for attendees that are unable to be onsite in Orlando. Visit the conference website at nodigshow.com and explore the pages in this magazine for more information on all the ways you can virtually participate in the 2021 No-Dig Show.

I'd like to thank our 2021 Conference Chair Dr. John Matthews of the Trenchless Technology Center at Louisiana Tech University and Vice Chair John Milligan of Vermeer for volunteering their time and expertise to help us make this show an exceptional event.

NASTT exists because of our dedicated volunteers and the 2021 Board of Directors that includes many of the top people in our industry. One of our goals is to make sure our Board reflects an industry cross-section of trenchless technology experts. I'd like to introduce our newest Board

members: Stephanie Nix-Thomas, P.E., President of Claude H. Nix Construction Co.; Drew Sparks, Director of Engineering of Integrated Trenchless Engineering; and Jim Williams, P.E., PMP, Senior Associate of Brierley Associates. We know your industry knowledge and leadership capabilities will benefit our organization and the industry.

I'd like to recognize the returning Board members that have been appointed to Executive positions: Matthew Wallin of Bennett Trenchless Engineers is our Vice Chair; Tiffanie Mendez of Sunbelt is our Secretary; Greg Tippett of Stantec is our Treasurer; and Richard (Bo) Botteicher of Lithos Engineering is our Officer-at-Large.

I would also like to recognize and thank the outgoing board members who have volunteered their time and industry expertise to help run NASTT: Michael Davison of Sanexen Water Inc.; Frank Firsching of ClockSpring|NRI; Gerard P. Lundquist, P.E. of National Grid; and Michelle Macauley, P.E., LEG of Macauley Trenchless. We appreciate all your time and commitment to so many NASTT committees and to the trenchless industry. We are lucky to have you among us.

The first issue of the year is always a special one because we highlight and thank our Board members, so please turn to page 30 and read about our newest members and the returning Board that will continue their service in 2021.

We look forward to offering many creative options for trenchless training and education throughout the year including our Virtual Good Practices Courses and our virtual or in-person Regional Chapter meetings, conferences and webinars. Stay tuned as we roll out a wide range of opportunities to meet your professional needs.

Our Society is only as strong as our members and volunteers. I have gotten to see first-hand the time and sacrifice that each of you have made. Since our committees align with the strategic plan, I challenge our membership to participate in the NASTT committees. Education and the college curriculum will continue to evolve as we focus on bringing trenchless technology to every corner of North America. I thank you for your dedication and your commitment during what can only be described as one of the most challenging and unusual years of our lifetime!

Alan Goodman, Chair

North American Society for Trenchless Technology (NASTT)

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with

Dr. Jonghoon Kim

Dr. Jonghoon Kim is the founding Vice-President of the NASTT South Central Chapter, and was instrumental in the formation of two NASTT Student Chapters – at Oklahoma State University (OSU) and most recently at the University of North Florida (UNF). Dr. Kim joined the faculty at UNF in August, 2020. We caught up with him recently to get his thoughts on the current state and future opportunities for the trenchless technology industry.



What first inspired you to become interested in construction & engineering, particularly underground construction?

In 1994, Seongsu Bridge, which was only 20-years old and crossed Han River to access Seoul metropolitan center, collapsed and many Koreans were in shock. Due to this accident, 49 Koreans fell into the river, and 32 died, and 5 were injured. I lost one of my best friends. I was a high school student and just about to decide what I wanted to study in college. This disaster was the biggest motivation for me to become a good engineer in the construction/engineering field.

Outline your experience of first being introduced to trenchless technology methods and applications.

I started as a designer in an engineering firm in Phoenix, AZ in 2006. The responsibilities of my job were to design underground utilities, write-up the specs, etc. One of the ADOT projects involved installing a waterline underneath the Union Pacific Rail Road. The project manager decided to use the jack and bore method, which I had never heard of before. I thought the only way to install this pipe was the open-cut method. This trenchless method that we used was very impressive. This project was the first time that I was exposed to trenchless technology. After that, I went back to Arizona State University (ASU) to pursue a Ph.D. and my advisor, Dr. Samuel

Ariaratnam, offered me several trenchless courses to learn more about trenchless technologies. In the last 4 years, I taught a trenchless technology class at Oklahoma State University (OSU) as the assistant professor and I have a plan to teach this trenchless technology class here at the University of North Florida (UNF).

How did you first get involved with NASTT? What are some of the goals and initiatives you would like to see NASTT pursue?

As I mentioned above, my advisor, Dr. Samuel Ariaratnam at ASU, recommended that I joined the ASU-NASTT Student chapter in 2013. Since then, I have participated in several No-Dig conferences and NASTT activities. The first No-Dig Conference that I participated in was in Sacramento, CA. The conference atmosphere was phenomenal, with the energy of innovation emitting from each technical session and good interaction with people in the exhibition hall. Ever since I got involved in the ASU-NASTT, I served as the student chapter vice-president, presented my research papers, and engaged in most activities, which include the poster competition, sewer inspection, and industry engagement. After joining OSU as a faculty member, I established and served as an OSU-NASTT Student Chapter academic advisor and took the students to the conference for the last 4 years. In the meantime, I served as a vice-president

for NASTT South Central Chapter until May 2020. I became a faculty member of UNF in August 2020 and I established the UNF-NASTT Student Chapter. As of now, we have 15 undergraduate student members and I have a plan to coordinate with the trenchless industries to grow the UNF-NASTT Student Chapter in Jacksonville, FL.

What are your thoughts on the current state of the trenchless industry? What areas do you see evolving in STEM education and post-secondary academics?

Trenchless technologies are environmentally and socially friendly construction methods for utility industries. The way I look at this, the trenchless method is continuously growing and expanding in the construction industry (e.g., installation, replacement, repair and maintenance). From the academic perspective, we are still looking for cutting-edge construction technologies; however, the government grants for this kind of research in these areas are not being funded much. There is still a great opportunity to develop new applications related to trenchless technologies.

Is the trenchless industry generally doing a good job of attracting young professionals? What do you think can be done to better engage students and young professionals in the trenchless industry?

For sure, academics need support from the trenchless industry to develop course materials, financing assistance, etc., to expose this technology to students. The current college programs are questioning why this trenchless technology class needs to be in the student curriculum. Therefore, I feel offering the trenchless technology course as an elective class, the students would take more interest in underground construction or trenchless technology. Based on my academic experiences, many students have not been exposed to trenchless technologies during their internships or classroom education. For this reason, I think we have to offer younger generations exposure to this modern trenchless technology.

Biggest challenges facing the trenchless industry today? Has acceptance and understanding of trenchless technology improved?

Failing to locate existing infrastructure before repairing or installing new infrastructure causes a

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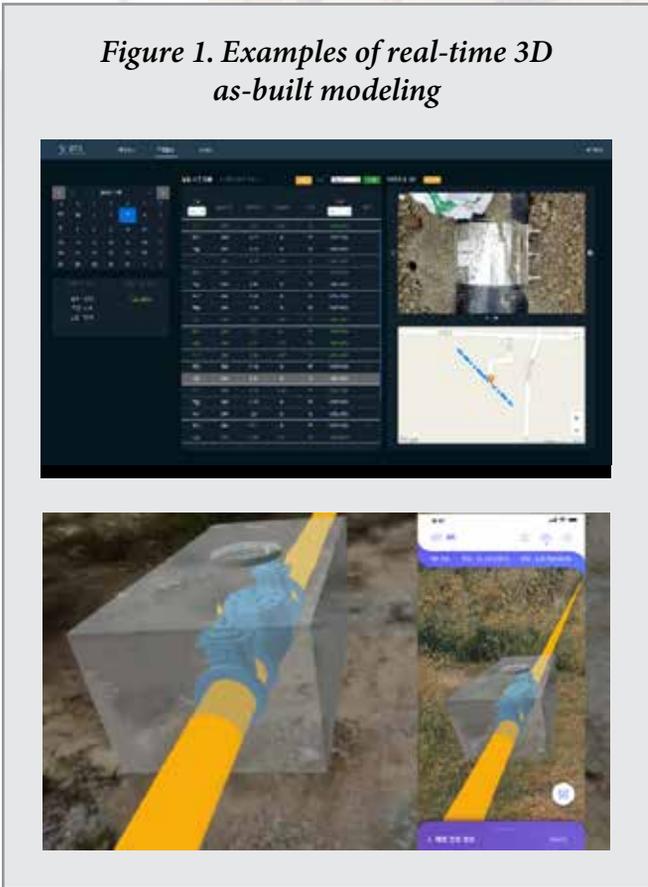
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high possibility of construction accidents. As we know, the high priority of construction is to minimize these risks. There are a lot of unknown obstacles, geology and geologic issues during underground construction. For these reasons, any non-invasive technologies, which include remote sensing, digital photogrammetry, radiometric, seismic refraction, spectral analysis of surface waves, etc., are the best to understand the existing underground conditions. Recently, I had a great opportunity to be involved in a real-time 3D as-built modeling project with a company named Movements (<http://www.movements.kr>) in Korea. We monitored and kept the records of the real-time pipe installation (open-cut) in 3D as-built models using AI, GIS, and AR to enhance project efficiency, productivity and accuracy during the construction phase. Figure 1 shows an example of the project. I am willing to endorse the use of these 3D modeling-technologies for future trenchless projects.

What do you personally enjoy most about working in the trenchless technology field?

I have enjoyed and I enjoy working in the trenchless industry because new methods are continuing to be innovated and developed. This nature of the industry is an excellent example of interdisciplinary engineering. It keeps me fresh and excited. I can see that the trenchless industry keeps growing. 🇺🇸

Figure 1. Examples of real-time 3D as-built modeling



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Positioned for Growth



Mohawk Valley Water Authority Steps Boldly into the Future

By Eric G. Schuler P.E.



Mohawk Valley Water Authority (MVWA) has not historically been the most “trenchless-focused” organization. That’s what attracted me to coming on-board as the Director of Engineering.

MVWA is a regional water authority founded by New York State in 1996 and is currently headquartered in Utica NY. It was formed out of a necessity to consolidate 18 Municipalities and their public water systems spanning 2 counties, under a singular umbrella of management and operation. Over 700 miles of pipe exist throughout the system, including mains as old as 1848 that are still in service. Over 25 percent of MVWA underground infrastructure is greater than 100 years old; 36 percent in the 50-100 year range. Being in the Northeast, the change in seasons is not always kind to pipes of advanced age. Freeze-thaw cycles wreak havoc on older mains and highlight the problem areas throughout the distribution system.

From an outsider’s perspective, I saw a lot of potential for implementation of various trenchless evaluation and rehabilitation methods. MVWA has a history of utilizing HDD or Jack-&-Bore when practicable for new installations (i.e. crossing a railroad, interstate,

canal, etc.). But when it comes to evaluation and rehabilitation of existing infrastructure...I saw a clean slate.

MVWA already has a handful of engineers that have been involved in the trenchless world for some time through NASTT memberships, conference attendance, demo participation, and management of new installations as discussed above. The primary focus for the organization’s capital funding over the last decade or so was primarily increasing covered storage, pumping, and treatment capabilities. There has been interest in moving the organization to an evaluation and rehabilitation mindset for some time now, but it wasn’t there on the priority list yet.

A small “pilot” project was established in 2020 to implement a Spray-in-Place pipe (SIPP) rehabilitation in a residential neighborhood in Utica. It isn’t a huge-dollar high-footage project, but it will allow us to implement a specific application in the aged distribution system. Currently we are working through NYS Department of Health approval for the selected material before moving into the bidding phase. Best case scenario we get this pilot done by early fall 2021.

Regardless of how successful this specific pilot is, we will be conducting additional pilots following right after utilizing different materials and application methods. We all know any one "trenchless" approach isn't a one-size-fits-all solutions, so we are aiming to have experience with as many tools in the tool belt as possible. Organizational familiarity with varying rehabilitation methods will help staff plan for appropriate implementation scenarios over the next decade.

Aside from rehabilitation, we have also begun engaging companies specializing in pipeline condition assessment. MVWA has both raw and finished water transmission mains ranging from 70-100 years old that are in need of evaluation. Knowing of potential problem areas before a catastrophic failure occurs will be critical in managing these key assets into the future. MVWA is positioned for growth through service expansion to additional

communities and construction of new computer chip fabrication facilities in Marcy, NY. Increases in projected water demands make the need for investing wisely in existing and new infrastructure critical so water can keep flowing to the tap. We are looking forward to the use of innovative trenchless evaluation and rehabilitation techniques that will move us into the future.



Eric Schuler is the Director of Engineering for the MVWA, a public water authority serving 18 municipalities in Central New York. Eric is Vice Chair of the Northeast Regional Chapter of NASTT (NASTT-NE).

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Hello Trenchless Colleagues!

We are excited to get back to in person events and are hopeful for the future! Last year was challenging for us all, yet 2021 will provide new opportunities and ways to expand the trenchless industry.

We bet that you are looking for solutions to your infrastructure challenges. And we know that you will find solutions at the NASTT 2021 No-Dig Show! Our conference presents premier technical presentations featuring the latest technology and research, innovative trenchless product and service exhibits and unmatched networking opportunities for the trenchless industry. You will not want to miss your chance to expand your knowledge toolbox when we reconvene in Orlando, Florida, March 28—31.

The No-Dig Show technical program features a wide selection of topics covered in six tracks over the course of three days. Included in the session schedule are three forums in which audience participation is encouraged. We're bringing back the Innovative Products Forum with a format that showcases innovative product releases in the trenchless industry. Companies presenting products in this session are this year's Abbott Innovative Products & Services Award finalists.

This conference isn't just technical sessions, there are many networking opportunities, as well. Check the conference schedule in this preview for more information and be sure to download the NASTT No-Dig Show Smart Phone App! The app is a great way to get involved with the attendee community. Everything you need to make the most of your time at the Show will be right at your fingertips.

Things might look a little different at the 2021 conference as we adhere to safety and health guidelines and pivot to evolve with changing times, but rest assured that the technical expertise and innovation you expect from the NASTT No-Dig Show will be at the forefront of your experience.

Welcome to Orlando!



John Matthews
2021 No-Dig
Program Chair



John Milligan
2021 No-Dig
Program Vice
Chair



The No-Dig Show is owned by the North American Society for Trenchless Technology (NASTT), a not-for-profit educational and technical society established in 1990 to promote trenchless technology for the public benefit. For more information about NASTT, visit our website at nastt.org.



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Sun Shines Again on the Trenchless Industry

NASTT 2021 NO-DIG SHOW RETURNS TO SUNNY ORLANDO!

The world's largest Trenchless Technology Show is back in action after a year's hiatus due to the Covid-19 pandemic. Returning to sunny Orlando for the first time since 2014, the 2020 No-Dig Show in Denver CO was one of the first events to be canceled due to the onset of Covid-19, and the 2021 show is one of the first in-person industry events to return as the pandemic wanes.

This is no surprise because as NASTT Executive Director Matthew Izzard observes, the "trenchless technology industry is notorious for finding solutions and for people actually wanting to get out and be proactive".

Six tracks of 160 peer-reviewed, presentations, detailing environmentally friendly trenchless solutions and cost-saving opportunities for municipalities and utilities, make the NASTT No-Dig Show a premier educational opportunity for forward-looking underground infrastructure professionals. With over 120 informative trade exhibits and multiple networking events, the NASTT No-Dig Show is the must-attend conference charting the course for the bright and sunny future immediately ahead for trenchless technology. This year for the first time an innovative On-Demand option is available after the in-person event from April 1 through June 30.

Enjoy!

No-Dig Show Events & Networking Synopsis:

SUNDAY MARCH 28, 2021

- 7:00 AM – 5:00 PM - West E/F Lobby**
Attendee & Exhibitor Registration
- 12:00 PM – 1:00 PM - W230 AB**
NASTT Chapter Chair & Vice Chair Meeting
- 1:00 PM – 2:00 PM - W230 AB**
Annual General Meeting
- 2:00 PM – 3:30 PM - W232 AC**
MASTT Chapter Board of Directors & Membership Meeting
- 3:00 PM – 4:00 PM - W232 A**
Pacific Northwest Chapter Meeting
- 3:30 PM – 5:00 PM - W232 C**
SESTT Chapter Board of Directors & Membership Meeting
- 4:00 PM – 5:30 PM - W230 AB**
NASTT Program Committee Meeting
- 5:30 PM – 7:00 PM - Sunburst Terrace**
Municipal Scholarship Reception

MONDAY MARCH 29, 2021

- 7:00 AM – 5:00 PM - West E/F Lobby**
Attendee & Exhibitor Registration
- 8:30 AM – 9:30 AM - West E/F Lobby**
Coffee Break
- 11:40 AM – 11:45 AM - West E/F Lobby**
Exhibit Hall Ribbon Cutting Ceremony
- 11:45 AM – 1:45 PM - West Hall E**
Opening Luncheon
- 11:45 AM – 3:45 PM - West Hall E**
Exhibit Hall Open
- 5:30 PM – 7:00 PM - West Hall E**
Exhibit Hall Open
- 5:30 PM – 7:00 PM - West Hall E**
NASTT 20th Annual Educational Fund Auction & Reception

TUESDAY MARCH 30, 2021

- 7:00 AM – 5:00 PM - West E/F Lobby**
Attendee & Exhibitor Registration
- 7:00 AM – 8:00 AM - West E/F Lobby**
Coffee Break
- 12:00 PM – 3:30 PM - West Hall E**
Exhibit Hall Open
- 12:00 PM – 3:30 PM - West Hall E**
NASTT Innovative Product Review
- 6:00 PM – 9:00 PM - Hyatt Orlando Garden Terrace**
Celebration Reception (ticketed event)
- 7:00 PM – 10:00 PM - West Hall F2**
Gala Awards Dinner

WEDNESDAY MARCH 31, 2021

- 7:00 AM – 1:00 PM - West E/F Lobby**
Attendee & Exhibitor Registration
- 7:00 AM – 8:00 AM - West E/F Lobby**
Coffee Break
- 10:00 AM – 1:00 PM - West Hall E**
Exhibit Hall Open
- 12:30 PM – 1:00 PM - West Hall E**
Closing Luncheon



MARCH 28-31 | ORLANDO, FL

NO-DIG SHOW

2021

FORUMS

MONDAY, MARCH 29

3:45 PM - 4:35 PM - W230 AB

Service & Lateral Rehabilitation Forum

MA-T3-01 and MA-T3-02

Moderator:

John Matthews

Trenchless Technology Center

This forum will provide a discussion on service & lateral rehabilitation driven by audience participation.

TUESDAY, MARCH 30

8:00 AM - 8:50 AM - W230 AB

CIPP Forum

TM1-T3-01 and TM1-T3-02

Moderator:

Cindy Preuss, Aegion

This forum will provide a discussion of CIPP driven by audience participation.

10:20 AM - 12:00 PM - W230 AB

Innovative Products Forum

TM2-T3-01 and TM2-T3-02

Moderator:

Matthew Izzard, NASTT

Join us for a showcase of innovative product releases in the trenchless industry. Companies presenting products are 2021 Abbott Innovative Product & Services Award finalists.



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*"CrowdCompass AttendeeHub"
from your app store. Then search
"The NASTT 2021 No-Dig Show"
to join the fun.*

COVID-19 Precautions and Procedures



BEFORE YOU ARRIVE

- Are you symptom free? If you feel sick, please stay home. You can refer to the [cdc.gov](https://www.cdc.gov) website for any questions on COVID-related symptoms.
- During the registration process you will be asked to acknowledge and accept our Terms and Conditions. Please review the document provided before completing your registration.
- Have your digital or print confirmation ready when you arrive – the more prepared you are, the faster entry will be.
- Please make sure you have packed a face mask; face masks will be required at all times while at the venue.
- All attendees will be required to follow safety guidelines even if you have been vaccinated for COVID-19.
- We have an Emergency Action Plan in place, including an open line of communication with local health officials.
- Before the doors open, we will conduct inspections to ensure the venue is safe, clean and ready for networking!

ARRIVING AT THE NASTT 2021 NO-DIG SHOW

- We are taking additional measures to ensure your health and safety at the NASTT2021 No-Dig Show. Please plan accordingly and allow extra time when arriving at the show and making appointments with your colleagues and prospects.
- Daily temperature screenings will be conducted upon show entry for everyone.
- Daily health self-assessments will be conducted upon show entry for everyone.
- No hugs or handshakes this year. The NASTT 2021 No-Dig Show has a no-contact policy in place.

- We will implement queue lines where 6-foot distancing is safely enforced.
- Transparent barriers on registration counters will be implemented for enhanced safety, and staff will regularly clean all equipment

INSIDE THE SHOW

- Face masks will need to be worn inside the show at all times. Please make sure you have a face mask with you.
- Please follow all recommended health and safety measures including staying at least 6 feet from one another, washing your hands often and covering your mouth when you cough or sneeze.
- We have designed the show to allow for social distancing and one-way entrances/exits.
- We will remind you to keep a safe distance from others with floor graphics and stanchions.
- We have increased staff and security to provide the best customer service and information accessibility.
- Seating areas will be properly distanced and transparent shields will be placed at all concession stands.
- Trash will be removed from the exhibit hall with greater frequency.
- Daily disinfecting will take place to sanitize all seating, restrooms and frequently touched public areas.
- Food and drink will be consumed in designated areas only.
- Feeling sick unexpectedly at the show? Medical personnel will be on site and available to help anyone feeling unwell.

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NASTT Events Calendar



NASTT is continuing to monitor the COVID-19 situation with guidance from federal, state and local governments and health officials, in determining whether to cancel or postpone scheduled in-person events. For the latest information and upcoming NASTT course offerings, visit: www.nastt.org/training/events



Since its inception in 1991, NASTT's No-Dig Show has been the premier North American conference and trade show for the trenchless technology industry. Thousands of professionals from around the globe attend to learn new methods and systems that will save money and improve infrastructure. This conference provides attendees an opportunity to learn trenchless methods, network with peers and gain knowledge from vendors during exhibit hall hours. NASTT's No-Dig Show is the ideal event for municipalities, contractors and engineers.



March 28-31, 2021
Orange County Convention Center
Orlando, Florida



April 9-13, 2022
Minneapolis Convention Center
Minneapolis, Minnesota



April 30-May 4, 2023
Oregon Convention Center
Portland, Oregon

Upcoming Conferences, Courses & Events

March 25
ISTT Webinar: Considerations of Design and Construction for Horizontal Directional Drilling
Online

March 28-31
NASTT 2021 No-Dig Show
Orlando, FL

March 29
NASTT's 20th Annual Educational Fund Auction
Orlando, FL and Online

March 30
NASTT's Celebration Reception
Orlando, FL

April 1 - June 30
NASTT No-Dig Show On-Demand Technical Sessions & Virtual Exhibit Hall
Online

September 13-14
South Central Trenchless Technology Conference
Sugar Land, TX

November 8-10
No-Dig North
Vancouver, BC

November 15-16
Northeast Regional Chapter Trenchless Technology Conference
West Point, NY

What is the cost to exhibit?

NASTT Member Rate:

\$2,300 In-line 10'X10'
\$2,500 Corner/Island 10'X10'

Non-Member Rate:

\$3,800 In-line 10'X10'
\$4,000 Corner/Island 10'X10'

Sponsorships

There are a variety of sponsorship opportunities for every price range:

- Gala Awards Dinner Event Sponsor
- Closing Luncheon Sponsor
- Mobile App Sponsorship Opportunities
- Pre-Gala Reception Sponsor

To sponsor or exhibit at any of these events, please contact NASTT:

888-993-9935

NEW THIS YEAR!

Virtual attendees will have access to all 150+ pre-recorded technical presentations and the ability to network with each other while learning more about each of our exhibitors throughout virtual exhibit showcase. Virtual attendees can register for our New Installation track, Rehabilitation track or attend the full conference.

The on-demand presentations will be available from April 1 – June 30, allowing for plenty of time to view as many presentations as you would like. CEUs will be available to all virtual attendees.

Full Conference registrants attending in person in Orlando can add on the on-demand option to view technical presentations they missed, tune in again to sessions they loved and stop by exhibit booths for more information.



EDUCATION

View all 150+ pre-recorded presentations from April 1 – June 30. At registration you can choose to attend the New Installation track, Rehabilitation track or the full conference.

NETWORK

You will have the opportunity to network with other virtual attendees and learn more about our exhibitors and sponsors while having direct access to their contact information.

SPONSOR

Sponsorships include an exclusive listing and the option to provide a featured video on the home page.

ON DEMAND REGISTRATION: <https://bit.ly/20xZrAg>





March 28 – 31, 2021
ORANGE COUNTY CONVENTION CENTER - ORLANDO, FL

THANK YOU
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APRIL 10-14 | MINNEAPOLIS, MN

NO-DIG SHOW

2022

Call for Abstracts

Submission Deadline: June 30, 2021



The North American Society for Trenchless Technology (NASTT) is now accepting abstracts for its 2022 No-Dig Show in Minneapolis, MN at the Minneapolis Convention Center on April 10-14, 2022. Prospective authors are invited to submit a 250-word abstract outlining the scope of their paper and the principal points of benefit to the trenchless industry. The abstracts must be submitted electronically at NASTT’s website by June 30, 2021: nastt.org/no-dig-show.

Abstracts from the following subject areas are of interest to the No-Dig Show Program Committee:

Potable Water and Pressure Systems

- Pipeline Inspection, Locating, and Condition Assessment
- Pipe Rehabilitation
- Pipe Bursting
- Emerging Technologies
- Case Studies

Wastewater, Storm water and Non-pressure Systems

- Advanced Pipeline Condition Assessment
- I&L and Leak Detection
- Pipeline and Laterals Rehabilitation
- Pipeline Inspection, Locating, and Condition Assessment
- Cured-in-Place Pipe Lining
- Sliplining
- Pipe Bursting
- Spray Applied Linings
- Grouting
- Manhole Rehabilitation
- Case Studies

Energy Pipeline Systems

- Pipeline Inspection, Locating, and Condition Assessment
- Aging System Rehabilitation
- New Trenchless Installation
- Standards and Regulations

Trenchless Research and Development

- University and Industry Initiatives
- Education and Training

Industry Issues

- Subsurface Utility Engineering
- Submittal Requirements and Quality Assurance/Quality Control
- Project Budgeting and Prioritization
- Funding for “Green” Technologies
- Selection Criteria for Contractors
- Social Costs and Impacts
- Carbon Footprint Reduction
- Sustainable Construction Practices
- Industry Trends, Issues and Concerns
- Differing Site Condition Claims

New Installations – Tunneling, Boring and Pipe Ramming

- New Concepts or Trenchless Equipment, Materials and Methods
- New Applications for Boring Techniques (Auger Boring and Pipe Ramming)
- Pilot Tube Boring (Tunneling)
- Case Studies

Horizontal Directional Drilling (HDD)

- New Concepts and Applications for Horizontal Directional Drilling Equipment, Materials and Methods
- Case Studies

Microtunneling

- New Concepts and Applications for Microtunneling Equipment, Materials and Methods
- Case Studies

Questions?

Please contact:

Michelle Hill

NASTT Program Director

E: mhill@nastt.org
P: 888-993-9935

For more information visit

nodigshow.com



The No-Dig Show is owned by the North American Society for

Trenchless Technology (NASTT), a not-for-profit educational and technical society established in 1990 to promote trenchless technology for the public benefit. For more information about NASTT, visit our website at nastt.org.

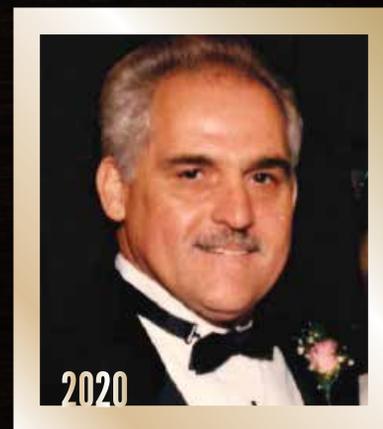
A *Legacy* of *Trenchless Technology*

The NASTT Hall of Fame honors members who have made outstanding accomplishments and exceptional contributions to the advancement of the North American trenchless industry and NASTT. We are grateful for their years of service and lasting impact on trenchless technology.

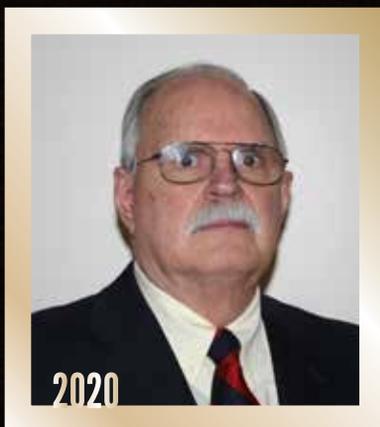
Nominees can be current or former NASTT members who have been members for a minimum of 10 years and are age 50 or older. Nominations accepted online March through August. Only current NASTT members can submit nominations. 2022 nominations are now open!

Visit www.nastt.org/no-dig-show/hall-of-fame for details.

The 2020 Hall of Fame inductees will be recognized at the 2021 No-Dig Show in Orlando FL March 28-31.



James S. Barbera (1940-2019)
Founder, Barbco



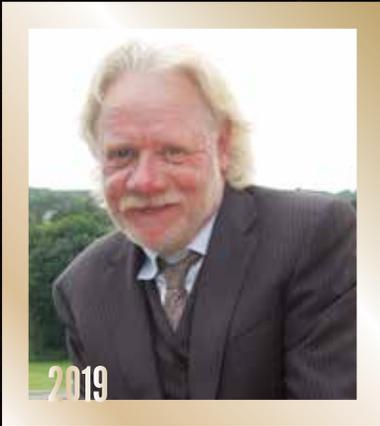
Tom Marti
*Vice President, Engineering & Technology,
Underground Solutions, Inc., (Aegion)*



Lynn Osborn
Retired, Insituform Technologies



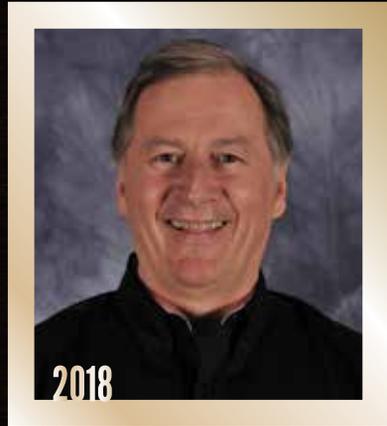
Maynard Akkerman
*President, CEO and Owner,
Akkerman, Inc.*



Chris Macey
*North American Technical Practice
Leader for Condition Assessment and
Rehabilitation of Pipelines, AECOM*



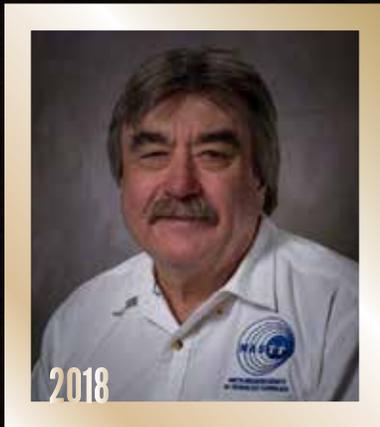
Robert Westphal (1944-2020)
*Senior Advisor of Operations,
Michels Corporation*



Chris Brahler
*President and CEO,
TT Technologies*



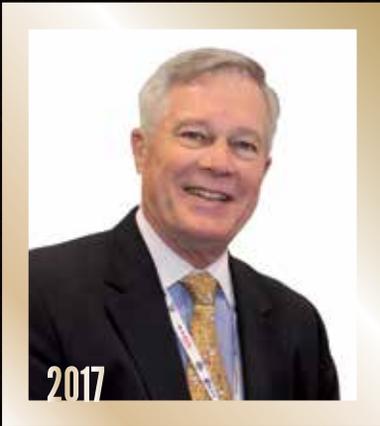
Ian J. Doherty
Founder, Trenchless Design Engineering



George Ragula
*Retired, Distribution Technology
Manager, Public Service Electric & Gas
(PSE&G), Founder, RagulaTech*



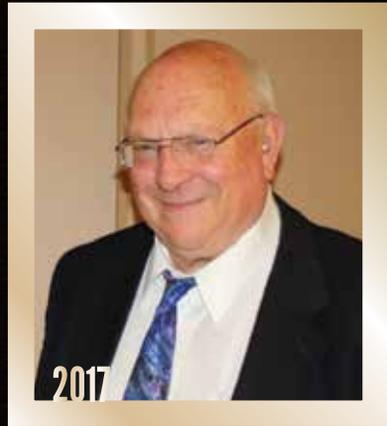
Joseph L. Abbott (1953-2010)
*National Sales Manager,
Godwin Pumps*



John Hemphill
*Former Executive Director,
ISTT and NASTT*



David T. (Tom) Iseley
*Former Director, Trenchless Technology
Center, Louisiana Tech University*



Roderick W. Sutliff (1934-2014)
Founder, R.S. Technical Services



Martin Cherrington
"Father of HDD"



Ken Foster
Trenchless Technology Consultant



Richard Thomasson
*Former Senior Associate,
ARCADIS US*



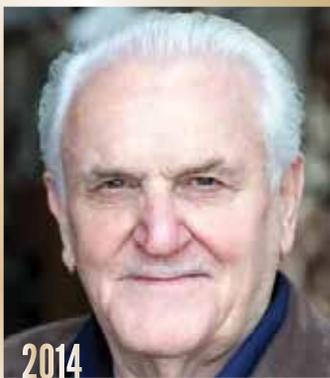
Ron Halderman (1947-2020)
Director of HDD, Mears Group



David Magill, Jr. (1943-2014)
President, Avanti International



Kaleel Rahaim
*Retired, Business Manager, Pipeline
Remediation Polymers, Thermoset Resins
Division, Interplastic Corporation*



Robert Affholder
Vice Chairman, SAK Construction



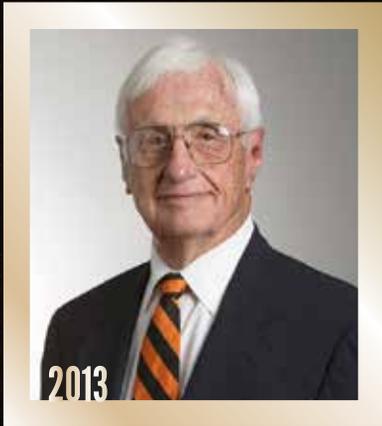
Joseph Loiacono
*Retired, Business Development,
Aqua-Pipe*



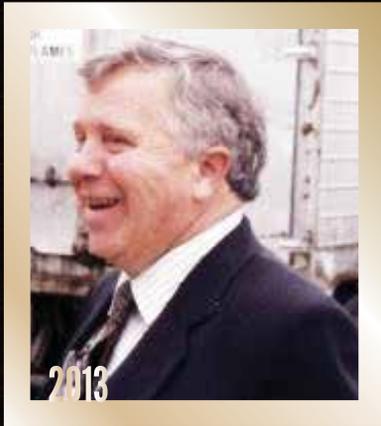
Dr. Ray Sterling
*Professor Emeritus, Louisiana Tech
University, Former Director, Trenchless
Technology Center*



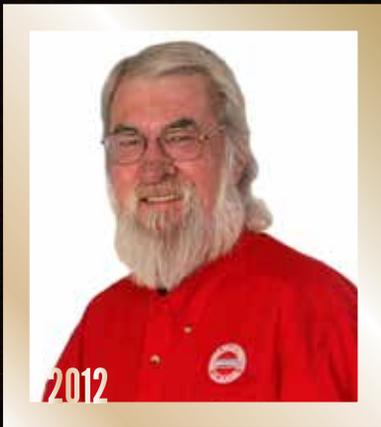
Dr. David Bennett
*Owner and President,
 Bennett Trenchless Engineers*



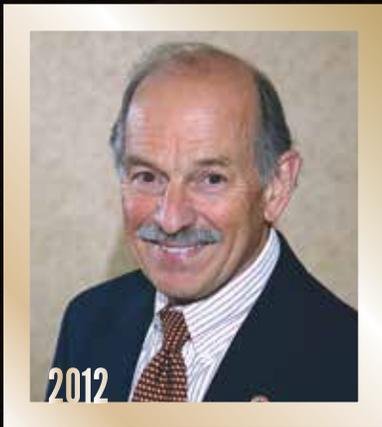
Ed Malzahn (1921-2015)
*Founder and Chairman of the Board,
 The Charles Machine Works, Inc.*



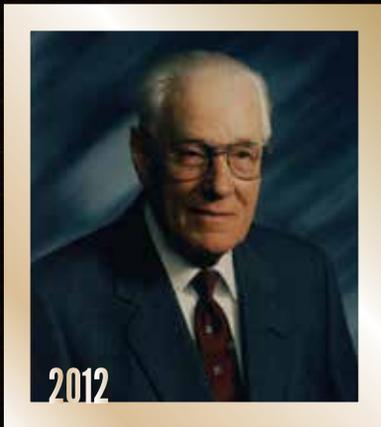
Eric Wood (1935-1994)
Co-Founder, Insituform Group Limited



Frank Canon
Sr. Acct. Rep., Halliburton



Bernie Krzys
*Founder, Benjamin Media, Inc.- Publisher
 of Trenchless Technology Magazine*



Gary Vermeer (1918-2009)
*Founder and Chairman,
 Vermeer Corporation*



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Introducing the

NASTT 2021 BOARD OF DIRECTORS



Keeping it **STEADY** *and*
FORGING AHEAD!

In the wake of a tumultuous uncertain year, the 2021 NASTT Board of Directors is poised to resume the rapid growth NASTT and the trenchless technology industry have experienced in recent years. As the organization leading and promoting the trenchless technology industry, NASTT provides the membership with educational resources, activities, national and regional conferences, networking events, webinars and much more. With creativity and hard work from both the NASTT Board and Staff, the organization has been able to maintain its position as the leading-edge organization for underground construction professionals, navigating through these challenging times.

Guiding the way are the nineteen members of the NASTT Board of Directors, generously volunteering their own time to provide overall direction for the organization. Directors are elected by the NASTT membership each year in the fall. Only elected Directors may serve as Officers of the Society and are appointed by the Board of Directors.

Ending their tenure on the Board in 2020 were Michael Davison, Frank Firsching, Gerry Lundquist and Michelle McCauley. NASTT thanks them for their outstanding contributions to the organization and looks forward to continuing to work with them in other facets of the organization.

Elected in 2020 as new Directors were: Stephanie Nix-Thomas, P.E., President, Claude H. Nix Construction Co., Andrew (Drew) Sparks, Director of Engineering, Integrated Trenchless Engineering, A Laney Group, Inc., and Jim Williams, P.E., PMP Senior Associate, Brierley Associates. Welcome these fine people to the NASTT Board!

Meet the 2021 NASTT Board of Directors on these following pages!

Executive Officers



CHAIR & INTERNATIONAL REPRESENTATIVE

Alan Goodman

*Gas Market Development Manager,
HammerHead Trenchless*

Alan Goodman has more than twenty years of experience in the underground construction industry. Alan began his career in the auger boring/ HDD industry as a sales representative and is currently employed with

HammerHead Trenchless as Market Development Manager for Oil & Gas in the United States and Canada. After learning Japanese in high school, Alan studied abroad in Japan and served as an Ambassador for the Rotary International exchange program. Alan completed his education with a B.A. in International Business from the Stephen F. Austin State University in East Texas and had the opportunity to manage the Asia/Australia business and utilize his Japanese.

During his tenure at HammerHead Trenchless, he has worked closely with municipalities, engineering firms, and contractors around the world providing customer training, technical support, pre-project planning, project specifications, and installations for pipe ramming, pipe bursting and slitting, cured-in-place pipe (CIPP) and other trenchless projects.

He is the Past Chair of NASTT's South Central chapter which includes Oklahoma and Texas. Alan also serves on the NASTT No-Dig Show Program Committee.

Alan is also an active member of the following industry associations: DCA (Distribution Contractors Association), AGA (American Gas Association), CGA (Common Ground Alliance), PLCAC (Pipe Line Contractors Association of Canada), and NUCA (National Utility Contractor's Association).



VICE CHAIR

Matthew Wallin, P.E.

*Partner & Senior Project Manager,
Bennett Trenchless Engineers*

Matthew Wallin is a Principal Partner and Senior Project Manager with Bennett Trenchless Engineers, located in Folsom, California. BTE's engineering practice is focused entirely on trenchless technology design, construction management, and claims

assistance with clients and projects located throughout California, as well as Texas, Florida, Nebraska, Iowa, and Canada.

Matthew holds both Bachelor's and Master's degrees in civil engineering from Case Western Reserve University in Cleveland, Ohio. He began his career working for URS in Oakland, California in 2000 in their geotechnical group. Since that time, Matthew has focused his practice on geotechnical engineering and the design and construction management of new pipeline projects using horizontal directional drilling, microtunneling, open-shield pipejacking, pipe ramming, tunneling and auger boring.

Matthew has been a member of NASTT since 2002 and has participated in the organization in many capacities. He has been an active member in the Western Chapter (WESTT) since 2003 and previously served as a member of the Board of Directors and as the Chapter Treasurer from 2008 to 2016. He joined the No-Dig Program Committee in 2010 and has acted as a session leader for the annual No-Dig Show since that time. Matthew is also an instructor for NASTT's HDD Good Practices Course as well as the Introduction to New Trenchless Methods Course, each of which are taught annually at the No-Dig Show and at other off-site venues throughout the year.



SECRETARY

Tiffanie Mendez

*Director of Sales, Western States,
Sunbelt Rentals*

A 23-year liquids solutions and management professional, Tiffanie began her career in the early 90s in Yuma, AZ., focusing on specialty equipment rental systems and design/build liquids handling systems.

Her early focus was groundwater

dewatering, pump and treat systems, sewer bypass systems and construction storm water runoff management. After relocating to Northern California in 2005, the design/build systems focus grew to include temporary plants for environmental remediation, low and medium voltage electrical power systems, and compressed air systems.

Tiffanie is now the Director of Sales for Sunbelt Rentals, Western States. She holds a BSBA from Northern Arizona University and an MBA, General Management from California State University, East Bay. Tiffanie has been a part of the NASTT No-Dig Show Program Committee since 2016 and believes the future of the industry lies in preparing the new leaders of the trenchless industry now. As such, she particularly passionate about the student programs and student chapters associated with NASTT.

NASTT 2021 Board Members



TREASURER

Greg Tippett, P.Eng.

Regional Delivery Lead, Western Canada Water Group, Stantec Consulting Ltd.

Greg Tippett is the Regional Delivery Lead for the Western Canada Water Group at Stantec Consulting Ltd. He is currently responsible for the group's project delivery and quality control. Greg graduated from Lakehead University in 2003 and has been working

as a consulting engineer in Edmonton, Alberta's Capital Region since. Throughout his career, Greg has specialized in the design, assessment, and construction of municipal underground infrastructure. Greg has successfully designed and implemented a number of projects within the Capital Region that included the use of several trenchless technologies. His past trenchless experience includes case bore, pipe jacking, horizontal directional drilling, microtunneling and conventional tunneling.

Greg has been an active member of the Northwest Chapter of NASTT since 2009 and is the current Chair of the Chapter's Board. In 2010, Greg joined the NASTT-NW Conference planning committee and has never looked back. Since then he has served in many different capacities on these committees, including Conference Chair for the 2016 and 2018 Conferences. In 2019, Greg was very proud to Chair the first ever national show for NASTT in Canada, No-Dig North.



OFFICER-AT-LARGE

Richard (Bo) Botteicher, P.E.

Senior Project Manager, Rehabilitation Services Market Sector, Lithos Engineering

Bo Botteicher currently serves as Senior Project Manager for the Rehabilitation Services Market Sector for Lithos Engineering. Bo brings over 20 years of experience in the underground

infrastructure industry including extensive trenchless new installation and rehabilitation projects for the water, wastewater, reclaimed water, stormwater, industrial and power markets. Bo has been involved with multiple historical projects related to horizontal directional drilling (HDD), sliplining, and pipe bursting across the US.

Bo has been involved with the North American Society for Trenchless Technologies (NASTT) since 2008. He is a past Chair and board member of the Rocky Mountain Chapter of NASTT. He has also participated on the NASTT No-Dig Show Program Committee and served as its chair in 2015. Bo is a member of the American Society of Civil Engineers (ASCE) and the American Water Works Association (AWWA) organizations.



IMMEDIATE PAST CHAIR

Craig Vandaele

General Manager of Alternative Delivery and Business Development, Michels Corporation

Craig Vandaele is the General Manager of Alternative Delivery and Business Development for Michels Tunneling a Division of Michels Corporation. Craig has more than 20 years of experience in the North American tunneling and trenchless technology industries. His vast experience includes design, inspection, construction and construction management of trenchless projects throughout North America.

Craig has a deep understanding of the complexities of trenchless projects. In his eleven years at Michels, he has served as the project manager on many significant tunneling, HDD, and cured-in-place pipe (CIPP) rehabilitation projects. Among them are the McOrmond Drive Sanitary and Storm Sewer Trunks in Saskatoon, Saskatchewan, Canada; Big Lake Offsite Gravity Portion (W14) in Edmonton, Alberta, Canada; Vancouver City Central Transmission Project, Vancouver, British Columbia, Canada; and Upper Northwest Interceptor Sections 3 & 4 in Sacramento, Calif. He has worked on projects that include conventional tunneling, microtunneling, EPBTBM, pipe jacking, pipe bursting, CIPP and shaft construction of various types and sizes.

Craig is proud to be a leader and an advocate of the trenchless technology industry. He is active in many industry organizations, including North American Society for Trenchless Technology Northwest Chapter (Past chair), Tunnel Association of Canada (TAC) and of course NASTT. Craig has co-authored papers for several No-Dig Shows.

Directors



Alan Ambler, P.E.

Owner, AM Trenchless

Edward "Alan" Ambler has 18 years of experience working on engineering projects including the World Islands in Dubai and cruise ship berth construction in Alaska. While an employee at the City of Casselberry, Florida, Alan managed the day-to-day operations of a municipal utility while developing the capital improvement program and executing projects. Alan has designed over 370,000 linear feet of pipeline projects and is a national leader in trenchless technologies, such as pipe bursting.

Alan joined NASTT in 2013 and serves as a Track Leader on the NASTT

NASTT 2021 Board Members

No-Dig Show Program Committee. Alan is the Chair of NASTT's Pipe Bursting Center of Excellence and a co-author of Pipe Bursting Good Practices Guidelines, 3rd Edition, 2019. Alan also volunteers as an instructor for NASTT's Good Practices Training Courses. Alan has a BS in Civil Engineering, a MS in Environmental Engineering, holds two patents, and is the owner of AM Trenchless LLC.

Alan loves to play guitar, cook for his wife and coach baseball for his three boys.

Over the past several years, Lisa has used her knowledge and experience to focus on Capital Improvement Projects that leverage trenchless technology to economically renew aging wastewater collection systems. She has experience with both CIPP and directional drilling methodologies. Lisa has long been a champion of trenchless technology, as it is proven to be both an effective and economical solution for improving wastewater collections systems.

Lisa holds Bachelor of Science degrees in both mathematics and civil engineering, and she is a licensed professional civil engineer in California.



Lisa Arroyo, P.E.

President, Arroyo Trenchless

Lisa Arroyo is the founder and President of Arroyo Trenchless, Inc. Prior to starting Arroyo Trenchless, Lisa was the Wastewater System Manager for the City of Santa Barbara.

During her 17-year tenure with the City of Santa Barbara, Lisa held progressively increasing roles of responsibility in the areas of engineering design, project

development, and program management. She oversaw the operation and maintenance of the City's wastewater treatment plant, collection system and laboratory. She managed a multi-million-dollar Capital Improvement Program and a \$20 million operating budget.



Dan Buonadonna, P.E.

Global Technology Leader, Jacobs's Condition Assessment and Rehabilitation Services (CARS) Practice

Dan Buonadonna is the Global Technology Leader for Jacobs's Condition Assessment and Rehabilitation Services (CARS) practice. He has over 17 years of pipeline analysis, design, and rehabilitation experience for over 1,400 miles of buried water, sewer, and industrial infrastructure.

As a junior engineer, Buonadonna began in the field, doing inspections on

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NASTT 2021 Board Members

buried pipelines. Of the man-entry pipe crawling, Buonadonna jokes, "Being of modest build, it was once said that I was 'made for the work' and found myself being 'volunteered' for many of the confined space pipe crawling tasks. It taught me a healthy respect for the practical aspects of pipeline condition assessment, and also a great appreciation for the technical innovations that could improve the accuracy and safety of our work."

As a consulting engineer, his focus has evolved to trenchless condition assessments, trenchless rehabilitation technologies, and buried infrastructure asset management. Speaking on the state of the trenchless market today, Buonadonna says the industry overall is robust and increasing demand has resulted in a healthy, competitive marketplace. One of the challenges, he notes, will be continuing to innovate and increasing the value proposition of a trenchless approach. Buonadonna says, "If elected to the NASTT board I would advocate for increased dialogue and coordination between the condition assessment and rehabilitation technology markets. These fields go hand-in-hand in providing solutions to our communities. In addition to the continued investment in new tools to break technical frontiers, I support improved education and understanding between owners, engineers, contractors and manufacturers to manage the risk exposure of all parties."

He has authored over 20 technical publications on pipeline asset management and holds a seat as an Industrial Advisory Board Member for the Trenchless Technology Center at Louisiana Tech University. Dan holds a Bachelor's degree in Civil Engineering from the University of Notre Dame, and a Master's in Environmental Engineering from the University of California, Berkeley. Buonadonna is a regular presenter at the NASTT No-Dig Show and is also a member of the Society's Pacific Northwest Chapter. He's also served on the NASTT No-Dig Show Program Committee and has participated in NASTT training and webinars. He's also active with the Trenchless Technology Center at Louisiana Tech as a member of its Industrial Advisory Board and is involved with the Water Research Foundation as part of Peer Advisory Committees.

"I feel the trenchless technology field is exceptionally dynamic and I enjoy the exercise of constantly applying critical thinking to new challenges, I appreciate the opportunity to serve a widespread need and I feel privileged to work with similarly dedicated professionals every day."



Maureen Carlin, Ph.D.

Vice President of Engineering and Preconstruction Services for the US Division, Bothar Group

Dr. Maureen Carlin is the Vice President of Engineering and Preconstruction Services for the United States (US) Division of the Bothar Group of companies. Prior to her involvement with Bothar, Dr. Carlin spent six years with Laney Group, Inc. Maureen has more than 16 years' experience in

construction engineering and project management for both vertical

commercial construction and trenchless pipeline construction. Carlin's areas of expertise are in advanced project planning and market analysis for Horizontal Directional Drilling and Direct Pipe engineering and construction projects both domestically and internationally. This includes knowledge of established markets such as oil, gas, water and power in addition to emerging markets such as desalinization, offshore cabling and wind farming and military applications.

Carlin received B.S. degrees in Civil Engineering and Architectural Engineering from the Missouri University of Science and Technology. While working on large-scale and complicated projects in Las Vegas, Nevada, she received a M.B.A from the University of Nevada-Las Vegas. Carlin went on to receive a Ph.D. Civil Engineering with an Emphasis in Construction Engineering and Management. Carlin spent extended time in mainland China developing her dissertation studying horizontal directional drilling methods in China compared to North America.



Chris Knott

Lead Trenchless Estimator, BTrenchless

With more than 26 years in civil utilities construction, Chris Knott began his career as a laborer and quickly progressed to an operator for an auger bore crew. He then advanced to supervisor, overseeing the auger bore crews, pipe ramming crews and the directional drilling operations. Chris enjoyed working with a variety of trenchless methods, and ultimately took

on project management and estimating.

Chris began working at BT Construction, Inc. in 2005 in the role of both trenchless estimator and project manager. He has been integral to the formation of their trenchless division, BTrenchless, and is currently the lead trenchless estimator, reviewing all work involving bores and tunnels. Additionally, his expertise is utilized to market BTrenchless, Inc. as the region's premier tunneling contractor, showcasing their ability to perform Pipe Ramming, Auger Boring, Pilot Tube, TBM, Microtunnels, Hand Tunneling and Slip Lining as the Director of Business Development.

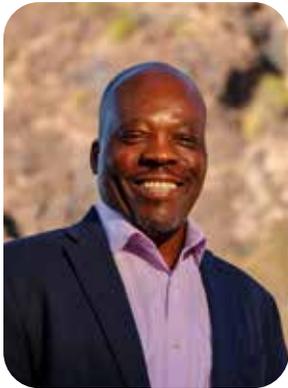
Over the years, Chris has become a valuable resource for engineers and owners alike, helping to determine the best trenchless methods in a wide array of soil conditions. He has a passion for sharing the capabilities and opportunities of trenchless construction, helping to inspire young engineers by presenting the applications of trenchless construction at annual presentations, hosted by The Colorado School of Mines (Microtunneling Short Course) and the University of Colorado-Boulder.

His natural ability to convey an aggressive but attainable game plan stems from decades of coaching lacrosse. Chris often brings the enthusiasm of a championship game to his professional endeavors, as witnessed in the organization of the inaugural Rocky Mountain NASTT No-Dig in Denver in 2010.

NASTT 2021 Board Members

Involved with RMNASTT since its inception, Chris serves on its board as an officer, helping with the local NASTT show, clay shoot, and recently contributing to the Program and Auction Committee for the NASTT No-Dig Show.

Chris continues to contribute fully to the foundation and growth of the trenchless industry and progress the NASTT membership. He generates energy and provides expertise to all his pursuits, both on and off the field or in this case, in and out of the field.



Babs Marquis, CCM

*Trenchless Practice Lead – East Coast,
McMillen Jacobs Associates*

Babs Marquis has more than 26 years' experience in underground project design and construction. He is the McMillen Jacobs Associates Trenchless Practice Lead for the East Coast, and is located in the Burlington, MA office. Previously, Babs worked for Jacobs Engineering Group for 10 years and Stone

& Webster Engineering Corporation for 11 years as a construction manager. During his extensive career in the trenchless industry, Babs has been involved in major tunneling and trenchless projects in the northeast for clients such as the Massachusetts Water Resources Authority, Boston Water & Sewer Commission, the Metropolitan District Commission (Hartford, CT), and Narragansett Bay Commission (Providence, RI), DC Clean Rivers Project, (Washington, DC), New York City Department of Design & Construction, and New York City Department of Environmental Protection.

For the past 18 years, Babs has focused on underground construction management for tunnels and conveyance pipelines, including water and wastewater pipeline design and construction projects, with an emphasis on trenchless construction methods. He has worked on various pipeline projects utilizing microtunneling with wet retrieval; pipe jacking; horizontal auger bore; and pipeline renewal methods such as pipe bursting, slip-lining as well as cured in place pipe lining. Babs was involved with the planning and design of the East Boston Branch Sewer Relief Project as part of the Boston Harbor cleanup, ordered under a Massachusetts Water Resources Authority (MWRA) consent decree. From 2009 to 2011 he was resident engineer on the project's pivotal microtunneling and pipe bursting components. In 2011, East Boston Branch Sewer Relief was named North American Society for Trenchless Technology (NASTT) Project of the Year. Babs has authored and coauthored several papers for the NASTT No-Dig Show, American Society of Civil Engineers (ASCE) Pipelines Conference, and Rapid Excavation & Tunneling Conference (RETC); and is a member of NASTT, ASCE, Underground Construction Technology (UCT), and the Construction Management Association of America (CMAA).

Babs is the current Chair for Northeast Regional Chapter of NASTT (NASTT-NE).



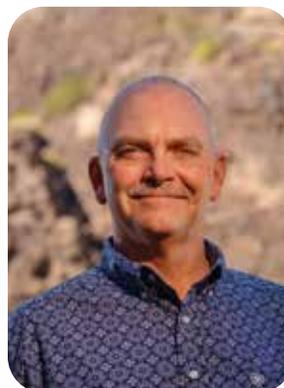
John Matthews, Ph.D.

*Director of the Trenchless Technology
Center & Associate Professor, Louisiana
Tech University*

Dr. Matthews has over 16 years of experience in the rehabilitation and inspection of infrastructure systems. He is the Director of the Trenchless Technology Center (TTC) and an Associate Professor of Civil Engineering and Construction Engineering

Technology at Louisiana Tech University. Prior to rejoining the TTC, he served as the Pipe Renewal Service Line Manager at Pure Technologies providing clients with guidance on the selection and use of trenchless rehabilitation technologies. Prior to joining Pure, he served as Battelle's Water Infrastructure Management Lead, where he led multiple water and sewer infrastructure research studies. Prior to joining Battelle, he led multiple projects at the TTC relating to the development of automated decision support systems for technology selection. He has also been involved in numerous projects relating to condition assessment technology selection and field evaluation of trenchless rehabilitation technologies.

He has given more than 150 conference presentations and authored more than 220 publications in the area of trenchless technology for which he has received two International Society for Trenchless Technology (ISTT) No-Dig Awards (2005, 2012) and a North American Society for Trenchless Technology (NASTT) Outstanding Paper Award (2015). He has been an active member of NASTT since 2003, serving on the NASTT No-Dig Program Committee and various other committees. He also serves as a NASTT Course Instructor for both the Laterals Good Practices and Intro to Trenchless Technology – Rehabilitation Good Practices Courses. He was elected to the ISTT Board of Directors in 2020. In 2013, he was awarded the NASTT Ralston Young Trenchless Achievement Award. He is also an active member of the American Society of Civil Engineers (ASCE) and American Water Works Association (AWWA) and he currently serves on the Editorial Advisory Board for Trenchless Technology Magazine. He also serves as an Associate Editor for the ASCE Journal of Pipeline Systems Engineering and Practice.



Rick Melvin

*National Product Specialist, TT
Technologies, Inc.*

Rick Melvin is a National Product Specialist for TT Technologies, Inc. He has been involved in a variety of underground construction applications for over 20 years. This includes sales and servicing of pipe ramming, horizontal directional boring machines and pipe bursting systems.

NASTT 2021 Board Members

Rick has also been heavily involved in pursuing overall growth of the trenchless technology market. He has assisted in educating engineers and contractors on the extensive benefits of various available trenchless technologies and trenchless equipment techniques.



Stephanie Nix-Thomas, P.E.

President, Claude H. Nix Construction Co.

Welcome to the Board!

Stephanie Nix-Thomas earned her degree in civil and environmental engineering with a business minor from Utah State University in 1984. She worked as a consultant engineer in Salt Lake City for seven years before moving to the State Department of Environmental Quality

where she worked in water quality as an environmental engineer. In 1992 she moved to the policy office of DEQ as a liaison with small businesses and Native American tribes.

In January 2000 Stephanie joined her family's construction business, Claude H. Nix Construction Co. Her experience in engineering and government proved to be beneficial as she and her brother, Jon Nix, purchased and took control of the business from their parents in 2002. She also found that underground construction, especially trenchless technologies, was her career of choice. It has held her attention for 20 years!

In 2004, Nix Construction completed the first pilot tube microtunneling project in the state of Utah and, in 2005, they made the decision to focus their general contracting company on trenchless methods of construction. In the same year, they won recognition from NASTT for pioneering pilot tube pipe ramming on the commuter rail project in Utah. Over the years, the company has gained expertise in not only pilot tube microtunneling, but also tunnel bore, auger bore, pipe ramming, pipe bursting and any combination of methods. They have made choosing the "right horse for the course" with respect to trenchless methods, a resource for construction projects and for assisting engineers with trenchless designs.

At the inception of the Rocky Mountain Chapter of NASTT, Nix Construction established Utah's first group of participants. Stephanie was involved from the beginning and organized one-day Training Day Conferences in Utah in 2015 and 2016. In the fall of 2016, she led the organization of the first regional chapter conference on the west side of the Rockies and has led or helped with conferences in Utah and Colorado since. She has also served as the chapter treasurer since 2016. Recently, she has volunteered on the Auction Committee for No-Dig. In addition to NASTT, Stephanie is an active member of Associated General Contractors and American Society of Civil Engineers.



Charles Pullan, P.Eng.

*Senior Project Engineer, City of Calgary
Water Resources Department*

Charles Pullan is a Senior Project Engineer with The City of Calgary's Water Resources department in Calgary, Alberta. Charles holds a Bachelor of Science degree in Civil Engineering from the University of Calgary. In his current role, Charles focuses on linear capital construction of water, sanitary, and drainage systems. Charles has been involved with various trenchless technologies, including electromagnetic inspection of PCCP water mains, HDD projects, and microtunneling installations.

Charles has been heavily involved in the Northwest Chapter of NASTT since 2014 and has been part of the organizing committee for the 2015 and 2017 Northwest Trenchless Conferences. Charles has also co-authored papers for NASTT's No-Dig conference and various Northwest Trenchless Conferences.



Chris Sivesind

Territory Sales Manager, Akkerman

Chris Sivesind is a Territory Sales Manager with Akkerman, pipe jacking and tunneling equipment manufacturer. Chris is responsible for sales in the western-most portions of the United States as well as Western Canada, Europe and Southeast Asia. Chris' career in the pipe jacking and tunneling industry has been multi-faceted. Early

on, he was regional manager for his family's pipe jacking and auger boring construction business. Following this, he worked as west coast sales representative and specialty shoring installation consultant for a trench safety rental group. Prior to Akkerman, Chris worked for another pipe jacking equipment manufacturer. He is an active participant in industry associations NASTT, ISTT and CSITT, has authored and presented several papers at their conferences and served as chair and secretary for the Pacific Northwest Chapter of NASTT. Chris received his formal education from Washington State University with a bachelor's degree in Business Administration. Go Cougs!



**Andrew
(Drew) Sparks**
*Director of Engineering,
Integrated Trenchless
Engineering, (Laney
Group, Inc.)*

**Welcome to the
Board!**

Drew Sparks is geotechnical engineer with 23 years of experience and is a registered professional engineer in 24 states. He has 16 years of experience in designing Horizontal Directional Drill and Direct Pipe® projects up to 48-inches in diameter and lengths over 13,000 feet.

Drew worked on a team of engineers to develop a design procedure for Direct Pipe® design as well as developed a proprietary software program to evaluate the hydraulic fracture and drilling fluid surface release risk for Horizontal Directional Drill crossings.

Drew received his B.S. in Civil and Environmental Engineering and a M.S. in Geotechnical Engineering from Brigham Young University. Drew currently holds the position of Secretary for the ASCE Manual of Practice Committee for Direct Pipe® and is serving as the Director of Engineering for Integrated Trenchless Engineering, Inc.



**Jim Williams,
P.E., PMP**
*Senior Associate,
Brierley Associates*

**Welcome to the
Board!**

Jim Williams' experience includes 26 years in the trenchless industry in design and project management in HDD and other trenchless projects including design/build and EPC delivery methods, allowing him to remain on the cutting edge of current technology in this niche. He has completed projects as an owner, a consulting engineer, and a contractor, resulting in a uniquely comprehensive perspective on project execution in the areas of water, wastewater, gas distribution, and other conveyance needs.

Jim has a BS in Environmental / Civil Engineering from the University of Florida and is the current Chair of the South Central Regional Chapter of NASTT.

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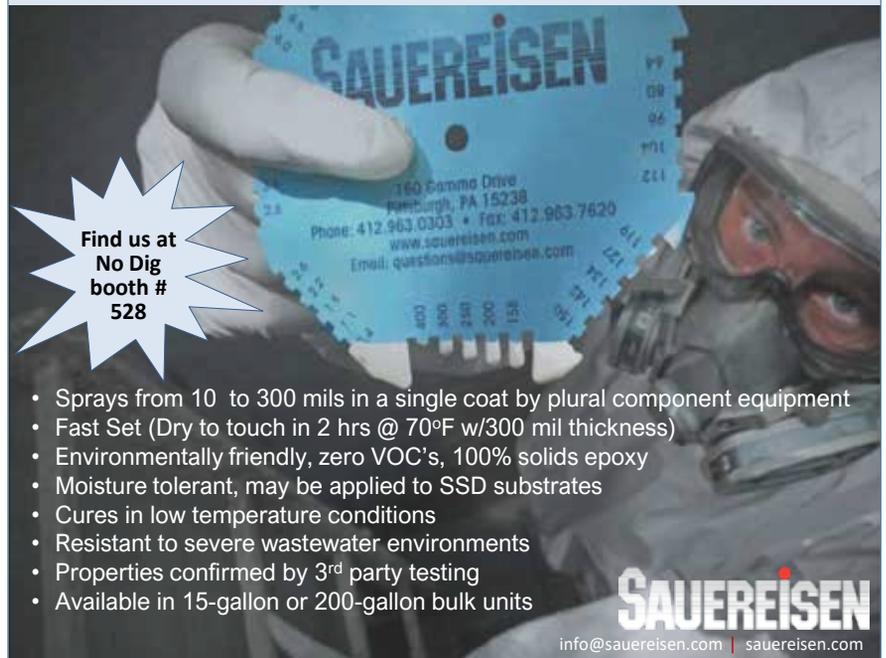


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Insituform Hires Cindy Preuss for Sr. Business Development Manager Role



Insituform Technologies, an affiliate of Aegion Corporation, the world's largest cured-in-place pipe (CIPP) provider in underground pipeline rehabilitation, announced that Cindy Preuss, P.E. has joined the

company as Senior Business Development Manager for the Northern California and Pacific Northwest Regions.

Cindy brings more than 21 years of professional engineering experience working in the design consulting industry, where she was an important driving force for evaluating, designing, and promoting trenchless technologies for myriad pipeline projects in the West. Formerly Principal/Vice-President and Associate of HydroScience Engineers and Harris & Associates, respectively, her reputation in the industry is both impressive and significant, and Insituform is fortunate to have her aboard.

Hailing from the University of California at Berkeley, Cindy is well known both nationally and regionally through her recent service on the NASTT Board of Directors, the WESTT Board of Directors, the Northern California Pipe Users Group (PUG), and through her current service as an instructor for the NASTT Trenchless Good Practices Courses offered nationally. She is a strong asset to both the trenchless industry and the Insituform team.

Cindy will be responsible for handling business development in the Northern California and Pacific Northwest Regions, in addition to participating in R&D and strategic planning in the pressure pipe rehabilitation arena. She can be reached at cpreuss@aegion.com or at (925) 408-3815.



Ted Flaxman (right) with (from left) Rolf Bielecki, Dec Downey and Dr. Tohyama (Photo courtesy of Dec Downey)

Remembering Ted Flaxman, ISTT Chairman Emeritus & Founder (1928-2020)

It is with regret, but much fondness, that we remember the life and contribution of ISTT Chairman Emeritus Ted Flaxman who died December 8, 2020, aged 92.

Ted (EW) Flaxman, Fellow of the Institution of Civil Engineers, had a distinguished career with Binnie and Partners (now Black and Veatch). As Past President of the Institution of Public Health Engineers (IPHE), he chaired the organizing committee of the IPHE Conference "Trenchless Construction for Utilities," the 1st No-Dig Event in 1985. In his concluding address, he proposed a series of international trenchless events, the formation of the International Society for Trenchless Technology (ISTT), an industry journal, and an annual prize for innovation. With customary vigor, he made all of these promises happen, and ISTT was established in 1986.

Ted served as its Chairman from 1986-2003 and as a Guarantor until 2016. In 1988 he was elected as a Fellow of the Royal Academy of Engineers. He received the Kurose Award in 1993 and the UKSTT's Lifetime Achievement Award in 2014. Ted was Master of the Worshipful Company of Water Conservators in 1996 and with Ted Jackson he published a "Sweet and Wholesome Water-five centuries of the history of water bearers in London."

A much accomplished leader, visionary and friend who did much to encourage generations of trenchless technologists, he had a keen wit and joked that his epitaph should be 'Ted Flaxman fled taxman!'

Respectfully,
Dec Downey

HammerHead Trenchless Appoints Jeff Gabrielse as Managing Director



Hammerhead Trenchless has announced that Jeff Gabrielse has been named Managing Director, assuming leadership of the HammerHead brand within the newly formed Rehabilitation and Replacement (“R&R”) division of The Toro Company. Gabrielse will be overseeing the HammerHead

R&R business, continuing its focus on delivering innovative trenchless equipment and solutions for the water, wastewater and gas markets.

“The rehabilitation and replacement of underground utility infrastructure is so important in the life cycle of the pipe,” said Angie Drake, Vice President Construction, of the Toro Company. “Jeff’s skills, knowledge and experience in the underground construction industry make him a perfect fit to drive the future growth of the HammerHead R&R business for The Toro Company family of brands.”

Gabrielse has a proven track record of success in leadership positions within the Charles Machine Works (CMW) having most recently served as Director, Customer Services for Subsite Electronics and HammerHead Trenchless. In this role, he managed all customer support, product support, training, applications specialists and professional services. Gabrielse began his career with HammerHead in 2008 as a regional sales manager. In 2017, Gabrielse transferred to CMW’s then-owned MTI Equipment to be the sales and purchasing manager and was subsequently promoted to General Manager prior to the sale of that business in 2019, after which he rejoined the HammerHead leadership team.

“This is an exciting time for HammerHead and I’m honored to have the opportunity to lead the organization,” said Gabrielse. “HammerHead is uniquely positioned to serve the growing need to address deteriorating underground utility infrastructure through its combination of rehabilitation and replacement product offerings. I am excited about Hammerhead’s position in the market and the opportunities we have to continue to deliver an innovative suite of trenchless equipment and solutions while also being a trusted partner to our valued customers.”



Answering the Call for Pandemic Protection

PPM Site Services Branches Into First Call PPE & TestHere.com

An industry-leading contractor for the renewal of gas distribution pipelines using the patented Starline CIPL lining technology, NASTT member Progressive Pipeline Management (PPM) works in challenging situations including highways, bridges, railroad lines, canals and environmentally sensitive areas on behalf of public utility clients.

Parallel to this pipeline renewal work, sister company PPM Site Services offers environmental cleanup remediation and response services for natural disasters, hazardous materials spills, and cleaning AMTRAK tunnels and stations. In March 2020, the company experienced a surge of requests for decontamination services related to COVID-19.

Today, PPM Site Services has contracts with large clients from Boston to Florida to clean and decontaminate buildings, vehicles, offices, warehouses and public facilities.

With over 400 employees and contractors cleaning in contaminated zones, or at the frontlines on trenchless pipeline projects, PPM quickly developed its own innovative and far-reaching PPE program. First Call PPE was formed in May 2020, and began to meet the heavy demand for COVID-19 PPE for First Responders and construction workers. Focusing on USA-made PPE, First Call supplies customers on industrial sites and gas utilities with high quality products such as Kimberly-Clark NIOSH-certified N95 masks rated for non-medical use, and BIOGLOVE, a hand and surface antimicrobial defense spray.

In December 2020 PPM formed TestHere.com with an effective web-based model for safe, convenient and efficient drive-through test sites. These portable sites can provide quick turnaround rapid antigen or antibody testing, and same-day-or-next PCR tests for employees of various small, medium and large businesses.

We keep construction sites safe, and our workers healthy and working! Beating COVID-19 is 100% about managing the virus with good and safe working practices. For more information visit www.firstcallppe.com.

Primus Line Announces John Moody as Director of Sales for USA and Canada



In his five years with Primus Line John Moody has been instrumental in establishing Primus Line trenchless technology in the

U.S. marketplace. He has been able to build strong customer relationships, attract new partners, and focus operators and utilities on the benefits of the product.

For John Moody, the biggest challenge facing the Canadian and U.S. markets is the shift from gravity lines to pressure pipes: "The failure rate in the pressure pipe segment with ductile iron and cast iron along with the challenges associated with asbestos cement pipe is increasing exponentially. Expertise and awareness is growing, but the transition from gravity piping to pressure piping is significant. This is where the 20 years of experience we have with Primus Line is critical." That is why he sees it as his

job to educate pipe owners about the real advantages and disadvantages of the various rehabilitation methods in each individual case. "Not just making a sale but building trust with the owner is the ultimate goal."

Among other projects, John Moody was involved in the Fort Lauderdale drinking water emergency bypass kit and the rehabilitation of 18,000 feet of a 6 inch wastewater line at the Houston Oil Refinery. The latter project involved Primus Line's longest pull-in in one piece in the U.S. to date (4,500 feet).

John Moody has been a salesman or project manager in the construction industry for over 25 years in areas including highway, water, stormwater and sewer. He has now spent the last ten years heavily involved in sales of pipe lining, spiral pipe and CIPP for pressure pipe. In his new role, he will guide the market growth efforts and client sales of the Primus Line Inc. in the U.S. and Canada. Together with his team of four Area Sales Managers, he will continue to promote the trenchless technology and provide excellent technical solutions using the Primus Line® system. John Moody is sure: "2021 is going to be our best year yet!"



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Department of Energy Announces REPAIR Program for Natural Gas Pipeline Retrofitting Projects

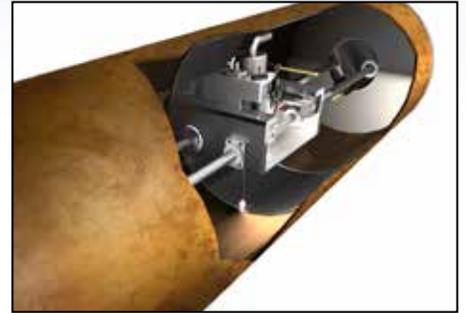
The U.S. Department of Energy is funding 10 projects as part of the Advanced Research Projects Agency-Energy's (ARPA-E) Rapid Encapsulation of Pipelines Avoiding Intensive Replacement (REPAIR) program. REPAIR teams will develop natural gas distribution pipeline retrofitting technology to rehabilitate existing cast iron and bare steel pipes by creating new, robust pipes inside of old ones.

The selected REPAIR teams are developing smart coatings, robotic systems to line the

inside of pipes, inspection tools to verify the integrity of the deposited coating, and mapping tools to enable 3D renderings of pipes and adjacent underground infrastructure. Technologies developed through these projects are intended to extend the life of rehabilitated pipes by a minimum of 50 years and ensure they have sufficient material properties to operate without reliance on the exterior pipe, all while meeting utility and regulatory requirements for use in natural gas distribution pipes.

Legacy pipes are still in use today and make up roughly 3 per cent of distribution pipes in use.

These legacy pipes account for a disproportionate number of leaks compared to modern pipe materials. REPAIR teams are developing technologies to address



deficiencies while also working toward a 10-to-20-times cost reduction compared to excavation/replacement pipeline rehabilitation projects.

For more information, contact Dr. Jack Lewnard, Program Director
jack.lewnard@hq.doe.gov

(Read the upcoming 2021 issue of the NASTT-NE Trenchless for Gas Infrastructure, published in May, for a progress update on the ARPA-E REPAIR team projects.)

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Vermeer Corporation Acquires Electric-Powered HDD

Vermeer Corporation announced today it has acquired electric-powered horizontal directional drilling (HDD) and fluid systems technology from Normag.

Through this acquisition, Vermeer assumes the rights to develop, manufacture and distribute the proven fully electric HDD rigs, generator sets and fluid management systems, which are currently operating across Europe under the Normag brand.

As a world leader in the HDD and fluid management industry, this acquisition is a key part of the Vermeer strategy to meet growing demand for electric-powered worksite solutions.

The Normag electric HDD technology offers a unique integrated electric power system that optimizes efficiency across the generator set, drill rig and fluid management systems during operations. When connected to the electric grid, the system can operate as a fuel-free system.

All systems have also been designed to match standard international shipping container dimensions to reduce the machine footprint, jobsite set-up time, complexity and cost. "With this technology already proven in operations across Europe, our Vermeer team can now fast-track an electric HDD offering that helps operators better control their cost of operations and worksite impacts through reduced fuel use, near-zero emissions, limited noise and an overall smaller rig footprint," said Vermeer President and CEO Jason Andringa. "This investment critically supports our innovation and product development focus to

continually help customers optimize their worksite efficiency, while limiting environmental impact."

The Normag HDD system technology has been in development for more than eight years in the Netherlands. It was purpose-built to help companies comply with European transportation and worksite regulations and meet their goals to lower their environmental and worksite impacts.

As the products get established in Europe, the company will look to introduce them in key global markets where electric systems are desired, including North America and Australia. The intent is to bring the products to those markets within the next 24-36 months.



Sunbelt Rentals to Participate in American Rental Association's "CLEAN. SAFE. ESSENTIAL." Program

Program emphasizes safe rental operations for the COVID-19 pandemic and the future



Sunbelt Rentals, North America's premier equipment rental company, announced it is participating in the American Rental Association's (ARA) Clean. Safe. Essential. program. The program is aimed at raising awareness of the rental industry's commitment to safety best practices related to COVID-19.

"Sunbelt Rentals is committed to the safety of our customers and employees and, from the outset of the pandemic, proactively introduced new safety and operational protocols," says Katy Lovering, vice president of operational excellence at Sunbelt Rentals. "There is so much uncertainty right now and we want to help provide peace of mind in any way we can. Safeguarding our people and our customers is our number one priority."

"We are pleased that Sunbelt Rentals has committed to the Clean. Safe. Essential. program and will be displaying the logo in each branch location," says Tom Doyle, ARA vice president, program development. "There are over 3,500-member rental locations participating in this program. Through its participation, Sunbelt Rentals is demonstrating to employees and customers their priority and commitment to safety."

By joining this program, Sunbelt Rentals branch locations receive a completion certificate as Clean. Safe. Essential. compliant and will have established uniform guidelines along

with other rental companies in the industry. ARA previously reviewed Sunbelt's extensive COVID-19 related safety and operational protocols and trainings and deemed them as compliant with the ARA's Clean. Safe. Essential. program requirements.

Sunbelt Rentals will continue to work with ARA to advance the program through industry awareness and sharing of best practices.



To date, Sunbelt Rentals has already established curbside pickup of rental equipment, which will be a permanent offering, and can be requested via an online reservation or by phone. In addition,

the company is following stringent sanitizing, cleaning and handling guidelines, per the CDC, and observing social distancing and the wearing of face coverings at its branches.

We MAKE IT HAPPEN! With a passionate team of 15,000 rental experts, a growing network of over 900 locations and an extensive equipment fleet that exceeds \$10 billion, Sunbelt Rentals helps professionals and do-it-yourselfers get things done. With a highly diversified offering of equipment, solutions and services available, we assist customers throughout North America extend their capabilities, complete projects on-time and handle times of crisis. No matter if you are in commercial, industrial, residential, or municipal industries, we are constantly advancing the idea of what an equipment company can do for its customers.

Customers are encouraged to reserve equipment online at www.sunbeltrentals.com

Trenchless Pipe Replacement: A Constant Evolution



The world of trenchless technology is constantly and forever changing and evolving. From milling and felt liners to pipe bursting, manufacturers and contractors are continuously developing new and better ways to replace pipe while it's still in place. Though the technique has been used for years, Sprayed in place pipe replacement (SIPP) is gaining more traction in the residential and commercial market of the United States.

Recently a manufacturer based in Huntington Beach California has developed a new technology that utilizes air to distribute the sprayed resin. IPP Solutions is an industry leader in research and development, and wanted to give their customers a reliable piece of equipment that was built and supported in the United States. This would reduce long wait times for resin and replacement parts. The team at IPP Solutions worked tirelessly on research and development to build compact air-driven equipment and spray head that have proven to be very effective.

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Barbco, Inc. promotes Thomas W. Schmidt to Vice President, Business Development

Barbco, Inc, a world class manufacturer of capital equipment for the trenchless excavation, horizontal directional drilling, and



underground manufacturing industries is pleased to announce, Thomas W. Schmidt, has been promoted into the newly created position of Vice President, Business Development. Mr. Schmidt is a

manufacturing veteran with many years of leadership in numerous local plants including Harrison Paint, Heinemann Saw Company, and Georgia Pacific. While reporting directly to the Owners, he will lead the charge to world domination of the capital equipment market for the trenchless excavation and underground manufacturing industries.

Mr. Schmidt is a long time Canton, Ohio resident with a B.A. from Kent State University (Summa Cum Laude), a M.B.A. from the University of Akron (Cum Laude), holds APICS certification, and is a Leadership Stark County graduate. He is also a passionate local business advocate and dedicated community volunteer. Currently, he is the Treasurer for the National Sales and Marketing Executives, Akron Canton Board of Directors. He has recently been elected as Vice President of

the newly formed Stark County Manufacturer's Workforce Development Partnership. Moreover, he serves on the Governor's blue ribbon Manufacturing Extension Partnership Progressive Roundtable in the state of Ohio.

Last fall, Mr. Schmidt was 'knighted' as a Squire of Hope by the St. Baldrick's Foundation recognizing his long history in raising

both awareness and money in the Fight Against Childhood Cancer! Finally, by Mayoral Proclamation, May 10th is officially "Tom Schmidt Day" in Massillon, Ohio in recognition of his decades of community service and charitable activities to make his community a great place to live, work, and play. He resides in Canton, Ohio and is married with two sons and two granddaughters.



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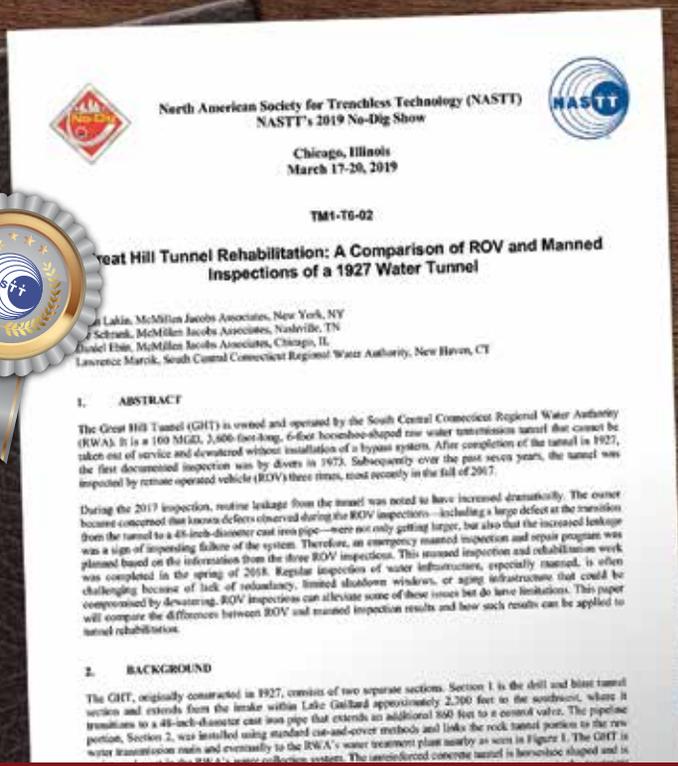
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GREAT HILL TUNNEL REHABILITATION: A Comparison of ROV and Manned Inspections of a 1927 Water Tunnel

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ABSTRACT

The Great Hill Tunnel (GHT) is owned and operated by the South Central Connecticut Regional Water Authority (RWA). It is a 100 MGD, 3,600-foot-long, 6-foot horseshoe-shaped raw water transmission tunnel that cannot be taken out of service and dewatered without installation of a bypass system. After completion of the tunnel in 1927, the first documented inspection was by divers in 1973. Subsequently over the past seven years, the tunnel was inspected by remote operated vehicle (ROV) three times, most recently in the fall of 2017.

During the 2017 inspection, routine leakage from the tunnel was noted to have increased dramatically. The owner became concerned that known defects observed during the ROV inspections—including a large defect at the transition from the tunnel to a 48-inch-diameter cast iron pipe—were not only getting larger, but also that the increased leakage was a sign of impending failure of the system. Therefore, an emergency manned inspection and repair program was planned based on

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the information from the three ROV inspections. This manned inspection and rehabilitation work was completed in the spring of 2018. Regular inspection of water infrastructure, especially manned, is often challenging because of lack of redundancy, limited shutdown windows, or aging infrastructure that could be compromised by dewatering.

ROV inspections can alleviate some of these issues but do have limitations. This paper will compare the differences between ROV and manned inspection results and how such results can be applied to tunnel rehabilitation.

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BACKGROUND

The GHT, originally constructed in 1927, consists of two separate sections. Section 1 is the drill and blast tunnel section and extends from the intake within Lake Gaillard approximately 2,700 feet to the southwest, where it transitions to a 48-inch-diameter cast iron pipe that extends an additional 860 feet to a control valve. The pipeline portion, Section 2, was installed using standard cut-and-cover methods and links the rock tunnel portion to the raw water transmission main and eventually to the RWA's water treatment plant nearby as seen in Figure 1. The GHT is an integral asset in the RWA's water collection system. The unreinforced concrete tunnel is horseshoe shaped and is the last link in a series of connected reservoirs and tunnels that convey raw water from remote areas to the treatment plant. The tunnel could only be accessed through the Intake Gate House within Lake Gaillard prior to this project. The original contract drawings for the tunnel show that a downstream access shaft was installed, but the condition of the access shaft and the

watertight cover were unknown as the portal was buried beneath a quarry access road. Therefore, until the tunnel was depressurized, and the shaft uncovered, the functionality of this access point was unknown.

The GHT, operationally, is the sole conveyance of raw water between the reservoir and the water treatment plant, making routine manned inspection and maintenance nearly impossible.

Available outage times are measured in hours at off-peak demand times, so putting personnel into the tunnel to inspect on a regular basis is not an option for the RWA.

GEOLOGIC SETTING

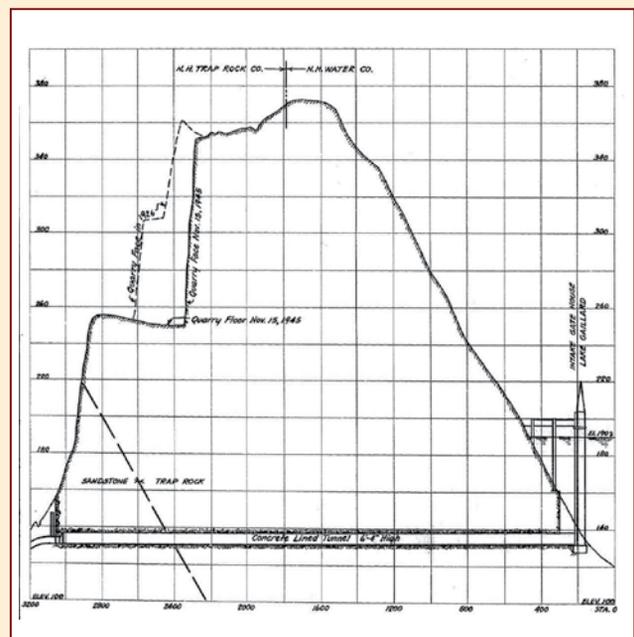
The project area is located in the central lowlands of Connecticut within the Gaillard graben (down-dropped bedrock block). This graben formed over 140 million years ago during regional extensional faulting along the Foxon Fault (west side) and Eastern Border Fault (east side). As the graben dropped, sediments eroded off the bordering

metamorphic highlands and were deposited as sedimentary strata within the graben. Concurrently, thick, tabular basalt flows periodically covered the sedimentary strata within the graben and became interbedded with these strata as the graben subsided.

Differential movement along the faults that border the graben caused the interior block and overlying sediments and flows to become rotated. The bedding in the project area dips at approximately 13 degrees to the northeast. Subsequent erosion of the highlands and graben material has removed the sedimentary rock and exposed the resistant basalt flows. These exposed flows form a northwest-southeast monocline (Totoket Mountain) that dips at approximately 12 to 13 degrees to the northeast.

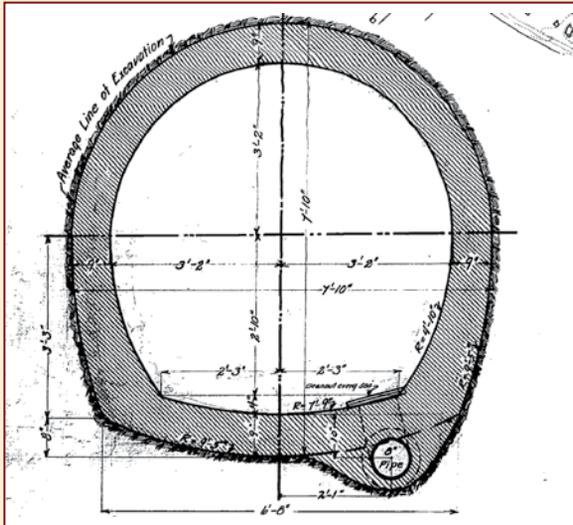
The GHT alignment is located between the inlet along the western shoreline of Lake Gaillard and the outlet portal on the west side of Totoket Mountain. The tunnel crosses beneath both Totoket Mountain and the arcuate-shaped North Branford trap rock

Figure 1. Plan and profile of the Great Hill Tunnel



Great Hill Tunnel Rehabilitation

Figure 2.
Cross Section of Tunnel



(basalt) quarry, which is located on the west side of the mountain. The tunnel alignment crosses beneath the North Branford quarry along a 200-foot-wide restricted zone that bisects the quarry. Quarry excavation within this restricted zone is maintained at no lower than El. +211 feet to provide adequate cover (approximately 70 feet) and mitigate the impacts of blasting on the tunnel. The tunnel was excavated through the trap rock and sandstone in a 7-foot 10-inch wide by 7-foot 10-inch high horseshoe shape, as seen in Figure 2. As shown in the figure, there is a minimum 9-inch-thick plain concrete final lining that results in finished inside dimensions of 6 feet 4 inches wide by 6 feet 4 inches high. Based on geologic mapping, the GHT penetrates the Holyoke Basalt (trap rock) from the Intake Gate House to approximately Sta. 24+30, and the underlying Shuttle Meadow Formation (sandstone) west of Sta. 24+30.

The Holyoke Basalt, which overlies the Shuttle Meadow Formation, consists of at least two thick flows of massive, finely crystalline basalt that directly underlie the majority of Totoket Mountain, including the North Branford quarry. This lower Jurassic-age basalt is at least 350

feet thick in the project area, is generally fresh to slightly altered, and the originally near vertical columnar joints now dip at approximately 13 degrees to the southwest. The Shuttle Meadow Formation is exposed along the western edge of Totoket Mountain and underlies the lowlands in the vicinity of State Route 80. This lower Jurassic-age unit consists of interbedded sandstone (arkose), siltstone, shale, and conglomerate. The thickness of each of the sedimentary layers is generally less than 3 feet but ranges up to about 20 feet in the project area for shale layers.

The contact between the Holyoke Basalt and Shuttle Meadow Formation is baked (hardened), welded together from the heat of the overlying basalt flow, and occurs at around Sta. 24+30 in the tunnel. No weathering is present on the upper contact of the Shuttle Meadow Formation where it underlies the Holyoke Basalt in the project area.

GROUNDWATER CONDITIONS

Based on available groundwater information, the Holyoke Basalt and Shuttle Meadow Formation are considered to be poor aquifers. The interbedded siltstone and shale of the Shuttle Meadow Formation most likely act as aquitards within this unit, restricting vertical groundwater flow. Additionally, the contact between the Shuttle Meadow Formation and the overlying Holyoke Basalt is tight and relatively impermeable. Artesian groundwater pressure may be present at the contact between the gently dipping, truncated sandstone beds in the Shuttle Meadow Formation and the Holyoke Basalt.

The contact between Holyoke Basalt flows observed in the quarry is distinct but not open. No water has been observed flowing

from the contacts between the two exposed basalt flows. Additionally, no holes or cavities were observed in the basalt. The contact between the basalt and the underlying Shuttle Mountain Formation is baked and tight. No permeable zones were observed along the upper and lower contact of the Holyoke Basalt (JA, 2011).

PAST INSPECTIONS AND MAINTENANCE

The GHT is the sole raw water transmission line supplying water to the RWA's nearby water treatment plant, the largest in the RWA system. This treatment plant supplies potable water to most of the 16 towns within the RWA's distribution system and, because of pressure zone configurations and existing legacy restrictions within the distribution network, only local clear-well storage is available during water treatment plant outages. In a total shutdown of the treatment plant, RWA has only a couple of hours of supply, necessitating any inspection work to be undertaken while the tunnel remains in operation. Performing inspections at low demand times, such as overnight during winter months, would allow for the facility to operate at low flows, thus enabling personnel and/or equipment to enter and function within the tunnel.

The first documented inspection of GHT was conducted in 1973 with a commercial diver (JA, 2011). Diver entry, at the time, did not follow any Occupational Safety and Health Administration (OSHA) standards. OSHA, established in 1971, did not adopt its first commercial diving safety standard until July 22, 1977 (OSHA, 2011). For the 1973 inspection, the diver entered the watered tunnel with both a tether to the surface and air bottles within the tunnel, which were moved around during the inspection on a hand truck. As the diver neared the point at which the tunnel transitions to a pipeline at approximately Sta. 29+61, the diameter of the conduit narrowed. Flow, which was still ongoing, increased in velocity, causing the air bottles and hand truck to be pulled into the pipeline, dragging the diver with it. The diver was unable to climb his way out of the

Great Hill Tunnel Rehabilitation

tunnel, so the diver's attendants obtained the aid of some of the miners at the nearby quarry and physically dragged the diver back to the surface. To aid in his rescue, the diver removed his weight belt and left it in the tunnel. He was then rushed to the submarine base in Groton, CT, for decompression treatment. The diver survived this incident, however the owner has been reluctant to repeat this method.

In 1998, the first 160 feet of the tunnel (starting at the intake building) were inspected, again by a commercial diver. This was done only to investigate what appeared to be air bubbles in the lake. It was believed that a hole in the concrete lining was allowing air to escape the tunnel and providing a means for eels to enter. This limited inspection did not find any damage to the liner.

Apart from some localized inspections of the intake chamber (the entry point into the tunnel), the next documented inspection of GHT did not happen until 2011, 38 years after the failed diver inspection. For the 2011 inspection, RWA opted to use an ROV equipped with high-definition cameras, halogen lighting, and sonar. This inspection became the baseline for the RWA, noting that the tunnel was generally in good condition. During this 2011 inspection, two main defects were identified by the ROV. The first, located in the crown at approximately Sta.23+15, did not appear to pose a risk to the operation of the tunnel. Although the liner had failed in a small area of the crown, the area was still watertight, even though the void was the full thickness of the lining. The defect was estimated to be about 2.5 feet wide and 3 feet long. Just upstream of the transition point at approximately Sta. 29+61, however, a large liner defect was identified, measured, and monitored for leakage, see Figure 4a. The defect in the lining was estimated to be approximately 6 inches wide and 8 inches long with a larger cavity behind the lining. This cavity was estimated, based on sonar measurements, to be a minimum of 1.6 feet deep, 6 feet wide, and 3 feet long. More definitive measurements could not be

obtained because the sonar array could not look further back into the void. Although the observed exfiltration was noted, the team was unable to quantify it. Through dye injection into the water stream, water was seen to flow into the defect and out of the tunnel; however, a crew stationed on the surface at a nearby suspected leakage point did not observe the dyed water.

Therefore, the team was unable to conclude that the two were linked. The inspection report recommended installing leakage monitoring because of the poor condition of the transition point. Additionally, reinspection was recommended within 10 years if leakage monitoring was installed, or within 2 years if not.



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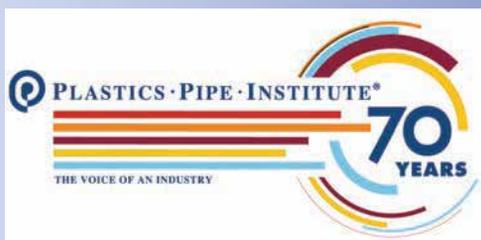
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Recent ROV Inspections

2017 Planned ROV Inspection In the spring of 2017, RWA performed a second ROV inspection of the GHT (MJA, 2017). This was both a reinspection of those portions of the tunnel that were inspected in 2011 and an inspection of the 48-inch-diameter cast iron pipeline and associated 36-inch-diameter cast iron access portal riser between the tunnel transition point and the gate house located near Forest Road. The specific purposes of the inspection were to observe, document, and assess the tunnel and pipeline conditions and, should the need for repairs be evident, to make recommendations. Information gathered during the inspection was compared to data collected during the 2011 inspection and used by the RWA to identify capital investments to ensure reliable operation and water delivery through the GHT. Because of a combination of low reservoir levels and excessive wind conditions at the time of the inspection, water quality within the tunnel was poor, with high turbidity. This made for poor visibility in the water column for the ROV throughout the course of the inspection. In addition, there appeared to be more organic material coating the interior surface of the tunnel than in the 2011 inspection, making detection of some surface anomalies difficult.

Because the various shrinkage cracks observed during the 2011 inspection were not felt to pose a risk to the integrity of the tunnel, the inspection team did not spend any significant time attempting to relocate and reinspect any of these locations during this planned 2017 inspection. The organic material coating made it extremely difficult to see the concrete lining of the tunnel directly, and any attempt to find these smooth, healed cracks would have taken significant effort and time, with little benefit. The previously identified crown defect at approximately Sta. 23+15 was found to have changed little, and it again appeared that no water was exfiltrating the tunnel at this location. This defect was again classified as a narrow and fully penetrating structural feature defect because it locally

interrupted the concrete lining but did not appear to have a cavity behind the lining nor was it considered to affect operational reliability at the time.

What was of concern to the inspection team was the apparent increase in the size of the defect at the transition point at approximately Sta. 29+61. The defect now measured 24 inches radially by 36 inches longitudinally in the liner with a large cavity behind it, measuring at least 23 inches deep by 39 inches wide (MJA, 2017). There was also concrete debris in the invert that was not previously seen in 2011. While exfiltration was observed, the inspection team was unable to quantify the exfiltration at this location. In addition to optical cameras, side scanning sonar was used to map the extent of the defect. This inspection was able to continue through the 48-inch pipeline to the gatehouse.

2017 Emergency ROV Inspection

During the fall of 2017, increased leakage, as well as a secondary leakage site, were noted at the surface above the tunnel alignment. The RWA grew concerned that the condition of the known defects had changed or that a new defect was also leaking, either of which could lead to failure of the lining. Therefore, the RWA commenced an emergency ROV inspection. Because the RWA had started to perform routine inspections with ROVs, their operations personnel and the ROV contractor were familiar with the facilities and inspection process, especially the safety and operational aspects. This greatly expedited the mobilization and completion of this new emergency ROV inspection.

The emergency ROV inspection found that the dimensions of the deflection at the transition point at Sta. 29+61 had not significantly changed since the previous inspection in the spring (SeaView, 2017). However, cracking was observed propagating from the defect, which suggested that an additional part of the liner could fail. It was unknown if this cracking was new since the last inspection or was just

now being seen because the visibility was considerably better than during the previous inspection. The ROV continued down the pipeline in an attempt to determine the source of the newly noticed secondary leakage. With the use of saline dye, the secondary leak was found in the invert of the 48-inch pipeline at approximately Sta. 30+05. It was also in this area that the 1973 diver's weight belt was found.

MANNED INSPECTION AND REPAIRS

Based on the ROV results from the 2011 inspection, the planned 2017 inspection, and the emergency 2017 inspection, RWA began procurement for the design and installation of a temporary bypass system, to allow for the continued operation of the water treatment plant while taking the GHT out of service. Separately from this procurement, RWA also procured contracts for the Design/Resident Engineering Inspection for repairs to the tunnel and construction of the necessary repairs. The temporary bypass system, designed and installed by others under a separate contract, was built to carry approximately 30–40 MGD from the reservoir to the raw water transmission line, downstream of the tunnel repair work area. It was installed, maintained and operated throughout the duration of the repair work by a contractor, hired specifically by the RWA for this piece of work.

Tunnel Repair Design

Design for the tunnel repair began on November 1, 2017 and was based on the information collected during the three previous ROV inspections as no other data was available. Because of operational restrictions from the RWA, McMillen Jacobs Associates completed the design, aided in procurement, and inspected the tunnel repairs under a hard deadline, which required that the tunnel and pipeline be reassembled and operational before May 1, 2018. This six-month timeline, in conjunction with the relatively unknown condition of the tunnel liner outside of the

few areas identified in the ROV inspections, created the need for a design that was both fair to the RWA and the contractor, but also provided a mechanism to monitor construction costs, time, and quality. The resulting design provided a series of standard repair details to be used by the contractor, based on the field determination of the specific defects identified in the tunnel, once access was available. In addition, volume estimates for the amount of grouting behind the existing liner were provided as a "worst case." All bid items were based on unit pricing. The contractor was provided an estimated quantity of work shifts that it would be responsible to cover (which included all costs for equipment and manpower on the site), while performing some of the basic, generic tasks. All other items were added to the contractor's shift rate as additional work items, to be paid in addition to the shift rate.

On November 29, 2017, the RWA and McMillen Jacobs met with two prequalified contractors with the draft design and specifications. The project was explained to both contractors, and time was provided for them to ask questions and comment on the design. Those questions and comments were then used by the design team to finalize the contract document

package. These final documents were revised and issued to the preselected construction firms on December 4, 2017. These contractors then had until December 8, 2017, four days, to prepare their cost proposals for consideration by RWA. By the following Monday, December 11, 2017, RWA had elected to enter into negotiations with one of the contractors. Once these negotiations were completed a preconstruction meeting was held on January 9, 2018. The original contractor mobilization date was set for mid-January; however, due to complications with the bypass installation work this was delayed by a few weeks.

2018 Initial Manned Inspection

The initial manned tunnel inspection of the GHT was performed on Friday, February 16, 2018, and included representatives from the contractor, McMillen Jacobs, and RWA. A rescue team provided by a subcontractor was present throughout the initial inspection and for all the in-tunnel work. The inspection team accessed the tunnel from the intake shaft, and the rescue team provided a safety attendant who remained at the bottom of the intake shaft during the tunnel inspection. The remaining four members of the rescue crew were stationed in the intake building at the surface.

The purpose of the manned inspection was to visually evaluate the stability of the liner for rehabilitation and document major defects. There were concerns about the stability of the liner at the downstream end where the major defects through the liner had been observed by the ROV, and whether some initial repairs were required before the rehabilitation program could begin. The major observations from the initial manned inspection included:

- Seepage under pressure was observed entering the tunnel through construction joints in the first 71 feet of the tunnel (section within Lake Gaillard), but no seepage was observed coming through the concrete tunnel liner between the joints. The inflow was approximated at 50 to 100 gpm.
- Holes in the liner (other than minor seeps) started appearing at Sta. 15+50. The holes went through the entire thickness of the concrete liner, so any void space and the bedrock behind the liner were visible. In one hole at Sta. 17+29, a half-barrel from a blast hole from tunnel construction was visible in the bedrock.
- The holes in the liner consistently showed void spaces between the extrados of the

Figure 3. Before and after chemical grouting on the left arch



Great Hill Tunnel Rehabilitation

liner and the bedrock. The void spaces meant that the bedrock was self-supporting and not putting weight on the liner and was interpreted as the best-case scenario.

- Some of the void space behind the liner was extensive, including some greater than 2 feet thick and extending upstream and downstream from the holes in the liner.
- Some honeycombed concrete was visible in the tunnel liner exposed by the liner defects, particularly where the largest holes in the liner occurred.
- The largest holes in the liner were at the downstream end near the transition to the pipeline. Also, at the downstream end the cracks in the liner were more open and wider than those upstream. There were also several deep concrete spalls that did not fully penetrate through the liner.
- One of the largest holes in the liner, at Sta. 23+15, was 38 inches long, 18 inches wide, and 18 inches deep with seepage into the tunnel occurring through it. Concrete debris—including one

piece 33 inches long by 11 inches wide by 7 inches thick—was observed in the tunnel invert below this hole. Another hole, at Sta. 24+90, was 4 feet long, 12 inches wide, and 19 inches deep. A piece of wood was visible behind the liner and was likely a piece of formwork from the original tunnel construction.

- At the start of the transition zone at Sta. 29+61, the largest hole in the liner was present from the 1:00 to the 3:00 position in the tunnel arch, with water flowing out of it at the base. The hole was 2 feet 3 inches wide, 4 feet 11 inches long, 9 inches deep, and penetrated through the liner. There was significant cracking of the liner adjacent to this hole with two large pieces of concrete (approximately 2 feet long by 1 foot wide) that were clearly deteriorated that appeared ready to fall out. Extensive void space and self-supporting sandstone bedrock were visible behind the liner and concrete debris was present on the tunnel invert.

Figure 4. Views of defect at transition to pipeline at Sta. 29+61 from various inspections.
Note that the red line is in approximately the same location in each image



4.a –Defect during 2011 ROV Inspection (SeaView, 2011)



4.b –Defect during 2017 Emergency ROV Inspection



4.c –Defect after dewatering and minor scaling for safety



4.d –Looking into void (downstream), approximately 10 feet deep



4.e –Defect after saw-cutting and chipping in preparation for repair



4.f –Welded wire mesh in place during shotcrete repair

Figure 5. Views of defect in crown at Sta. 23+15 from various inspections



5.a –Defect during 2011 ROV Inspection (SeaView, 2011)



5.b –Defect after dewatering



5.c –Welded wire mesh in place for shotcrete repair

2018 Initial Manned Inspection Conclusions and Recommendations

The main conclusion from the 2018 initial manned inspection was that, in general, the concrete liner was in good condition considering the age of the tunnel and the concrete technology available at the time of construction. There were some honeycombing and segregation of the concrete visible in the liner around the larger defects, which could explain why the holes occurred where they did (in the areas of poorest quality concrete); however, the majority of the tunnel had a limited number of defects. No bulging or deformation of the liner was observed, which indicated that the liner was not taking any weight from the surrounding rock mass, and the bedrock observed behind the liner was self-supporting.

For the initial inspection, four types of defects were defined. Type I defects were defined as surficial features that are minor, localized, and penetrate less than one-quarter of the liner thickness. Type II defects were non-penetrating structural features that penetrated up to half of the liner thickness. Type III defects were fully penetrating structural features that were narrow and did not compromise the structural integrity of the liner. Type IV defects

were defined as structural integrity defects that fully penetrated the liner and that may compromise the integrity of the liner.

Based on the initial inspection, the first priority after the contractor installed the required utilities in the tunnel was to scale the hole at Sta. 29+61 and install 5-foot-long epoxy resin rock bolts into the bedrock through the hole for temporary support since all of the manpower, equipment, and supplies for the tunnel rehab needed to pass through this section of the tunnel.

Once the rock bolts were installed, it was recommended that the concrete liner be carefully scaled back to sound concrete to remove any deteriorated concrete and debris, and as the liner was scaled, shotcrete and additional rock bolts were to be installed as needed as the bedrock was uncovered. The additional shotcrete and rock bolts were recommended since there was concern that the concrete across the entire crown of the tunnel at this location may have been of very poor quality and deteriorated. Once scaling began, the extent of the deteriorated concrete was found to be limited and did not even extend to the top of the crown.

Another recommendation resulting from the

initial inspection was for the heavy seepage at the construction joints in the first 71 feet of the tunnel to be injected with chemical grout. At each joint, the injections were supposed to chase the seepage around the joint and then seal them off. This was attempted with limited success and was not considered critical for the operation of the tunnel (Figure 3). Because this was not deemed critical to the continued operation of the tunnel, no other methods for sealing the joints were considered.

The other holes, defects, and major cracks were repaired in accordance with the design. The initial manned inspection allowed a general classification of the number and types of repairs to be completed, and their prioritization for the rehabilitation program. This included 54 defects ranging from Type I (surficial feature) to Type IV (structural integrity defect). This initial classification was further defined once work in the tunnel began and additional inspections could occur.

Once construction access and utilities were established within the tunnel, an additional approximately 15 defects were identified, which were generally classified initially as Type I and Type II.

Great Hill Tunnel Rehabilitation

COMPARISON OF INSPECTION FINDINGS

The main defect observed in each of the four inspections (2011 ROV inspection; 2017 ROV planned inspection; 2017 ROV emergency inspection; 2018 initial manned inspection) was at the transition to the pipeline at Sta. 29+61, as shown in Figure 4. Images from the spring 2017 planned ROV inspection are not included because of low visibility. As can be seen, the ROV images from the 2011 inspection and 2017 emergency inspection show the surficial condition of the liner when there is good visibility. With low visibility, overall condition of the defect is hard to discern. However, sidescanning sonar was used to take measurements of the defect and its change in size. Additionally, to a limited degree, the ROV was able to view into the large defect.

Similarly, Figure 5 shows views of the crown defect at Sta. 23+15 as seen during the various inspections. As shown in Figure 5(b), there was a similarly sized defect, although slightly less severe immediately upstream. Because of the poor visibility during the 2017 planned ROV inspection, it is unclear when this defect arose. Finally, Figure 6 shows images from the 2011 ROV inspection and the manned inspection of a surficial crack at Sta. 6+90. With good visibility, the defect was fully visualized with the ROV.

However, during the 2017 planned ROV inspection, the defect could not be found because of the poor visibility.

CONCLUSIONS

Facility owners, responsible for the ongoing monitoring and maintenance of our country's aging infrastructure, are faced with many difficulties. Rising costs, shrinking budgets, and increasingly stringent safety standards are just a few of the many issues that are faced when attempting to provide for reliable facilities and uninterrupted operations. As such, it is important to use the best and most cost-effective tools for each task. For inspections of tunnels, it may not always be

Figure 6. Views of defect in tunnel sidewall at Sta. 6+90 from various inspections



6.a – Defect during 2011 ROV Inspection (SeaView, 2011)



6.b – Defect after dewatering

feasible to put a team of people into a structure to perform a regular inspection. Safety requirements for divers and manned entry may introduce undesirable risks that owners are not willing to take. Operational restrictions may also play into the decision on how best to monitor critical tunnels and pipelines. The inability to remove a tunnel from operations severely restricts the possible inspection methodologies. Each of these issues may strongly suggest that an ROV inspection is the best available option. Owners and consultants must be aware, however, of the capabilities and limitations of the technology so that inspection results are understood fully. ROVs are great at seeing surficial defects. However, from the experience of this project it is apparent that what often appeared to be a small surficial defect during the ROV and initial manned inspections, which potentially could be repaired with cement mortar patching, was actually a TYPE III repair once the sawcutting and chipping commenced. While the surficial defects could be small, the surrounding concrete was often of poor quality, decomposed or honeycombed. On other occasions there was a large cavity behind the surficial concrete that was only found when sounding the concrete with a hammer, or commencing saw cutting and chipping, while trying to get to sound concrete for a necessary repair.

As technology improves and changes, so too will the capabilities of the ROV. Operators are constantly pushing for longer umbilicals to provide for greater inspection distances. As electronics continue to become smaller and more powerful, the ability to make watertight enclosures to house them will continue to improve ROV capabilities.

ROV inspections are a useful tool for programmed inspections when operational, safety, and budgetary constraints are a concern. They cannot always replace manned inspections but can be an excellent supplement that allow for inspections to be performed more regularly and on an emergency basis.

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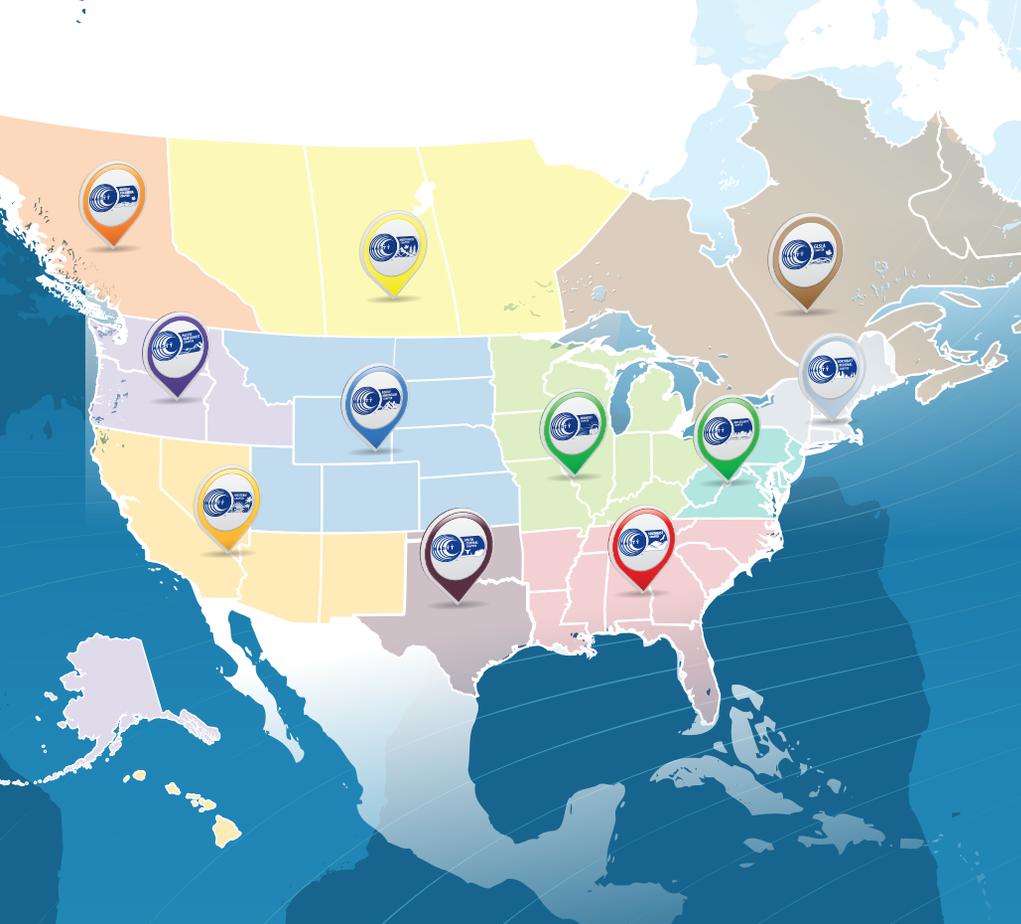
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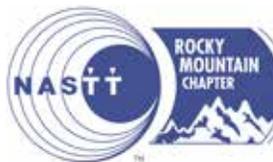
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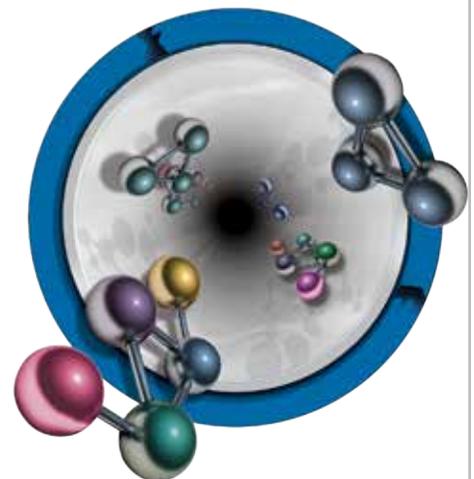
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