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October 22, 2025

Mr. Jordan Kannianen
Deputy Executive Director
North Dakota Industrial Commission
State Capitol – 14th Floor
600 East Boulevard Avenue, Department 405
Bismarck, ND 58505-0840

Dear Mr. Kannianen:

Subject: Quarterly Progress Report Entitled "iPIPE 3.0: intelligent Pipeline Integrity Program"
Contract No. G-059-116; UND Project – Fund 41000-UND0029076
EERC Fund 29076

Attached is the quarterly progress report for the subject project for the period July 1 – September 30, 2025.

If you have any questions, please contact me by phone at (701) 777-5402 or by email at amcrae@undeerc.org.

Sincerely,

DocuSigned by:
Austin McRae
2CF0ADBF88C44D7...

T. Austin McRae
Oilfield Operations Specialist

TAM/kal

Attachment

c/att: Brent Brannan, North Dakota Industrial Commission

iPIPE 3.0: INTELLIGENT PIPELINE INTEGRITY PROGRAM

Quarterly Progress Report

(for the period July 1 – September 30, 2025)

Prepared for:

Jordan Kannianen

North Dakota Industrial Commission
State Capitol, 14th Floor
600 East Boulevard Avenue, Department 405
Bismarck, ND 58505-0840

Contract No. G-059-116

Prepared by:

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October 2025

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EXECUTIVE SUMMARY

This report documents activity conducted by the intelligent Pipeline Integrity Program (iPIPE) 3.0 for the North Dakota Industrial Commission Oil and Gas Research Program for July 1 – September 30, 2025. The goal of iPIPE is to advance technologies that reduce the frequency and duration of pipeline releases. iPIPE 3.0 operates with seven industry members, led by the Energy & Environmental Research Center. We are pleased to provide a model program for how to collaborate between government and industry and put innovation ahead of regulation. iPIPE is finding what could not be seen with previous technology and preventing larger impacts. iPIPE has achieved these with satellite technology, advanced inspection tools, and smart sensors. We have also expanded technology typically reserved for oil and gas systems to produced water systems. Today, at least three major produced water systems in North Dakota operate with artificial intelligence (AI) leak detection technology sprung from iPIPE. iPIPE 3.0 is advancing preventive technology for in-line inspection, methane detection, and sensors with AI and working to make detection affordable. This report provides an update on these exciting efforts.

Highlights of the first year of iPIPE 3.0 included the vetting of over 45 technology providers and the final selection of seven for technology demonstration projects. Efforts in the second half of 2024 focused on negotiating and executing subcontracts with each of the technology providers as well as kicking off project tasks. Each project has continued to progress throughout the year regarding both scope and in-kind support.

- Bridger Photonics (Bridger) completed its second of three flight campaigns capturing a baseline dataset. Bridger is working to advance methane detection over snow cover. The second flight compares summer data with the first flight conducted over snow cover. A third flight over snow cover will reveal the advancements achieved with this technology.

- Novitech completed fabrication and assembly of a full-scale prototype. The prototype is a 12-inch axial crack detection in-line inspection tool. This is a new capability for the industry.

- Direct-C completed a second deployment of its sensors at a host terminal in Cushing, Oklahoma. Direct-C is lowering the cost associated with mass deployment of passive leak detection sensors.

- Vanguard completed upgrades to its methane detection and quantification sensor and user interface application and conducted test flights with the Methane Emissions Technology Evaluation Center. Vanguard's technology was awarded the "Expert Commentator Pick for Most Innovative" by the Texas Oil and Gas Association at its 2025 technology showcase meeting.

iPIPE 3.0: INTELLIGENT PIPELINE INTEGRITY PROGRAM
Quarterly Progress Report
July 1 – September 30, 2025

BACKGROUND

The intelligent Pipeline Integrity Program (iPIPE) includes industry organizations that account for a majority of oil and gas in North Dakota gathered and transported to commodity markets. iPIPE is the industry's response to former Governor Doug Burgum's challenge to eliminate pipeline leaks through innovation.[1] The program is a pinnacle in demonstrating the option for innovation over regulation. Since 2018, iPIPE has vetted over 145 technologies and conducted 12 technology projects that have ranged from technology in and on the pipe to technology orbiting the earth. Members of iPIPE collaborate monthly to discuss advancements in leak detection and conduct technology projects that explore applications within their assets. The Energy & Environmental Research Center (EERC) manages the activity of iPIPE, which includes technology scouting, technical evaluation, contract management, field activity, project performance, reporting, and coordination of member meetings.

iPIPE 3.0 is active with seven members: Enbridge, Energy Transfer Partners, Chevron Corporation, Marathon Petroleum Logistics, ONEOK, South Bow, and TC Energy.

The goal of the program is to advance technologies that reduce the frequency and duration of pipeline releases.

The objectives to achieve this goal are as follows:

- Select multiple projects for demonstration from the technology-scouting efforts.
- Grow industry membership.
- Foster industry collaboration through monthly member meetings and an annual member forum.
- Advance technology to commercial application and demonstrate commercial deployment.

The following summarizes program activities from July 1, 2025, through September 30, 2025.

[1] www.ndoil.org/industry-responds-to-governors-initiative-to-improve-pipeline-technology-program-funding-approved-by-north-dakota-industrial-commission (accessed October 2024).

ACCOMPLISHMENTS DURING REPORTING PERIOD

- Program-level activities
  - Program management
    - The EERC continued working with the iPIPE industry member-selected technology providers to execute contracts for iPIPE 3.0.
    - The iPIPE 4.0 proposal was submitted to the North Dakota Industrial Commission (NDIC).
  - Program meetings
    - On July 17, August 21, and September 18, 2025, iPIPE held monthly member meetings to update all members on program status. The meeting agendas include safety, determination of quorum, approval of minutes, project updates, and business of the membership.
  - Member recruitment
    - iPIPE continues to seek new members and develop strategic relationships.

- Technology demonstration project updates
  - Bridger Photonics (Bridger) – This project will work to overcome the limitations of using lidar over snow cover, ideally resulting in a technology capable of detecting methane in all of North Dakota's seasons.
    - Bridger completed its second of three flight campaigns over North Dakota. The summer flight campaign covered 464 pipeline miles and 1000 facilities providing a baseline to compare against data captured over snow cover.
    - The probability of detection during the first winter campaign was lower by a factor of two relative to the summer campaign. Bridger aims to reduce that factor for the second winter campaign based on data and insights gathered to date.
  - Direct-C – This project aims to demonstrate mass leak detection monitoring of critical assets at a significant cost reduction when compared to present technology.
    - Direct-C continued monitoring its first set of sensors and communication devices at Enbridge's Edmonton Terminal in Alberta and completed another deployment at a second Enbridge facility in Cushing, Oklahoma.
  - Flowstate + TOKU – This project will integrate TOKU's cutting-edge pressure sensor data with Flowstate's computational pipeline-monitoring system to significantly enhance the accuracy and reliability of leak detection and localization within complex pipeline networks, all in compliance with industry cybersecurity standards.
    - Flowstate has proposed to complete the remaining scope of the project on a Bridger Pipeline asset due to the Chevron acquisition of Hess Corporation (Hess). Continued fluid withdrawal tests on the current system would require new legal agreements that would likely significantly impact the timeline of the project. Flowstate has an existing relationship with Bridger Pipeline, and Bridger Pipeline has systems already equipped with TOKU sensors.
    - The dynamic (live) data connection with on the current pipeline asset remains active and is providing data to aid in ongoing technology development.
  - Flyscan – This project is designed to add methane detection capability to Flyscan's automated aerial right-of-way (ROW) technology for pipeline inspection.
    - Flyscan continued the design of the alpha airborne unit.

  - KMAX – This project will improve offerings of smaller-diameter in-line inspection tools by developing a circumferential magnetic flux leakage (CMFL) tool capable of inspecting 4-inch-diameter pipelines.
    - ♦ KMAX progressed toward tool commissioning and software development.
  - Novitech – This project will develop a prototype inspection system with a new multifield CMFL magnetizer module to enable detection and identification of axially oriented stress corrosion cracking (ASCC).
    - ♦ Novitech completed fabrication and assembly of a full-scale prototype unit.
  - Vanguard – This project adds improved functionality to Vanguard's tunable diode laser absorption spectroscopy methane sensor to enhance automation and leak quantification.
    - ♦ Vanguard completed improvement of its technology's software with particular focus on user-friendliness and minimizing computational resources required.
    - ♦ Vanguard conducted controlled-release testing with the Methane Emissions Technology Evaluation Center (METEC).

- Technology selection
  - iPIPE continues to engage with companies from around the globe that offer emerging technologies.

MEMBERSHIP AND FINANCIAL INFORMATION

The budget proposed to the NDIC Oil and Gas Research Program was $6,000,000, as shown in Table 1. Table 2 presents greater detail on the current budget and actual expenses incurred by the program.

Project progress is shown in Figure 1.

Table 1. iPIPE 3.0 Original Budget

Sponsors	Contribution
NDIC – Cash	$3,000,000
Industry – Cash	$900,000
Technology Providers – In-Kind	$2,100,000
Total	**$6,000,000**

Table 2. iPIPE 3.0 Expected Budget and Expenses to Date

Sponsors	Expected Budget	Actual Expenses as of 9/30/2025		Balance Remaining of Expected Cash Budget
NDIC Share – Cash	$3,000,000		$1,879,171	**$1,120,829**
Industry Share – Cash	$975,000		$475,010	**$499,990**
Technology Providers – In-Kind	$2,100,000	*Bridger*	*$375,000*	
		Direct-C	*$173,272*	
		Flowstate + TOKU	*$210,344*	
		Flyscan	*$888,165*	
		KMAX	*$255,886*	
		Novitech	*$207,835*	
		Vanguard	*$52,763*	
		TOTAL	**$2,163,265**	
Total	**$6,075,000**		**$4,517,446**	**$1,620,819**

FUTURE ACTIVITIES

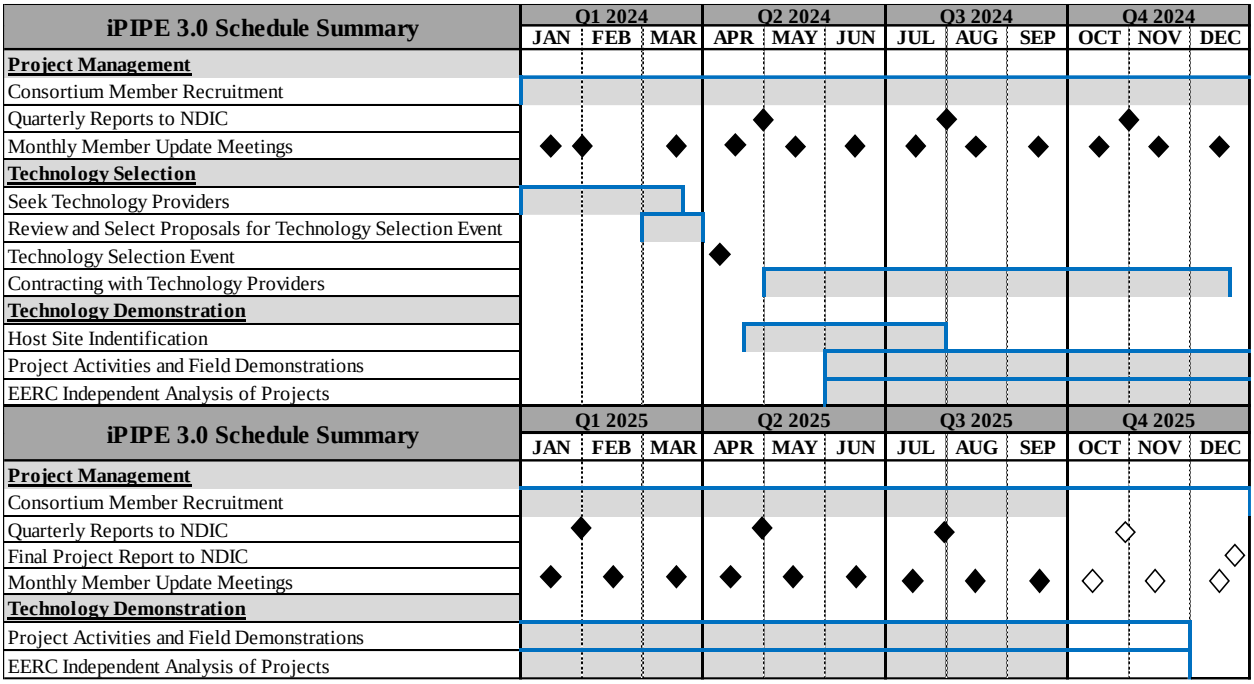

Figure 1. Project progress.

The planned activities for the next quarter are detailed below:

- Program-level activities
  - iPIPE looks forward to presenting the iPIPE 4.0 proposal.
  - iPIPE will continue discussions with potential program members.

- Technology demonstrations
  - Bridger will be prepared for the third and final flight campaign which will be over snow cover. This is almost entirely dependent on weather.
  - Direct-C will continue to work with iPIPE to establish additional test sites and continue data collection and monitoring at Enbridge's Edmonton Terminal.
  - Flowstate and TOKU will continue data collection and technology development and enhancements.
  - Flyscan will complete the design and begin fabrication of the airborne alpha prototype unit. They will test components and subsystems throughout the assembly and begin testing the full unit once completed.
  - KMAX complete development for the software required for the prototype 4-inch CMFL tool and validation testing. They will also plan for the field trial.
  - Novitech will begin validation testing and arranging the field trial.
  - Vanguard is expected to complete remaining scope and reporting.

- Technology selection
  - The EERC will continue to seek exciting emerging technologies and engage with companies from around the globe.

- Notice of contract extension: Three of the subcontracts will extend beyond the NDIC contract period of December 31, 2025. The projects are as follows: Flowstate/TOKU, Flyscan, and Novitech. Subcontract modifications will be executed after the EERC submits for contract extension of iPIPE 3.0. All subcontracts are anticipated to be completed in 2026.