REX2024
PRCI Research Exchange

Aerial Right of Way Patrol using Automated Threat Detection

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San Diego, California
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PRCI LEADING PIPELINE RESEARCH
Pipeline Research Council International

ROW-3-1 Airborne Automated Threat Detection System

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PRCI
LEADING PIPELINE RESEARCH

Catalog No. PR-417-203902-R01

Develop Remote Sensing and Leak Detection Platform that can Deploy Multiple Sensor Types

ROW 3-1 / ROW 3-1A

Contract number PR-417-203902
Contract number PR-417-193901

Contractor Project Number #AATI-341

Prepared for the
Surveillance, Operations, and Monitoring Technical Committee
Of
Pipeline Research Council International, Inc.

Prepared by:
American Aerospace Technologies, Inc.

Authors:
David Yoel, Tina Sicilia, Matt Bogaart, Jeremy Fernandes

Release Date:
September 29, 2021

Version	Date of Last Revision	Date of Uploading	Comments
R01	04/29/2022	04/29/2022	
R02	10/13/2023	10/31/2023	Updated to add Flight 4 results

ROW-3-1 Airborne Automated Threat Detection System

- **PR-417-203902-R01 Develop Remote Sensing and Leak Detection Platform That Can Deploy Multiple Sensor Types**
- Automated Threat Detection
- Suitable for medium altitude long endurance unmanned aircraft capable of beyond visual line of sight (BVLOS)
- Quantify acceptable detection limits
- Identify sensors to meet requirements

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Using Advanced Technology for Golf

- In Golf One Number can indicate the success or failure of a hole
- Much more information can be collected using technology
- Similar information is now readily available to the public
- This information allows for more analysis and informed decisions

HOLE	1	2	3	4
BLUE	598	366	174	570
GOLD	531	336	144	522
RED	497	321	125	486
Chris	6	6	4	7
Cale	6	6	4	7
Kent	8	5	4	7

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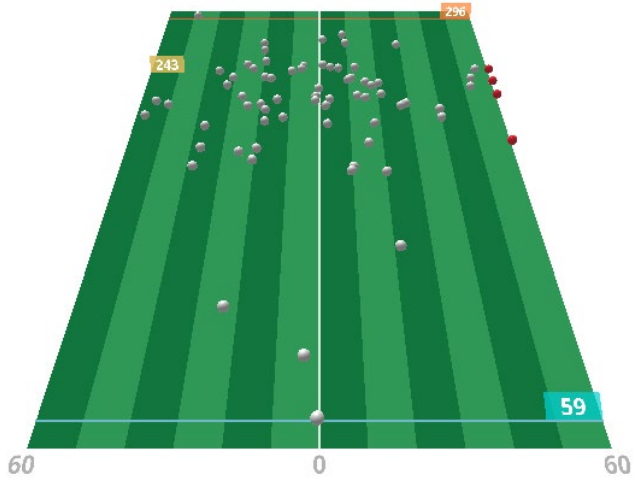

Using Advanced Technology for Right of Way Monitoring

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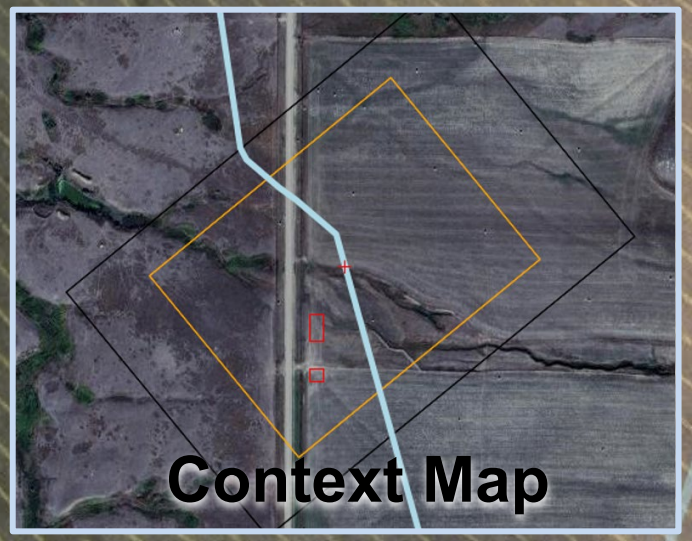
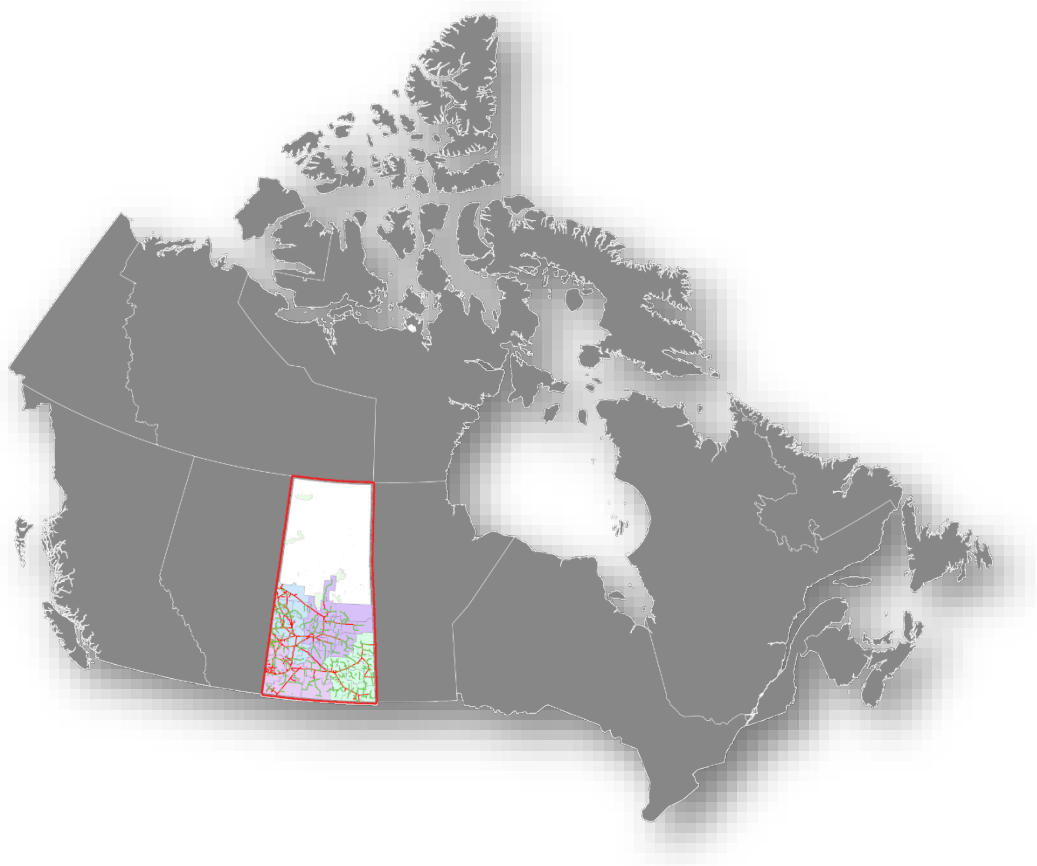
AiRanger UAS in flight

Using Advanced Technology for Right of Way Monitoring



TransGas System Overview

- TransGas operates an “Expansive” system in Saskatchewan
- 15,000 km (10,000 miles) of Transmission Pipelines
- A distribution focus, serving 93% of the communities in the province
- Over half of the system is small diameter (less than ø4”) low volume
- Higher cost data products have not been feasible most of our system



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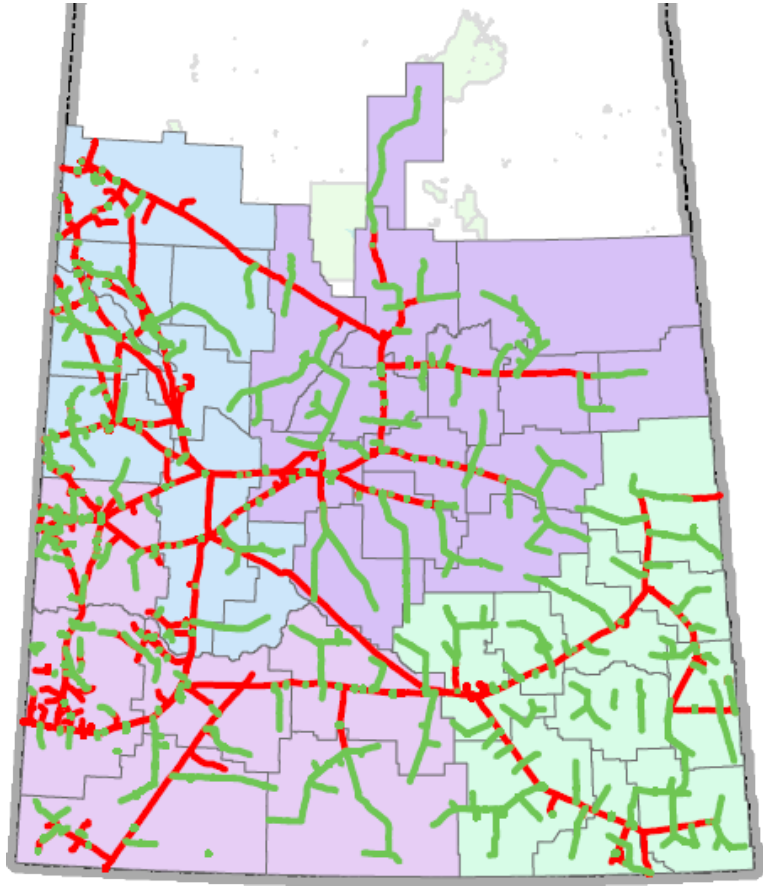
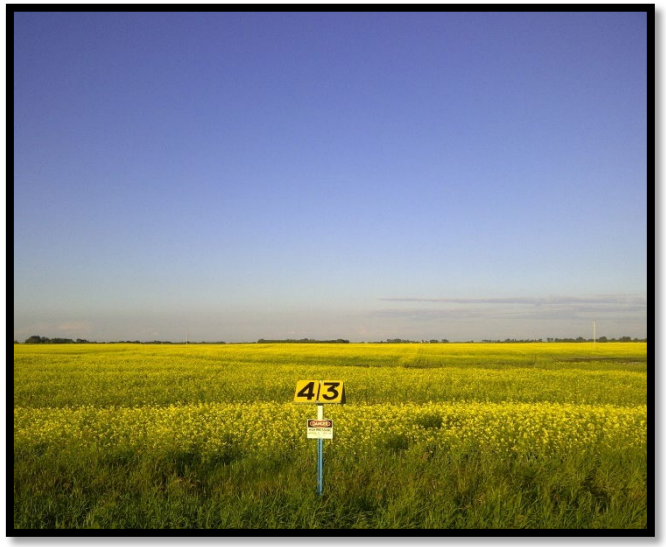


TransGas System Overview

Urban - 1%

Rural – 99%



Implementation of the Research

- Easier due to integration with existing Aerial Patrol inspections
- Cost is lower due to integration with existing Aerial Patrol inspections
- The pilot and spotter continue to notify operations of extreme threats
- Annual inspection to supplement
- Integration with the company GIS system allows for extra value

Improved Threat Detection

- Better identifications where pipeline alignment is not obvious
- There seems to be a perception that old threats are not reportable
- Automated threat detection reports findings unnoticed in the past
  - Expansion of Urban Areas
  - Animal activity / erosion
  - Excavators

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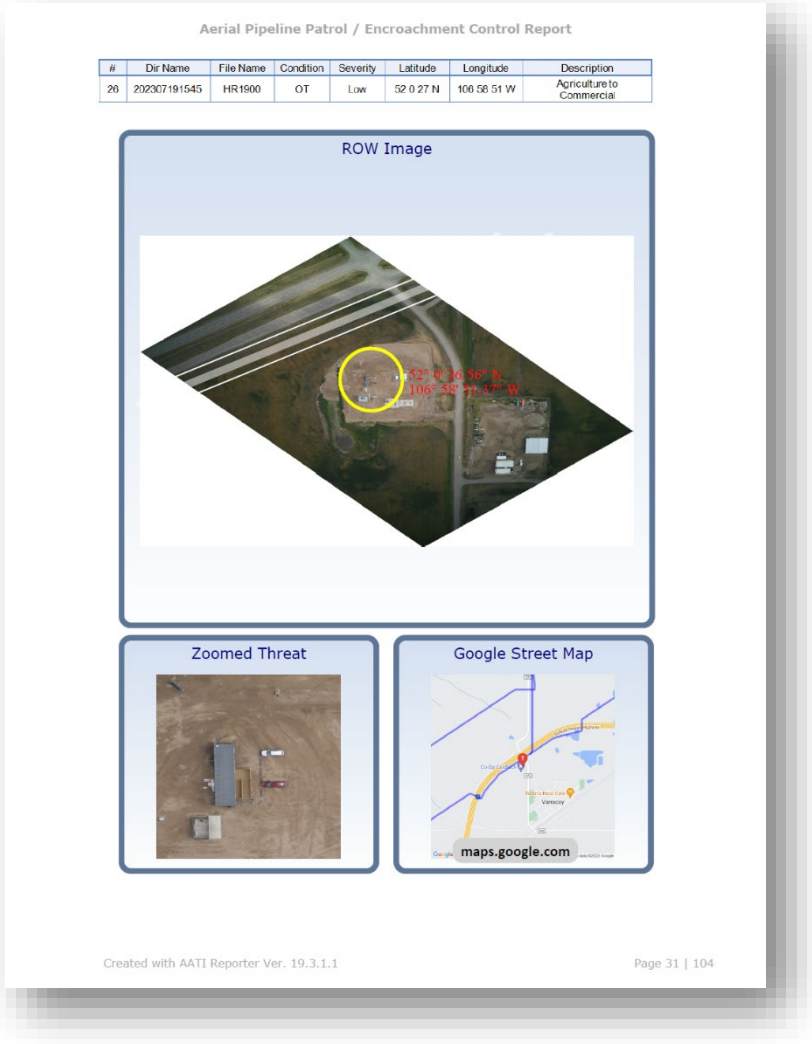

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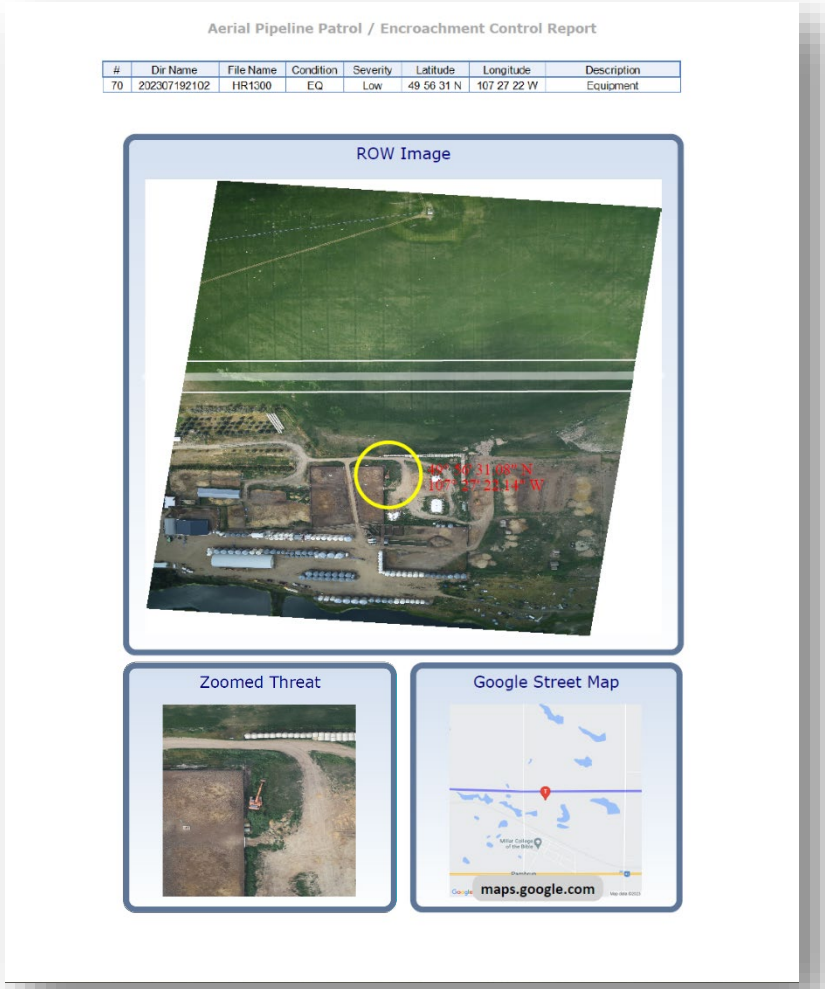
Improved Threat Detection - Excavators



Improved Threat Detection

Flight – 19 July 2023 00438_Sask_TGL_20230719 Minute 1,453 to Minute 1,742	Patrol Name Sask TGL	Images Scored	Total Threat Count	True Positive	False Positive	False Negative	True Negative	Raw Score (Recall)	F1 Score	Precision
	00438_Sask_TGL_20230719	1,835	448	350	126	98	1,700	0.78	0.76	0.74

- **382-mile patrol scored**
- **351 miles of corridor was issue free**
  - 1,700 images
  - True Negative score 92%
- **31 miles of corridor contained threats**
  - Most False Negatives were in clusters where one vehicle was missed
- **Similar results to PRCI Report**
  - Entirely different terrain
  - Much larger data set (382 vs 87 miles)

Encroachment Monitoring

- Monitoring developments for 10 yrs. with annual aerial photos
- Follow up inspections added for higher risk encroachments and new developments
- High resolution imagery improves desktop assessments
- Pipe location shown by Aerial Marker
- Crossing process is improved for proposed developments

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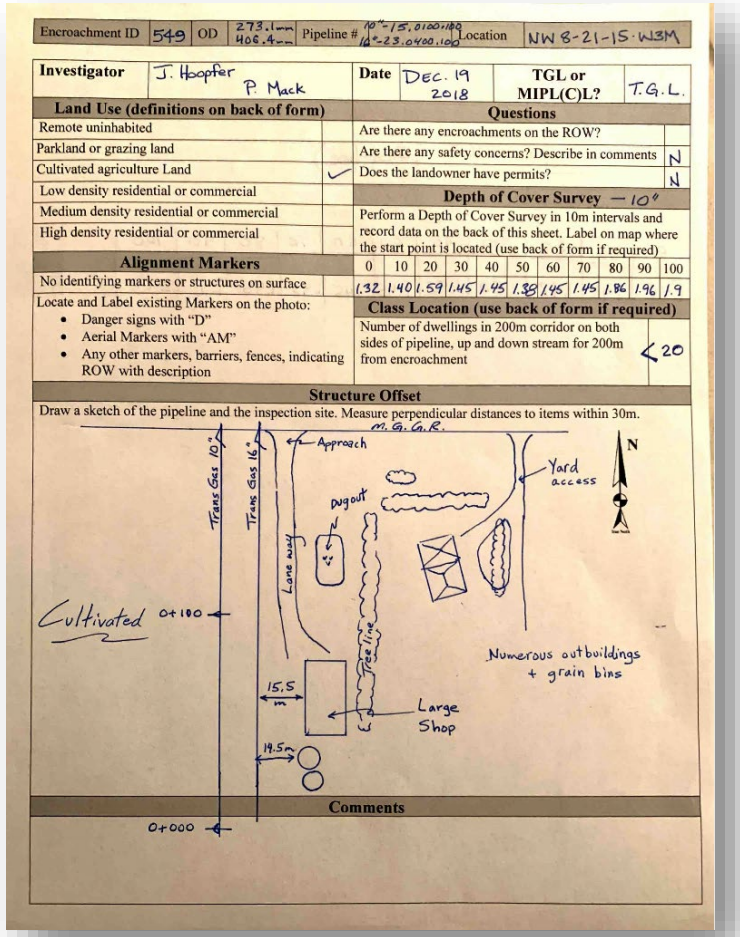

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Conclusion

- Sensors can effectively detect major threats to the pipeline system
- Much more information is now available to manage the Right of Way
- Information enables better analysis and more informed decisions

thank you

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