

PIGGING IN THE CLOUD: THE CAPABILITIES & VALUE PROPOSITION FOR THE CLOUD-BASED VIRTUALIZATION OF PIGGING OPERATIONS

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Abstract

Pipeline pigging projects are streamlined and made more transparent at all phases and to all stakeholders with cloud-based virtualization and mapping of pigging operations. Cloud-based software platforms which send and receive data and images from ground-based AGMs, signalers, tracking equipment, and personnel can provide near-real-time pig positions and status during pigging operations.

Pipeline pigging operations created in such online platforms have a high degree of reusability – permanently capturing man-hour investments in all aspects of the survey and run process providing strong ROI. Safety is enhanced as the number of personnel required to be present on a pipeline is reduced. Pig passage events are automatically transmitted to the cloud 24-hours-a-day and pigging activity can be monitored and commented on from anywhere.

Managers can coordinate and monitor multiple jobs simultaneously, further reducing the number of man-hours consumed by a single run. Safety is increased as stakeholders can receive instant notification of changes to a project as well as potentially hazardous developments such as inclement weather, nearby lightning strikes, heat/cold/UV alerts and more.

Run virtualization and recording provide unique techniques unavailable to traditional pigging operations. One example: should a pig become stuck, operators have the unique ability to “rewind” a run’s state to the precise moment when pressures spiked, getting a snapshot of the pipeline at that instant.

Permanent database storage of completed runs allows for easy reference to previous work and provides for rapid comparisons of multiple runs year-over-year and can lead operators to identify developing problems on their lines.

Introduction

In 2020 CDI (Control Devices, Inc.) began development of a comprehensive cloud-based web service which provides pipeline pig tracking project management, scheduling, tracking, and reporting services. This system, **GlobalTrack™**, has at its core the ability to monitor and to simulate the movements of up to three tools at any one time within a pipeline, as well as to provide project stakeholders with near-real-time access to all of this information during a run.

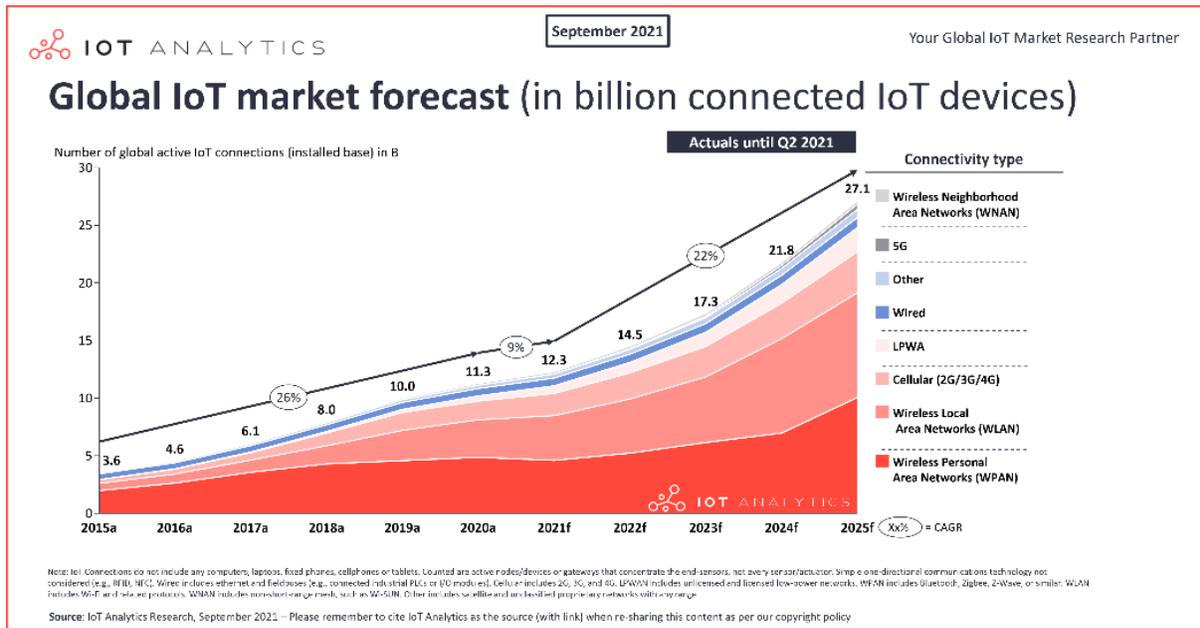
These basic pig tracking and run simulation and monitoring functions are further enhanced by a wide range of capabilities which bring the entire workflow from the initial pipeline survey to post-inspection reporting into a single centralized repository.

The consolidation of this large workflow, coupled with pig passage detection equipment that provides swift and automatic updates of passage events via satellite and cellular networks has several benefits to be explored.

The Internet of Things & Pig Tracking

Over the last few years communication technologies such as cellular networks and satellite transceivers have allowed for the creation of remote tracking and locating equipment that can broadcast detection events through the Internet. Unfortunately, the cost of owning and operating these systems, coupled with the remoteness of many pipelines and implicit lack of infrastructure along them, has meant that their use was confined to projects where both the infrastructure allowed, and the costs could be justified.

The rise of the Internet of Things (IoT) and its need for tiny devices to transmit and receive small amounts of data to end-users has created an enormous market for low power Internet-connected systems. As major electronic firms have entered the IoT market with everything from thermostats to automobiles, the number of connected devices has risen to many billions.



Global Internet Connected IoT devices (in billions) projected through 2025

The large IoT market has raised the market cap of, and created significant increased competition among, the satellite and cellular communications companies. These market forces have lowered the pricing of wireless communications systems significantly, directly benefiting pipeline pig tracking systems.



CDI's satellite-equipped AGM

Advantages of Tracking in the Cloud

There are many compelling reasons to bring the process of tracking pipeline pigs into the cloud. The strongest of them are:

1) Time Savings

Upper management and the Integrity Managers of a pipeline have a high demand of their time during peak inspection seasons. It is not always practical to be on-site for routine Launches and Receives. While text groups and phone calls can keep management informed, having the ability to visually track any number of pigs simultaneously while at your desk performing other work is a powerful tool.

2) Risk Management & Safety

It has become increasingly difficult to justify the expense of, and risk to, non-essential personnel on work sites – especially in the post-COVID world. Pulling much of the task of pig tracking into the cloud means fewer people on the pipeline resulting in a savings of both time and risk.

3) Globally Distributed Talent Pools

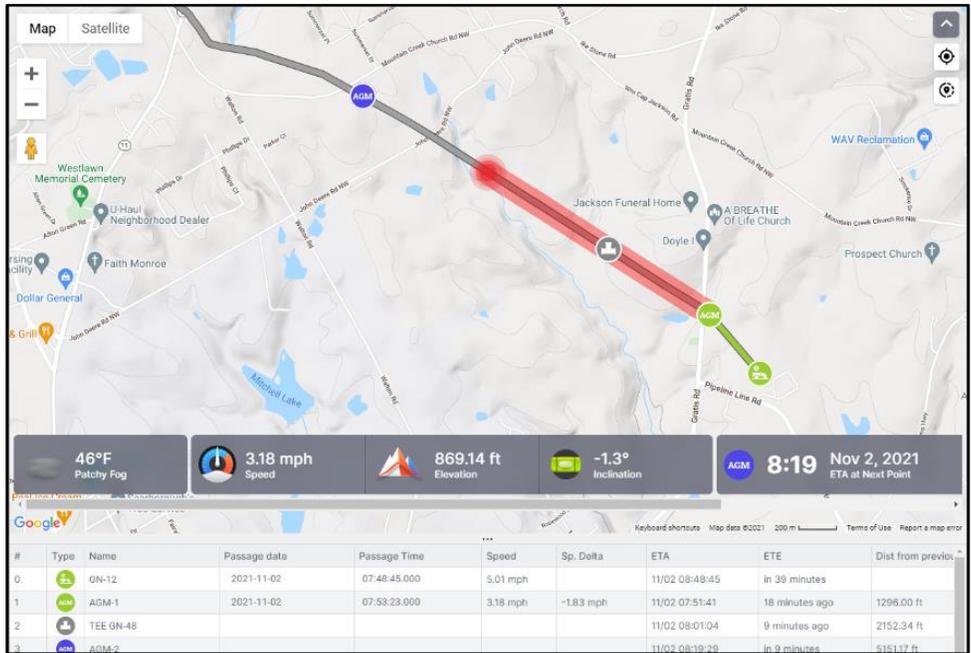
Having live pig tracking in the cloud allows companies to pull the best talent from virtually anywhere in the world. No longer are companies constrained to hiring personnel that can be physically on-site – the work can come to them.

Pig tracking, primarily above-ground marking for intelligent inspection tools has unique logistical challenges. Cloud-based pig tracking provides a number of tools that a tracking contractor or pipeline operator can mix and match to streamline their work and to help further mitigate risk.

Real-Time Tracking of a Project from Anywhere

With the use of a standard web browser, users with proper credentials can see a project’s progress from anywhere in the world. This means that managers and field personnel alike share a real-time view of any number of runs in progress.

Pigs’ movement through a pipeline and their projected locations, as well as points that have successfully reported a passage time, are all viewable in a generic web browser.



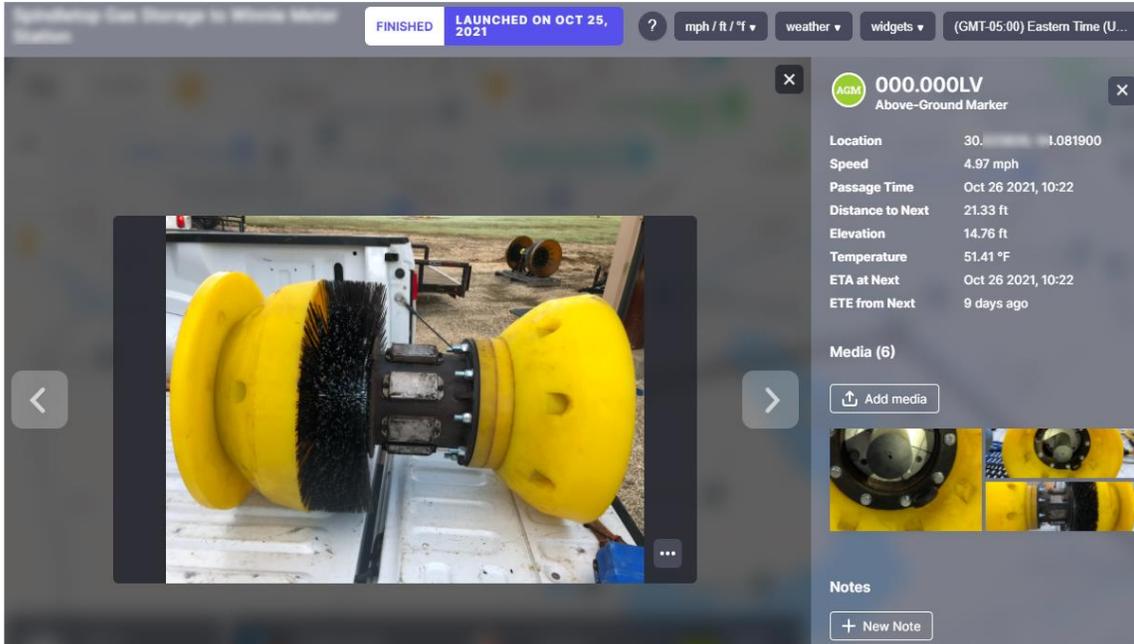
CDI GlobalTrack™ showing passed pipeline (green), pig location (red)

Centralized Data Storage

Data generated through the survey of and tracking on a pipeline is captured into a central repository and saved indefinitely. Cloud services can be used as references to gauge the performance of pigs and tracking services run-over-run and year-over year.

Photographs, site sketches and notes pertaining to the work on the line can be entered into and captured by GlobalTrack™. Notes can be attached to individual tracking points and might hold information such as a gate code, landowner’s telephone number, etc.

Photographs of the condition of tools pre- and post-run can also be quickly and permanently recorded as part of the job as we see here.



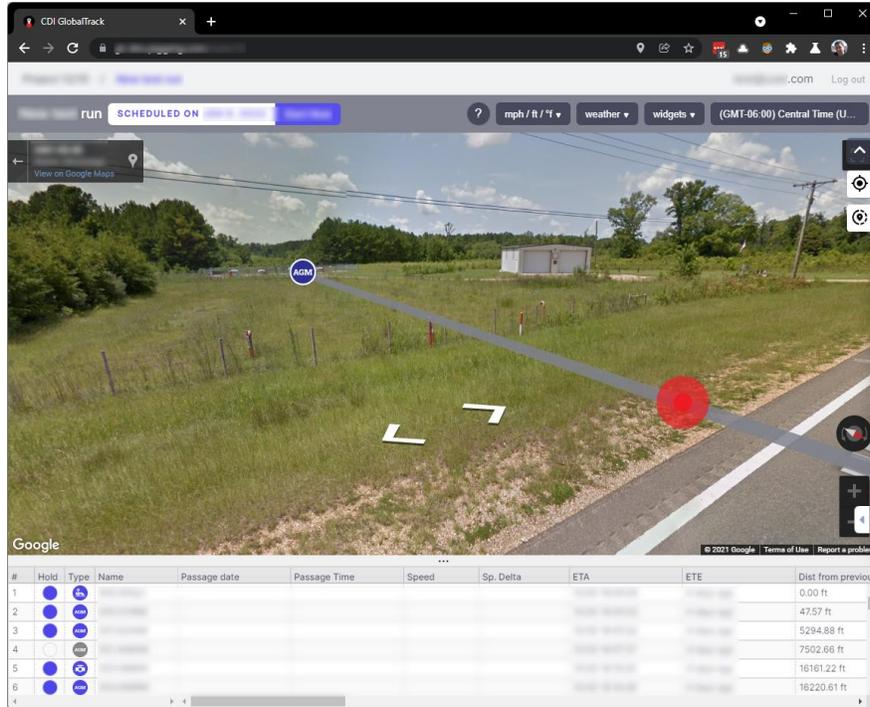
Storing images of tools, AGM locations, etc. in the cloud permanently attaches them to the run and ensures they are available for references indefinitely.

Virtualized Tool Tracking

By building upon the massive capabilities of Google Maps and Google Street View, it is possible to project a pipeline route along with the location of launchers, receivers and AGM points in the browser window allowing for true virtual pig tracking.

From one's office, Google Street View allows for real-time tracking of the tool along the ground as though you were there. In the image below, we see a valve site in the extreme background with a blue AGM icon illustrating the location of the AGM device. In the foreground we see a grey line representing the pipeline and a red dot which indicates the location in real-time of the pig within the line.

As the simulation moves the tool along the pipeline, the red dot is shown moving at its proper speed.



*Real-Time Street View from within CDI **GlobalTrack**™ of an AGM's location (background, blue dot), pipeline route (grey), pig's real-time location (foreground, red)*

Centralized Information

A cloud-based approach to pipeline AGM and tracking work allows for much or all of the information regarding a project to be stored in, and managed by, the software. Since the information is stored in the cloud it is broadly accessible anywhere in the world to individuals with proper credentials.

Time spent developing a survey and project with a cloud-based system can be re-used any number of times, thus capturing those costly man-hours.

Inventory & Asset Management

Inventory of any kind of pipeline pigging tools can be managed by the software. Having tool inventory in a cloud-based service means that scheduling of tools, their refurbishment status, and all aspects of the tool itself can be viewed by anyone anywhere provided they have the proper credentials.

Further, allocating assets to projects with a cloud-based system means that the software can ensure that equipment is not required to be on different jobs at the same time and technicians can flag devices in an equipment pool as unavailable for use when they are being refurbished or repaired.

To further reduce and help manage risk, cloud-based pig tracking systems can track the location of assets such as equipment and vehicles on the line. Should equipment become lost or stolen, it's location can be retrieved and viewed on the map.

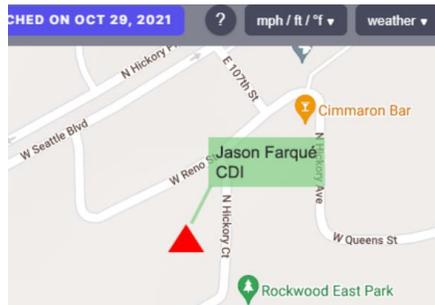
Internet connected devices can have many parameters of their performance monitored from remote. Their internal temperature, humidity, battery level, and GPS location can be known. This information can be used in a variety of ways to troubleshoot and generally monitor the performance of these devices.



Remote Asset performance monitoring

Personnel Monitoring

The movements of tracking crews on a pipeline are extremely important. For tracking crews, it is extremely useful to know, without texting or calling on the phone, the location of other members of a team. This knowledge increases their safety and situational awareness. Cloud-based systems can retrieve the GPS location of in-field users and display them on the map in real-time.



The author's location displayed in Broken Arrow, Oklahoma

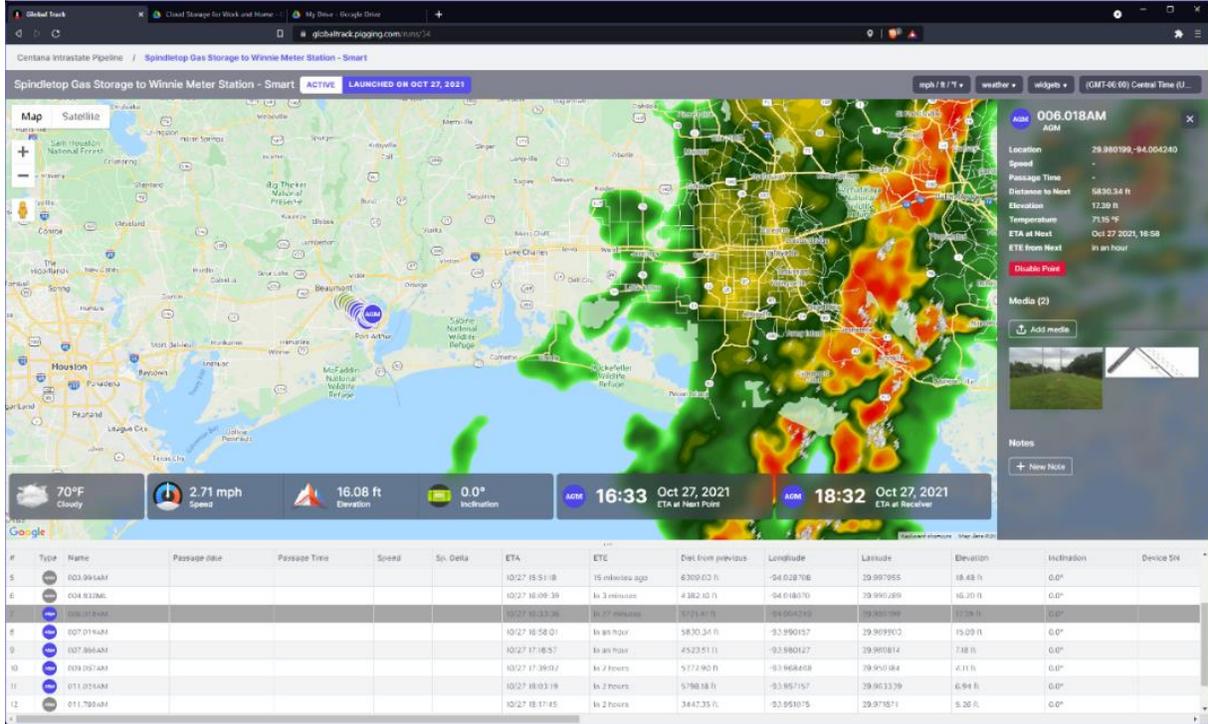
Weather Forecasting and Alerts

Since a project's start-date is known to the system, weather forecasting allows cloud-based tracking services to present relevant information about upcoming inclement weather.

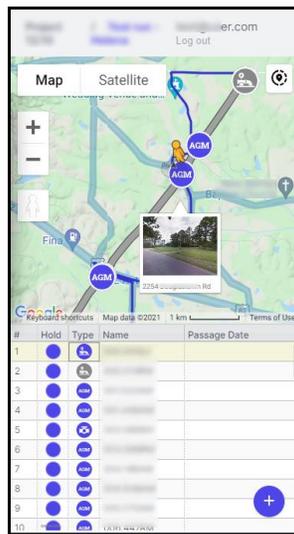
Forecasting can be useful to caution field personnel that the environment is particularly hot or cold. For example, automated text messages and emails can advise that the temperature is going to be below freezing or that the Ultraviolet light index for a run date is going to be harsh.

CDI **GlobalTrack™**, for instance, has the ability to see lightning strikes with 5-minute resolution anywhere in the world. Should lightning strike near the pipeline all stakeholders, including those in their offices, can receive a text message that they should exercise caution.

These types of automated notifications regarding the changing conditions on a pipeline provide decision-makers with useful and actionable data.



GlobalTrack™ UI showing an inspection run in progress with radar weather information



GlobalTrack™ on mobile phone showing pipeline route and driveline

A Case Study of the Benefits of Remote Cloud-Based Tracking

A European pipeline operator approached CDI with a problem. They were seeking a way to track pigs over extremely mountainous terrain with real-time feedback of their tool's location 24 hours a day.

For this project the operator was faced with a two-day intelligent inspection run which required four tracking teams working in 12-hour shifts. The terrain was extremely mountainous with very poor access and with little to no communications; the safety of tracking teams working in those conditions and in the dark of night presented a serious safety problem.

CDI provided remote cloud-based pig tracking of satellite-equipped AGM units, which allowed for the number of teams to be cut in half and for all the equipment to be preset and placed during daylight hours in the days before the tool run.

Real-Time cloud-based pig tracking meant that the operator was able to monitor the progress of the inspection tool from the launcher to the receiver from the safety of their offices. Stakeholders for this project were spread throughout both Europe and North America.

Once the run was complete, the operator was able to generate a full report before the AGM units were even retrieved, and the deployed devices were retrieved at his leisure.



CDI provided remote tracking services to this pipeline through difficult mountainous terrain

In this case the operator was not only able to reduce his overall cost by cutting the staff required to track the tools in half, but satellite feedback from the AGMs also allowed the position of the tool to be known by all of the stakeholders at all times rather than only when the tracking teams were within cellular range.

Because the inspection tool would have been out of communication for several hours at three mountainous points along the pipeline, the continuous and automated tracking provided by the

satellite equipped AGMs and cloud-service yielded a reduction in the overall stress level of everyone involved. This is difficult to quantify.

Conclusion

Tracking pigs from one's office has long been an unattainable dream for many of CDI's customers. Technological advancements and the falling prices of communications systems have finally made this dream a reality.

A full-featured cloud-based pig tracking system not only makes this possible, but also allows for cost-savings and risk reduction to be achieved. Automated communications and passage detections further reduce the possibility of human error, increasing overall job satisfaction of owner/operators.

As the benefits of cloud-based pig tracking software become more widely known and realized, CDI expects that the use of such systems will become the norm.