



The 53rd Annual IPLOCA Convention
Bangkok, 3rd October 2019

PIPELINE CONSTRUCTION REMOTE MONITORING
AGOSTINO NAPOLITANO

SAIPEM
AT A GLANCE

EXTRAORDINARY
IS OUR
EVERYDAY

1 2 3 4 5

BUSINESS STRUCTURE

5 AREAS, A SINGLE IDENTITY

We have developed five autonomous areas, divided into commercial strategy, project implementation, technology, innovation, business strategy and partnerships.

Offshore E&C



Onshore E&C



Offshore Drilling



Onshore Drilling



XSIGHT



WORLDWIDE PERMANENT PRESENCE

€8.9 bn

REVENUES 2017

€7.3 bn

NEW CONTRACTS 2017

€262 mln

INVESTMENTS 2017

60

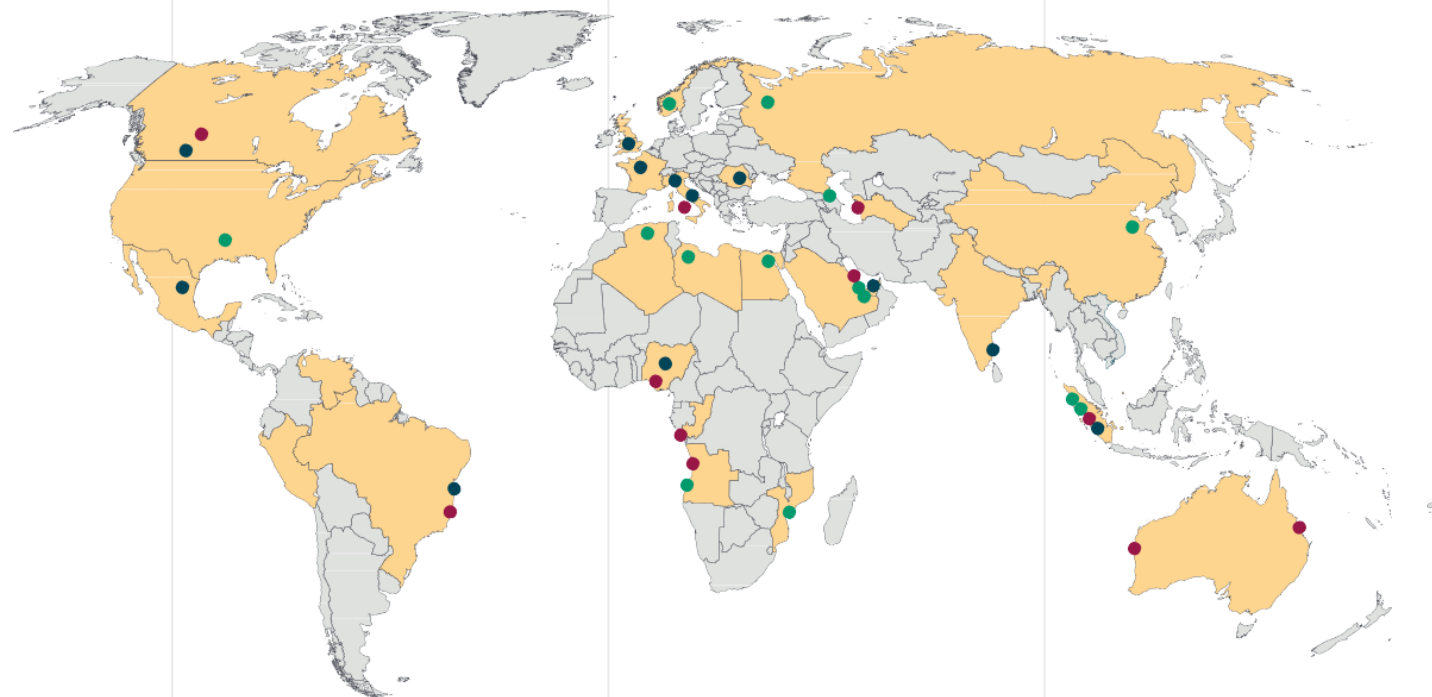
COUNTRIES IN WHICH
WE OPERATE

9

FABRICATION YARDS

32,000

EMPLOYEES



● ENGINEERING CENTRES

● YARDS

● OTHER MAIN LOCATIONS

SOLUTIONS**GLOBAL
SOLUTION
PROVIDER****RENEWABLES**

We make the most of our assets and engineering and construction expertise, working on the development of renewable energy: from offshore wind farms and geothermics to biorefineries and clean plants.

**INFRASTRUCTURE**

Thanks to integrated skills, we internally manage infrastructural projects with a high level of complexity, cutting-edge technologies and great attention to environmental sustainability.

**DECOMMISSIONING**

We have the necessary skills and resources to dismantle oil plants and infrastructure in a sustainable way.

**OPERATION AND
MAINTENANCE**

We assist our clients throughout the entire life cycle of plants, also through MMO contracts.

MILESTONES

SAIPEM: 60 YEARS OF HISTORY



RECORDS

AN IMPRESSIVE TRACK RECORD

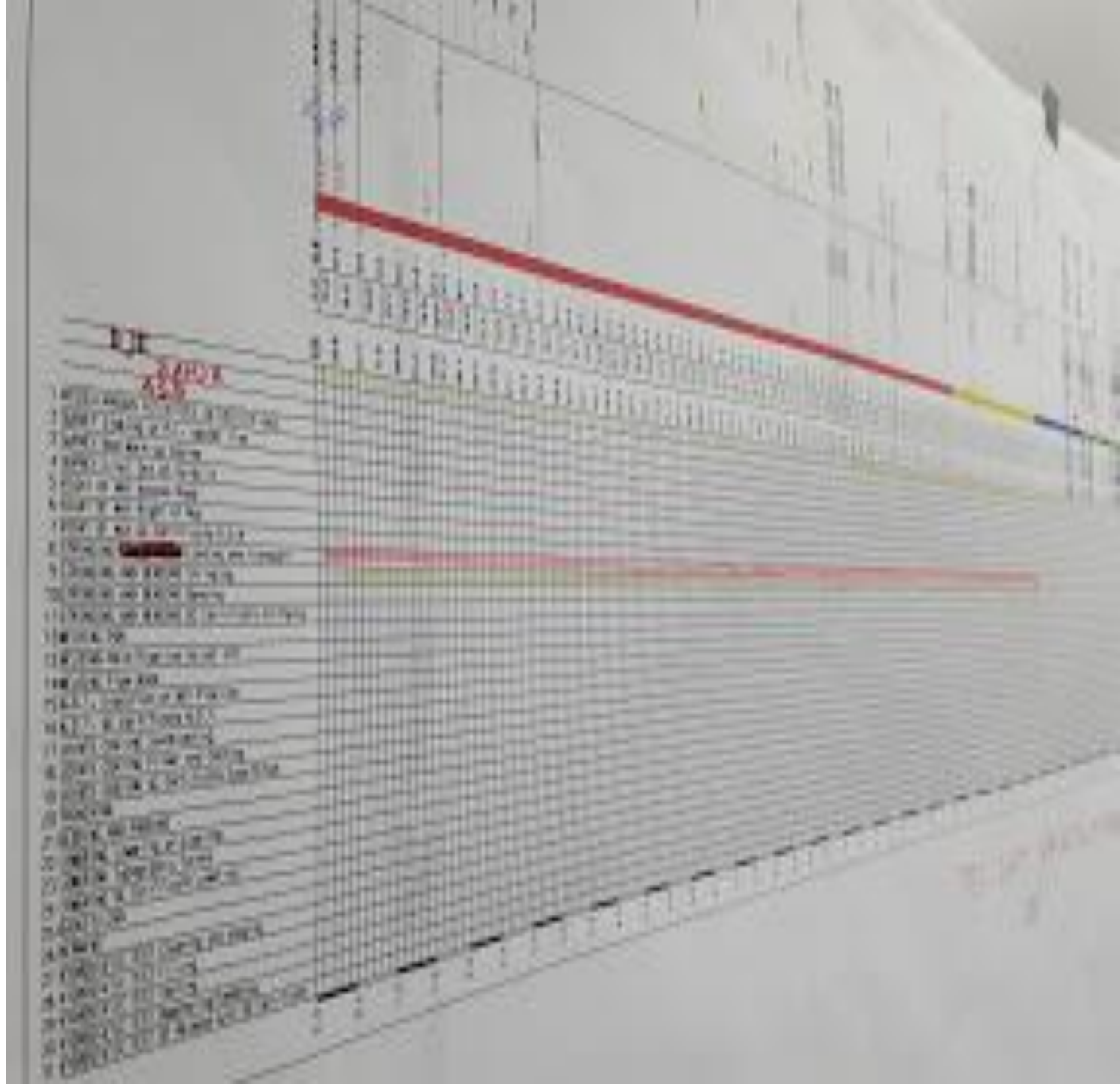
>100 GRASS-ROOTS COMPLEXES DESIGNED AND BUILT	>2,000 PROCESS UNITS DESIGNED AND BUILT	>7,500 ONSHORE WELLS DRILLED	>2,000 OFFSHORE WELLS DRILLED	>130,000 KM OF LAND PIPELINES, SEALINES AND TRUNKLINES DESIGNED AND BUILT	>100 OFFSHORE EPCI PROJECTS IN THE LAST 10 YEARS
---	---	--	---	---	---

PIPELINE CONSTRUCTION REMOTE MONITORING

Many factors can contribute to the success or failure of onshore pipeline construction projects.

Contractors have invested, over the years, resources and time to improve the HSE, planning, monitoring, productivity, and quality control of their works.

Nevertheless, transparency or accuracy or timely reporting of project status is yet to be a standard.

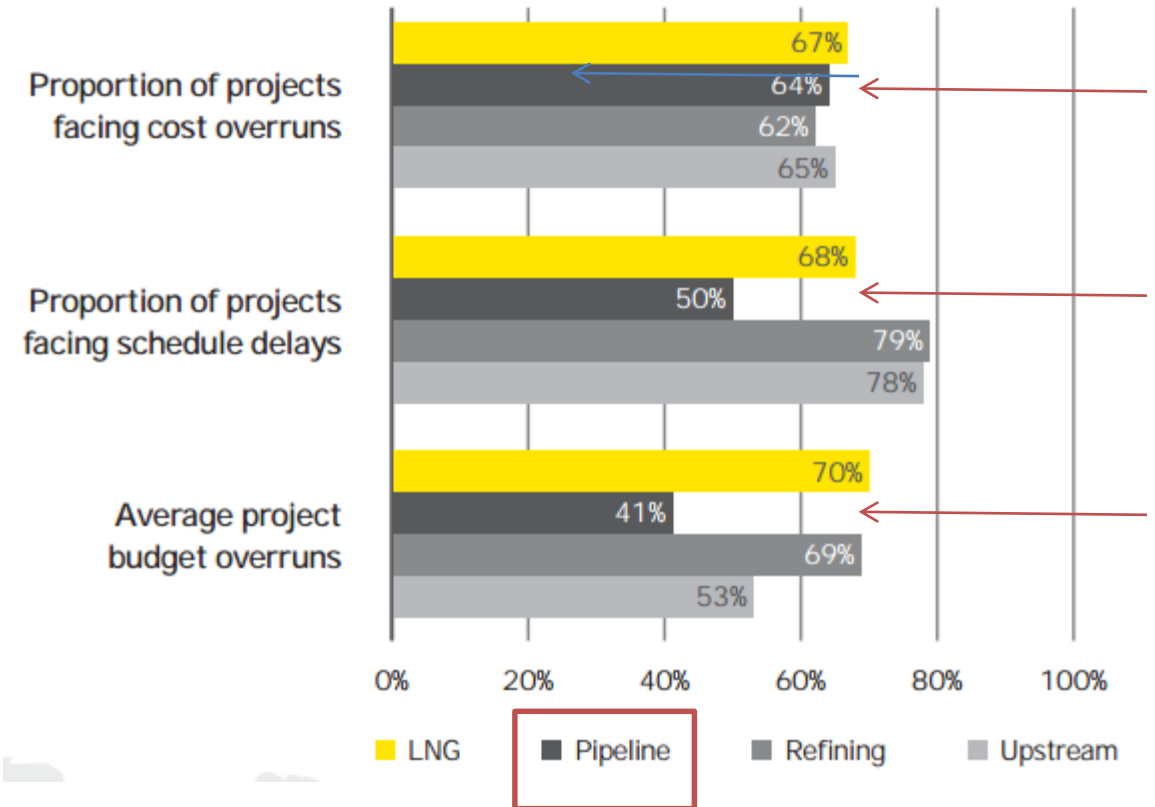


PIPELINE CONSTRUCTION REMOTE MONITORING

Industry performance data suggests that the factors that result in budget overruns or schedule delays are common across oil and gas projects (E&Y*)

Due to their scale, complexity and cost, the impact is more profound on megaprojects.

Furthermore, pipeline construction usually suffers unforeseen site conditions which results in tremendous delays.



Proportions of projects facing cost overruns, schedule delays and average project budget overruns

*Spotlight on oil and gas megaprojects E&Y

PIPELINE CONSTRUCTION REMOTE MONITORING

Despite pipeline construction can look like a moving manufacturing assembly line, the main difference is that the materials are brought to the designed location and the construction process travels linearly.

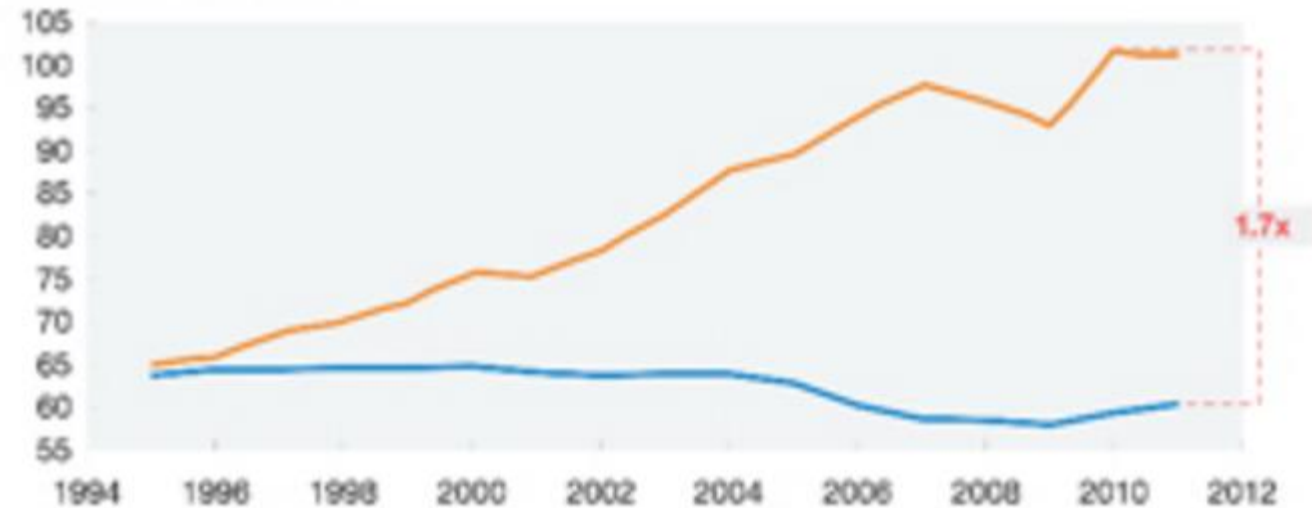


Productivity in manufacturing has nearly doubled, whereas in construction it has remained flat.

Overview of productivity improvement over time

Productivity (value added per worker), real, \$ 2005

\$ thousand per worker



Source: Expert interviews; IHS Global Insight (Belgium, France, Germany, Italy, Spain, United Kingdom, United States); World Input-Output Database

McKinsey & Company

PIPELINE CONSTRUCTION REMOTE MONITORING

Over the decades, there have been improvements in manufacturing processes, the same are not visible in construction projects and particularly in pipeline construction.



PIPELINE CONSTRUCTION REMOTE MONITORING

Manufacturing is done in a single location under a controlled environment, using well-organized sequencing strategies in order to optimize efficiency and increase safety.

Construction jobs are anything but a single location, and likely take place in an inhospitable environment.

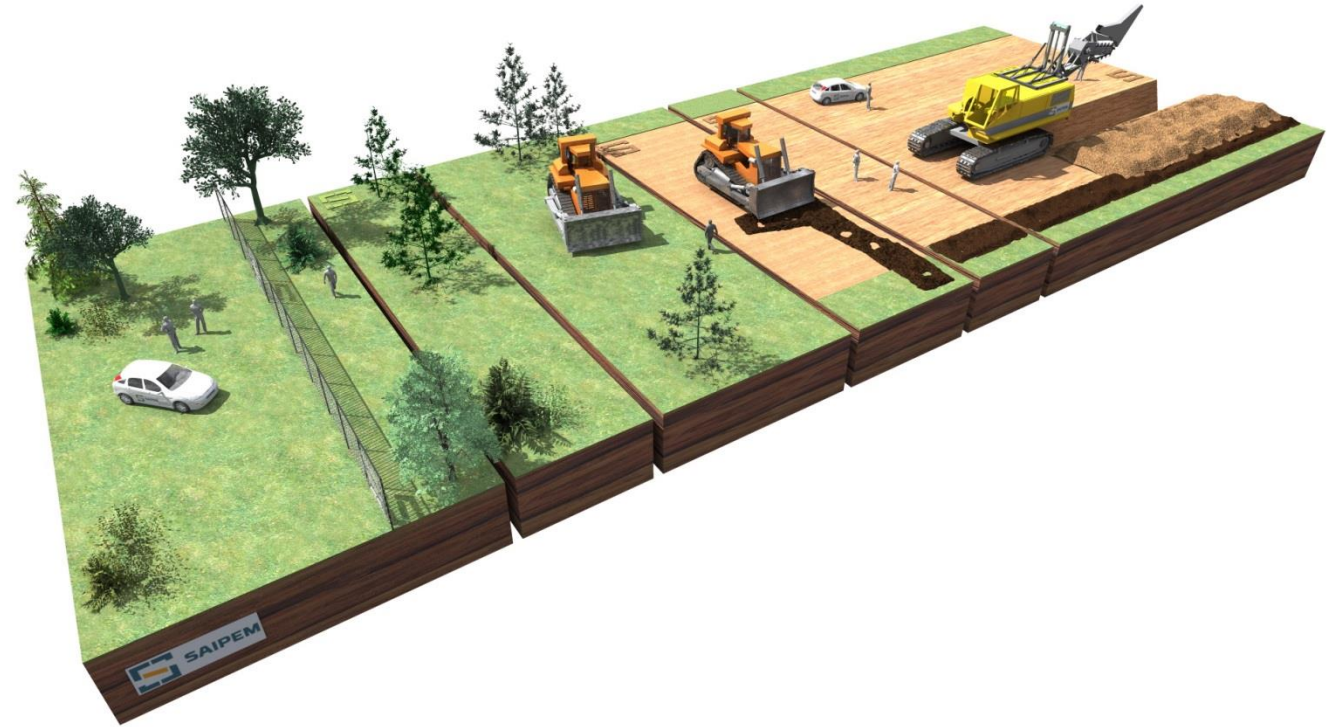
In pipeline construction, **environment constraints, highly influence the capacity to maintain the desired quality standards or the planned production rates.**

Too many variables driven by the specific location of the construction project do not allow for the same improvement in manufacturing industry.



PIPELINE CONSTRUCTION REMOTE MONITORING

Pipeline construction is nothing but a sequence of phases between accessing the site and leaving them in the same conditions (or improved) after the pipes are buried in the ground.



PIPELINE CONSTRUCTION REMOTE MONITORING

Experience shows that non-technical issues can effect project results such as :

- People management;
- Contracting and procurement strategies;
- Organization and governance;
- Non transparent communication;

Understanding (on site) where problems, risks, wastes, are occurring and how to eliminate non-value adding activities it is very difficult.



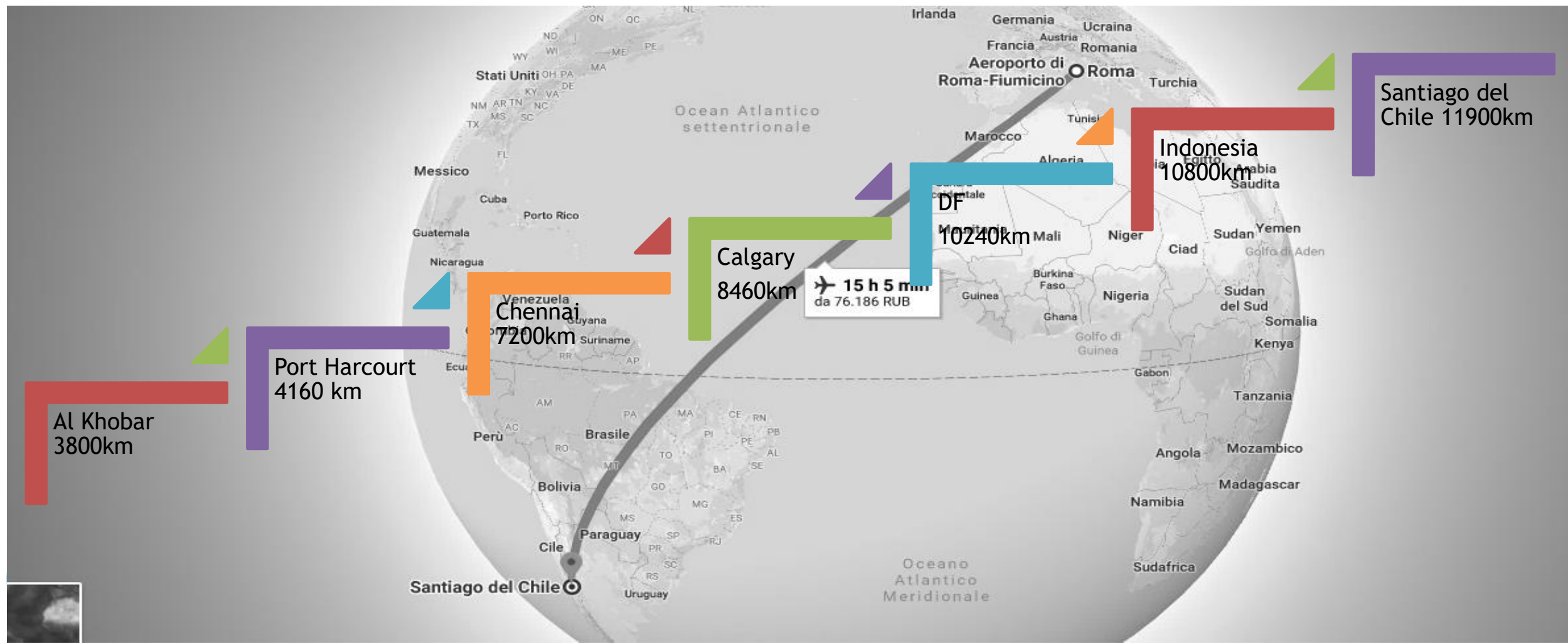
PIPELINE CONSTRUCTION REMOTE MONITORING

MBWA technique by walking around workplaces by randomly visiting different sites, can allow to discover and fix problems earlier and efficiently.

In MBWA, communication is spontaneous and bi-directional, and on-the-job coaching is also possible.



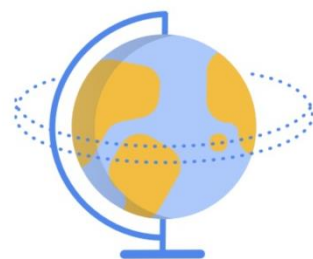
PIPELINE CONSTRUCTION REMOTE MONITORING



PIPELINE CONSTRUCTION REMOTE MONITORING



JAN 2018

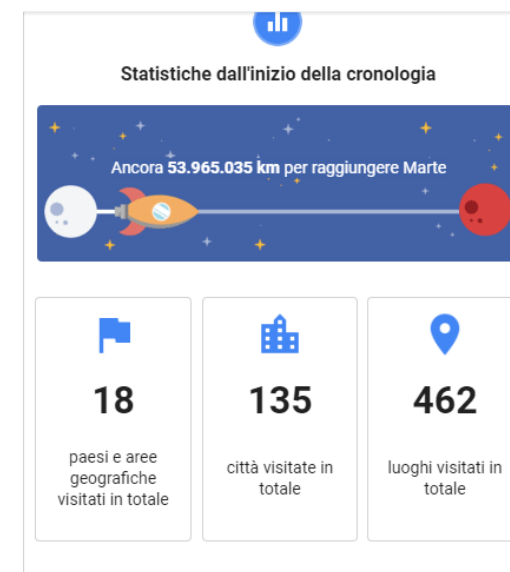


Giro del mondo

7,6 volte

Hai viaggiato per 306.344 km, pari a 7,6 volte il giro del mondo

DEC 2018



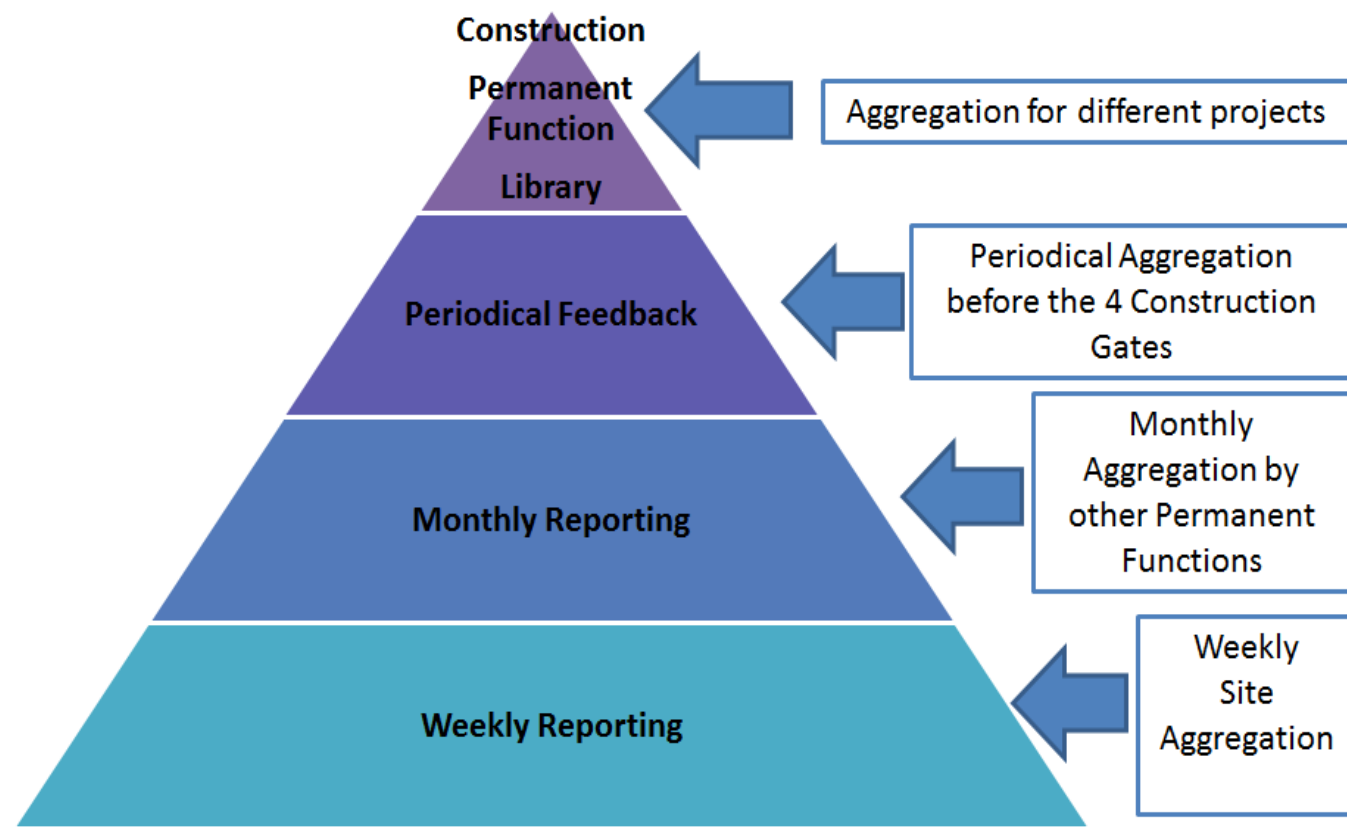
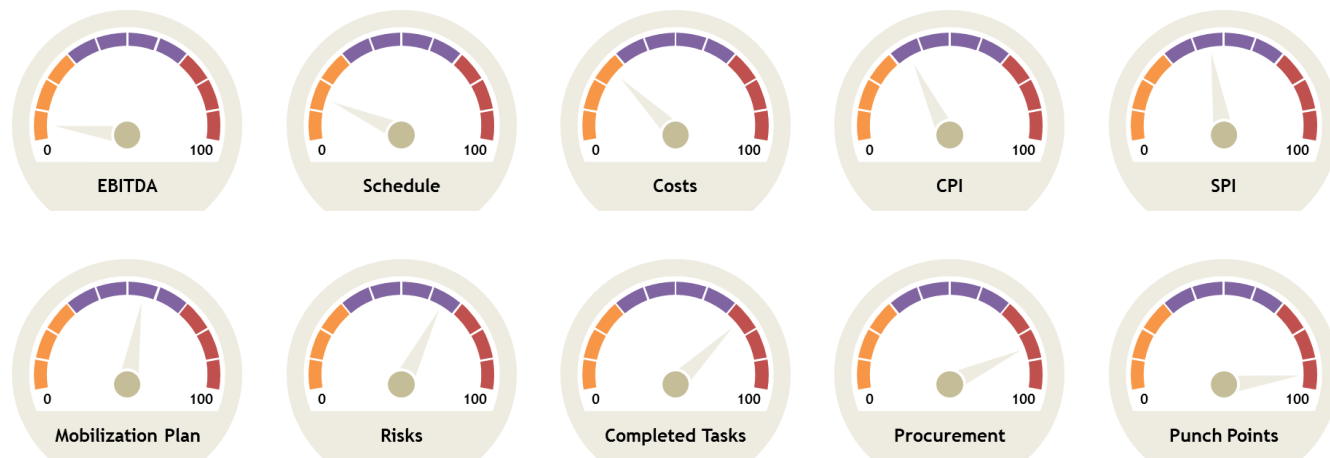
OCT 2019

PIPELINE CONSTRUCTION REMOTE MONITORING

Hence MBWA is not always possible and remote monitoring is also essential.

Project reports, however, can often slip into weekly or monthly updates.

Such frequency doesn't provide any value to the Portfolio Manager for which it is very difficult to understand the "daily" status of a project by simply reading the reports.



PIPELINE CONSTRUCTION REMOTE MONITORING

50% of project facing delays;
Too low productivity improvement over the decades;
Intensive labour impact with high turnaround;
Construction phases spread over kilometers;
MBWA not physically possible;
Project status reporting inadequate;

Management extremely hard.



PIPELINE CONSTRUCTION REMOTE MONITORING

How could it gain better visibility around things going wrong on projects?

Can technology help in having a better visibility, a transparent and timely communication between the project execution, the remote sites and head office?

May we have a real time or near real time remote monitoring?



PIPELINE CONSTRUCTION REMOTE MONITORING

In Industry 4.0, the production elements have beside their physical representation also a virtual identity, a data object that is stored in the data cloud.

Such virtual identity can include a variety of data and information about the product, from documents, to 3D models, individual identifiers, current status data, history information and measurement or test data



PIPELINE CONSTRUCTION REMOTE MONITORING

Examples of some technologies applied on the Spence Project in Chile have been gathered in this presentation:

Geospatial Technologies:

(barcoding, GIS, GPS)

Enhanced IT tools

(Digital Camera, Video)

Imaging technologies

(Photogrammetry, Lidar, Videogrammetry, Drone survey)

AR/VR applications

Integration between all technologies is only at the beginning.

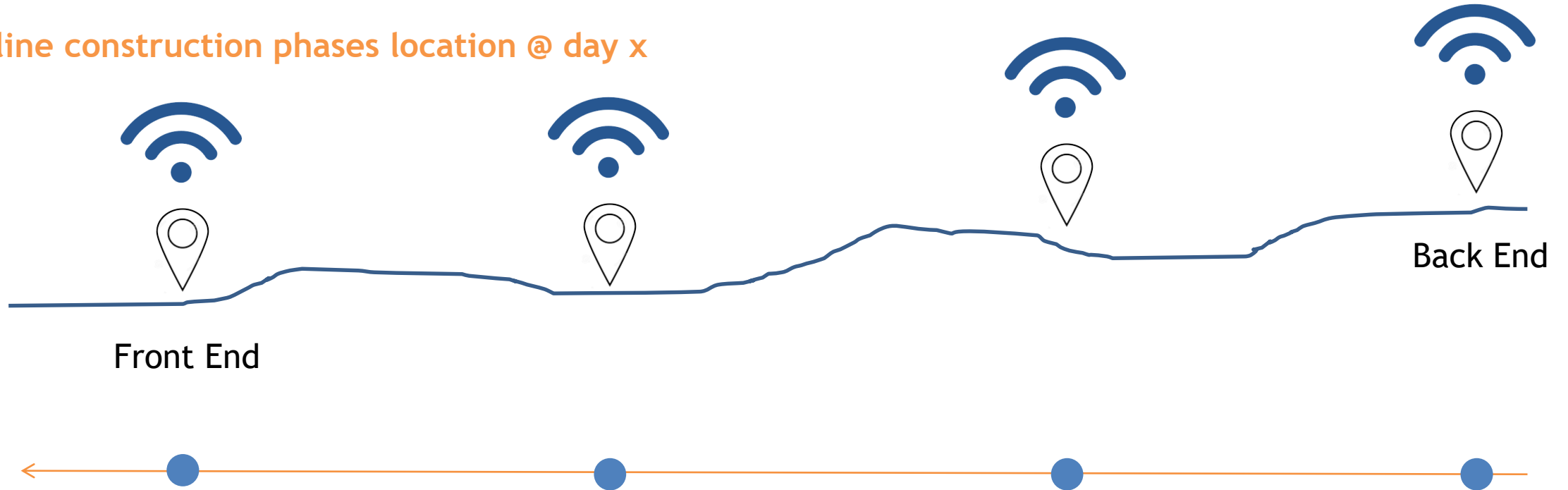




Geospatial Technologies
What if GPS tracking is used to visually monitor
where the construction phases equipment
are (in real time)?

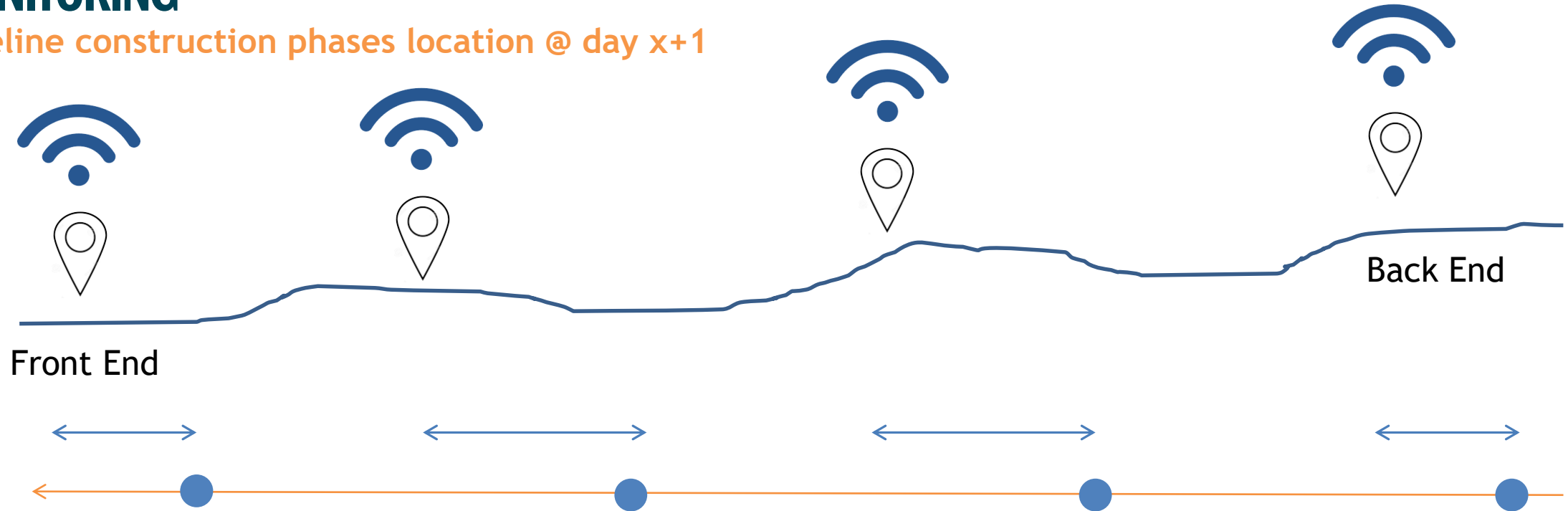
PIPELINE CONSTRUCTION REMOTE MONITORING

Pipeline construction phases location @ day x



PIPELINE CONSTRUCTION REMOTE MONITORING

Pipeline construction phases location @ day $x+1$





Terminal Station

Estaciones Impulsion

Construction

All Activities

LAND RESTORATION

HYDROSTATIC TEST

BACKFILLING

LOWERING

TRENCHING

INTERNAL JOINTS COATING

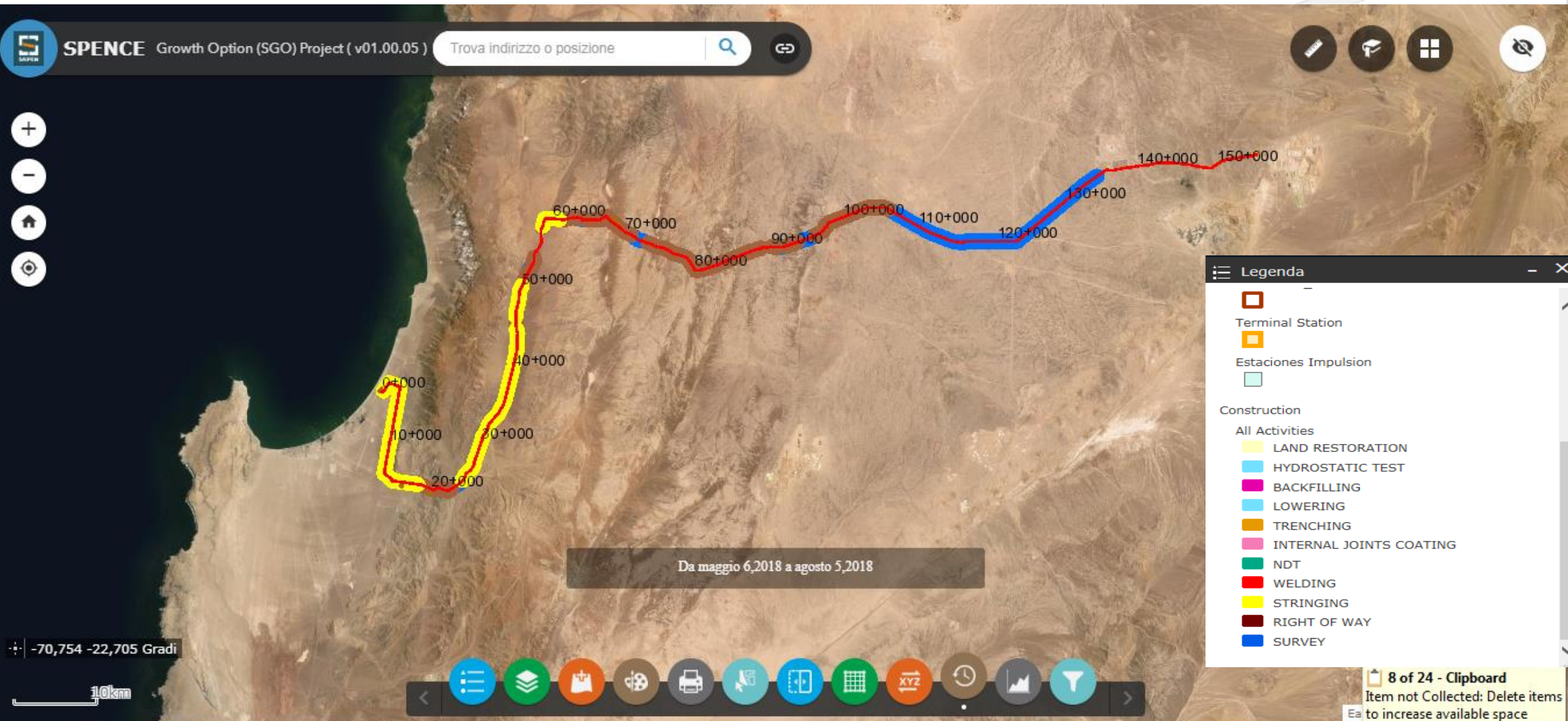
NDT

WELDING

STRINGING

RIGHT OF WAY

SURVEY




SPENCE Growth Option (SGO) Project (v01.00.05)

Trova indirizzo o posizione



Da maggio 6,2018 a novembre 4,2018

-70,747 -22,627 Gradi

10km



Legenda



Terminal Station



Estaciones Impulsion



Construction

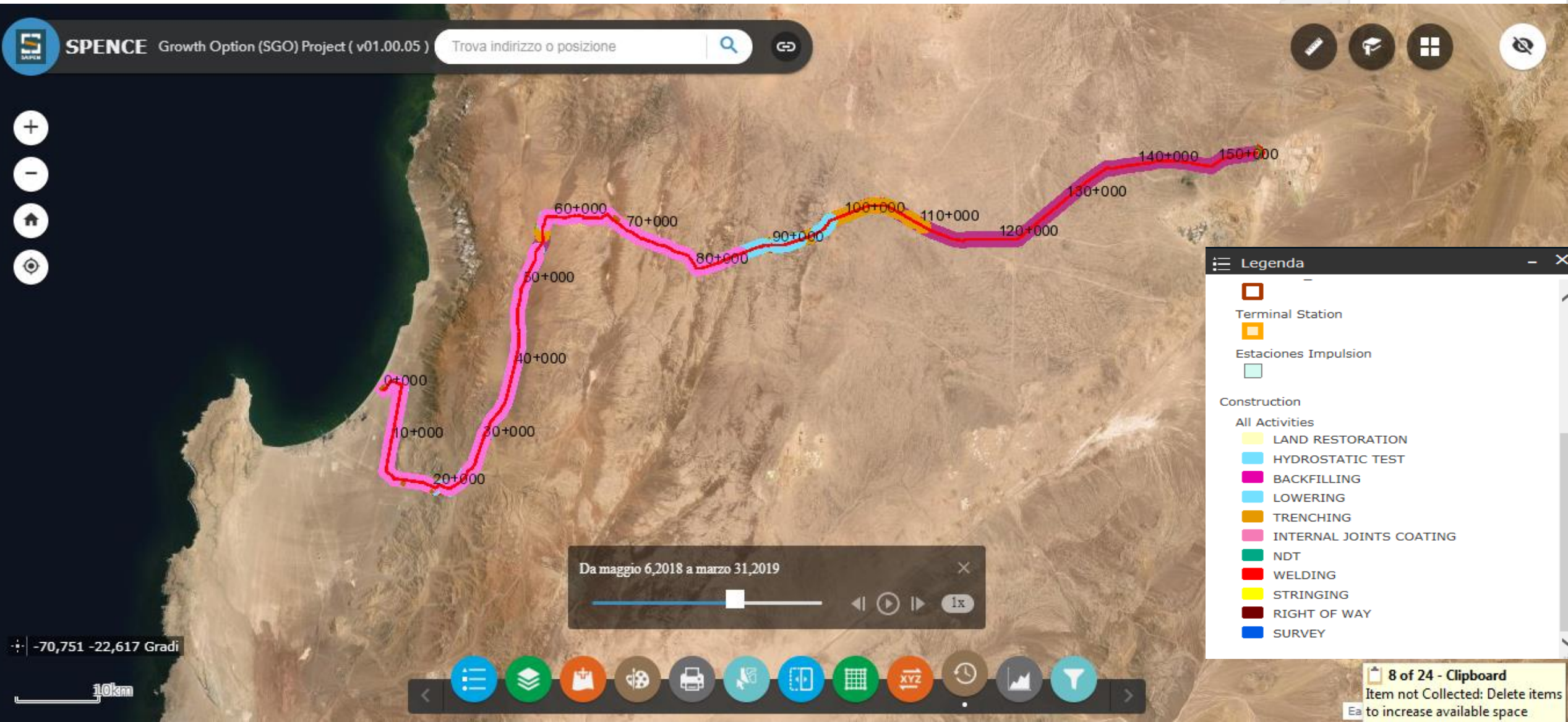
All Activities

- LAND RESTORATION
- HYDROSTATIC TEST
- BACKFILLING
- LOWERING
- TRENCHING
- INTERNAL JOINTS COATING
- NDT
- WELDING
- STRINGING
- RIGHT OF WAY
- SURVEY

8 of 24 - Clipboard

Item not Collected: Delete items to increase available space





Terminal Station

Estaciones Impulsion

Construction

All Activities

LAND RESTORATION

HYDROSTATIC TEST

BACKFILLING

LOWERING

TRENCHING

INTERNAL JOINTS COATING

NDT

WELDING

STRINGING

RIGHT OF WAY

SURVEY


SPENCE Growth Option (SGO) Project (v01.00.05)

Trova indirizzo o posizione



Da maggio 6,2018 a giugno 30,2019

-70,163 -23,196 Gradi

10km

Legenda



Terminal Station



Estaciones Impulsion



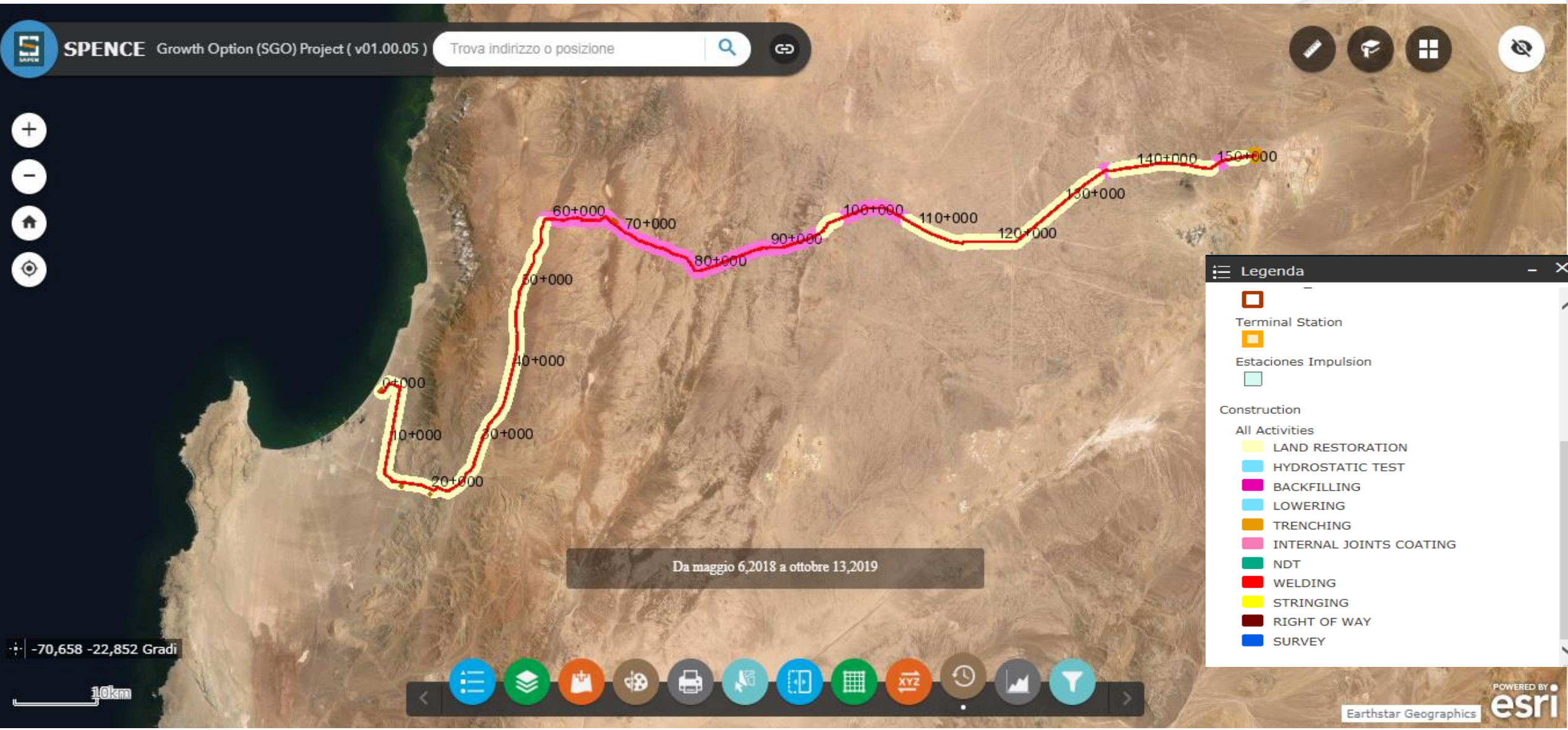
Construction

All Activities

- LAND RESTORATION
- HYDROSTATIC TEST
- BACKFILLING
- LOWERING
- TRENCHING
- INTERNAL JOINTS COATING
- NDT
- WELDING
- STRINGING
- RIGHT OF WAY
- SURVEY

8 of 24 - Clipboard

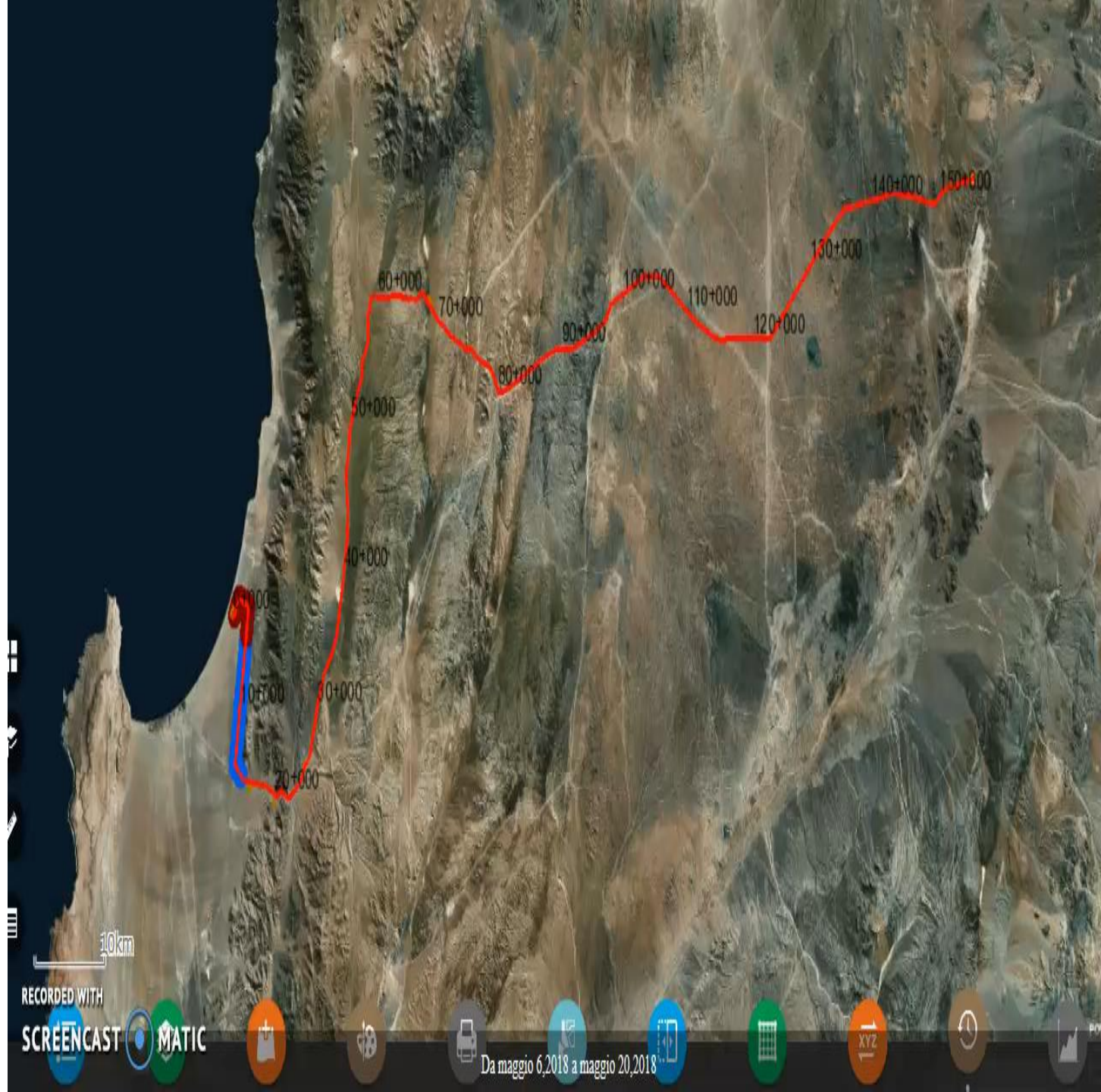
Item not Collected: Delete items to increase available space



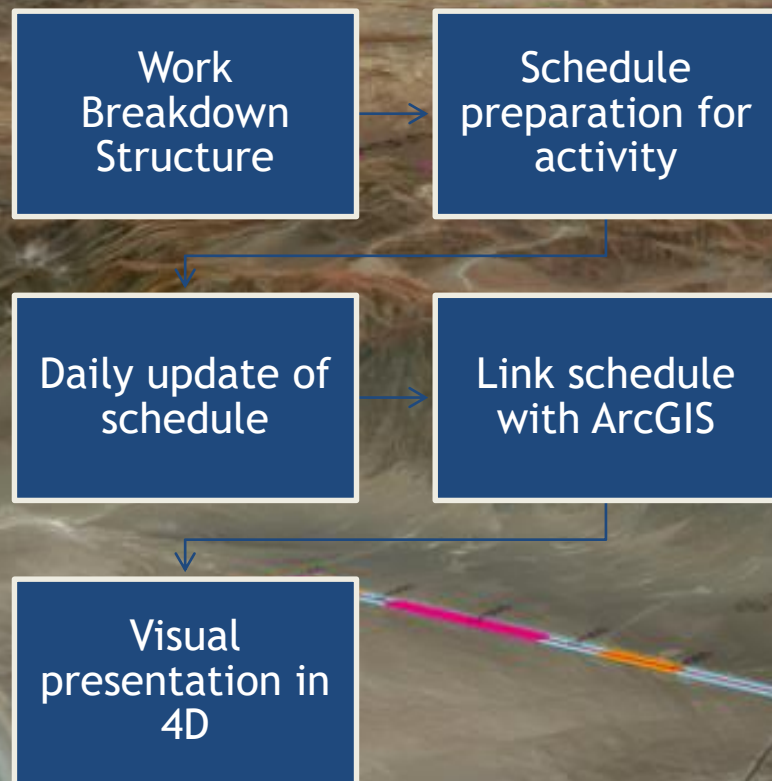
PIPELINE CONSTRUCTION REMOTE MONITORING

Geospatial Technologies

Construction Daily Timelapse to have a video that lets you see how the Project is progressed



Geospatial Technologies



Legenda

- terminal station
- Estaciones Impulsion
- Construction
- All Activities
 - LAND RESTORATION
 - HYDROSTATIC TEST
 - BACKFILLING
 - LOWERING
 - TRENCHING
 - INTERNAL JOINTS COATING
 - NDT
 - WELDING
 - STRINGING

PIPELINE CONSTRUCTION REMOTE MONITORING

Geospatial Technologies

Site daily pipeline construction phases productivity



WBS Liv2

PIPELINE - CONVEYANCE SYSTEM

WBS Liv3

Tramo: Section 3- PS3 to Terminal Station

WBS Liv4

Area: SC3_1 - Section 3 - Pipeline from KP63 to KP154

Activity 1 (required)

WELDING

Activity 1 Split (required if present)

PS3 TO MINESITE

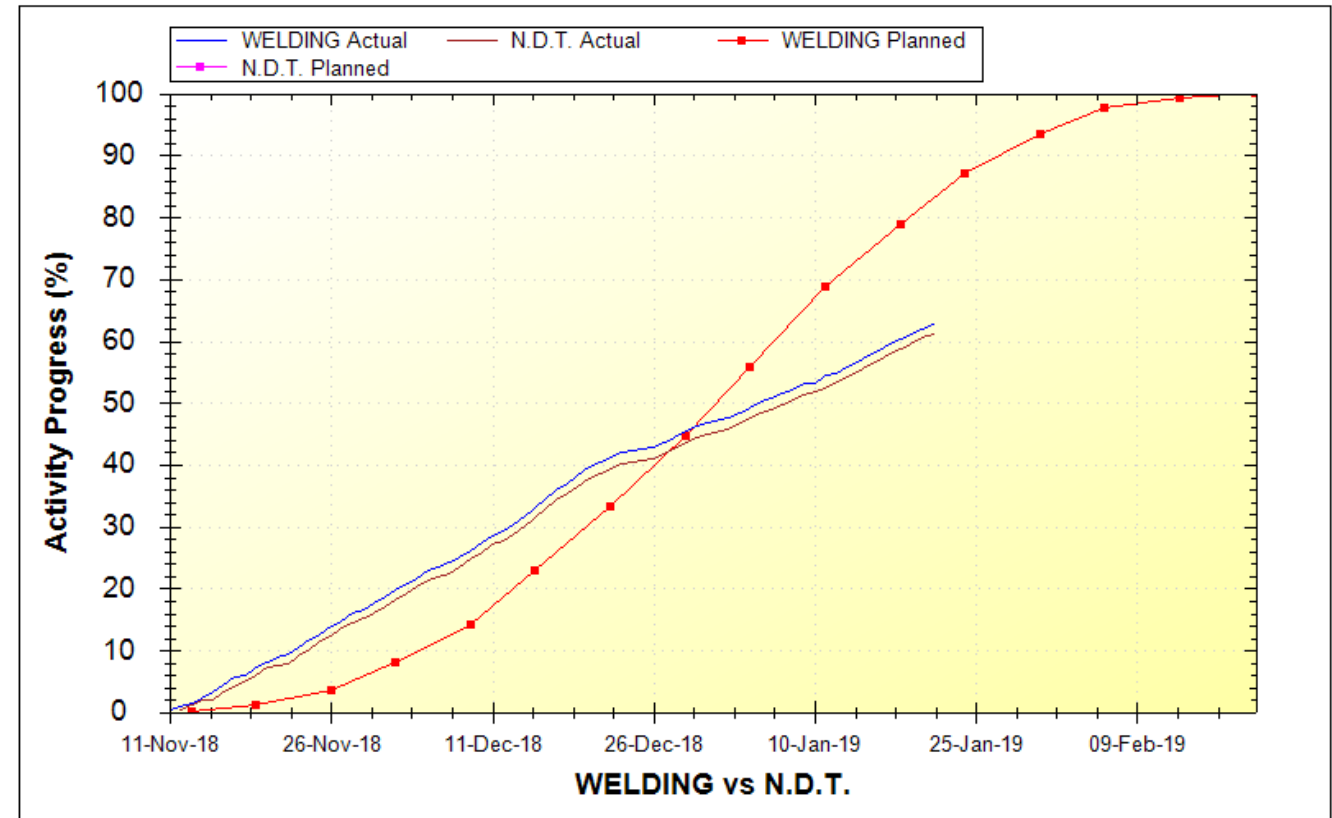
Activity 2 (optional)

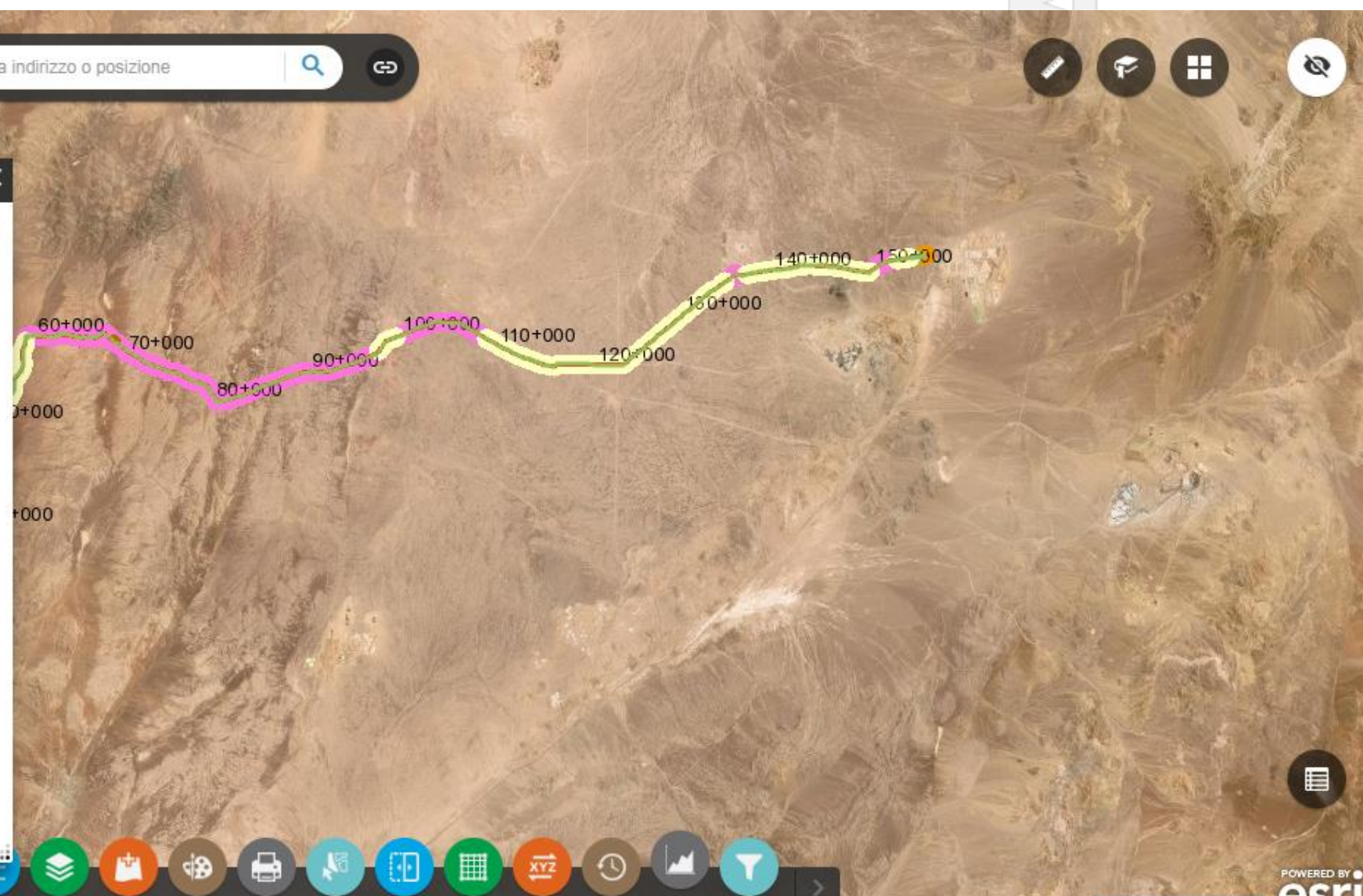
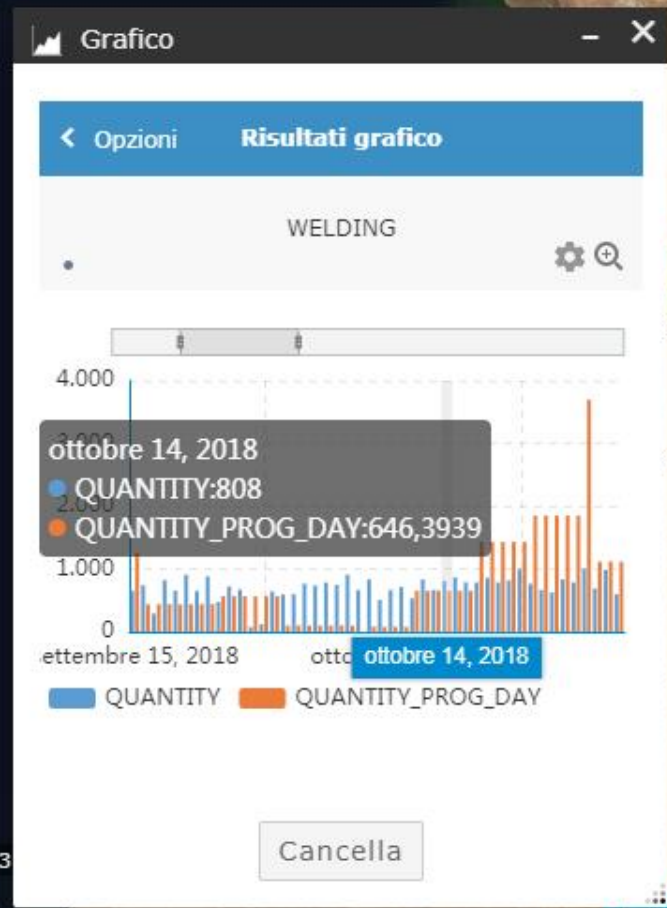
N.D.T.

Activity 2 Split (optional)

PS3 TO MINESITE

Draw Graphic





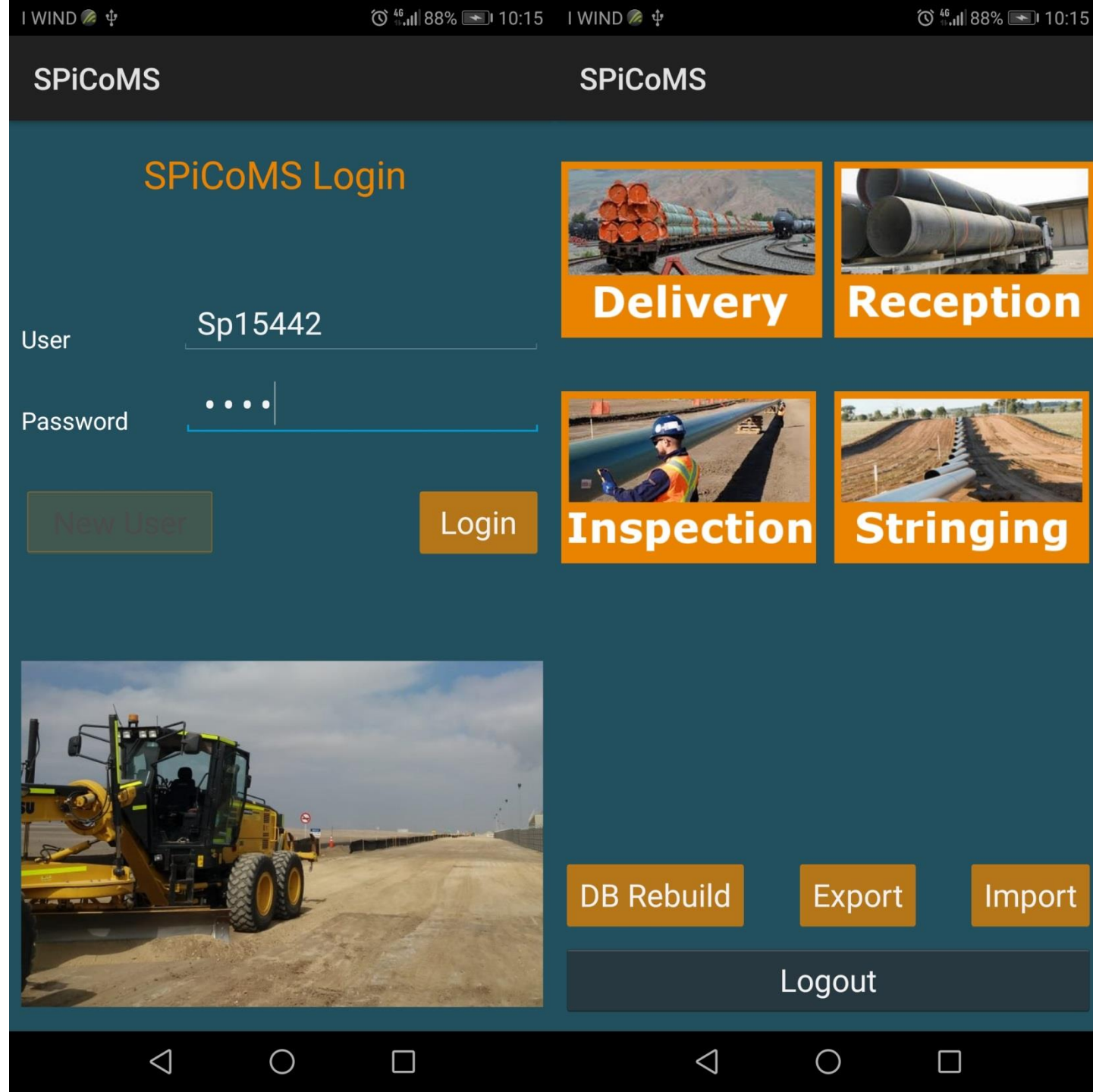


PIPELINE CONSTRUCTION REMOTE MONITORING

Geospatial Technologies

Barcoding is normally used to track linepipe and Other materials from Mill to final location. Smartphone can be used to read barcode whenever a single phase is completed and quality control completed.

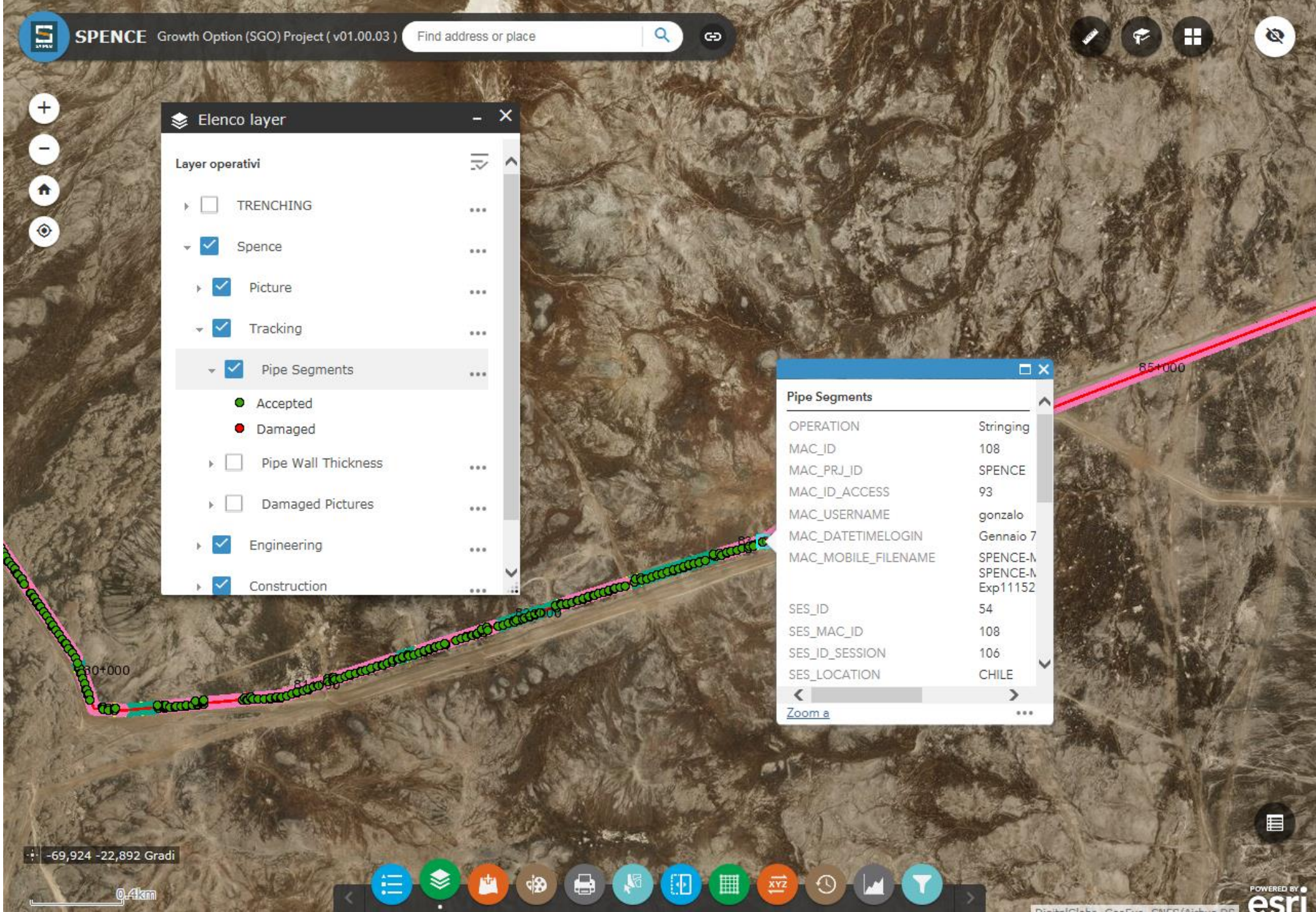
Smartphone built in GPS, the location of each pipe is defined and the quality and physical progress can be recorded and visualized into the same web GIS application





Geospatial Technologies

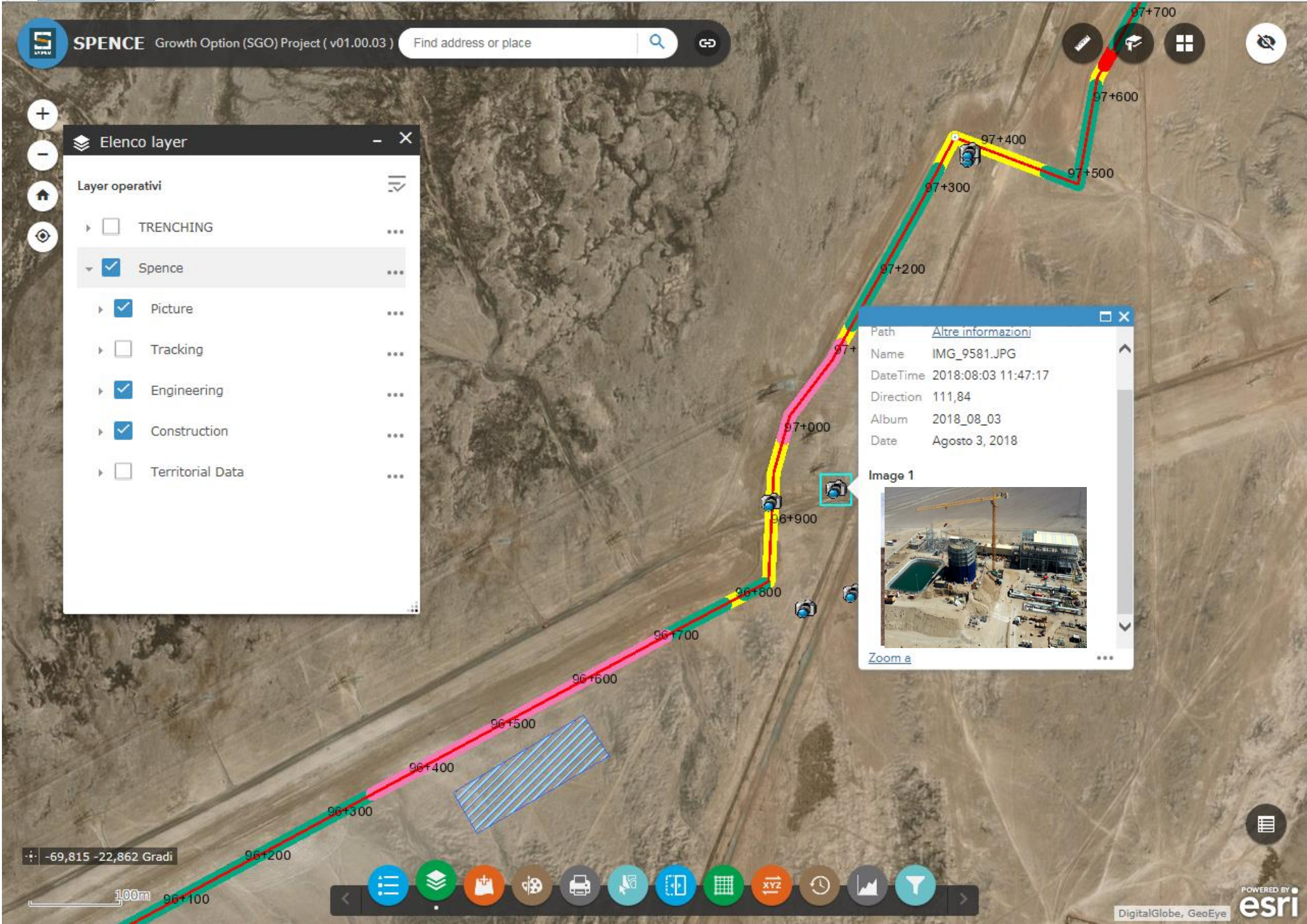
Site daily pipeline construction phases productivity by barcode reading, picture collection,





Geospatial Technologies

Picture Management
System (Culture)



PIPELINE CONSTRUCTION REMOTE MONITORING

Enhanced IT tools

As built involves topographical instrumentations (total station and GPS) and a survey crew that follows pipeline construction and manually collect data from site walking along pipeline (minimum set of data on Welded Joints, bends, ground features and isolated point information)

Survey crew is obliged to walk within the trench after lowering or after partial backfilling.



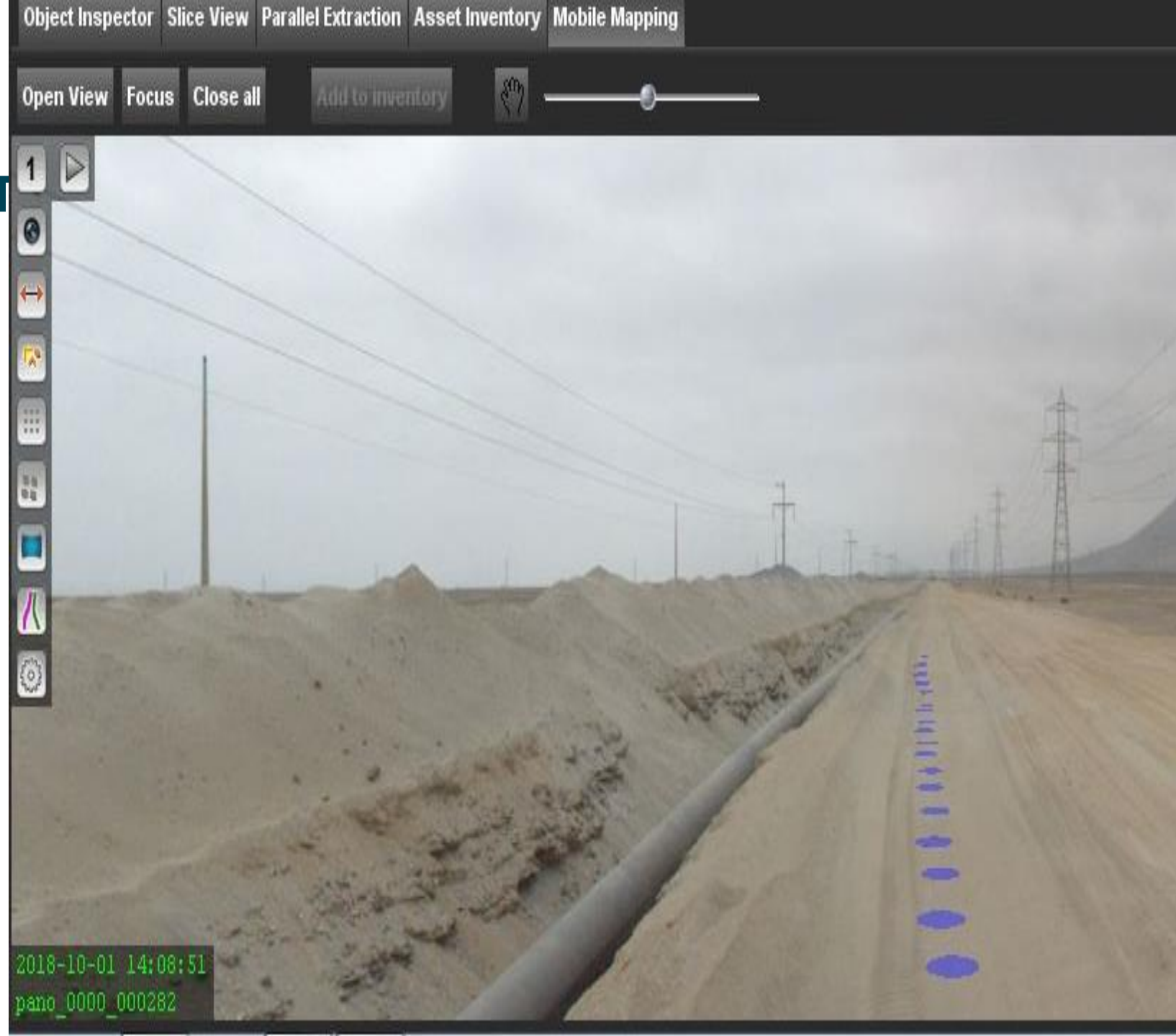


PIPELINE CONSTRUCTION REMOTE MONITORING

Enhanced IT tools

A 3D (or point cloud) models of site from digital photos using an Image sensor system installed on the roof of a 4WD Pick-up allowed to digitalized the as built production.

The crew drives along the ROW, parallel to the lowered pipe as soon lowering phase is completed collecting site data (spherical images, GNSS position, IMU attitude information)

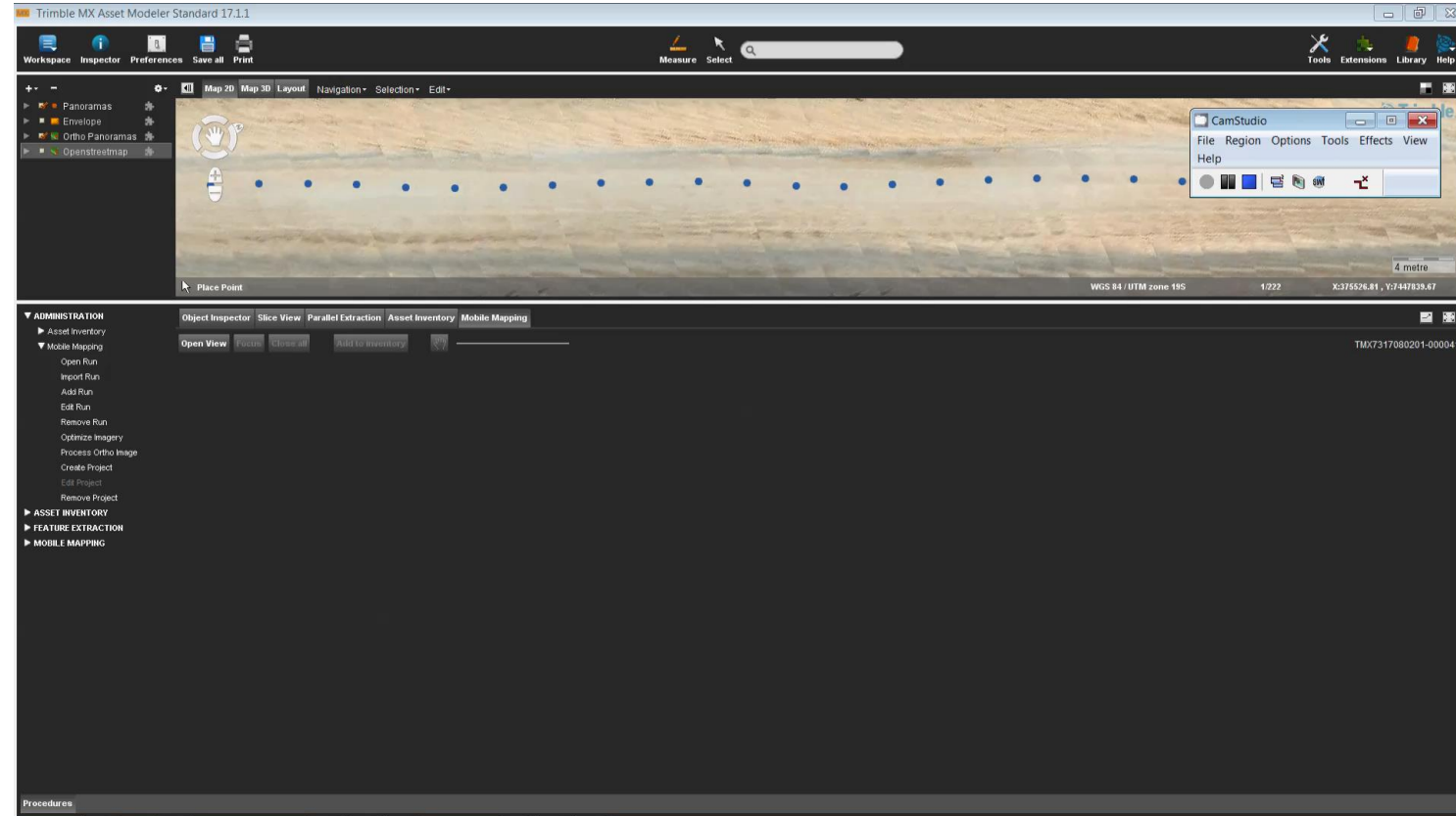


PIPELINE CONSTRUCTION REMOTE MONITORING

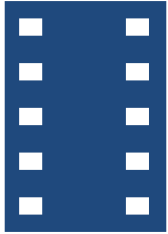
PIPELINE CONSTRUCTION REMOTE MONITORING

Enhanced IT tools

Data acquired are processed to extract geographical information and As Built data while allowing the team a full immersive navigation in a Virtual Reality environment



PIPELINE CONSTRUCTION REMOTE MONITORING



PROJECT TIMELAPSE

SPICOM provide a zoomable video that lets you see how the Project is progressed over the schedule



QUALITY CONTROL DATA

Quality Inspections Forms Signed and available in the system.
Pipe as built information available on tablet for *in-situ* identification (Location, Wall Thickness, Depth, of cover, Welding Number, etc)



CONSTRUCTION HYSTORY DATA

All construction pictures are stored in the system and geolocalized and accessible to all stakeholders.



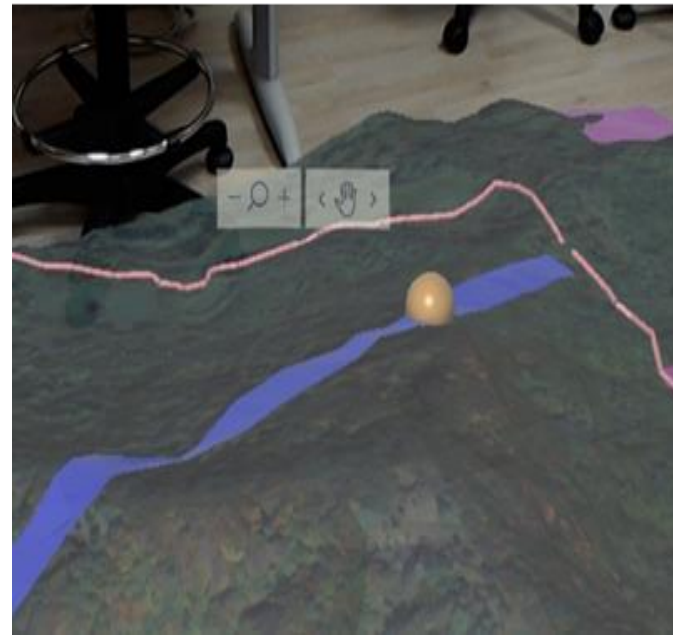
SATELLITE DATA

Satellites, Sentinel-1 (all weather radar mission) and Sentinel-2 (high-resolution optical mission) images available for the entire asset life to check site differences along time

PIPELINE CONSTRUCTION REMOTE MONITORING

Future for management of pipeline construction projects is unavoidably moving to virtual environment, remote control trough digitalization.

Risks and opportunities, wastes and values are to be identified in real time to help production optimization and improve visibility.





THE 53RD ANNUAL IPLOCA CONVENTION
Bangkok, 3rd October 2019

**PIPELINE CONSTRUCTION REMOTE
MONITORING**

Agostino.Napolitano@saipem.com

THANK YOU

