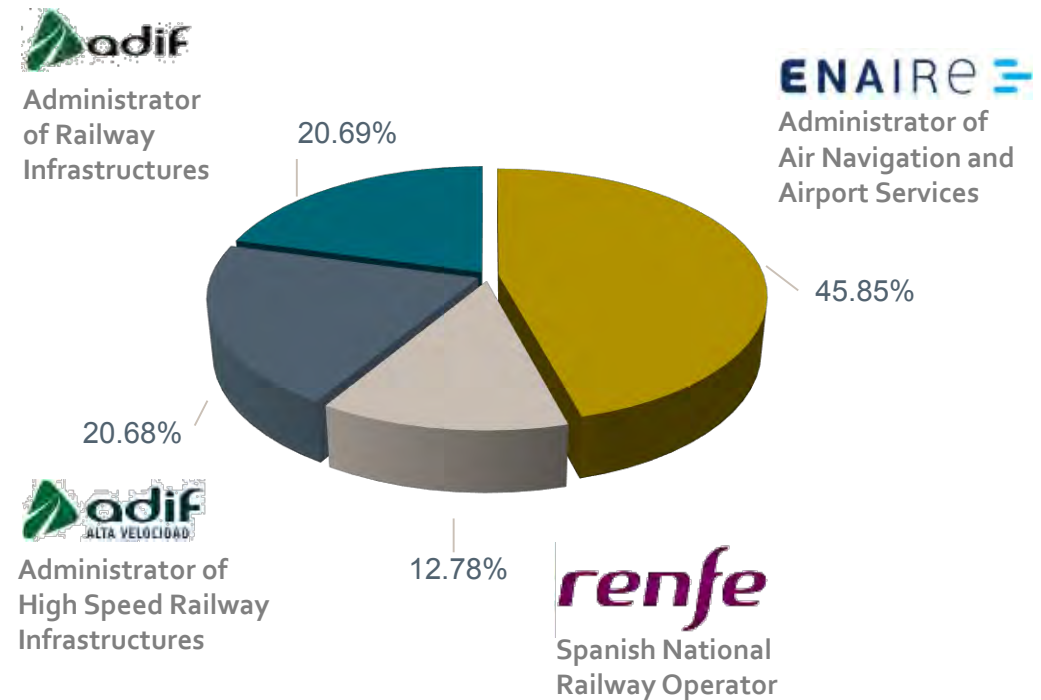




**INECO IS A SPANISH  
STATE-OWNED  
TRADING COMPANY  
UNDER THE MINISTRY  
OF PUBLIC WORKS  
THROUGH ITS  
SHAREHOLDERS:**

### *Shareholders*



## OUR FIGURES

Turnover

**182.46**  
million euros

Operating profit

**4.37**  
million euros

Staff

**2,366**  
employees

*As at December 2014*

## WHAT WE DO

*Ineco is a global leader in transport engineering and consultancy*

*Our global and multimodal nature, as well as being present throughout the life cycle of infrastructures, really sets us apart from our competitors*





## INECO AROUND THE WORLD



## INNOVATION

R&D+i  
effort  
€ 3.886 M

Percentage of  
turnover  
2.13%

34 innovation  
projects

20  
internal projects

---

14  
collaborative projects in  
a consortium

*As at December 2014*

## INECO'S FIRST STEPS WITH DRONES

*Kick-off innovation project in May 2014*



***MICRODRONES FOR  
STRUCTURAL INSPECTIONS***

## WHY THINK OF DRONES

*Bridge bearings are located in difficult places*



*High costs for inspection  
Access is not possible*



## WHAT DID WE DO

- Market research
- Analysis of Legal aspects
- Acquisition of drones
- On site practice
- Summary report
- Opportunities

*DEVELOPMENT OF A NEW PRODUCT*

***Innovation***

# ALL WE NEED



Remote controls

- <http://atooisuv.weebly.com/>
- <http://www.dronetools.es/es/servicios.html>
- [http://www.dronevision.es/fotografia\\_aerea/](http://www.dronevision.es/fotografia_aerea/)
- [www.skyspecs.com](http://www.skyspecs.com)
- [www.cambridgeuav.com](http://www.cambridgeuav.com)
- [www.albotix.es](http://www.albotix.es)
- [www.cartodata.com](http://www.cartodata.com)
- <http://www.r2drones.com/6.html>
- <http://www.todophantom.com/>
- [www.dji.com](http://www.dji.com)
- [www.orbitgis.es](http://www.orbitgis.es)
- [www.marcusuav.com](http://www.marcusuav.com)
- <http://www.engr.colostate.edu/ece-sr-design/AY11/quadcopter/>
- <http://www.bladehelis.com/>
- <http://www.as.northropgrumman.com/products/ghrq4a/index.h>
- <http://www.ga-asi.com/products/aircraft/predator.php>
- <http://www.sciencedaily.com/releases/2011/07/110701203725.ht>
- <http://www.uavforge.net/>
- <http://diydrones.com/>
- <http://www.helikraft-rchicopters.com/store/1909/futaba/6ex-2-r6zfs-6ex-ss.html> (picture of RC controller)
- <http://dlnmhgip6vzuc.cloudfront.net/images/products/10061-0;>
- <http://www.digi.com/products/wireless-wired-embedded-solutio>
- [rmodules/xbee-pro-xsc#overview](http://www.digi.com/products/wireless-wired-embedded-solutio)
- <http://www.iflyrc.com.au/images/xbee%20900.jpg>
- <http://www.onlineethics.org>
- <http://heighttech.com/produkte/>
- <http://intervivoro.com/otras-secciones/proyecto-drone/>
- <http://www.geosoluciones.cl/fotos-aereas-con-uav/>

Drone  
Manufacturers



Models

## THE LAW

*Spanish Law 18/2014, article 50:*

### *Operations with aircrafts piloted by remote control*

- Two groups, MTOM under or above 25 kg
- Pilot license required
  - Includes a theoretical and practical exam
- Pilot > 18 years
- Medical certificate Class 2
- Maximum height 400 feet (120 m)
- Maximum distance to operator 500 m
- Far from urban zonas and people
- Drone Operator registration in AESA

## Draft of new European Law in progress



European Aviation Safety Agency

### Advance Notice of Proposed Amendment 2015-10

#### Introduction of a regulatory framework for the operation of drones

RMT: n/a – 31.7.2015

*New categories*

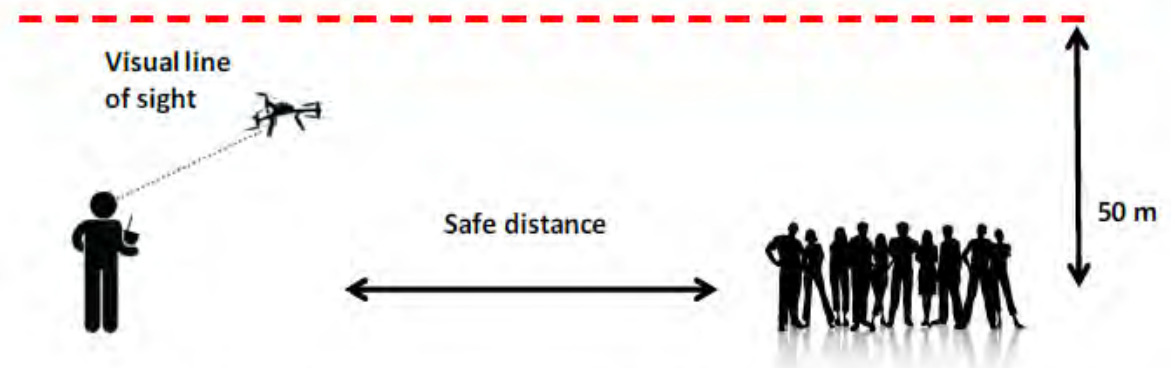


Figure 2: Limitations in the 'open' category: visual line of sight, maximum altitude and minimum distance with respect to uninvolved persons on the ground.



## Acquisitions



*SYMA X5C Explorer*



*DJI Inspire 1*



# Flight simulators

*Phoenix R/C5*



*Flightgear 3.0*





## We work with all kind of structures

*Bridges*



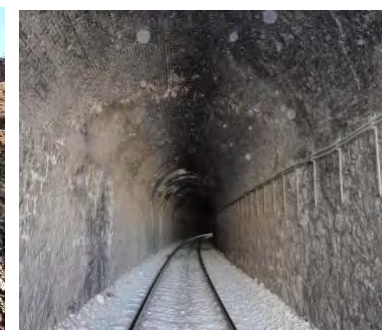
*Buildings*



*Earthworks*



*Tunnels*



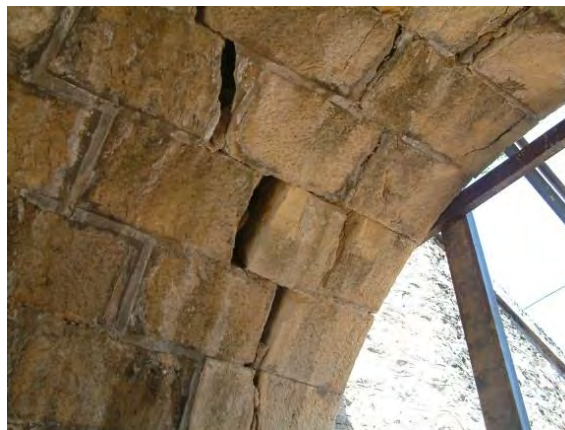


## We analyze all kind of materials

*Concrete*



*Masonry*



*Steel*



*Wood*



*Soil*



*Water*





## Building inspection





# Environmental





# BRIDGE INSPECTION





## Bridge inspection



## INECO'S NEXT STEPS WITH DRONES

*Kick-off innovation project in August 2015*



***MULTIPURPOSE DRONES***

## LINES OF INVESTIGATION

- Certification of drone pilots
- Registration of Ineco as a drone operator
- On site training
- 3D modeling using photogrammetry
- Topographic surveying
- Thermal imaging

## CERTIFICATION OF PILOTS & REGISTRATION AS DRONE OPERATOR

### *Spanish Law 18/2014*

- Pilot - Theoretical exam
- Pilot - Practical exam
- Pilot - Flying test
- Pilot - Medical test
- Insurance
- Characteristics drone
- Safety measures
- Maintenance manual
- Risk analysis
- Flight routes

### *Registration*



## SAFETY – BEST PRACTICES

Height, limit 400 ft. (120 m)

Distance between drone and pilot, limit 500 m

No flying over cities and villages

No flying over concentrations of people

8 km distance to airports (CTR)

Always in direct visual line of contact

No flying at night

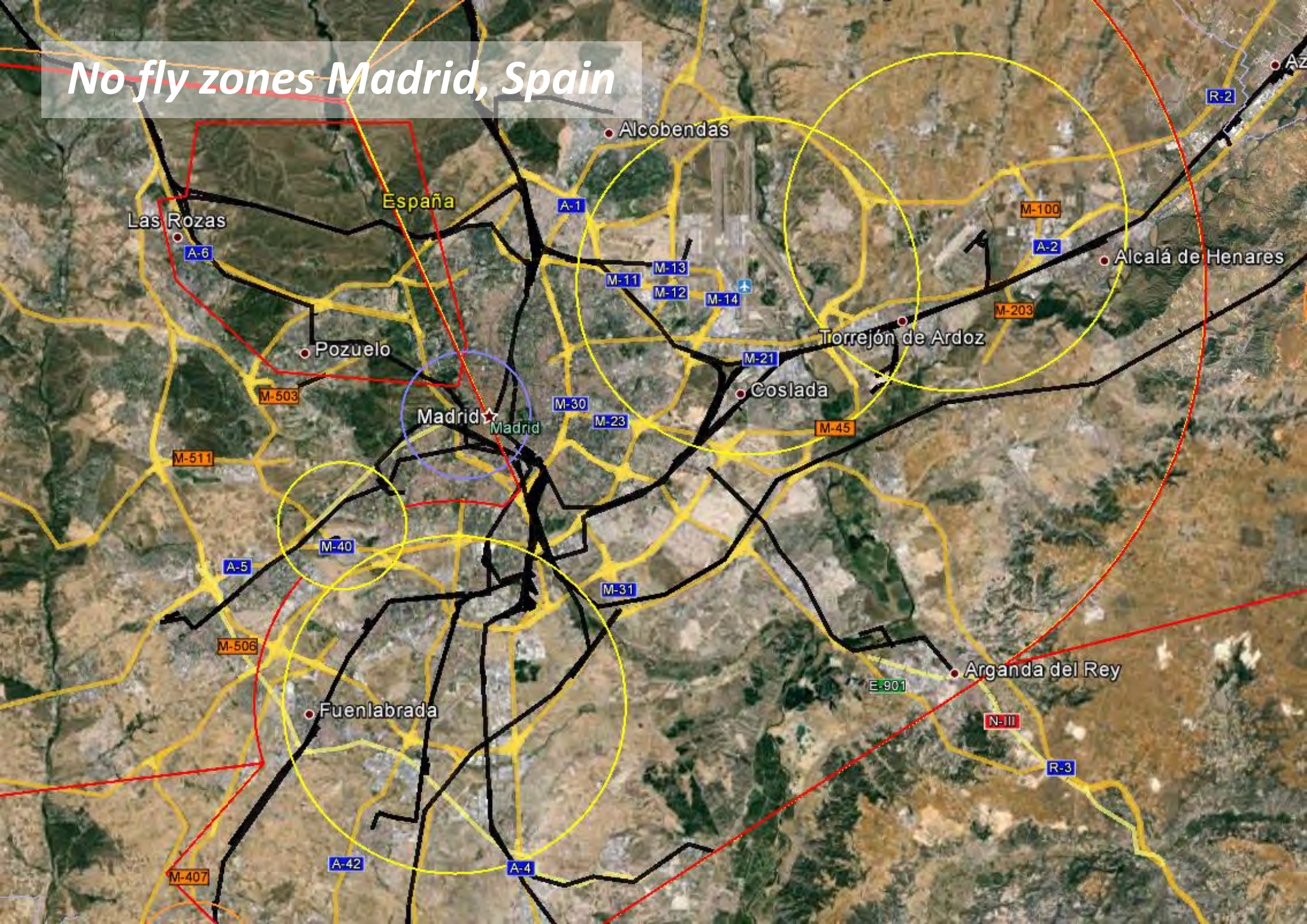
Checklist



***No fly zones***



# No fly zones Madrid, Spain





## DIFFICULTIES TO TRANSFORM INNOVATION INTO BUSINESS

Legal limitations

Investments (second drone)

Risks during flying (crashes)

Weather conditions

Battery limitations (max. 20 minutes)

Clients don't want to change

Work schedule of the pilots

How to do the pricing





ON SITE TRAINING





## Bridge bearing inspection



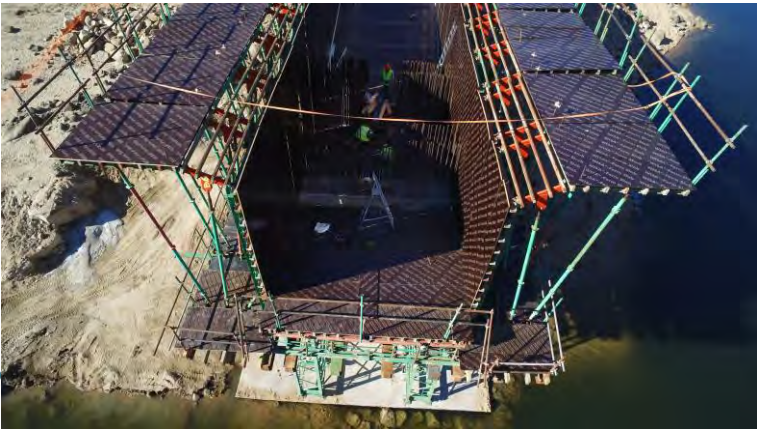
*Viaduct in High Speed Line  
Madrid-Valladolid*





**ON SITE TRAINING**





**New road bridge construction site**





# 3D Modeling

## *Viaduct in High Speed Line Madrid-Valladolid*





# 3D Modeling

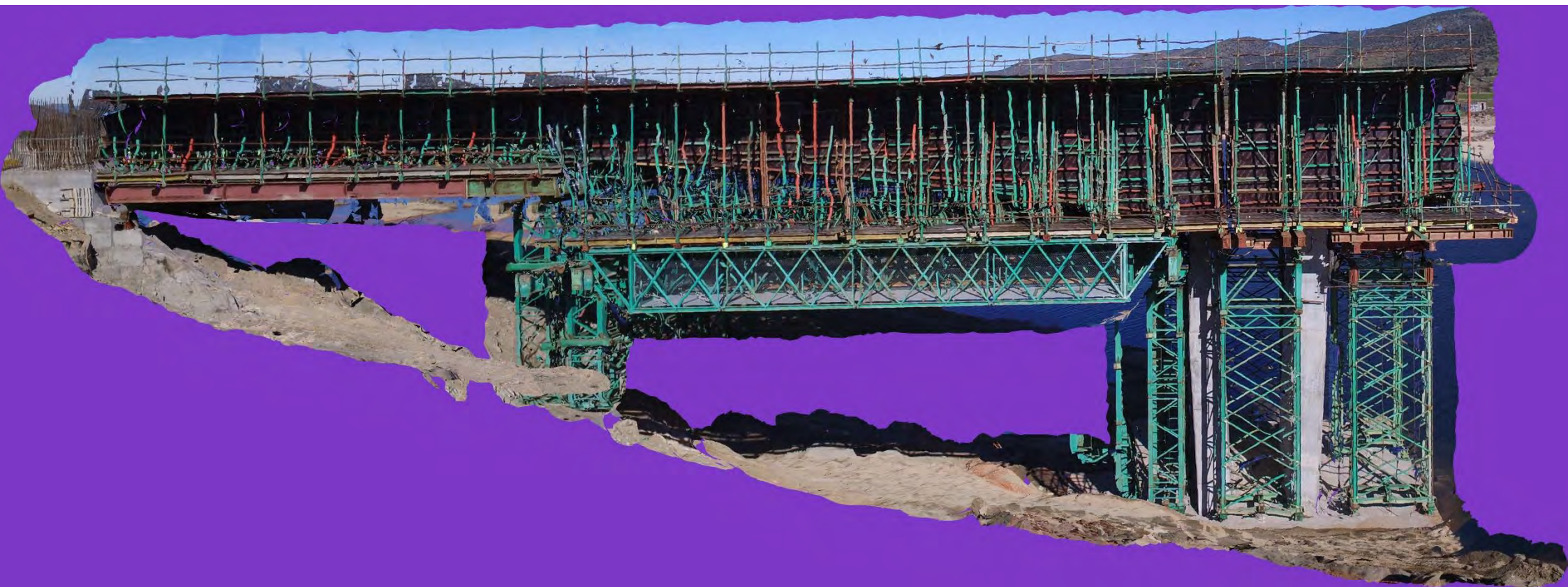


*Viaduct in High Speed Line Madrid-Valladolid*



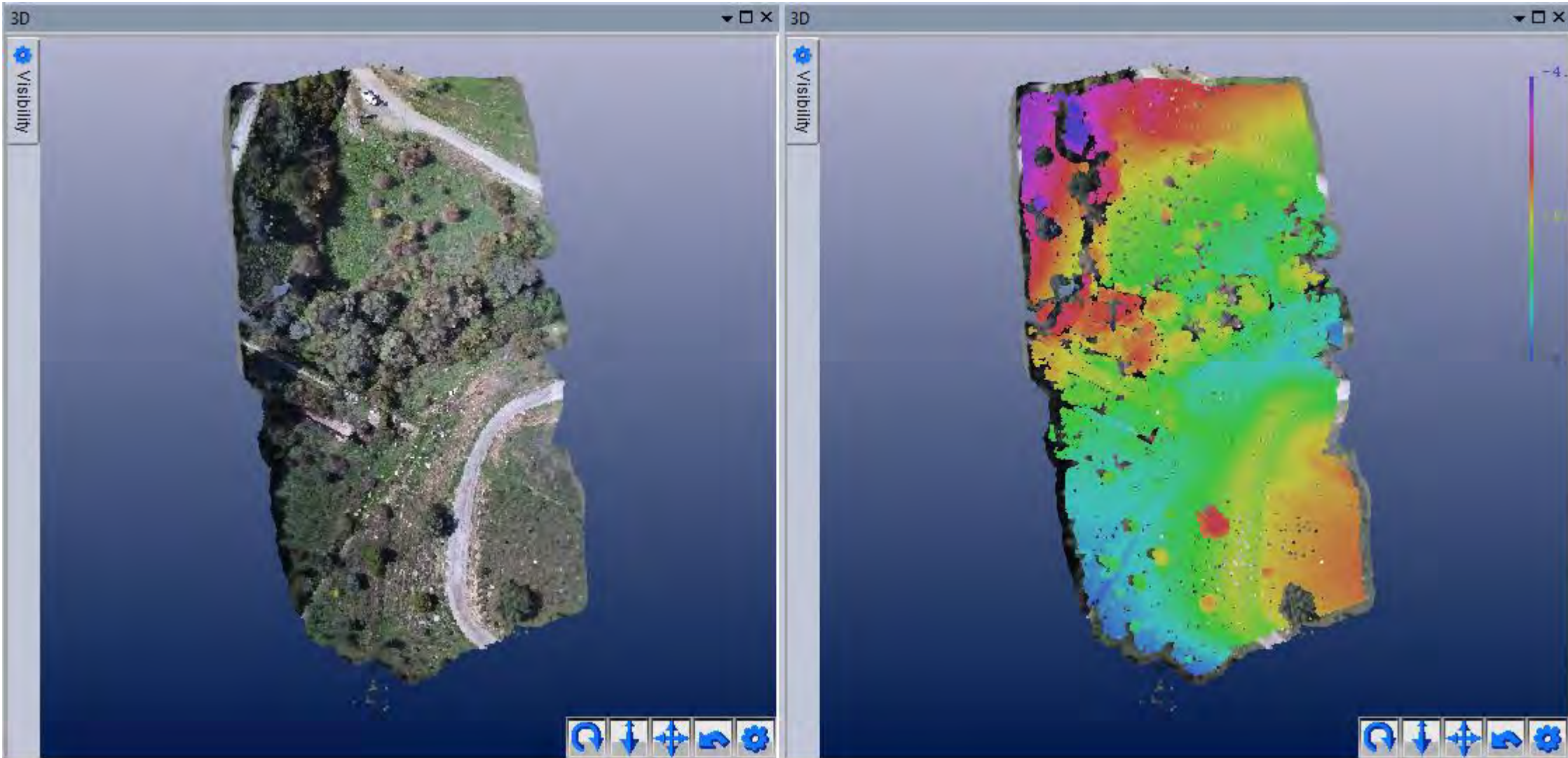
# 3D Modeling

*Construction new road bridge*

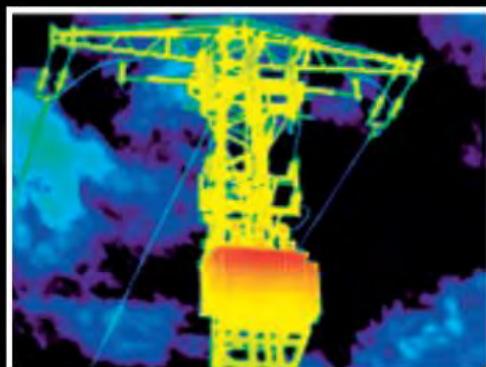
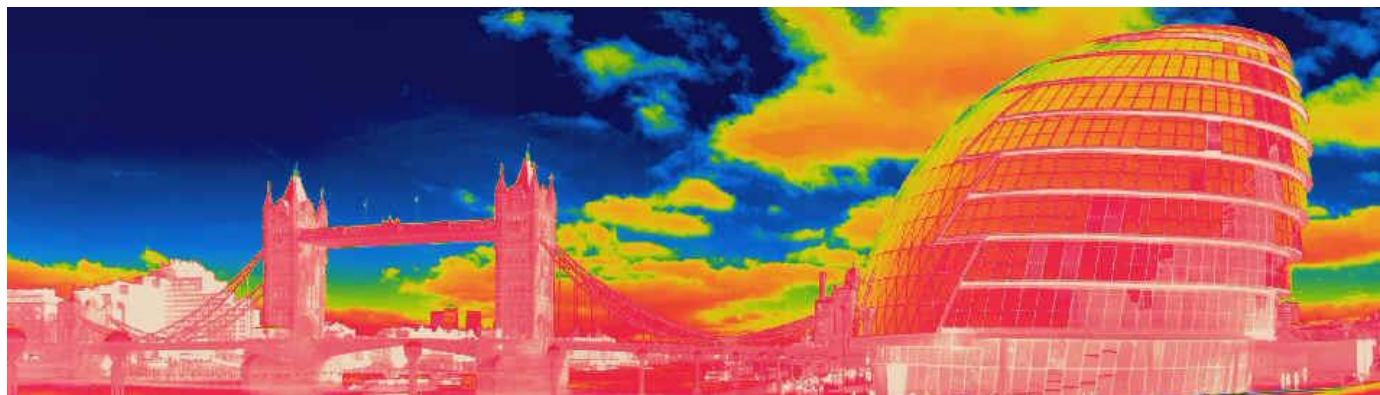




# Topographic surveying



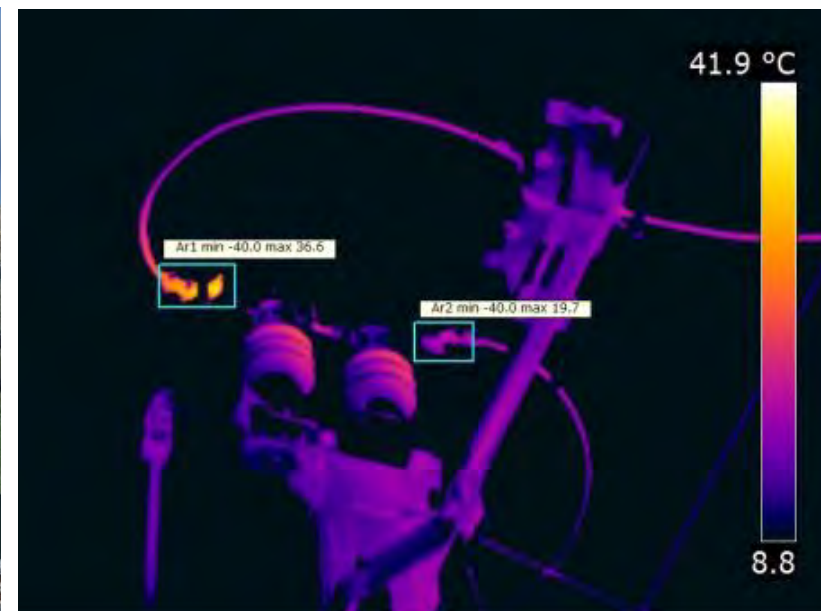
## Thermal imaging



Source: NEC



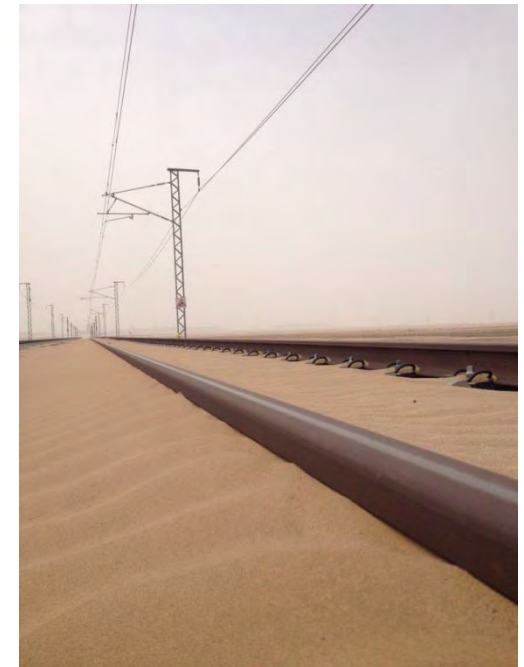
# Thermal imaging





## SOLUTIONS IN ARID CLIMATES

- Detection of sand and rocks on the train track
- Extreme climatic conditions
- Compatibility of RPAS with high speed lines
- Movements in earthworks
- Structural inspections
- IR cameras
- Digital Surface Modeling



*Special interest for Haramain High Speed train Makkah-Madinah*



\*) Financed by:



\*) Supported by:

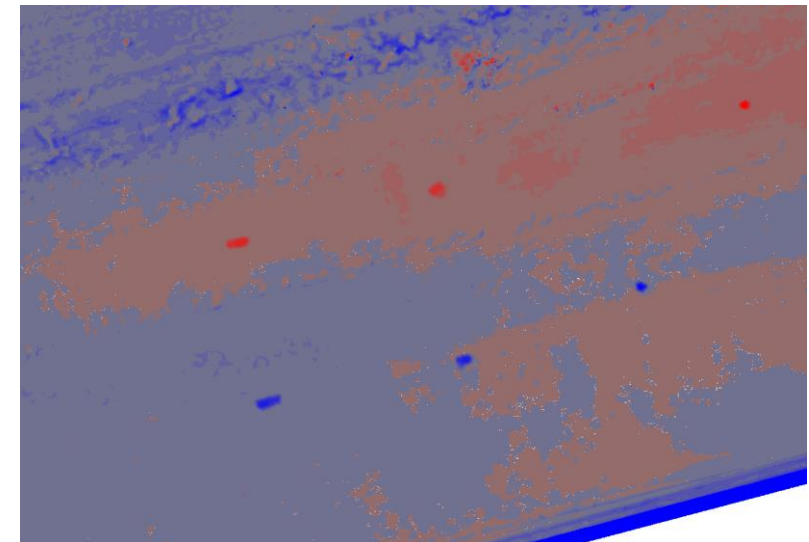


\*) Supported by:



## SIMULATION: TRACK INVASION OF ROCKS

*Tested on an abandoned railway line*



*Automatic detection of changes  
(participation: Elecnor Deimos)*





## Inventions: boat-dron for bridge inspection







*INTERNATIONAL SEMINAR ON DRONES FOR TRANSPORT*

# USE OF DRONES FOR RAILWAY INFRASTRUCTURES INSPECTIONS IN SPAIN

どうもありがとうございます

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