STASS

System Two Assess and Seal Solution

NIA Innovation

Richard Hynes-Cooper (LCNI 2018)

we are the network

The problem

Large diameter mains – Intelligence and leakage

- NGN have 1,700 km of Tier 2 and 3 assets
- Repair or assessment has significant impact and is expensive.
- There are 3 key drivers for intervention in relation to these assets:
  - Leakage identification and repair
  - Proactive risk management
  - Confirmation of as laid data
- During 2015 NGN carried out in excess of 1,100 repairs to large diameter leaking joints.
- The largest population within the Tier 2 to 3 range was 12”, 18” and 24” with associated repair costs circa £5m.

The project

Proactive management of large diameter assets…

Inspection and repair

Leakage

- Maximise the opportunity from the excavation with up to 64 joints or connections treated or sealed from 1 point of entry (256m).

Proactive risk management

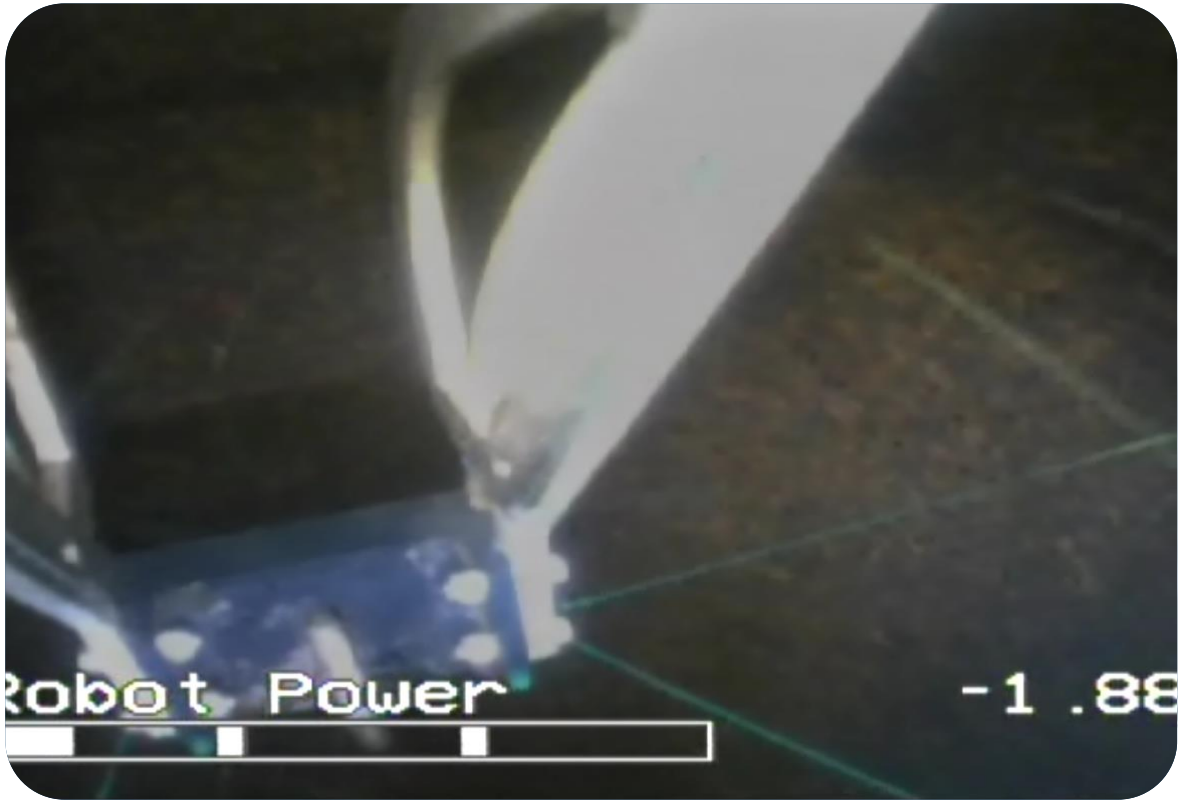
- Objective to be proactive, to treat joints and connections based on either confirmation of a leak or if statistical data generated identifies other areas for proactive maintenance.

Validation of as laid data

- Increase the information on GIS to create a balance of visual data and location data to better gain intelligence relating to the depth, number of joints per pipe length and the location of pipe features.

The project

What development and assessment was required to enable the delivery of more efficient operations…



Data capture

- The data generated from the inspection process must be captured and transferred to NGN back office systems.

STC and procedural requirements

- The development of skills, training and competency to enable an in-house delivery model is a key project requirement

Operational efficiency

- Measure the impacts that the solution enables in terms of customer, safety and cost.

The Challenge

Management and repair of large diameter assets with improved efficiency and intelligence…

Large diameter gas mains suffer from leakage, have debris issues and may need to be replaced as part of a repair CBA.

- **Customer and stakeholder** - Time to repair using existing methods (2-3 weeks).
- **Safety and environment** - Large and deep excavations create risk to operatives and increased spoil to landfill.
- **Cost and efficiency** - One hole, one repair results in significant costs .

Less holes, less leakage, less road works

The Technology

A different approach using 3 existing technologies…

(1) Synthotrax Intelligent Robotic Vehicle (2) ALH Bond and Bolt Technique and (3) ALH Main / Flex-spray LC12 sealants

- **Access** – Single excavation?
- **Distance** – 260 metres?
- **Task** – Pick one????
- **Communication and data capture** – What protocol? How many languages? Storage? *(How much is too much data??)*
- **Operating model** - Development of system that can be operated by NGN direct labour teams to maximise cost benefit.

The Technology

The pipe… who, where and what?

Access:

- Encirclement clamp 12” to 23”
- Bond and Bolt in ≥24” pipe

Treatment:

- Full 360 degree joint spraying (ALH Mainspray)

Identify and locate:

- Targeted feature spraying (point laser)
- Line laser greater aligning and aiming accuracy
- Sonde

Vision:

- One Titan™ Pan and Tilt camera for full circumferential vision
- One fixed front-facing camera
- One fixed rear camera

The Field Trials (Pt.1)

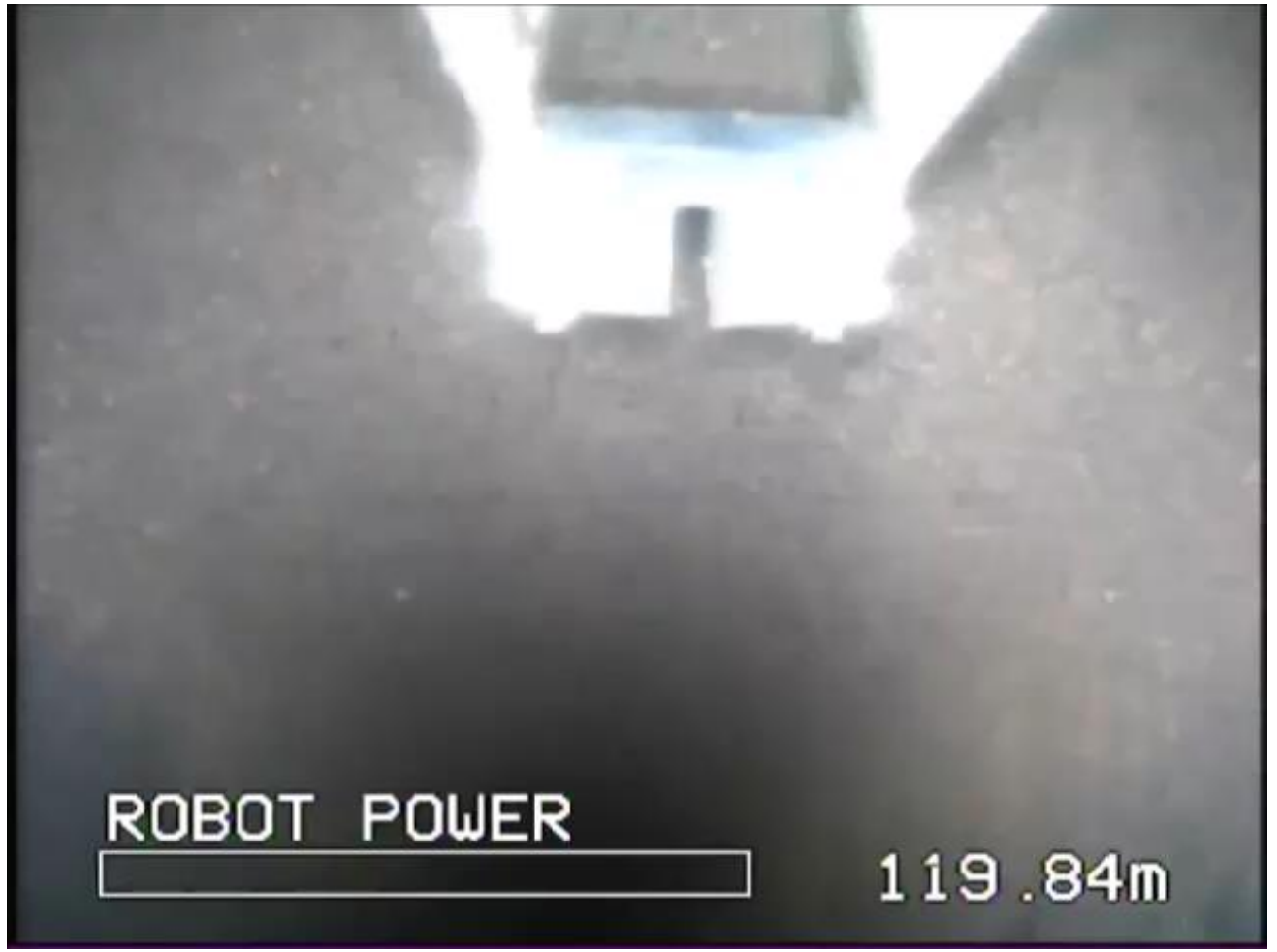
Initial success and learning…

Progress to date - 7 Trials completed

- Variation based on learning, in order meet 100% of objectives, robot B had limitations.
- Confidence gained that Flexspray is resolving leakage – targeted and accurate.
- Provided an Inside out picture of mains & features.
- Sealant deployed on 32 joints in 2 ¼ hrs (average 4 mins Joint to Joint).
- NGN led operation – Not a specialist service.

The Field trials

Initial success and learning…



The Technology

Challenges identified from initial field trials

- During initial field trials the project team encountered more arduous conditions than expected.
- The main challenge is associated with the level and variability of debris present within the gas mains, which has reduced and varied the travel distance requiring additional maintenance time on site.
- Other challenges relating to in-pipe location, positional detection and accuracy of sealant release were identified.

The Technology

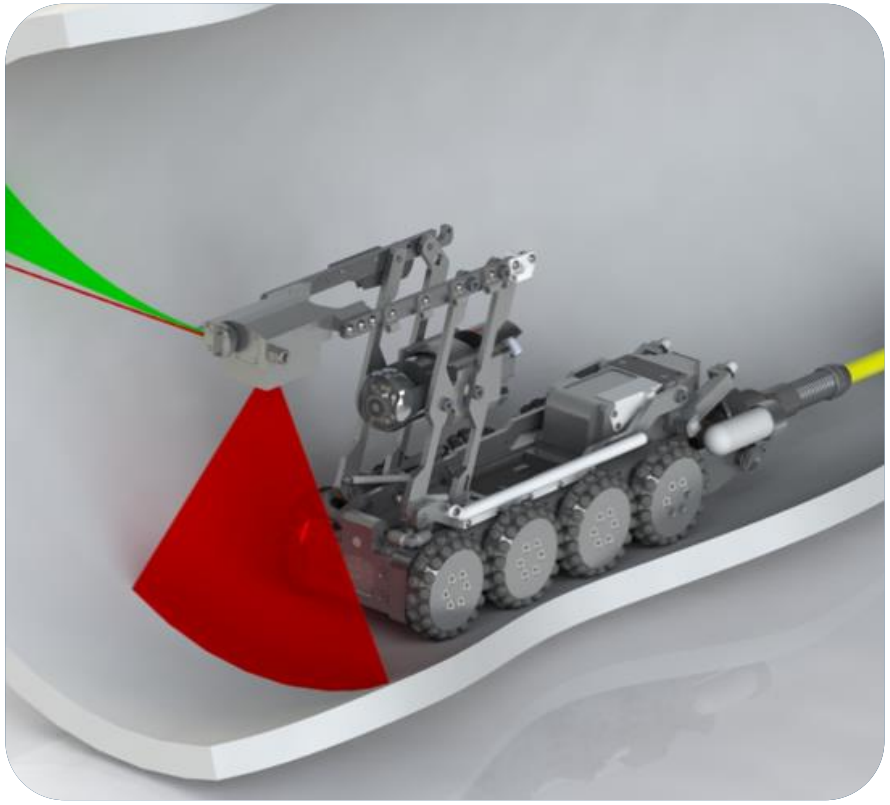
Challenges identified from initial field trials…

- Significant assessment and design was completed to identify functionality requirements
- The STASS 'long wheel base' design was commissioned.
- These design developments include:
  - New driven wheels
  - Substantial additional weight
  - Drive chains with a tensioning system to meet the needs to the challenge identified

ROBOT A Concept	ROBOT B (SWB)	ROBOT C (LWB)
		
VISION AND SPRAY LIMITATIONS DRIVE DISTANCE & DEBRIS LIMITATIONS PROTOTYPE	DISTANCE LIMITATION JOINT SPRAYING ONLY WET DEBRIS ISSUE OPTIMISED 12" to 18" 80 -130m TRAVEL	16" & ABOVE VERTICAL LIVE LAUNCH MODULAR DRIVE SYSTEM MULTIPLE WHEELS & CHAIN TRACKS LASER AND SPRAY TARGETER ACTUATED LIFTER INCREASED WEIGHT IMPROVED SONDE ENCLOSURE

The Technology

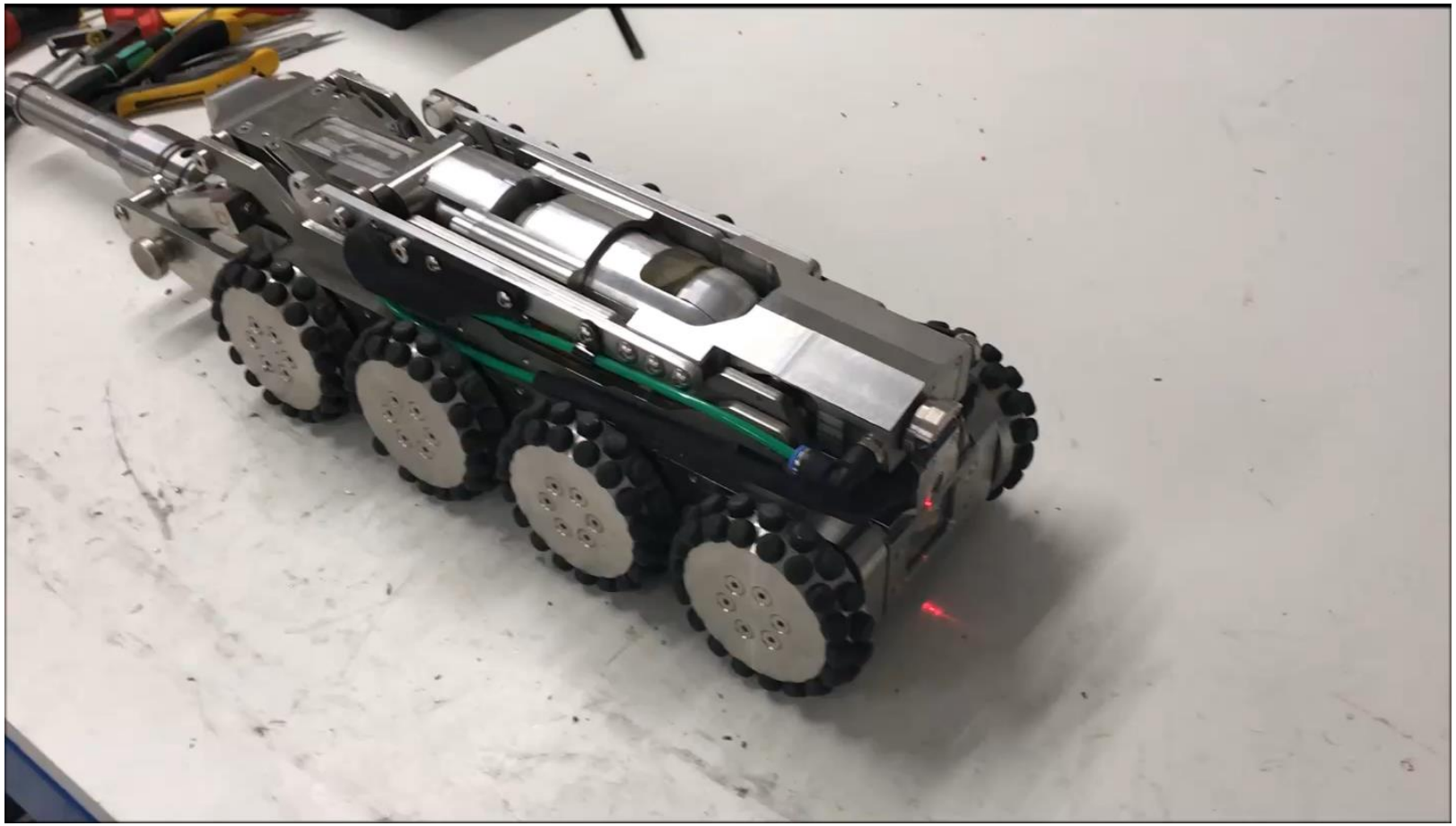
Over coming the identified challenges…



- Spinning nozzle spraying
- 16” and above
- Laser targeted for overspray protection
- Extendable camera & spray head
- Increased weight +30% for max distance
- Brush attachment for debris disturbance
- Multiple 'wheel options' for variable conditions witnessed on trials
- Now compatible with 'chain' tracks (Anti Jamming)
- Various configurations of height (Anti grounding)
- New mountings and dual drive uses sprockets to eject debris from mechanism (tank / JCB)
- Ride heights are limited by the access hole (6” typical)

The Field trials

Expectations, assessment and learning



The Field trials

Case Study – Colne Road, West Yorkshire

Single day summary…

NGN DLO engineers delivered:

- Vertical launch the robot via a Bond and Bolt connection to a 24” main.
- Identification of debris in the bottom of the main.
- Identification of network features such as joints and plugs via in-built Sonde to allow data capture and recording.
- Successful travel of approximately 100m (into the junction of the main road from Huddersfield to Holmfirth without disrupting traffic flow).
- Identification of ‘loose lead’ becoming detached from the inside of lead yarn joints.
- Identification of clear water ingress into the 24” main and direction of travel of water as it ran into the main.
- Internal main spray treatment of 17 24” lead yarn joints via targeted and precise deployment of ‘glow in the dark’ sealant which was visible on camera.

The Field trials

Next steps…

- Field trials will continue to until late November 18 to prove full size range;
- 12” – 2 off
- 16” – 1 off
- 18” – 3 off
- 20” – 2 off
- 24” – 5 off
- 36” – 3 off
- Development of in-house documentation and process to formalise SCO requirements
- Opportunity for dissemination with others
  Contact Richard Hynes-Cooper / Wez Little
- Transition in December to Project Closure – under 18 months to a new established technique