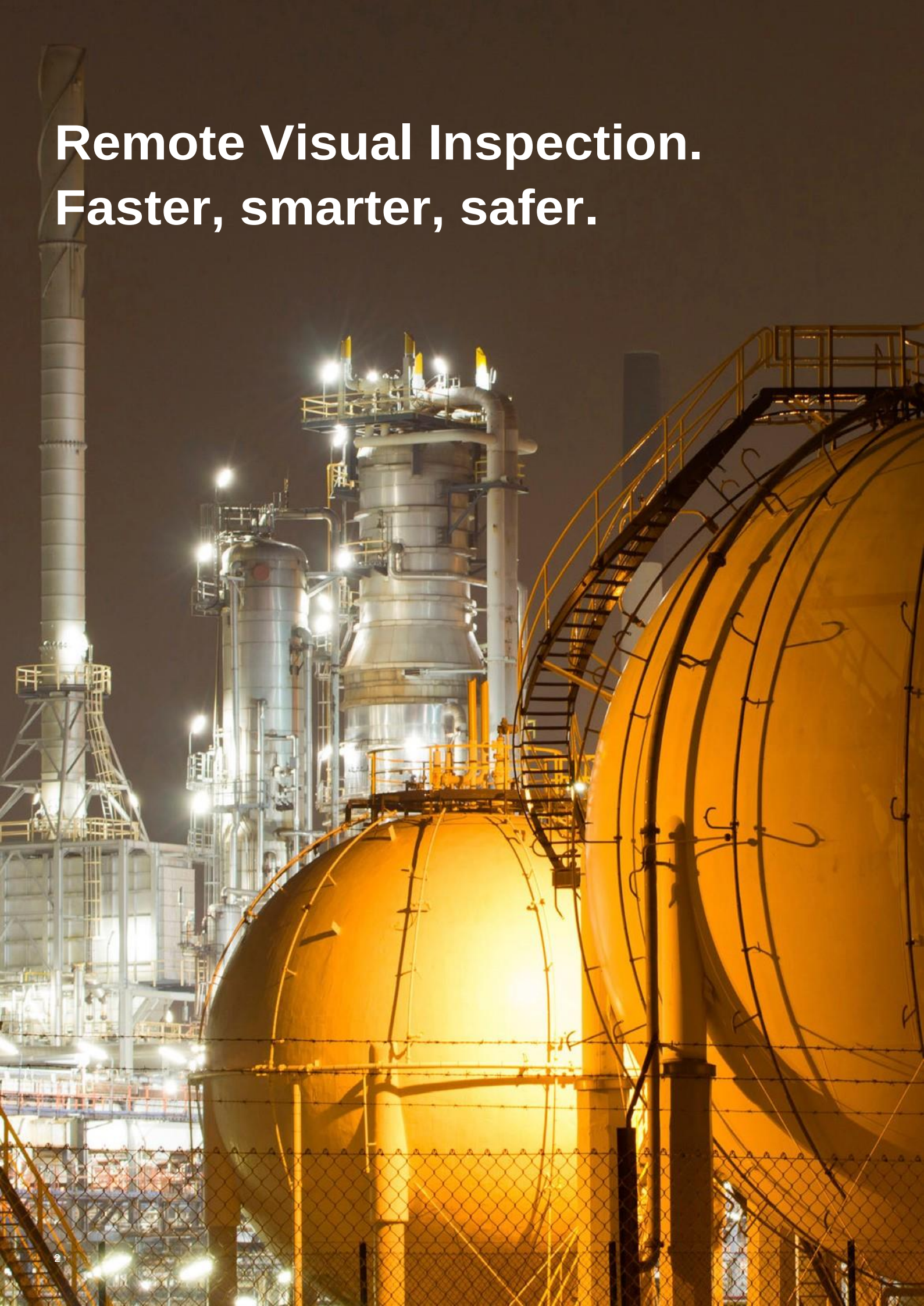
Waygate Technologies
a Baker Hughes business

FAST RVI

Robotic Visual Inspection in confined space

Remote Visual Inspection.
Faster, smarter, safer.

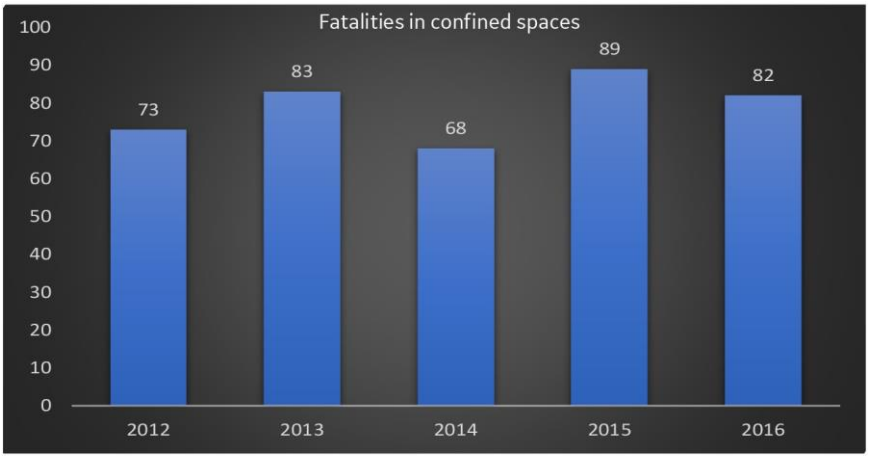


The US Occupational Safety and Health Authority (OSHA) estimates that two million workers annually enter confined spaces in some 225,000 workplaces.

If we translate this statistic globally, it is clear that tens of millions of workers enter confined spaces every year. The implications are clear - confined spaces are a universal problem for industry.

The aforementioned example of a confined space accident also highlights the statistic that more than half of all workplace confined space fatalities involve workers trying to rescue their colleagues.

These fatalities occur where people have gone to the rescue of others and found themselves in similar trouble.



Data Source: U.S. Bureau of Labor Statistics, primary and secondary source of injury by major private industry division, 2012-2016 Census of Fatal Occupational Injuries in Confined Spaces

Confined Spaces

Visual Inspection is the most performed inspection type in the Oil and Gas industry, 80% of all inspections are Visual Testing (VT).

Today there are two ways to perform a visual inspection inside confined spaces. The traditional way is to physically access the confined space through manways. Certified and experienced engineers will enter and “look” at the predefined locations to take pictures for reporting. Beside very expensive organizational issues such as watchmen and ventilation this procedure is very dangerous for the experts.

The more advanced way is a pan-tilt-zoom (PTZ) camera mounted onto a rod. Todays camera technology delivers remarkable results. However this technique has obvious limitations. It still requires 2 operators, one holding the camera and the other performing the inspection. Most features in vessels are out of reach and still require manpower entering the confined space.k

The right way

The FAST RVI allows to perform a full remote visual inspection while drastically reducing risk for the operator. The inspection camera is carried by a robot and deployed through the manway. The whole system can be operated by one inspector. It can be navigated to predefined places and perform the inspection in a structured and professional way.

The duration and quality of these inspections are greatly increased. The platform with the inspection camera mounted is deployed through the manway of the asset to inspect. Only one operator is required for deployment and performing the actual inspection. The operator navigates the robot to the area of interest and starts the inspection using the powerful pan-tilt-zoom camera. Once all pictures and videos taken the operator moves to the next location.

The FAST RVI allows the operator to access areas that could not be accessed by a human, get more coverage, inspect behind baffles and obstacles. Path planning and 3D navigation aids will help to get reliable, repeatable and reproducible data, a step change for your reports.

The saving

With this system human entry in confined spaces becomes obsolete. You save the very time consuming process of preparation, risk assessments or watchmen. This leads to tremendous cost saving for the asset owner and the inspection service provider.

Key takeaways

The FAST RVI allows to inspect areas that cannot be accessed by a human (separator walls, overhead installations, ..)

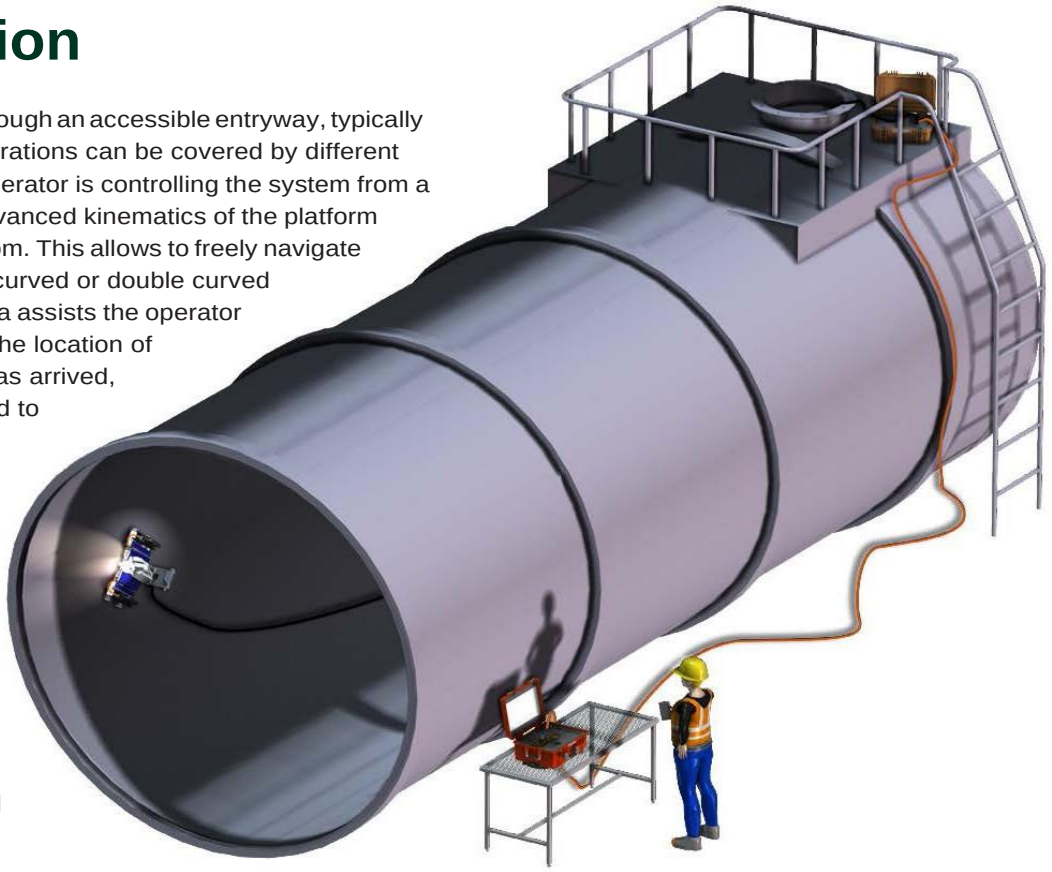
Eliminates human entry in confined spaces and perform the inspection from a safe and remote location.

The platform can be easily adapted to most PTZ cameras on the market. For our customers this means they can use the equipment they already own.

The Inspection

The FAST RVI is deployed through an accessible entryway, typically the manway. Several configurations can be covered by different deployment methods. The operator is controlling the system from a safe remote location. The advanced kinematics of the platform has several degrees of freedom. This allows to freely navigate inside tanks and vessels on curved or double curved surfaces. An overview camera assists the operator in maneuvering the robot to the location of interest. Once the platform has arrived, the inspection camera is used to collect the required footage per inspection plan. Using the extreme high zoom capabilities (up to 40x optical zoom) most data will be collected from the opposite wall, which allows a very clear view on the features to inspect.

At any point in time the operator stays out of the dirty and dangerous confined space area.



What the asset owners say

SHELL

"Many oil and gas operations involve process vessels and tanks. Maintaining these assets is a potentially dangerous and very expensive task. Shell is working on a project to develop inspection robots for operations in pressurised vessels and tanks. The Petrobot project is a joint-industry project facilitated by Shell with funding from the European Union (EU). The ultimate aim is to reduce human exposure to the risks of inspection in confined spaces. Preparing vessels for human entry is expensive and time consuming. Petrobot benefits include reduced costs and time for vessel inspection and reduced entry in confined space for inspection activities."

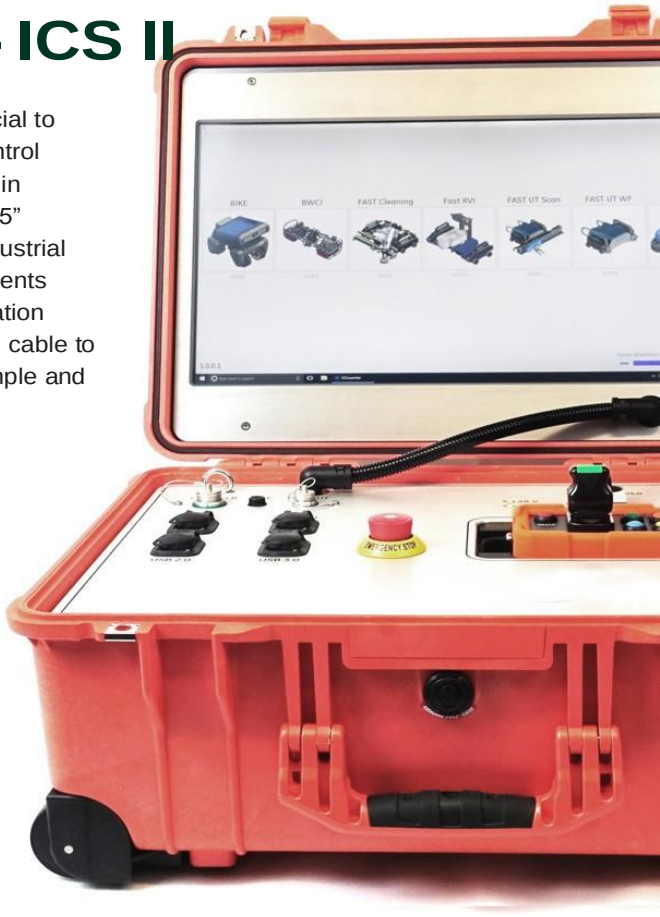
CHEVRON

"It is of great importance to roll of the FAST RVI for the CHEVRON strategy regarding internal inspection of pressure vessels, tanks and other process equipment. It is our top priority to do internal visual inspections remotely, especially in confined spaces with the objective of reducing or avoiding inspectors entering these areas only for inspection purposes. We expect by the use of this advanced inspection system we will reduce the risk to the inspectors, reduce the time and costs associated to internal inspections, especially during maintenance shutdowns; and we also expect to increase the coverage and quality of the images and information collected, when compared to the traditional inspection process."

STATOIL

"It was the first time that a so-called crawler, a small robot on wheels equipped with a camera, was used on the Norwegian shelf to inspect a knock out drum instead of sending personnel into the knock out drum. By avoiding blinding, cleaning and scaffolding inside the knock out drum, we saved about 1,500 hours. Additionally HSE was improved by not exposing personnel when entering into the knock out drum. The image resolution provided by the inspection camera was so good that light surface corrosion was detected, which was verified and checked out with phased array from outside during the turnaround."

Integrated Control Station – ICS II



To operate a robotic inspection system in an industrial environment it is crucial to have a reliable control station. With the second generation of Integrated Control Station - ICS II - the operator has the all-one-one tool at his hand. It comes in a rugged hardshell case (Pelicase®). All embedded components, as the 21.5" touchscreen, high performance PC or Joystick are selected according to industrial standards. This means extreme robustness and reliability in harsh environments as well as guaranteed spare parts for 10 years. Simplicity and ease of operation was key when developing the ICS II. The operator needs to plug one single cable to connect the BIKE platform. Operation by use of the integrated joystick is simple and self explaining.

Spec Check

- 48V Control Station (max. 480W)
- integrated industrial computer (Intel i7-6600U, 8GB RAM,128GB mSATA)
- Microsoft Windows 10 OS
- Integrated 21.5" touchscreen monitor (Full HD, 1200cd/sqm Ultra High Brightness, Rugged industrial, glove friendly)
- I/O: GBit Ethernet, 2xUSB 2, 2xUSB 3.0, Encoder Out
- Integrated rugged navigation joystick
- Industrial emergency stop system
- Pelicase® fanless, IP67 (closed) on rollers
- Weight: 21kg (46lbs)
- Power Supply: 110-230 VAC

Inspection Camera

Ca-Zoom® line of PTZ cameras is ideal for inspecting large areas such as tanks and vessels, pipelines or nuclear power installations while avoiding manned access. Rugged and durable Ca-Zoom PTZ cameras put image management in the palm of your hand, with high-powered lighting, integrated image capture and full motion video recording.

Ca-Zoom PTZ 140 incorporates a 36x optical with a 12xdigital for a 432x total zoom capability. Additionally, the Ca- Zoom PTZ 140 camera is equipped with two high-power 35 watt lights offered with wide and narrow beam spreads.

Features

- High-performance, variable spot and flood lighting control
- Automatic and manual focus control
- 36xoptical / 12x digital for a total of 432x Zoom
- Resolving power of 1/2 mil diameter wire at 1.8m (6.0 ft) distance
- On-screen zoom magnification, pressure, PTZ position, time/ date, character generation display and user logo

System components

1 FAST RVI crawler

The FAST RVI is a reliable, field service proven robotic inspection system, equipped with strong magnetic wheels it can easily climb metallic structures and perform remote/overhead inspections. Navigation aids and a wide angle top view camera (optional) support the operator. The basic robotic crawler consists of main chassis with 2 wheel drive units

2 Top View Navigation Camera

HD wide angle camera to mount on FAST RVI platform.

- Built-in high power LED lights
- Including 10m cables (PWR/COM) to connect to interface box
- Integrated in control software

3 10m cable hose

10m standard cable hose to connect FAST RVI to interface box.

- 2x control and power for crawler wheel drives
- Covered in plastic protection tube

4 ICS - Integrated Control Station

Fully rugged remote control station to operate Inspection Robotics platforms. Built in a hard case shell with integrated Touchscreen and Joystick.

- 48V IR control station
- Integrated computer
- Integrated touchscreen monitor
- Integrated navigation joystick

5 Interface (Manway) box

Rugged interface box to connect FAST RVI crawler to Control Station. Box to be positioned at the entryway of test specimen (manway).

6 30m umbilical

30m umbilical cable on a reel to connect interface box to Control Station

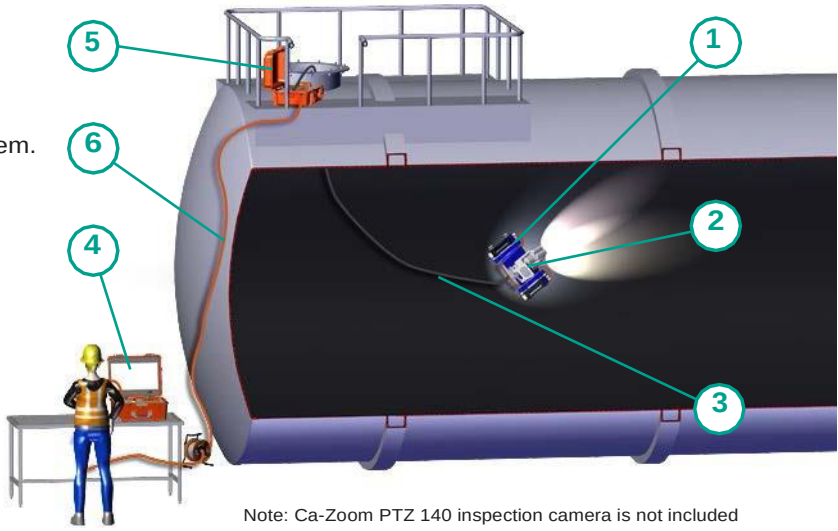
What you need to get started

FAST RVI Inspection Kit

0680017

The FAST RVI Inspection kit comprises of standard components needed to safely operate the inspection system. This kit includes:

- FAST RVI main chassis with 2 wheel drive units packed in rugged hard shell case
- Inspection camera adapter for Ca-Zoom PTZ inspection camera
- Top view navigation camera with integrated LED lights
- 10m standard cable hose (control and power for crawler + navigation camera in plastic tube) to connect FAST RVI to interface box
- Rugged interface box (to be positioned at entryway)
- 30m umbilical cable on cable reel to connect interface box to Control Station
- Integrated Control Station (Rugged hardshell with integrated computer, touchscreen, joystick, motor control)



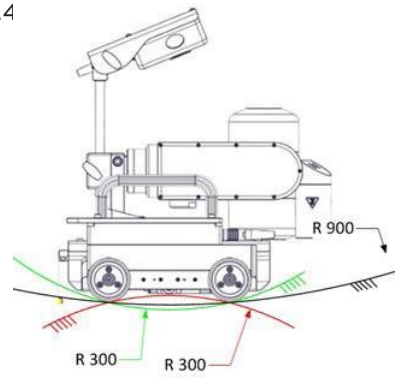
Note: Ca-Zoom PTZ 140 inspection camera is not included

Technical specifications

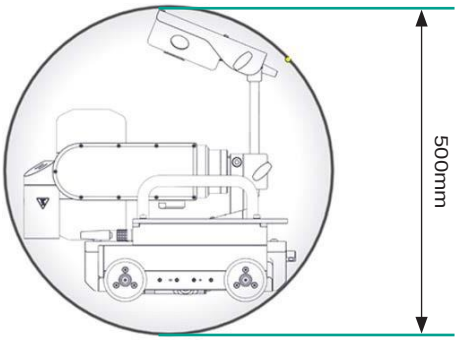
FAST RVI Basic platform (PTZ camera not mounted)		
Dimensions	Length Width Height	**250mm (9.9”)** **490mm (19.3”)** **160mm (6.3”)**
Weight	w/o cables and cameras	**9.3kg (20.5lb)**
Speed	fully adjustable	**-40mm/s ... 40mm/s (-2.4”/s ....2.4”/s)**
Payload	overhead on clean ferromagnetic surface	**15kg (33lb)**
Drives	2 integrated drive units with 48V brush-less DC motors	
Power Supply	48V via umbilical cable from supply station	
Motor Controller	integrated Inspection Robotics motor controller	
Communication	GigaBit Ethernet with power over Ethernet	
Cable length	Umbilical - supply station to manway box	**30m**
	hose-manwaybox to crawler	**10m** (20m/30m on request)
Supply Station (delivered in rugged hard shell case)		
Control	Integrated Control Station	
Power Supply	AC 50Hz/60Hz	**100V ... 240V**
Cleaning	Length Width Height	**340mm (13.4”)** **350mm (13.8”)** **130mm (5.1”)**
Weight	w/o cables and accessories	14kg (31lb)

Content basic set	
BOX 1: Basic platform (hard shell case <23kg)	• FAST RVI basic platform • rubber mat for deployment • top view camera with cables • PTZ camera holder • tools and accessories for camera mounting
BOX 2: Supply Station (hard shell case <23kg)	• rugged Laptop / industrial built in PC with touchscreen • rugged control joystick for navigation • Inspection Robotics 48V supply station • 2m Ethernet cable • 10m umbilical cable manway box to crawler
Manway Box and cable reel	• 30m cable from Supply Station to Manway Box • Manway Box (<5kg) to be positioned at entryway

For in-vessel inspection a minim vessel radius of 300mm (11.8”) is mandatory. This allows for axial driving. Full maneuverability, incl. spot turn is possible at a radius of 900mm (35.4



Minimum size of entryway for safe deployment and retrieval of the inspection system is 500mm (20”).



Deployment and operation

Depending on the size, location and accessibility of the vessel different deployment options are available. For easy-to-access horizontal vessels side deployment is a fast and efficient way to insert the system. For vertical vessels top deployment using a tripod is the preferred choice.

Deployment Scoop for side deployment

Deployment Crane for top- and side deployment

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