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Reducing Maintenance Burden through Inspection Automation using AI-powered Borescope Technology

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Visual Inspection Products

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Waygate Technologies Product Evolution

WelchAllyn®
Color endoscope with charge coupled device and television viewing
October 1978

WelchAllyn I.P.G.
May 1985

Fibertron, Inc.
January 1992

EVEREST IMAGING
January 1996
WelchAllyn I.P.G. and Fibertron merge to form Everest Imaging

GE Inspection Technologies
August 2005
GE Inspection Technologies acquires Everest VIT, Inc.

January 2020
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May 1983
VIT Visual Inspection Technologies, Inc.

May 1999
Everest·VIT INC.
COMPLETELY FOCUSED ON REMOTE IMAGING™
Everest Imaging and VIT merge to become Everest VIT, Inc.

October 2020
Inspection Robotics

June 2017
BAKER HUGHES a GE company

July 2022
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Inspection: A necessary evil.

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Difficult Choices　(two overreactions)

- "Remove the Engine! If it's even close, SAFETY FIRST!"

- "Who cares if we make money!"

- "Leave it on wing and fly it, you idiot! Do you want us to go broke?"

- "It'll be fine!"

The ideal line, of course, safety and profitability

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Waygate is here it help.

The three aspects of inspection:

- **Find it/See it**

- **Measure it/Decisions**

- **Save it/Connect it**

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Find it/See it

TL:DR

Best image you can buy
Best steering in the business

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Mentor Visual iQ's HD resolution

- Market leading 1.2 mega pixel CCD imager
- Digital zoom becomes a more powerful inspection tool: HD pixilation at 1.7X zoom level is equal to SD at 1.0X
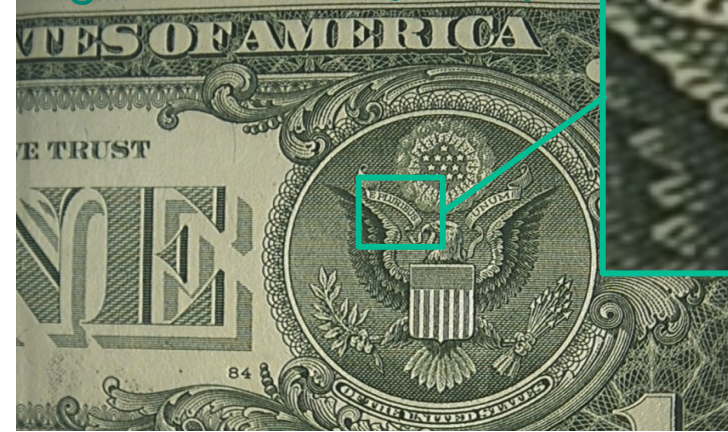
1.2-mp Highest Def

vs

.79-mp

vs

.44-mp SD
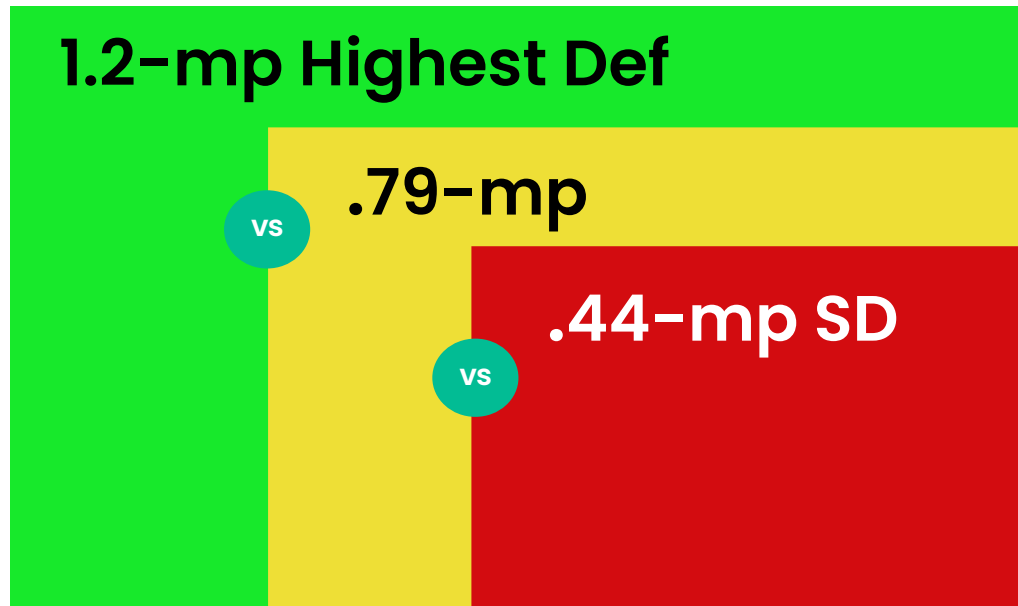
Standard Definition (0.44MP)

3X mag

High Definition (1.2MP)

3X mag

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Live Video Image Transforms

- Brightness
- Dark Boost
- Adaptive Noise Reduction
- Distortion Correction
- Long Exposure
- Invert
- Inverse +
- Single View
- Illumination
- Color Saturation
- Rotate
- Overlay

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HDR to See Improved Image

Still image capture – automatically executed feature

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Measure it/Decide

TL:DR

3rd gen 3D measurement
3D Phase on demand point and shoot
Precision and accuracy

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Waygate Measurement

- Design Philosophy

- Fast/Easy to Use
- Accurate
- Dependable
- Automated

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3D Phase Measurement

Fast: No tip change. See the damage, measure the damage.

Accurate: Over 30 images analyzed by our advance algorithms for each measurement result.

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Measurement Technologies: 3DPM Structured Light

Capturing White Light and Structured Light Images

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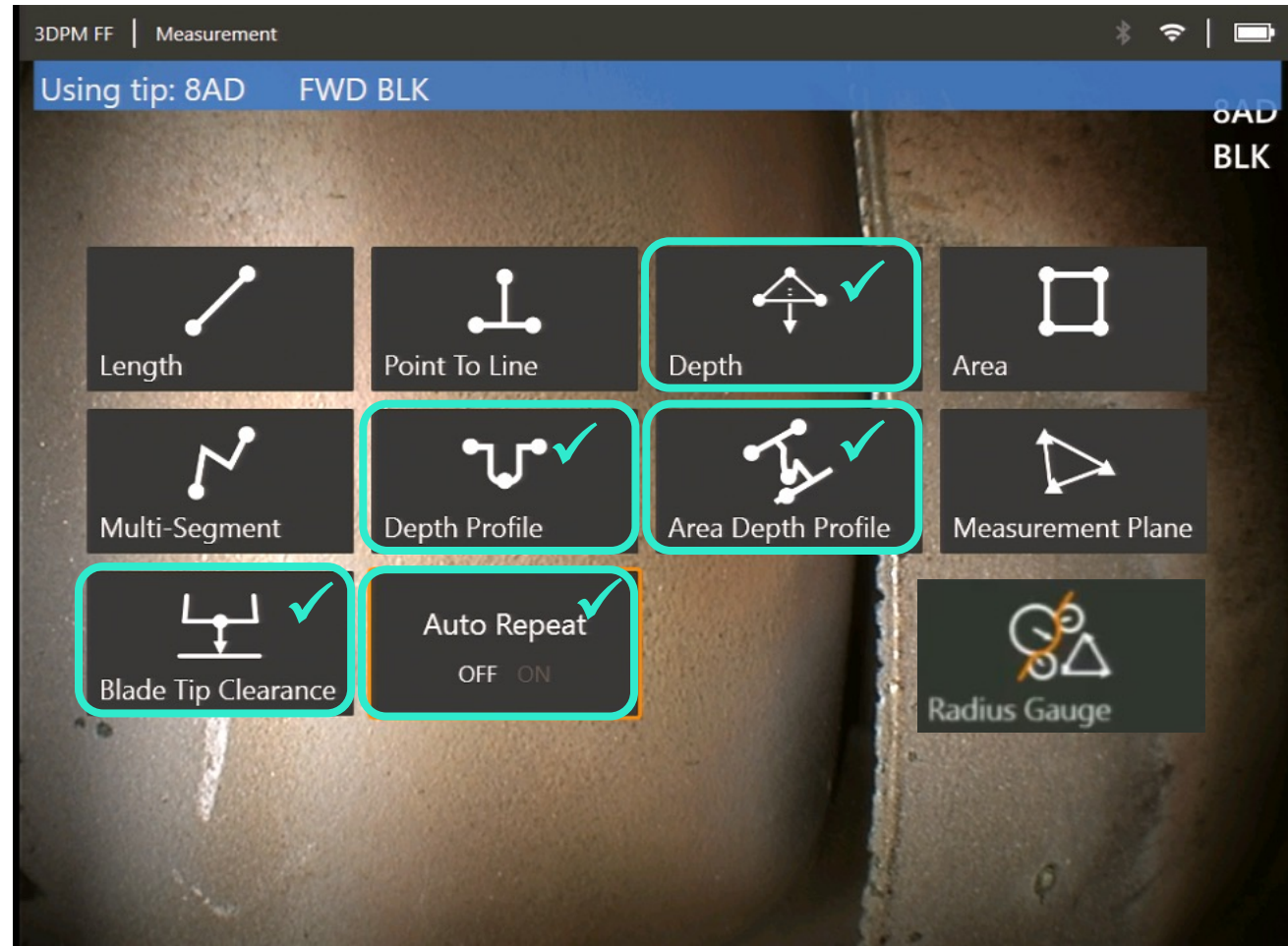# 3DPM Image Views With Point Cloud Visualization
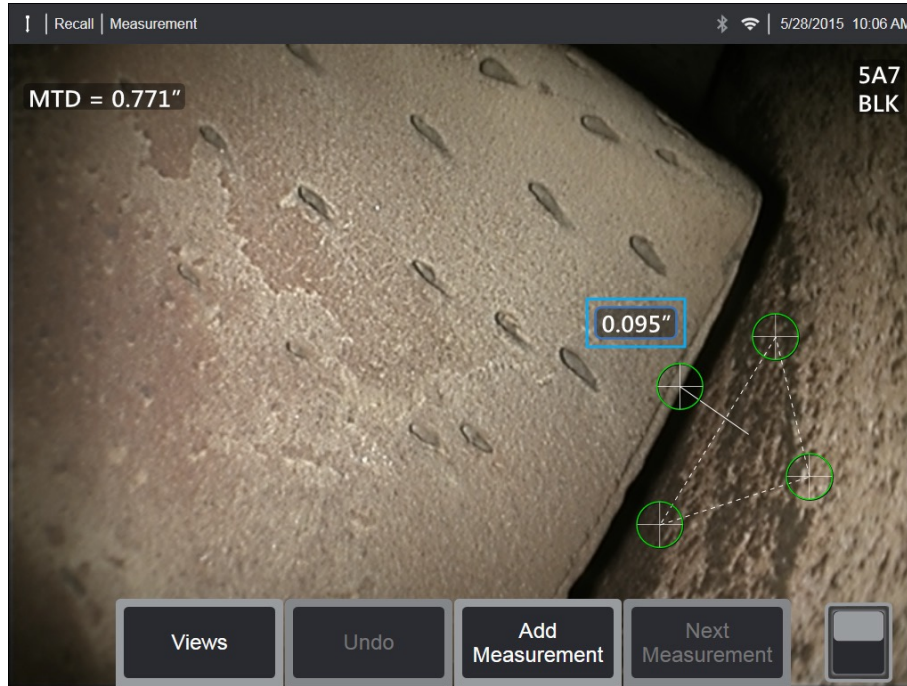
Measurement View
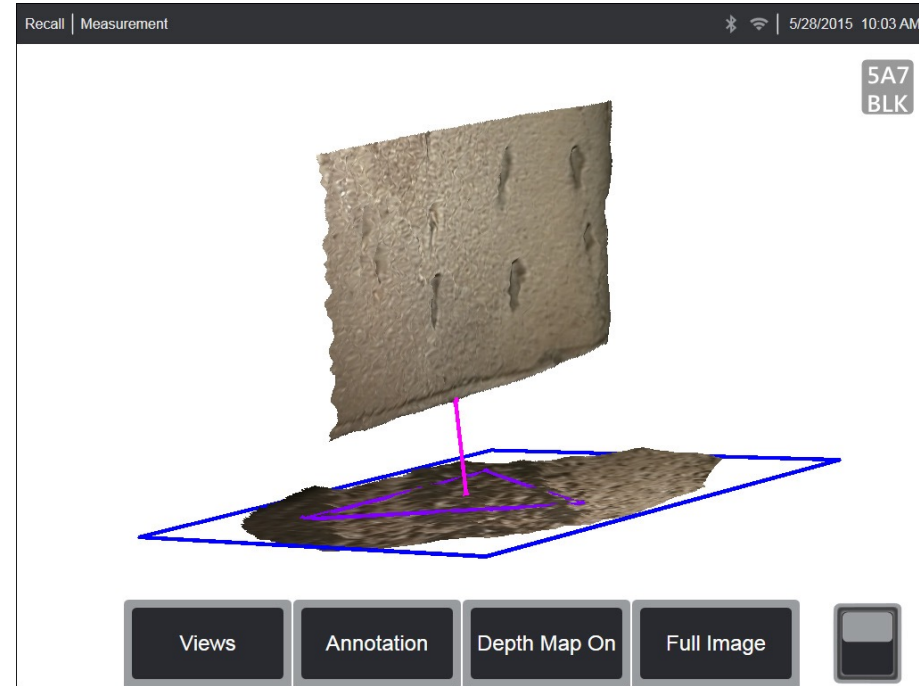
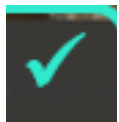3D Point Cloud View with interactive point cloud visualization

Real3D™ Measurement Types

With machine learning, we are training the videoprobe to do more and more of these measuremets automatically.

Fully automated, or semi-automated measurement types

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Introducing the new Waygate T1 Videoprobe System!

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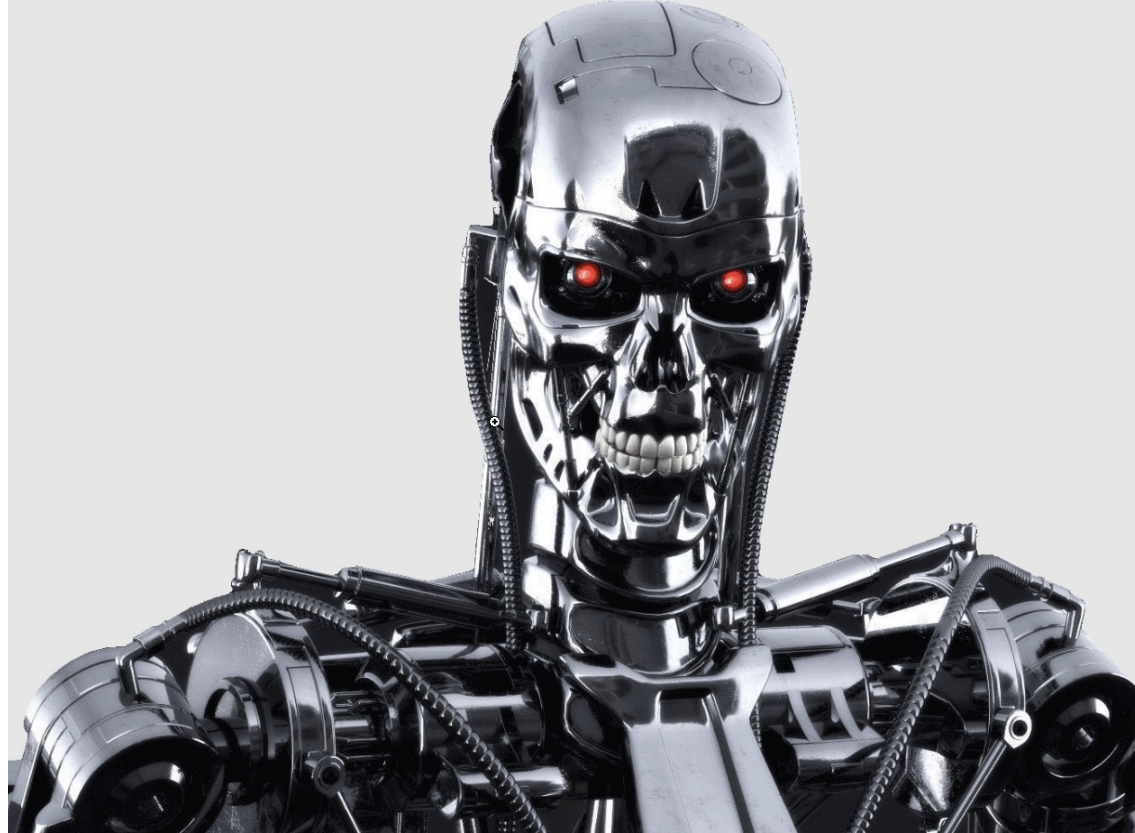
Save it/Connect it

TL:DR

Menu directed inspection
InspectionWorks digital ecosystem
Real time collaboration
Instant access to inspection data

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Menu Directed Inspection (MDI) – VideoProbe App

An MDI digitally tags images with context data, at the time of capture

- Enables **consistently** tagged inspection images from across the fleet

- Context information is correlated at image capture and thereby ensures **data integrity**

- **Eliminates** need for manual note-taking

- **Automatic** inspection report creation

- **No more meaningless inspection images!**

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Menu Directed Inspection(MDI)
Making a routine inspection

- Provides 5 levels of inspection detail
- Generate reports with up to 1600 images
- Up to 2,500 total inspection points
- Automatically create DICONDE compatible .xml database tags for search, retrieval, and analytics (metadata)

MDI Builder
PC Software Tool

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InspectionWorks Connect Local

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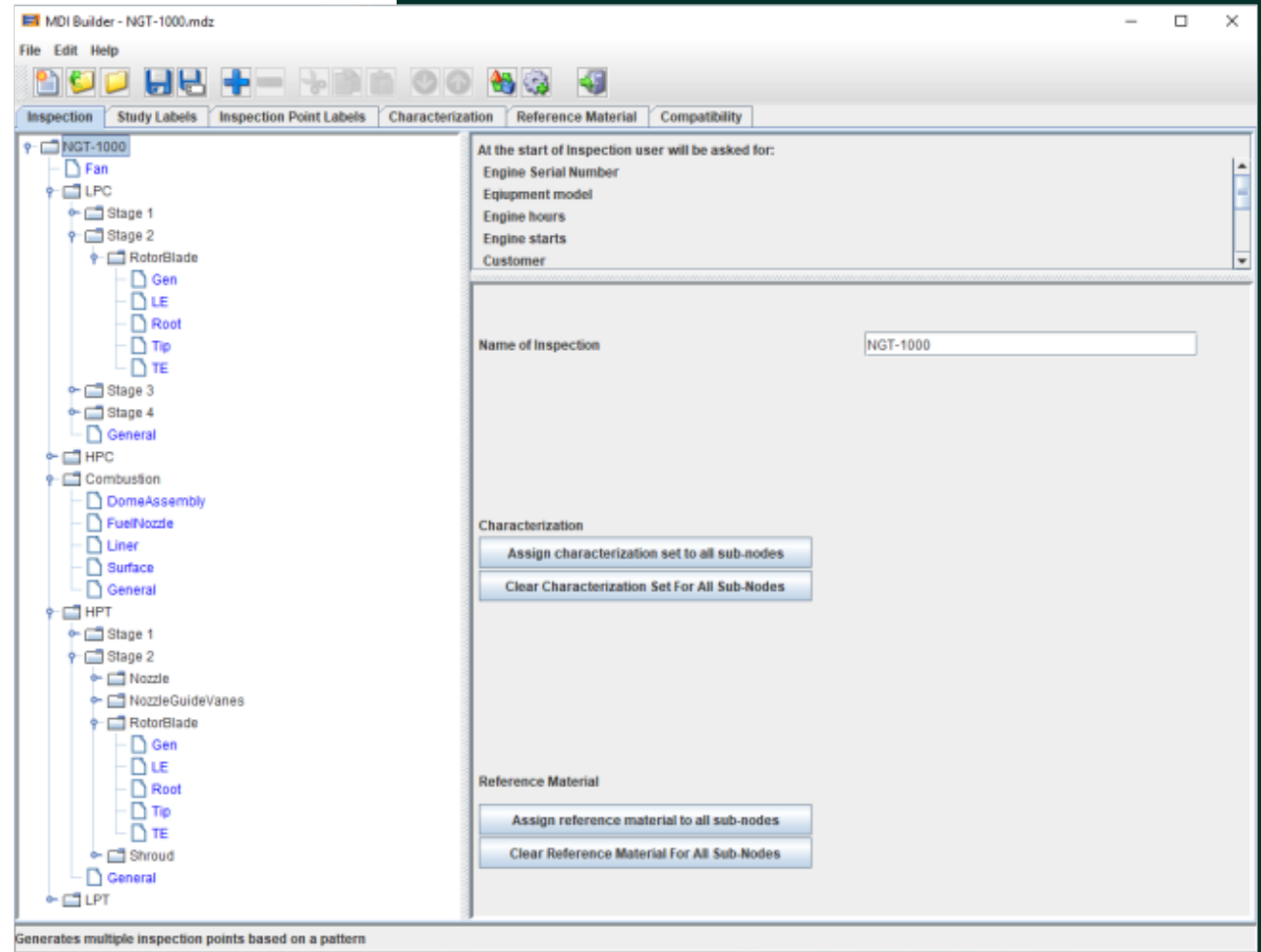
Data transfer from turning tool to MVIQ

Rhinestahl RC3000NG Turning Tool System

USB A to B Cable

Turning tool functionality

- Motorized rotation of engine core
- Continuous/Single blade/Interval
- Communicates Engine type, Stage, and Blade number to the handset

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Turning Tool data communications
Smart data capture feature

Live screen view
Automatic annotation & image capture

1 →
2 →
3 →
4 →

Smart File Naming → HPT1_Blade 18.JPG

On screen annotation
1. Engine serial number
2. Engine type and drive connection
3. Engine stage
4. Blade number

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InspectionWorks Insight

API

Insight Cloud Services
AWS Cloud

Customer / OEM Host / Cloud
Data Lake/ Servers

wi-fi or Ethernet

Optional Smart Phone Hotspot

Google Chrome

Remote User Profile

- Inspector
- Supervisor
- Colleague
- Asset Owner
- Ops Center
- Trainee

PC – Web Access
Global Access
No software to install
Only Google Chrome required

Connected Devices
Upload MDI data via MViQ wi-fi or via PC to IW Insight Cloud

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VideoProbe Digital Ecosystem Recap

MDI Builder
Condition Based Inspection

InspectionWorks
Cloud Services

Store/Analyze/Share

ADR

Report

Pre-Inspection → **Inspection** → **Post -Inspection**

InspectionWorks Connect
Live Collaboration

3D Measurement

Run MDI

Prior Inspection Access

ADR

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But Wait.......

There's
More

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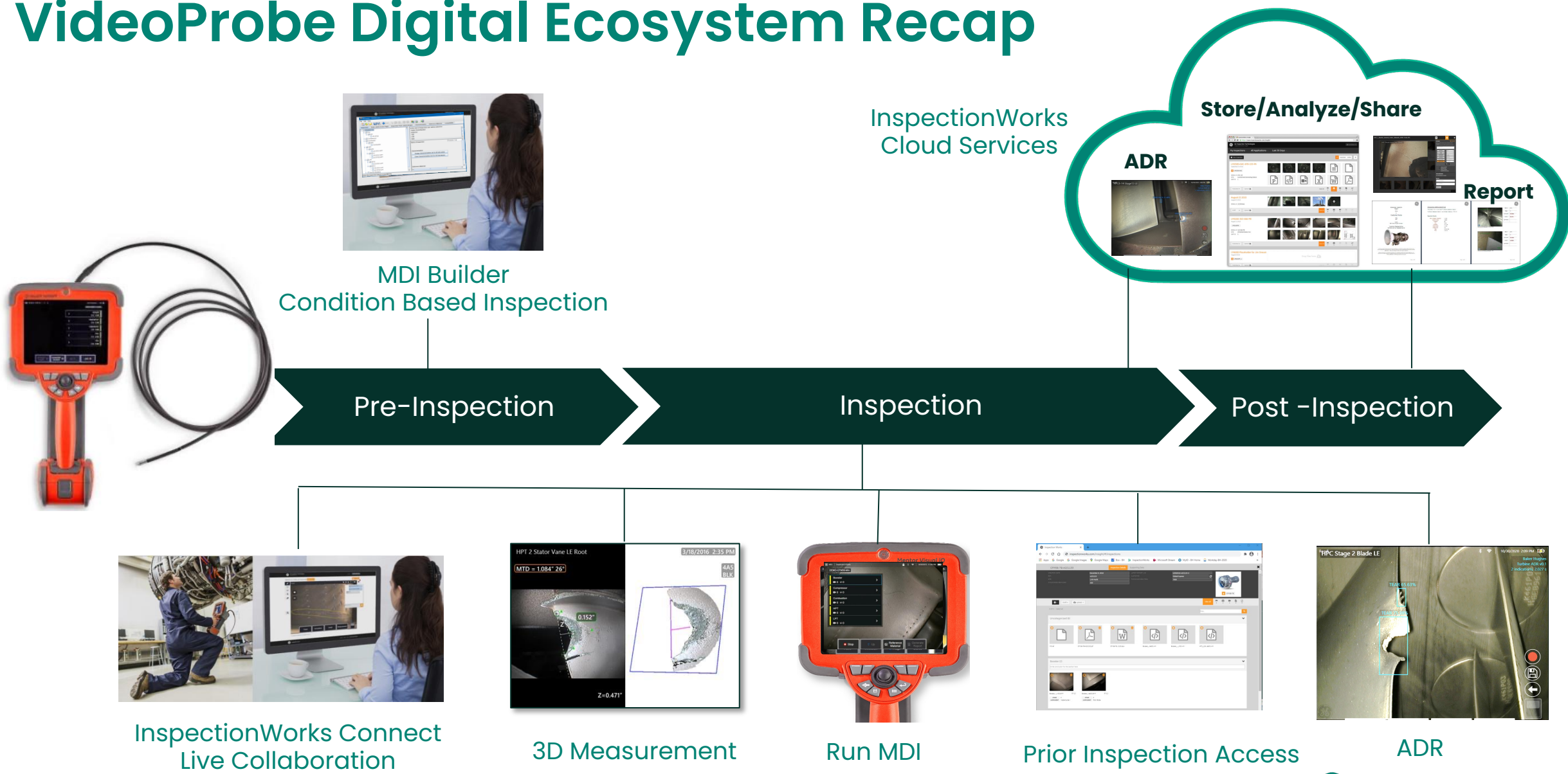
Introducing the new Waygate T1 Intelligent Machine Learning Videoprobe System!

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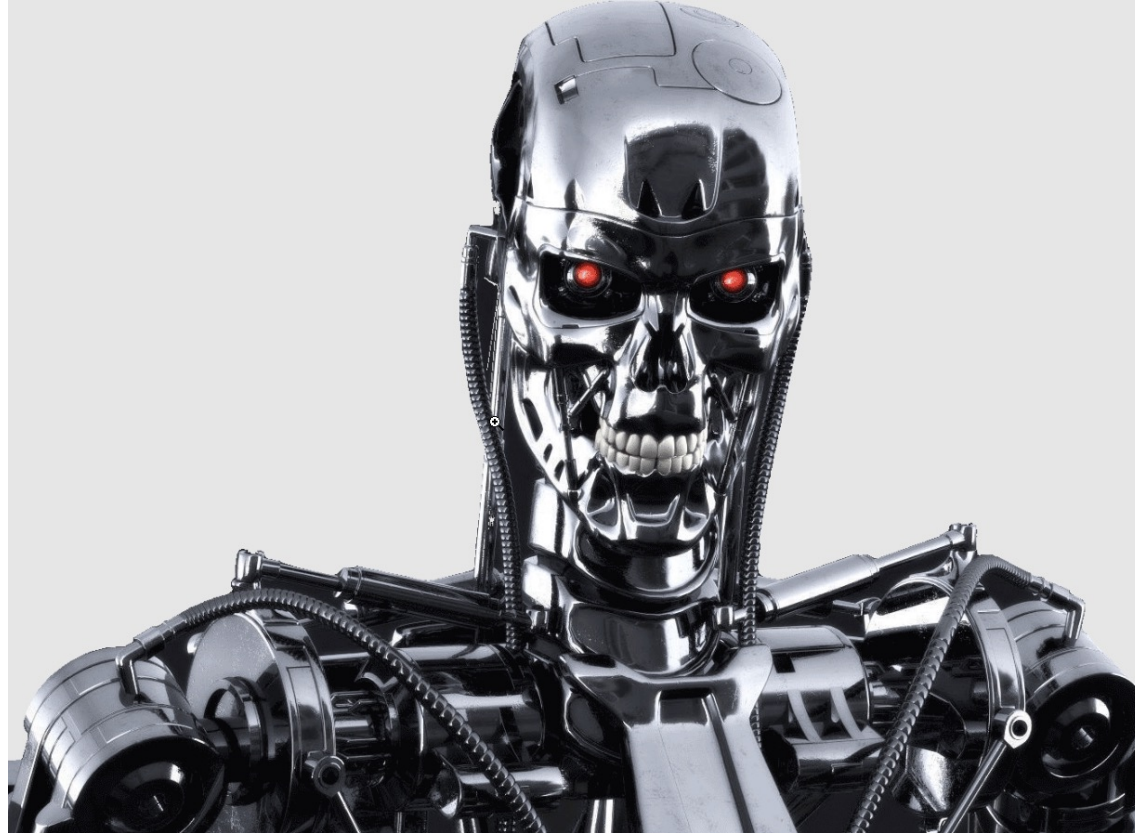
MViQ | Analytics, bringing AI to inspections

Industry first advanced analytics ('Still-Image' & 'Live'), models **running directly on the Mentor Visual iQ** system and designed to assist the inspector perform their inspection duties, improving productivity and accuracy of results.

1st party public analytics

Run at "edge" on Mentor Visual iQ system

Developed and qualified by Waygate Technologies

Available to all customers through InspectionWorks Store (Public) for deployment and update(s)

90-day free trial post 3.60 upgrade

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Example: LM2500 assist–S Blade Counter

3rd party public analytics

Run at "edge" on Mentor Visual iQ system

Developed and qualified by 3rd party company

Available to all customers through **InspectionWorks Store (Public)** for deployment and update(s)

90-day free trial post 3.60 upgrade

AIIR INNOVATIONS

Example: Aiir Lite Rotate Aiir Lite Combustor

3rd party private analytics

Run at "edge" on Mentor Visual iQ system

Developed and qualified by 3rd party company

Available to select customers through MViQ3.60 Feature Keys for deployment and update(s)

ROLLS ROYCE

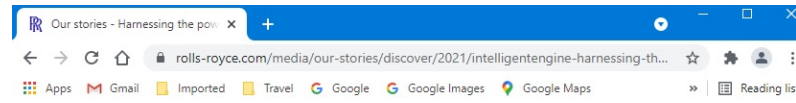**Example: Rolls-Royce *Intelligent Borescope***

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Visual Inspection Analytics
ADR (Assisted Defect Recognition)

Proprietary OEM Software
Rolls Royce OEM Analytics

https://www.rolls-royce.com/media/our-stories/discover/2021/intelligentengine-harnessing-the-power-of-ai-to-deliver-more-intelligent-engine-inspections.aspx
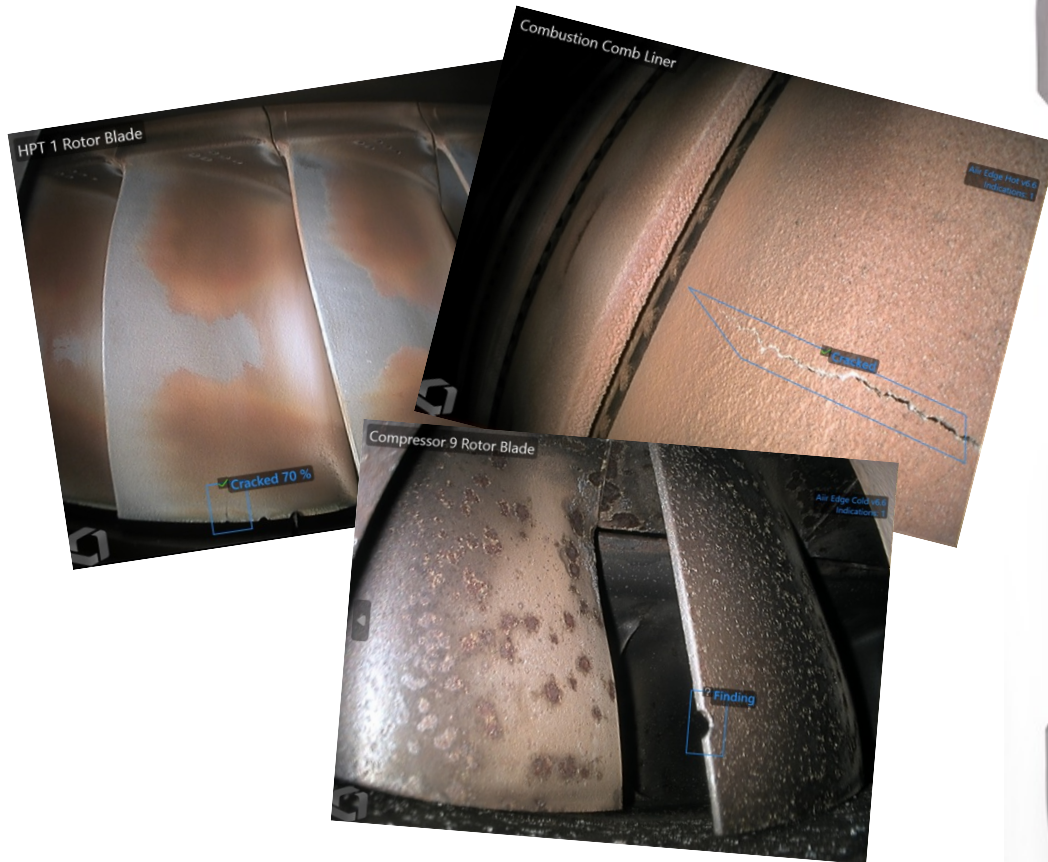

What is an
INTELLIGENT BORESCOPE?

TIMES AROUND THE WORLD
2,400
An average aircraft does 20,000 flights in its lifetime – that's the equivalent of 60 million miles or 2,400 times around the world.

20,000
TOTAL ENGINE COMPONENTS
The engine's blades need regular inspections. One way of getting inside the engine to look at them is with a borescope.

12hrs
A routine borescope inspection can take an aircraft out of service for 12 hours – that's 12 hours that the aircraft is on the ground and not in the air.

RHINESTAHL TURNING TOOL
The Intelligent Borescope is connected to an automatic Rhinestahl turning tool that positions the blade. After each blade is successfully positioned it sends a signal to the borescope to capture the image automatically.

INTELLIGENT BORESCOPE
The tip of the Intelligent Borescope, is enabled with a scanner that can generate 3D colour images. As it moves through the engine, the borescope captures images which are analysed by the AI App installed on the Borescope handset and sent to the cloud.

5mins
Once the AI process is complete the operator has to review the predictions. In the days before we had this App, processing this data would take an operator 90 minutes – it now takes just five.

AI FACIAL RECOGNITION
The App maps the blade in the same way a face is mapped looking for inconsistencies or irregularities. This is the first time facial recognition AI technology has been used in this way in aerospace inspections.

30mins
The Intelligent Borescope is an industry first AI application enabled borescope that can capture and process image data in around 30 minutes for certain inspections.

OS 3.70 | Aiir Edge Hot & Cold

... live ADR finding crack; save

Find defects
Quickly label + save
Continue inspection

Questions?

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