

NDT CASE STUDY of the Quarter

Turbine Engine

Engine Specs:

- Narrow internal passages
- Complex blade geometries.

Camera Details

Model: RVI Inspector Plus
 Probe Dia.: 2.8 mm — 1.0 mm



Remote Visual Inspection

Aircraft Engine Inspection with Ultra-Thin Industrial Videoscope

INTRODUCTION

Aircraft engine inspection is one of the most demanding applications in remote visual inspection (RVI). Modern turbine engines contain extremely narrow internal passages, complex blade geometries, and sensitive components that require regular inspection without unnecessary disassembly.

In many situations, inspectors must access areas with limited entry diameters while maintaining sufficient image quality and maneuverability. This is where ultra-thin industrial videoscopes have become increasingly important.

Today, probe diameters below 2.8 mm — and even below 1.0 mm — are expanding the possibilities of non-destructive inspection in aerospace maintenance and manufacturing environments.

The Challenge of Aircraft Engine Inspection

Aircraft engines operate under extreme thermal and mechanical stress. During maintenance inspections, technicians commonly look for:

- ✓ Cracks
- ✓ Foreign object damage (FOD)
- ✓ Blade deformation
- ✓ Carbon deposits
- ✓ Coating deterioration
- ✓ Cooling hole blockage
- ✓ Corrosion and wear

However, many modern engines offer only very limited access points. Traditional larger-diameter videoscopes may not fit into cooling channels, guide vane gaps, or internal cavities. At the same time, inspectors still require:

- Stable image quality
- Flexible articulation
- Reliable illumination
- Accurate navigation inside complex geometries

Balancing miniaturization and inspection performance remains one of the key technical challenges in aerospace RVI.

Why Ultra-Thin Videoscopes Matter

Ultra-thin videoscopes allow inspectors to enter previously inaccessible areas without removing additional components from the engine.

Typical applications include:

- Turbine blade inspection
- Combustion chamber inspection
- Cooling hole examination
- Fuel nozzle inspection
- Internal cavity inspection
- Narrow passage verification

Probe diameters between 0.95 mm and 2.8 mm are increasingly used where conventional 4 mm or 6 mm systems are too large.

In practical aerospace maintenance, reducing disassembly directly reduces downtime and maintenance cost.

The Difference Between Fiberscope and Videoscope

Traditionally, ultra-small inspections were performed using optical fiberscopes. While fiberscopes remain useful in certain applications, modern ultra-thin videoscopes provide several advantages:

Improved Digital Imaging

Digital CMOS imaging enables image capture, recording, and documentation.

Better Reporting Capability

Inspection images and videos can be stored for maintenance records and quality documentation.

Easier Training and Collaboration

Live image display allows multiple technicians to review inspection results simultaneously.

Enhanced Workflow

Portable touchscreen systems improve navigation, file management, and reporting efficiency.

As digital imaging technology continues to improve, ultra-thin videoscopes are increasingly replacing traditional fiberscopes in many industrial applications.

Practical Limitations of Ultra-Thin Probes

Although ultra-thin videoscopes provide major advantages, there are also engineering limitations.

Miniaturization creates challenges such as:

- Lower light output
- Reduced articulation space
- Limited sensor size
- Increased fragility
- Higher repair complexity

For probes below 1.2 mm, even small mechanical impacts can damage internal optical fibers or articulation structures.

Therefore, successful use of ultra-thin videoscopes requires careful handling and realistic expectations regarding durability and repair cost.

Selecting the Right Probe Diameter

Choosing the correct probe diameter depends on balancing accessibility and image quality.

0.95 mm – 1.2 mm: Suitable for extremely restricted access areas where entry size is the primary limitation.

1.8 mm – 2.8 mm: Often considered the best balance between flexibility, durability, and inspection performance.

4 mm – 6 mm: Preferred for general turbine inspection where higher image resolution and stronger articulation are required.

In many aerospace inspections, combining multiple probe diameters provides the most practical solution.

Future Trends

The aerospace inspection industry continues to push toward:

- Smaller probe diameters
- Higher image resolution
- Better articulation systems
- Dual-camera technology
- Improved portability
- AI-assisted defect recognition

However, practical usability and reliability remain more important than excessive feature complexity.

For many maintenance teams, inspection efficiency, durability, and serviceability are still the most critical factors in daily operation.

Conclusion

Ultra-thin industrial videoscopes are transforming aircraft engine inspection by enabling access to previously unreachable internal areas while reducing disassembly requirements. As aerospace maintenance demands continue to evolve, the balance between miniaturization, image quality, and practical reliability will remain a key focus for the RVI industry.

The future of aircraft engine inspection is not only about smaller probes — but also about smarter, more practical inspection solutions.