



Collaborative Endoscope Development to Speed Medical Instrumentation Delivery

For over 50 years FISBA is actively developing and producing precision micro optics for endoscopy. Throughout the decades our reputation for quality and performance has grown along with our range of distinctive optical product offerings, and the sustained expansion of our capabilities to cover every aspect of product design, from concept to volume production. We can offer our customers the full range of design and production services for endoscope development and fabrication.

Exceptional endoscope performance depends upon every aspect of the development process, from requirements definition to test and validation to product delivery. Our experts have a deep understanding of the interactions among design trades, fabrication processes, test procedures, and final system operation.



For example, our recent endoscope development collaboration as a member of the [RaVeN-NA4pi](#) consortium highlights the importance of those attributes. Those capabilities extend

far beyond a single design. We have a long history of consistently and reliably supplying components and subsystems to support major manufacturers in industrial, commercial, and life sciences applications. These competencies and capabilities merge with our culture to provide an optimum collaborative partner for your endoscopy project.

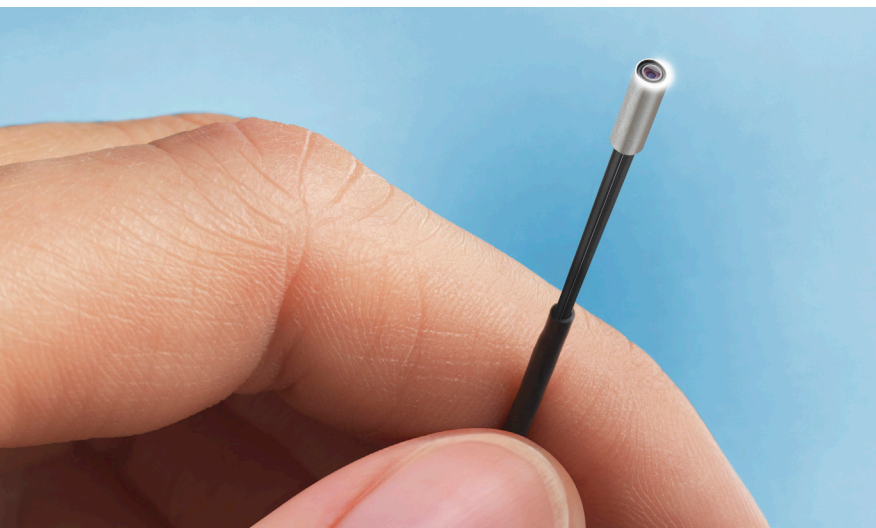
System developers looking for manufacturing partners — particularly in optics — are presented with many options, many vendors who can point to specific areas of proficiency. Of course, medical equipment fabricators are looking for associates with both the expertise and the facilities to successfully collaborate, but the most successful collaborations also need an intangible: a corporate culture with a “spirit of partnership” that has been our core value from our start more than 60 years ago. That’s why every member of our team concentrates on the details. [“At some point, it’s only details that separate us from the competition,”](#) says Andreas Kunz, Business Director of Advanced Optical Components, [“but those details become more important as technical requirements get tighter, as optical systems become more precise and more powerful.”](#) Here’s how those details come together to make us the first-choice partner for your endoscope development.

Endoscopy

Since 1965 we have been actively involved in the design and production of several generations of endoscope components and systems, and we offer medical manufacturers the opportunity to leverage our expertise for collaborative endoscope development. Our expertise in optical design has provided us intimate knowledge of the key elements of endoscope performance: magnification, depth of focus, light intensity, distortion, contrast, and resolution. As with any precision system, the final system design is the result of fundamental engineering tradeoffs, including image quality vs. design envelope, performance vs. environmental resistance, design complexity vs. scalable cost targets, among others.

Although these factors generally must be considered for any optical design, it’s a mistake to think of endoscope design as a single set of tradeoffs. Endoscopy holds the promise of improving patient outcomes while simultaneously keeping costs under control, which is driving its rapid expansion into new and unique applications with distinct requirements. For example, sinusscopes, laryngoscopes, and bronchoscopes all aid in the diagnosis of respiratory disease, while angioscopy assists with cardiovascular disease, laparoscopy guides abdominal surgeries, arthroscopy does the same for joint degeneration, while gastroscopy and ureteroscopy provide information to guide diagnosis of gastrointestinal and urinary tract conditions, respectively. The illumination requirements vary just as widely, with white light, specific color, or near-infrared irradiance serving to provide visible images, distribution of tissue autofluorescence, or the location of fluorophore uptake by specific molecular targets.

All those factors influence traditional optical design parameters, such as resolution, magnification, and size and orientation of the field-of-view, so an endoscope manufacturing part-



ner must have an understanding of the biological environment and medical purpose of the instrument. For example, we have a member of the RaVeNNA4pi consortium, an association of industrial, academic, and clinical partners dedicated to improving the clinical outcomes for bladder cancer.

Bladder cancer — even low-grade cancer — regularly recurs, so frequent patient monitoring is critical. That means total costs must be kept under control, but it also means that any diagnostic modality must be able to easily and accurately track changes in any given patient. Endoscopic imaging is often more efficient and cost-effective than alternative diagnostic approaches, but with the requirement to compare anatomical structures over time, image quality could not be sacrificed. In fact, the consortium concluded that the cornerstone of their holistic approach rested on reliable 3D digital image production, storage, and processing.

The top-level requirements dictated a need for both high resolution and full angular coverage, which in turn required a rotatable field-of-view. In addition, the position and rotation of the endoscope need to be precisely monitored to insure the fidelity of the 3D image reconstruction. Those operational requirements levy additional constraints on the optical design — constraints unique to this particular application. Our experience, expertise, and cultural principles allowed us to seamlessly design, fabricate, and integrate a high-quality imaging system into a complex instrument that promises to improve the standard of care for bladder cancer. That design includes an actuated inner focusing lens and both white light and fluorescence excitation sources all integrated into the wet environment of the urinary bladder.

The RaVeNNA4pi effort has unique requirements, but so does every endoscopic instrument. The bladder endoscope development effort illustrates the effectiveness of our approach to manufacturing partnerships:

- Understand global system functional requirements
- Flow down to optical design requirements
- Iterate design, maintain communication to ensure smooth integration
- Fabricate, coat, and assemble optics of unsurpassed quality
- Develop relevant metrics and test procedures
- Support system integration and validate performance

This is our process, a process that maintains focus on customer needs, a process with a demonstrated track record of success.

Consistent and Reliable Quality

The RaVeNNA4pi endoscope provides an example of the range of skills and expertise that we bring to optical design projects. Those characteristics are not limited to a single product, but they reflect an adaptable, consistent tradition of quality. In the time that we have opened our services to the general marketplace, our components have become essential enabling technologies for enhanced system performance across applications in life sciences, manufacturing, telecommunications, and other industrial sectors.

Representative Custom Endoscope Capabilities

The optical requirements for endoscopic imaging are not in themselves extraordinarily challenging; the challenge comes from having to meet exacting requirements within extremely limited volumes, and operating in demanding

environments. Our expertise allows us to succeed with such enterprising approaches as:

- 4K stereo-vision for robotic surgery integrating CMOS chip-on-tip and illumination options
- Flat optics and prism assemblies with proprietary optical coatings to allow angled viewing in both chip-on-tip and rigid endoscopes.
- Specialized visible and NIR multispectral coatings for mirrors, dichroic beamsplitters, and filters optimizing tissue recognition for surgical and surveillance applications.
- Aspheric optical surfaces for high-fidelity image acquisition and reconstruction.
- White-light and fluorescence illumination combined with chip-on-tip vision for full color control with either standard RGB or customized wavelength combination sources and optimized color filter design.

Looking for a partner to expedite your endoscope development?

Then you're looking for:

...facilities for rapid prototype fabrication and volume production.

Our facilities include 70,000 square feet of production space; 5,000 square feet of ISO class 7 clean rooms; in-house grinding and polishing machines; world-leading glass molding for both oxide and chalcogenide glasses; in house metallic, dielectric, and absorptive coating capability; metrology for monitoring optical flats, traditional curvatures, and aspheric surfaces.



...the design expertise to efficiently meet your needs.

Our optical design team are experts in such design tools as CodeV, Zemax, LightTools, and SolidWorks. Our program management and production staff implement Six Sigma and Design of Experiments methods throughout product development; and First-Article Inspection, 6S, and ISO 9001:2015 processes are integrated into all our fabrication activities.

... a demonstrated history of exemplary optical device and component production.

Since 1965 we have been manufacturing highquality optics, first for endoscopy, then extending to illumination modules, collimating lenses for laser diodes, specialized microscope objectives, up to complete full-function "chip-on-tip" endoscopes. Our component fabrication expertise covers a wide range of high-quality micro-optics, with diameters down to 0.3 mm, double-sided aspheres as small as 1.8 mm in diameter, custom micro-objectives starting at 1.6 mm diameter, and complex prisms with dimensions as short as 0.7 mm.

... a culture built on attention to customer needs.

From our formation in 1957, we have been guided by the "Spirit of Partnership" — a credo deeply assimilated into our corporate culture. This attitude leads to outstanding customer service, which our customers have recognized with more than half a dozen outstanding supplier awards from leading optical systems integrators, and special recognition from the prestigious SPECTARIS German industrial association for "60 years of successful collaborative partnership."

-You're looking for **FISBA**

Questions? Contact our specialists:



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