

Custom Optics - Trends, Challenges, the Design Process and Quality Assurance

If you require a professional image processing system to meet specific needs it is essential that the lens also meets all the necessary criteria to ensure long-term functionality. We spoke to Rob Watkinson from Resolve Optics about overcoming the limitations of off-the-shelf products and achieving the best results.

IEEN Europe: What are the technological trends driving customers to ask your help to solve their new optical product design challenges?

Watkinson: As a specialist in custom optical design and manufacture, we do not typically deal with trends directly. Most enquiries we receive are for an application that is optically more demanding requiring high performance, high-resolution, compactness, robustness, radiation resistant or a large format image where an off the shelf lens is not available or would necessitate that you accept a compromise in one or more aspects of optical performance.

That being said – one trend that we broadly see across many markets is a push for higher resolution optical systems. As manufacturers introduce new sensors with smaller pixels and higher pixel counts, the subsequent demand on optics is significantly increasing. It is becoming increasingly difficult to meet these demands from traditional optics, resulting in a need to use aspheric lens designs and exotic materials to meet the performance required by these high-resolution sensors.

IEEN Europe: Describe customer needs in different industrial/applicational areas (that you serve) which are most challenging?

Watkinson: As a specialist in custom optical design - Resolve Optics



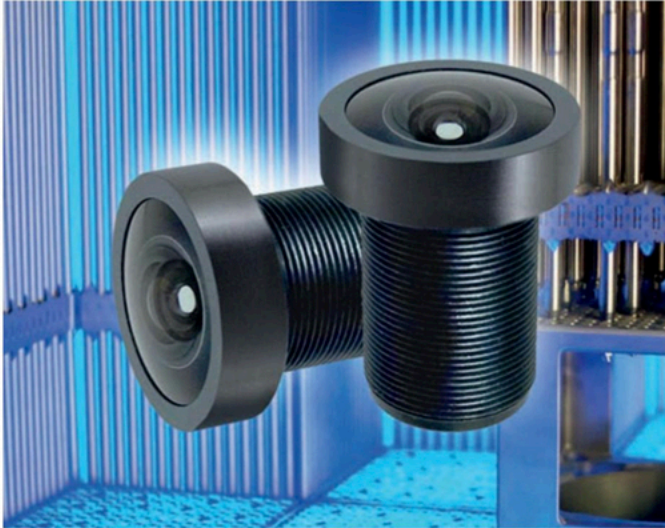
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Resolve Optics rigorously optically tests 100% of all lenses it supplies.

has experience of partnering with camera, sensor and optical instrument developers plus integrators in markets ranging from the nuclear industry, defence and aerospace industries to industrial vision and healthcare applications. Each industry has its own unique challenges, for instance the nuclear industry requires radiation resistant optics. From our 30 years' experience, we typically find the biggest challenges come from space and military applications. These applications will often come with strict requirements in terms of size, weight and operating environment, and being able to withstand elevated levels of vibration and shock, large temperature swings or in the case of space, cosmic radiation. As well as making the mechanical design challenging, these requirements can increase the difficulty of creating a suitable optical design. For example, specifying optics that fit into a small operating envelopes, can make it more difficult to maintain their performance. Likewise, maintaining lens performance over a large temperature range or when exposed to radiation, will limit the choice of materials available to the optical designer, making the design more challenging. This is where our decades of experience can really help create the application optimised lens or optical system our customer requires.





Fixed focus lens for nuclear inspection with non-browning glass for high radiation resistance.



Lenses used in defence applications are typically designed to meet military standards, often requiring increased durability and resistance to harsh environmental conditions

IEN Europe: Supply chain problems have increased in different industrial sectors over the last few years. Has this impacted the design of lenses and optical systems?

Watkinson: We hear that some parts of the optics and photonics industry are experiencing significant supply chain disruptions, characterized by shortages of certain materials, longer lead times, and a scarcity of skilled labour. These issues have been driven by post-COVID demand surges and geopolitical tensions that can cause production bottlenecks. Fortunately, Resolve Optics has been largely unaffected by supply chain issues. One area we have experienced challenges is with the supply of Germanium which has become extremely difficult to source globally, forcing the need to consider alternative chalcogenide type glasses for IR lens designs.

IEN Europe: What does a typical process look like from first contact to final decision on a new production custom lens or optical system?

Watkinson: When we first receive a new customer enquiry – Resolve Optics experienced design team will spend a week or two reviewing the requirement to ensure we can offer the best fit solution. This design process is a collaborative, iterative, and ISO 9001-certified workflow that is proven to transform client specifications into high-performance optical systems. The key stages of our process are a free initial consultation and feasibility evaluation, generation of a design proposal, optimization of the optical design, engineering and software modelling to simulate, test, and optimize the lens performance, ensuring it meets or exceeds requirements, prototyping and testing followed, after approval of the prototypes by production and supply. This overall process for designing and delivering production batches of a new fixed focus

lens will typically take up to 6 months and for more complex custom zoom lens designs longer.

IEN Europe: What steps and tests are typically involved in your production and quality management processes?

Watkinson: This is governed by individual customer requirements. Resolve Optics undertakes that 100% of the lenses we supply will be optically tested and further testing as specified by the customer and agreed during the design process. We maintain a strict GRN procedure and all components are traceable back to the original material supplier. If requested material certificates and inspection reports can be supplied with more detailed information. For example, we have our own in-house vibration and shock testing equipment to ensure the lenses we produce for space, military, and harsh industrial applications can withstand operational stresses.

IEN Europe: If a customer needs certification for their new lens or optical product, how do you support them?

Watkinson: We are always happy to discuss and collaborate with the customer to ensure they have everything they need. As previously mentioned, we have invested in advanced MTF testing and vibration / shock testing equipment to provide in-house certification in these areas. If it is something that we cannot supply in house, we have established agreements with third parties to ensure every element of certification can be covered.

IEN Europe: Thank you for these insights!

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N° 3 - MARCH 2026

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