



Welcome to the Autumn 2021 edition of 'Lens Innovation' – a twice yearly eNewsletter from **Resolve Optics Ltd.** Each issue of Lens Innovation is designed to keep you informed about the latest technological developments, applications advances and breaking news in the optical design and manufacture industry.

If a particular feature interests you do not hesitate to contact us or follow the link for further information. We welcome your feedback.



Mark Pontin
(Managing Director)

INFORMATION GUIDELINES:

Using Technology to Reduce Lead Times & Produce Better Lenses

Even employing highly skilled engineers and technicians, trained to use the most sophisticated design and manufacturing techniques, lenses and optical systems can still vary in quality.

As part of Resolve Optics mission to make sure every lens supplied to customers meets and exceeds the agreed specification – we are continuously looking at ways of improving and automating procedures.

A vital part of this process is to produce a reliable lens design that fulfils our customers stated needs. At Resolve Optics we use the latest OpticStudio optical design software and Solidworks 3D CAD software that enables a 3D optical design to be exported directly to our 3D CAD software. This investment in technology eliminates any possible errors that could be caused by the manual recreation of the optical design. The result is that we are able to produce a reliable design for your new lens or optical system quickly and accurately.



The most common technique for determining the performance of an optical system is by measuring its Modulation Transfer Function (MTF). The MTF of a lens is a measurement of its ability to transfer contrast at a particular resolution. In other words, MTF is a way to incorporate lens resolution and contrast into a single specification. MTF can be used for optical components as simple as a single element spherical lens to those as complex as a multi-element zoom lens system.

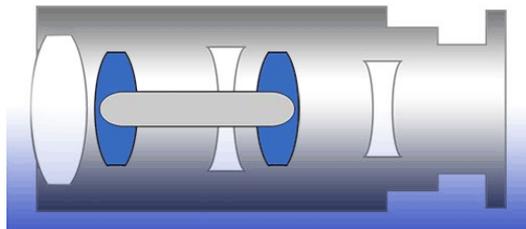
Unfortunately, traditionally MTF testing is a laborious manual procedure that relies upon the expertise and skill of a trained optical technician. Resolve Optics investment in a fully automated MTF and distortion test centre has allowed us to make incredibly accurate and repeatable measurements. If required, this allows us to accurately characterise a lens and provide the customer with those details. This characterisation can then be incorporated into the finished system to create incredibly accurate optical systems.

In today's competitive photonics industry – production efficiency is also critical. The introduction of a sophisticated Material Requirement Planning (MRP) system at Resolve Optics has allowed us to switch to a process of dedicated stores personnel kitting works orders in advance, enabling a much swifter turn around in production, increasing output and ensuring on-time deliveries. Beneficially the MRP system also provides accurate and extensive traceability back to origin for all components used in the lenses and optical systems that we supply. For market sector demanding high reliability such as aerospace, defence, medical and nuclear industries, accurate documentation of an incredible amount of detail throughout the manufacturing process is essential to regulatory compliance and product quality.

To learn more about how advanced technology is helping Resolve Optics reduce lead times and produce better lenses and optical systems – [click here](#)

VIEWPOINT:

Comparing Traditional & Optically Corrected Zoom Lenses



A zoom lens is a versatile optical component, used in cameras, sensors and instruments, that offers the user a useful range of different focal lengths in a single lens. This is in comparison to a fixed focus lens, which only offers a single focal length. A zoom lens typically allows for quick and easy re-framing of a scene while staying in the same physical position.

and disadvantages?

But do all types of zoom lens offer the same advantages

First of all – let's look at how a traditional zoom lens works. A traditional zoom lens relies on a complex cam mechanism to control the individual movement of the different optical cells within the lens to maintain focus throughout the zoom range. This method requires very accurately machined components to ensure a consistent movement that does not make the image jump and move around. To ensure smooth zoom movement these moving parts are required to be greased and this can be a problem in harsh environments or in space applications.

By comparison, optically corrected zoom lenses, also known as optically compensated zoom lenses) are simpler in design relying on two optical cells moving together each side of a fixed cell. Advantageously this movement is linear so there is no need for complex cam mechanisms. The movement in an optically corrected zoom lens is effectively a push-pull movement. The benefits of an optically corrected zoom lens design include simplified construction, they are more rugged than traditional zoom lenses and no greases are required for smooth zoom operation making them ideal for space applications or harsh environments. However, optically corrected zoom lenses do have limitations – they are not suited for applications requiring a large field-of view or where a zoom range greater than x4 is required.

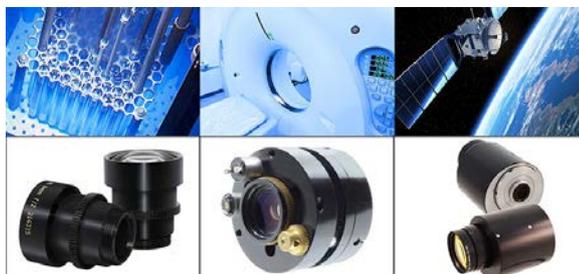
To learn more about optically corrected zoom lenses from Resolve Optics; [click here](#).

TECHNOLOGY FORUM:

Radiation Resistance – What does it mean and how do optimised lenses maintain throughput?

Radiation resistant, radiation hard or non-browning lenses are all terms used to refer to a lens designed for use in a radioactive environment.

When exposed to Gamma or X-ray radiation the majority of optical materials will change colour, typically dark brown, resulting in almost total loss of transmission. There are a few optical materials available that are naturally non-browning, such as



fused silica and quartz. However, there are simply not enough of these materials available to provide the variety required for a good lens.

Fortunately, standard optical glass can be stabilized against the transmittance loss caused by ionizing radiation by adding cerium to the composition. The added cerium changes the intrinsic colour of the glass from white to a yellowish tint. The goal of creating a cerium-doped glass, is to optimize the cerium content in order to achieve high stability against radiation while keeping the tint colouring to a minimum.

Cerium doped glasses are designed to maintain transmission when exposed to very high levels of gamma or x-ray radiation. These glasses will initially change colour slightly and then they will stabilise and maintain a high level of transmission.

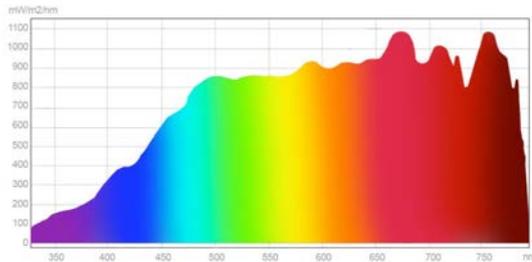
While Resolve Optics has extensive experience of supplying fixed focus and zoom radiation resistant lenses for applications in nuclear reprocessing and power generation – today our expertise is helping organisations operating in a growing number of different and interesting applications.

In medical research – our radiation resistant lenses form targeting elements in synchrotron radiation therapy machines and also in commercial x-ray instrumentation. In outer space all instrumentation, sensors and cameras are subject to constant bombardment by radiation that will quickly degrade and make inoperative standard optical components. Space borne applications present a challenging environment, subject to radiation, where camera lens servicing or replacement is highly undesirable. Recently several satellite manufacturers and an international space agency selected Resolve Optics to supply them with a selection of high performance, radiation tolerant zoom lenses because of our expertise in this area and willingness to work with them on adapting our standard non- browning zoom lens designs to be 'space ready'.

For further information on radiation resistant lenses and optical systems: [click here](#).

DESIGN FOCUS:

Wide bandwidth lenses – what is possible?



Traditionally optical lenses have been designed for use in specific wavebands such as the Ultraviolet, Visible or Infrared regions where they offer good performance over a reasonably narrow bandwidth e.g. visible lenses – 400-700 nm. However recently we have received more and more enquiries for optimised lenses that can cover a much wider bandwidth – for instance – 350 to 1000 nm.

So what's the problem I hear you say! The problem that optical designers face when designing a lens for a wide bandwidth is keeping the two ends of the spectrum in focus at the same time. While such a lens design is not impossible, it does require a significant number of elements and the use of exotic glass types to achieve adequate focus. Another way to achieve similar focus correction over a wide bandwidth is to use a catadioptric lens (mirror lens). Both of these options will consequently be larger and much more expensive than lenses that operate over a narrower specific waveband.

Unfortunately, we have also found that it is generally impractical to try and image a wide bandwidth even if you have the ability to refocus. Refocusing will enable you to bring the UV band into sharp focus but you visible and IR transmission will now be out of focus and producing a very strange image.

I would love to be able to say that there is an easy fix to viewing wide bandwidths with a single lens but there just isn't. The best we can do is fully understand what a customer are trying to achieve with their application and then work with them to achieve the best solution possible.

To tell us about the wide bandwidth application: [click here](#)

PROJECT NEWS:

In this newsletter feature we share with you the latest news on some of the interesting OEM lens design, development and manufacture projects that we are currently working upon.

A new larger image format optical module for high-speed imaging

New 8-channel and 16-channel beam splitter optical modules have been designed and supplied under OEM contract to Specialised



Imaging (Pitstone, UK) for the next generation of their SIM multi-channel framing camera.



The SIM family of ultra-high-speed cameras are used in leading research laboratories around the world. They are capable of capturing up to 32 images at 1 billion frames per second and proven to be able to capture visual data from even the most fleeting of phenomena.

Managing Director of Specialised Imaging – Wai Chan commented “We were looking to upgrade the design of our SIM multi-channel framing camera to meet the expected higher performance demands from our customers in the next couple of years. As a part of this review, we decided a new multi-channel beam splitter optical module that could deliver better performance than the current model was a key factor. To meet the design goals for our new SIM camera we specified that the beam splitter optical module should be compact, with a system aperture of f2.8 giving us up to 16 channels with a 17mm viewport on each channel. Added to this already challenging design specification we stated that the new beam splitter optical module should also be able to incorporate high quality, user changeable filters that would allow our next generation SIM cameras to satisfy the expanding market demand for high-speed hyperspectral imaging. Having worked with Resolve Optics previously on design and development of key optics for our camera systems we again turned to them for this demanding project. I am very pleased to say that the Resolve Optics team has risen to the challenge and designed a beam splitter optical module that meets all of our specifications”.

For further information on OEM design of challenging optical systems – [click here](#). To learn more about Specialised Imaging’s SIM family of ultra-high-speed multi-channel framing cameras go to <https://www.specialised-imaging.com/>.

Ensuring Long Term Security of Lens Supply



Choosing to incorporate off-the-shelf lenses into your product is often driven by the allure of lower upfront costs. However, adopting such a strategy means accepting risks including having little control over security of supply and compromised performance compared to commissioning an optimised custom design.

Earlier this year a customer asked us if it is still possible for Resolve Optics to supply 15 off of a specialist lens design designed specifically for them that they had not ordered for just over 10 years. While

these lenses had been superseded by a new lens that is still in production at Resolve Optics. the customer required the old design lenses for a legacy product order they had received from an important customer.

As part of our commitment to all our OEM customers – no lenses are ever considered obsolete if ordered in more than the agreed minimum quantity. Consequently, we were happy to assist and went to our archives pulled all the drawings and build instructions. long story short, these lenses have been delivered to a happy customer who has kept their customer happy by being able to continue to deliver a legacy product that was a standard part of their operating protocols.

For further information on our custom lens design and manufacture service – [click here](#).

HOT OFF THE PRESS

This newsletter feature is written to inform you about what's new at Resolve Optics.

Smart Working at Resolve Optics

We are now 6-months into our 4-day working week program at Resolve Optics. Feedback from customers has been resoundingly positive as they can still contact us 5-days per week and there has been no impact on deliveries. Our staff love the 4 longer day working regime as it has enabled them to improve their work life balance. The result of this motivational move has led to increased productivity and greater output ensuring our customer receive their orders on time.



Kitted parts – how they have improved production efficiency

In years past we allowed our production engineers to pick and kit their own parts when building lenses for customer orders. In 2020 we decided to have a dedicated member of staff to pick and kit all works



orders. Works orders are now picked and kitted in advance of going into production, so the parts are ready as soon as a technician is available to start production. Since employing this new method of kitting we have noticed a considerable increase in efficiency with much less down time between jobs allowing for greater output.

Better working environment

New air conditioning installed in our production area now enables this environment to be kept at a constant ambient temperature of 22° C. In this new comfortable and clean working environment our production technicians have not only improved productivity but now can confirm that complex optical systems are assembled with all element movements fully operational at a known temperature.



Coming soon to a screen near you

We had hoped that our new company video was going to be completed in time for our Autumn newsletter. Not quite! Keep a look out for the launch (in November) of this informative new video – see www.resolveoptics.com/oem-design-manufacture/

THE LAST LAUGH:

Here are a few 'optical jokes' to brighten your day.

A nurse walks into the doctor's office and says: Doctor, there's a man here who says he's invisible. Oh don't worry that's my pal from the optics lab. Tell him I can't see him now.

My friend works for the telephone company, repairing fibre optic cables. I've told him he should wear eye protection when working on lit cables, because the laser energy can cause permanent eye injury. He said he would look into it.

News Report: A person has died during the manufacturing of the world's largest lenses. He fell into a vat of molten optical glass and made a spectacle of himself.

A vulture boards an airplane, carrying two dead raccoons. The stewardess looks at him and says, I'm sorry, sir, only one carrion allowed per passenger.

What department do Optical Technicians work for? Eye-T



"P.A.Y.F.O.R.Y.O.U.R.G.L.A.S.S.E.S."

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