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Welcome to the Autumn 2020 edition of 'Lens Innovation' – a periodic 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.

Covid-19 is still presenting the world with many challenges. Resolve Optics has taken steps to meet those challenges whilst ensuring our staff have a safe and secure working environment. During the last 8 months we have increasingly used our teleconferencing facility to troubleshoot and quickly solve customer questions relating to delivered lenses. In addition, the ability to share and discuss 3D CAD images of prototype lens designs with participants in different locations has enabled us to accelerate new developments. If you are considering a product development that requires optimised optics to enhance its likelihood of success when launched do not hesitate to contact us.

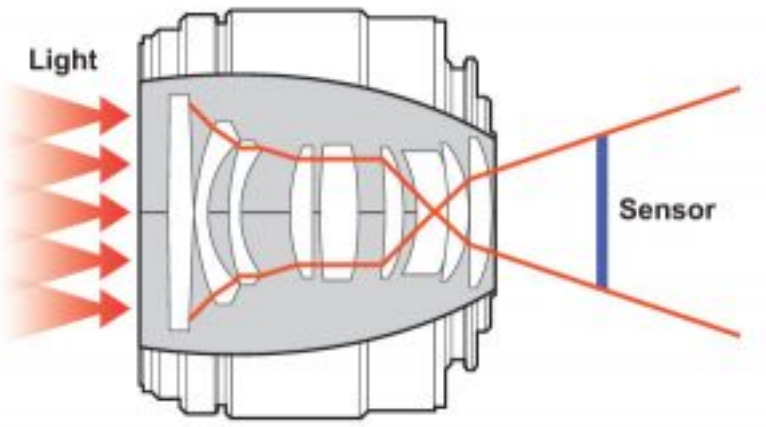
Stay Safe

Mark Pontin
(Managing Director)

Printable version (pdf)

INFORMATION GUIDELINES:

Reducing Product Size – how does it impact Optical Design and Performance?



Across many industries, the trend in recent years has been all about the manufacturing of ever-smaller mechanical, optical and electronic products and devices. Reducing the size of an optical product requires innovative design and manufacturing techniques but what is the impact on performance?

There are various factors that govern the size of an optical system and for the purpose of this article we consider the design of a fixed focus lens. The key factors that affect the size of a fixed focus lens are the sensor it is designed for plus the aperture or f number, focal length and resolution required to meet the requirements of the target application(s).

The larger the sensor area the bigger the clear aperture at the front of your lens needs to be to avoid clipping or severe vignetting.

A requirement for a large aperture (f/ number) will also affect the size of the lens. This goes hand in hand with the focal length, for example if you require a 40 mm focal length lens and an f/2 aperture the clear diameter at the front of the lens will be 20 mm diameter.

Fl = Focal length
f = Aperture
CL = Clear diameter

By comparison, changing optical resolution has more effect on the length of your fixed focus lens as the higher the resolution the more elements that are required for colour correction. In designing a high resolution lens you have to squeeze these elements in somewhere so inevitably the length of the lens must increase.

As an optical designer you can play around with the aperture and distortion to reduce the diameter and length of your fixed focus but this will always necessitate a compromise in performance.

As a rule of thumb, a performance optimised optical design will require the physical lens to be as long as its focal length. So, if you have a requirement for a 50 mm focal length then you should allow for a space of approximately 50 mm for the lens in your product design.

For fixed focus lenses this rule is quite loose as you can reduce the length of a design to a point, However, designing more compact zoom lenses is a much more challenging prospect.

As before a performance optimised zoom lens design will require the lens to be as long as its longest focal length. Shortening the design will always involve compromises with distortion and performance. Such compromises may be acceptable depending on the application. There is a limit as to how short a zoom lens design can go by which time the performance of the lens has dropped significantly.

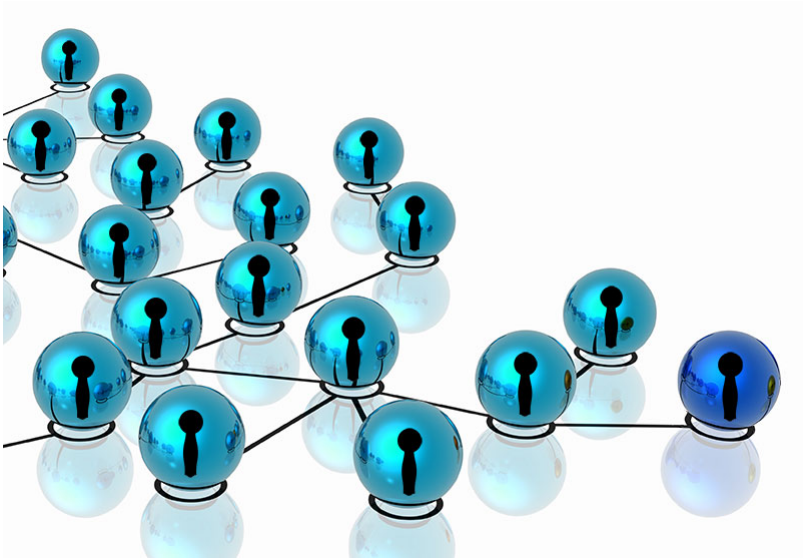
In the discussion above we have only considered the space required for the lens, and not the other elements required to capture the results of your optical application.

When you have a space limited application – I would always recommend that you talk to Resolve Optics ahead of the selecting your camera or sensor if possible. This will enable us to advise how much room is likely to be required for the lens which will then give you a better idea of what camera or sensor you can fit within the space envelope.

Click here to discuss a lens design for a space-limited application or product.

VIEWPOINT:

The Importance of a Secure Optics Supply Chain



Most companies rely upon suppliers to deliver components, systems, and services to enable them to construct and offer products to their customers in a timely and effective manner. In today's busy global market – it is how we do business.

Security of supply of optical components and systems is a critical factor for any instrument, sensor or camera company who has an ongoing requirement and needs to ensure they can offer an unbroken smooth supply of a product. Incorporating off-the-shelf optical components or systems into your product from a large, established supplier at first glance would appear a safe way of securing supply.

While off-the-shelf optical components and systems often offer the allure of competitive pricing this is conditional on a continuing mass market demand for them. As one of many customers for an off-the-shelf optical component or system you may not be a priority for the manufacturer and they may change the design or make it obsolete without even notifying you. Consequently, the supply chain for off-the-shelf optical components and systems is not as secure as you had first thought.

Incorporating optics specially designed and optimised for your application not only gives you security of supply but can improve the performance of your product and increase your competitiveness. These important advantages will have a positive impact on your bottom line.

Resolve Optics is an agile and efficient optical design and manufacture company that can react very quickly to our OEM customer needs. We work extremely hard to ensure that our customer feel secure. As 80% of our optical product developments are unique to one client we can ensure that your lenses will be available for as long as they need them. We can even upgrade lenses to keep in line with changes in technology. Security of supply is knowing that your product will always be available and that the product will not change or become obsolete.

To discuss securing the supply of your critical optical components / systems **Click here**

TECHNOLOGY FORUM:

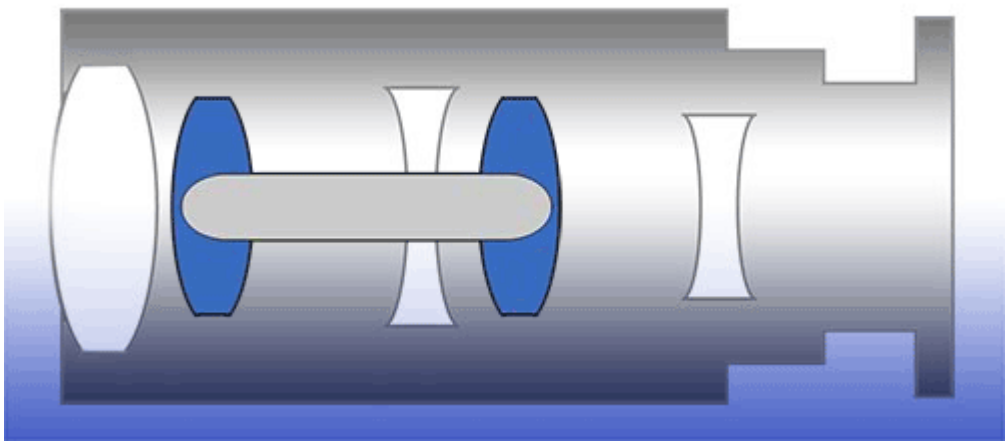
A New Simple Optically Compensated Zoom Lens

One of the biggest advantages of using a zoom lens is that it allows you to change focal lengths without changing your lens. A zoom lens provides a range of variable focal lengths which can be adjusted using the zoom ring on the lens. Because of this inbuilt versatility – zoom lenses are complex with lots of close tolerance components sliding and rotating within each other. This is fine under normal conditions, but at extremely low and high temperatures or in the vacuum of space producing these movements presents a challenge.

In order for the components of a zoom lens to move smoothly typically grease is used. Modern synthetic greases are much better at not stiffening in cold or melting and running when hot but they still pose a problem. There are also special greases specifically designed for space applications but these greases tend to be thick and not useable for fine mechanics.

During 2020 – Resolve Optics has been developing an optically corrected zoom lens – a design concept that vastly reduces the moving parts of a zoom lens to just a single push pull movement. This innovation eliminates the need for complex cams and tubes in tubes that are required in traditional zoom lenses.

While our new optically corrected zoom lens does have limitations such as the zoom range being limited to approximately 4x, and they do not cope with very wide angles, this radical new design shows real promise for use in spaceborne applications and also in hazardous environments. Below is a schematic representation of how our new optically corrected zoom lens works.



In this new design there are two groups of elements that move together in relation to a middle group. The movement is linear so there is no requirement for complex cam profiles. The optically corrected zoom lens beneficially also maintains focus and resolution throughout its zoom range. We are looking for partners to ‘road-test’ our new optically compensated zoom lens. If you would like to know more please send us details of your target application in this **attached form**.

DESIGN FOCUS:

Turning up the Heat

With few optical solutions available ‘off-the-shelf’ – Resolve Optics has established an international reputation for designing and producing specialist optical systems for high temperature applications.

For high temperature applications, optical systems need to be designed to ensure performance is maintained at the application operating temperature. When materials heat up there is expansion. The rate of expansion differs depending on material types. To avoid an optical system going out of focus as it reaches operating temperatures you must take careful consideration of the rate of expansion of components and air spaces. Temperature also affects the refractive index of materials so this needs to be taken into account as well. To maintain performance over a given temperature range, Resolve Optics designs its high temperature optical systems to be athermal.

Over the last decade – Resolve Optics has accumulated the expertise to enable it to design and manufacture specialist optical systems that will effectively operate up to 950°C without the need for additional cooling equipment. This has made it possible for our customers to undertake applications including optical inspection inside an engine or operating furnace as well as non-invasive monitoring of high temperature processes including incineration, recycling, smelting and chemical manufacturing.

If you wish to remotely monitor a hot process safely and wish to discuss a specialist optical system optimised for your 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.

Aerial surveillance image of coastal erosion in the North of France.

Aerial surveillance of coastal erosion

Coastal erosion is subject of environmental concern which requires accurate aerial data. Aerial surveillance specialists – IMAO SAS have undertaken a photogrammetric survey in the North of France using their extra-large format camera which incorporates ultra-high performance high definition lenses.

Aerial Surveillance work depends on the weather, and is challenged every day by how much data you can acquire when the sky is clear. Incorporating 3 ultra large format, low distortion custom lenses, developed by Resolve Optics, the IMAO B66 extra-large format camera produces high quality aerial surveillance images two to three times larger than the standard image size generated by other large format cameras on the market. As a consequence, not only are less images required for geographic data mapping but also these images require less processing time saving operators time and money.

In 2017, IMAO SAS and Resolve Optics Ltd. received €1.68 million funding from a European Union Horizon 2020 programme to develop an ultra-large format aerial surveillance camera.

For further information **click here**.

Radiation Hard Lenses for Satellite UHD Video Cameras

Sen is a UK based video streaming data business launched with the goal of streaming real-time videos of Earth and space to smart phones. Sen launched its first set of Ultra-High Definition (UHD) video cameras into space in 2019 and successfully demonstrated the excellent performance of its video streaming platform. The next step in Sen's plan is to launch its own satellite constellation so that it has full control over its live data stream.

To make technology work in space is not straight forward, with both mechanical and environmental challenges, such as extreme temperature changes and radiation that can damage electronics and hardware. Space is also very mass sensitive because each gram costs money to launch. As a consequence, Sen decided they needed a specialist provider who could custom design and manufacture cameras to meet both the unique constraints of spaceflight hardware and the environmental challenges of operating in space for several years. Commercially available camera lenses were not suitable for this application because the glass would increasingly suffer from radiation 'browning' – meaning that image quality would gradually deteriorate over the life of the satellite.

Sen approached Resolve Optics to assist with this project because of its expertise in custom designing low mass, high performance lenses using radiation resistant glass that could meet the harsh demands of the space environment.

Charles Black of Sen commented "It has been great working with Resolve Optics, who took our requirements in terms of optical performance, mass and mounting points and designed lenses that addressed both the mechanical and environmental challenges of our spaceborne application. After the first satellite has launched in 2021 – Sen will be sharing videos of Earth using Resolve's lenses and we can't wait to share them. Please do check out **https://sen.com** for news and look to download the video viewing app once it's available in December 2021. After that, we plan to launch many more satellites and we are confident Resolve will continue to meet our requirements and high standards".

Watch a Sen 4K UHD video of Earth from space: **https://www.youtube.com/watch?v=wVn6ANxuJrc**

HOT OFF THE PRESS

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

In the Press: Off-the-shelf vs. Optimised lenses

Optics play an important part if you want to get the best possible results from your instrument, sensor or camera system. Recently leading process publication – PCN Europe – recently interviewed Mark Pontin., Managing Director of Resolve Optics on the age-old dilemma of choosing off-the-shelf versus an optimised lens for your product.

Read interview in full: **click here.**


10 exclusiveinterview

Off-the-Shelf versus Application Optimised Lenses – a key decision for instrument, sensor and camera

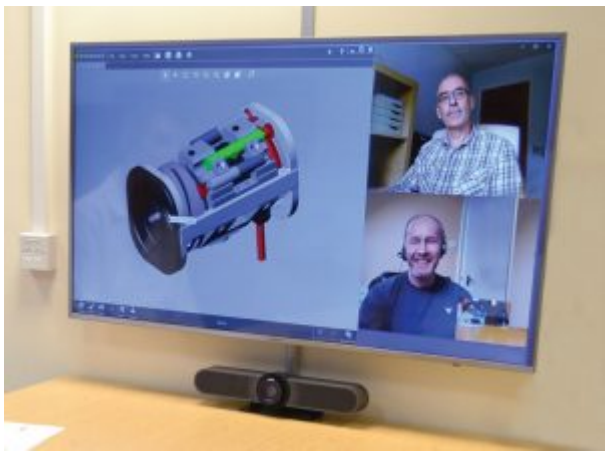
Optics play an important part if you want to get the best possible results with your system. We interviewed Mark Ponting, Managing Director of Resolve Optics, about how this can be assured.

COVID safe production environment

To maintain timely delivery of lenses and optical systems to clients worldwide during the COVID-19 pandemic – Resolve Optics has invested in personal protective equipment, protective screens and introduced special working guidelines to safeguard our optical production and testing staff.

Learn More: **https://www.resolveoptics.com/careers/**

When travelling to a meeting is not an option



The COVID-19 pandemic has changed the way that most of us conduct business. Travelling to an important face-to-face meeting is likely to be off the agenda unfortunately for the foreseeable future. Installed in 2018, our video teleconferencing facility has enabled us to undertake detailed discussions with our existing and prospective customers around the world. Being able to share and discuss a 3D CAD image of a prototype lens design with a new customer in different locations has helped us to accelerate their lens development. For existing customers, we have used the video teleconferencing facility to troubleshoot and quickly solve questions raised on delivered lenses.

For further information regarding our video teleconferencing facility – **click here**.

THE LAST WORD:

How to Source Critical Photonics Information During the Pandemic?

The COVID-19 global pandemic is likely to drastically change the conferences and exhibitions industry. How will the photonics industry adapt to changes when the lockdown has been lifted?

Since the early part of 2020, virtually all industry conferences, tradeshows and exhibitions have been cancelled or postponed and there is dwindling confidence that any future date in 2021 will be viable.

Without doubt the organisers of conferences and exhibitions industry are resilient, and our human need to interact and exchange information face-to-face will result in a recovery in time.

In the meantime, however, we welcome your feedback as to how your organisation would like to gain critical information on new photonics products and services, technological innovations and applications advances to support and help drive your business forward?

Click here for feedback form.

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