

Avionics & Space Technology





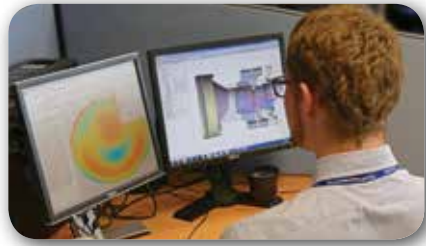
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Machine
Adaptor 2 HSK 63

- Single Tool
- Toolkit
- Adaptor
- Machine
- Settings
- Data Output

EXIT



Differentiators

A unique combination of world-class design and state of the art manufacturing

Qioptiq offers an unrivalled pedigree in the design and manufacture of advanced optronic solutions, delivering world-class performance and affordability to end users around the globe.

In-house design and manufacturing software

- Optical design
 - Advanced visual analysis
 - Bespoke material library for all optical materials
 - Best in class athermalisation
 - BRDF database for stray light analysis
- Coating design
 - Custom solutions
 - Enhanced durability
 - Laser protection
 - Visor coatings
 - Multi colour notch coatings
 - Neutral outside world coatings

- Finite element analysis
 - Shock simulation & modelling
- Electronic design
 - Software, algorithms & C4I
 - Servo-control

Manufacturing control and metrology

- State of the art manufacturing facilities
 - Design for manufacture
 - Customised processes
 - Automated test
 - Unique optical coatings
- Precision polymer optics
 - Freeform surfaces
 - Coatings
- Additive manufacturing

Technology management

- Delivering solutions for tomorrow

Accreditations

- AS9100, ISO 9001, ISO14001 Certified

Multiple manufacturing locations around the globe

- In-house, low-cost manufacturing

Infrastructure

- ITAR compliance

Key technologies and capabilities for tomorrow's requirements





Avionics Design Capability

Transforming customer requirements into reality

The Advanced Optronics design team is a highly skilled and motivated group of customer focused engineers. By discussing and understanding every aspect of a project's requirements with the customer, we can provide the optimum design solution that accomplishes all of the project objectives.

Working with the customer at every stage

- Listen to customer requirements and design constraints
- Discuss the design options based on expertise and experience
- Create innovative design solutions for review with the customer
- Deliver the optimum design solution, engineered for manufacture

Design through project teams

Projects are delivered by a team of designers and engineers. This approach ensures that the final design is both technically proficient and suitable for volume production.

Project Team

- Optical Design
- Mechanical Design
- Electronic Design
- Development Engineering
- Manufacturing Engineering
- Test Engineering

Designing world class solutions to meet demanding requirements

- Experts at tailoring designs to meet challenging space envelopes
- Military HUD's
- Commercial HUD's
- Military HMD's for fast jets and rotary wing platforms

Novel & affordable solutions – engineered to perform in the toughest military environments





Manufacturing for Avionic Displays

Global solution

Qioptiq is a vertically integrated organisation with manufacturing facilities in North America, United Kingdom, Germany and Singapore.

We offer state of the art design and manufacturing to provide precision solutions optimised for low cost, high volume production.

We provide a complete in-house capability for the design, simulation, manufacture, test and qualification of advanced optronic modules.

Leading the way

Leading the world in technology and facilities, Qioptiq provides solutions to meet the individual requirements of civil and military customers for cockpit displays and laser protection.

Outstanding expertise in optical and mechanical design, optical coating and holography has earned the company a worldwide reputation for innovation and excellence.

It has a complete in-house capability to process a full range of optical materials and to design, fabricate, polish, coat and mount optical elements.

This manufacturing capability includes state-of-the-art, volume optical processing, vacuum deposition coatings, mechanical processing, assembly and test.

Qioptiq has a dedicated Helmet-Mounted display (HMD) facility, with best in class capability.

We produce aspheric lenses and hybrid optics, as well as free form optics.

A key technology area within Qioptiq is the vacuum coating section where the next generation of coatings and dielectric combiners is already in production. Having delivered over 15,000 combiner elements, the company is a leader in holography and operates the most productive facility in the world for Avionic holograms.





Avionic Helmet Mounted Displays

Visible advantage

Qioptiq has a respected international reputation for the design and manufacture of optical modules for Head-Up, Head-Level, Head-Down and Helmet-Mounted displays.

We have been designing and manufacturing optical modules for Head-Up Displays (HUDs) for more than 30 years. Qioptiq fulfills over 50% of the world's demand for HUD optical modules. Systems are custom designed and analysed using in-house computer software for optical designs. End to end system modelling with sequential and non-sequential ray tracing enable complete system optimisation.

To meet the ever increasing demand for brighter, lighter and more compact display modules, Qioptiq has fully exploited the use of plastic technologies for both optical element and lens housing requirements as well as pilot display visor coatings.

The company offers a total capability in HUD optical modules from initial design through to volume production.

Qioptiq has designed and manufactured over 25,000 Head-Up and Head-Down Display optics for more than 30 aircraft types for both military and commercial markets.

Qioptiq HUD optical modules are in service with international airlines in Europe, the USA and executive jets worldwide.

For Helmet-Mounted applications, the company has designed and manufactured a variety of optical modules to satisfy the increasing demand for lightweight, compact displays. These advanced systems include rotary wing applications such as UH Tiger and fast jet fixed wing applications such as Eurofighter Typhoon and F-35.

- Visors and HMD optics
- Full colour HMD's
- Rate of production - over 100 HMD's per month





Avionic Laser Protection

Visible protection

Qioptiq is recognised for its expertise in laser protection. Its capability extends from protection filters - optimised to integrate with sensors and sighting systems - through to the volume manufacture of spectacles, goggles and visors.

The company has led the way in the design, analysis, optimisation and manufacture of advanced, high transmission Electro Optic Protective Measures (EOPM) devices for over 30 years; in the US defence market Qioptiq is the leading supplier.

Protection can be provided over the full threat spectrum, from visible to far Infra Red, for both fixed, agile or broadband threats.

Hardware has been developed to meet a wide range of requirements, protecting systems and personnel, in both ground and airborne environments.

Designs for EOPM devices are optimised to suit the requirements of each individual application, drawing upon sophisticated modelling and the company's optical design and fabrication capabilities.

For all applications it is essential to balance the conflicting requirements of operational performance (such as transmission, haze, display visibility, colour perception, comfort) and laser protection (such as optical density and threat wavelengths).

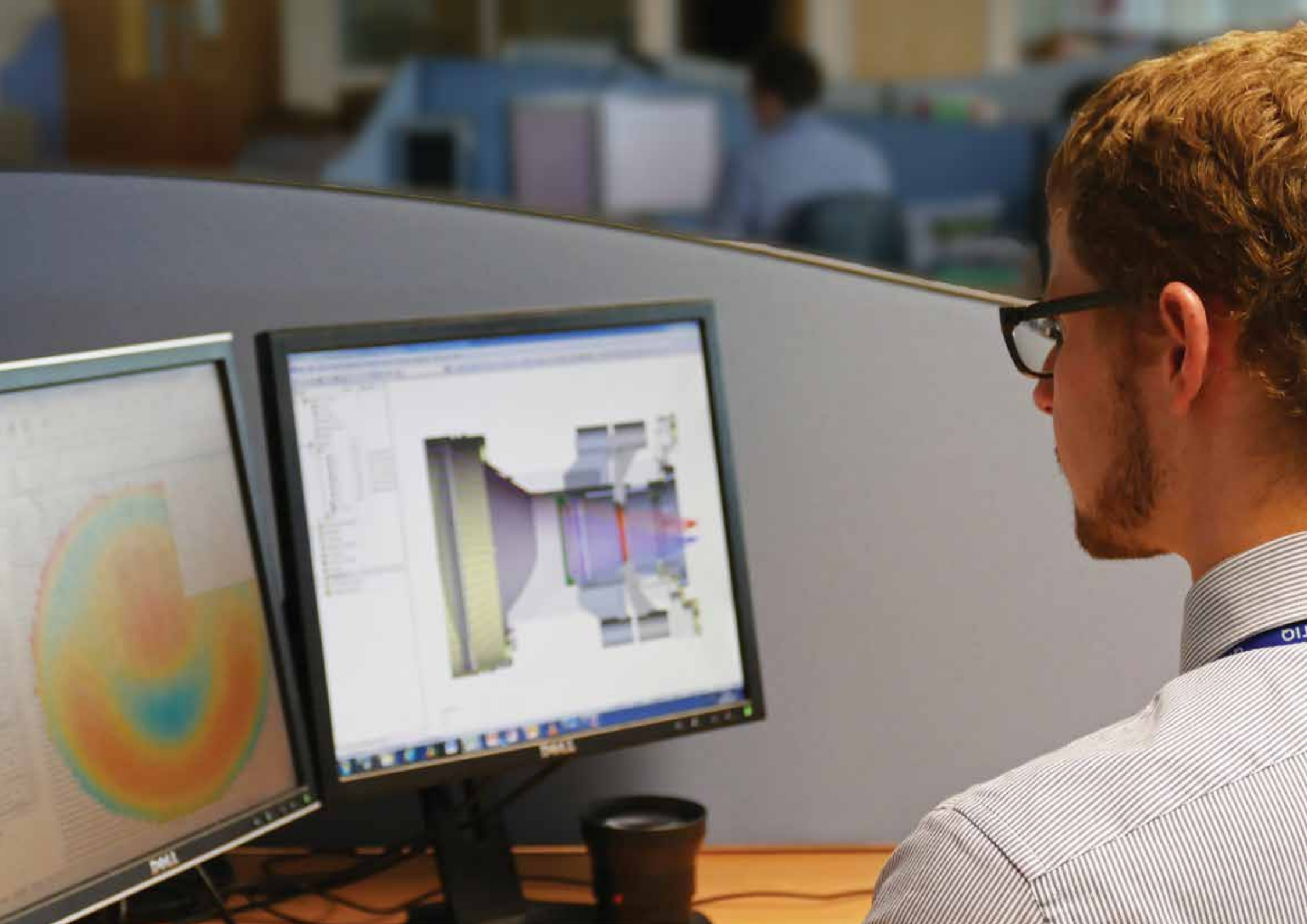
The extensive experience of Qioptiq within this field enables it to maintain maximum operational ability whilst also providing highly effective laser protection.

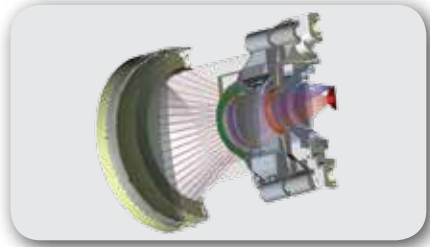
This expertise has won recognition from many key customers throughout the world. Volume manufacturing is proven, with over 15,000 high transmission, general-purpose laser goggles and 15,000 aircrew visors and spectacles produced to date. Qioptiq is also addressing an increasing number of demands for EOPM solutions in civil markets.

Solutions include; dielectric and holographic coatings, absorbing glasses, organic dyes and non-linear optical materials. All of these technologies have been applied to a variety of substrates and Designs have been fully tested with armoured vehicles, fixed wing aircraft, fast jets and helicopters. They are available in a wide variety of frames and can be used with night vision goggles or fitted inside standard respirators.

Customer support

A key feature of operations at Qioptiq has long been its outstanding after-sales service - particularly in terms of training, spares and test equipment availability. Increasingly, customers around the world seek to become self sufficient in repair and maintenance - and the company is keen to provide the necessary expertise and resources to satisfy this requirement.





Design Solutions

Complete innovative designs for all platforms and domains

At Qioptiq we use our expert domain knowledge and defence experience to design and manufacture bespoke solutions for our customers.

We design and manufacture every aspect of the system (including optics, coatings and metalwork), so we can optimise the solution to deliver the maximum performance and affordability.

Our engagement with the end user community gives Qioptiq engineers unique insight into the key requirements for optical systems when used in theatre.

This domain knowledge is incorporated into every solution we create to deliver the best possible product for the end user.

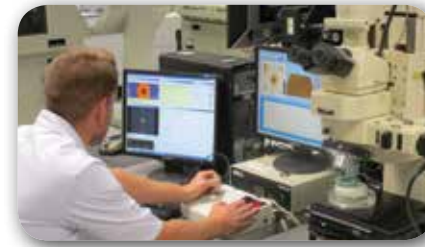
We pride ourselves on our ability to design for manufacture. All of our solutions are optimised for our state of the art manufacturing processes incorporating continuous improvement activities to enhance performance and improve productivity.

Our design solutions are delivered by an expert team of highly qualified designers, engineers and manufacturing technicians.

We have world-class talent in our design team including one of the largest dedicated optical design teams in Europe and a highly regarded mechanical analysis team to deliver solutions for the most technically challenging requirements.

Our investment in bespoke design tools and software, allied with our extensive opto-mechanical materials database and weapon shock library is second to none. This capability enables us to deliver solutions that perform in the most challenging of environments.





Manufacturing Capability

Vertically integrated capabilities in global facilities

Optical materials processed

- All optical glass
 - Zeonex, Acrylic, Polycarbonate
- Optical plastic
- Infrared materials
 - Aluminium
 - AMTIR™ materials
 - BaF₂, LiF, CaF₂, MgF₂
 - Silicon, Germanium, Gallium Arsenide
 - Gasir-1, Gasir-5, IG2-IG6 materials
 - Sapphire, Spinel, ALON®
 - Zinc Selenide, Zinc Sulphide, Zinc Sulfide
 - Multi-spectral, Tuftran®

Optical fabrication

- Component diameters of 10 mm to 600 mm
- Conventional polishing
- Diamond turning
- Magneto-Rheological finishing

Optical coatings

- Anti-reflection
- Mirrors
- Beamsplitters
- Multi-spectral
- MWIR/LWIR
- SWIR/LWIR
- Ultra-durable coatings
- Laser protection

Automated linespread testing

- Visible, MWIR, LWIR

Interferometry

- Testing
- Stitching
- White light

Metal machining

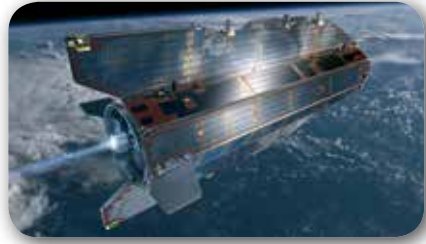
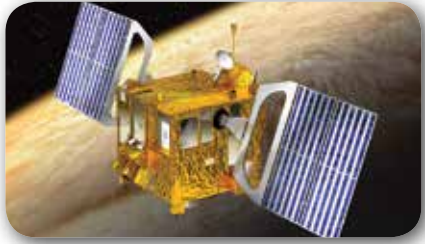
- Full CNC machine shop
- Metal finishing

Defence and aerospace global manufacturing locations



Global infrastructure to deliver high performance product





Specialist Glass For Space Programmes

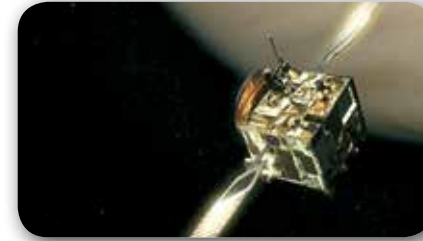
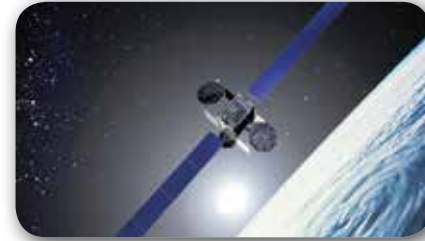
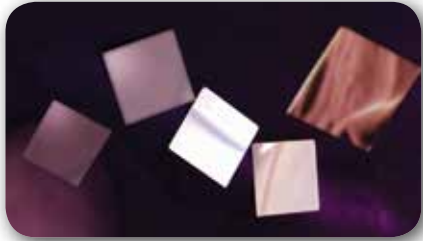
Qioptiq Space Technology

- Purpose built factory
- Design and Manufacture of radiation-stable Optical Solar Reflectors (OSRs) and Coverglasses
- Over 45 years of space heritage
- Space qualified
- Supplies 80% of the World's Coverglass and OSR requirements
- Unique Patented Glass formulations
- Performance enhancing coatings
- High volume in-house manufacture
- Bespoke solutions
- ISO 9001, ISO 14001 and AS9100 Accredited

Space Qualified Radiation Shielding Glass

- Pilkington Borosilicate Glass types
- CMG, CMX, CMO
- Cerium Dioxide stabilisation prevents colour centre formation
- Ultra-Violet, Electron and Proton Radiation Protection
- CMG – Thermal expansion coefficient matched to GaAs
- Thermal expansion coefficient matched to Si
- High emissivity
- Standard thicknesses from 50 to 500 μm
- Strength enhancement for increased yield at bonding
 - Athermalisation, thermal gradients, apressurisation
- Stray light analysis, narcissus analysis Power System Protection

- 
- ◆ **1971** Pilkington CMS Glass Qualified
 - ◆ **1971** First European Contract
 - ◆ **1974** First non-European Contract
 - ◆ **1976** First International Contract
 - ◆ **1977** First SSM contract
 - ◆ **1979** First Major Contract direct with US
 - ◆ **1982** Office opened in U.S.A
 - ◆ **1982** Pilkington CMX Glass Qualified
 - ◆ **1983** Production moves to purpose built factory
 - ◆ **1986** Queen's Award for Technology Achievement
 - ◆ **1988** Extension to existing facility
 - ◆ **1989** Special Glass Melter commissioned
 - ◆ **1989** CMZ Qualified
 - ◆ **1991** U.V.S. Mirrors Qualified
 - ◆ **1992** ITO/UVS Mirrors Qualified
 - ◆ **1993** PST 10 Years Old
 - ◆ **1993** CMG Qualified
 - ◆ **1995** IRR/AR Qualified (GaAs)
 - ◆ **1996** Expansion of manufacturing area
 - ◆ **1997** Development of Blue/Red (Silicon)
 - ◆ **1998** Produced thick CMO & CMO Mirrors
 - ◆ **1998** Blue I Red Qualified
 - ◆ **2006** Name changed to Qioptiq
 - ◆ **2008** Melter moved from PSG to QST
 - ◆ **2009** First glass melt completed at QST
 - ◆ **2010** Glass verification testing complete



In Space We Have You Covered

Solar Cell Coverglasses

- Selection of glass types available
- Proven on-orbit heritage, LEO through GEO and beyond
- Widest range of thicknesses in industry (50 to >500 μm)
- Thermal expansion coefficient match to cell
- Wide range of geometries available on request
- ESD protection available
- Performance Enhancing Coatings
 - Single layer Anti-reflection coatings
 - Multilayer Anti-reflection coatings
 - Conductive Anti-reflection coatings
 - UV reflection coatings
 - Infrared reflection coatings
 - ATOX resistant coating
 - Specialised coatings to manage thruster erosion

Thermal Management

- Optical solar reflectors (OSRs) for Passive Thermal control
- Proven on-orbit heritage
- Choice of glass types CMX or CMO
- Low solar absorption
- High emissivity
- ESD protection
- High performance over wide range of angles of incidence
- Performance Enhancing Coatings
 - Ultra-Violet reflection enhancement
 - Conductive coatings
 - Conductive edge coating
 - Combination coatings

- | | | |
|--|-------------------------------------|------------------|
| ■ Mars Exploration Rovers (Spirit and Opportunity) | ■ Space Systems Loral (1300 Series) | ■ MARS EXPRESS |
| ■ Direct-TV | ■ ARABSAT | ■ VENUS EXPRESS |
| ■ Sirius Satellite Radio | ■ TURKSAT | ■ ATV |
| ■ Kepler | ■ TDRSS | ■ SKYNET 4 |
| ■ GPS | ■ Space Telescope | ■ SKYNET 5 |
| ■ Deep Impact | ■ GRO | ■ NATO 3 |
| ■ Intelsat 5 | ■ ROSAT | ■ NATO 4 |
| ■ Intelsat 6 | ■ EURECA | ■ DISCS Series |
| ■ Intelsat 7 | ■ GIOTTO | ■ SP Series |
| ■ Intelsat 8 | ■ GOES | ■ MILSTAR Series |
| ■ Intelsat 10 | ■ ARTEMIS | ■ AEHF 1 & 2 |
| ■ Inmarsat 1 & 2 | ■ EOS Series | ■ ODIN |
| ■ Utatsats | ■ Polar Platform | ■ UHF Series |
| ■ Boeing 376 Series | ■ ENVISAT | ■ EXSAT |
| ■ Boeing 601 Series | ■ SPOT Series | ■ WGS |
| ■ Boeing 702 Series | ■ ERS Series | ■ MUOS |
| ■ Astrium E2000 Series | ■ TOPEX | ■ AEHF 3&4 |
| ■ Astrium E3000 Series | ■ CLUSTER | |
| ■ Lockheed Martin (A2100 Series) | ■ Venus Radar Mapper | |
| | ■ HIPPARCOS | |
| | ■ ROSETTA | |
| | ■ MARS Lander | |

About Qioptiq:

Qioptiq designs and manufactures photonic products and solutions that serve a wide range of markets and applications in the areas of industrial manufacturing, medical and life sciences, research and development, defence and aerospace.

The company is known for its high-quality standard components, products and instruments, its custom modules and assemblies, its leading-edge innovation, its precision manufacturing and its responsive global resourcing.

Through a series of acquisitions, Qioptiq has an impressive history and pedigree, and benefits from having integrated the knowledge and experience of LINOS, Point Source, Spindler & Hoyer, Gsänger, Optem, Pilkingtons, and others.

Qioptiq has a worldwide presence with locations throughout Europe, Asia and the USA.

For further information visit: www.qioptiq.com

Qioptiq Limited, Glascoed Road, St Asaph
Denbighshire, LL17 0LL, United Kingdom

Tel: +44 (0)1745 588000 Fax: +44 (0)1745 584258
Email: sales@uk.qioptiq.com Web: www.qioptiq.com



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Issue 1

FS 1300 Series – Courtesy of Space System LORAL corporation, Rosetta – courtesy of ESA, GOCE – courtesy of ESA, Venus Express – Courtesy of ESA, Jules Verne ATV – Courtesy of ESA, ARTEMIS 28 – courtesy of ESA, Boeing 702 Satellite in Orbit – courtesy of Boeing

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