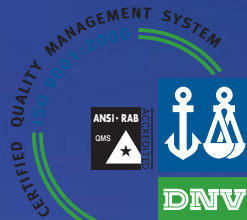


OPHIR

Ophir Optics, Inc.



Optical Elements



CO₂ Optics



Lens Assembly

Ophir Optics, Inc. was established in the United States in 2002 as a premier manufacturer of Infrared Optical Components and has facilitated the finest IR optical fabrication facility possible. Equipment includes the latest generation diamond turning machines, CNC fabrication machines, coating chambers and testing equipment including Computer Generated Holographic (CGH) testing equipment.

Our Engineering and Management Team has over 75 years of combined experience with IR Technologies and commercial and military programs; and operates under an approved Technology Control Plan.

Optics Group Areas of Expertise

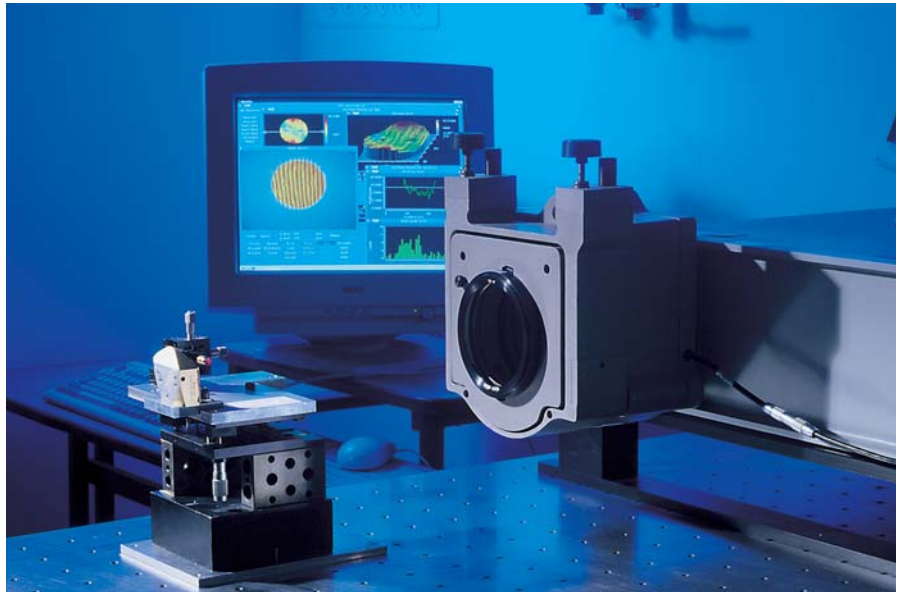
Ophir Optics Inc. designs and manufactures IR optics for the military, commercial (IR vision and FLIR) and industrial markets (CO₂ laser machining applications)

- Optical Lens Assemblies for MWIR & LWIR Cooled and Uncooled Cameras
- High Power CO₂ Optics for Industrial Lasers
- Optics for Medical Systems
- FLIR Optics (3-5 μ and 8-12 μ)
- Missile Optics
- Metal Optics



Quality Assurance

Ophir Optics, Inc. is certified to ISO 9001:2000 and is structured to operate to both commercial standards and US military specifications. Our QA department uses an effective combination of the world's most advanced test and measurement equipment as well as unique techniques such as Computer Generated Holography for measuring aspheric surfaces.



Zygo GPI Interferometer



FT-IR Spectrophotometer (Perkin Elmer) Spectrum GR

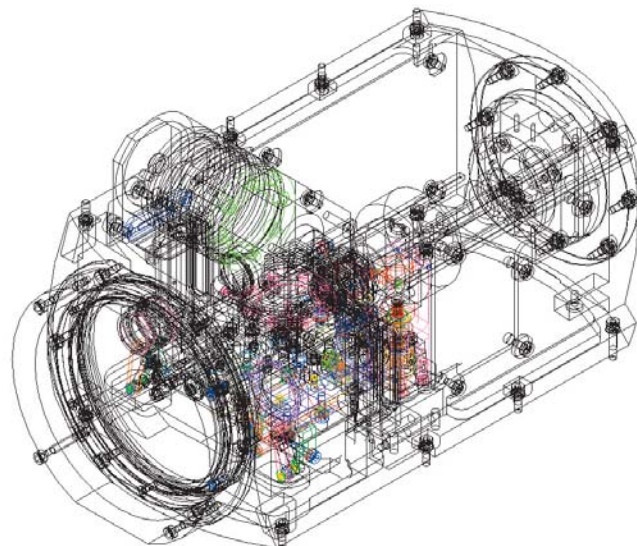


Research & Development

'Unique Solutions for Unique Requirements'

Ophir's R&D department focuses on design and development of lens assemblies and improving manufacturing techniques. The goal is to develop lens assemblies with very high optical & mechanical performance, while aiming to achieve the highest manufacturing efficiencies. In close association with our customers, we strive to provide unique solutions, perfectly tailored to their specific requirements.

Ophir employs Optical Designers, Mechanical Engineers, Software Engineers and Physicists - using the most advanced optical and mechanical design software.







CNC Polishing

The conventional polishing department at Ophir produces spherical elements, windows, domes, prisms and mirrors from all known materials for the IR spectrum and has additional capabilities in the visible range. This department is unique in its abilities to produce a wide range of high precision elements in prototype and low rate production, as well as high precision elements in mass production.

During its years of operational experience, unique techniques of micro-polishing have been developed which enable Ophir to easily produce elements needed for high transmission and low scattering and absorption applications.

Manufacturing capabilities include the most advanced machines existing on the market for grinding, polishing, centering and shaping of optical components. This technically advanced machinery is perfectly complemented by conventional optical manufacturing equipment, proven over many years to produce state-of-the-art precision elements.

Ophir is capable of producing elements from a minimum diameter of 3mm to a maximum diameter of 350mm with dimensional tolerances of 0.01mm. Quality achievements include surface finish of 10-5 scratch and dig, parallelism of 1" and irregularity of $\lambda/10$ P-V at 0.633μ on Germanium, Silicon, Zinc Sulfide, Zinc Selenide, Calcium Fluoride, Galium Arsenide, PMMA, Quartz, Fused Silica, and other exotic materials, as well as most types of glass.

Capabilities: Conventional Polishing

| | |
|--|---------------|
| Diameter (max.) | 350mm |
| Diameter (min.) | 3mm |
| Diameter Tolerance | ± 0.01 mm |
| Radius of Curvature (min.) | 4mm |
| Centration | 0.005mm |
| Irregularity ($\lambda @ 0.633\mu$ P-V) | $\lambda/10$ |
| Power | $\lambda/10$ |
| Scratch and Dig | 10-5 |
| Parallelism | 1" |



LOH CNC SPM 2/120 Grinding Machine



Conventional Spindle Polishing Machine





Optical Coatings

Ophir is known to be a world leader in the development, production and application of advanced optical coatings for a broad range of substrates.

Selected Optical Coatings

FLIR Optics for 3-5 μ /8-12 μ

- High Efficiency AR
- High Durability AR
- Super Hard Durability
- High Reflectivity Mirrors
- Hard Carbon
- Rain Erosion Resistant

General Applications

- AR-V
- AR Broadband
- AR Double and Triple Band
- Long and Short Pass Filters
- Conductive Coating
- Neutral Density

CO₂ Optics for Medical and Industrial

- Lasers
- Zero Phase Shift Mirrors
- 90° Phase Retardation Mirrors
- AR/AR on ZnSe
- Dichroic Mirrors
- Total and Partial Reflector
- High Reflectivity Turning Mirrors

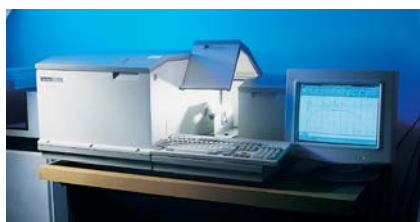
The above are available on Ge, ZnS, ZnSe, Si, CaF₂, GaAs, AMTIR, Glass



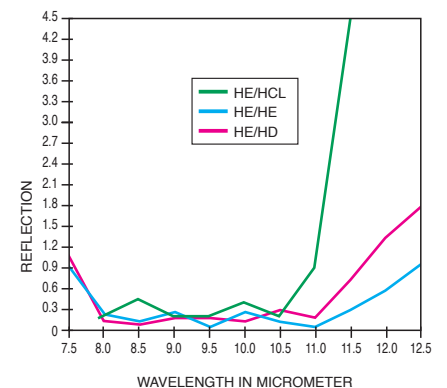
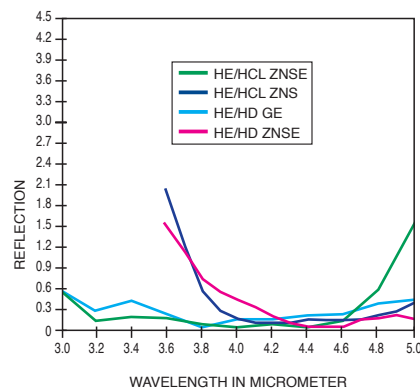
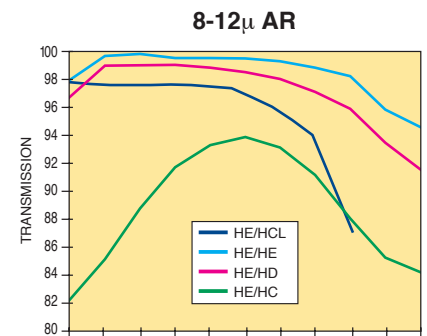
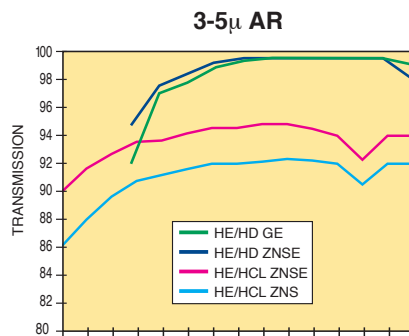
160 Balzers Vacuum Coating Chambers provide the highest quality coating available

Ophir uses a wide range of coating techniques including thermal evaporation (resistance heating and electron gun coating) and plasma assisted chemical vapor desposition and sputtering. These techniques enable the development of special super 'hard' or enhanced coatings with exceptional specifications including hard carbon coatings.

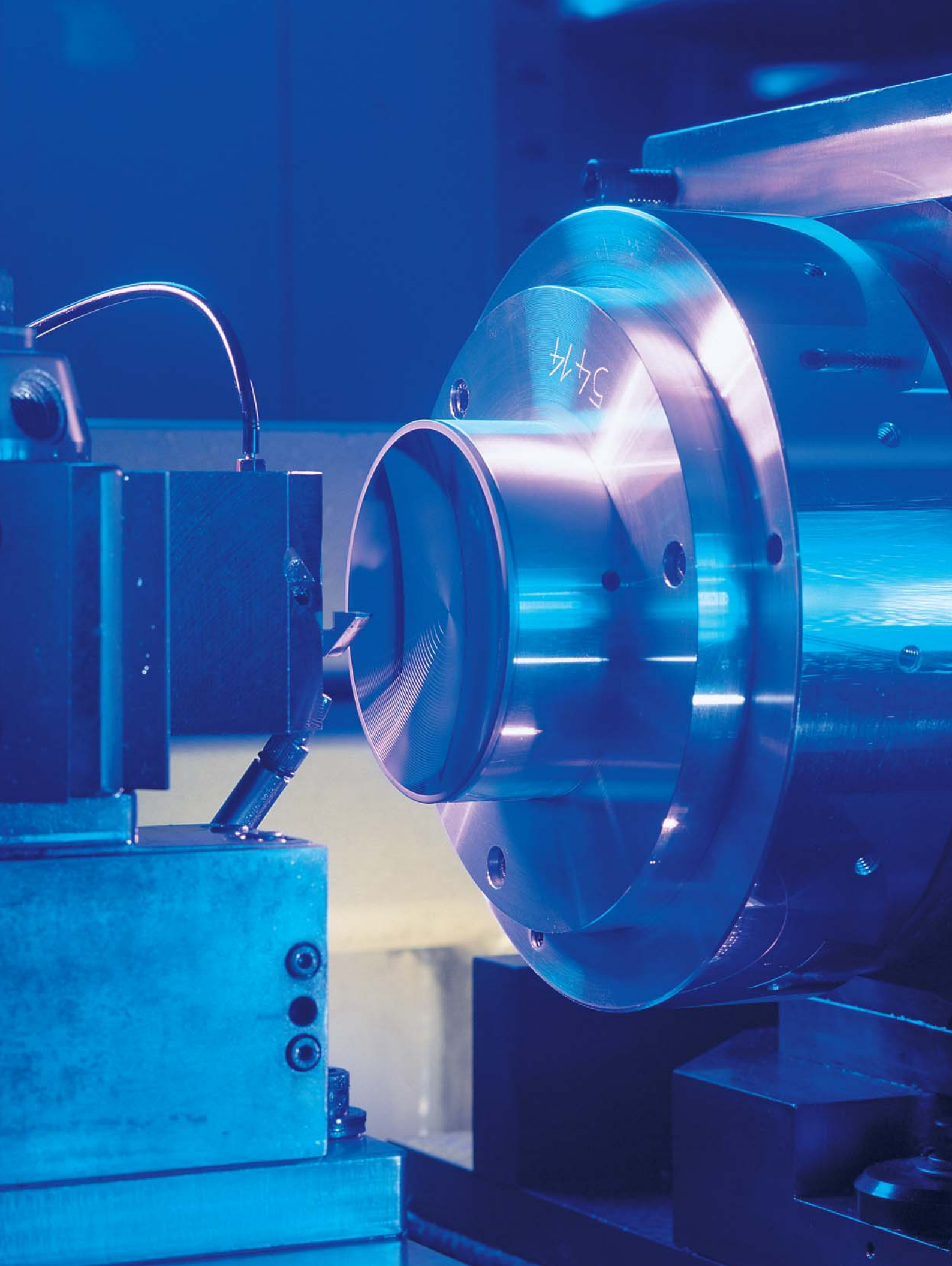
Ophir's coating experts are often called upon to provide rapid and effective solutions to problems which arise in new applications, many of which require original, innovative and complex designs and manufacturing technologies.



FT-IR Spectrophotometer (Perkin Elmer) Spectrum GX



High Efficiency (HE) and High Durability (HD) AR Coatings available on Ge, ZnS, ZnSe, Si, CaF₂, GaAs, Amtr Super Hard Coating (HC like) for Ge, ZnS, ZnSe





Diamond Turning

The diamond turning department was established to provide in-house diamond turning capabilities. The department contains the most advanced diamond turning machines. These, together with the department's know-how, enable Ophir to achieve the highest levels of accuracy and surface quality on a wide range of substrates including Ge, Si, ZnSe, ZnS, Cleartran™, CaF₂, GaAs, AMTIR, PMMA, Al and Cu.

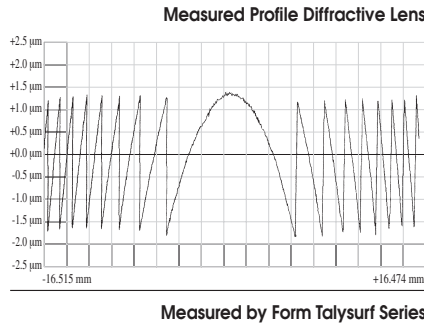
The department is equipped with dual axis turning machines and also boasts advanced testing equipment such as Zygo interferometers (including the GPI version), a Talysurf Profilemeter and unique holographic testing equipment which enable measurement of both aspheric and diffractive surfaces.

Ophir can machine reflective and refractive materials, as well as acrylics and other plastic based materials, round and truncated optical elements, perfect spherical or complex aspheric and diffractive surfaces. Paraboloids, ellipsoids and hyperboloids, with on and off axis symmetry, are all standard demands to the Ophir diamond turning team.

With its years of diamond turning experience Ophir's team of engineers is responsible for the manufacture of many highly specialized, customized elements. The unique strength of the Ophir diamond turning department stems from our exploration of new production methods. This exploration enables us to produce one-off and high volume cost-effective aspheric and diffractive elements to extremely high standards.

The years of diamond turning experiences enable our engineers not only to produce

according to a given design, but also to work together with customers' optical design teams to provide alternative solutions to improve the overall performance of an optical system.



Form Talysurf Series (Rank Taylor Hobson)

Capabilities: Diamond Turning

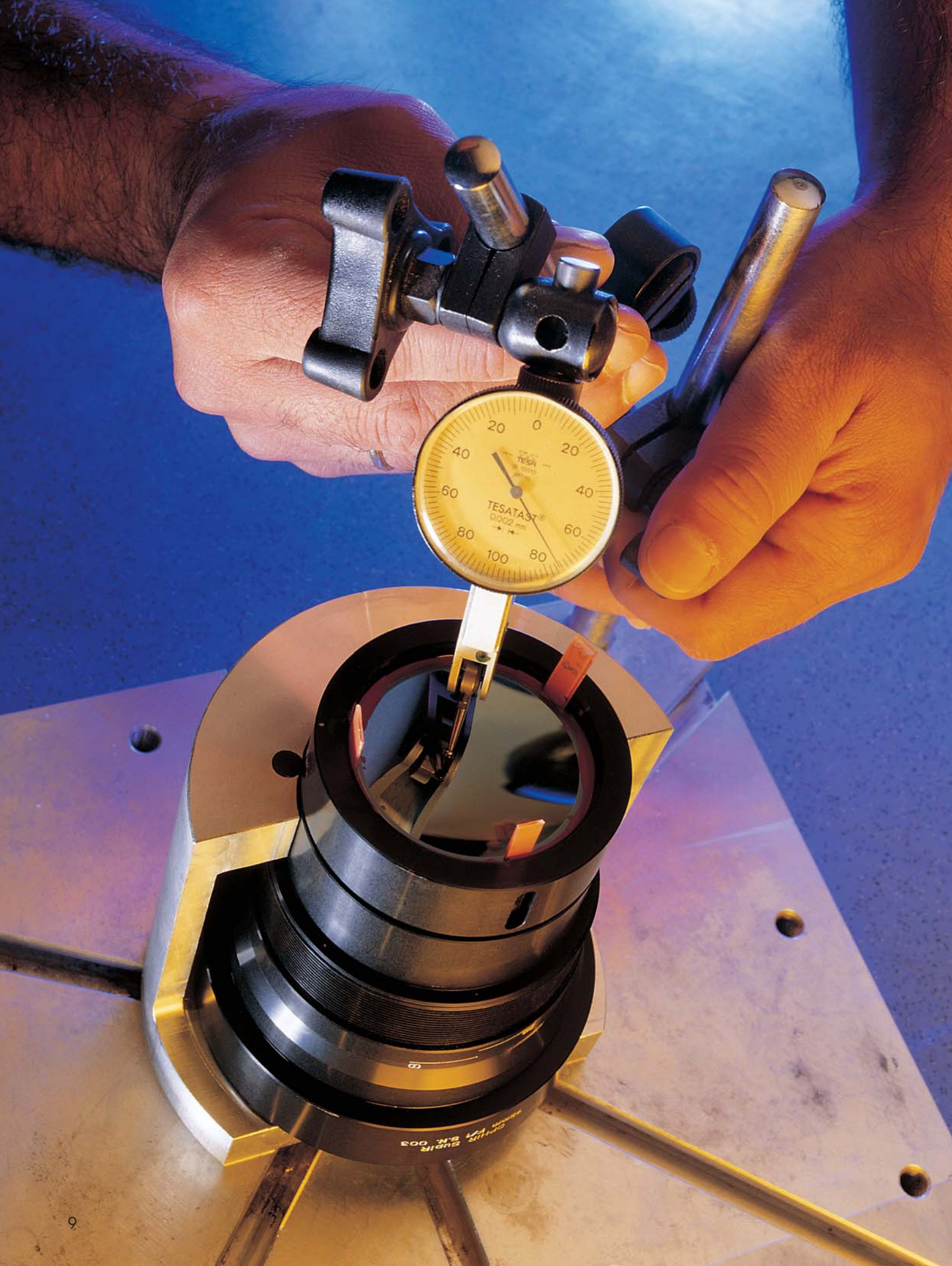
| | |
|--|--|
| Diameter (max.) | 400mm |
| SAG (max.) | 180mm |
| Irregularity ($\lambda @ 0.633\mu$ P-V) | Less than 1/2 Fringe for $\phi 150$ mm |
| Power | $\pm 0.05\%$ Radius of Curvature |
| Roughness | 30Å RMS for Ge and Al |

Capabilities: Diffractive Lenses

| | |
|-----------------------------|----------------|
| Groove Width | Less than 20µm |
| Accuracy of Groove Position | Less than 20µm |
| Accuracy of Groove Depth | $\pm 0.05\mu$ |



Ultra precision diamond turning machine





Optical Lens Assembly

Ophir has drastically expanded its optical and mechanical design capability, thus enabling the company to offer complete, unique and highly effective solutions for a wide variety of lens assembly projects.

Ophir's competitive advantage stems from the superior production know-how and the most advanced design techniques and skills drawn from the years of experience of its highly qualified, academic staff. Indeed, Ophir's staff has developed a patent which has enabled a revolutionary breakthrough in cost-efficient lens assembly design enabling superior performance combined with simpler assembly and fewer optical elements.

Ophir SupIR™ lens assemblies rely on the unique combination of state of the art optical components, aspheric and spherical lenses, coupled with the worlds most advanced diffractive elements, superior coatings, and world class optical design ability. Ophir is able to translate its expertise in all of these areas into high

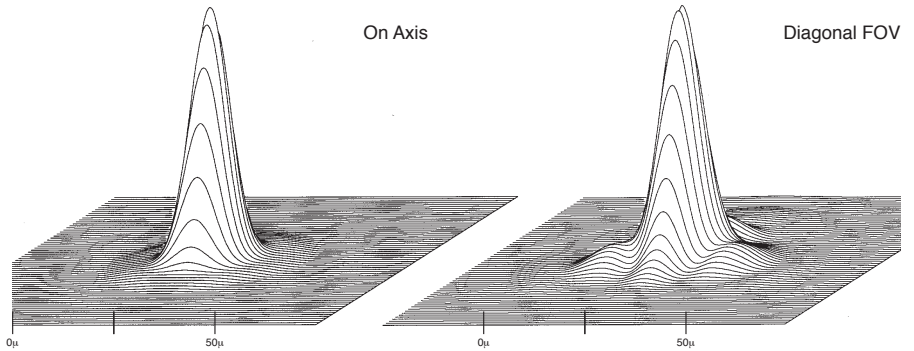
performance unique products at competitive prices.

Ophir designs and produces single, dual and three-field-of-view lenses in addition to zoom lenses, in the 3-5 μ and 8-12 μ range, for both cooled and uncooled cameras.

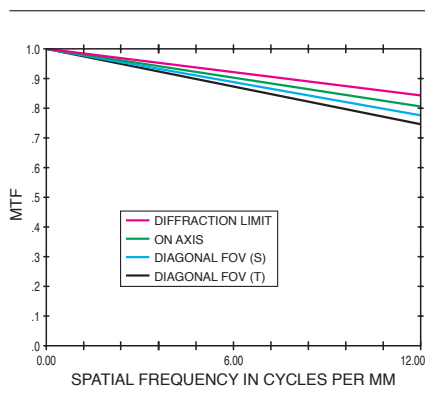
Amongst the company's products are lenses with standard focal lengths and various f-numbers. Ophir's research and development and engineering team also provides innovative, optical, lens assembly solutions for special projects and applications according to the



SupIR POP - Plug in Optic Payload specific, and in many cases, stringent requirements of the customer.



Point Spread Function (8-12 μ , 150mm F/1 Lens)



SupIR Lens Assemblies



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