



CONSULTING GROUP
«SODEJSTVIE»

**MULTICHANNEL
OPTOELECTRONIC
THERMAL IMAGING
SYSTEMS**

The Consulting Group «Sodejstvie» presents the products of the Optron Company

The Optron company (research and production) was established in 2017 on the basis of a team of highly qualified engineers and technologists from the Prateko NPKF.

Since 2001, Protek has been developing and manufacturing optical polycrystalline materials from zinc selenide and zinc sulfide and products based on them. The company produces multi-channel optoelectronic vision systems for the defense industry. The company received orders from the Ministry of Defense of the Russian Federation and had licenses for the development and production of aircraft, weapons and military equipment.



**Consulting Group
«Sodejstvie»**

The Consulting Group «Sodejstvie» is the management company of the Optron Company.



The Optron Company is a manufacturer of modern optoelectronic systems (OES)

Prateco has developed and manufactured products for the defense industry by order of such well-known companies as JSC "RSC "MiG", Central Research Institute "MELZ", JSC "Research Institute "Kulon", Research and Production Association "Polyus", Central Research Institute "Cyclone", Research Institute of Technical Glass of the Aviation Industry "NITS", GosNIIAS, FSUE "NPO "Astrophysics" and others.

The Optron company continued to develop optoelectronic systems with both a high viewing range and miniature optoelectronic systems (OES) for individual civilian use.

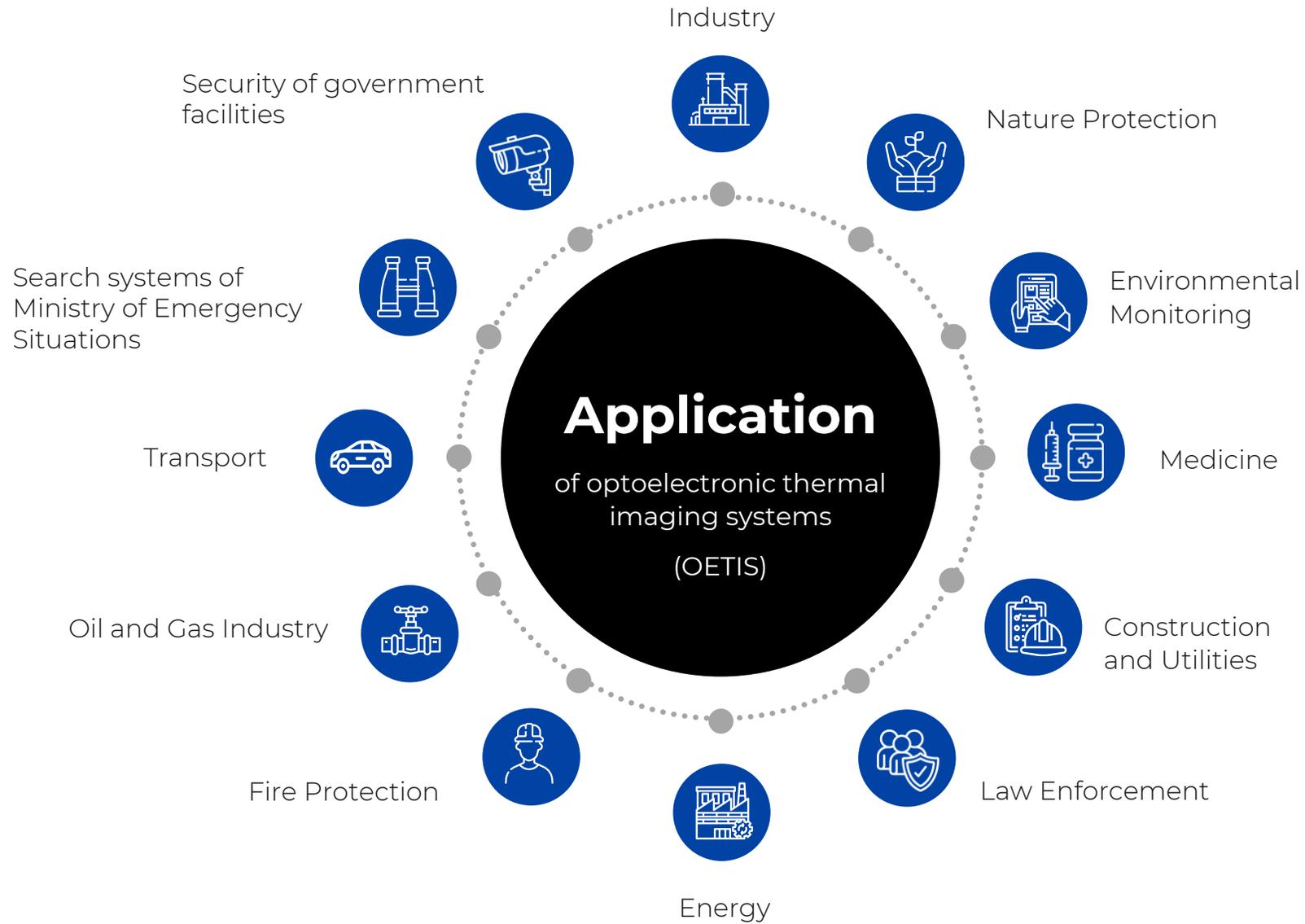
Optron has experience in all stages of the product lifecycle, from concept to small-scale production, including successful state and military tests, as well as military equipment production.



Technical vision systems

A vision system is a system that provides detection, automatic control and analysis of objects based on their images.

Currently, there is a growing interest in vision systems that can provide visibility in any conditions - in a difficult meteorological situation (fog, rain, snow, dust, smoke, etc.), in low light levels, in conditions of intense light interference. **Multichannel optoelectronic thermal imaging systems (OETIS)** can solve this problem. In these devices the disadvantages of some channels are compensated for by the advantages of other channels, enabling 24/7 and all-weather operation.



Wavelength range of optoelectronic systems (OES)

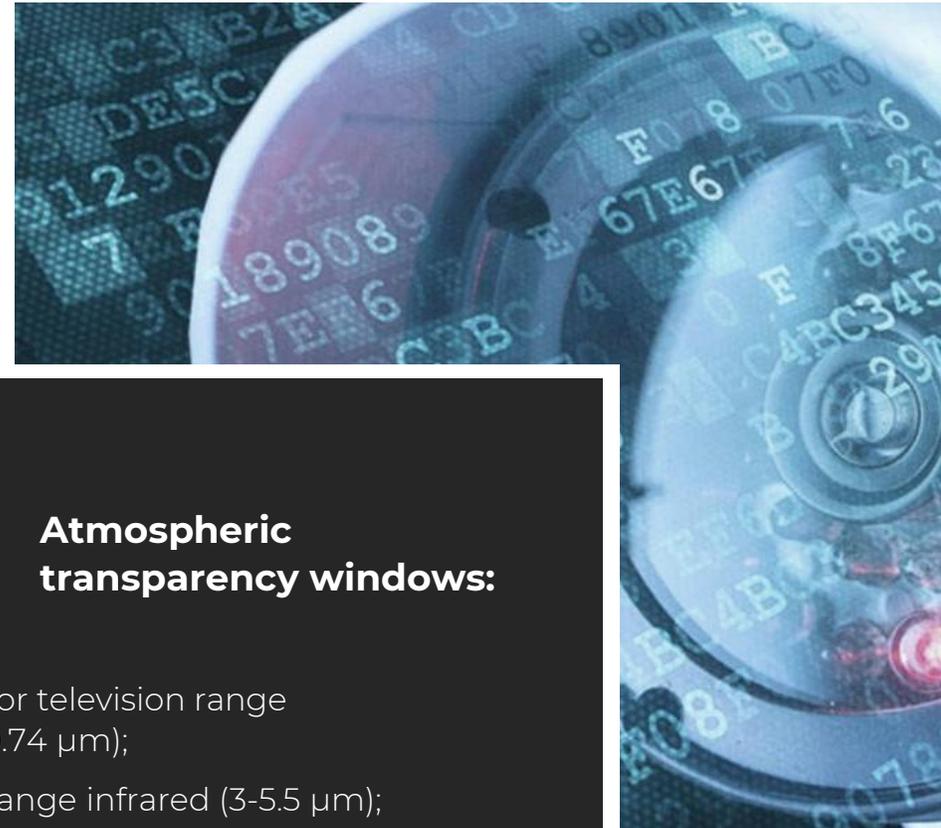
Optical devices operate in wavelength ranges of electromagnetic radiation that correspond to windows of atmospheric transparency.

Obviously, the most effective devices are those that use all three transparency windows (new generation devices) for operation. There is considerable interest in their development, both in Russia and abroad.

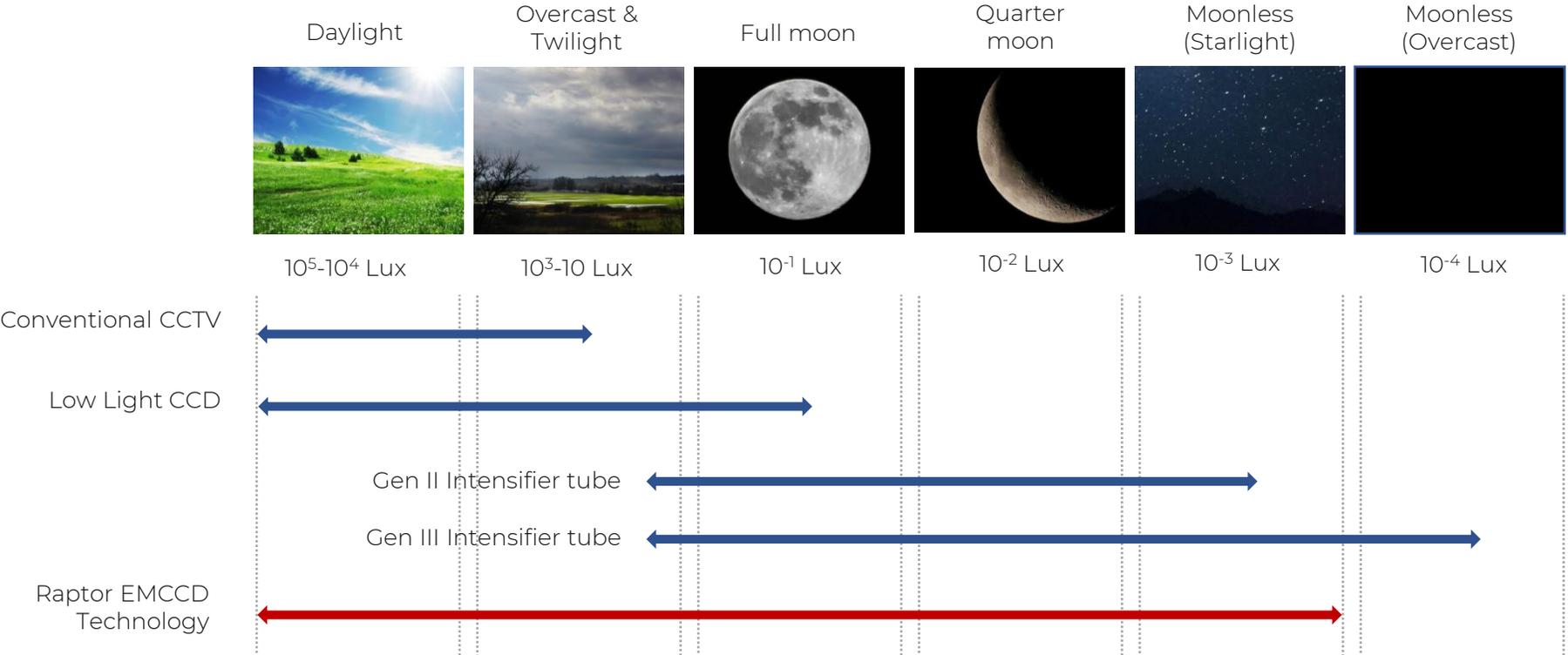


Atmospheric transparency windows:

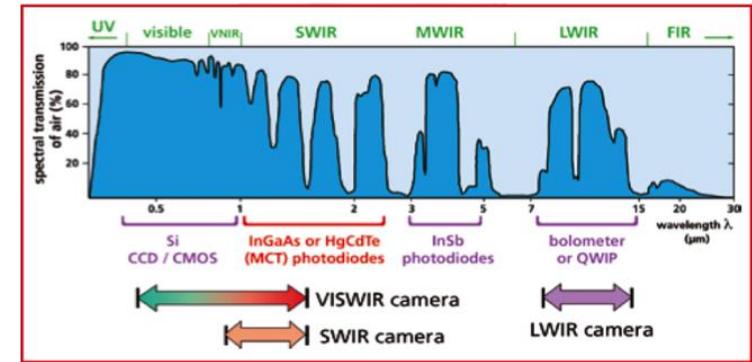
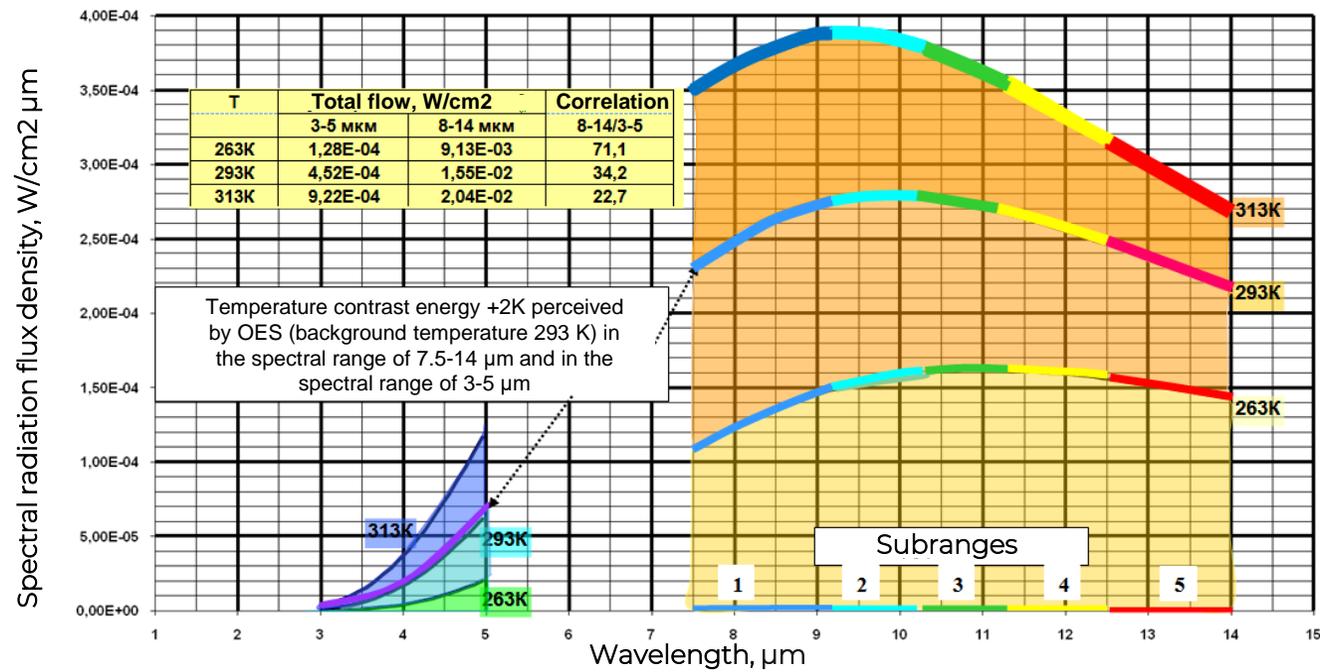
- visible or television range (0.48-0.74 μm);
- short-range infrared (3-5.5 μm);
- long-range infrared or thermal range (8-14 μm).



Spectral transmittance of the atmosphere



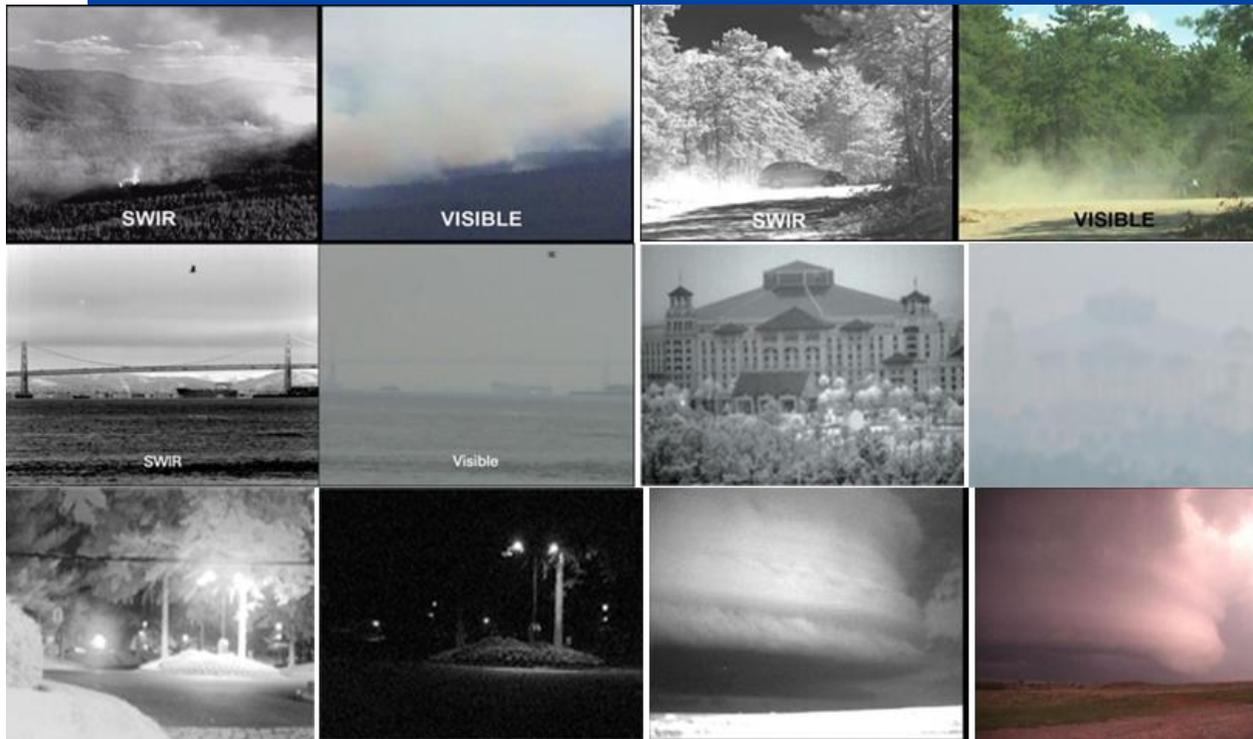
Other specifications



Spectral transmittance of the atmosphere.

Spectral flux density and radiation brightness level for three temperature values (263K, 293K and 313K) in spectral ranges of 3-5 μm and 7.5-14 μm .

Comparative images of **television** and short-range **infrared**



Comparative images



Image of objects in the visible spectrum.



Imaging of objects in the infrared spectral region of 8-12 μm .



Mixed image (visible + infrared).



Market overview: Russian and foreign optoelectronic systems

Examples of foreign multi-channel systems are Voyager and Navigator systems (FLIR System, USA), in Russia — multichannel survey and search engine «Spectrum». All of these instruments are made according to the principle of modular design, when in one device there is a set of separate channels for different ranges with lenses corresponding to the given range.

Main trends in the development of opto-electronic thermal imaging systems abroad

1. Development of dual- and multi-band OESs with the following combinations of working spectral sub-bands:

- visible and longwave IR;
- middle and longwave IR;
- two longwave IR and visible;
- longwave and far longwave IR;
- mid-wave and two long-wave IR;
- in the visible and all IR bands from near-wave to long-wave;
- UV band;
- radio wavelength range.

2. Development of multi-band radiation receivers.

3. Development of new optical materials.

4. Reduction of mass dimensions and cost.

5. Software development.



Vision multi-channel thermal imaging systems

The Vision series is a 24-hour optical-electronic surveillance system. They provide information in all environments: day and night, including fine mist, clouds, smoke. The devices can have different shapes, sizes and specifications depending on the location and the customer's technical requirements.

The systems can be installed on a rotating platform on observation towers, masts, unmanned aerial vehicle, fire helicopter, etc.

Competitive advantages over similar Voyager systems

- longer detection range;
- compactness;
- low price.



System V3



System V4



System V5

Basic technical characteristics

Option	Value	
	V5	V3, V4
Range of detection/recognition of a man-sized figure, m	3000/1300	2700/1300
Range of detection/recognition of a 2.3X2.3 object, m	6000/2500	5000/2000
Spectral range of sensitivity, m - thermal imaging channel - TV channel	8 – 12 0.4 – 0.7	8 – 12 0.4 – 0.7
Lens focal length, mm	180/73	132/58,7
Photodetector type: - thermal channel - TV channel	uncooled microbolometer CCD Matrix	uncooled microbolometer CCD Matrix
Receiver format: thermal matrix/television matrix, pixels	640×480/768X582	384×288/640X480
Receiver element pitch, μm	25 × 25	25 × 25
Operating temperature range, 0 C ⁰	от – 40 до + 60	от – 40 до + 60
Start-up time (cold start), not more, s	60	60
Power supply DC, V	12	12
Weight, not more, kg	12 (camera)	9 (camera)

Miniaturization of optoelectronic systems.

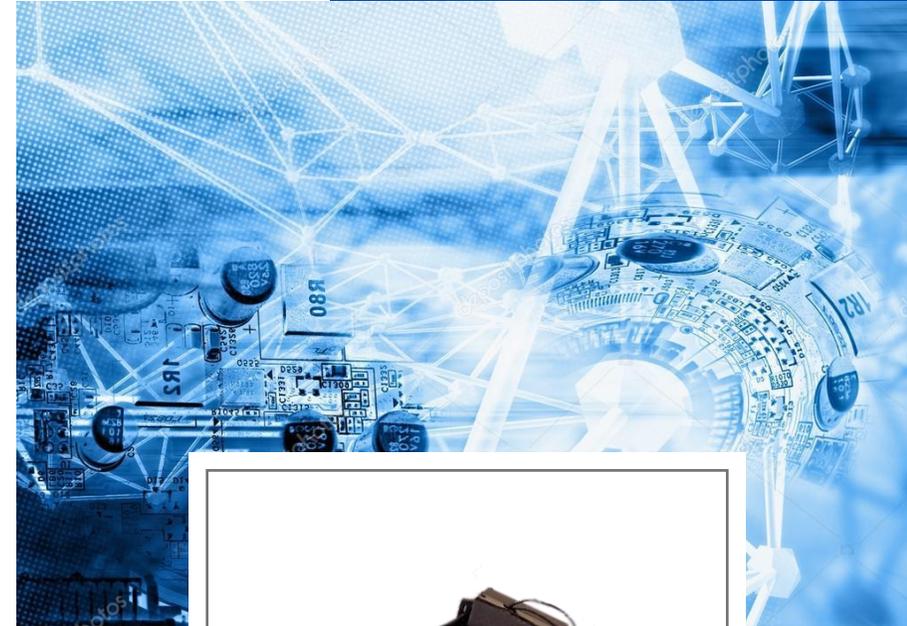
Vision 7 (V7) system

The creation of miniaturized optoelectronic systems is a global trend in optoelectronic instrumentation. One type of miniature OES are thermal or multi-channel glasses.

V7 are compact and comfortable. The image is transmitted to the lenses of the glasses and, if necessary, to the displays fixed, for example, on the helmet.

Applications of Mini OES

V7 can be useful to special units, law enforcement agencies, the Ministry of Emergency Situations, as well as miners, hunters, travelers. They can be used to find people in smoky places and in the dark, to put out fires, to detect traces, hidden rooms, cars, etc.



Basic technical characteristics V7



Option	Value
Viewing angle, degrees	24x18
Detection range/ human figure recognition, m	100-150
Image size, pxl	384x288
Image format	4:3
Image Bit	12 bit (TPV)
Module weight, g	30-40



Innovation

A prototype of a multi-channel miniature system is currently under development, in which the working channels are combined into a common optical system with a single input window, with signal processing and image transmission to a single integrated image display.

As a result, we plan to get a competitive prototype of multi-channel ECO with improved range and image quality, compactness, reduced weight and cost.

Vision 9 (V9) system

The V9 system, currently under development, will have a comprehensive optical channel, combining both visible and infrared transmissions. It will be more functional, lightweight, ergonomic and have a miniaturised module hidden in the temple of the glasses.

Competitive advantages of the V9

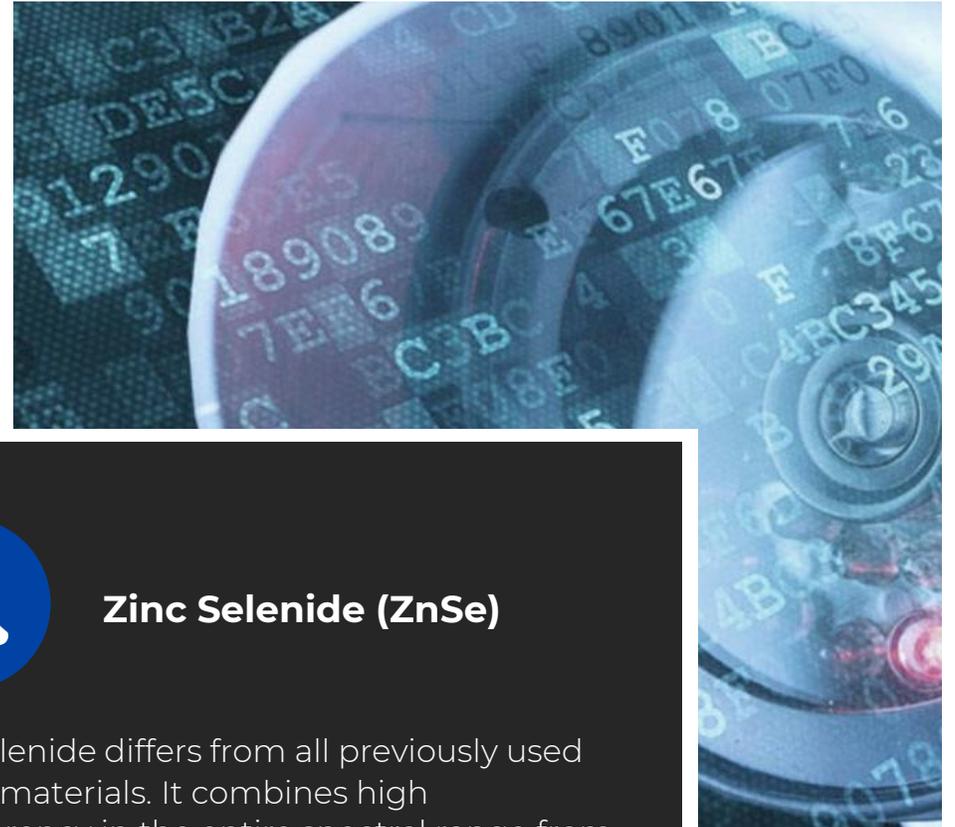
- Bispectral.
- Compact size.
- Autonomy.
- Integration.



Optical elements based on **Zinc Selenide** and **Zinc Sulfide**

Requirements for the optical element of a new generation optoelectronic system:

- high transparency in a wide spectral range from the visible to the far infra-red part of the spectrum;
- possibility of manufacturing of various shapes and large sizes (up to 350 mm);
- resistance to atmospheric phenomena (non-hygroscopicity, thermal resistance);
- acceptable mechanical properties (strength, abrasion resistance, etc.).



Zinc Selenide (ZnSe)

Zinc Selenide differs from all previously used optical materials. It combines high transparency in the entire spectral range from visible to far infrared (0.5-20 μm) with mechanical and optical strength, chemical resistance to the atmosphere.

Optical elements based on Zinc Selenide and Zinc Sulfide

The use of ZnSe and ZnS materials to manufacture optical elements for OESs on their basis will make it possible to create a new generation of devices with characteristics that are significantly higher than those of modern devices.



Zinc Sulfide (ZnS)

Zinc Sulfide has better thermomechanical properties than ZnSe.

Optical elements based on Zinc Selenide and Zinc Sulfide

Unframed optical elements made of Zinc Selenide-based material.

Products using such optical elements, fully prepared for installation on the object.

Competitive advantages

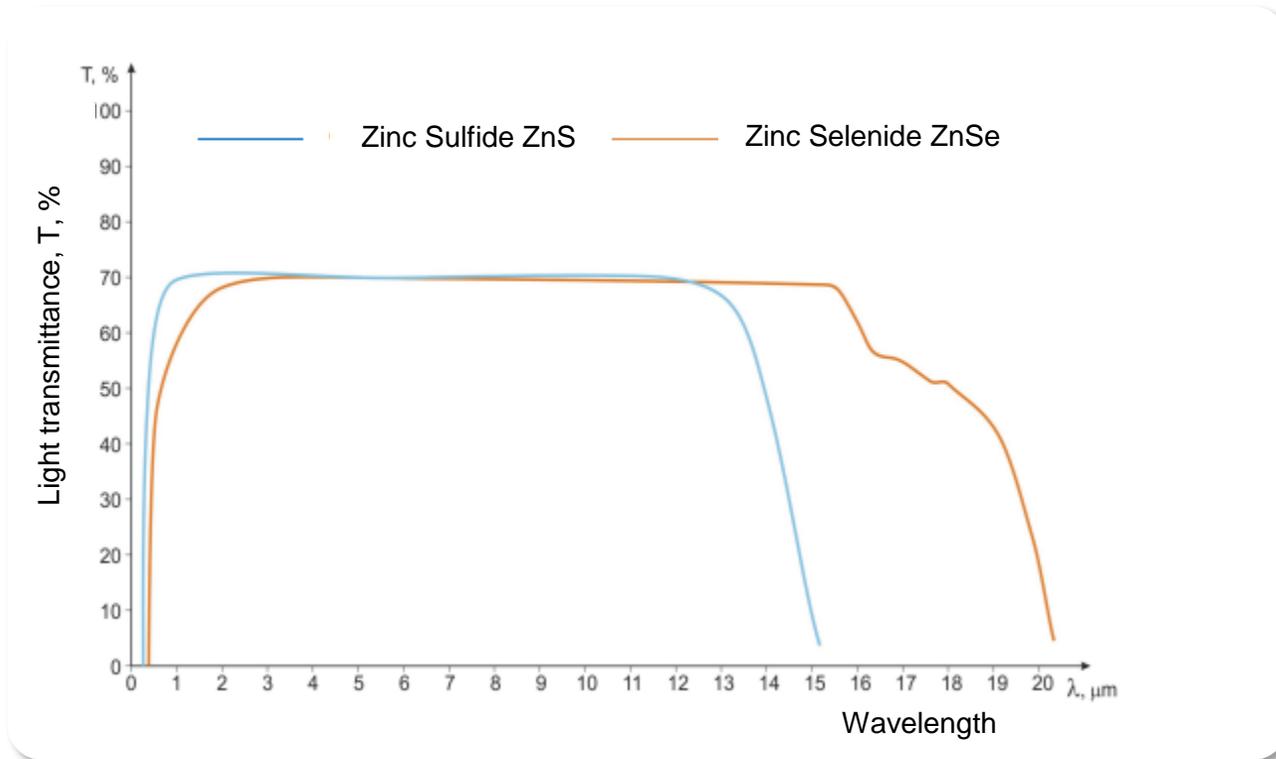
Russian optical elements have comparable IR quality and a much lower price than their foreign counterparts. This is especially evident in the manufacture of large products over 100 mm in diameter.



Basic technical characteristics

Material properties	ZnSe	ZnS
Density, g/cm ³	5,27	4,09
Knoop hardness	130	250
Ultimate transverse bending strength, kg/mm ²	3,0	5,0
Temperature resistance, °C	60	120
Softening/melting point, °C	1 520	1 800
Index of refraction at a wavelength of 10,6 microns	2,41	2,19
Spectral transmittance range, μm	0,5-20	0,4-14
Transmittance with antireflection coatings (in the wavelength range of 8 to 12 mcm), %	up to 98-99	up to 95-98
Absorption coefficient at wavelength of 10.6 μm, cm ⁻¹	5·10 ⁻⁴	-
Maximum product size, mm	270	70

Basic technical characteristics



Spectral transmittance without enlightenment



Outlook for development

Relevance

Technical vision systems arouse the interest in organizations of different spheres of activity. We created a vision system for the Ministry of Emergency Situations. Currently, we are working on a program for object protection together with JSC "Russian Railways".

Foreign companies from Japan, China, Qatar, and Dubai show great interest in our developments.



In development

Glasses V9

Ergonomic optical and thermal goggles with elements hidden in the temples and image transmission to the lenses of the glasses.



In development

TTIS

Miniature dual-channel television and thermal imaging system (TTIS) - a combination of visible and infrared range.



In development

Sight

Dual-range optoelectronic sight with augmented reality function for day and night hunting