

2.12. NEW DEVELOPMENT OF INSTRUMENTS FOR TERRORISM FIGHTING BASED ON INTROSCOPY TECHNIQUE

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One of the most informative ranges of electromagnetic spectrum is infrared (IR) one and this can be explained by the fact that basic part of self electromagnetic radiation generated by the most surrounding objects of natural or artificial origin is concentrated within this range. IR range covers wave lengths from 0.76 to 1,000 mcm (corresponds to frequency range of 300 to 0.3 THz). This rather wide spectrum range conventionally can be split in five intermediate sub-ranges – near (0.76 – 1.1 mcm), short-wave (1.1 – 2.5 mcm), middle wave (3.0 – 5.5 mcm), long wave (8 – 14 mcm) and far (15 – 1,000 mcm) ranges correspondingly. Sometimes two first sub-ranges are combined in one, i.e. 0.76 – 2.5 mcm.

IR ranges of 3 – 5.5 mcm & 8 – 14 mcm are the working ranges of the **thermal vision technical instruments (TVTI)**. It is necessary to underline that 8 – 14 mcm range is more informative, fully-coincide with the most wide low-loss air transmission window and corresponds to the maximal radiation ability of monitored objects within the temperature range from minus 50°C to plus 500°C.

Modern, **third generation** thermal vision systems can be split in two basic classes:

- Surveillance systems (indicating or viewing);
- Measuring or radiometric systems (thermographs).

In the paper will be reviewed the surveillance TVTI, which take special place and are of special importance when solving searching and inspection tasks. TVTI performing above functions in combination with the surveillance functions are called *search & inspection* or just *search* instruments.

Depending on the operation distance (range) TVTI conventionally can be split in three groups:

- **Short operating range TVTI:** provide detection of human activity at distance 0.7–1.0km and car detection at distance 1.5 – 2.0 km;
- **Medium operating range TVTI:** provide detection of human activity at distance 1.2 – 1.5 km and car detection at 2 – 4 km correspondingly as well as aircraft detection at 8 km;
- **Increased operating range TVTI:** those TVTI provide operation in the range exceeding one stipulated for medium one.

In the fig. 1 presented are new non-cooled thermal vision systems developed by the Scientific-Production Center of anti-terrorist and forensic equipment “Spektr-AT” LLC (NPTs Spektr-AT LLC) as well as samples of products of leading foreign company. Four classed of thermal vision systems are presented in the figure:

- Hand-held;
- Portable;
- Stationary;
- Mounted on various platforms (vehicles).

Hand-held thermal vision instruments. IR-imagers of series “KATRAN” and “SPRUT” belong to the short operating range instruments. This equipment is mostly used by law-enforcement authorities, security structures and state security agencies for provision of: search and rescue activities; evidence recover; detection of hidden and secret places; night patrolling; covert monitoring and surveillance activities; public safety during public events; environment protection, etc.

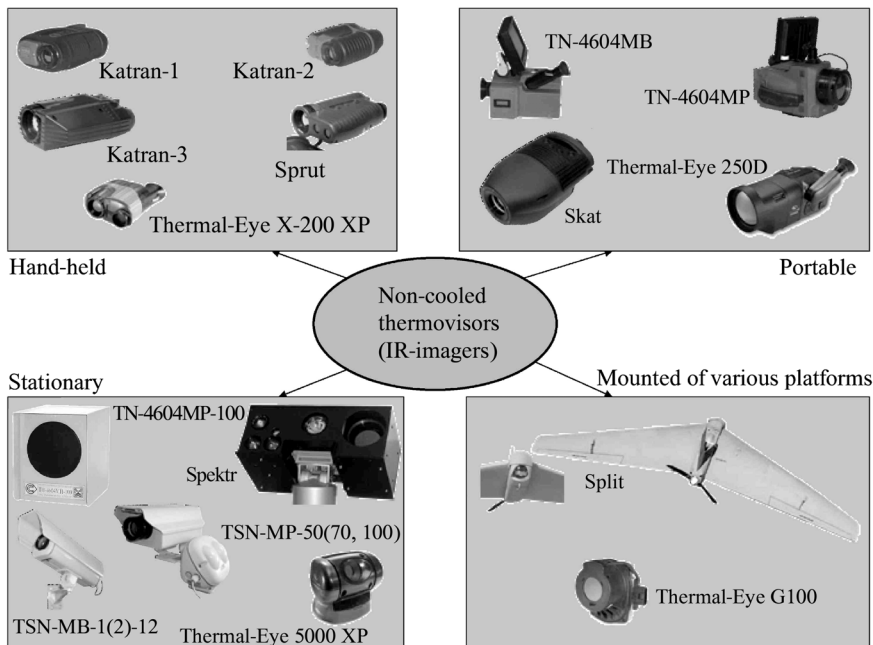


Fig. 1. Non-cooled thermal vision systems manufactured by the NPTs Spektr-AT LLC

Portable thermal vision systems (PTVS). The “SKAT” and “SKAT-2” systems belong to medium operating range equipment. The area of application of those systems is wider in comparison with the hand-held instruments. In addition to tasks solved with the help of the last ones, PTVS help to solve more comprehensive search tasks if would be mounted on tripod equipped with pan-tilt module (PTM). For example, PTVS can provide panoramic view of object or area of special interest.

Stationary thermal vision systems. In this class the most interesting is multi-channel surveillance-search system of “SPEKTR” series. In such system the following channels can be combined:

- *Thermal vision* operating in the range 7 – 14 mcm;
- *Laser location* operating in the range 780 – 940 nm;
- *Near Infra red* operating in the ranges 700 – 1,000 nm & 1,000–1,700 nm;
- *Thermal vision* operating in the range 350–700 nm with spectral sub-ranges, each sub-range has band 20 – 50 nm and is automatically selected with the help of interference filters;
- *Measuring* (Laser range-finder) with operating wave length 1.54 mcm;
- *Auxiliary* used to equip system with various lighters type and IR-searchlights.

Combination in one system of the different informative channels helps to compensate disadvantages inherent to this or that channel due to advantages of the other ones and hence to provide efficient 24/7 operation of the whole system.

Thermal vision systems mounted on various platforms (vehicles). These are systems specially designed to be mounted on aircrafts (including UAVs), various land-based vehicles, and waterborne crafts as well as on any other vehicles including some exotic ones. They can have one or several channels, operate in the mode when collected information is transmitted to some destination point or recorded on the built-in electronic media.

The functionality capability of discussed in the paper thermal vision equipment and blocks are the key elements, which finally determine performance of any new surveillance instruments, systems and special search & inspection.