

MILITARY REQUIREMENTS AND SPECIFICS OF THE ATMOSPHERIC ACOUSTO-OPTICAL LOCATOR WITH AN ELECTRONIC SCANNER

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The theses present a concept for an atmospheric acousto-optical locator developed in line with modern military requirements. The system combines acoustic and optical methods to enhance target detection efficiency. Its central element is an electronic scanner that ensures high-speed data processing. An analysis of the locator's key characteristics under complex atmospheric conditions has been conducted.

The model considers the effects of turbulence, temperature gradients, and air humidity. A comparison with traditional observation and detection methods has been performed. Simulation results demonstrate significant advantages of the new technology. Special attention is given to issues of electromagnetic compatibility and interference protection. Recommendations have been developed to optimize the system's design and operation. The technology shows high potential for application in modern military complexes.

1. General requirements for military detection systems. The atmospheric acousto-optical locator with an electronic scanner is designed for use in military reconnaissance, surveillance, and early warning systems. To be effective in combat conditions, the system must meet strict requirements, including [1-6]: high accuracy in object coordinate determination; high processing speed and rapid response; stable operation under complex meteorological conditions; resistance to jamming and enemy countermeasures; minimal power consumption and compact dimensions; these criteria ensure the system's integration into modern military platforms, including unmanned aerial vehicles (UAVs), ground reconnaissance complexes, and naval air defense systems [7-10].

2. Reliability and resistance to external factors. Military reliability requirements include:

- operation in extreme climatic conditions;
- protection against electromagnetic interference;
- durability and fault tolerance.

3. Detection accuracy and target identification. The acousto-optical locator must provide precise coordinate determination of airborne, ground, and naval targets in real time. Key parameters include:

- angular resolution: $\Delta\theta = \frac{\lambda}{D}$;
- ranging accuracy: $\sigma_R = \frac{\lambda c}{2B}$;
- detection of low-observable targets.

System sensitivity must ensure detection of objects with a radar cross-section (RCS) as low as 0.01 m² (stealth targets). Capability to operate under active countermeasures (jamming, optical and electronic camouflage).

4. Real-time performance and data processing. Military detection systems require minimal latency in target acquisition and tracking. Key requirements include: system response time: less than 10 ms; data update frequency: at least 100 Hz. Implementation of adaptive algorithms: Kalman filtering for trajectory prediction; artificial neural networks for target classification.

System functionality must include: automatic target tracking; determination of dynamic object parameters (speed, trajectory); real-time data transmission to centralized combat systems.

5. Energy efficiency and mobility. Modern military requirements demand reduced weight and power consumption of equipment. Weight and size constraints: system weight not exceeding 20 kg for portable solutions; compatibility with mobile carriers (vehicles, UAVs). Energy efficiency: power consumption not exceeding 200 W; use of energy-efficient laser diodes and processors.

The atmospheric acousto-optical locator with an electronic scanner must provide high accuracy, real-time performance, resistance to jamming, and adaptability to environmental conditions, making it an essential tool in modern military surveillance and detection systems.

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