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## MILITARY EQUIPMENT USED IN ASTRONOMICAL RESEARCH

Although they no longer meet all the modern requirements and technologies, devices and equipment of the twentieth century still demonstrate the development of ideas and engineering thought, show the history of advanced development and the technical optimization of equipment. Therefore, their in-depth study is crucial for the continuous development of engineering and instrument-making. This includes scientific, industrial, household, as well as military units, the more so because information about the latter has for some time been somewhat limited. In some cases, the equipment intended to be studied in the military sphere changed its purpose and was used for other tasks without changing its design characteristics.

The Astronomical Museum of Taras Shevchenko National University of Kyiv, which preserves and deeply studies the history of the Astronomical Observatory, which has been operating in Kyiv for over 175 years, has a collection of military equipment among its great number of exhibited objects. Besides that, most of them were applied in the army for some time and then for various reasons changed their purpose to be used in scientific research. Some way modified, they have successfully continued to serve their main functions for a long time, and today, when the public demonstrates rising attention to the Armed Forces, they are generating great interest among visitors.

These devices include: machine gun cameras, commander tracking telescope, aircraft onboard clock, marine binoculars, field telephone of a radio operator, decoder, aerial cameras, a telescope made from an aviation projectile, phototheodolite, etc. In addition to the devices, there are also descriptions, operating instructions, and technical data sheets to them, some documentation on their transfer, records on processing and results of use.

An in-depth study of these already museum exhibits can both enrich the history of military and scientific tools and provide ideas and ways for the development of new and modernization of already existing equipment.

Thus, the authors teamed up to study the collection of devices and military equipment of the Astronomical Observatory Museum. For instance, the paper dedicated to the subject of this study entitled “Military equipment used in research. Phototheodolite” was originally published in the journal “Military and Historical Bulletin” of the National Defense University of Ukraine named after Ivan Cherniakhovskyi [1].

Phototheodolite КФТ-10/20 is one of the largest exhibited objects in this collection. It is a kind of optical trajectory measuring device designed for the determination of position and orientation of a fast-moving object in space. It is an angle measuring system with a moving optical part and a wide-angle lens. It is designed for visual tracking of the movement of shells, aircraft, helicopters, torpedoes, and missiles. In the course of observation, an object gets photographed numerous times with simultaneous registration of the azimuth angles and the location of the optical

axis of the mount [2]. This offers an opportunity to accurately analyze the movement of the test piece, detect deviations from the calculated trajectory path, and find out the reasons for the failure of technical characteristics to meet the requirements, and so on. High angular accuracy and the ability to record the entire process of movement have made it possible to use these systems for decades. However, moving forward, the requirements for angle measuring equipment became stricter, so highly accurate modern models were used instead [3].

Having studied a series of papers on the history of instruments, devices and equipment, which were used in both military field and scientific research, special optical instruments for visual observations are of great interest. The authors study this direction using three exhibited objects of the Astronomical Museum – the Zeiss binoculars, the commander tracking telescope, and the marine binoculars BMT-110 – as an example.

Optical or visual observations in the army and navy are come down for the detection of land, sea, and air targets, weather phenomena, means of navigation, identification and determination of the parameters of movement of targets and the nature of their actions. In addition, these observations are required whatever the weather, time of the day, without breaks and, if possible, covering the entire horizon. Visual and optical instruments have long been the main source of positional and photometric information about celestial events for astronomical observations. Unlike large stationary telescopes, portable moving monoculars and binoculars made it possible to effectively carry our expeditionary and mass surveillance and observe fast-moving celestial objects, including artificial satellites. Today, special optical instruments for visual observations, in particular, the binoculars of the Astronomical Observatory, are poorly studied and require further study.

Therefore, each new measuring device, instrument, or complex, first of all, appears based on the needs of its application, and, secondly, based on the study, analysis, and improvement of already existing and recent analogs. Technology evolution is possible only considering the previous history of each direction. This allows you to avoid unwanted technical errors, take the best experience, trace the evolution of change, and, perhaps, find out new functions of a certain technical device.

At the same time, studying the history of the creation of devices and equipment, their use, and modernization for any field of human activity help preserve valuable ideas and even developments that have not been used, but can potentially manifest themselves. This study can also protect researchers, developers, and manufacturers from the wrong paths chosen by predecessors. And everyone else can understand the rough path of scientific thought.

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