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deposition with a heat input of 0.9 kJ/mm, the impact energy of the coarse-grained region of the 28GR steel was 41 J and the steel 30Ch2SN2MFA - 9 J. At the same heat input, in the softened HAZ regions, the average impact energy for 28GR steel increased to 93 J, against 42 J in 30Ch2SN2MFA steel. In general, the results of the Charpy test are correlated with microhardness studies, since the toughness values are inversely proportional to the hardness values.

Differences of HAZ softening characteristics for investigated steels are explained by the difference in their alloying. High content of carbide-forming elements Cr, Mo, V in 30Ch2SN2MFA steel prevent the softening processes in HAZ regions which are heated to temperatures of high tempering. At the same time, the high content of Si in this steel not only delays the formation of cementite at temperatures of 200…350 °C, which contributes to the increase of tempering resistance, but also adversely affects its toughness.

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AUGMENTED REALITY IN THE INTERESTS OF ESMRM AND MUNITIONS SAFETY

The key to NATO's munitions safety policy is the Explosives Safety Munitions Risk Management (ESMRM). The ESMRM guides are outlined in the Allied Logistics Publications ALP-16 Ed. A “ESMRM in NATO Planning, Training, and Operations”. The custodian of the ALP-16 is ESMRM Panel (AC/305) of the NATO Logistics Committee. As an important current task, ESMRM panel experts consider reducing the gap between risk assessments and decision-making on a specific storages topology.

According to the author, in this context, the application of the technology of Augmented Reality (AR) can be very effective. It will allow you to virtually work out the optimal 3D topology of the storage in the real-world terrain with the choice of the required combination of munitions in the stacks and the distance between them, taking into account dynamic visualization of the distribution of risk areas (site plan). In addition, with the help of AR, it will be possible to share information on the current distribution of risk areas at the tactical level so that commanders of any management unit could choose safe locations and least risky routes for moving units or knowingly make appropriate decisions based on the expected level of ESMRM risks along the selected route. For this purpose, the visualization on the AR devices of ESMRM risk areas will be provided when they are intersected by combat vehicles or soldiers on foot, standardizing the required symbols. The reason for this should be to update the APP-6 Ed.D for the introduction of special symbols to display different levels of risk zones on the map of estimated explosive safety of munitions in storages. This will create the basis for the use of such symbols in the tactical AR system in order to inform when maneuvering or the selection of places of disposition.

AR will radically update the learning and training process for munitions safety officers and ESMRM, which will simplify the process of integrating ESMRM into NATO training and maneuvers. On this base in the future, it will be possible to effectively carry out inspection of the storages with the UAV for compliance with the design scheme and the requirements of AASTP-1, AASTP-5, ALP-16 with the virtual overlay of the 3D-topology of the storage stacks compliant with the standards, on the actually implemented. The scope of AR applications also includes visualization of data from embedded munitions monitoring sensors.

Of no less interest is the prospect of combining AR and algorithms of artificial intelligence (in particular, Microsoft Common Objects in Context (MS-COCO) or Limpid Armor Inc. (Ukraine)) to recognize objects in images for controlling the access to storages and remote guidance of weapons in their perimeter security systems.

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COMPARISONS AND ANALYSIS OF THE STATE OF THE NAVIGATORY ARMY OF THE UKRAINIAN ARMED FORCES

The experience of warfare in internal armed conflict gained in recent years has confirmed the growing role of artillery to defeat the enemy in conducting operations against illegal armed groups, especially when they have armored vehicles, artillery, anti-aircraft weapons, and other weapons and weapons. Troops and artillery are the only versatile means capable of firing with the necessary precision and performing the bulk of the fire tasks.

The undoubted condition of success in any operation is the reliable fire of the enemy, much of which is performed by the missile troops and artillery. The importance of missile troops and artillery is determined by the fact that only this kind of troops is capable of performing the tasks of firing the enemy in any weather, terrain and time of combat, as well as to provide fruitful interaction and continuous support missile strikes and fire artillery formations.

Currently, there are different types of barrel artillery, self-propelled and trailed artillery, ranging from 105-mm to 203-mm, armed with artillery units of the Armed Forces (AF) of all countries of the world. Data analysis shows:

- the largest groups of barrel artillery have the USA, Russian Federation, Peoples Republic of China;
- the group of barrel artillery of countries at the European theater of war (with the exception of the Russian Federation) does not exceed 1000 units, and the share of self-propelled artillery in these countries is more than 50%;
- Artillery units of the NATO countries of the NATO bloc are equipped with the same artillery systems, artillery in these countries is not divided by organizational and staff characteristics;