



## THIN-FILM COATING

# CASE STUDY

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**T**he safety and mission success of our troops on the battlefield is a major concern for all Americans. When this concern can be addressed with something that we create here at North American Coating Laboratories (NACL), that helps add meaning and purpose to our everyday work. Such an event occurred here at NACL when we were tasked with helping to make a head-mounted remote eyepiece display rugged enough to meet the demands of the military on an optical material that is soft and susceptible to severe damage through even delicate handling.

Our customer for this program was looking to supply the military with a remote eyepiece that could be mounted to a variety of critical mission systems such as visors, glasses, and electronic sights. Giving our troops a remote visual display from their weapon would allow them to see around corners unexposed therefore helping to keep them safer overall and increasing their mission awareness. The additional benefit afforded to our customer would be the ability to wire this remote eyepiece to either a day or night vision riflescope. The flexibility this optic afforded our troops allowed for situational awareness that gave our troops real-world overlaid display symbols that helped them determine between friendly and hostile assets.

Since this unit needed to be mounted to the user's head via a pair of field glasses or a visor, the weight of the device was of major concern. Bulky metal and glass optics increase user fatigue and in a real-world battle situation, this is not acceptable. This challenge was met by providing the lens optics in a lightweight polymer material. Although the polymer material addressed

polysiloxane hardcoating. This optically matched hardcoating offers superior chemical and abrasion resistance while maintaining the highest levels of optical clarity. NACL worked in conjunction with the customer's engineering staff to guarantee smooth and conformal coatings that gave the optic a robust yet smooth finish. The polysiloxane coating was used to seal the entire unit

reflecting displayed images critical to the mission at hand.

The combination of NACL's dip and vacuum applied coatings endured one of the most extensive testing sequences ever performed on a polymer optic. Among these were military grade adhesion, temperature cycling, thermal shock, salt-fog exposure, severe abrasion, sand, wind weathering, and fungus exposure.



the weight concerns, a new very real challenge occurred. This challenge was how could a soft piece of optical plastic endure all the harsh environments our troops see on a daily basis?

NACL was able to meet this challenge by being one of only a handful of companies in the world that offer both dip and vacuum applied coating solutions in one facility. A further value-added benefit provided by NACL was the ability to provide a clear and linear supply-chain to our customer. They would not need to send their optics to multiple locations of multiple treatments. To tackle the complex challenges of this project, NACL used a combination of technologies to address the durability concerns of our customer, while also maintaining the critical optical performance of the unit.

The first technology NACL utilized was a dip-applied thermally cured

and help it survive exposure to extreme environment and humidity cycling, while also resisting sandstorms, and harsh cleansers used in the field to remove contaminants from the display surface.

In addition to the polysiloxane hardcoating utilized by NACL, a series of vacuum deposited coatings were applied to the optical device to help process the displayed image with the clearest and most crisp display image quality. The remote eyepiece was tasked with functioning in both day and night light settings. This optical challenge meant that NACL would need to optimize their coatings for multiple lighting environments. Among the vacuum applied thin-film coatings deployed by NACL were a ruggedized aluminum coating, a high-efficiency anti-reflective coating, as well as a partially transmissive mirror coating that allowed for real-world vision while also

Numerous tests were performed in a continuous loop one after the other which confirmed that even a test weathered item would still perform at or above the necessary standards.

NACL's coating solutions were not only well received by the military, they also helped result in an indefinite quantity, indefinite delivery order for 40,000 units. These optical devices would outfit our front-line and special ops soldiers in some of the most critical missions they faced. The safety the remote eyepiece afforded our troops was invaluable to mission success and the reduction of casualties. In many cases the day to day operations of a company become mundane. When a project comes along that challenges a company and puts significant meaning behind its work, that's is when your corporate culture and passion combine to create something truly incredible. 