



# Defense-Wide Manufacturing Science & Technology (DMS&T) Program

## Enabling Manufacturing Technologies for Large Optical Windows

### PROBLEM / OBJECTIVE

There is a growing need in the DoD for very large transparent ceramic windows for reconnaissance applications and transparent armor. Current programs require windows in excess of 18" x 35", with future requirements anticipated up to 36" x 36" and larger. Of the materials being considered, ALON<sup>®</sup> Optical Ceramic has a unique combination of properties and producibility. It is currently manufactured routinely in sizes up to 15" x 27", and is now available in sizes as large as 18" x 36". This program will improve ALON production processes so that large monolithic panels meeting requirements can be produced.

### APPROACH/ BENEFITS

#### **Approach**

- Identify and manage risks associated with scaling up windows from the current size capability to 36" x 36"
- Modify existing processing equipment so that it has sufficient temperature capabilities to manufacture large ALON windows, with a goal of producing windows with finished dimensions of 36" x 36" or larger. This modification can be done for a fraction of the cost of purchasing new equipment.
- Evaluate new and lower cost forming techniques to determine the best method for producing very large green plates
- Develop the ability to form, heat treat, and polish large ALON windows
- Gradually scale up the process for large monolithic ALON sheets. 36" x 36" x 0.5" windows will be demonstrated at the conclusion of the program (June 2014)

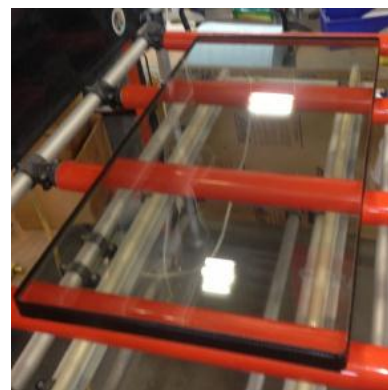
#### **Benefit**

- Capability
  - Increase, by two fold, the producible size of reconnaissance windows and transparent armor applications
    - Larger monolithic windows enable better sensor performance
  - Increase throughput capacity by >100% for ALON<sup>®</sup> Optical Ceramic products
  - Establish capability for ALON reconnaissance windows, which are 2 times lighter and 10 times more durable than the current state of the art (Cleartran)
    - Stronger window material affords better crew protection
    - More durable window material increases operational time
- Benefits to acquisition and sustainment communities
  - Lower life-cycle costs vs. currently available window materials
    - Initial acquisition cost will be competitive with Cleartran

- Based on environmental testing, ALON will last ten times longer
- Transparent armor solution at half the weight and thickness of conventional glass laminates
- Shorten delivery time for ALON products by 25%
- Benefits to the Defense Industrial Base
  - Establish a stable, scalable, and state-of-the-art domestic industrial manufacturing base to ensure production readiness for current and future reconnaissance and transparent armor requirements
  - Increase manufacturing capacity and throughput for multiple ALON products
    - Reconnaissance and IR windows
    - Transparent armor
    - Missile domes
- Defense Systems Impacted
  - Transparent armor kits for Blackhawk and Chinook helicopters
  - Common Infrared Countermeasures system
  - Joint Air to Ground Missile
  - Joint Light Tactical Vehicle
  - Mine Resistant Ambush Protected vehicle

### ***Progress/Recent Accomplishments***

- Delivered three 18" x 35" x 0.5" windows in Jan/Feb 2013.
- Received an order for five 18" x 35" windows from a DOD customer.
  - One window delivered in May 2013. Additional four to be delivered in September 2014
- Windows as large as 24" x 36" are in process
- Completed evaluation of forming techniques and completed scale up of lower-cost forming laboratory, for windows up to 36" x 36".
- Heat treatment equipment for 36" x 36" in place with qualification studies underway.



### **POINT OF CONTACT**

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