

## Compact Beam Steering for Infrared Countermeasure (IRCM) Applications

The overall goal of this Phase II program was to develop an MWIR laser beam steering system with the following attributes:

- Angular coverage of at least 90 degrees
- Pointing accuracy of 1 milliradian
- Transmission across the 1-5 micron wavelength range
- Ability to withstand up to 5W of energy without damage
- Response time of  $\leq 200$ ms
- Size compatible with existing IRCM jamming systems

In the interest of working towards these goals, a single-element, single-wavelength beam steering system was built under the Phase I contract. This breadboard system enabled us to assess system performance in terms of optical transmission, tracking bandwidth, Size, Weight and Power (SWaP) and steering accuracy. Due to the success of the single-wavelength breadboard system, in Phase II we were able to move on to an achromatic Risley prism beam steering design.

When a prism pair is oriented as shown in (a), they both refract light in the same direction and act as a single prism with twice the prism angle of either. In (b), each prism has been rotated about the optical axis by the same angle, but in opposite directions. In this case the beam remains close to the plane defined by the optic axis and the refracted beam shown in (a). In (c), each prism has been rotated by  $90^\circ$  and they combine to act as a parallel plate – with no net angular deviation. Thus, any point in a circular field of regard can be achieved by adjusting the angle between the prisms to obtain the desired deflection off-axis, and then rotating the pair to steer the beam in the desired direction.

