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Pushing Freeform Optical Manufacturing: Fabricating Optimax's Largest Freeform Component

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While manufacturing the largest extreme freeform optic that Optimax has fabricated to date, several issues associated with the size and complex shape of the optic were encountered, including generation and polishing of the part, logistics of moving such a large part around the shop floor, and devising efficient metrology methods. These challenges and their solutions will be discussed.

Intro

Freeform optical components are gaining popularity with designers due to their ability to improve optical and aerodynamic performance for many applications. However, there are complications involved with the manufacture and metrology of freeform shapes, which have little or no symmetry. An extreme freeform shape is a freeform that possesses a deviation from a best fit sphere that is on the same order as the size of the part. Current technology for the manufacture of these shapes is limited by the outer dimensions of the part and the geometry of the freeform surfaces.

Optimax has significantly advanced its ability to manufacture and measure extreme freeform geometries, most currently with a large freeform window. The outer dimensions of the finished part will be 585 x 480 x 155 mm, with 170 mm of concave (CC) sag, and deviation from a best fit sphere of over 400 mm, placing this part firmly in the category of extreme freeform shapes. Reference features called fiducials or datums have been incorporated into the design of the part to provide information about the location and orientation of the optical surfaces, helping to characterize surface figure error and aid in the manufacture and measurement of the part [1]. A rendering of the finished part is shown in Figure 1.

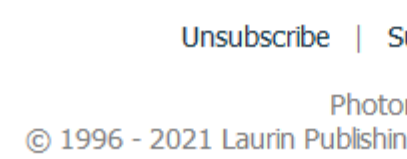

Figure 1

Rendering of the final shape of the 585 mm freeform window. (A) Convex side. (B) Concave side including fiducials.

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