1086-K1-901 **Alexander J Hahn***, Department of Mathematics, University of Notre Dame, Notre Dame, IN 46556. *The Gauss-Bonnet Theorem and the Sydney Opera.*

When its architect, Jorn Utzon, decided that he could take the design of the various triangular curving roof vaults of the Sydney Opera complex from a sphere of the same radius (246 feet), the Opera project was saved. This meant that all the vaults could be built as fan-like configurations of ribs that, because they curved in the same way, could be constructed from identical sequences of standardized rib segments. The concrete rib segments could be mass produced on site from molds. This would reduce cost, save time, and insure the feasibility of the project. When it came time for the outer surfaces of Utzon's spherical vaults to be covered by a sophisticated tile system, the question of the surface area of his spherical triangles became relevant. Had Utzon's triangles been geodesic (all sides lie on great circles), their surface areas would have been provided by Girard's Theorem. But Utzon's triangles are not geodesic (two sides do lie on great circles, but not the third). This fact connects the computation of the surfaces areas of Utzon's roof vaults to the Gauss-Bonnet Theorem of Differential Geometry. My presentation will describe this theorem and examine this connection. (Received September 15, 2012)