Table 33 Four optimized "equivalent" ellipsoidal shells: values of the decision variables and the weight of the shells after possibly multiple executions of SUPEROPT. Dimensions are in inches. The optimum designs listed here were obtained with the use of only mode 1 and mode 2 axisymmetric imperfections.

	isogrid-stiffened, imperfect		**isogrid-stiffened, perfect**		**unstiffened, imperfect***	**unstiffened, perfect**
xinput Table 28	skin thickness	isogrid height	skin thickness	isogrid height	skin thickness	skin thickness
0.	0.12453	0.66766	0.14020	0.59807	0.2269	0.35820
2.554500	0.16641	0.60783	0.14166	0.85281	0.1575	0.28972
5.666450	0.14460	0.97928	0.10000	0.50387	0.5991	0.34052
8.753630	0.16082	1.2562	0.11349	0.79681	0.3050	0.21352
11.79770	0.10412	1.1540	0.10000	0.68664	0.2672	0.26590
14.77232	0.10000	0.80422	0.10160	1.0421	0.2456	0.20147
17.63477	0.10162	1.2686	0.10000	0.55000	0.2553	0.25367
19.63631	0.13795	0.88339	0.11191	0.55488	0.1862	0.19872
21.26065	0.10201	0.70560	0.10000	0.39187	0.2059	0.18310
22.70426	0.10411	0.58445	0.11417	0.35828	0.1646	0.15937
23.86535	0.19869	0.51581	0.10569	0.23963	0.1789	0.14621
24.54286	0.10000	0.34417	0.15146	0.33231	0.1437	0.13888
24.75000	0.19779	0.46660	0.10822	0.27718	0.1771	0.14864
	isogrid stiffener thickness	isogrid spacing	isogrid stiffener thickness	isogrid spacing		
	0.090531	2.9154	0.05834	2.8884		
shell weight	86.101 lb		60.952 lb		96.461 lb	85.352 lb

*See Table 93 (Section 9.0) and the discussion and figures associated with Table 93 for a considerably heavier but much better "**unstiffened, imperfect**" optimum design. The **unstiffened, imperfect** shell listed here is significantly **under-designed** because it will collapse at a very low external pressure (Fig. 94) if it happens to have a **non-axisymmetric** initial imperfection, a type of imperfection for which it was not designed in the particular application of GENOPT described in this paper. In this paper optimum designs of shells with **only axisymmetric imperfections** can be obtained because **BIGBOSOR4 cannot handle shells of revolution with non-axisymmetric initial imperfections.** In the presence of only axisymmetric imperfections the unstiffened, imperfect shell optimized as dictated by the input for the "DECIDE" processor listed in Table 57 develops a locally thick circumferential band at xinput = 5.666 inches, THKSKN(3)=0.5991 inch. The effect of this thick circumferential band is to isolate the apex from the remainder of the shell, leading to axisymmetric buckling modal imperfection shapes such as those displayed in Figs. 74 and 75. The meridional profile of the axisymmetrically imperfect shell significantly differs from that of the perfect shell only in a small neighborhood of the apex of the shell, a characteristic that renders the collapse pressure of the optimized unstiffened shell especially sensitive to non-axisymmetric imperfection shapes. See Section 9.0 for a slightly different formulation of the optimization problem (Table 77) by means of which this problem is avoided. In Table 77 a relatively high lower bound is set for the thickness of the shell wall at the apex. This simple device leads to optimum designs in which the axisymmetric linear buckling modal imperfection shapes display much more deformation away from the shell apex (Figs. 145,146 and Figs. 202, 203 and Figs. 229, 230) than that shown in Figs. 74 and 75.