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Abstract

Astrometric positions for 1387 stars and proper motions for a subset of 1135 stars brighter than $V=15$ in a 1.5 degree surrounding the young open cluster Trumpler 37 are presented. Membership probabilities are presented for those stars with measured proper motions, and 486 stars with probabilities of >80% are identified.

Keywords

Trumpler 37, open cluster stars

Disciplines

Astrophysics and Astronomy | Stars, Interstellar Medium and the Galaxy

MEMBERSHIP IN THE YOUNG CLUSTER TRUMPLER 37

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ABSTRACT

Astrometric positions for 1387 stars and proper motions for a subset of 1135 stars brighter than $V = 15$ in a 1.5° field surrounding the young open cluster Trumpler 37 are presented. Membership probabilities are presented for those stars with measured proper motions, and 486 stars with probabilities of $> 80\%$ are identified.

1. INTRODUCTION

The open cluster Trumpler 37 (Co 2137 + 572, $l = 99.3^\circ$, $b = 3.73^\circ$), identified as the nucleus of the Cepheus OB 2 association (Simonson 1968), is one of the very youngest clusters ($\log \tau < 6.5$), and its distance of less than 1 kpc makes it also one of the nearest of its age group. Yet it has received little attention in studies of stellar evolution compared to other clusters of comparable ages such as IC 1805, NGC 2244, NGC 2264, and NGC 6530 (Lynga 1985). Of these, it most nearly resembles NGC 2244, which is embedded in the central "hole" of the Rosette Nebula. Tr 37 similarly lies in a region of reduced emission surrounded by the H II region IC 1396. Barnard's Milky Way atlas (1927) describes it thus: "The very center of these nebulous masses is gritty with small stars which are entirely free of nebulosity. All around this stars for some distance are veiled in nebulosity." On the Palomar Sky Survey red photograph, the nebula appears exceedingly Rosette-like, and though it is larger in angular size, this is primarily due to the greater distance of the Rosette. Actually, both the nebula and the cluster are quite comparable to the Rosette in physical extent. A number of recent radio studies of IC 1396 have noted this similarity (Wendker and Baars 1980; Heske and Wendker 1986).

As listed in Lynga's cluster catalog, both NGC 2244 and Tr 37 show similar amounts of visual absorption, about 1.5 mag. The relative neglect of Tr 37 by astronomers to date may be due in part to its general lack of concentration, accentuated by its larger angular extent on the sky. Lynga classifies Tr 37 as a Trumpler class IV object, less distinct from the background than NGC 2244, which he assigns a Trumpler class II. In his original survey of clusters, Trumpler (1930) assigned them both to class IV, and noted that Tr 37 seems to be a more populous grouping of stars.

The central star of the cluster, HD 206267, was included in a recent study of "Trapezium-like" systems by Abt (1986). It is one of the youngest examples of these multiple-star systems, which Abt likens to the Trapezium (θ^1 Orionis) in having components of nearly identical separation. Though not quite as complex and active a region as Orion, the interaction between stars and gas is still quite evident in the vicinity of the cluster (Wendker and Baars 1980). That, together with the relative youth and proximity of Trumpler 37, promises interesting results for studies of the early evolution of stars. However, fundamental observational data is spotty.

Alksinis (1958) has published an extensive set of magnitudes (m_{pg}) and approximate spectral types (no luminosity

classes are given) for stars in the Cepheus region, including about a hundred members of the cluster, but these have not been tied to photoelectric UBV sequences or modern MK spectral types. Only a few of the brighter stars in the cluster were included in a spectroscopic and photometric study of the Cepheus association by Simonson (1968). The only focused scrutiny of the cluster remains the paper of Garrison and Kormendy (1976), who published MK classifications for 51 stars and photoelectric UBV photometry for 37 stars brighter than $V = 10.1$ in a region about 3° (48 pc) in diameter surrounding Tr 37. They derive a distance modulus of 9.9 for the cluster, and their earliest main-sequence spectral type of O6 indicates that the cluster is comparable in age ($2-4 \times 10^6$ yr) to the very youngest open clusters, such as NGC 2244 (Marshall *et al.* 1982) and NGC 6530 (van Altena and Jones 1972). The Garrison and Kormendy photometry has been supplemented by photoelectric $UBVRI$ magnitudes of 26 fainter cluster stars $10.5 < V < 15.75$ by Cardon de Lichtbuer (1982). Most recently, Kun (1986) has identified 155 H α emission stars fainter than $V = 13$ in a 19.5 square degree field centered on Tr 37 (approximately the same coverage as Garrison and Kormendy), and has presented photographic $UBVR$ magnitudes for them.

No comprehensive membership studies of the cluster have been undertaken previously. This study presents measurements of astrometric positions of 1387 stars along with proper motions for 1135 stars brighter than $V = 15$ within approximately 0.75° (12.5 pc) of the cluster center. The astrometric positions and membership probabilities for Tr 37 should establish a foundation for further photometric and spectroscopic studies of its member stars, adding to the roster of nearby young clusters suitable for studies of stellar evolution.

II. PLATE MEASUREMENT AND REDUCTION

The plate material for this study consisted of 17 Yerkes plates covering seven overlapping fields centered on the star HD 206267 (R.A. (1950) = $21^h 37^m 24^s$, Dec. (1950) = $57^\circ 15' 45''$). Table I lists pertinent data for the plates, and Fig. 1 [Plate 5] shows the coverage of the overlapping fields. We refer to these as the center field, east field, northeast field, etc. All star images on the plates, a region roughly 1.5° in diameter, were measured using the PDS microdensitometer at Yale University Observatory. Positions and magnitudes for each image were reduced using a two-dimensional Gaussian fitting program written by Jin-Fuw Lee for the PDP 11/60 computer at Yale.

TABLE I. Yerkes Observatory plate material for Tr 37.

Field	Plate ID	Date	Exposure
Center	F367	July 22, 1937	36 min.
Center	F373	July 24, 1937	22 min.
Center	π 24169	Aug. 2, 1973	30 min.
Center	π 24185	Aug. 4, 1973	25 min.
East	F374	July 24, 1937	35 min.
East	π 24186	Aug. 4, 1973	25 min.
East	π 24275	Oct. 19, 1973	30 min.
Northeast	F370	July 22, 1937	30 min.
Northeast	π 24189	Aug. 5, 1973	25 min.
Northwest	F369	July 22, 1937	18 min.
Northwest	π 24274	Oct. 19, 1973	30 min.
West	F368	July 22, 1937	25 min.
West	π 24184	Aug. 4, 1973	25 min.
Southwest	F381	July 26, 1937	20 min.
Southwest	π 24187	Aug. 5, 1973	25 min.
Southeast	F380	July 26, 1937	25 min.
Southeast	π 24183	Aug. 4, 1973	25 min.

Proper motions were computed by an iterative least-squares-fitting procedure as described in our study of NGC 2244 (Marshall *et al.* 1982). Proper motions for each separate field were computed independently. Thus the solutions for the center field involved four plates, two first epoch (1937) and two second epoch (1973); the east field involved three plates, one first epoch and two second epoch, and all the other fields used a pair of plates. In each case, linear and quadratic terms in the coordinates and magnitude were used, but since color measurements were unavailable for most of the stars, no color terms were included; nor were they found necessary in our previous study, which used both Yerkes and Allegheny plates.

The proper motions derived for each separate field were transformed to the proper motions of stars on the central plate with a linear least-squares fit involving the overlapping stars in each field; only rotation, translation, and scale change were included in the fit. These consolidated values of the proper motions were then used to derive membership probabilities. The consolidated proper-motion vector-point diagram is shown in Fig. 2. The limited number of plates used in each solution compared to our study of NGC 2244, which involved 18 plates, and the smaller epoch difference, 36 yr as opposed to 57 yr, produces a scatter in proper motions that is greater than in our previous work. There is nevertheless a clear concentration of points near zero relative motion which represents the cluster against a more widely dispersed background of field-star motions. The separate distributions are more clearly recognizable on the marginal histograms of the proper motions shown in Fig. 3.

The field and cluster distributions were derived using a program supplied by Dr. E. Green. The program fits two-dimensional Gaussians to both the field and cluster proper-motion distributions, with due account taken for the proper-motion errors of each individual star. Where more than two plates were used in the solutions, the errors used as input to the program were derived from the residuals in the plate solution. In the two-plate solutions, no such formal error was produced (the residuals in these cases are attributed

FIG. 2. Observed proper-motion vector-point diagram for Trumpler 37. The direction toward the solar apex and a line parallel to the galactic plane are indicated. The units are in arcseconds per century.

FIG. 3. Marginal distributions of the vector-point diagram rotated 48° to align X and Y with the minor and major axes of the field distribution. The observed distributions are drawn with a thin line, while the computed fits are drawn with a heavy solid line. (a) Histogram for X motions. (b) Histogram for Y motions.

entirely to proper motion), so the error was determined by assuming that the error for a single star was the same as the average for stars of similar magnitude in the multiple-plate solutions scaled to one plate pair.

The fitting program allows one to hold field parameters fixed while searching for a best fit to the cluster parameters. It was found, in accord with Cudworth's analysis of M22 (Cudworth 1986), that a Gaussian was not the best fit to the field-star distribution, and the final fits we present represent a compromise between underemphasizing the peak or overemphasizing the wings of the fitted field distribution. We favored the latter extreme, noting, as Cudworth does, that the derived probabilities are more sensitive to the values of the field-star distribution in the vicinity of the cluster proper-motion peak.

Parameters for cluster and field-star fits are listed in Table II. The proper-motion centers and standard deviations are listed in arcseconds per century. The standard deviations listed for the cluster are a measure of the internal precision of the derived proper motions, not of the internal velocity dispersion of the cluster, which should be smaller by almost an order of magnitude as we discuss later in this paper. The precision is about 4 times less than that of our study of NGC 2244. That study utilized 18 plates in the solution, however, so the results for Tr 37 are consistent with the measurement errors for a single star in the NGC 2244 study.

III. POSITIONS AND MEMBERSHIP PROBABILITIES

The final results of the plate measurement and proper-motion analysis are listed in Table III. Numbers in column 1 refer to the identification charts in Figs. 4 (a)–(g) [Plates 6–12]. Coordinates in columns 2 and 3 were computed with transformations found by fitting the measurements of a dozen stars to positions given in the AGK3 catalog. The listed coordinates are epoch 1950 and refer to the equator and equinox of 1950. They should be reliable to 0".1, except for stars that have no derived proper motion as noted below. Proper motions in columns 4 and 5 are given in seconds of arc per century. Proper motions are not given for stars where a good image center could be measured on only one plate. This was the case primarily for faint stars that did not appear on the first-epoch exposures. V magnitudes in column 6 were derived by fitting photometric magnitudes from Garrison and Kormendy (1976) and Cardon de Lichtbuer (1982) to instrumental magnitudes derived from the plate scans. These magnitudes should be used with caution: they are only provided to aid in identifying stars on our charts. While the fit of instrumental to observed magnitudes is good to 0.1 mag for the fainter stars ($V > 10$), the PDS photometry reduction we used did not account for saturation in the densest images, systematically affecting the precision of fit for the brighter stars. These may be in error by 0.3 mag. We have made additional photoelectric measurements of about one

hundred stars in the cluster, and will publish these data separately when we have accumulated a more complete set of measurements.

Probabilities of cluster membership, computed from the fitted cluster parameters, are listed in column 7, and a quality estimate is listed in column 8. This quality estimate was made as follows. For all stars in the center and east fields (i.e., those with multiple-plate solutions), a quality class of 1 was assigned to those whose residuals from the plate solutions were less than 0.08 arcsec/century (σ for fitting of the center plate series), and a quality class of 2 to those with higher residuals. In all other fields, a quality class of 1 was assigned to all stars brighter than $V = 14.5$, since this is where the scatter in the residuals for the multiple-plate solutions became significantly greater.

IV. DISCUSSION

A histogram of the membership probabilities is shown in Fig. 5, illustrating a clear differentiation between field and cluster stars. Since the internal errors in this study are greater than in our previous ones, greater caution must be used in applying these numbers, however, and we would urge that only stars with $P > 80\%$, that is, 486 stars in all, be considered potential cluster members. That this criterion is consistent with the photometric results is borne out by its inclusion of the brighter O and B stars in the area, which are surely cluster members, and its rejection of the brighter stars identified with late spectral types in Alksinis' 1958 study. Kun (1986) has noted that bright early-type stars in this region seem dispersed over an area far larger than that of a typical cluster, and suggests that they may not all be part of the same group, or that the system may not be gravitationally bound. Thus the latter criterion, the rejection of brighter late-type stars, is likely to be more selective than the inclusion of bright early-type stars, as is indicated by our derived probabilities.

More specifically, 149 stars in our study have been identified with those in Alksinis' study. A cross reference to the identification numbers in both studies is given in Table IV; the stars studied by Alksinis are designated Alks, the numbers in the current study MVA. Seven of these stars yielded only positions in the current study, the remaining 142 both positions and proper motions. Of 35 stars in the field with spectral classes earlier than A0 according to Alksinis, 25, or 71%, are probable kinematic cluster members. A notable exception is HD 206267 itself (Alks 466, MVA 460), which has a computed membership probability of 67. This star, having the earliest spectral type in the region, is surely a cluster member, as we note in a footnote to Table III. The image of this multiple system suffers from blending of the components (with star MVA 461) on the first-epoch plates, producing a spurious determination of the image center. This is the only case in this study for which image blending is severe.

Of 49 stars with spectral types later than F0 in Alksinis' study, 42 (86%) turn out to be kinematic nonmembers. Some of the remaining seven stars (MVA 550, 555, 800, 883, 1050, 1166, and 1539) may be chance coincidences or spectroscopic misidentifications, but they also deserve further scrutiny as possible evolved or pre-main-sequence members of the cluster. Three radial velocities of MVA 550 obtained by one of us (LAM) with the echelle spectrometer of the Fred L. Whipple Observatory and the Multiple Mirror Telescope indicate that it is a single-line

TABLE II. Membership probability parameters for Tr 37.

Parameter	Cluster	Field
Number	655	543
u_x center	+0".01/cent.	+0".06/cent.
u_y center	-0.02	+0.09
u_x dispersion	± 0.19	± 0.50
u_y dispersion	± 0.28	± 1.56

TABLE III. Observational data for stars in Tr 37.

MVA	α	(1950.0)	δ	μ_{α}	μ_{δ}	ℓ	P	Q	MVA	α	(1950.0)	δ	μ_{α}	μ_{δ}	ℓ	P	Q
2	21 35 13.74	56 57 55.0				14.7			103	21 35 27.22	57 29 15.4	-0.87	-1.05	14.1	0	2	
3	21 35 11.98	56 58 22.6	-0.17	0.05	13.9	93	1		104	21 35 32.63	57 30 43.2	-0.39	0.32	14.4	75	1	
4	21 35 10.08	56 59 33.0	3.15	-4.90	13.3	0	1		105	21 35 30.75	56 58 10.0						
5	21 34 47.68	56 59 26.7	0.13	-0.23	13.6	92	1		106	21 35 32.92	56 58 48.3	-3.02	0.36	10.2	0	2	
6	21 34 56.85	56 59 19.2			14.6				108	21 35 38.73	56 59 24.7	-0.17	0.12	13.1	92	1	
7	21 35 9.05	57 0 10.2	0.01	0.75	13.9	9	1		110	21 35 5.78	56 57 55.7	0.61	-0.51	13.9	32	1	
8	21 35 7.93	57 0 9.2			15.0				111	21 36 12.34	56 58 31.5	0.07	0.25	14.3	88	1	
9	21 35 13.35	56 59 22.9	0.10	-0.13	14.8	94	2		112	21 36 9.40	56 58 40.2			14.9			
10	21 35 14.26	56 59 31.1	-0.12	0.26	14.5	90	1		113	21 35 50.39	56 59 50.7	3.68	1.31	14.3	0	2	
11	21 35 17.96	56 59 11.1			14.9				114	21 35 55.53	57 0 17.7	-0.12	0.15	12.5	93	1	
12	21 34 55.31	57 0 37.5			14.9				115	21 36 4.52	57 0 22.2			14.8			
13	21 35 0.30	57 0 50.4	0.55	-0.37	13.6	37	1		116	21 36 5.16	57 0 21.9	-0.29	0.13	14.5	88	2	
14	21 35 0.30	57 1 22.5	0.22	-0.28	13.4	89	1		117	21 35 39.33	57 1 37.2	0.11	0.20	14.7	90	2	
15	21 35 22.29	57 1 52.3	-0.85	1.14	13.8	0	2		118	21 35 47.26	57 1 5.9	-0.03	-0.18	14.2	92	1	
16	21 35 23.16	57 0 8.7	0.32	0.17	14.8	79	2		119	21 35 6.06	57 1 9.7	-0.17	0.29	14.9	87	2	
17	21 35 25.64	57 0 14.8			15.0				120	21 35 47.44	57 2 29.1	0.51	-0.42	14.4	0	1	
18	21 35 14.23	57 3 40.9			15.0				122	21 36 6.82	57 1 39.8	0.09	-0.49	14.4	70	1	
19	21 35 2.95	57 4 3.0	0.74	0.04	14.3	14	1		123	21 36 10.61	57 2 11.2	-0.39	0.38	14.8	68	2	
20	21 34 58.22	57 5 55.9	0.05	-0.43	12.6	78	2		124	21 36 25.11	56 59 11.1	-1.19	-0.13	13.8	0	1	
22	21 35 8.75	57 5 13.5	0.39	-0.01	14.6	83	2		125	21 36 14.81	57 2 56.5	-0.10	0.18	14.5	92	1	
23	21 35 13.59	57 5 17.2	0.25	0.06	14.6	0	2		126	21 36 14.00	57 2 38.7	-0.78	-0.58	15.0	0	2	
24	21 35 17.62	57 5 36.6			14.4				127	21 36 21.74	57 2 29.2			14.9			
25	21 35 17.87	57 4 44.4	-0.32	0.21	11.9	86	1		129	21 36 19.69	57 3 41.1	-2.19	0.52	14.7	0	2	
26	21 35 27.52	57 4 56.0	-0.35	0.32	11.8	79	1		131	21 36 0.04	57 3 41.1			13.6			
27	21 35 22.36	57 6 12.4			14.7				132	21 36 2.29	57 4 12.4	-0.31	-0.61	13.8	8	1	
28	21 35 28.87	57 6 15.7	-1.43	1.09	13.8	0	1		133	21 35 58.08	57 5 1.8	0.49	-1.07	12.4	0	1	
29	21 35 35.89	57 4 31.8	0.12	0.14	13.7	92	1		134	21 35 41.62	57 6 49.8	-0.52	0.28	13.3	59	1	
30	21 35 37.82	57 5 8.3	-0.22	0.33	14.7	84	2		135	21 35 46.45	57 7 25.4			13.7			
31	21 35 1.89	57 7 23.8			14.8				136	21 35 46.43	57 6 54.2	0.15	-0.39	14.8	0	2	
32	21 34 47.94	57 8 1.7	-0.17	0.36	12.3	83	1		137	21 35 45.36	57 6 29.2			14.8			
33	21 34 42.35	57 8 5.5	0.10	0.35	14.3	78	1		138	21 35 52.13	57 7 39.9			15.0			
34	21 34 56.33	57 9 24.0	-0.01	0.44	14.3	73	1		139	21 35 52.91	57 6 47.0	0.53	0.10	14.7	0	2	
35	21 35 5.37	57 9 53.0			15.1				140	21 36 1.39	57 6 0.5			14.8			
36	21 35 9.56	57 10 0.1			14.9				141	21 36 14.05	57 5 33.3			14.8			
37	21 35 20.17	57 9 23.2			15.1				143	21 36 16.75	57 4 34.8			15.1			
38	21 35 26.11	57 9 59.2			15.1				144	21 35 51.63	57 9 35.9	0.34	-0.15	11.8	88	1	
40	21 35 29.74	57 9 7.7			14.9				145	21 35 0.87	57 8 54.0			14.9			
41	21 35 39.35	57 9 25.6			14.8				146	21 36 8.52	57 7 53.1	0.21	-0.16	14.3	92	1	
43	21 34 50.12	57 12 16.7	-0.54	0.45	14.3	24	1		147	21 35 10.15	57 7 31.0	0.19	-0.03	11.1	93	1	
44	21 34 54.41	57 12 42.1			14.5				148	21 35 21.90	57 7 32.6	-0.04	0.29	11.1	89	1	
45	21 35 7.09	57 12 32.4	-0.10	0.01	12.6	94	1		149	21 36 14.97	57 8 14.1	0.20	0.15	13.7	89	1	
49	21 35 16.72	57 11 48.2	0.29	-0.59	12.7	52	1		150	21 36 19.04	57 8 50.3	0.13	-0.03	13.6	0	1	
50	21 35 16.40	57 11 10.3			14.8				151	21 36 22.02	57 8 42.7	0.49	0.04	11.2	68	1	
51	21 35 21.69	57 11 40.1			14.9				152	21 36 22.18	57 9 27.2	-2.42	0.79	11.9	0	1	
52	21 35 23.21	57 11 1.5	-0.62	0.97	14.2	0	2		153	21 35 8.52	57 9 36.3	-0.11	0.01	12.0	94	1	
53	21 35 29.77	57 11 20.2	0.09	-0.43	13.2	80	1		154	21 35 51.89	57 10 47.4	-0.46	-0.33	12.6	30	1	
54	21 34 42.12	57 14 8.7	-0.28	0.34	13.5	81	1		155	21 35 52.75	57 10 50.8	0.68	-0.59	13.9	14	1	
57	21 35 14.61	57 14 23.5			14.4				156	21 35 10.51	57 9 31.0			15.0			
58	21 35 21.63	57 14 27.9	-0.42	0.23	14.7	0	2		157	21 36 3.00	57 10 25.3	0.18	0.15	14.7	0	2	
59	21 35 8.90	57 16 38.1	-0.70	-0.07	11.0	0	1		158	21 36 9.19	57 10 56.5			15.1			
60	21 35 18.54	57 17 40.1	-0.01	-0.12	13.3	93	2		159	21 36 9.01	57 11 18.5			14.7			
61	21 34 46.21	57 19 11.0	-0.35	0.17	13.5	84	1		160	21 35 38.47	57 11 0.3			15.1			
63	21 35 4.92	57 20 35.9	-0.06	-0.01	10.8	94	1		161	21 35 40.32	57 11 33.8			14.9			
65	21 34 51.26	57 21 32.6	0.50	-0.40	13.8	62	1		162	21 35 38.24	57 12 39.0	-0.12	-0.19	12.7	91	1	
66	21 34 43.49	57 21 58.4	-0.79	1.25	10.5	0	1		163	21 35 42.32	57 12 20.0	0.21	-0.27	13.3	89	2	
67	21 34 53.62	57 22 31.0	-0.98	0.04	10.9	0	1		164	21 35 47.54	57 11 42.2	-0.06	0.30	12.1	88	1	
68	21 34 54.73	57 23 30.7	0.33	0.56	10.7	13	1		165	21 35 56.75	57 11 45.7	-0.04	0.28	14.4	0	1	
69	21 35 5.59	57 21 54.9			14.8				166	21 35 47.08	57 12 42.1	-0.58	0.10	9.9	51	1	
70	21 35 16.57	57 22 0.7	-0.13	0.14	13.3	93	1		167	21 35 39.09	57 13 39.2	-0.76	0.26	14.2	16	2	
71	21 35 15.85	57 21 31.6	-0.17	-0.27	8.7	84	1		168	21 35 48.57	57 15 6.3	-0.21	-0.05	14.4	90	2	
72	21 35 23.78	57 20 12.6			15.0				169	21 35 51.45	57 14 44.9	-0.32	0.20	13.8	86	1	
73	21 35 23.29	57 20 17.9			15.1				170	21 35 54.53	57 13 34.4	-0.21	0.20	12.9	90	1	
74	21 35 27.67	57 20 52.9	0.52	-0.58	12.5	34	1		171	21 36 2.79	57 14 20.0			14.8			
75	21 35 30.27	57 22 5.9	0.50	-0.52	13.8	46	1		172	21 36 19.08	57 13 19.4	-0.03	-0.09	12.9	94	1	
77	21 35 15.95	57 23 5.9			15.0				173	21 36 21.23	57 13 8.9	-0.12	0.06	14.5	0	2	
78	21 35 24.70	57 23 42.9			13.8				174	21 36 21.70	57 13 0.0			14.9			
79	21 34 56.84	57 23 50.3			15.0				175	21 35 14.78	57 12 44.9			15.1			
80	21 34 59.36	57 24 18.0	0.33	-0.23	13.6	8*	1		176	21 36 14.40	57 12 31.6			15.2			
81	21 34 52.05	57 24 35.8	-0.23	-0.11	11.2	89	1		177	21 36 9.27	57 16 1.2	-0.31	0.28	12.6	84	1	
82	21 35 23.95	57 24 2.9			15.2				179	21 36 2.74	57 16 54.0			14.7			
83	21 35 21.29	57 24 34.7	-0.02	0.05	13.9	94	1		180	21 35 37.91	57 15 58.7			14.9			
84	21 34 58.26	57 25 40.1	0.10	-0.18	13.4	93	2		181	21 35 46.03	57 17 48.8	-0.20	0.12	11.5	92	1	
85	21 34 53.82	57 25 52.8	0.97	-0.20	13.9	2	1		182	21 35 47.21	57 17 17.1	-0.19	-0.14	11.6	90	1	
86	21 34 55.64	57 26 4.9	0.25	-0.34	11.9	86	1		183	21 35 51.22	57 17 25.6			14.8			
87	21 34 44.29	57 25 57.6	0.21	-0.09	13.6	93	1		184	21 35 47.47	57 19 38.9	0.06	-0.19	14.9	0	2	
88	21 34 44.34	57 25 47.0	0.22	-0.03	13.7	92	1		185	21 35 36.84	57 18 47.4	0.09	-0.85	13.3	5	2	
89	21 35 16.01	57 27 1.5	-0.70	0.34	14.8	20	2		186	21 35 36.10	57 20 20.2	-1.34	-1.40	9.4	0	1	
90	21 35 16.39	57 25 48.0	0.16	-0.50	10.4	71	1		188	21 35 59.62	57 18 26.2			14.8			
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TABLE III. (continued)

MVA	a	(1950.0)	b	μ_0	μ_1	μ_2	P	Q	MVA	a	(1950.0)	b	μ_0	μ_1	μ_2	P	Q
202	21 36 28.45	57 13 26.4							202	21 37 35.87	57 1 58.4	-0.36	-0.03	14.8	81	2	
203	21 36 14.88	57 21 21.1	0.19	-0.14	13.3	93	1		203	21 37 41.54	57 1 29.5			15.0			
204	21 35 53.77	57 22 29.5	-0.48	0.04	12.2	70	1		204	21 37 34.38	57 0 37.6			15.0			
205	21 35 46.23	57 22 59.1			15.1				205	21 36 33.92	57 7 37.2			15.0			
206	21 35 45.26	57 23 18.3			15.1				206	21 36 40.92	57 7 41.8			15.1			
207	21 36 0.01	57 22 59.3			15.2				207	21 35 44.31	57 7 31.1			15.0			
208	21 35 51.17	57 24 1.2	-0.07	0.38	14.9	81	2		208	21 37 53.52	57 3 29.3	-0.17	0.60	14.7	43	2	
209	21 36 10.41	57 22 59.8	-0.02	-0.14	12.4	93	1		209	21 38 0.91	57 1 41.7	0.39	0.02	14.4	0	1	
210	21 36 10.54	57 23 33.9	0.47	-0.20	12.0	78	1		210	21 38 21.85	57 1 10.3	0.22	-0.28	14.5	50	2	
211	21 36 4.05	57 23 51.0			15.0				211	21 38 23.75	56 59 55.4			14.4			
212	21 36 15.10	57 23 33.4	-2.34	0.37	14.4	0	1		212	21 38 23.02	56 59 3.5	-0.79	0.16	12.6	9	1	
213	21 36 36.92	57 21 52.3			15.2				213	21 38 12.98	56 58 31.5	-0.17	-0.07	14.6	92	2	
214	21 36 38.55	57 21 35.4			15.1				214	21 38 34.50	56 58 25.7	-0.15	0.46	12.1	72	1	
217	21 36 29.18	57 23 18.9	-0.03	0.05	10.9	94	1		217	21 38 35.85	56 58 4.3	-0.30	0.36	9.5	79	1	
218	21 36 24.87	57 23 50.5			15.1				218	21 38 30.43	57 1 3.0	-1.57	-0.06	11.2	0	1	
219	21 35 31.46	57 23 1.6	-0.46	0.02	12.7	73	1		219	21 38 4.92	57 3 27.2	-0.61	0.33	11.1	39	1	
220	21 36 33.35	57 22 29.6	-0.39	0.14	13.9	81	1		220	21 38 12.61	57 3 21.3	0.32	0.20	13.4	77	1	
221	21 36 46.01	57 22 5.9	-0.05	-0.26	12.6	90	1		221	21 38 17.69	57 3 18.1	-0.14	0.25	14.4	90	1	
222	21 36 24.16	57 24 35.3			15.1				222	21 38 3.13	57 4 9.5	-2.07	0.72	14.8	0	2	
223	21 36 27.63	57 24 33.1	-1.34	0.23	14.7	0	2		223	21 38 16.92	57 4 57.4			14.8	33	2	
224	21 35 28.59	57 24 33.3	0.09	-0.23	12.8	92	1		224	21 38 21.45	57 4 3.9	0.10	-0.09	14.4	94	2	
225	21 36 25.65	57 25 17.8			14.7				225	21 38 34.41	57 4 35.7	0.01	-0.18	14.7	92	2	
226	21 36 38.14	57 24 25.5	-0.82	-0.59	14.4	0	1		226	21 38 45.73	57 4 31.3	1.35	-1.90	14.0	0	1	
227	21 35 19.82	57 24 66.7			14.5				227	21 38 37.31	57 0 52.0	0.10	-0.10	13.3	94	1	
229	21 35 38.13	57 25 58.6	0.13	-0.35	12.8	87	1		229	21 39 26.23	56 57 58.8	-0.07	0.26	12.2	90	1	
230	21 35 46.72	57 26 20.7			14.8				230	21 39 22.18	57 0 35.5	-0.51	-0.02	13.9	60	1	
231	21 36 0.44	57 25 34.0			15.1				231	21 39 24.52	57 2 32.5	0.23	-0.34	12.4	87	1	
232	21 35 38.71	57 28 43.9	-0.24	0.27	14.2	86	2		232	21 38 2.61	57 6 51.6	0.05	0.15	12.5	93	1	
233	21 35 43.99	57 28 16.4	0.11	0.13	14.4	0	1		233	21 38 12.85	57 6 43.5	-0.66	0.32	11.0	29	1	
234	21 36 2.22	57 27 8.4	0.29	-0.35	14.1	82	2		234	21 38 10.55	57 7 25.7			14.9			
235	21 35 59.53	57 28 7.7			15.1				235	21 38 14.23	57 7 25.7	0.60	-1.24	13.8	0	1	
236	21 35 35.79	57 30 21.4			15.0				236	21 38 16.88	57 7 50.5	0.05	0.34	14.8	94	2	
237	21 35 37.20	57 30 24.6			14.2				237	21 38 10.97	57 8 15.0	0.49	-0.37	12.7	67	1	
239	21 35 57.48	57 29 34.5			14.8				239	21 38 13.55	57 8 27.9	0.61	-0.47	14.6	37	2	
241	21 36 6.57	57 27 52.0	0.11	1.08	14.4	0	1		241	21 38 12.21	57 8 22.0	0.91	-0.40	11.6	3	1	
242	21 36 8.56	57 27 43.9			14.6				242	21 38 21.70	57 7 55.9	0.15	0.18	14.8	89	2	
243	21 36 20.28	57 27 12.4	-0.26	0.47	14.1	64	2		243	21 38 38.98	57 7 33.3	-0.07	-0.14	13.2	93	1	
244	21 36 23.58	57 26 42.5	0.95	-0.93	14.3	0	1		244	21 38 47.10	57 6 13.0			15.1			
245	21 36 26.03	57 25 39.5	-0.03	-0.04	14.2	93	2		245	21 38 36.95	57 5 18.5			15.0			
246	21 36 32.79	57 25 15.3			14.9				246	21 38 42.36	57 5 1.5			15.1			
247	21 36 37.74	57 25 58.6			14.7				247	21 38 52.32	57 5 28.8	-0.26	-0.16	14.6	85	2	
248	21 36 14.48	57 28 54.0			14.7				248	21 38 51.73	57 6 3.7	0.94	-1.41	13.2	0	1	
249	21 36 1.93	57 30 9.7			14.6				249	21 38 53.78	57 6 2.6	0.66	-0.45	15.0	26	2	
251	21 35 55.45	57 30 45.3			14.9				251	21 39 2.31	57 6 11.5	0.51	0.42	14.9	12	2	
252	21 35 50.70	57 31 35.1	-0.02	-0.28	11.7	89	1		252	21 39 5.65	57 5 45.4	0.50	-0.06	14.8	70	2	
253	21 35 48.82	57 32 1.8	-1.31	0.30	12.7	0	1		253	21 39 10.99	57 6 24.1			15.1			
254	21 35 0.54	57 32 28.5	-0.29	-0.37	13.1	57	1		254	21 39 13.50	57 6 20.0	0.10	-0.16	13.8	93	1	
255	21 35 10.89	57 31 31.6			14.8				255	21 39 14.24	57 5 5.9	-0.43	0.39	13.0	64	1	
256	21 35 15.05	57 30 40.9	-0.75	0.55	11.2	6	1		256	21 39 24.41	57 5 44.0	-0.01	0.62	13.8	32	1	
257	21 35 24.39	57 29 19.0	-0.03	0.22	14.5	91	2		257	21 39 25.49	57 6 0.5	-0.14	0.11	13.9	93	2	
258	21 35 23.92	57 28 47.4	0.33	-0.25	13.4	87	1		258	21 39 45.55	57 2 52.8	0.71	-0.44	12.6	21	1	
259	21 35 27.53	57 27 58.0	1.23	-0.84	13.6	0	1		259	21 39 38.52	57 7 5.3	-0.80	0.23	14.0	9	1	
260	21 36 32.44	57 27 26.3	0.88	-0.36	14.6	5	2		260	21 39 54.67	57 2 52.6			12.9			
261	21 35 29.88	57 30 2.9			14.7				261	21 39 57.48	57 4 31.5	0.17	0.02	12.6	93	1	
263	21 35 40.35	55 57 50.0	-0.03	-0.13	13.6	93	1		263	21 39 57.61	57 4 46.7	0.19	0.09	12.4	91	1	
264	21 35 52.59	56 58 27.8			14.8				264	21 38 5.79	57 10 27.6	0.16	0.44	14.3	60	1	
265	21 35 58.55	56 59 45.9	-0.09	0.02	14.5	0	2		265	21 38 11.24	57 9 51.5	0.22	0.03	11.5	92	1	
266	21 36 32.67	57 1 8.0	-0.07	-0.13	13.5	92	2		266	21 38 0.80	57 8 53.6	0.10	0.35	14.7	78	2	
267	21 36 43.89	57 1 3.4	0.11	-0.05	14.3	93	1		267	21 38 12.84	57 10 22.8	-0.20	0.25	13.1	89	1	
268	21 35 49.37	57 0 55.7	0.25	-0.02	9.1	0	1		268	21 38 17.03	57 11 6.5	0.34	0.15	14.6	77	2	
269	21 35 57.60	57 0 45.1	-0.59	0.09	14.8	47	2		269	21 38 20.23	57 16 10.2	0.07	-0.17	14.4	93	1	
270	21 37 12.24	56 58 22.5	-0.20	-0.02	14.8	91	2		270	21 38 32.27	57 9 44.8	0.01	0.06	11.8	94	1	
272	21 37 19.38	56 59 54.5			14.9				272	21 38 28.84	57 9 27.2	-0.13	-0.61	12.5	27	1	
273	21 37 11.01	57 0 34.0	-2.53	2.31	10.1	0	2		273	21 38 42.40	57 8 55.7			15.0			
274	21 37 5.59	57 1 9.9	-2.58	2.34	11.9	0	1		274	21 38 42.42	57 8 53.1			15.1			
275	21 36 53.71	57 1 20.4	-0.15	0.25	14.7	90	2		275	21 38 46.83	57 9 21.7	-0.01	0.14	13.1	93	1	
276	21 36 56.35	57 1 31.8	-0.20	-0.01	14.5	92	2		276	21 38 46.84	57 9 49.9			15.1			
277	21 36 52.36	57 2 5.3	0.29	-0.17	12.8	0	2		277	21 38 57.45	57 9 53.2	0.15	-0.20	14.9	92	2	
278	21 37 6.69	57 2 12.5	-0.53	0.37	14.8	49	2		278	21 38 56.32	57 9 11.0	0.01	0.32	14.2	86	1	
279	21 37 10.60	57 2 20.8			14.9				279	21 38 58.88	57 9 30.5	-0.44	0.27	14.8	72	2	
280	21 36 35.51	57 4 11.0			15.0				280	21 39 5.36	57 8 21.2	-0.39	0.47	14.2	57	1	
281	21 36 39.88	57 3 47.3	0.11	-0.92	15.0	2	2		281	21 39 7.85	57 9 25.0			15.2			
282	21 36 46.59	57 3 49.1			15.0				282	21 39 15.91	57 6 52.0	-0.27	0.55	14.9	50	2	
283	21 36 48.41	57 4 48.3			15.1				283	21 39 23.99	57 8 28.1	-0.13	0.34	14.3	86	1	
284	21 36 57.19	57 4 38.6	-0.25	-0.51	15.0	33	2		284	21 39 27.60	57 9 17.9	0.09	0.43	14.5	66	2	
285	21 35 59.85	57 5 20.9	-0.39	-0.05	14.8	76	2		285	21 37 54.53	57 12 34.9			15.0			
286	21 37 13.95	57 3 24.1	0.32	-0.61	12.6	4	1		286	21 38 2.14	57 11 56.2	0.15	-0.26	14.8	91	2	
287	21 37 17.31	57 1 54.4	0.20	-0.27	13.4	90	2										

TABLE III. (continued)

MVA	α	(1950.0)	δ	u_a	u_b	V	P	Q	MVA	α	(1950.0)	δ	u_a	u_b	V	P	Q
408	21 36 47.27	57 9 4.7	0.04	0.18	14.2	92	1		511	21 37 51.31	57 20 27.9	-0.90	0.09	14.4	0	1	
409	21 36 47.96	57 9 26.0			14.8				512	21 37 45.84	57 21 16.7	0.80	-0.25	14.1	0	1	
410	21 36 52.30	57 9 37.8	-0.28	-0.03	14.4	89	1		513	21 37 47.58	57 21 26.2	0.75	-0.61	14.0	8	2	
411	21 36 55.84	57 8 45.6	-0.10	0.07	13.8	93	2		514	21 37 51.40	57 21 32.6	-0.06	0.11	12.0	94	1	
412	21 37 6.41	57 8 26.5	0.11	0.01	9.1	93	2		515	21 37 52.36	57 21 39.8			15.1			
413	21 37 7.05	57 9 52.6	0.83	-0.65	11.8	2	1		516	21 37 56.50	57 20 43.1	0.40	-0.22	13.9	83	1	
414	21 37 12.84	57 8 54.5	-0.35	-0.31	13.3	56	1		517	21 37 44.77	57 22 19.4			14.8			
415	21 37 18.12	57 6 34.7	-0.01	0.23	13.4	0	1		518	21 37 11.29	57 22 28.2			15.1			
416	21 36 45.94	57 10 43.1			15.0				521	21 37 10.08	57 23 46.2	-0.16	-0.33	12.2	80	1	
417	21 37 10.51	57 10 27.8			14.8				523	21 37 26.73	57 23 14.5	-0.23	0.06	12.4	91	1	
418	21 37 14.76	57 10 11.7	0.46	-0.42	13.6	67	1		525	21 37 38.59	57 22 56.2			14.8			
419	21 37 31.05	57 7 38.0	-0.17	0.11	14.5	92	1		526	21 37 43.75	57 22 48.6			14.8			
420	21 37 33.99	57 6 17.1	-0.01	0.11	11.1	94	1		527	21 37 47.96	57 22 48.3	0.01	0.03	13.9	94	1	
421	21 37 34.03	57 7 33.6	-0.27	-0.07	13.3	88	1		528	21 36 39.31	57 25 4.5			15.0			
422	21 37 43.45	57 5 34.6	0.46	-0.55	11.6	46	1		529	21 36 47.29	57 25 12.4			15.0			
423	21 37 53.12	57 5 6.6	0.09	0.17	8.9	92	1		530	21 36 53.21	57 24 47.3			15.1			
425	21 36 30.55	57 13 30.7			15.1				531	21 36 53.13	57 24 22.0			15.1			
426	21 36 35.67	57 13 13.8	-0.07	-0.14	11.3	93	1		532	21 37 1.84	57 25 9.5	-0.03	-0.02	13.4	94	1	
427	21 36 44.10	57 12 49.6			14.8				534	21 37 13.75	57 25 13.6	0.14	0.21	14.0	89	1	
428	21 37 18.51	57 12 54.6			14.9				535	21 37 28.17	57 24 24.7	-0.25	0.18	11.0	90	1	
430	21 37 36.49	57 11 19.2	0.13	-0.04	11.8	94	1		537	21 37 43.84	57 23 44.3	-0.02	0.06	13.8	94	1	
431	21 37 41.35	57 9 33.3	-0.02	-0.10	13.0	94	1		538	21 37 45.84	57 23 45.1			14.9			
432	21 37 47.75	57 10 24.4	0.17	-0.28	13.7	90	1		539	21 37 47.50	57 23 49.5	-0.17	0.16	13.6	92	1	
433	21 37 51.27	57 10 15.5	-1.74	0.53	14.5	0	1		540	21 37 48.19	57 23 52.5			14.9			
434	21 37 55.25	57 8 58.6	-0.14	-0.25	14.3	85	2		541	21 37 57.06	57 23 59.9			15.1			
435	21 37 54.87	57 10 36.1	-0.31	0.19	13.5	87	1		542	21 37 59.70	57 24 25.2	5.14	0.90	14.9	0	2	
436	21 38 3.03	57 9 42.5	0.25	0.11	14.1	89	1		544	21 37 33.43	57 25 12.5			15.0			
437	21 37 45.53	57 12 11.9	0.07	-0.19	11.3	93	1		545	21 36 44.82	57 26 27.4	0.29	-0.31	11.2	87	1	
438	21 36 46.52	57 13 59.7	-1.15	1.15	10.7	0	1		546	21 37 6.68	57 26 13.7	0.26	-0.32	12.5	87	1	
439	21 36 40.95	57 13 47.7			14.8				547	21 37 5.92	57 27 3.4	-1.84	0.45	12.5	0	1	
440	21 36 20.57	57 14 56.2			14.5				548	21 37 15.48	57 27 15.1	0.17	-0.04	13.6	93	1	
441	21 36 23.23	57 15 26.3	-0.34	0.36	14.3	74	2		549	21 37 14.74	57 26 36.2			14.7			
442	21 36 25.28	57 15 38.0			14.8				550	21 37 18.72	57 26 15.5	0.12	-0.29	11.3	91	1	
443	21 36 37.71	57 15 30.4	0.38	0.17	14.8	0	2		551	21 37 18.38	57 25 56.0			15.0			
444	21 36 42.40	57 15 0.2	-0.15	-0.47	14.8	0	2		552	21 37 31.35	57 26 17.4	-0.66	0.74	14.5	5	3	
445	21 36 47.84	57 15 37.8	-2.14	3.08	13.1	0	2		553	21 37 29.97	57 25 42.7	0.14	0.88	13.5	0	1	
446	21 36 54.39	57 15 21.2	-0.25	-2.06	11.9	0	1		554	21 37 37.45	57 26 43.0	-0.44	0.50	11.4	47	1	
447	21 35 53.56	57 15 5.9	-0.03	-0.11	11.5	94	1		555	21 37 49.09	57 25 34.8	-0.21	-0.01	9.1	91	1	
448	21 37 9.58	57 14 10.4	0.13	0.18	14.6	89	2		556	21 37 52.79	57 26 48.8	-0.42	0.48	11.0	54	1	
449	21 37 16.69	57 13 58.0	0.10	0.07	14.6	0	2		557	21 37 53.04	57 27 1.3	-0.88	0.90	13.8	0	1	
450	21 37 18.19	57 13 58.9	-0.02	0.22	13.7	91	1		558	21 36 56.77	57 27 48.0	0.23	-0.32	9.9	88	1	
451	21 37 25.33	57 14 49.5	-0.06	-0.10	11.6	94	1		559	21 36 57.95	57 28 23.3	-1.17	1.41	14.6	0	2	
452	21 37 31.70	57 14 40.9			14.7				560	21 37 2.54	57 28 75.5	0.35	-0.26	14.1	82	2	
453	21 37 38.73	57 14 38.4			15.0				561	21 37 14.21	57 28 23.3	0.32	0.15	14.6	0	2	
454	21 37 39.89	57 14 56.9	-0.35	-0.09	12.1	94	1		562	21 37 33.22	57 28 3.5			15.1			
455	21 37 49.02	57 14 8.0	-0.61	0.98	10.4	0	1		563	21 37 33.61	57 28 6.7			15.1			
456	21 36 34.34	57 15 55.3			14.9				564	21 37 35.27	57 28 32.3	0.35	-0.30	11.2	84	1	
457	21 36 37.75	57 15 45.1	0.07	-0.15	14.3	0	2		565	21 37 43.51	57 28 36.6	0.26	-0.05	12.1	92	1	
458	21 36 45.04	57 15 54.1			14.6				566	21 37 46.21	57 28 52.3	0.27	-0.29	10.6	89	1	
459	21 36 46.74	57 15 36.1	-0.23	0.13	14.3	0	1		567	21 37 59.06	57 28 44.2	0.13	-0.12	13.6	94	1	
460	21 37 24.62	57 15 44.5	-0.37	-0.16	5.1	67	*		568	21 36 56.41	57 29 10.9	0.32	0.09	14.1	83	2	
462	21 37 23.74	57 16 3.1	-0.01	-0.02	8.1	94	2		569	21 37 3.99	57 29 19.8	-0.11	0.12	12.8	93	1	
463	21 37 38.90	57 15 20.7	-0.55	-0.18	11.7	32	1		570	21 37 53.07	57 30 1.3	0.54	0.10	13.5	49	1	
464	21 37 54.22	57 15 23.5	-0.04	0.03	8.4	94	1		571	21 36 55.20	57 29 59.5	0.02	0.10	12.7	94	1	
465	21 37 53.88	57 15 2.8	-0.01	-0.07	11.1	94	1		572	21 36 57.14	57 30 7.2	0.02	-0.34	14.2	86	1	
466	21 37 22.78	57 15 58.1	0.70	-0.69	12.9	5	1		573	21 37 25.22	57 30 28.4	0.92	-0.33	14.7	4	2	
467	21 37 30.42	57 15 52.7	0.18	-0.10	14.1	0	2		574	21 37 44.98	57 31 17.9	0.25	-0.11	14.2	0	1	
468	21 36 35.53	57 17 52.8	-0.14	-0.21	10.6	89	1		575	21 37 53.54	57 31 35.4	-0.13	-0.13	12.2	91	2	
469	21 36 44.63	57 17 47.8	-0.19	-0.12	13.7	90	1		576	21 37 57.71	57 31 21.0	0.43	-0.09	12.1	0	1	
470	21 36 53.75	57 17 35.7			14.8				577	21 38 6.17	57 30 52.6	0.14	-0.32	12.6	88	2	
471	21 36 38.46	57 17 16.6	-0.75	0.46	11.5	13	1		578	21 36 53.87	57 31 42.5	0.11	-0.13	13.7	94	1	
472	21 36 46.56	57 18 22.5	0.39	-0.29	13.4	81	1		579	21 36 45.76	57 32 4.5	-1.77	-0.74	12.4	0	1	
473	21 36 49.79	57 18 37.3	-0.03	0.11	14.2	94	1		580	21 38 24.15	57 11 59.5	-0.02	-0.06	14.3	94	1	
474	21 36 51.56	57 19 47.7	-0.06	0.03	12.5	94	1		581	21 38 25.09	57 12 4.5			14.9			
475	21 37 11.27	57 19 32.4			15.2				582	21 38 30.85	57 11 43.2	0.52	-0.14	14.1	68	2	
476	21 37 4.30	57 19 14.6			15.2				583	21 38 37.59	57 12 12.5	-0.07	-0.02	10.6	94	1	
477	21 37 7.87	57 19 0.6			14.9				584	21 38 39.63	57 11 30.3	-0.18	-0.12	14.2	91	1	
478	21 37 15.41	57 18 37.7			14.7				585	21 38 45.85	57 10 54.0	-0.00	-0.05	13.8	94	1	
479	21 37 26.95	57 18 22.4	1.03	-0.74	11.7	0	1		586	21 38 44.54	57 11 30.5			14.8			
480	21 37 36.83	57 17 49.5	-0.22	0.26	13.2	88	2		587	21 38 48.71	57 11 45.2	-0.25	0.04	14.7	0	2	
482	21 37 33.25	57 17 28.0			14.3				588	21 38 55.39	57 11 26.2	2.14	0.10	13.1	92	1	
483	21 36 49.28	57 20 44.2	0.60	-2.45	13.0	0	1		589	21 39 5.60	57 10 57.1			15.0			
485	21 36 57.43	57 20 23.1			15.2				590	21 39 21.46	57 10 36.8	-0.03	0.23	13.7	91	1	
486	21 37 1.43	57 21 25.4	0.16	0.14	13.6	91	2		591	21 39 31.79	57 10 17.2	0.65	-0.51	11.2	25	1	
488	21 37 9.61	57 20 11.7	1.39	-1.07	14.0	0	1		592	21 39 49.81	57 10 28.8	-0.13	-0.11	12.2	93	1	
489	21 37 10.74	57 20 8.7			14.8				593	21 39 48.60	57 10 48.2	-0.25	-0.25	13.7	81	1	
490	21 37 15.98	57 19 29.3</															

TABLE III. (continued)

MVA	α	(1950.0)	δ	u_a	u_b	V	P	Q	MVA	α	(1950.0)	δ	u_a	u_b	V	P	Q
609	21 33	9.55	57 13 41.4	-0.50	0.16	14.3	0	1	701	21 39	14.28	57 25 32.3	-0.42	0.35	14.8	0	2
610	21 33	18.79	57 13 30.7			14.0			702	21 39	20.84	57 26 1.4	-0.35	-0.10	12.3	88	1
611	21 34	17.55	57 12 38.5	0.25	-0.52	14.8	45	2	703	21 39	31.34	57 25 55.0	-0.20	0.05	13.5	92	1
612	21 33	27.93	57 13 45.2	-0.52	0.28	13.3	60	1	704	21 38	17.51	57 27 34.2	-0.04	0.44	14.6	0	2
613	21 39	35.06	57 12 49.8	-1.54	-0.37	11.3	0	1	705	21 38	24.55	57 28 43.4	-0.49	0.33	12.2	62	1
614	21 39	34.94	57 11 46.2	0.23	0.12	14.4	89	2	706	21 38	22.75	57 29 27.6	0.46	-0.71	13.6	19	2
615	21 39	50.09	57 11 48.4	0.12	-0.52	12.3	94	1	707	21 38	28.27	57 29 14.5	-0.07	-0.15	12.7	93	1
616	21 39	44.77	57 14 23.9	0.27	1.35	10.8	0	1	708	21 38	27.69	57 28 54.8	0.38	-0.05	13.1	86	1
617	21 39	45.53	57 14 18.5	-0.93	-0.42	13.5	75	2	709	21 38	31.28	57 28 49.5	0.31	0.38	14.3	48	2
618	21 38	7.33	57 15 33.1	0.51	-0.56	14.4	27	2	710	21 38	32.15	57 23 4.5	0.27	-0.15	14.4	91	2
619	21 38	6.80	57 15 55.8	-0.58	0.20	14.4	45	2	711	21 38	32.84	57 23 9.6	-1.48	0.82	12.5	0	1
620	21 39	5.02	57 15 55.3	0.25	-0.02	14.5	91	2	712	21 38	42.57	57 23 50.6	0.12	0.11	12.6	93	1
621	21 39	23.66	57 15 30.7	0.02	0.20	13.4	92	1	713	21 38	39.25	57 28 7.5	-0.09	0.15	10.8	93	1
622	21 39	25.85	57 15 12.5	-0.22	0.55	14.9	51	2	714	21 38	41.27	57 28 11.6	-0.03	0.18	12.6	92	1
623	21 39	31.27	57 15 35.7	-0.27	0.01	14.6	0	2	715	21 38	42.02	57 27 12.1	0.03	0.11	12.9	94	1
624	21 39	34.24	57 15 11.4	0.09	0.22	14.2	0	2	716	21 39	12.02	57 27 3.1	0.35	-0.43	13.8	77	1
625	21 39	51.15	57 15 45.8	-0.15	-0.16	14.6	91	2	717	21 39	22.49	57 27 15.7	-0.58	0.20	13.1	0	1
626	21 38	6.84	57 15 57.2	0.25	-0.16	13.7	91	2	718	21 39	27.27	57 27 9.8	-0.15	-0.96	12.2	0	1
627	21 38	10.75	57 16 53.5	0.25	0.03	13.9	91	1	719	21 39	36.24	57 28 9.0	0.29	0.05	14.3	89	1
628	21 38	11.56	57 17 2.1	0.10	-0.38	14.8	84	2	720	21 39	7.42	57 28 27.4	-2.30	1.47	14.2	0	1
629	21 38	17.44	57 17 18.6			15.0			721	21 39	15.35	57 29 10.8	-0.13	0.09	14.4	93	1
630	21 38	29.04	57 17 23.9			14.9			722	21 39	27.64	57 29 23.4	-0.52	0.15	14.4	0	1
631	21 38	38.72	57 17 34.9			15.0			723	21 39	33.51	57 29 15.3	-0.31	0.82	13.2	5	1
632	21 38	39.55	57 17 19.5	-0.55	0.59	14.1	11	1	724	21 38	13.99	57 31 1.8	-0.56	0.93	14.4	1	1
633	21 38	44.93	57 17 0.0	-0.15	-0.04	15.0	93	1	725	21 38	25.25	57 30 39.1	-0.06	-0.01	11.4	94	1
634	21 38	47.06	57 17 43.8	-0.23	0.33	13.6	84	1	726	21 38	46.88	57 30 25.0			14.8		
635	21 39	16.58	57 16 39.8	-0.12	0.17	14.5	0	2	727	21 39	1.62	57 30 29.7			14.4		
636	21 39	25.73	57 16 27.2	0.33	-0.13	14.6	89	2	728	21 39	8.69	57 30 18.4	0.01	-0.52	11.7	62	1
637	21 39	25.44	57 16 59.3			14.4			729	21 39	15.28	57 30 7.3	-0.90	1.68	14.2	0	2
638	21 39	40.77	57 15 53.6	1.00	-0.13	11.1	1	1	730	21 39	31.18	57 30 3.2	-0.21	-0.22	14.7	0	2
639	21 38	6.71	57 19 4.2	0.79	-0.15	14.8	0	2	731	21 39	33.02	57 31 52.2	-0.10	-0.37	13.9	79	1
640	21 38	13.58	57 19 14.5	-0.37	0.12	10.7	94	1	732	21 38	15.51	57 32 39.1	-0.16	0.16	11.3	92	1
641	21 38	20.66	57 19 30.3	0.06	0.12	14.2	93	1	733	21 38	25.04	57 31 55.2	0.42	-0.09	14.3	0	1
642	21 38	8.57	57 20 9.4	-0.20	-0.15	14.5	88	2	734	21 38	40.75	57 31 18.9	-0.85	0.95	13.7	0	1
643	21 38	25.88	57 19 51.7			14.9			735	21 38	54.23	57 31 50.5	0.53	-0.37	14.6	0	2
644	21 38	31.31	57 20 30.9			14.9			736	21 38	58.07	57 31 49.5	0.13	-0.07	11.5	94	1
645	21 38	35.97	57 19 44.5	0.30	0.12	14.4	85	1	737	21 39	12.35	57 31 50.8	-1.13	0.31	11.8	0	1
646	21 38	56.35	57 19 58.5	-0.14	0.26	12.4	90	1	738	21 39	13.35	57 31 43.6	0.09	-0.34	14.4	0	2
647	21 38	54.02	57 18 38.9	0.19	-0.25	14.5	90	2	739	21 39	22.73	57 31 33.3	1.37	-0.48	14.3	0	1
648	21 39	4.12	57 19 26.4			15.1			740	21 39	42.12	57 31 48.2	-0.07	-0.12	12.8	0	1
650	21 39	5.37	57 18 38.3	0.80	0.25	14.8	0	2	741	21 39	49.54	57 31 34.1	0.17	-0.20	10.7	91	2
651	21 39	14.30	57 19 6.5	-0.36	0.27	12.9	81	1	742	21 39	51.52	57 31 17.8	0.48	-0.11	14.5	0	1
652	21 39	13.63	57 18 43.6	-0.75	0.10	14.1	15	2	743	21 39	54.77	57 31 2.2	0.16	0.20	14.0	89	1
653	21 39	26.65	57 19 24.9	-0.22	0.64	14.7	32	2	744	21 39	54.75	57 30 17.1	0.25	-0.04	14.1	92	1
654	21 39	35.02	57 18 54.7	-0.32	0.63	13.7	3	2	745	21 39	49.93	57 29 34.7	-2.35	0.34	14.5	0	2
655	21 39	49.36	57 19 3.4	0.40	-0.06	14.3	81	2	746	21 39	39.46	57 32 48.7	-0.19	-0.06	9.9	91	1
656	21 39	59.00	57 19 25.8	0.48	-0.36	11.5	66	2	747	21 38	24.47	57 32 38.0	-0.23	-0.14	9.6	88	1
657	21 38	4.25	57 21 29.9	-0.05	-0.13	12.7	93	1	748	21 38	57.53	57 3 1.3	0.02	-0.23	9.9	90	2
658	21 38	7.95	57 21 17.9	-0.14	0.04	15.6	94	1	749	21 39	53.07	56 59 25.5	-0.05	-0.10	12.6	94	1
659	21 38	13.32	57 20 28.3			15.0			750	21 39	53.78	56 59 26.5	-0.80	0.51	13.0	4	1
660	21 38	7.82	57 21 31.2	0.29	-0.05	13.2	94	1	803	21 40	5.93	57 5 11.3	0.01	0.01	12.9	94	1
661	21 38	14.68	57 22 35.1	-0.14	0.03	15.3	94	1	804	21 40	4.29	57 6 34.0	-0.79	0.47	13.5	5	1
662	21 38	15.88	57 22 51.1	-0.00	-0.34	13.9	86	1	805	21 40	2.05	57 8 43.2	0.01	0.01	10.8	94	2
663	21 38	19.39	57 22 51.0	0.49	0.17	14.2	0	1	806	21 39	53.76	57 9 4.1	0.55	-0.51	13.5	40	1
664	21 38	27.86	57 23 22.9	-0.11	0.80	14.1	6	1	807	21 40	1.13	57 10 0.6	-0.40	0.13	12.3	81	1
665	21 38	27.86	57 23 22.9	-0.11	0.80	14.1	6	1	808	21 40	1.46	57 10 6.9	-1.26	-0.13	14.4	0	1
666	21 38	27.26	57 23 45.3	-0.29	-0.13	14.7	84	2	809	21 40	5.74	57 12 4.0	0.30	0.11	13.8	85	1
667	21 38	25.88	57 23 53.5	-0.11	0.66	14.5	27	2	810	21 40	2.09	57 18 10.5	-0.23	-0.04	12.7	90	1
668	21 38	44.36	57 22 0.6	0.31	0.00	14.7	0	2	811	21 40	3.16	57 18 6.0	-0.81	0.63	11.7	2	1
669	21 38	42.02	57 23 37.0	0.22	0.02	12.4	92	1	812	21 40	4.54	57 18 52.6	-0.39	0.44	12.1	63	1
670	21 38	49.47	57 23 35.1	0.17	-0.60	12.4	51	1	813	21 40	5.15	57 19 26.3	0.52	-0.30	13.8	66	1
671	21 38	49.55	57 21 51.8	-0.28	-0.67	12.6	5	1	814	21 40	6.48	57 23 49.7	0.20	-0.32	13.4	88	1
672	21 38	49.41	57 21 14.8	4.34	-1.49	7.6	0	2	815	21 40	1.29	57 25 43.3	0.62	-0.32	14.6	47	2
673	21 38	43.73	57 21 21.5	8.22	-1.70	8.1	0	1	816	21 40	15.43	57 4 40.2	-0.02	0.19	14.3	92	1
674	21 38	49.78	57 21 15.0	0.53	-1.95	13.7	0	2	817	21 40	10.09	57 6 39.8	-0.21	0.11	14.2	92	1
675	21 38	56.60	57 22 23.5	1.63	-1.22	14.3	0	1	818	21 40	18.77	57 5 35.4	-0.39	0.76	12.4	9	1
676	21 39	13.29	57 21 48.0	0.38	0.22	11.6	66	1	819	21 40	24.83	57 5 36.3	-0.61	-0.49	13.6	2	1
677	21 39	14.49	57 22 32.2	-0.52	0.44	14.5	0	2	820	21 40	24.82	57 7 8.0			13.5		
678	21 39	12.34	57 22 47.5	-0.25	-0.19	14.7	84	2	821	21 40	45.28	57 1 32.6	-0.26	0.11	13.9	90	1
679	21 39	16.77	57 20 48.6	0.10	-0.05	14.8	94	2	822	21 40	49.32	57 7 2.0	0.13	-0.12	11.1	93	2
680	21 39	23.11	57 22 33.2	-0.57	0.32	15.6	26	1	823	21 40	51.33	57 7 44.5	0.85	-0.49	13.4	5	1
681	21 39	40.64	57 21 27.3	0.15	0.18	14.6	0	2	824	21 40	46.24	57 9 0.9	0.03	0.25	14.4	90	1
682	2																

TABLE III. (continued)

Star	RA	Dec	Mag	Parallax	Proper Motion	Radial Velocity	Distance	Notes
843	21 40 15.12	57 23 52.4	11.3	0.12	0.12	10.3	13	1
844	21 40 18.82	57 23 45.8	11.3	0.12	0.12	10.3	91	1
845	21 40 17.15	57 23 47.4	11.3	0.12	0.12	10.3	43	1
846	21 40 17.44	57 23 52.3	11.3	0.12	0.12	10.3	13	1
847	21 40 24.75	57 24 51.7	11.3	0.12	0.12	10.3	0	1
848	21 40 24.71	57 24 51.3	11.3	0.12	0.12	10.3	0	1
849	21 40 23.33	57 24 41.3	11.3	0.12	0.12	10.3	0	1
850	21 40 30.21	57 25 33.7	11.3	0.12	0.12	10.3	91	1
851	21 40 44.63	57 24 31.7	11.3	0.12	0.12	10.3	92	1
852	21 40 47.74	57 24 51.3	11.3	0.12	0.12	10.3	25	1
853	21 40 50.51	57 24 31.3	11.3	0.12	0.12	10.3	31	1
854	21 40 50.73	57 24 43.2	11.3	0.12	0.12	10.3	91	1
855	21 40 51.37	57 25 55.1	11.3	0.12	0.12	10.3	93	1
856	21 40 42.51	57 25 31.4	11.3	0.12	0.12	10.3	93	2
857	21 40 44.23	57 25 25.3	11.3	0.12	0.12	10.3	42	1
858	21 40 10.37	57 25 49.2	11.3	0.12	0.12	10.3	1	1
859	21 40 10.77	57 25 40.4	11.3	0.12	0.12	10.3	25	1
860	21 40 28.32	57 25 58.3	11.3	0.12	0.12	10.3	33	1
861	21 40 17.48	57 25 51.8	11.3	0.12	0.12	10.3	70	1
862	21 40 40.31	57 25 25.3	11.3	0.12	0.12	10.3	0	1
863	21 40 50.42	57 25 25.3	11.3	0.12	0.12	10.3	16	1
864	21 40 58.25	57 25 20.7	11.3	0.12	0.12	10.3	75	1
865	21 41 8.67	57 25 14.8	11.3	0.12	0.12	10.3	54	1
866	21 41 56.75	57 25 31.7	11.3	0.12	0.12	10.3	13	1
867	21 41 42.56	57 25 31.4	11.3	0.12	0.12	10.3	57	2
868	21 41 42.48	57 25 31.4	11.3	0.12	0.12	10.3	57	2
869	21 41 42.48	57 25 31.4	11.3	0.12	0.12	10.3	57	2
870	21 41 15.52	57 25 25.3	11.3	0.12	0.12	10.3	4	1
871	21 41 11.10	57 25 27.9	11.3	0.12	0.12	10.3	90	1
872	21 40 56.33	57 25 25.3	11.3	0.12	0.12	10.3	94	1
873	21 41 4.76	57 25 25.3	11.3	0.12	0.12	10.3	46	1
874	21 41 23.93	57 25 25.3	11.3	0.12	0.12	10.3	23	1
875	21 41 27.08	57 25 41.6	11.3	0.12	0.12	10.3	58	2
876	21 41 25.40	57 25 9.2	11.3	0.12	0.12	10.3	0	1
877	21 41 30.22	57 25 15.3	11.3	0.12	0.12	10.3	3	1
878	21 41 32.13	57 25 29.2	11.3	0.12	0.12	10.3	12	1
879	21 41 34.65	57 25 7.5	11.3	0.12	0.12	10.3	0	2
880	21 41 14.69	57 25 23.3	11.3	0.12	0.12	10.3	77	1
881	21 41 32.01	57 25 35.6	11.3	0.12	0.12	10.3	0	1
882	21 41 25.38	57 25 25.6	11.3	0.12	0.12	10.3	9	2
883	21 41 15.77	57 25 45.6	11.3	0.12	0.12	10.3	81	2
884	21 41 10.93	57 25 38.3	11.3	0.12	0.12	10.3	55	1
885	21 41 55.52	57 25 41.1	11.3	0.12	0.12	10.3	46	1
886	21 41 2.11	57 25 20.1	11.3	0.12	0.12	10.3	42	1
887	21 41 1.23	57 25 12.4	11.3	0.12	0.12	10.3	4	1
888	21 41 1.77	57 25 16.6	11.3	0.12	0.12	10.3	97	1
889	21 41 1.77	57 25 16.6	11.3	0.12	0.12	10.3	97	1
890	21 41 8.30	57 25 17.2	11.3	0.12	0.12	10.3	19	2
891	21 41 23.00	57 25 59.5	11.3	0.12	0.12	10.3	92	1
892	21 41 12.80	57 25 6.8	11.3	0.12	0.12	10.3	91	1
893	21 40 47.46	57 25 17.4	11.3	0.12	0.12	10.3	70	2
894	21 40 59.50	57 25 13.5	11.3	0.12	0.12	10.3	0	1
895	21 41 5.80	57 25 32.6	11.3	0.12	0.12	10.3	94	2
896	21 41 13.08	57 25 29.7	11.3	0.12	0.12	10.3	4	2
897	21 41 20.83	57 25 59.1	11.3	0.12	0.12	10.3	94	1
898	21 41 33.32	57 25 2.7	11.3	0.12	0.12	10.3	0	2
899	21 41 23.58	57 25 25.0	11.3	0.12	0.12	10.3	94	1
900	21 41 23.50	57 25 49.9	11.3	0.12	0.12	10.3	0	1
901	21 41 18.77	57 25 13.5	11.3	0.12	0.12	10.3	0	1
902	21 41 32.94	57 25 57.3	11.3	0.12	0.12	10.3	87	1
903	21 41 5.70	57 25 54.5	11.3	0.12	0.12	10.3	0	2
904	21 41 28.80	57 25 35.5	11.3	0.12	0.12	10.3	7	2
905	21 41 25.69	57 25 56.5	11.3	0.12	0.12	10.3	93	1
906	21 41 20.03	57 25 1.7	11.3	0.12	0.12	10.3	13	1
907	21 41 13.05	57 25 52.5	11.3	0.12	0.12	10.3	93	1
908	21 41 9.30	57 25 37.3	11.3	0.12	0.12	10.3	63	2
909	21 41 1.89	57 25 33.0	11.3	0.12	0.12	10.3	36	1
910	21 41 53.02	57 25 53.9	11.3	0.12	0.12	10.3	11	1
911	21 42 0.34	57 25 33.1	11.3	0.12	0.12	10.3	41	1
912	21 42 1.51	57 25 38.5	11.3	0.12	0.12	10.3	79	2
913	21 42 14.07	57 25 34.4	11.3	0.12	0.12	10.3	6	2
914	21 42 31.36	57 25 4.1	11.3	0.12	0.12	10.3	74	1
915	21 42 39.73	57 25 31.9	11.3	0.12	0.12	10.3	0	1
916	21 42 41.93	57 25 24.6	11.3	0.12	0.12	10.3	8	1
917	21 42 42.48	57 25 23.8	11.3	0.12	0.12	10.3	90	2
918	21 43 2.55	57 25 38.0	11.3	0.12	0.12	10.3	1	1
919	21 42 43.49	57 25 50.4	11.3	0.12	0.12	10.3	73	2
920	21 42 3.09	57 25 32.1	11.3	0.12	0.12	10.3	92	2
921	21 42 38.78	57 25 15.0	11.3	0.12	0.12	10.3	37	1
922	21 42 36.55	57 25 27.8	11.3	0.12	0.12	10.3	0	1
923	21 42 59.66	57 25 19.9	11.3	0.12	0.12	10.3	85	1
924	21 42 58.81	57 25 42.8	11.3	0.12	0.12	10.3	0	1
925	21 41 58.40	57 25 28.1	11.3	0.12	0.12	10.3	26	2
926	21 42 13.94	57 25 47.8	11.3	0.12	0.12	10.3	88	2
927	21 42 35.68	57 25 45.1	11.3	0.12	0.12	10.3	0	1
928	21 42 45.45	57 25 35.7	11.3	0.12	0.12	10.3	92	2
929	21 42 58.05	57 25 54.7	11.3	0.12	0.12	10.3	0	2
930	21 43 2.37	57 25 52.3	11.3	0.12	0.12	10.3	1	1
931	21 42 34.85	57 25 29.1	11.3	0.12	0.12	10.3	79	1
932	21 42 27.65	57 25 33.5	11.3	0.12	0.12	10.3	33	2
933	21 42 38.10	57 25 33.8	11.3	0.12	0.12	10.3	0	2
934	21 43 0.42	57 25 21.8	11.3	0.12	0.12	10.3	0	1
935	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
936	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
937	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
938	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
939	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
940	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
941	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
942	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
943	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
944	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
945	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
946	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
947	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
948	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
949	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
950	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
951	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
952	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
953	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
954	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
955	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
956	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
957	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
958	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
959	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
960	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
961	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
962	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
963	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
964	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
965	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
966	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
967	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
968	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
969	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
970	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
971	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
972	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
973	21 43 45.20	57 25 1.5	11.3	0.12	0.12	10.3	93	1
974	21 43 45.20	57 25 1.5	11.3					

TABLE III. (continued)

MVA	α	δ	μ_1	μ_2	V	P	Q	MVA	α	δ	μ_1	μ_2	V	P	Q
1053	21 38 36.70	57 47 11.1	-0.40	0.07	9.7	50	1	1182	21 34 1.19	57 30 5.3	1.77	-2.62	14.5	0	1
1054	21 38 13.12	57 49 56.5	-0.60	-0.28	11.0	13	1	1183	21 33 51.12	57 30 24.9	-0.04	0.17	12.5	92	1
1055	21 37 58.16	57 51 32.5	0.37	-0.47	13.6	67	1	1184	21 33 42.58	57 31 13.5			14.3		
1056	21 38 0.25	57 52 14.2	-0.53	0.37	11.3	45	1	1185	21 33 34.66	57 30 57.9	0.23	-0.79	10.3	12	1
1058	21 38 17.72	57 52 43.2	0.05	-0.05	11.2	54	1	1186	21 33 40.30	57 32 41.5	-0.31	-0.65	12.1	5	1
1069	21 38 48.71	57 48 31.4	-0.72	-0.19	11.3	91	1	1187	21 34 31.30	57 32 5.7	-0.95	-1.80	13.7	0	1
1070	21 38 50.64	57 37 40.4	0.13	0.13	12.3	30	1	1188	21 34 53.55	57 31 11.7			14.3		
1071	21 39 24.75	57 35 45.7	-0.13	-0.77	13.8	0	1	1189	21 34 16.63	57 34 14.8			14.5		
1072	21 39 31.37	57 37 35.4	-0.35	0.07	12.0	84	1	1190	21 34 21.31	57 39 32.4	0.53	4.70	11.1	0	1
1073	21 39 56.75	57 34 30.5	-0.06	1.51	13.4	0	1	1191	21 33 27.66	57 41 15.2	-0.63	-0.40	12.2	4	1
1074	21 39 56.98	57 35 49.7	1.21	-0.50	12.2	0	1	1192	21 33 25.38	57 41 25.5			14.1		
1075	21 39 25.61	57 38 42.6			12.3			1193	21 33 27.82	57 41 25.2	0.09	-0.99	12.2	1	1
1076	21 40 5.27	57 36 57.9	0.06	0.37	13.3	78	1	1194	21 33 13.68	57 42 21.7			14.4		
1077	21 39 13.40	57 42 49.7	-0.28	-0.63	12.8	11	1	1195	21 33 46.23	57 42 54.5			14.5		
1079	21 39 46.60	57 41 12.2	-0.25	0.62	12.2	37	1	1197	21 33 55.88	57 43 42.3	0.16	-0.90	13.1	3	1
1079	21 40 5.32	57 18 44.0			12.1			1198	21 34 17.40	57 41 45.0	-0.93	0.50	13.8	1	1
1080	21 40 5.63	57 40 51.5			12.9			1199	21 33 32.01	57 46 4.5	1.17	-1.01	13.4	0	1
1081	21 40 5.95	57 41 43.1	-0.50	0.81	12.0	4	1	1200	21 33 28.66	57 50 30.1	-0.20	-0.02	13.7	91	1
1082	21 39 24.52	57 47 23.7	-0.67	0.22	10.8	30	1	1201	21 33 43.50	57 50 32.6	0.02	-0.14	12.7	93	1
1083	21 39 42.54	57 47 0.5	0.03	0.32	13.3	94	1	1202	21 34 55.68	57 36 16.4			14.6		
1084	21 39 29.48	57 48 11.0	-0.07	-0.32	12.7	94	1	1203	21 34 38.75	57 39 5.5			14.4		
1085	21 39 28.77	57 51 8.2	-0.09	0.35	12.8	93	1	1204	21 34 35.45	57 39 48.2	-0.34	-0.52	13.1	18	1
1086	21 39 49.03	57 49 59.3	0.55	-0.37	13.4	55	1	1205	21 34 47.30	57 39 16.3			14.6		
1087	21 39 52.07	57 49 44.3	-0.29	-0.07	13.8	96	1	1206	21 39 52.38	57 41 25.9	0.09	-0.71	13.7	21	1
1088	21 40 16.97	57 43 37.7	-0.13	0.12	14.1	92	1	1207	21 34 31.17	57 41 32.4			14.6		
1090	21 39 55.17	57 51 15.3	-0.35	0.32	12.1	77	1	1208	21 35 5.07	57 39 40.9	0.35	-0.21	13.8	96	1
1091	21 40 19.92	57 37 51.5	-0.17	1.81	6.9	0	1	1209	21 35 1.51	57 41 45.1			14.5		
1092	21 40 29.05	57 37 34.1	1.77	0.39	13.6	1	1	1210	21 35 1.75	57 42 40.0	0.09	-0.04	14.3	94	1
1093	21 40 34.45	57 36 38.4	-0.02	-0.22	11.5	91	1	1211	21 34 45.16	57 44 0.3	0.51	-1.56	12.3	0	1
1094	21 40 38.57	57 33 49.7	0.30	0.66	11.3	5	1	1212	21 34 28.44	57 44 22.5	0.02	-0.21	13.4	32	1
1095	21 40 54.02	57 35 0.4	0.42	-0.60	14.2	41	1	1213	21 34 44.55	57 45 45.1	0.25	-0.53	12.1	55	1
1096	21 40 54.26	57 35 53.0	0.63	-0.25	13.5	47	1	1214	21 34 36.74	57 47 53.0	-0.05	-0.45	12.4	69	1
1097	21 40 47.92	57 36 8.5	1.50	-1.00	10.4	1	1	1215	21 34 38.33	57 48 7.5	0.03	-0.47	12.9	72	1
1098	21 40 55.55	57 37 5.4	0.15	0.20	13.9	92	1	1216	21 34 45.37	57 48 19.7	-0.61	0.70	11.9	6	1
1099	21 40 26.19	57 40 11.5	-0.21	-0.07	13.5	94	1	1217	21 34 40.33	57 50 12.7	-0.18	-0.10	12.4	91	1
1100	21 40 46.76	57 39 22.4	0.23	-0.35	13.7	90	1	1218	21 35 31.07	57 33 27.3	-1.82	1.75	12.6	0	1
1101	21 40 54.44	57 33 27.7	1.05	0.11	12.7	93	1	1219	21 35 58.40	57 34 41.2			14.3		
1102	21 40 58.56	57 40 11.9	0.81	-0.13	12.3	71	1	1220	21 36 0.44	57 35 15.8			14.4		
1103	21 40 10.94	57 40 13.3	-0.32	0.02	12.6	86	1	1221	21 35 24.33	57 36 5.5	0.27	-0.77	13.3	15	1
1104	21 40 36.53	57 43 33.3	0.44	-0.33	13.1	69	1	1222	21 35 43.29	57 36 55.5			14.5		
1105	21 40 58.79	57 42 47.9	0.09	0.11	12.4	33	1	1223	21 36 13.37	57 37 56.1	-0.31	-0.56	13.4	15	1
1106	21 41 4.34	57 43 7.7	0.13	-0.13	12.5	93	1	1224	21 35 15.52	57 38 45.0	0.07	-0.28	14.0	90	1
1107	21 41 16.97	57 42 14.5	0.27	-0.44	12.8	62	1	1225	21 35 33.28	57 34 35.0	0.12	-0.72	11.5	92	1
1108	21 41 15.23	57 44 58.0	-0.70	0.52	13.4	0	1	1226	21 35 21.44	57 42 5.1	0.25	0.10	13.8	99	1
1109	21 40 20.29	57 46 32.1	0.88	-0.79	13.5	1	1	1227	21 35 13.79	57 42 14.5	-0.16	-0.50	13.4	26	1
1110	21 40 44.71	57 45 23.6	0.20	-0.86	13.1	0	1	1228	21 35 43.59	57 41 15.6			14.5		
1111	21 40 42.15	57 46 13.3	1.37	0.33	13.8	0	1	1229	21 35 47.25	57 41 11.1			14.4		
1112	21 40 34.57	57 45 23.5	0.15	-1.30	12.3	0	1	1230	21 35 58.32	57 42 15.7			14.4		
1113	21 40 59.73	57 45 35.4	0.40	0.30	12.9	34	1	1231	21 36 15.68	57 41 47.1	-2.07	2.56	13.3	0	1
1114	21 40 33.36	57 47 9.3	-0.34	0.25	13.9	85	1	1232	21 35 38.35	57 43 47.4			14.5		
1115	21 40 14.66	57 53 37.0	0.50	0.20	12.1	20	1	1233	21 35 43.22	57 44 0.4			14.7		
1116	21 40 27.42	57 52 35.1	0.29	-0.54	13.5	3	1	1234	21 35 45.77	57 44 42.1	-0.55	0.37	14.7	57	2
1117	21 40 43.55	57 53 14.1	-0.40	0.58	13.3	28	1	1235	21 35 53.48	57 45 16.1	0.44	-0.46	14.3	63	1
1118	21 41 21.66	57 42 0.2	-0.73	-0.11	13.1	5	1	1236	21 35 53.38	57 44 6.6	-1.48	-0.50	12.2	0	1
1119	21 41 14.59	57 33 48.4	1.22	-0.11	12.7	93	1	1237	21 35 4.78	57 43 55.5			14.6		
1120	21 41 13.95	57 35 0.5	-0.57	0.21	13.7	44	1	1238	21 36 15.47	57 44 4.6			14.2		
1121	21 41 35.47	57 45 0.1			12.0			1239	21 36 55.80	57 45 33.2			14.7		
1122	21 41 13.10	57 51 50.9			13.3			1240	21 36 11.12	57 46 14.4			14.6		
1150	21 35 11.94	57 32 43.6			13.4			1241	21 36 12.70	57 46 6.3			14.7		
1151	21 35 5.46	57 32 45.5	1.35	-0.53	13.3	50	1	1242	21 35 1.55	57 45 13.0	-0.72	-1.17	13.2	0	1
1152	21 34 47.56	57 32 23.4	-0.55	2.03	11.9	0	1	1243	21 35 1.50	57 43 45.4	-0.55	0.14	10.4	27	1
1153	21 34 35.75	57 26 15.2	-0.84	0.39	12.3	0	1	1244	21 35 11.50	57 43 5.7	-0.04	0.14	13.7	93	1
1154	21 35 12.94	57 45 55.8	-1.47	-2.15	12.8	0	1	1245	21 35 25.74	57 43 25.1	-1.03	0.53	13.0	0	1
1155	21 33 22.44	57 17 26.4	-0.62	0.44	12.6	44	1	1246	21 35 28.35	57 43 18.5	-0.12	-0.30	13.0	83	1
1156	21 33 37.90	57 17 37.3	-0.34	-0.59	12.7	38	1	1247	21 35 55.42	57 43 37.3	-0.12	0.17	14.0	93	1
1157	21 33 34.85	57 18 8.7	1.15	-1.07	13.5	0	1	1248	21 35 41.43	57 50 44.2	-0.80	0.19	14.1	0	1
1158	21 33 51.92	57 18 1.3	-0.27	-0.32	13.1	68	1	1249	21 35 51.59	57 51 6.7	-0.69	-0.05	12.8	16	1
1159	21 33 52.59	57 18 48.3	0.30	-0.59	11.6	59	1	1250	21 32 46.42	56 57 47.6			13.8		
1160	21 34 6.33	57 19 35.1	0.08	0.00	14.0	94	1	1251	21 32 44.36	55 59 23.0			13.5		
1161	21 40 36.63	57 20 13.6	0.14	-0.32	12.3	83	1	1252	21 32 5.46	57 1 28.4	-0.30	0.42	13.5	72	1
1162	21 34 27.29	57 19 34.4	0.25	1.56	13.7	0	1	1253	21 32 40.32	57 1 22.1	-0.45	0.20	12.4	55	1
1163	21 34 30.56	57 20 9.5	0.25	0.13	14.3	93	1	1254	21 32 46.36	57 1 3.6	-0.34	0.50	14.5	55	1
1164	21 33 43.88	57 20 28.5	-0.21	1.40	14.2	0	1	1255	21 32 56.10	57 0 54.5	3.15	0.20	14.4	0	1
1165	21 33 51.15	57 20 37.4	0.14	0.76	14.4	93	1	1256	21 32 38.73	57 1 56.3	-1.49	0.52	13.5	0	1
1166	21 33 35.57	57 21 37.4	-0.02	-0.25	11.7	94	1	1257	21 32 5.73	57 4 45.3	0.29	-0.51	13.9	55	1
1167	21 34 15.65	57 21 24.1	0.44	-0.52	13.5	59	1	1258	21 32 17.21	57 4 32.1	-0.54	0.42	12.5	93	1
1168	21 34 13.30	57 21 48.2	0.05	-0.12	12.0	94									

TABLE III. (continued)

MVA	α	δ	μ	σ	μ	σ	MVA	α	δ	μ	σ	μ	σ
1275	21 32 32.53	57 11 23.1	-0.31	-0.45	13.7	95	1371	21 34 34.43	55 56 4.1	0.20	0.36	14.4	68
1276	21 32 33.24	57 10 25.0	-0.15	-0.21	14.1	93	1372	21 34 37.55	55 56 5.2	0.27	0.36	14.2	89
1277	21 32 36.81	57 12 9.7	-0.32	-0.26	14.1	75	1373	21 35 14.05	56 40 7.5	-0.13	-0.09	12.8	92
1278	21 32 48.97	57 12 45.1			14.5		1375	21 35 31.74	56 39 23.9			14.6	
1279	21 32 32.95	57 15 0.1			14.5		1376	21 35 25.53	55 47 2.0	0.12	0.27	14.5	86
1280	21 32 37.85	57 15 55.5	0.22	0.05	14.0	90	1378	21 35 43.12	55 38 59.0			12.2	
1281	21 32 11.75	57 15 4.7	-0.48	-0.21	13.9	45	1379	21 35 47.93	56 31 43.5	-0.22	-0.33	14.3	72
1282	21 32 37.82	57 20 37.3	-1.21	0.67	12.6	0	1380	21 35 51.47	55 39 30.5	-1.11	0.75	13.2	0
1283	21 32 1.33	57 22 9.7	-1.42	1.15	12.5	0	1381	21 35 58.09	56 40 7.5	-0.39	2.89	13.0	0
1284	21 32 29.74	57 22 25.3	-0.38	0.33	13.9	74	1382	21 35 25.82	56 42 9.5	0.10	-0.15	12.1	93
1285	21 32 19.52	57 23 14.5	-0.46	0.81	12.7	4	1383	21 35 24.52	55 42 43.7	-0.36	-0.05	14.4	80
1286	21 32 31.47	57 23 14.9	-0.22	-0.13	13.6	94	1384	21 35 53.25	55 43 14.4	-0.05	0.16	12.9	93
1287	21 32 33.32	57 23 31.4	-0.15	0.07	13.6	92	1385	21 36 5.32	55 41 37.4	0.21	-0.60	13.0	51
1288	21 31 56.95	57 27 9.8	-0.24	-0.39	13.5	41	1386	21 36 7.31	55 40 24.9	0.19	-0.37	11.5	85
1289	21 32 5.84	57 27 40.5	-1.32	0.18	12.5	0	1387	21 36 16.74	55 39 43.2	-1.58	0.54	14.2	0
1290	21 32 24.68	57 27 21.6	0.31	-0.20	10.9	83	1388	21 36 20.24	55 40 49.7	-2.83	-0.31	10.6	0
1291	21 32 37.98	57 23 15.8	-4.02	2.09	12.1	0	1389	21 35 24.41	56 44 5.7	-0.00	-0.11	12.1	94
1292	21 32 36.07	57 23 5.7			13.8		1391	21 35 2.10	55 45 14.0	-0.78	0.31	13.6	11
1294	21 32 50.30	57 25 1.8	1.12	-0.79	14.2	0	1392	21 36 9.51	56 45 47.0	-0.32	-0.10	10.0	0
1295	21 32 47.02	57 29 35.5			12.0		1393	21 36 17.12	56 48 14.9	0.49	-0.15	14.3	74
1298	21 32 22.95	57 2 14.8	-1.78	0.95	11.5	0	1394	21 35 44.47	55 47 27.5	-0.10	0.57	13.8	93
1299	21 32 31.10	57 2 0.7	-0.23	0.14	13.4	93	1395	21 35 27.24	56 47 13.2	-2.40	2.14	13.0	0
1300	21 32 41.62	57 5 36.7	0.21	0.35	13.4	69	1396	21 36 0.75	56 43 26.7	0.31	0.05	11.5	87
1301	21 32 42.22	56 59 24.7			14.5		1397	21 36 0.48	56 45 37.3	0.16	0.49	12.6	47
1302	21 32 51.66	56 57 25.9			12.3		1398	21 36 12.47	56 49 0.5	0.22	-0.11	13.3	92
1303	21 32 57.77	56 55 59.2	0.16	-0.50	12.9	70	1399	21 36 12.90	56 48 20.6			14.6	
1304	21 32 1.56	56 55 0.8	0.11	-0.90	12.1	2	1400	21 35 19.52	56 48 26.4	0.05	0.40	12.7	74
1305	21 32 13.36	56 55 50.6	-1.33	-0.33	13.2	55	1401	21 35 1.87	56 48 42.8	-0.25	0.15	13.2	90
1306	21 32 15.95	57 1 21.1	0.47	-0.38	14.4	73	1402	21 35 7.51	56 48 8.6	-0.14	-0.46	11.8	60
1307	21 32 4.42	57 2 44.5	0.22	0.45	12.1	81	1403	21 35 21.42	55 49 23.4	-0.28	-0.19	12.2	81
1308	21 32 20.25	57 4 23.8	1.16	0.42	14.2	0	1404	21 35 20.51	55 49 33.8	-0.38	-0.01	13.2	80
1309	21 32 20.10	57 5 7.9	0.27	-0.79	12.7	12	1405	21 35 28.77	55 49 21.8	-0.09	0.07	13.7	94
1310	21 32 52.91	57 5 33.2	-0.52	0.27	14.2	59	1406	21 35 39.15	55 48 35.9	0.02	-0.16	13.3	93
1311	21 32 55.60	57 5 35.9	0.22	-0.12	14.3	92	1407	21 35 34.12	56 49 57.2	-0.07	0.05	12.9	94
1312	21 32 24.36	57 4 24.6	-0.25	-0.19	12.3	34	1408	21 35 44.35	55 51 4.1	-1.00	1.20	13.9	0
1313	21 34 33.44	57 6 37.0	0.31	-0.33	12.4	84	1409	21 35 51.56	56 50 51.7	-0.35	0.22	14.6	83
1314	21 34 35.34	57 7 5.5	-1.33	1.07	12.7	0	1410	21 35 57.41	56 50 38.9	-1.04	0.56	14.3	0
1315	21 32 24.27	57 7 28.8	0.61	-0.66	10.3	14	1411	21 35 6.32	56 49 45.0	-1.00	0.45	12.7	0
1316	21 32 23.53	57 7 46.1	1.70	-0.46	12.6	22	1412	21 35 9.26	56 50 44.9			14.7	
1317	21 32 35.41	57 7 1.9	0.33	-0.56	15.0	43	1413	21 36 11.75	56 50 57.5	0.29	-0.54	14.0	60
1318	21 32 46.43	57 8 15.8	-0.23	0.12	11.3	90	1414	21 35 21.46	56 51 48.1	-0.01	0.13	13.5	93
1319	21 32 52.18	57 7 43.2	-0.07	-0.01	14.4	94	1415	21 34 53.21	56 52 3.5	-0.63	0.40	13.3	29
1320	21 30 54.47	57 9 25.2	1.48	-1.20	14.4	0	1416	21 35 12.26	56 53 23.4	-0.23	-0.02	14.1	90
1321	21 32 1.68	57 9 35.9	0.25	-1.58	13.3	0	1417	21 35 20.42	56 53 1.5			12.6	
1322	21 34 14.14	57 9 51.7	1.03	-0.13	12.1	0	1418	21 36 0.64	56 52 37.1	0.68	0.37	13.8	21
1323	21 34 12.44	57 10 11.5	-1.21	-0.20	12.6	86	1419	21 36 3.07	56 52 51.0			14.7	
1324	21 32 7.90	57 12 1.7	-0.55	0.36	13.2	27	1420	21 36 12.31	56 53 32.3	-1.47	0.26	12.3	0
1325	21 32 7.86	57 12 37.3	-0.77	-0.20	14.5	7	1421	21 35 1.77	56 54 53.2	-0.49	0.12	11.9	68
1326	21 32 23.32	57 13 10.8	-0.53	0.35	12.9	57	1422	21 35 20.21	56 54 38.5	-0.16	-0.11	13.4	91
1327	21 32 56.04	57 13 49.6	0.18	-0.24	14.2	92	1423	21 35 55.75	56 55 20.6			14.3	
1328	21 34 11.95	57 14 35.8	-0.31	-0.40	9.3	45	1425	21 36 24.53	56 53 58.4	0.83	0.34	13.2	0
1329	21 35 2.50	57 15 34.5	0.33	-0.58	12.7	33	1426	21 36 27.81	56 55 24.2	-0.13	0.12	14.2	93
1330	21 34 27.10	57 15 24.4	-0.31	0.23	14.3	85	1427	21 35 12.22	56 56 45.5	0.12	0.10	12.4	92
1331	21 34 29.37	57 14 45.1	-0.23	-0.50	2.9	0	1428	21 35 40.35	56 56 50.4	-0.17	0.71	11.5	13
1332	21 34 32.62	57 14 45.5	-0.23	-0.59	9.5	0	1429	21 35 7.30	56 56 15.4	0.27	0.23	13.9	78
1333	21 32 45.01	57 17 3.1			14.5		1431	21 37 11.75	56 39 25.0	0.06	0.19	13.0	91
1334	21 32 9.38	57 17 43.6	0.48	0.13	13.9	59	1434	21 37 33.21	56 39 55.2	-0.11	0.46	14.2	73
1335	21 32 11.07	57 17 52.6	0.55	-0.90	13.4	2	1436	21 36 46.70	56 42 34.5	-0.94	1.19	13.9	0
1336	21 32 10.75	57 17 40.2	-0.15	-0.10	11.8	82	1437	21 36 54.50	56 43 40.0	-1.11	-0.13	13.1	0
1337	21 32 58.50	57 20 49.2	0.35	0.25	13.7	78	1438	21 37 15.54	56 41 37.0	-0.05	-0.27	13.3	97
1338	21 32 2.01	57 27 16.0	0.21	0.37	14.1	80	1439	21 36 52.35	56 44 44.5	0.39	0.29	12.8	52
1340	21 34 37.43	56 53 37.7	-3.48	1.52	10.3	0	1441	21 36 51.32	56 45 1.9	-1.58	1.25	12.6	0
1341	21 34 37.14	56 39 1.0			11.3		1442	21 37 0.34	56 45 14.5	0.06	-0.15	14.1	93
1342	21 34 50.77	56 39 21.6	-1.48	-0.98	12.0	0	1443	21 37 16.72	56 43 54.6	-1.27	-0.64	13.1	0
1344	21 34 15.54	56 40 54.4	-0.36	0.37	14.2	4	1444	21 37 30.59	56 43 23.6	0.03	-0.25	9.5	91
1345	21 34 33.58	56 40 11.8	-0.55	0.37	14.5	1	1445	21 37 32.73	56 42 51.3	0.45	0.14	11.9	64
1346	21 34 2.01	56 43 50.9	0.52	-0.01	12.7	0	1446	21 37 35.12	56 42 15.2	-0.15	0.91	12.0	2
1347	21 34 52.24	56 43 41.4			14.5		1447	21 37 43.64	56 41 4.3	-0.40	0.10	14.5	80
1348	21 34 7.95	56 45 21.1	-0.37	0.13	14.2	81	1448	21 37 46.07	56 41 14.3	0.07	-0.12	14.1	34
1349	21 34 19.41	56 45 21.9	-0.37	0.79	13.3	0	1449	21 36 25.18	56 46 35.2	-0.51	0.44	14.5	46
1350	21 34 36.32	56 45 9.5	-0.14	0.36	14.0	93	1450	21 36 35.45	56 47 16.8	0.33	0.18	13.7	78
1351	21 34 51.59	56 45 56.5	0.14	-0.29	12.3	71	1451	21 36 40.42	56 47 53.2	-0.21	0.06	14.3	92
1352	21 34 21.97	56 45 55.8	0.02	-0.37	13.0	94	1452	21 36 47.55	56 48 13.2	0.23	0.27	13.9	91
1353	21 34 59.15	56 45 28.3	-0.15	0.26	14.2	94	1453	21 36 50.55	56 48 34.5	0.13	0.04	13.6	92
1354	21 34 10.03	56 45 32.2	-0.34	-0.11	10.9	75	1454	21 36 48.57	56 48 55.4	0.04	-0.57	13.5	27
1355	21 34 24.21	56 45 46.7	-0.35	0.21	14.5	78	1455	21 37 6.05	56 49 22.7	0.10	0.27	14.1	87
1356	21 34 34.37	56 45 3.0	-1.10	-0.88	14.3	0	1456	21 36 41.22	56 49 30.3	-0.26	0.23	14.2	90
1357	21 34 21.97	56 45 47.0	-0.01	0.26	13.1	24	1457	21 36 37.12	56 51 53.5	-0.74	0.46	14.5	11
1358	21 34 45.72	56 45 2.3	-0.28	0.33	14.5	83	1458	21 36 40.52	56 51 43.4	0.23	0.39	13.1	59
1359	21 34 49.50	56 45 51.4	-0.16	0.37	12.6	52	1459	21 36 44.58	56 53 14.3	-0.92	-0.62	10.3	0
1360	21 34 0.82	56 51 2.6			13.0		1461	21 36					

TABLE III. (continued)

MVA	a	(1957.0)	b	-c ₁	-c ₂	V	P	Q	MVA	a	(1950.0)	-c ₁	-c ₂	V	P	Q
1471	21	37	14.02	56	53	40.4	-0.04	-0.22	13.4	91	1					
1472	21	37	18.75	56	54	12.0	-0.29	0.25	13.5	86	1					
1473	21	37	22.84	56	55	31.1	-2.42	1.15	14.2	0	1					
1474	21	39	8.30	56	40	42.1	-0.13	0.20	13.1	91	1					
1475	21	38	5.63	57	51	4.7	-0.56	-0.18	13.7	61	1					
1476	21	37	58.26	56	41	35.8	0.12	-0.15	13.2	93	1					
1477	21	38	26.29	56	41	10.5	-0.46	-0.10	12.1	77	1					
1478	21	38	35.43	56	40	58.1	0.37	0.07	11.9	80	1					
1479	21	38	36.99	56	41	33.4	-0.37	0.56	12.7	23	1					
1480	21	38	32.19	56	41	56.4	-1.23	-0.16	13.1	0	1					
1481	21	38	35.22	56	42	32.3	0.22	0.52	13.6	31	1					
1482	21	38	45.89	56	41	28.3	0.68	0.34	11.5	4	1					
1483	21	37	47.94	56	43	12.0	-0.47	0.10	12.7	65	1					
1484	21	38	0.59	56	43	39.8	-3.71	0.00	12.7	16	1					
1485	21	37	59.74	56	44	22.2	0.02	0.09	13.5	94	1					
1486	21	37	39.64	56	45	51.6	-0.10	0.13	13.3	93	1					
1487	21	37	45.23	56	45	12.9	-0.37	0.05	12.6	83	1					
1488	21	37	56.48	56	45	33.2	-0.07	0.09	14.3	93	1					
1489	21	37	59.70	56	45	49.9	-3.78	-0.47	12.5	0	1					
1490	21	37	35.34	56	45	25.4	0.35	-0.65	14.2	35	1					
1491	21	37	51.99	56	46	32.5	-0.03	-0.17	12.6	93	1					
1492	21	37	47.73	56	45	55.2	-1.05	-0.28	12.3	0	1					
1493	21	37	48.04	56	47	10.7	-0.01	0.19	-4.0	92	1					
1494	21	37	25.03	56	49	15.6	-0.36	0.62	14.5	36	2					
1495	21	37	35.45	56	48	37.3	-0.38	-0.33	12.9	80	1					
1496	21	37	58.83	56	48	14.3	-0.03	-0.49	10.9	64	1					
1497	21	38	4.21	56	48	32.4	-0.09	0.67	13.5	15	1					
1498	21	38	15.06	56	47	20.6	-0.29	-0.21	14.3	79	1					
1499	21	38	20.09	56	47	5.4	-0.10	-0.12	13.2	92	1					
1500	21	38	28.56	56	45	58.0	-0.75	0.35	13.6	14	1					
1501	21	38	38.34	56	46	0.1	-0.14	0.12	14.3	93	1					
1502	21	38	13.53	56	48	25.1	-0.64	-0.85	14.0	2	1					
1503	21	38	22.87	56	48	46.7	1.56	0.67	13.1	0	1					
1504	21	38	23.72	56	48	42.3	-0.02	0.14	13.2	93	1					
1505	21	38	37.60	56	47	26.4	-0.36	0.13	14.0	84	1					
1506	21	38	35.73	56	48	0.5	-0.21	0.74	11.9	8	1					
1507	21	38	30.17	56	50	28.0	-0.75	0.33	12.2	14	1					
1508	21	37	53.96	56	49	46.8	-0.12	0.07	14.4	93	1					
1509	21	37	54.14	56	49	57.2	1.27	-2.72	13.4	0	1					
1510	21	38	3.83	56	50	25.5	-0.01	0.26	12.2	90	1					
1511	21	38	30.72	56	49	42.1	0.26	0.27	14.3	78	1					
1512	21	37	23.50	56	51	33.4	-0.15	-0.05	14.4	93	1					
1513	21	37	23.67	56	51	26.8	0.96	-0.55	14.2	1	1					
1514	21	37	35.72	56	51	13.4	-0.31	0.27	14.2	84	1					
1515	21	37	40.25	56	51	51.3	-0.44	0.31	14.5	71	1					
1516	21	37	40.24	56	51	9.7	0.25	-0.26	14.2	90	1					
1517	21	37	44.61	56	52	3.5	0.07	-0.21	13.4	92	1					
1518	21	37	13.94	56	52	53.1	-0.35	0.05	14.4	84	1					
1519	21	37	25.56	56	52	55.2	0.11	0.06	14.6	93	2					
1520	21	37	42.87	56	53	33.0	0.74	-0.31	13.7	89	1					
1521	21	37	38.23	56	53	51.9	-0.93	-0.40	13.3	3	1					
1522	21	38	25.94	56	51	48.5	-0.43	-0.16	14.5	82	1					
1523	21	38	30.91	56	52	48.4	-0.13	0.30	14.4	88	1					
1524	21	38	22.23	56	53	37.6	-0.19	0.44	13.3	74	1					
1525	21	38	15.47	56	54	1.0	-1.24	0.39	14.5	0	1					
1526	21	37	47.64	56	54	63.6	0.65	-0.02	14.6	36	2					
1527	21	37	32.80	56	55	49.4			14.6							
1528	21	37	29.14	56	56	32.5			14.8							
1529	21	37	44.45	56	56	9.1	-0.53	-0.95	14.6	0	1					
1530	21	38	2.00	56	55	8.0	0.16	0.17	14.3	30	1					
1531	21	37	53.34	56	56	0.1	-1.20	0.77	13.3	0	1					
1532	21	37	49.47	56	55	35.7	1.30	0.76	12.5	0	1					
1533	21	38	6.10	56	54	46.2	-0.37	-0.65	13.2	3	1					
1534	21	38	13.99	56	56	14.2	0.12	0.02	13.5	94	1					
1535	21	38	12.72	56	56	95.8	-0.36	-0.05	11.6	86	1					
1536	21	38	27.12	56	56	51.1			14.1							
1537	21	38	21.71	56	57	10.4	-1.64	3.19	11.3	0	1					
1538	21	38	15.66	56	57	32.9	-1.46	0.92	13.5	0	1					
1539	21	38	46.18	56	57	20.4	0.32	-0.29	12.0	86	1					
1540	21	38	58.86	56	57	59.6	-1.09	2.18	12.0	0	1					
1541	21	38	2.04	56	47	55.0	-0.10	-0.23	13.6	89	1					
1542	21	38	54.86	56	57	2.8	-0.06	0.10	13.5	94	1					
1543	21	38	55.55	56	57	29.4	0.62	-0.21	13.6	51	1					
1544	21	38	56.23	56	59	46.3	-0.98	0.78	10.5	0	1					
1545	21	38	56.40	57	3	40.7	-3.67	2.26	12.6	0	1					
1546	21	38	12.32	56	47	13.6	0.07	-0.07	13.4	94	1					
1547	21	39	13.91	56	47	5.0	-0.09	-1.11	12.3	0	1					
1548	21	39	13.65	56	50	50.4	-0.19	0.26	13.8	88	1					
1549	21	39	13.95	56	51	15.6	0.01	-0.03	12.4	94	1					
1550	21	39	25.51	56	52	19.4	0.29	0.04	11.0	88	1					
1551	21	39	25.92	56	50	10.1	0.22	0.19	14.3	77	1					
1552	21	39	31.03	56	48	39.1	0.12	0.09	14.4	93	1					
1553	21	39	43.40	56	43	25.3	-0.06	-0.04	14.2	94	1					
1554	21	39	45.41	56	43	43.4	0.91	-0.31	10.2	12	1					
1555	21	39	55.15	56	49	9.4	0.70	-0.29	11.7	30	1					
1556	21	39	25.14	56	51	20.7	0.47	-0.02	13.4	75	1					
1557	21	39	14.98	56	52	20.2	-0.01	0.35	13.2	83	1					
1558	21	39	48.36	56	52	50.2	-0.34	0.32	14.6	86	2					
1559	21	39	21.70	56	54	34.3	-0.64	0.01	14.4	31	1					
1560	21	39	14.13	56	55	25.0	0.15	-0.56	14.6	57	2

FIG. 5. Histogram of the cluster membership probabilities for all stars in the field with measured proper motions.

spectroscopic binary. Until further observations are obtained of this and other stars in the region, we cannot determine whether the center-of-mass velocity of MVA 550 is consistent with cluster membership. (Heske and Wendker (1986) have measured radial velocities of H_2CO in the IC 1396 region, obtaining heliocentric velocities near Tr 37 of between -13 and -20 km/s. The radial velocities we measure for MVA 550 are -25 , -16 , and -6 km/s, with precision better than ± 0.5 km/s for each measurement.)

Comparing our memberships with Simonson's (1968) study of Cepheus OB2, we find eight stars in common. Simonson's membership determinations depend on photometric determinations of the distance moduli of individual stars. All four of his definite members are kinematically probable members. His two "possible" members (HD 206773 = MVA 864 and HDE 239710 = MVA 59) are kinematic nonmembers. The remaining two stars (HDE 239724 = MVA 412 and HDE 239727 = MVA 423) were considered by Simonson to be distant nonmembers. We assign them high probabilities of membership. HDE 239724, a B1 V star according to Garrison and Kormendy (1976), is considered a member in their study. HDE 239727, an A2 Ia according to Garrison and Kormendy, is designated a nonmember, in agreement with Simonson but in disagreement with our results.

Garrison and Kormendy's study includes a total of 16 stars in common with ours. They determined UBV magnitudes and spectral types for all of these stars, and the derived color excesses were used to construct an H-R diagram for the cluster. Only two stars are considered nonmembers of Tr 37 according to them: MVA 423, mentioned above; and MVA 455, a B5 Ib-II, which we determine to be a probable member. Of the remaining 14 Garrison and Kormendy stars, seven are probable kinematic members and seven are probable nonmembers. All but one (MVA 59) of the latter group (MVA 967, 864, 1158, 1331, 1328, and 1584) are found in the outer fields of our study. Two of these (HD 207049 = MVA 967 and HD 205850 = MVA 1331) are giants of class B8 and F3, respectively. The distance of all these stars from the cluster center lends credibility to their indicated nonmembership, but again these stars merit further scrutiny.

Most of the $H\alpha$ stars selected by Kun (1986) are too faint to appear on our first-epoch plates or lie outside the region we have studied. Nevertheless, since stars of this type are generally believed to be very young objects, their membership in the cluster should afford another check of our probabilities. Of 11 common stars, seven (63%) have kinematic membership probabilities greater than 80%, one (Kun 60 = MVA 1355) has a probability of 78%, and the remaining three stars appear to be kinematic nonmembers. The high proportion of members among these faint red stars contrasts notably with the low proportion of members among the bright red stars identified by Alksinis.

The internal velocity dispersion of an open cluster would be expected to be of the order of 1 km/s (Mathieu 1985). For the youngest clusters, which may not be relaxed or even bound systems, somewhat larger dispersions may be found. A dispersion of 2.2 km/s has been measured for the young cluster of stars near the Trapezium by McNamara (1976). The observed proper-motion dispersion in X for Tr 37 cluster members corresponds to a velocity dispersion at 1 kpc of 9.5 km/s. Since this is consistent with the measurement er-

TABLE IV. Cross identifications of Alksinis and MVA stars.

ALKS	MVA	ALKS	MVA	ALKS	MVA
158	1360	450	182	502	883
162	106	451	144	503	901
166	1420	452	194	505	898
168	1465	453	147	506	881
169	1459	454	153	507	945
171	1440	455	217	508	950
172	1467	456	468	509	936
174	1444	457	426	510	964
176	1529	458	471	511	938
179	1535	459	438	512	921
181	1537	460	545	703	1183
182	1539	461	268	704	1191
185	1544	462	558	705	1188
188	1563	463	412	708	1216
199	1589	464	273	709	1244
291	1582	465	550	711	1226
204	1584	466	460	712	252
413	1288	467	535	713	1154
414	1261	468	420	715	1030
415	1284	469	564	716	1007
416	1262	470	463	717	1022
417	1272	471	437	718	1034
418	1295	472	566	719	1016
419	1277	473	455	721	1037
420	1270	474	555	722	1046
422	1336	475	423	723	1057
423	1315	476	556	724	576
424	1166	477	464	726	1050
425	1318	478	319	727	732
426	1358	479	577	730	735
427	1328	480	630	731	1061
428	1322	481	662	732	1060
429	1323	482	747	733	1001
431	1331	483	318	734	1044
432	1332	484	583	735	1063
435	81	485	713	736	1069
436	67	486	633	737	736
437	68	488	800	740	728
438	86	489	700	741	737
439	45	490	680	742	1082
440	63	491	638	743	746
441	59	492	616	744	741
442	71	493	656	747	1091
443	90	495	811	748	1110
444	101	496	812	749	1097
445	26	497	846	750	864
446	186	498	847	751	1098
447	166	499	850	752	908
448	181	500	822	763	967
449	164	501	903		

rors in our previous study of NGC 2244, scaled roughly by the square root of the number of plates in the solutions, we conclude that this dispersion is almost entirely accounted for by random error and does not significantly reflect the internal kinematics of the cluster. More plate material over a longer baseline, or alternatively radial-velocity studies such as those reported by Mathieu (1985), will be required for such investigations.

The only anomaly in the observed proper-motion distribution is the inequality between the dispersion of the proper motions in X (0.19 arcsec/century) and in Y (0.28 arcsec/century). We have investigated a number of sources of error in our measurement and reduction procedure and have so far been unable to determine the cause of the discrepancy. It should be noted that the X and Y dispersions refer to a frame rotated 48° to right ascension and declination (see Fig. 2) so as to align the major and minor axes of the field distribution with the coordinate axes. Thus the observed discrepancy cannot be accounted for by an elongation of the star images in right ascension due to improper guiding, or a failure to account for refraction effects in the plate solution. The larger Y dispersion is in the direction of the galactic plane, and it is possible that the distribution of field proper motions in this direction has contaminated the cluster distribution. Nevertheless, the discrepancy between X and Y dispersions was also noted on plate solutions utilizing only brighter stars in the inner regions of the center plates, where one would expect field-star contamination to be diminished. Better proper motions, using new plates at a later epoch, might resolve the issue. The alternative possibility, that the cluster is expanding along the galactic plane, seems untenable, since the velocity of expansion implied by the Y dispersion, almost 14 km/s, would be unrealistically high, as we noted earlier.

Whatever the cause of the discrepancy in the X and Y dispersions, its effect is that our proper-motion membership probabilities are based more on the X proper motions than the Y , but the agreement with other criteria of cluster membership that we have discussed previously bears out the adequacy of the kinematic probabilities. Until a source of the discrepancy is identified, however, interpretation beyond the use of membership probabilities should be made with caution.

No comprehensive photometric or spectroscopic studies exist for the entire region at the scale at which we have studied it, but we can infer from the similarity between the appearance of Tr 37 and NGC 2244 that the former cluster is as entangled with absorbing material as the latter, and that dif-

ferential absorption across the cluster is likely to cause significant uncertainties in interpreting the spatial distribution, the luminosity function, or the color-magnitude diagram of the cluster (Marschall *et al.* 1982). In the case of IC 1805, which is also similar in age and appearance to Tr 37 and NGC 2244, Johnson *et al.* (1961) noted variations in $E(B - V)$ ranging from 0.62 to 0.98, and Vasilevskis *et al.* (1965) remarked on the scatter this introduced into the color-magnitude diagram of the cluster even when members were selected by proper-motion criteria. Moreover, a recently published study of ultraviolet extinction in the region around Tr 37 (Clayton and Fitzpatrick 1987) indicates considerable variation in the properties of absorbing material across the cluster. We therefore attempt no such color-magnitude analysis here, pending the results of a photoelectric photometric study of the cluster members currently being undertaken by the authors.

Nevertheless, the selection of probable member stars, together with the coordinates and identification charts provided here, should encourage further studies of the population of this relatively accessible young cluster. A set of even larger-scale finding charts for the region, 15 arcmin on a side, especially useful for identifying stars on a TV guider, is available from the authors.

V. SUMMARY

Positions for 1387 stars, along with 1135 proper motions, have been presented for a field of 1.5° diameter including the cluster Trumpler 37. Stars in this sample with derived membership probabilities of $> 80\%$ should provide a reliable subset for further studies of the stellar content and internal kinematics of the cluster.

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