# SOME ECONOMIC PROBLEMS OF INTERNATIONAL SPACE TELECOMMUNICATIONS VOLUME II

by

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# APPENDICES

## APPENDIX A

## DERIVATION OF BASIC INTELSAT DATA

Data were drawn from several different sources and estimated by several methods. A description of the sources and methods follows below.

### Estimates Using International Telecommunications Union Data Directly

The great majority of data are from countries reporting to International Telecommunications Union. Explanatory notes a through h at the foot of Table XII which follows indicate the eight relevant International Telecommunications Union data sources for pairs of communicating regions. A footnote from a through h in the 10th column of Table XII following this Appendix designates which of the eight International Telecommunications Union sources applies to the minute and word data for a given pair.

The International Telecommunications Union data were derived as follows:[1]

Two committees of the International Telecommunications

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[1]U.S., Department of State, Working Paper, Report of the Chairman of the United States Delegation to the Meeting of the Plan Committee of the International Telephone and Telegraph Consultative Committee and the International Radio Consultative Committee for the Development of the International Network, Rome, Italy, Unclassified TD Serial No. 952, CCITT/CCIR Plan Committee, CCITT Document 46, 1964, pp. 3-9.

Union, the International Telephone and Telegraph Consultative Committee (CCITT) and the International Radio Consultative Committee (CCIR), formed a Plan Committee which met in Rome, Italy, from November 25th through December 11th of 1964 and set up an Intercontinental Working Group to adopt, on the basis of statistical information with respect to all types of international telecommunications projected for 1968 and 1975, a program to establish tables of traffic figures for telephone, telex, and telegraph respectively, for the years 1968 and 1975. Separate Sub-working Groups were established to study telephone, telex, and telegraph matters. The three Sub-groups--Telephone, Telex, and Telegraph--met simultaneously each day until their work was completed.

The basic statistical information that the Sub-groups had to work with was the result of a questionnaire sent and reported earlier in 1964 to the communications administrations, both government and private operating agencies, of several nations, by the CCITT Secretariat. In the questionnaire, the Secretariat had divided the world into 34 geographical zones for tabulation purposes and requested each country to furnish its own combined inbound and outbound telephone, telegraph, and telex traffic volume estimates for 1968 and 1975, as well as its actual 1962 volume, to and from these zones. Also available were: amendments to the questionnaire results as supplied by individual delegations at the Rome meeting, which updated delegations' questionnaire answers; traffic data with respect to relations between countries, as developed previously by African, Asian, and Latin American sub-committees; and documents submitted by the CCITT Secretariat which analyzed the traffic data submitted. Neither the questionnaire nor the additional sources were available to this author.

Each Sub-group worked as follows:

Telephone Sub-Group. In order to obtain uniformity for those relations where large discrepancies existed in the figures reported by the two terminal countries, the delegations of such countries where possible were contacted by the Telephone Sub-Group to effect a reconciliation in the traffic figures. This resulted in resolving some of the discrepancies. Where no reconciliation was available, it was generally agreed by the Sub-group to use the higher figures. In those cases where the information was incomplete or wholly absent for one zone to another zone, the figures supplied by the terminal countries in the other zones were accepted. Where no information was available from either terminal or zone, no attempt was made to determine the missing data.

Telex Sub-Group. Because of the large number and the magnitude of the discrepancies which appeared in traffic data submitted, the Telex Sub-Group approached the problem of reconciliation in a different manner than that used by the Telephone Sub-Group. This Sub-Group contacted the delegations of the larger countries to effect a reconciliation where the differences in their traffic figures were higher than 20 percent. It was agreed by the parties concerned to take an average of the two figures. In the interest of conserving time, the Sub-Group applied this criterion to all relations except where the difference was not more than 20 per cent, in which case the higher of the two figures was used. Where traffic information was not available for one terminal or zone, the figure supplied by the terminal countries in the corresponding zone was accepted. An examination of the 1968 and 1975 forecasts disclosed that the rates of increase applied independently by each terminal country varied widely. Because of this and the fact that some intercontinental telex circuits have been established for only a relatively short time and have experienced phenomenal growth in this developing period, the Group decided to work on a more uniform basis for forecasting.

On the basis of a Telex Study published by Siemens, a German manufacturing company, countries were divided into three groups: (1) countries with telex subscribers of less than one per 100,000 population; (2) countries with between one and ten telex subscribers per 100,000 population; and (3) countries with telex subscribers of more than ten per 100,000 population. From a study submitted to the XIth International Communication Assembly, Genoa, October, 1963, concerning the development of intercontinental telex traffic, factors of growth for 1968 and 1975 were determined for each of the above groups as follows;

| | | |
|---|---|---|
| Group 1 | -- 1968 | 5 times 1962 volume |
| | -- 1975 | 10 times 1962 volume |
| Group 2 | -- 1968 | 3 times 1962 volume |
| | -- 1975 | 6 times 1962 volume |

Group 3 -- 1968 2 times 1962 volume
-- 1975 4 times 1962 volume

For relations between countries belonging to different groups, the coefficients for the less developed country were normally used. Where no telex service was offered in 1962, but a country forecast service for 1968, such a forecast was used as a basis for the 1975 figure. If information was wholly lacking, no attempt was made to estimate telex service.

The application of the above rules produced in some cases substantially different forecasts from those originally reported by administrations and private operating companies. This was called to the attention of the full Intercontinental Working Group at the time of the submission of the report of the Telex Sub-Group. Each delegation was asked to review the telex tables as prepared by the Sub-Group and, if a delegation was not in agreement with these statistics, to submit any changes that appeared necessary to the CCITT Secretariat for inclusion in the final report of the meeting.

Telegraph Sub-Group. This Sub-Group proceeded generally along the lines of the Telephone Sub-Group. It reconciled the differences in the figures reported by each terminal country in a given relation generally by taking the average of the two figures where the difference was large, and the higher figure in the case of minor differences. Where information was not available for one terminal in a given relation, the figure supplied by the other terminal was accepted.

The reports of the Sub-groups were adopted by the Joint Plan Committee, with the report of the Telex Sub-Group being amended in a few cases.

Estimates using available International Telecommunications Union data as proxy estimators

In the case of some pairs, mainly involving South and Central American regions, one of three different estimation methods was used to obtain data. All three methods used direct International Telecommunications Union estimates from above as "proxy" estimators, and in addition made use of extrapolation methods. However, the three differed with respect to the types of estimators and methods used.

The three methods and the identification of the type(s) of message (telephone, telegraph, and telex); the year(s) (1968, 1975); and the pairs on which each method was employed follow below.

The first method. This first estimation method was used to obtain several 1975 telephone and telegraph estimates involving South and Central American pairs when these were not directly available. It involved obtaining the geometric average rate of growth of estimated minutes (telephone) and words (telegraph) for each pair between 1962 and 1968, since the 1962 and 1968 data were available for the South and Central American pairs in question;[2] and then compounding each pair's relevant 1968 estimate by its average rate in order to obtain a 1975 estimate. Those estimates derived by this procedure are the 1975 telephone estimates for

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[2]Available from International Telecommunications Union, op. cit., pp. 59-60, 131-2.

communicating regional pairs 3-29, 3-30, 3-31, 3-32, 3-33, and 3-34; and 1975 telegraph estimates for pairs 29-30, 29-31, 29-32, 29-33, 29-34, 30-31, 30-32, 30-33, 30-34, 31-32, 31-33, 31-34, 32-33, 32-34, and 33-34.

Estimates derived by this procedure are characterized by footnote i in Table XII which follows.

The second method. The second estimation method was used for certain 1975 telex estimates involving South and Central American pairs. It involved simply doubling the 1968 telex estimates for these pairs. These 1968 estimates were available directly from the International Telecommunications Union.[3] This procedure was used because those 1975 telex estimates which were available involving South and Central American regional pairs almost all represented a doubling of the 1968 figure for each pair. The pairs for which this second procedure was used were 29-30, 29-31, 29-32, 29-33, 29-34, 30-31, 30-32, 30-33, 30-34, 31-32, 31-33, 31-34, 32-33, 32-34, and 33-34. The estimates derived by this procedure are characterized by footnote j in Table XII below.

The third method. This third estimation prócedure was used to obtain 1975 telephone estimates for certain South and Central American regional pairs. According to this method, the (geometric) average rate of growth of total estimated telephone minutes between developed America (i.e., United States and Canada) and underdeveloped America (i.e., Central

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[3] Ibid.

and South America) between 1968 and 1975 was applied to the 1968 telephone minute estimates of the South and Central American pairs in question.[4] The 1968 estimate for each such pair was then compounded on the basis of this average rate of growth in order to obtain 1975 estimates.

This procedure was dictated by the inappropriateness of the two preceding methods. The first could not be used because the excessively low base figure of most 1962 estimates would have created a 1962-68 average rate of growth which would have been excessively high for realistic extrapolation to 1975. The second could not be used because available 1975 telephone estimates did not consistently involve the "doubling" relationship which would have made the second method feasible. The method involves the assumption that all intra-American growth rates between 1968 and 1975 will be similar, i.e. that intra-Central-and-South-American growth will be like growth between North America (United States and Canada) and Central-South America.

Pairs whose 1975 telephone minute estimates were obtained in this way were 29-30, 29-31, 29-32, 29-33, 29-34, 30-31, 30-32, 30-33, 30-34, 31-32, 31-33, 31-34, 32-33, 32-34, and and 33-34. Estimates derived by this procedure are characterized by footnote k in Table XII below.

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[4]Growth rates were calculated on the basis of International Telecommunications Union, op. cit., pp. 131-2; and 1968 estimates were derived from the same source.

<u>Estimates using basic data provided by the Federal Communications Commission and rates of growth calculated from International Telecommunications Union data</u>

Estimates involving a few pairs were gotten by using Federal Communications Commission data as a base to which average geometric rates of growth derived from International Telecommunications Union data were applied. Data unavailability or else lack of suitability of other procedures dictated this convention. The 1968 and 1975 estimates contained in Table XII below of daily telephone minutes between the continental United States and Canada ($28^1$ - 27) and of daily telex minutes between continental United States and Hawaii ($28^2$ - $28^3$) and between continental United States and Canada ($28^1$ - 27) were all derived in this way. The estimates so derived are characterized by footnote 1 in Table XII below. The latest available Federal Communications Commission estimates of telephone and telex minutes, for 1964,[5] were used as bases from which post-1964 estimates were derived by extrapolation. In order to express all basic data on comparable daily terms, these 1964 Federal Communications Commission data, which were expressed in annual terms, were divided by the estimated number of average days in a communication year--300--which was used as the standard deflator of all annual into daily estimates.[6] The 1964 Federal

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[5]Federal Communications Commission, <u>Statistics of the Communications Common Carriers, 1964</u> (Washington D.C.: Federal Communications Commission, 1965), pp. 30, 164.

[6]International Telecommunications Union, <u>op. cit.</u>, p. 28.

Communications Commission United States-Canada telephone estimate had the special characteristic that it was based only on minutes for which American Telephone and Telegraph Company facilities were used, and thus involved some degree of understatement, which, in the absence of relevant data, could not be corrected.

Various rates of traffic growth, all gotten from the International Telecommunications Union, were used to compound the 1964 Federal Communications Commission daily estimates in order to obtain estimates for 1968 and 1975. The rate of growth which was used for Canada-continental United States telephone traffic in the absence of more direct data was the average (geometric) rate of growth of minutes per day between 1968 and 1975 for all telephone communication between Canada and non-United States regions (i.e. total communication involving Region 27 communicating with each of regions 1 through 26 and 29 through 34). International Telecommunications Union provided the sources for deriving this rate.[7] Thus for continental United States-Canada telephone traffic, it was assumed that the average annual 1964-1975 growth in continental United States-Canadian average minutes per day does not differ significantly from the estimated International Telecommunications Union 1968-75 average annual growth of minutes per day between Canada and all non-United States

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[7]In Tables 1 INT AF, 1 INT AL, 1 INT AS, and 1 INT EU of International Telecommunications Union, op. cit., pp. 131-2.

regions. In the case of telex minute per day estimates for traffic between the continental United States and Hawaii and the continental United States and Canada, average (geometric) rates of growth between 1968 and 1975 were derived from International Telecommunications Union information which applied to these pairs[8] and were used to compound the appropriate deflated Federal Communications Commission 1964 base year estimates discussed above.

Estimates using data provided totally by the Federal Communications Commission

Estimates for a few pairs were obtained by using Federal Communications Commission data completely. Base year estimates were compounded by using rates of growth derived from Federal Communications Commission data. The continental United States-Hawaii ($28^2$ - $28^3$) telephone estimates for 1968 and 1975, as well as the 1968 and 1975 estimates for telegraph traffic between the continental United States as one pair member and Canada, Hawaii, and Alaska in turn as the other (i.e., $28^1$-27, $28^2$-$28^3$, and $28^2$-$28^4$) were all derived in this way. Estimates so derived are characterized by footnote m in Table XII below.

Growth rates in all four cases were calculated on the same basis. From Federal Communications Commission information on the total number of telephone messages per year from 1955 to 1965 between the continental United States and Hawaii,

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[8]International Telecommunications Union, op. cit., p. 29.

an average (geometric) rate of telephone message growth was derived.[9] This rate was used as a "proxy" growth rate for the annual growth in average daily minutes of continental United States-Hawaii ($28^2 - 28^3$) telephone traffic between the years 1965 and 1968, and years 1968 and 1975. From Federal Communications Commission information on number of telegraph messages per year from 1955 to 1964 involving the continental United States as one pair member and Canada, Hawaii, and Alaska in turn as the other, average geometric rates of annual telegraph message growth were derived for each of communicating regional pairs $28^1 - 27$, $28^2 - 28^3$, and $28^2 - 28^4$.[10] These rates were used as "proxy" growth rates for the annual growth in "average" daily telegraph words for each of the three pairs between years 1964 and 1968, and years 1968 and 1975.

The base data to which the above four growth rates were applied so as to generate 1968 and 1975 estimates were also provided by the Federal Communications Commission in similar form for all four pairs.[11] All the base estimates were initially expressed in annual terms and thus had to be divided by the standard 300-days-per-year deflator.[12] In the case of the telephone estimate (continental United

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[9]Letter from Ben F. Waple, Secretary, Federal Communications Commission, Washington D.C., April 1, 1966.

[10]*Ibid.*

[11]*Ibid.*

[12]*Supra*, p. 160.

States-Hawaii), the latest base year available was 1965; for the three base telegraph estimates, the latest available year was 1964. Because base year data were expressed in terms of messages as the reporting unit rather than minutes (telephone) or words (telegraph), the standard units employed in this study, it was necessary to "convert" messages to minute or word equivalents. This was done by multiplying the message estimates by "converters" obtained from the Federal Communications Commission which estimated the average number of minutes per telephone message and average words per telegraph message. These "converters" were as follows: (1) for telephone traffic between the continental United States and Hawaii, a figure of 7.70 minutes per message was used, which was the duration of the average 1964 telephone message between the continental United States and Hawaii;[13] (2) for telegraph traffic between the continental United States and Hawaii, a figure of 26.8 words per message was used, which was the number of words in the average 1964 telegraph message between the continental United States and Hawaii;[14] (3) for telegraph traffic between the continental United States and Canada, a figure of 24.5 words per message was used, which was the number of words in the average 1964 telegraph message between the continental United States and Canada;[15] (4) for telegraph traffic between

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[13] Federal Communications Commission, op. cit., p. 31.

[14] Ibid., p. 160.

[15] Ibid., p. 159.

the continental United States and Alaska, a figure of 26.8 words per message was used, which was the number of words in the average 1964 continental United States-Hawaii telegraph message above. It was used here as a "proxy" for the number of words in the average 1964 continental United States-Alaska message, because the direct number was unavailable. Since all these "converters" would be applied to post-1964 estimates, it had to be assumed that their value remained constant in the subsequent years after 1964 for the communicating pairs to which they were relevant.

Estimates using data provided by both the Federal Communications Commission and American Telephone and Telegraph Company

The estimate of average daily telephone minutes for 1968 and 1975 between the continental United States and Alaska ($28^2$ - $28^4$) was derived from basic data provided by the Federal Communications Commission and American Telephone and Telegraph Company. These estimates are characterized by footnote n in Table XII below. Again the method is that of compounding a base figure by an estimated rate of growth in order to project 1968 and 1975 estimates.

The rate of growth used is the average (geometric) growth rate of continental United States-Alaska telephone messages between 1960 and 1965.[16] This rate serves in the absence of more directly pertinent information as a "proxy"

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[16] Letter from C. A. Ulffers, Jr., Assistant Vice-President, American Telephone and Telegraph Co., March 1, 1966.

rate for the average (geometric) growth of daily telephone minutes for years 1965 through 1968 and 1968 through 1975.

The base used is the number of telephone messages between the continental United States and Alaska for 1965 used above in calculating the growth rate. It was deflated by the standard deflator of 300 communication days per year[17] and then multiplied by 7.43 minutes per message, which is the number of minutes in the average 1964 telephone message between the continental United States and Alaska.[18] The result was a base expressed in terms of daily 1965 telephone minutes. It was assumed here that the "converter" of messages into minutes, when applied to post-1964 estimates, kept its constant 1964 value of 7.43.

<u>Estimates for a pair considered to be in domestic traffic, and thus not accountable in international requirements data</u>

The pair $28^2$-$28^1$ is considered domestic traffic and thus is not included in the estimate of international requirements. This is indicated by footnote o for this pair in the 10th column of Table XII of this Appendix.

<u>Estimates included in data for other pairs and which cannot be disaggregated</u>

Because of imperfections in the reporting process, estimates for some pairs were included in the estimates for others, and could not be disaggregated.

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[17] *Supra*, p. 160.

[18] Federal Communications Commission, *op. cit.*, p. 30.

Data for Regional pair 13-15 are included in data for 12-15; 13-16 in 12-16, 13-17 in 12-17, 13-18 in 12-18, 13-19 in 12-19, 13-20 in 12-20, 13-29 in 12-29, 13-30 in 12-30, 13-31 in in 12-31, 13-32 in 12-32, 13-33 in 12-33, 13-34 in 12-34; data for $28^1$-13, $28^3$-13, $28^4$-13 are included in $28^2$-13; $28^1$-23, $28^3$-23, and $28^4$-23 in $28^2$-23; $28^1$-24, $28^3$-24, and $28^4$-24 in $28^2$-24; $28^1$-25, $28^3$-25, and $28^4$-25 in $28^2$-25; $28^1$-26, $28^3$-26, and $28^4$-26 in $28^2$-26; $28^2$-1, $28^3$-1, and $28^4$-1 in $28^1$-1; $28^2$-2, $28^3$-2, and $28^4$-2 in $28^1$-2; $28^2$-3, $28^3$-3, and $28^4$-3 in $28^1$-3; $28^2$-4, $28^3$-4, and $28^4$-4 in $28^1$-4; $28^2$-5, $28^3$-5, and $28^4$-5 in $28^1$-5; $28^2$-6, $28^3$-6, and $28^4$-6 in $28^1$-6; $28^2$-7, $28^3$-7, and $28^4$-7 in $28^1$-7; $28^2$-8, $28^3$-8, and $28^4$-8 in $28^1$-8; $28^2$-9, $28^3$-9, and $28^4$-9 in $28^1$-9; $28^2$-10, $28^3$-10, and $28^4$-10 in $28^1$-10; $28^2$-11, $28^3$-11, and $28^4$-11 in $28^1$-11; $28^2$-12, $28^3$-12, and $28^4$-12 in $28^1$-12; $28^2$-14, $28^3$-14, and $28^4$-14 in $28^1$-14; $28^2$-15, $28^3$-15, and $28^4$-15 in $28^1$-15; $28^2$-16, $28^3$-16, and $28^4$-16 in $28^1$-16; $28^2$-17, $28^3$-17, and $28^4$-17 in $28^1$-17; $28^2$-18, $28^3$-18, and $28^4$-18 in $28^1$-18; $28^2$-19, $28^3$-19, $28^4$-19 in $28^1$-19; $28^2$-20, $28^3$-20, and $28^4$-20 in $28^1$-20; $28^2$-21, $28^3$-21, and $28^4$-21 in $28^1$-21; $28^2$-22, $28^3$-22, and $28^4$-22 in $28^1$-22; $28^2$-27, $28^3$-27, and $28^4$-27 in $28^1$-27; $28^2$-29, $28^3$-29, and $28^4$-29 in $28^1$-29; $28^2$-30, $28^3$-30, and $28^4$-30 in $28^1$-30; $28^2$-31, $28^3$-31, and $28^4$-31 in $28^1$-31; $28^2$-32, $28^3$-32, and $28^4$-32 in $28^1$-32; $28^2$-33, $28^3$-33, and $28^4$-33 in $28^1$-33; $28^2$-34, $28^3$-34, and $28^4$-34 in $28^1$-34; $28^1$-$28^3$ in $28^2$-$28^3$; and $28^1$-$28^4$ in $28^2$-$28^4$. The characterization of a given communicating pair mentioned above by footnote p in the

10th column of Table XII of this Appendix indicates the inclusion of that pair's requirements in the circuit estimate of another pair just mentioned.

Some bias is introduced by this unavoidable procedure. If two pairs, the first of whose requirements include those of the second, are accommodated by two different satellites, then the effect on satellite circuit requirements is to understate them on the satellite(s) which cover the pair whose requirements are included in those of the second pair; and overstate them on the satellite(s) which cover the pair whose requirements artificially include those of the first pair. If the two pairs are covered by the same type of satellite coverage, there is no bias since the over-statement and under-statement of requirements on the same satellite cancel each other.

It is assumed that the total resultant biases arising from such over- and under-statement are not serious, for the following reasons: (1) The estimates for Region 13 which are misplaced in Region 12 estimates are not quantitatively significant, as an examination of the relevant numerical data of Table XII at the foot of this Appendix shows. (2) The mis-statement arising from assuming that trans-Pacific traffic to the United States East Coast ($28^1$) terminates for purposes of estimating international requirements at $28^2$, and trans-Atlantic to the United States West Coast ($28^2$) terminates at $28^1$, does not involve significant over- and under-statement. This is because much trans-Pacific traffic to $28^1$ and trans-Atlantic traffic to $28^2$ will probably first arrive at $28^2$ and $28^1$ respectively, which are the termini at which they are counted here for international requirements purposes. The traffic then will be relayed by land line or domestic satellite across the continental United States from $28^2$ to $28^1$ in the case of trans-Pacific traffic, and $28^1$ to $28^2$ in the case of trans-Atlantic traffic, a domestic portion of the route which is of no interest here in estimating international intelsat requirements.[19] (3) What mis-statement there is of requirements estimates involving Alaska ($28^4$) and Hawaii ($28^3$) is not as quantitatively important as it might appear, since by far the greatest majority of United States traffic involves the East and/or West Coasts rather than Alaska and Hawaii as termini.

Estimates which could not be obtained

There are many communicating pairs for which data estimates were either wholly or partially unavailable. Traffic for which this is the case is designated by footnote q in Table XII below of this Appendix. Unavailable estimates were assumed to be zero for computational purposes. It was felt that the understatement arising from unavailability was not great since these unavailable estimates accounted for only nine percent of total observations. Unavailable estimates accounted for even a smaller percentage of requirements, since they were mainly drawn from pairs whose members have relatively insignificant communications requirements

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[19] *Supra*, p. 166.

with each other, e.g. Asia, Africa, South America.

Estimates included as special requirements

The 1968 and 1975 telephone, telegraph, and telex traffic between the continental United States and its receiving and sending stations associated with the Apollo and other space projects is not separately estimated, but rather is included as part of the aggregate total special Apollo circuit requirements for the two communicating pairs involved, i.e. those numbered 667 and 668 in Table XII below.[20] The entry in the second column of Table XII below where ordinarily the second pair member would be reported was left blank to indicate that there is no fixed ground station terminus for Apollo circuit requirements. The fact that telephone, telegraph, and telex requirements are included as special Apollo requirements is indicated by footnote r for the two pairs in the 10th column of Table XII below.

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[20]These special Apollo circuit requirements are reported in *supra*, Chapter II, p. 35 and in *infra*, Appendix B, pp. 221-2.

TABLE XII

SUMMARY OF INFORMATION RELEVANT TO ESTIMATION OF CIRCUIT REQUIREMENTS ON AN INTELSAT SYSTEM

| Number of Each Communicating Pair (1) | Regions Composing Each Pair (2) | Type of Satellite Coverage for Each Pair (3) | Estimated 1968 daily telephone minute requirements (4) | Estimated 1975 daily telephone minute requirements (5) | Estimated 1968 daily telegraph word requirements (6) | Estimated 1975 daily telegraph word requirements (7) | Estimated 1968 daily telex minute requirements (8) | Estimated 1975 daily telex minute requirements (9) | Footnote reference Source Below (10) | Pre-1968 submarine cable capacity (circuits) (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1-2 | A or I | 82,000 | 170,000 | 56,600 | 58,700 | 20,100 | 40,170 | b | |
| 2 | 1-3 | A or I | 6,900 | 16,800 | 48,000 | 49,000 | 4,240 | 8,400 | b | |
| 3 | 1-4 | A or I | 80,232 | 159,200 | 37,996 | 32,948 | 32,615 | 77,960 | b | |
| 4 | 1-5 | A or I | 76,600 | 164,300 | 65,000 | 65,200 | 47,240 | 94,600 | b | |
| 5 | 1-6 | A or I | 41,250 | 82,000 | 37,000 | 37,400 | 18,606 | 35,185 | b | |
| 6 | 1-7 | A or I | 32,800 | 60,500 | 73,200 | 77,200 | 10,700 | 18,300 | b | |
| 7 | 1-8 | A or I | 3,646 | 8,314 | 25,180 | 26,205 | 3,610 | 7,790 | b | |
| 8 | 1-9 | A or I | 1,662 | 3,153 | 9,500 | 10,420 | 2,535 | 4,800 | b | |
| 9 | 1-10 | A or I | 5,130 | 9,577 | 10,240 | 11,310 | 3,755 | 12,085 | b | |
| 10 | 1-11 | A or I | 38,483 | 76,985 | 62,574 | 56,694 | 34,739 | 67,757 | b | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 11 | 1-12 | A or I | 1,600 | 3,500 | 10,050 | 10,070 | 1,700 | 3,500 | b | |
| 12 | 1-13 | I | 1,140 | 2,280 | 1,100 | 1,200 | 1,200 | 2,400 | d | |
| 13 | 1-14 | A or I | 1,780 | 5,000 | 57,000 | 57,000 | 1,530 | 3,290 | d | |
| 14 | 1-15 | A or I | 875 | 1,225 | 50,000 | 63,000 | 600 | 1,200 | a | |
| 15 | 1-16 | A or I | 520 | 1,200 | 7,200 | 8,100 | 2,000 | 4,000 | a | |
| 16 | 1-17 | A or I | 600 | 1,300 | 15,000 | 18,000 | 630 | 1,260 | a | |
| 17 | 1-18 | A or I | 780 | 1,600 | 18,000 | 22,000 | 1,190 | 2,380 | a | |
| 18 | 1-19 | A or I | 1,000 | 2,200 | 48,000 | 55,000 | 2,020 | 4,040 | a | |
| 19 | 1-20 | A or I | 1,500 | 3,600 | 38,000 | 50,000 | 3,020 | 6,048 | a | |
| 20 | 1-21 | A or I | 270 | 1,000 | 33,000 | 35,000 | 250 | 1,100 | a | |
| 21 | 1-22 | I | 2,070 | 8,000 | 190,000 | 315,000 | 1,230 | 2,460 | a | |
| 22 | 1-23 | I | 350 | 1,000 | 26,000 | 30,000 | 1,000 | 2,000 | a | |
| 23 | 1-24 | I | 160 | 300 | 32,000 | 40,000 | 600 | 1,200 | a | |
| 24 | 1-25 | I, P | 180 | 700 | 38,300 | 44,000 | 2,200 | 4,400 | a | |
| 25 | 1-26 | I, P | 3,865 | 8,000 | 170,000 | 200,000 | 12,000 | 31,000 | a | |
| 26 | 1-27 | A | 6,500 | 14,000 | 101,000 | 120,000 | 2,200 | 4,400 | a | 104 |
| 27 | 1-28[1] | A | 22,000 | 58,000 | 255,000 | 280,000 | 6,000 | 12,000 | a | 250 |
| 28 | 1-28[2] | I, P | | | | | | | p | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 29 | 1-28[3] | I, P | | | | | | | p | |
| 30 | 1-28[4] | I, P | | | | | | | p | |
| 31 | 1-29 | A | 80 | 200 | 25,000 | 40,000 | 200 | 400 | a | |
| 32 | 1-30 | A | 190 | 400 | 55,000 | 65,000 | 500 | 1,000 | a | |
| 33 | 1-31 | A | 50 | 100 | 250,000 | 40,000 | 250 | 500 | a | |
| 34 | 1-32 | A | 40 | 80 | 7,000 | 9,000 | 250 | 500 | a | |
| 35 | 1-33 | A | 280 | 600 | 60,000 | 45,000 | 1,800 | 3,600 | a | |
| 36 | 1-34 | A | 60 | 100 | 25,000 | 40,000 | 600 | 1,200 | a | |
| 37 | 2-3 | A or I | 21,250 | 53,800 | 37,800 | 41,200 | 3,700 | 5,550 | b | |
| 38 | 2-4 | A or I | 205,400 | 439,400 | 44,500 | 45,500 | 23,000 | 41,500 | b | |
| 39 | 2-5 | A or I | 135,400 | 338,400 | 80,300 | 85,400 | 45,350 | 80,700 | b | |
| 40 | 2-6 | A or I | 116,830 | 257,000 | 44,000 | 52,000 | 17,000 | 25,500 | b | |
| 41 | 2-7 | A or I | 72,762 | 195,022 | 74,450 | 85,500 | 8,400 | 14,000 | b | |
| 42 | 2-8 | A or I | 3,200 | 7,500 | 13,070 | 15,280 | 1,450 | 2,600 | b | |
| 43 | 2-9 | A or I | 1,968 | 4,107 | 11,700 | 14,200 | 1,490 | 2,860 | b | |
| 44 | 2-10 | A or I | 2,200 | 4,600 | 8,000 | 9,800 | 1,600 | 13,000 | b | |
| 45 | 2-11 | A or I | 9,522 | 19,704 | 19,700 | 20,900 | 10,575 | 18,310 | b | |
| 46 | 2-12 | A or I | 1,000 | 2,000 | 4,600 | 5,000 | 1,000 | 2,000 | b | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 47 | 2-13 | I | | | | | | | q | |
| 48 | 2-14 | A or I | 1,175 | 2,500 | 18,000 | 21,000 | 500 | 1,100 | d | |
| 49 | 2-15 | A or I | 130 | 200 | 12,000 | 15,000 | 120 | 1,240 | a | |
| 50 | 2-16 | A or I | 53,200 | 100,000 | 350,000 | 400,000 | 19,000 | 38,000 | a | 320 |
| 51 | 2-17 | A or I | 2,400 | 5,300 | 22,000 | 280,000 | 3,500 | 7,000 | a | |
| 52 | 2-18 | A or I | 850 | 1,900 | 16,000 | 18,000 | 650 | 1,300 | a | |
| 53 | 2-19 | A or I | 410 | 900 | 12,000 | 16,000 | 100 | 200 | a | |
| 54 | 2-20 | A or I | 24 | 53 | 4,000 | 5,000 | 155 | 310 | a | |
| 55 | 2-21 | A or I | 120 | 275 | 5,000 | 7,000 | 50 | 100 | a | |
| 56 | 2-22 | I | 103 | 400 | 12,000 | 15,000 | 40 | 80 | a | |
| 57 | 2-23 | I | 119 | 255 | 11,000 | 14,000 | 65 | 130 | a | |
| 58 | 2-24 | I | 15 | 25 | 2,700 | 3,000 | 100 | 200 | a | |
| 59 | 2-25 | I, P | 60 | 150 | 8,500 | 10,500 | 400 | 800 | a | |
| 60 | 2-26 | I, P | 80 | 150 | 7,500 | 9,000 | 330 | 700 | a | |
| 61 | 2-27 | A | 840 | 1,700 | 8,000 | 9,000 | 200 | 400 | a | |
| 62 | 2-28[1] | A | 10,000 | 26,000 | 100,000 | 120,000 | 3,750 | 7,500 | a | 213 |
| 63 | 2-28[2] | I, P | | | | | | | p | |
| 64 | 2-28[3] | I, P | | | | | | | p | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 65 | 2-28[4] | I, P | | | | | | | p | |
| 66 | 2-29 | A | 180 | 400 | 7,00 | 9,000 | 75 | 150 | a | |
| 67 | 2-30 | A | 410 | 900 | 9,000 | 11,000 | 5 | 10 | a | |
| 68 | 2-31 | A | 70 | 300 | 4,000 | 5,000 | 115 | 230 | a | |
| 69 | 2-32 | A | 20 | 40 | 2,000 | 2,500 | 105 | 210 | a | |
| 70 | 2-33 | A | 220 | 500 | 6,000 | 7,000 | 750 | 1,500 | a | |
| 71 | 2-34 | A | 160 | 300 | 5,000 | 6,000 | 920 | 1,840 | a | |
| 72 | 3-4 | A or I | 3,000 | 6,150 | 16,208 | 15,469 | 1,370 | 2,800 | b | |
| 73 | 3-5 | A or I | 5,714 | 15,500 | 60,000 | 67,000 | 5,110 | 10,400 | b | |
| 74 | 3-6 | A or I | 7,124 | 17,175 | 36,400 | 51,700 | 1,435 | 2,565 | b | |
| 75 | 3-7 | A or I | 7,300 | 18,500 | 21,000 | 23,800 | 570 | 1,000 | b | |
| 76 | 3-8 | A or I | 98 | 265 | 2,300 | 2,900 | 45 | 130 | b | |
| 77 | 3-9 | A or I | 245 | 505 | 1,100 | 1,560 | 95 | 230 | b | |
| 78 | 3-10 | A or I | 50 | 131 | 2,460 | 3,000 | 95 | 156 | b | |
| 79 | 3-11 | A or I | 1,168 | 2,405 | 18,635 | 18,835 | 1,136 | 2,015 | b | |
| 80 | 3-12 | A or I | —— q | —— q | 190 | —— q | —— q | —— q | b | |
| 81 | 3-13 | I | | | | | | | q | |
| 82 | 3-14 | A or I | 40 | 200 | 4,000 | 5,000 | —— q | —— q | d | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 83 | 3-15 | A or I | 10 | 25 | 8,000 | 9,500 | 30 | 60 | a | |
| 84 | 3-16 | A or I | 5,000 | 15,000 | 15,000 | 20,000 | 2,000 | 3,000 | a | |
| 85 | 3-17 | A or I | 140 | 300 | 1,200 | 1,600 | 20 | 40 | a | |
| 86 | 3-18 | A or I | 1,740 | 3,500 | 13,000 | 15,000 | ___q | ___q | a | |
| 87 | 3-19 | A or I | 490 | 1,000 | 7,700 | 8,900 | 5 | 10 | a | |
| 88 | 3-20 | A or I | 10 | 30 | 750 | 800 | 5 | 10 | a | |
| 89 | 3-21 | A or I | ___q | ___q | 800 | 1,000 | ___q | ___q | a | |
| 90 | 3-22 | I | 30 | 100 | 3,200 | 4,200 | ___q | ___q | a | |
| 91 | 3-23 | I | ___q | ___q | 500 | 700 | ___q | ___q | a | |
| 92 | 3-24 | I | 2 | 5 | 600 | 700 | 10 | 20 | a | |
| 93 | 3-25 | I, P | 10 | 25 | 1,700 | 2,000 | 90 | 180 | a | |
| 94 | 3-26 | I, P | 10 | 15 | 1,000 | 1,200 | 3 | 6 | a | |
| 95 | 3-27 | A | 24 | 50 | 2,100 | 2,800 | 20 | 40 | a | |
| 96 | 3-28[1] | A | 2,200 | 8,000 | 36,000 | 45,000 | 730 | 1,460 | a | |
| 97 | 3-28[2] | I, P | | | | | | | p | |
| 98 | 3-28[3] | I, P | | | | | | | p | |
| 99 | 3-28[4] | I, P | | | | | | | p | |
| 100 | 3-29 | A | 130 | 280[i] | 1,000 | 1,500 | ___q | ___q | a | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 101 | 3-30 | A | 130 | 280[i] | 1,000 | 1,500 | —[q] | —[q] | a | |
| 102 | 3-31 | A | 50 | 90[i] | 1,000 | 1,500 | —[q] | —[q] | a | |
| 103 | 3-32 | A | 10 | 29[i] | 500 | 800 | 10 | 20 | a | |
| 104 | 3-33 | A | 110 | 280[i] | 1,800 | 2,200 | 10 | 20 | a | |
| 105 | 3-34 | A | 70 | 190[i] | 3,500 | 3,900 | 10 | 20 | a | |
| 106 | 4-5 | A or I | 390,480 | 965,800 | 49,800 | 50,000 | 84,380 | 144,100 | b | |
| 107 | 4-6 | A or I | 55,890 | 118,680 | 5,970 | 5,850 | 23,560 | 42,580 | b | |
| 108 | 4-7 | A or I | 23,110 | 55,217 | 50,798 | 54,887 | 6,400 | 10,900 | b | |
| 109 | 4-8 | A or I | 995 | 2,242 | 7,438 | 9,166 | 1,705 | 3,360 | b | |
| 110 | 4-9 | A or I | 977 | 1,830 | 4,237 | 4,580 | 1,638 | 3,065 | b | |
| 111 | 4-10 | A or I | 1,763 | 2,931 | 5,705 | 6,990 | 2,593 | 4,435 | b | |
| 112 | 4-11 | A or I | 19,229 | 37,516 | 23,373 | 23,261 | 21,257 | 38,237 | b | |
| 113 | 4-12 | A or I | 510 | 890 | 2,760 | 2,960 | 1,150 | 2,600 | b | |
| 114 | 4-13 | I | | | | | | | q | |
| 115 | 4-14 | A or I | 345 | 560 | 9,000 | 10,000 | 250 | 500 | d | |
| 116 | 4-15 | A or I | 25 | 50 | 6,000 | 7,000 | 50 | 100 | a | |
| 117 | 4-16 | A or I | 220 | 600 | 4,500 | 6,000 | 1,350 | 2,700 | a | |
| 118 | 4-17 | A or I | 13 | 20 | 1,500 | 2,000 | 50 | 100 | a | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 119 | 4-18 | A or I | 390 | 800 | 6,000 | 7,000 | 1,200 | 2,400 | a | |
| 120 | 4-19 | A or I | 17 | 20 | 3,000 | 4,000 | 60 | 120 | a | |
| 121 | 4-20 | A or I | 20 | 30 | 5,000 | 6,000 | 275 | 550 | a | |
| 122 | 4-21 | A or I | 15 | 20 | 5,000 | 6,000 | 70 | 140 | a | |
| 123 | 4-22 | I | 104 | 400 | 10,000 | 16,000 | 15 | 30 | a | |
| 124 | 4-23 | I | 9 | 15 | 6,000 | 7,000 | 165 | 330 | a | |
| 125 | 4-24 | I | 16 | 30 | 3,000 | 4,000 | 65 | 130 | a | |
| 126 | 4-25 | I, P | 20 | 70 | 6,000 | 7,000 | 356 | 712 | a | |
| 127 | 4-26 | I, P | 200 | 400 | 7,000 | 8,000 | 104 | 208 | a | |
| 128 | 4-27 | A | 540 | 1,300 | 8,000 | 10,000 | 252 | 504 | a | |
| 129 | 4-28[1] | A | 4,350 | 12,000 | 80,000 | 90,000 | 3,200 | 6,400 | a | |
| 130 | 4-28[2] | I, P | | | | | | | p | |
| 131 | 4-28[3] | I, P | | | | | | | p | |
| 132 | 4-28[4] | I, P | | | | | | | p | |
| 133 | 4-29 | A | 30 | 60 | 4,000 | 5,000 | 25 | 50 | a | |
| 134 | 4-30 | A | 230 | 400 | 3,000 | 4,000 | 85 | 170 | a | |
| 135 | 4-31 | A | 100 | 400 | 4,000 | 6,000 | 190 | 380 | a | |
| 136 | 4-32 | A | 6 | 10 | 2,000 | 30,000 | 180 | 360 | a | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 137 | 4-33 | A | 30 | 40 | 6,000 | 7,000 | 1,050 | 2,100 | a | |
| 138 | 4-34 | A | 8 | 10 | 4,000 | 5,000 | 440 | 880 | a | |
| 139 | 5-6 | A or I | 331,760 | 796,300 | 156,800 | 170,500 | 79,350 | 146,577 | b | |
| 140 | 5-7 | A or I | 90,420 | 226,120 | 160,450 | 180,500 | 14,005 | 25,010 | b | |
| 141 | 5-8 | A or I | 8,630 | 21,880 | 39,575 | 50,880 | 7,740 | 16,320 | b | |
| 142 | 5-9 | A or I | 6,737 | 13,593 | 33,900 | 43,700 | 12,332 | 21,200 | b | |
| 143 | 5-10 | A or I | 11,500 | 21,600 | 44,100 | 48,300 | 11,380 | 18,850 | b | |
| 144 | 5-11 | A or I | 72,300 | 161,560 | 68,045 | 62,245 | 59,970 | 119,410 | b | |
| 145 | 5-12 | A or I | 31,500 | 60,000 | 12,000 | 14,000 | 3,127 | 7,500 | b | |
| 146 | 5-13 | I | | | | | | | q | |
| 147 | 5-14 | A or I | 1,300 | 3,000 | 40,000 | 50,000 | 630 | 1,200 | d | |
| 148 | 5-15 | A or I | 175 | 350 | 20,000 | 25,000 | 15 | 30 | a | |
| 149 | 5-16 | A or I | 280 | 800 | 9,000 | 11,000 | 2,125 | 4,250 | a | |
| 150 | 5-17 | A or I | 20 | 40 | 4,000 | 5,000 | 115 | 230 | a | |
| 151 | 5-18 | A or I | 40 | 80 | 2,500 | 3,000 | 680 | 1,360 | a | |
| 152 | 5-19 | A or I | 20 | 30 | 5,000 | 6,000 | 350 | 700 | a | |
| 153 | 5-20 | A or I | 80 | 200 | 10,000 | 12,000 | 380 | 760 | a | |
| 154 | 5-21 | A or I | 150 | 300 | 15,000 | 17,000 | 550 | 1,100 | a | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 155 | 5-22 | I | 280 | 1,000 | 35,000 | 55,000 | 250 | 510 | a | |
| 156 | 5-23 | I | 35 | 60 | 9,000 | 10,000 | 280 | 560 | a | |
| 157 | 5-24 | I | 20 | 40 | 6,500 | 7,000 | 400 | 700 | a | |
| 158 | 5-25 | I, P | 70 | 250 | 12,000 | 14,000 | 2,800 | 5,600 | a | |
| 159 | 5-26 | I, P | 175 | 345 | 21,000 | 23,000 | 80 | 160 | a | |
| 160 | 5-27 | A | 1,700 | 6,000 | 15,000 | 17,000 | 510 | 1,020 | a | |
| 161 | 5-28[1] | A | 24,000 | 60,000 | 130,000 | 150,000 | 7,200 | 14,400 | a | |
| 162 | 5-28[2] | I, P | | | | | | | p | |
| 163 | 5-28[3] | I, P | | | | | | | p | |
| 164 | 5-28[4] | I, P | | | | | | | p | |
| 165 | 5-29 | A | 70 | 150 | 10,000 | 12,000 | 280 | 560 | a | |
| 166 | 5-30 | A | 40 | 80 | 4,000 | 5,000 | 35 | 70 | a | |
| 167 | 5-31 | A | 25 | 50 | 7,000 | 9,000 | 850 | 1,700 | a | |
| 168 | 5-32 | A | 5 | 10 | 5,000 | 7,000 | 450 | 900 | a | |
| 169 | 5-33 | A | 200 | 400 | 17,000 | 20,000 | 1,980 | 3,960 | a | |
| 170 | 5-34 | A | 75 | 150 | 14,000 | 17,000 | 1,000 | 2,000 | a | |
| 171 | 6-7 | A or I | 167,023 | 326,050 | 94,305 | 111,390 | 10,105 | 18,710 | b | |
| 172 | 6-8 | A or I | 8,270 | 16,145 | 25,050 | 32,540 | 6,615 | 11,620 | b | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 173 | 6-9 | A or I | 5,290 | 8,190 | 17,550 | 23,400 | 6,550 | 11,700 | b | |
| 174 | 6-10 | A or I | 4,500 | 9,080 | 14,000 | 19,000 | 5,760 | 10,740 | b | |
| 175 | 6-11 | A or I | 13,535 | 27,106 | 20,050 | 21,150 | 10,185 | 18,155 | b | |
| 176 | 6-12 | A or I | 950 | 1,760 | 2,800 | 4,300 | 1,140 | 2,700 | b | |
| 177 | 6-13 | I | | | | | | | c | |
| 178 | 6-14 | A or I | 1,645 | 3,000 | 25,000 | 35,000 | 1,000 | 2,000 | d | |
| 179 | 6-15 | A or I | 300 | 500 | 16,000 | 20,000 | 210 | 420 | a | |
| 180 | 6-16 | A or I | 1,000 | 2,200 | 6,500 | 9,000 | 630 | 1,260 | a | |
| 181 | 6-17 | A or I | 60 | 100 | 1,500 | 2,000 | 25 | 50 | a | |
| 182 | 6-18 | A or I | 70 | 150 | 5,000 | 7,000 | 110 | 220 | a | |
| 183 | 6-19 | A or I | 10 | 30 | 3,000 | 5,000 | 5 | 10 | a | |
| 184 | 6-20 | A or I | 30 | 50 | 5,000 | 7,000 | 160 | 320 | a | |
| 185 | 6-21 | A or I | 180 | 400 | 6,000 | 8,000 | 45 | 90 | a | |
| 186 | 6-22 | I | 170 | 700 | 12,000 | 20,000 | 75 | 150 | a | |
| 187 | 6-23 | I | 30 | 50 | 5,000 | 7,000 | 25 | 50 | a | |
| 188 | 6-24 | I | 20 | 40 | 2,500 | 4,000 | 75 | 150 | a | |
| 189 | 6-25 | I, P | 80 | 150 | 9,000 | 12,000 | 360 | 720 | a | |
| 190 | 6-26 | I, P | 87 | 170 | 6,000 | 8,000 | 210 | 440 | a | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 191 | 6-27 | A | 490 | 900 | 9,000 | 11,000 | 360 | 720 | a | |
| 192 | 6-28[1] | A | 6,780 | 13,540 | 75,000 | 80,000 | 5,000 | 10,000 | a | |
| 193 | 6-28[2] | I, P | | | | | | | p | |
| 194 | 6-28[3] | I, P | | | | | | | p | |
| 195 | 6-28[4] | I, P | | | | | | | p | |
| 196 | 6-29 | A | 160 | 350 | 6,000 | 7,500 | 50 | 100 | a | |
| 197 | 6-30 | A | 30 | 70 | 1,000 | 1,500 | 5 | 10 | a | |
| 198 | 6-31 | A | 20 | 40 | 4,000 | 5,000 | 50 | 100 | a | |
| 199 | 6-32 | A | 10 | 20 | 3,000 | 4,000 | 150 | 300 | a | |
| 200 | 6-33 | A | 200 | 400 | 7,500 | 8,500 | 510 | 1,020 | a | |
| 201 | 6-34 | A | 100 | 200 | 6,000 | 7,000 | 470 | 940 | a | |
| 202 | 7-8 | A or I | 13,140 | 30,345 | 36,110 | 41,230 | 2,800 | 5,210 | b | |
| 203 | 7-9 | A or I | 2,515 | 5,030 | 20,245 | 26,332 | 1,758 | 3,066 | e | |
| 204 | 7-10 | A or I | 2,301 | 5,602 | 15,155 | 17,195 | 1,100 | 1,700 | b | |
| 205 | 7-11 | A or I | 6,681 | 15,666 | 31,087 | 34,717 | 2,963 | 5,281 | b | |
| 206 | 7-12 | A or I | 1,303 | 3,004 | 6,090 | 7,115 | 800 | 1,700 | b | |
| 207 | 7-13 | I | | | | | | | q | |
| 208 | 7-14 | A or I | 1,430 | 3,200 | 25,000 | 30,000 | 850 | 1,800 | d | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 209 | 7-15 | A or I | 370 | 1,000 | 30,000 | 35,000 | 125 | 250 | a | |
| 210 | 7-16 | A or I | 2,700 | 8,400 | 15,000 | 18,000 | 1,350 | 2,700 | a | 60 |
| 211 | 7-17 | A or I | 3 | 10 | 1,500 | 2,000 | 40 | 80 | a | |
| 212 | 7-18 | A or I | ____q | ____q | 1,500 | 2,000 | 20 | 40 | a | |
| 213 | 7-19 | A or I | 10 | 25 | 1,500 | 2,000 | 15 | 30 | a | |
| 214 | 7-20 | A or I | 15 | 20 | 3,500 | 4,000 | 15 | 30 | a | |
| 215 | 7-21 | A or I | 40 | 150 | 2,500 | 3,500 | 20 | 40 | a | |
| 216 | 7-22 | I | 90 | 300 | 8,000 | 12,000 | 10 | 20 | a | |
| 217 | 7-23 | I | 10 | 20 | 1,500 | 2,000 | 10 | 20 | a | |
| 218 | 7-24 | I | 10 | 20 | 2,000 | 2,500 | 165 | 330 | a | |
| 219 | 7-25 | I, P | 40 | 130 | 6,000 | 8,000 | 120 | 240 | a | |
| 220 | 7-26 | I, P | 89 | 175 | 3,000 | 4,000 | 57 | 114 | a | |
| 221 | 7-27 | A | 720 | 1,400 | 10,000 | 12,000 | 70 | 140 | a | |
| 222 | 7-28[1] | A | 6,400 | 12,500 | 90,000 | 100,000 | 2,290 | 4,580 | a | |
| 223 | 7-28[2] | I, P | | | | | | | p | |
| 224 | 7-28[3] | I, P | | | | | | | p | |
| 225 | 7-28[4] | I, P | | | | | | | p | |
| 226 | 7-29 | A | 120 | 450 | 2,500 | 3,500 | 75 | 150 | a | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 227 | 7-30 | A | 20 | 100 | 800 | 1,200 | 5 | 10 | a | |
| 228 | 7-31 | A | 50 | 200 | 3,000 | 4,000 | 25 | 50 | a | |
| 229 | 7-32 | A | 20 | 60 | 1,500 | 2,000 | 20 | 40 | a | |
| 230 | 7-33 | A | 750 | 2,700 | 7,000 | 9,000 | 550 | 1,100 | a | |
| 231 | 7-34 | A | 300 | 1,100 | 4,000 | 5,000 | 325 | 650 | a | |
| 232 | 8-9 | A or I | 4,084 | 7,864 | 17,300 | 22,714 | 2,505 | 5,675 | b | |
| 233 | 8-10 | A or I | 3,434 | 6,558 | 14,010 | 18,200 | 1,750 | 3,200 | b | |
| 234 | 8-11 | A or I | 685 | 1,426 | 7,056 | 8,456 | 1,390 | 3,130 | b | |
| 235 | 8-12 | A or I | 2,299 | 4,617 | 8,300 | 10,800 | 1,050 | 2,100 | b | |
| 236 | 8-13 | I | | | | | | | c | |
| 237 | 8-14 | A or I | 3,260 | 6,100 | 17,000 | 20,000 | 1,000 | 2,500 | d | |
| 238 | 8-15 | A or I | 150 | 300 | 10,000 | 12,000 | 400 | 300 | a | |
| 239 | 8-16 | A or I | 150 | 450 | 1,800 | 2,500 | 250 | 500 | a | |
| 240 | 8-17 | A or I | 10 | 25 | 7,000 | 1,000 | 10 | 20 | a | |
| 241 | 8-18 | A or I | 30 | 75 | 800 | 1,200 | 10 | 20 | a | |
| 242 | 8-19 | A or I | 10 | 25 | 700 | 1,000 | 5 | 10 | a | |
| 243 | 8-20 | A or I | 10 | 200 | 1,000 | 1,500 | 5 | 10 | a | |
| 244 | 8-21 | A or I | 10 | 50 | 1,500 | 2,500 | 5 | 10 | a | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 245 | 8-22 | I | 16 | 80 | 2,700 | 4,000 | 5 | 10 | a | |
| 246 | 8-23 | I | 2 | 10 | 900 | 1,200 | —[q] | —[q] | a | |
| 247 | 8-24 | I | 9 | 10 | 300 | 400 | 10 | 20 | a | |
| 248 | 8-25 | I, P | 10 | 10 | 2,500 | 2,800 | 150 | 300 | a | |
| 249 | 8-26 | I, P | 40 | 80 | 2,500 | 4,000 | 5 | 10 | a | |
| 250 | 8-27 | A | 170 | 350 | 2,500 | 3,000 | 30 | 60 | a | |
| 251 | 8-28[1] | A | 1,400 | 5,300 | 25,000 | 30,000 | 1,320 | 2,640 | a | |
| 252 | 8-28[2] | I, P | | | | | | | p | |
| 253 | 8-28[3] | I, P | | | | | | | p | |
| 254 | 8-28[4] | I, P | | | | | | | p | |
| 255 | 8-29 | A | 10 | 20 | 500 | 800 | —[q] | —[q] | a | |
| 256 | 8-30 | A | 10 | 20 | 500 | 800 | 5 | 10 | a | |
| 257 | 8-31 | A | 10 | 20 | 300 | 400 | 5 | 10 | a | |
| 258 | 8-32 | A | —[q] | —[q] | 300 | 400 | —[q] | —[q] | a | |
| 259 | 8-33 | A | 40 | 80 | 1,000 | 1,500 | 60 | 120 | a | |
| 260 | 8-34 | A | 10 | 20 | 800 | 1,000 | 20 | 40 | a | |
| 261 | 9-10 | A or I | 6,467 | 11,406 | 39,570 | 55,180 | 6,010 | 10,800 | b | |
| 262 | 9-11 | A or I | 1,052 | 2,037 | 5,333 | 5,928 | 1,476 | 3,090 | b | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 263 | 9-12 | A or I | 9,483 | 17,501 | 21,800 | 27,000 | 5,250 | 10,500 | b | |
| 264 | 9-13 | I | | | | | | | q | |
| 265 | 9-14 | A or I | 700 | 1,400 | 6,000 | 7,000 | 125 | 500 | d | |
| 266 | 9-15 | A or I | 170 | 300 | 3,900 | 4,500 | 30 | 60 | a | |
| 267 | 9-16 | A or I | 110 | 350 | 1,200 | 1,500 | 135 | 305 | a | |
| 268 | 9-17 | A or I | 10 | 20 | 800 | 1,000 | 20 | 40 | a | |
| 269 | 9-18 | A or I | 10 | 20 | 150 | 200 | 15 | 30 | a | |
| 270 | 9-19 | A or I | 10 | 20 | 150 | 300 | 15 | 30 | a | |
| 271 | 9-20 | A or I | 10 | 20 | 200 | 300 | 10 | 20 | a | |
| 272 | 9-21 | A or I | 15 | 50 | 1,200 | 1,500 | 10 | 20 | a | |
| 273 | 9-22 | I | 40 | 120 | 6,300 | 8,800 | 30 | 60 | a | |
| 274 | 9-23 | I | 30 | 70 | 1,100 | 1,500 | 25 | 50 | a | |
| 275 | 9-24 | I | 50 | 100 | 2,000 | 2,500 | 20 | 40 | a | |
| 276 | 9-25 | I, P | 30 | 60 | 1,800 | 2,100 | 110 | 220 | a | |
| 277 | 9-26 | I, P | 30 | 60 | 750 | 1,200 | 12 | 24 | a | |
| 278 | 9-27 | A | 120 | 300 | 820 | 1,100 | 30 | 60 | a | |
| 279 | 9-28[1] | A | 1,050 | 1,800 | 2,700 | 3,400 | 485 | 960 | a | |
| 280 | 9-28[2] | I, P | | | | | | | p | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 281 | 9-28[3] | I, P | | | | | | | p | |
| 282 | 9-28[4] | I, P | | | | | | | p | |
| 283 | 9-29 | A | 60 | 120 | 250 | 350 | 55 | 110 | a | |
| 284 | 9-30 | A | 70 | 130 | 1,600 | 2,200 | 35 | 70 | a | |
| 285 | 9-31 | A | 10 | 20 | 150 | 250 | 75 | 150 | a | |
| 286 | 9-32 | A | 10 | 20 | 150 | 200 | 12 | 24 | a | |
| 287 | 9-33 | A | 20 | 30 | 750 | 1,000 | 210 | 420 | a | |
| 288 | 9-34 | A | 10 | 20 | 500 | 700 | 45 | 90 | a | |
| 289 | 10-11 | A or I | 2,705 | 4,364 | 10,340 | 11,800 | 4,425 | 7,297 | b | |
| 290 | 10-12 | A or I | 8,170 | 16,858 | 21,300 | 25,600 | 3,920 | 6,800 | b | |
| 291 | 10-13 | I | | | | | | | q | |
| 292 | 10-14 | A or I | 92 | 200 | 8,000 | 10,000 | 20 | 40 | d | |
| 293 | 10-15 | A or I | 36 | 85 | 8,000 | 10,000 | 5 | 100 | a | |
| 294 | 10-16 | A or I | 90 | 200 | 1,500 | 2,000 | 825 | 1,650 | a | |
| 295 | 10-17 | A or I | 10 | 40 | 2,000 | 2,500 | 50 | 100 | a | |
| 296 | 10-18 | A or I | 2 | 10 | 1,500 | 2,000 | 10 | 20 | a | |
| 297 | 10-19 | A or I | 1 | 10 | 1,500 | 2,000 | 1 | 2 | a | |
| 298 | 10-20 | A or I | 1 | 10 | 750 | 1,000 | 6 | 12 | a | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 299 | 10-21 | A or I | 8 | 20 | 4,000 | 5,000 | 10 | 20 | a | |
| 300 | 10-22 | I | 50 | 160 | 9,700 | 15,000 | 10 | 20 | a | |
| 301 | 10-23 | I | 5 | 10 | 2,500 | 3,500 | 10 | 20 | a | |
| 302 | 10-24 | I | 20 | 50 | 750 | 1,000 | 15 | 30 | a | |
| 303 | 10-25 | I, P | 10 | 30 | 2,000 | 2,500 | 90 | 180 | a | |
| 304 | 10-26 | I, P | 10 | 20 | 3,000 | 4,000 | 3 | 6 | a | |
| 305 | 10-27 | A | 60 | 130 | 1,700 | 2,000 | 110 | 220 | a | |
| 306 | 10-28[1] | A | 750 | 1,800 | 7,000 | 8,000 | 330 | 660 | a | |
| 307 | 10-28[2] | I, P | | | | | | | p | |
| 308 | 10-28[3] | I, P | | | | | | | p | |
| 309 | 10-28[4] | I, P | | | | | | | p | |
| 310 | 10-29 | A | 4 | 20 | 1,000 | 1,200 | 30 | 60 | a | |
| 311 | 10-30 | A | 31 | 70 | 1,500 | 2,000 | ____q | ____q | a | |
| 312 | 10-31 | A | 1 | 10 | 750 | 1,000 | ____q | ____q | a | |
| 313 | 10-32 | A | 3 | 20 | 200 | 300 | ____q | ____q | a | |
| 314 | 10-33 | A | 10 | 30 | 1,500 | 2,000 | 150 | 300 | a | |
| 315 | 10-34 | A | 5 | 20 | 1,500 | 2,000 | 240 | 480 | a | |
| 316 | 11-12 | A or I | 2,595 | 5,120 | 6,540 | 7,250 | 3,730 | 6,900 | b | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 317 | 11-13 | I | | | | | | | q | |
| 318 | 11-14 | A or I | 147 | 270 | 9,000 | 10,000 | 200 | 400 | d | |
| 319 | 11-15 | A or I | 45 | 60 | 6,000 | 7,000 | 10 | 20 | a | |
| 320 | 11-16 | A or I | 140 | 350 | 2,500 | 3,000 | 1,125 | 2,250 | a | |
| 321 | 11-17 | A or I | 10 | 10 | 1,000 | 1,200 | 115 | 230 | a | |
| 322 | 11-18 | A or I | 30 | 50 | 1,000 | 1,200 | 300 | 600 | a | |
| 323 | 11-19 | A or I | 10 | 10 | 1,000 | 1,200 | 25 | 50 | a | |
| 324 | 11-20 | A or I | 35 | 50 | 4,000 | 4,500 | 135 | 270 | a | |
| 325 | 11-21 | A or I | 20 | 30 | 3,000 | 3,500 | 70 | 140 | a | |
| 326 | 11-22 | I | 68 | 250 | 8,000 | 11,000 | 40 | 80 | a | |
| 327 | 11-23 | I | 10 | 20 | 2,500 | 3,000 | 490 | 980 | a | |
| 328 | 11-24 | I | 10 | 20 | 4,000 | 4,500 | 150 | 300 | a | |
| 329 | 11-25 | I, P | 30 | 70 | 7,000 | 8,000 | 620 | 1,240 | a | |
| 330 | 11-26 | I, P | 60 | 120 | 4,000 | 4,500 | 60 | 120 | a | |
| 331 | 11-27 | A | 550 | 1,100 | 8,500 | 10,000 | 320 | 770 | a | |
| 332 | 11-28[1] | A | 4,500 | 13,000 | 75,000 | 90,000 | 3,410 | 7,380 | a | |
| 333 | 11-28[2] | I, P | | | | | | | p | |
| 334 | 11-28[3] | I, P | | | | | | | p | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 335 | 11-28[4] | I, P | | | | | | | p | |
| 336 | 11-29 | A | 30 | 60 | 2,000 | 2,500 | 15 | 30 | a | |
| 337 | 11-30 | A | 30 | 30 | 2,000 | 2,500 | 10 | 20 | a | |
| 338 | 11-31 | A | 10 | 20 | 2,500 | 3,000 | 130 | 260 | a | |
| 339 | 11-32 | A | 10 | 1,000 | 1,500 | 120 | 240 | 240 | a | |
| 340 | 11-33 | A | 30 | 70 | 3,800 | 4,000 | 1,230 | 2,460 | a | |
| 341 | 11-34 | A | 20 | 30 | 2,000 | 2,800 | 900 | 1,800 | a | |
| 342 | 12-13 | I | | | | | | | q | |
| 343 | 12-14 | A or I | 29 | 190 | 5,000 | 7,000 | ——[q] | ——[q] | d | |
| 344 | 12-15 | A or I | 150 | 460 | 6,000 | 7,000 | ——[q] | ——[q] | a | |
| 345 | 12-16 | A or I | 60 | 180 | 1,500 | 2,000 | 500 | 1,000 | a | |
| 346 | 12-17 | A or I | ——[q] | ——[q] | 8,000 | 12,000 | ——[q] | ——[q] | a | |
| 347 | 12-18 | A or I | ——[q] | ——[q] | 950 | 2,300 | ——[q] | ——[q] | a | |
| 348 | 12-19 | A or I | 3 | 10 | 250 | 350 | 5 | 10 | a | |
| 349 | 12-20 | A or I | ——[q] | ——[q] | 200 | 300 | ——[q] | ——[q] | a | |
| 350 | 12-21 | A or I | 88 | 250 | 1,500 | 1,800 | 225 | 225 | a | |
| 351 | 12-22 | I | 153 | 700 | 10,000 | 18,000 | ——[q] | ——[q] | a | |
| 352 | 12-23 | I | 114 | 480 | 550 | 700 | 50 | 150 | a | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 353 | 12-24 | I | 1,000 | 2,300 | 2,000 | 2,500 | 500 | 1,000 | a | |
| 354 | 12-25 | I, P | 260 | 460 | 12,000 | 13,000 | 465 | 930 | a | |
| 355 | 12-26 | I, P | 20 | 23 | 2,300 | 3,000 | 50 | 100 | a | |
| 356 | 12-27 | A | 20 | 40 | 1,300 | 1,400 | — [q] | — [q] | a | |
| 357 | 12-28[1] | A | 1,800 | 7,500 | 12,600 | 14,000 | 40 | 80 | a | |
| 358 | 12-28[2] | I, P | | | | | | | p | |
| 359 | 12-28[3] | I, P | | | | | | | p | |
| 360 | 12-28[4] | I, P | | | | | | | p | |
| 361 | 12-29 | A | | 100 | 100 | 150 | — [q] | — [q] | a | |
| 362 | 12-30 | A | | 100 | 2,700 | 3,100 | — [q] | — [q] | a | |
| 363 | 12-31 | A | | 100 | 120 | 150 | — [q] | — [q] | a | |
| 364 | 12-32 | A | | 100 | 120 | 200 | — [q] | — [q] | a | |
| 365 | 12-33 | A | | 100 | 1,560 | 2,000 | — [q] | — [q] | a | |
| 366 | 12-34 | A | | 100 | 1,300 | 1,500 | — [q] | — [q] | a | |
| 367 | 13-14 | I | 17 | — [q] | 4,660 | 4,890 | — [q] | — [q] | e | |
| 368 | 13-15 | I | | | | | | | p | |
| 369 | 13-16 | I | | | | | | | p | |
| 370 | 13-17 | I | | | | | | | p | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 371 | 13-18 | I | | | | | | | p | |
| 372 | 13-19 | I | | | | | | | p | |
| 373 | 13-20 | I | | | | | | | p | |
| 374 | 13-21 | I | 38 | 40 | 3,345 | 3,840 | 150 | 450 | e | |
| 375 | 13-22 | I | 154 | 642 | 13,018 | 22,009 | | 10 | e | |
| 376 | 13-23 | I | 114 | 420 | 1,827 | 2,490 | 18 | 30 | e | |
| 377 | 13-24 | I | 1,033 | 2,300 | 3,610 | 4,566 | 325 | 1,010 | e | |
| 378 | 13-25 | I, P | 503 | 711 | 13,250 | 14,050 | 350 | 801 | e | |
| 379 | 13-26 | I, P | 13 | 16 | 3,876 | 5,127 | ——— q | ——— q | e | |
| 380 | 13-27 | A, I | | | | | | | q | |
| 381 | 13-28[1] | A, I | | | | | | | p | |
| 382 | 13-28[2] | A, I | | | | | | | q | |
| 383 | 13-28[3] | I, P | | | | | | | p | |
| 384 | 13-28[4] | I, P | | | | | | | p | |
| 385 | 13-29 | A, I | | | | | | | p | |
| 386 | 13-30 | A, I | | | | | | | p | |
| 387 | 13-31 | A, I | | | | | | | p | |
| 388 | 13-32 | A, I | | | | | | | p | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 389 | 13-33 | A, I | | | | | | | p | |
| 390 | 13-34 | A, I | | | | | | | p | |
| 391 | 14-15 | A or I | 1,800 | 4,000 | 9,000 | 12,000 | 375 | 750 | d | |
| 392 | 14-16 | A or I | 40 | 100 | 1,500 | 2,000 | 150 | 300 | d | |
| 393 | 14-17 | A or I | ____ q | ____ q | 1,600 | 2,200 | 20 | 40 | d | |
| 394 | 14-18 | A or I | ____ q | ____ q | 1,300 | 1,400 | ____ q | ____ q | d | |
| 395 | 14-19 | A or I | 2 | 10 | 2,000 | 2,500 | ____ q | ____ q | d | |
| 396 | 14-20 | A or I | 5 | 10 | 5,000 | 6,000 | 90 | 180 | d | |
| 397 | 14-21 | A or I | 346 | 557 | 3,586 | 4,650 | 16 | 22 | e | |
| 398 | 14-22 | I | 1,420 | 3,564 | 8,028 | 12,469 | | 60 | e | |
| 399 | 14-23 | I | ____ q | ____ q | 552 | 630 | 5 | 17 | e | |
| 400 | 14-24 | I | | 8 | 990 | 731 | 1 | 17 | e | |
| 401 | 14-25 | I, P | 8 | 14 | 5,320 | 6,020 | 105 | 330 | e | |
| 402 | 14-26 | I, P | 18 | 32 | 2,620 | 3,795 | ____ q | ____ q | e | |
| 403 | 14-27 | A | 60 | 110 | 4,000 | 4,600 | 5 | 10 | d | |
| 404 | 14-28[1] | A | 1,800 | 4,000 | 50,000 | 60,000 | 750 | 1,500 | a | |
| 405 | 14-28[2] | I, P | | | | | | | p | |
| 406 | 14-28[3] | I, P | | | | | | | p | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 407 | 14-28[4] | I, P | | | | | | | p | |
| 408 | 14-29 | A | 10 | 25 | 350 | 450 | ——[q] | ——[q] | d | |
| 409 | 14-30 | A | 2 | 5 | 300 | 400 | ——[q] | ——[q] | a | |
| 410 | 14-31 | A | 2 | 5 | 400 | 500 | ——[q] | ——[q] | d | |
| 411 | 14-32 | A | 2 | 5 | 250 | 350 | ——[q] | ——[q] | d | |
| 412 | 14-33 | A | 20 | 50 | 800 | 1,000 | ——[q] | ——[q] | d | |
| 413 | 14-34 | A | 4 | 10 | 300 | 500 | ——[q] | ——[q] | d | |
| 414 | 15-16 | A or I | 492 | 61 | 4,477 | 2,693 | 41 | 66 | g | |
| 415 | 15-17 | A or I | 288 | 445 | 3,976 | 3,138 | 109 | 220 | g | |
| 416 | 15-18 | A or I | 118 | 248 | 3,014 | 4,100 | 66 | 141 | g | |
| 417 | 15-19 | A or I | 89 | 121 | 6,552 | 9,654 | 89 | 201 | g | |
| 418 | 15-20 | A or I | 4 | 1 | 342 | 635 | | 2 | g | |
| 419 | 15-21 | A or I | 500 | 1,500 | 25,000 | 35,000 | 5 | 10 | c | |
| 420 | 15-22 | I | 60 | 350 | 9,000 | 15,000 | 65 | 130 | c | |
| 421 | 15-23 | I | 80 | 200 | 2,000 | 3,000 | 10 | 20 | c | |
| 422 | 15-24 | I | 3 | 10 | 3,500 | 5,000 | 5 | 10 | c | |
| 423 | 15-25 | I, P | 3 | 10 | 7,000 | 9,000 | 120 | 240 | c | |
| 424 | 15-26 | I, P | 6 | 10 | 1,500 | 2,000 | 10 | 20 | c | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 425 | 15-27 | A | 9 | 20 | 1,500 | 2,000 | 5 | 10 | c | |
| 426 | 15-28[1] | A | 530 | 1,250 | 22,000 | 25,000 | 130 | 260 | c | |
| 427 | 15-28[2] | I, P | | | | | | | p | |
| 428 | 15-28[3] | I, P | | | | | | | p | |
| 429 | 15-28[4] | I,P | | | | | | | p | |
| 430 | 15-29 | A | ___[q] | ___[q] | 700 | 1,000 | 5 | 10 | c | |
| 431 | 15-30 | A | ___[q] | ___[q] | 700 | 1,000 | 5 | 10 | c | |
| 432 | 15-31 | A | ___[q] | ___[q] | 300 | 400 | 5 | 10 | c | |
| 433 | 15-32 | A | ___[q] | ___[q] | 300 | 400 | 1 | 2 | c | |
| 434 | 15-33 | A | ___[q] | ___[q] | 750 | 1,000 | 5 | 10 | c | |
| 435 | 15-34 | A | ___[q] | ___[q] | 750 | 1,000 | 5 | 10 | c | |
| 436 | 16-17 | A or I | 110 | 177 | 6,012 | 3,280 | 157 | 192 | g | |
| 437 | 16-18 | A or I | 104 | 202 | 376 | 294 | 41 | 90 | g | |
| 438 | 16-19 | A or I | ___[q] | ___[q] | 178 | 151 | | 30 | g | |
| 439 | 16-20 | A or I | ___[q] | ___[q] | 46 | ___[q] | ___[q] | ___[q] | g | |
| 440 | 16-21 | A or I | 10 | 20 | 800 | 1,000 | 15 | 30 | c | |
| 441 | 16-22 | I | 2 | 10 | 2,000 | 3,000 | 20 | 40 | c | |
| 442 | 16-23 | I | ___[q] | ___[q] | 800 | 1,000 | 20 | 40 | c | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 443 | 16-24 | I | 2 | 10 | 800 | 1,000 | 10 | 20 | c | |
| 444 | 16-25 | I, P | | 10 | 500 | 800 | 10 | 20 | c | |
| 445 | 16-26 | I, P | 1 | 10 | 300 | 400 | 5 | 10 | c | |
| 446 | 16-27 | A | 15 | 25 | 750 | 1,000 | 20 | 40 | f | |
| 447 | 16-28[1] | A | 370 | 750 | 7,000 | 9,000 | 375 | 750 | c | |
| 448 | 16-28[2] | I, P | | | | | | | p | |
| 449 | 16-28[3] | I, P | | | | | | | p | |
| 450 | 16-28[4] | I, P | | | | | | | p | |
| 451 | 16-29 | A | 4 | 15 | 200 | 300 | 40 | 80 | c | |
| 452 | 16-30 | A | 2 | 10 | 200 | 300 | 5 | 10 | c | |
| 453 | 16-31 | A | 2 | 10 | 200 | 300 | 40 | 80 | c | |
| 454 | 16-32 | A | ——[q] | ——[q] | 200 | 300 | 5 | 10 | c | |
| 455 | 16-33 | A | 2 | 10 | 200 | 300 | 30 | 60 | c | |
| 456 | 16-34 | A | 2 | 10 | 200 | 300 | 20 | 40 | c | |
| 457 | 17-18 | A or I | 1,016 | 3,099 | 20,480 | 45,395 | 164 | 371 | g | |
| 458 | 17-19 | A or I | 6 | 28 | 1,531 | 1,622 | 6 | 94 | g | |
| 459 | 17-20 | A or I | 5 | 3 | 1,253 | 557 | 3 | 4 | g | |
| 460 | 17-21 | A or I | 1 | 5 | 700 | 900 | 1 | 2 | c | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 461 | 17-22 | I | 35 | 76 | 1,500 | 2,200 | 7 | 8 | c | |
| 462 | 17-23 | I | —q | —q | 700 | 1,000 | 4 | 8 | c | |
| 463 | 17-24 | I | 4 | 10 | 1,500 | 2,000 | 10 | 20 | c | |
| 464 | 17-25 | I, P | 2 | 10 | 1,300 | 1,400 | 5 | 10 | c | |
| 465 | 17-26 | I, P | 1 | 10 | 300 | 400 | 5 | 10 | c | |
| 466 | 17-27 | A | 2 | 10 | 900 | 1,000 | 2 | 4 | c | |
| 467 | 17-28[1] | A | 440 | 1,000 | 12,000 | 15,000 | 175 | 350 | c | |
| 468 | 17-28[2] | I, P | | | | | | | p | |
| 469 | 17-28[3] | I, P | | | | | | | p | |
| 470 | 17-28[4] | I, P | | | | | | | p | |
| 471 | 17-29 | A | —q | —q | 300 | 400 | | 1 | c | |
| 472 | 17-30 | A | —q | —q | 300 | 400 | | 1 | c | |
| 473 | 17-31 | A | —q | —q | 300 | 400 | —q | —q | c | |
| 474 | 17-32 | A | —q | —q | 300 | 400 | —q | —q | c | |
| 475 | 17-33 | A | —q | —q | 300 | 400 | | 5 | c | |
| 476 | 17-34 | A | 16 | 35 | 300 | 400 | 2 | 4 | c | |
| 477 | 18-19 | A or I | 80 | 179 | 1,303 | 1,928 | 40 | 270 | g | |
| 478 | 18-20 | A or I | 5 | 23 | 1,187 | 2,896 | 12 | | g | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 479 | 18-21 | A or I | ____q | ____q | 700 | 1,000 | ____q | ____q | c | |
| 480 | 18-22 | I | 8 | 50 | 2,150 | 3,200 | ____q | ____q | c | |
| 481 | 18-23 | I | ____q | ____q | 500 | 750 | | 1 | c | |
| 482 | 18-24 | I | 4 | 10 | 2,500 | 3,000 | 10 | 20 | c | |
| 483 | 18-25 | I, P | | 10 | 2,000 | 2,500 | 150 | 300 | c | |
| 484 | 18-26 | I, P | 1 | 10 | 300 | 400 | ____q | ____q | c | |
| 485 | 18-27 | A | 2 | 10 | 900 | 1,100 | 15 | 30 | c | |
| 486 | 18-28[1] | A | 475 | 800 | 10,000 | 12,000 | 235 | 470 | c | |
| 487 | 18-28[2] | I, P | | | | | | | p | |
| 488 | 18-28[3] | I, P | | | | | | | p | |
| 489 | 18-28[4] | I, P | | | | | | | p | |
| 490 | 18-29 | A | ____q | ____q | 300 | 400 | ____q | ____q | c | |
| 491 | 18-30 | A | ____q | ____q | 300 | 400 | ____q | ____q | c | |
| 492 | 18-31 | A | ____q | ____q | 300 | 400 | ____q | ____q | c | |
| 493 | 18-32 | A | ____q | ____q | 300 | 400 | ____q | ____q | c | |
| 494 | 18-33 | A | ____q | ____q | 300 | 400 | ____q | ____q | c | |
| 495 | 18-34 | A | ____q | ____q | 300 | 400 | ____q | ____q | c | |
| 496 | 19-20 | A or I | 43 | 61 | 9,753 | 12,338 | 22 | 37 | g | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 497 | 19-21 | A or I | 24 | 50 | 750 | 1,000 | 2 | 4 | c | |
| 498 | 19-22 | I | 160 | 900 | 1,3000 | 18,000 | 30 | 60 | c | |
| 499 | 19-23 | I | ______ q | ______ q | 1,500 | 2,000 | 2 | 4 | c | |
| 500 | 19-24 | I | 4 | 10 | 3,500 | 4,500 | 7 | 14 | c | |
| 501 | 19-25 | I, P | | 10 | 5,500 | 6,500 | 50 | 200 | c | |
| 502 | 19-26 | I, P | 4 | 10 | 3,000 | 4,000 | 2 | 4 | c | |
| 503 | 19-27 | A | 7 | 15 | 2,500 | 3,000 | 5 | 10 | c | |
| 504 | 19-28[1] | A | 190 | 450 | 12,000 | 14,000 | 50 | 100 | c | |
| 505 | 19-28[2] | I, P | | | | | | | p | |
| 506 | 19-28[3] | I, P | | | | | | | p | |
| 507 | 19-28[4] | I, P | | | | | | | p | |
| 508 | 19-29 | A | ______ q | ______ q | 300 | 400 | ______ q | ______ q | c | |
| 509 | 19-30 | A | ______ q | ______ q | 300 | 400 | ______ q | ______ q | c | |
| 510 | 19-31 | A | ______ q | ______ q | 300 | 400 | ______ q | ______ q | c | |
| 511 | 19-32 | A | ______ q | ______ q | 300 | 400 | ______ q | ______ q | c | |
| 512 | 19-33 | A | ______ q | ______ q | 300 | 400 | ______ q | ______ q | c | |
| 513 | 19-34 | A | ______ q | ______ q | 300 | 400 | ______ q | ______ q | c | |
| 514 | 20-21 | A or I | ______ q | ______ q | 300 | 400 | ______ q | ______ q | c | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 515 | 20-22 | I | 4 | 25 | 3,000 | 4,000 | ———[q] | ———[q] | c | |
| 516 | 20-23 | I | ———[q] | ———[q] | 2,000 | 2,500 | 2 | 4 | c | |
| 517 | 20-24 | I | 5 | 10 | 4,000 | 5,000 | 3 | 6 | c | |
| 518 | 20-25 | I, P | 2 | 10 | 5,500 | 6,500 | 280 | 560 | c | |
| 519 | 20-26 | I, P | 60 | 150 | 3,000 | 4,000 | ———[q] | ———[q] | c | |
| 520 | 20-27 | A | 25 | 50 | 4,000 | 5,000 | 18 | 36 | c | |
| 521 | 20-28[1] | A | 450 | 1,200 | 22,000 | 25,000 | 225 | 450 | c | |
| 522 | 20-28[2] | I, P | | | | | | | p | |
| 523 | 20-28[3] | I, P | | | | | | | p | |
| 524 | 20-28[4] | I, P | | | | | | | p | |
| 525 | 20-29 | A | ———[q] | ———[q] | 300 | 400 | 5 | 10 | c | |
| 526 | 20-30 | A | ———[q] | ———[q] | 500 | 700 | ———[q] | ———[q] | c | |
| 527 | 20-31 | A | ———[q] | ———[q] | 300 | 400 | ———[q] | ———[q] | c | |
| 528 | 20-32 | A | ———[q] | ———[q] | 300 | 400 | ———[q] | ———[q] | c | |
| 529 | 20-33 | A | 2 | 10 | 600 | 700 | 6 | 12 | c | |
| 530 | 20-24 | A | 2 | 10 | 500 | 600 | 5 | 10 | c | |
| 531 | 21-22 | I | 1,519 | 4,716 | 11,423 | 27,195 | 254 | 522 | e | |
| 532 | 21-23 | I | 2 | 8 | 942 | 1,052 | | 10 | e | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 533 | 21-24 | I | 2 | 6 | 1,506 | 1,587 | 5 | 16 | e | |
| 534 | 21-25 | I, P | 17 | 31 | 13,070 | 15,031 | 190 | 681 | e | |
| 535 | 21-26 | I, P | 3 | 3 | 1,845 | 2,634 | 2 | 4 | e | |
| 536 | 21-27 | A | 7 | 15 | 700 | 900 | 5 | 10 | d | |
| 537 | 21-28[1] | A | 670 | 1,900 | 27,000 | 31,000 | 120 | 240 | d | |
| 538 | 21-28[2] | I, P | | | | | | | p | |
| 539 | 21-28[3] | I, P | | | | | | | p | |
| 540 | 21-28[4] | I, P | | | | | | | p | |
| 541 | 21-29 | A | ____q | ____q | 300 | 400 | ____q | ____q | h | |
| 542 | 21-30 | A | ____q | ____q | 300 | 400 | ____q | ____q | h | |
| 543 | 21-31 | A | ____q | ____q | 300 | 400 | ____q | ____q | h | |
| 544 | 21-32 | A | ____q | ____q | 300 | 400 | ____q | ____q | h | |
| 545 | 21-33 | A | ____q | ____q | 300 | 400 | ____q | ____q | h | |
| 546 | 21-34 | A | ____q | ____q | 300 | 400 | ____q | ____q | h | |
| 547 | 22-23 | I | 445 | 1,752 | 30,036 | 50,774 | 235 | 464 | e | |
| 548 | 22-24 | I | 169 | 432 | 13,107 | 19,466 | 747 | 1,349 | e | |
| 549 | 22-25 | I, P | 378 | 904 | 55,814 | 80,504 | 1,540 | 3,311 | e | |
| 550 | 22-26 | I, P | 129 | 630 | 19,302 | 29,229 | 250 | 641 | e | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 551 | 22-27 | A, I | 50 | 200 | 17,000 | 25,000 | 75 | 150 | d | |
| 552 | 22-28[1] | A, I | 1,400 | 4,000 | 80,000 | 100,000 | 500 | 1,000 | d | |
| 553 | 22-28[2] | I, P | | | | | | | p | |
| 554 | 22-28[3] | I, P | | | | | | | p | |
| 555 | 22-28[4] | I, P | | | | | | | p | |
| 556 | 22-29 | A, I | 5 | 30 | 500 | 850 | —— [q] | —— [q] | h | |
| 557 | 22-30 | A, I | 5 | 40 | 4,000 | 5,000 | —— [q] | —— [q] | h | |
| 558 | 22-31 | A, I | —— [q] | —— [q] | 400 | 500 | —— [q] | —— [q] | h | |
| 559 | 22-32 | A, I | —— [q] | —— [q] | 400 | 600 | —— [q] | —— [q] | h | |
| 560 | 22-33 | A, I | | 10 | 1,500 | 2,500 | 5 | 10 | h | |
| 561 | 22-34 | A, I | | 10 | 1,200 | 2,000 | | 3 | h | |
| 562 | 23-24 | I or P | 2,243 | 3,437 | 44,882 | 50,032 | 433 | 693 | e | |
| 563 | 23-25 | P | 1,390 | 2,722 | 69,284 | 77,200 | 2,507 | 5,616 | e | |
| 564 | 23-26 | P | 672 | 1,069 | 47,249 | 53,630 | 541 | 1,109 | e | |
| 565 | 23-27 | A, I | 6 | 700 | 2,000 | 2,500 | 30 | 60 | d | |
| 566 | 23-28[1] | A, I | | | | | | | p | |
| 567 | 23-28[2] | P | 2,450 | 2,800 | 75,000 | 85,000 | 3,000 | 6,000 | d | 28 |
| 568 | 23-28[3] | P | | | | | | | p | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 569 | 23-28[4] | P | | | | | | | p | |
| 570 | 23-29 | A, I | 60 | 150 | 200 | 300 | 1 | 2 | h | |
| 571 | 23-30 | A, I | —[q] | —[q] | 300 | 500 | 1 | 2 | h | |
| 572 | 23-31 | A, I | —[q] | —[q] | 200 | 300 | 1 | 2 | h | |
| 573 | 23-32 | A, I | —[q] | —[q] | 200 | 300 | 1 | 2 | h | |
| 574 | 23-33 | A, I | —[q] | —[q] | 700 | 1,100 | 1 | 2 | h | |
| 575 | 23-34 | A, I | —[q] | —[q] | 300 | 400 | 1 | 2 | h | |
| 576 | 24-25 | P | 3,303 | 7,118 | 73,012 | 81,365 | 2,605 | 4,821 | e | |
| 577 | 24-26 | P | 482 | 879 | 16,089 | 18,977 | 228 | 464 | e | 80 |
| 578 | 24-27 | A, I | 70 | 120 | 6,000 | 7,000 | 40 | 80 | d | |
| 579 | 24-28[1] | A, I | | | | | | | p | |
| 580 | 24-28[2] | P | 1,500 | 3,300 | 45,000 | 55,000 | 1,400 | 2,500 | d | |
| 581 | 24-28[3] | P | | | | | | | p | |
| 582 | 24-28[4] | P | | | | | | | p | |
| 583 | 24-29 | A, I | 3 | 10 | 400 | 500 | 10 | 20 | h | |
| 584 | 24-30 | A, I | 10 | 20 | 700 | 900 | 15 | 30 | h | |
| 585 | 24-31 | A, I | | 10 | 300 | 400 | 5 | 10 | h | |
| 586 | 24-32 | A, I | | 10 | 200 | 300 | 10 | 20 | h | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 587 | 24-33 | A, I | 1 | 10 | 700 | 1,000 | 10 | 20 | h | |
| 588 | 24-34 | A, I | 1 | 10 | 700 | 1,000 | 10 | 20 | h | |
| 589 | 25-26 | P | 570 | 1,138 | 30,832 | 42,150 | 3,735 | 7,751 | e | |
| 590 | 25-27 | A, P, I | 210 | 400 | 12,000 | 14,000 | 540 | 1,080 | d | |
| 591 | 25-28[1] | A, P, I | | | | | | | p | |
| 592 | 25-28[2] | P | 5,850 | 13,400 | 155,000 | 176,000 | 8,000 | 10,000 | a | 100 |
| 593 | 25-28[3] | P | | | | | | | p | |
| 594 | 25-28[4] | P | | | | | | | p | |
| 595 | 25-29 | A, P, I | 25 | 60 | 4,500 | 5,000 | 150 | 300 | h | |
| 596 | 25-30 | A, P, I | 5 | 10 | 1,300 | 1,500 | 10 | 50 | h | |
| 597 | 25-31 | A, P, I | 2 | 10 | 1,900 | 2,200 | 100 | 300 | h | |
| 598 | 25-32 | A, P, I | 3 | 10 | 1,500 | 1,600 | 200 | 400 | h | |
| 599 | 25-33 | A, P, I | 6 | 20 | 2,800 | 3,200 | 500 | 1,000 | h | |
| 600 | 25-34 | A, P, I | 4 | 20 | 2,800 | 3,200 | 500 | 1,00 | h | |
| 601 | 26-27 | A, P, I | 560 | 1,100 | 12,000 | 14,000 | 650 | 1,300 | d | 80 |
| 602 | 26-28[1] | A, P, I | | | | | | | p | |
| 603 | 26-28[2] | P | 3,720 | 9,500 | 670,000 | 80,000 | 2,330 | 5,000 | d | |
| 604 | 26-28[3] | P | | | | | | | p | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 605 | 26-28[4] | P | | | | | | | p | |
| 606 | 26-29 | A, P, I | 4 | 10 | 400 | 500 | ______[q] | ______[q] | h | |
| 607 | 26-30 | A, P, I | 6 | 10 | 2,500 | 3,000 | ______[q] | ______[q] | h | |
| 608 | 26-31 | A, P, I | 1 | 10 | 800 | 1,000 | 10 | 20 | h | |
| 609 | 26-32 | A, P, I | 2 | 10 | 300 | 400 | 5 | 10 | h | |
| 610 | 26-33 | A, P, I | 2 | 10 | 1,000 | 1,200 | 5 | 12 | h | |
| 611 | 26-34 | A, P, I | 1 | 10 | 1,000 | 1,200 | 15 | 30 | h | |
| 612 | 27-28[1] | A | 2,364[1] | 4,727[1] | 178,923[m] | 124,828[m] | 249[1] | 498[1] | | |
| 613 | 27-28[2] | A, P, I | | | | | | | p | |
| 614 | 27-28[3] | A, P, I | | | | | | | p | |
| 615 | 27-28[4] | A, P, I | | | | | | | p | |
| 616 | 27-29 | A | 800 | 1,600 | 4,500 | 5,500 | 5 | 10 | h | |
| 617 | 27-30 | A | 600 | 1,200 | 16,000 | 19,000 | 30 | 60 | h | |
| 618 | 27-31 | A | 13 | 30 | 3,000 | 3,500 | 10 | 20 | h | |
| 619 | 27-32 | A | 5 | 10 | 1,200 | 1,300 | 5 | 10 | h | |
| 620 | 27-33 | A | 25 | 50 | 2,500 | 3,000 | 120 | 240 | h | |
| 621 | 27-34 | A | 6 | 10 | 1,300 | 1,200 | 125 | 250 | h | |
| 622 | 28[1]-28[2] | A, P, I | | | | | | | o | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 623 | $28^{1}$-$28^{3}$ | A, P, I | | | | | | | p | |
| 624 | $28^{1}$-$28^{4}$ | A, P, I | | | | | | | p | |
| 625 | $28^{1}$-29 | A | 8,400 | 22,000 | 65,000 | 75,000 | 230 | 460 | h | 128 |
| 626 | $28^{1}$-30 | A | 40,190 | 100,000 | 100,000 | 120,000 | 1,750 | 3,500 | h | 237 |
| 627 | $28^{1}$-31 | A | 8,250 | 23,000 | 85,000 | 90,000 | 1,480 | 2,960 | h | |
| 628 | $28^{1}$-32 | A | 3,600 | 10,500 | 38,000 | 40,000 | 1,140 | 2,280 | h | |
| 629 | $28^{1}$-33 | A | 7,200 | 24,000 | 66,000 | 72,000 | 3,270 | 6,540 | h | |
| 630 | $28^{1}$-34 | A | 8,000 | 21,000 | 50,000 | 53,000 | 2,530 | 5,060 | h | |
| 631 | $28^{2}$-$28^{3}$ | P | 58,813[m] | 232,655[m] | 59,228[m] | 79,730[m] | 1,281[l] | 2,563[l] | | 85 |
| 632 | $28^{2}$-$28^{4}$ | P | 26,399[n] | 62,657[n] | 25,701[m] | 22,646[m] | ——[q] | ——[q] | | 48 |
| 633 | $28^{2}$-29 | A, P, I | | | | | | | p | |
| 634 | $28^{2}$-30 | A, P, I | | | | | | | p | |
| 635 | $28^{2}$-31 | A, P, I | | | | | | | p | |
| 636 | $28^{2}$-32 | A, P, I | | | | | | | p | |
| 637 | $28^{2}$-33 | A, P, I | | | | | | | p | |
| 638 | $28^{2}$-34 | A, P, I | | | | | | | p | |
| 639 | $28^{3}$-$28^{4}$ | P | | | | | | | q | |
| 640 | $28^{3}$-29 | A, P, I | | | | | | | p | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 641 | $28^{3}$-30 | A, P, I | | | | | | | p | |
| 642 | $28^{3}$-31 | A, P, I | | | | | | | p | |
| 643 | $28^{3}$-32 | A, P, I | | | | | | | p | |
| 644 | $28^{3}$-33 | A, P, I | | | | | | | p | |
| 645 | $28^{3}$-34 | A, P, I | | | | | | | p | |
| 646 | $28^{4}$-29 | A, P, I | | | | | | | p | |
| 647 | $28^{4}$-30 | A, P, I | | | | | | | p | |
| 648 | $28^{4}$-31 | A, P, I | | | | | | | p | |
| 649 | $28^{4}$-32 | A, P, I | | | | | | | p | |
| 650 | $28^{4}$-33 | A, P, I | | | | | | | p | |
| 651 | $28^{4}$-34 | A, P, I | | | | | | | p | |
| 652 | 29-30 | A | 1,744 | 4,604[k] | 21,050 | 33,400[i] | 973 | 1,946[j] | f | |
| 653 | 29-31 | A | 2,239 | 5,911[k] | 15,900 | 23,700[i] | 1,782 | 3,564[j] | f | |
| 654 | 29-32 | A | 1,151 | 3,039[k] | 20,800 | 45,070[i] | 944 | 1,888[j] | f | |
| 655 | 29-33 | A | 1,926 | 5,085[k] | 7,100 | 10,940[i] | 1,871 | 3,742[j] | f | |
| 656 | 29-34 | A | 2,165 | 5,716[k] | 1,600 | 3,515[i] | 1,485 | 2,970[j] | e | |
| 657 | 30-31 | A | 909 | 2,400[k] | 14,900 | 27,000[i] | 190 | 380[j] | f | |
| 658 | 30-32 | A | 26 | 69[k] | 3,000 | 900[i] | 37 | 74[j] | f | |

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|
| 659 | 30-33 | A | 64 | 169[k] | 3,000 | 5,410[i] | 34 | 68[j] | f | |
| 660 | 30-34 | A | 26 | 69[k] | 3,100 | 5,320[i] | 37 | 74[j] | f | |
| 661 | 31-32 | A | 124 | 327[k] | 10,200 | 15,430[i] | 130 | 260[j] | f | |
| 662 | 31-33 | A | 51 | 135[k] | 9,300 | 14,120[i] | 118 | 236[j] | i | |
| 663 | 31-24 | A | 26 | 69[k] | 4,800 | 7,430[i] | 61 | 122[j] | f | |
| 664 | 32-33 | A | 492 | 1,299[k] | 18,100 | 27,520[i] | 230 | 460[j] | f | |
| 665 | 32-34 | A | 3 | 8[k] | 3,000 | 4,800[i] | 36 | 72[j] | f | |
| 666 | 33-34 | A | 1,853 | 4,892[k] | 99,600 | 250,000[i] | 1,087 | 2,174[j] | f | |
| 667 | 28[1] | A | | | | | | | r | |
| 668 | 28[2] | P | | | | | | | r | |

[a]International Telecommunications Union, *op. cit.*, Tables 1 INT EU, 2 INT EU, and 3 INT EU, following p. 131.

[b]*Ibid.*, Tables 1 INT EU or 2 INT EU or 3 INT EU, following p. 131; and Tables 1 EU and 2 EU and 3 EU, following p. 76.

[c]*Ibid.*, Tables 1 INT AF, 2 INT AF, and 3 INT AF, following p. 131.

[d]*Ibid.*, Tables 1 INT AS, 2 INT AS, and 3 INT AS, following p. 131.

[e]*Ibid.*, Tables 1 INT AS or 2 INT AS or 3 INT AS, following p. 131; and Tables 1 AS and 2 AS and 3 AS, following p. 68.

[f]*Ibid.*, Tables 1 INT AL or 2 INT AL or 3 INT AL, following p. 131; and Tables 1 AL and 2 AL and 3 AL, following p. 59.

[g]*Ibid.*, Tables 1 INT AF or 2 INT AF or 3 INT AF, following p. 131; and Tables 1 AF and 2 AF and 3 AF, following p. 39.

[h]*Ibid.*, Tables 1 INT AL, 2 INT AL, and 3 INT AL, following p. 131.

[i]*Supra*, pp. 157-8.

[j]*Supra*, p. 158.

[k]*Supra*, pp. 158-9.

[l]*Supra*, pp. 160-2.

[m]*Supra*, pp. 162-5.

[n]*Supra*, pp. 165-6.

[o]*Supra*, p. 166.

[p]*Supra*, pp. 166-9.

[q]*Supra*, pp. 169-70.

[r]*Supra*, p. 170.

## APPENDIX B

This Appendix elaborates on the process by which television and special circuit requirements were estimated, and summarizes the estimates.

### Estimation of Television Circuit Requirements

The basic data from which hourly television circuit requirements for the "typical" day of the policy period were derived were reported by the Communications Satellite Corporation.[1] The data were reported in terms of estimates of television circuit requirements between pairs of communicating areas through 1969. Column 1 of Table XIII below designates the pairs of communicating areas for which television requirements were estimated, and Column 2 presents the estimates. Certain assumptions had to be made about these basic estimates in order to convert them into hourly television circuit requirements for the "typical" day of each policy year. These assumptions were as follows:

1. The reported communicating areas of Column 1 were assumed to serve in proxy for those of the thirty-seven regions which are geographically similar to these reporting

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[1]Communications Satellite Corporation, Working Paper, Report on System Capability to Meet Television Transmission Needs through 1969, December 30, 1965 (in the files of the Corporation).

TABLE XIII

ESTIMATED TELEVISION CIRCUIT REQUIREMENTS (1972-1978)
ON AN INTELSAT SYSTEM

| Communicating Areas (1) | Television circuit estimates for communicating areas, Comsat Corp.[a] (2) | Regional pair(s) for which communicating areas serve as "proxy"[b] (3) | Circuit Estimates for each regional pair (1972-1978)[c] (4) |
|---|---|---|---|
| U.S.-Hawaii | 240 | $28^{2}$-$28^{3}$ | 480 |
| U.S.-Japan | 120 | $28^{2}$-25 | 240 |
| U.S.-Australia | 120 | $28^{2}$-26 | 240 |
| U.S.-Puerto Rico | 120 | $28^{1}$-30 | 240 |
| U.S.-Europe | 240 | 1-$28^{1}$ | 40 |
| | | 2-$28^{1}$ | 40 |
| | | 3-$28^{1}$ | 40 |
| | | 4-$28^{1}$ | 40 |
| | | 5-$28^{1}$ | 40 |
| | | 6-$28^{1}$ | [illegible] |
| | | 7-$28^{1}$ | 40 |
| | | 8-$28^{1}$ | 40 |
| | | 9-$28^{1}$ | 40 |
| | | 10-$28^{1}$ | 40 |
| | | 11-$28^{1}$ | 40 |
| | | 12-$28^{1}$ | 40 |

| (1) | (2) | (3) | (4) |
|---|---|---|---|
| U.S.-South America | 120 | 28[1]-31 | 60 |
| | | 28[1]-32 | 60 |
| | | 28[1]-33 | 60 |
| | | 28[1]-34 | 60 |
| Hawaii-Europe | 120 | 1-28[3] | 20 |
| | | 2-28[3] | 20 |
| | | 3-28[3] | 20 |
| | | 4-28[3] | 20 |
| | | 5-28[3] | 20 |
| | | 6-28[3] | 20 |
| | | 7-28[3] | 20 |
| | | 8-28[3] | 20 |
| | | 9-28[3] | 20 |
| | | 10-28[3] | 20 |
| | | 11-28[3] | 20 |
| | | 12-28[3] | 20 |
| Japan-Europe | 120 | 1-25 | 20 |
| | | 2-25 | 20 |
| | | 3-25 | 20 |
| | | 4-25 | 20 |
| | | 5-25 | 20 |
| | | 6-25 | 20 |
| | | 7-25 | 20 |
| | | 8-25 | 20 |

| (1) | (2) | (3) | (4) |
|---|---|---|---|
| | | 9-25 | 20 |
| | | 10-25 | 20 |
| | | 11-25 | 20 |
| | | 12-25 | 20 |
| Canada-Australia | 120 | 26-27 | 240 |
| Australia-Europe | 120 | 1-26 | 20 |
| | | 2-26 | 20 |
| | | 3-26 | 20 |
| | | 4-26 | 20 |
| | | 5-26 | 20 |
| | | 6-26 | 20 |
| | | 7-26 | 20 |
| | | 8-26 | 20 |
| | | 9-26 | 20 |
| | | 10-26 | 20 |
| | | 11-26 | 20 |
| | | 12-26 | 20 |
| Canada-Europe | 120 | 1-27 | 20 |
| | | 2-27 | 20 |
| | | 3-27 | 20 |
| | | 4-27 | 20 |
| | | 5-27 | 20 |
| | | 6-27 | 20 |
| | | 7-27 | 20 |

| (1) | (2) | (3) | (4) |
|---|---|---|---|
| | | 8-27 | 20 |
| | | 9-27 | 20 |
| | | 10-27 | 20 |
| | | 11-27 | 20 |
| | | 12-27 | 20 |
| Europe-South America | 120 | 1-31 | 5 |
| | | 2-31 | 5 |
| | | 3-31 | 5 |
| | | 4-31 | 5 |
| | | 5-31 | 5 |
| | | 6-31 | 5 |
| | | 7-31 | 5 |
| | | 8-31 | 5 |
| | | 9-31 | 5 |
| | | 10-31 | 5 |
| | | 11-31 | 5 |
| | | 12-31 | 5 |
| | | 1-32 | 5 |
| | | 2-32 | 5 |
| | | 3-32 | 5 |
| | | 4-32 | 5 |
| | | 5-32 | 5 |
| | | 6-32 | 5 |
| | | 7-32 | 5 |
| | | 8-32 | 5 |

| (1) | (2) | (3) | (4) |
|---|---|---|---|
| | | 9-32 | 5 |
| | | 10-32 | 5 |
| | | 11-32 | 5 |
| | | 12-32 | 5 |
| | | 1-33 | 5 |
| | | 2-33 | 5 |
| | | 3-33 | 5 |
| | | 4-33 | 5 |
| | | 5-33 | 5 |
| | | 6-33 | 5 |
| | | 7-33 | 5 |
| | | 8-33 | 5 |
| | | 9-33 | 5 |
| | | 10-33 | 5 |
| | | 11-33 | 5 |
| | | 12-33 | 5 |
| | | 1-34 | 5 |
| | | 2-34 | 5 |
| | | 3-34 | 5 |
| | | 4-34 | 5 |
| | | 5-34 | 5 |
| | | 6-34 | 5 |
| | | 7-34 | 5 |
| | | 8-34 | 5 |
| | | 9-34 | 5 |

| (1) | (2) | (3) | (4) |
|---|---|---|---|
| | | 10-34 | 5 |
| | | 11-34 | 5 |
| | | 12-34 | 5 |
| Canada-South America | 120 | 27-31 | 60 |
| | | 27-32 | 60 |
| | | 27-33 | 60 |
| | | 27-34 | 60 |

[a]From Communications Satellite Corporation, Working Paper, Report on System Capability to Meet Television Transmission Needs Through 1969, December 30, 1965, p. 2 (in the files of the Corporation).

[b]As explained <u>supra</u>, p. 211, and <u>infra</u>, p. 218, especially n. 2.

[c]As explained <u>infra</u>, pp. 218-21.

areas.[20]

2. The requirements of Column 1 pairs one or both of whose members represent a geographical aggregate--i.e. Europe and South America--were assumed to be allocated to the various regions (1 through 12, 31 through 34) composing the aggregate. Circuit requirements for reporting Column 1 pairs involving a single country and Europe as the other member were arbitrarily allocated equally to all twelve European regions (1-12), with one-twelfth of the U.S.-Europe requirement allocated to each regional pair. Estimates for pairs involving a single country and South America as the other member were arbitrarily allocated equally to all four South American regions (31-34), with one-fourth of the United States-South America requirement allocated to each regional pair. And estimates for Europe-South America were treated as estimates involving forty-eight regional pairs, as each of the four South American regions (31-34) was assumed to communicate with each of the twelve European regions (1-12), with the Europe-South America requirement allocated equally to all forty-eight regions. Column 3 of Table XIII reports the regional pairs for which each set of communicating areas of Column 1 serves as "proxy".

The assumption of equal circuit allocation to each

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20U.S. is a "proxy" for Regions $28^1$ or $28^2$ depending upon whether the non-U.S. member of the communicating pair in question is trans-Pacific ($28^2$) or trans-Atlantic ($28^1$); Hawaii is a "proxy" for $28^3$; Japan is a "proxy" for 25; Australia for 26; Puerto Rico for 30; Europe for 1 through 12; South America for 31 through 34; Canada for 27.

region within a geographical aggregate was arbitrarily chosen in the absence of more specific information as to what actual proportion of use would arise from each of the twelve, four, or forty-eight pairs requiring European and/or South American circuits.[3]

3. All hourly television circuit requirements for the policy period of T1 technology 1968 through 1971 were assumed to be "occasional," and thus met from existing non-peak capacity, not adding to system capacity requirements. Thus the hourly circuit requirements from television use in the period 1968-1971 were assumed to be zero, as their occasional and off-peak nature dictates. This assumption is in the spirit of the working paper of Communications Satellite Corporation which presented the basic data.[4]

4. It was assumed that requirements will build up over time from the initial non-peak-capacity occasional requirements of the early policy period of 1968-69, until they

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[3]It should be noted that simultaneous television transmission to more than one European and/or South American region (e.g. an Olympic telecast from Mexico to both French and British ground stations simultaneously) requires the same amount of satellite capacity as transmission involving only one regional pair (e.g. Mexico to Britain). This is because the multiple transmission will be accomplished via multiple ground stations receiving or sending the same satellite signal (connecting to the same satellite circuit) rather than through multiple satellite signals or circuits being required. Source: Communications Satellite Corporation, Working Paper, Report on System Capability to Meet Television Transmission Needs through 1969, December 30, 1965, pp. 2-3 (in the files of the Corporation).

[4]Communications Satellite Corporation, Working Paper, Report on System Capability to Meet Television Transmission Needs through 1969, December 30, 1965, p. 16.

represent double the circuit requirements of 1968-71 by the beginning of the new, higher-capacity T2 satellite system in 1972. This appears to be as "reasonable" an assumption as any other which could be made in the absence of an authoritative post-1970 forecast, both in light of expected television communications growth throughout the period and of the higher T2 capacity satellites expected to be available in 1972 to satisfy television circuit requirements.

5. It was assumed that the "doubled" requirements beginning in 1972 are additive upon intelsat capacity. This is because the higher levels of capacity needed to satisfy television requirements will be more readily available with the advent of T2 technology assumed to begin in 1972.[5]

6. It was assumed that the doubled, on-peak requirements beginning in 1972 will not change through 1978. The estimated 1972 television circuit requirements include one or two television channels of 120 circuits each[6] for almost all the major international communications routes, a number which appears adequate to satisfy their requirements for a seven year period.

7. Television requirements between non-major routes were not assumed to add to satellite capacity needs in the

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[5]Communications Satellite Corporation, Working Paper Summarizing the Considerations Leading to a Deployment Schedule for Satellites, December, 1965, p. 5 (in the files of the Corporation).

[6]Communications Satellite Corporation, Working Paper, Report on System Capability to Meet Television Transmission Needs through 1969, December 30, 1965, p. 6.

policy period. Non-major routes were assumed to use off-peak intelsat capacity for television transmission purposes, or else to sub-lease existing television peak requirements circuits from on-peak users on an occasional basis at times when they will not be used.

8. Estimated television circuit requirements were assumed to prevail for all hours of the "typical" day in each year of the policy period. While this is not particularly realistic, there was no way to define precisely the hours during which each inter-regional pair could be expected to require circuits for television use. Special events for which a live telecast demand existed could make almost any hour one in which television circuit requirements arose.

Given the above eight assumptions, Column 4 of Table XIII summarizes the hourly circuit requirements for each regional pair of Column 3 for the period 1972 through 1978, the years for which they were estimated to be greater than zero. All pairs not indicated in Columns 3 and 4 were assumed to have television circuit requirements of zero for the entire policy period.

Estimation of Special Circuit Requirements

Certain requirements on capacity were estimated which did not fall under the conventional telephone, telegraph, telex, and television designations. These were the requirements of the United States government for the Apollo moon project, estimated to be 150 circuits of Atlantic Ocean satellite capacity, and 100 circuits of Pacific Ocean capacity.[7]

When under activation, the project will require intelsat capacity for a continuous sequence of hours; and so the requirements of 150 and 100 circuits were estimated to exist for all hours of the "typical" policy day.

Although the Appolo project will conclude during the early to middle years of the policy period, it was assumed in the absence of additional information or projections that the 150 and 100 circuit requirements will continue at the same level for all policy years as the United States moves from Apollo to other space projects.

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[7]Communications Satellite Corporation, Working Paper Summarizing the Considerations Leading to a Deployment Schedule for Satellites, December, 1965, pp. 2-3 (in the files of the Corporation).

# APPENDIX C

## DERIVATION OF ORIGINAL ASSET VALUES AND OPERATING EXPENSES

Detailed discussion follows of the derivation of the original values of the six assets of the intelsat system, and of the five annual operating expenses. The first section discusses derivation of asset values; the second is concerned with the derivation of operating expenses.

### Derivation of Original Values of the Six Intelsat System Assets

The method by which the values of each of the six assets of the intelsat system--the "going concern asset; the command and control center; the orbiting satellite asset; the general and administrative asset; the ground stations; and the working capital asset--is discussed below for each asset.

"Going concern" asset value: the investment cost of getting started. The value of this asset was estimated in two stages. First, the four components of the "investment cost of getting started" were estimated and summed. Then the value derived from the summation was adjusted to reflect the fact that some of the component costs in the estimate have not been and/or will not be incurred in connection with the initiation of a post-1967 intelsat system, and so should not be charged to the cost of initiating such a system. Each of the stages is discussed in order.

The four components of the investment cost of getting started which were summed to form an unadjusted estimate of total asset value are: (1) the cost of experimental operational satellites; (2) the cost of engineering designs and the development of prototype satellites preparatory to decision on a final system; (3) the cost of a limited system before the full 1968 system is put in place; and (4) the cost of general organization.

These components were assumed to be private cost components, and so do not include those costs incurred through government spending which might be of benefit to an intelsat system. It was assumed that the money value of government costs (e.g. National Aeronautics and Space Administration research) is offset by the value of corresponding benefits to government (i.e. externalities not measured by the market, like international prestige), so that government has no role in the costing process for an intelsat system.

These four cost components were estimated as follows:

The first three were directly from Communications Satellite Corporation.[1] They are $23 million, $60 million, and $45 million respectively.[2]

The last component--organization cost--was estimated

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[1]Letter from William Kaht, Member, Technical Staff, Communications Satellite Corp., Washington D.C., April 13, 1966.

[2]Alternative estimates for cost components (1) and (2) were available. Source was U.S. Congress, House, Committee on Government Operations, Satellite Communications (Military-Civil Roles and Relationships), 89th Cong., 1st Sess., 1965, p. 33.

using various methods on a combination of sources for each of the years 1963 through 1967, from the time pre-system work began until its assumed time of termination. The five estimates obtained were then added.

The estimates and their method of derivation follow below for each of the five years.

1. The organization cost estimate for 1963 was $.94 million.[3] The figure was derived by taking the total of preliminary research and development and organization expenses for 1963, the first year of preliminary work on the intelsat system, of $1.013 million; subtracting $.173 million for survey and research and development expenses; and adding $.00125 million for interest on notes payable due to organization expenses and $.101 million for purchases of furniture, office equipment, automobiles, and leasehold costs.

2. The organization cost estimate for 1964[4] was $2.6 million. It was obtained by taking the total of salaries of officers and employees of $1.332 million and adding estimates for legal and other professional fees; data processing costs and equipment rental; travel and related expenses; printing, stationery, rent, and other office expenses; registrars' and transfer agents' fees; stockholders' report and meeting expense; employees' relocation expenses and insurance benefit

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[3]Communications Satellite Corporation, Prospectus (Washington D.C.: Communications Satellite Corp., 1964), pp. 40-1.

[4]Communications Satellite Corporation, Annual Report, 1965, p. 21.

premiums; and taxes and licenses.

3. The organization cost estimate for 1965 was $5.6 million.[5] This was obtained by taking the same components used in the 1964 estimate above: $3.037 million for salaries of officers and employees; and $2.596 million for all the other categories.

4. The organization cost estimate for 1966 was $8.0 million.[6]

5. The organization cost estimate for 1967 was $9.0 million.[7]

The sum of these five annual organization cost components was then taken. It is, rounded to the nearest million, $26 million [$10^6$ times (.94 + 2.6 + 5.6 + 8.0 + 9.0)].

This pre-system organization cost total of $26 million was then added to the estimates for the other three cost components to yield a total, rounded to the nearest million, of $154 million [$10^6$ times (23 + 60 + 45 + 26)].

The second stage of estimation of the value of the cumulative going concern asset was adjustment of the above total of $154 million to reflect the fact that some of the cost components of that estimate have not been and/or will not be incurred in connection with the initiation of a post-1967 intelsat system, and so should not be charged to

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[5] Ibid.

[6] Letter from Bruce Matthews, Financial Vice-President, Communications Satellite Corporation, Washington D.C., August 16, 1966.

[7] Ibid.

the cost of initiating such a system. Three such adjustments on the $154 million were necessary.

1. An adjustment was necessary to reflect the fact that some "costs of getting started" are applicable to meeting United States domestic requirements, rather than intelsat requirements. It was assumed here that half of the organizational costs of $26 million fit this category (e.g. cost of domestic licenses and taxes, cost of workers involved in solving domestic communication problems such as for lawyers filing briefs), and so were deducted from $154 million.

2. A second adjustment was necessary to reflect the fact that some pre-1968 "costs of getting started" were incurred for the specific purpose of implementing the Apollo moon project, which is unrelated to provision of an intelsat system. It was assumed that government payment for these is exactly equal to the cost of providing them, and is deducted from $154 million.

The Apollo amount deducted was estimated on the assumption that government will use 250 telecommunications circuits[8] and will pay the intelsat consortium the current charge of $.04 million per circuit per year[9] for the year 1967.[10]

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[8] Communications Satellite Corporation, Working Paper Summarizing the Considerations Leading to a Deployment Schedule for Satellites, December, 1965, pp. 2-3 (in the files of the Corporation).

[9] Letter from Bruce Matthews, Loc. cit.

[10] Communications Satellite Corporation, Working Paper Summarizing the Considerations Leading to a Deployment Schedule for Satellites, December, 1965, p. 3 (in the files of the Corporation). This Working Paper indicates the charge really began in the fall of 1966.

Thus $10 million ($.04 million multiplied by 250) was subtracted from $154 million. After 1967, Apollo circuit requirements were assumed to be added to the telephone, telegraph, telex, and television circuit requirements, as explained in Chapter II and Appendix B.

3. Another deduction from the $154 million investment cost of getting started comes from the offsetting revenue generated for the system as a result of pre-system costs incurred up to the beginning of the system in 1968. There are two such revenues: (a) revenue earned on pre-system funds before they are committed to investment in establishing and maintaining the intelsat system; and (b) revenue to intelsat from providing circuits that are commercially available as a sideline result of pre-system tests and launches.

Derivation of each of these types of offsetting revenue is discussed in order.

Unadjusted values of the first offsetting revenue for each year before the system is begun are presented in Table XIV below. The estimate of zero for 1967 was based on the assumption that all pre-system funds would be committed to use by then.[11] These five unadjusted values of Table XIV

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[11]Actually they have not been. Some of the 1967 first quarter net income of $1.23 million for Communications Satellite Corporation is revenue from investment of pre-system funds. Source is Wall Street Journal, April 11, 1967, p. 3. Thus the amount of pre-systems revenue that offsets the investment cost of getting started is understated, and "going concern" asset value thus overstated, although the extent of the mis-statement cannot be estimated, since the earnings report did not present income from investment of pre-system funds as a meaningful separate category.

were summed and then adjusted to reflect the fact that a part of the sum is allocable to the provision of United States ground stations for domestic communications satellites and rather than to an intelsat system. According to Communications Satellite Corporation, 45 percent of the unadjusted five-year pre-system revenue sum is allocable to such domestic United States ground stations.[12] Thus the adjusted total for this first type of pre-system revenue was estimated to be [illegible] million, rounded to the nearest million; i.e., [illegible] percent of the rounded five-year pre-system revenue sum from Table [illegible] of $21.8 million.

The second type of pre-system revenue, from circuits sold commercially on Early Bird [illegible], is estimated below in Table XV for each pre-system year. The estimates for 1968 and 1969 were based on the assumption that 720 circuits would be available during [illegible] as left-overs from pre-system circuit provision. These circuits are presumed to cease operation by the end of [illegible].[13] Each of the 720 circuits is assumed to be leased during [illegible] at a rate of $40,000 per year, [illegible].[14]

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[12] Letter from Bruce [illegible], *loc. cit.*, [illegible] that $110 million of $200 million [illegible] for intelsat investment; and [illegible] for domestic United States ground station investment.

[13] Communications Satellite Corporation, [illegible] Paper Summarizing the Consideration [illegible] for Satellites, December, 1965, [illegible] Corporation).

[14] Letter from Bruce [illegible], *loc. cit.*

TABLE XIV

TOTAL REVENUE FROM PRE-1968 TEMPORARY INVESTMENTS

| Year | Amount (millions of dollars) |
|---|---|
| 1963 | .385* |
| 1964 | 4.3 † |
| 1965 | 8.1 † |
| 1966 | 9.0 ‡ |
| 1967 | 0.000 ‡ |

*Based on Communications Satellite Corporation, Annual Report, 1964, p. 17

†Based on Communications Satellite Corporation, Annual Report, 1965, p. 19

‡Based on Letter from Bruce Matthews, Financial Vice-President, Communications Satellite Corporation, Washington D.C., August 16, 1966.

TABLE XV

TOTAL REVENUE FROM CIRCUIT PROVISION

VIA PRE-SYSTEM CAPACITY

| Year | Amount (millions of dollars) |
|---|---|
| 1965 | 2.0* |
| 1966 | 3.0† |
| 1967 | 18.0† |
| 1968 | 28.8‡ |
| 1969 | 28.8‡ |

*Based on Communications Satellite Corporation, Annual Report, 1965, p. 19

†Based on Letter from Bruce Matthews, Financial Vice-President, Communications Satellite Corporation, Washington D.C., August 16, 1966.

‡Based on Communications Satellite Corporation, Working Paper Summarizing the Considerations Leading to a Deployment Schedule for Satellites, December, 1965 (in the files of the Corporation); and Letter from Bruce Matthews, loc. cit.

Thus $28.8 million ($40,000 multiplied by 720) of pre-system revenue from circuit provision is assumed for each of two years. The total for this second type of offsetting revenue, derived by summing the revenues from Table XV for each of the five years 1965 through 1969, and rounded to the nearest million, is $80.6 hundred.thousand.

The total offset to the original $154 million of "going concern" asset costs arising from both types of pre-system revenue was thus estimated to be $92.6 million, the sum of the adjusted value of the first type--$12.0 million--and of the second revenue value directly above of $80.6 million.

The total of all three deductions from the initial pre-systems cost estimate of $154 million is $115.6 million ($13 million plus $10 million plus $92.6 million.)

Thus the original value of the "going concern" asset was estimated to be $154 million minus $115.6 million, or $38.4 million.

<u>Command and control center original asset value</u>. The command and control center is the location for central satellite tracking and routing facilities, and includes a computer as part of its operations. Original capital cost of the command and control center was estimated directly by Communications Satellite Corporation as $11 million--composed of $6 million for the center and $5 million for the computer.[15]

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[15] Letter from William Kaht, Member, Technical Staff, Communications Satellite Corporation, Washington D.C., April

2. Launches of the T1 satellites are expected to cost \$5.5 million, and those of the heavier satellites of the T2 system \$6.5 million. [illegible] satellite [illegible] heavier satellite [illegible] requires more booster [illegible] power than the T1 satellite, and thus, even though estimated to cost less, involves higher launch costs.[17]

3. Probability of a successful launch was estimated at .9 for the T1 satellite, and is expected to increase to .95 for the T2 satellite.[18]

4. Given the requirements estimates of Chapter II, the number of satellites which it was assumed will be needed in each year is estimated to be four for 1968, the first year of the T1 system, and four also for 1969. It was estimated that a fifth T1 satellite will be required in 1970, and a sixth in 1971 to satisfy the expanded needs of those years. For the first year of the T2 system in 1972, all T1 satellites were assumed fully depreciated and replaced by the higher

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[17] The figure of \$5.5 million is [illegible] paid the National Aeronautics and Space Administration [illegible] 7, 1967, p. [illegible] The figure of \$6.5 million [illegible] Communications Satellite [illegible] estimate [illegible]

[18] [illegible] Communications Satellite Corporation estimates .9 at present [illegible] is still [illegible] to [illegible]. Source is letter from William [illegible], Member, Technical Staff, Communications Satellite Corporation, Washington, D. C., April [illegible], 1966; and this is corroborated in a letter from [illegible], Manager, Communication Satellite Program, Advanced Program Development, Hughes Aircraft Company, El Segundo, California, March 7, 1966.

Original asset value of orbiting satellites. To obtain estimates for the value of the orbiting satellite asset, values first had to be estimated for its four cost components, and then additional assumptions made with respect to the way these components entered the cost function.

The four cost components are: (1) the original cost of a given satellite of both technologies; (2) the launch cost of a satellite under both technologies; (3) the probability of launch success; (4) the number of satellites and launches which will be required as well as the year in which it is estimated they will be required for each technology.

The estimation of each of the four components is explained in order.

1. Each satellite of the first technology, with a guaranteed five-year life, was estimated to cost $5.33 million; and each satellite of the second technology, was estimated to cost $3.5 million.[16]

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(footnote 15 continued) 13, 1966. For a more detailed description of command and control facilities, see Kenneth Gatland (ed.), Telecommunication Satellites (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1964), pp. 63, 109, 121, 131. Gatland estimates the value of command and control facilities at a capital cost of $24 million (p. 391); in U.S. Congress, House, Committee on Government Operations, Satellite Communications (Military-Civil Roles and Relationships), 89th Cong., 1st Sess., 1965, pp. 32-3, the estimated value ranges from $9 million to $10 million.

[16] Letter from William Kahe, Member, Technical Staff, Communications Satellite Corporation, Washington D.C., October 10, 1966; and Letter from Herbert Rosen, Manager, Public relations, TRW Systems Inc., Redondo Beach, California, October 3, 1966.

capacity satellites, assumed sufficient to satisfy all requirements until the beginning of 1976. It was estimated that by this time requirements will have grown to the point that a fourth T2 satellite is needed, and these four were assumed to remain sufficient for the remainder of the seven-year life of the T2 system.

The assumption was further made that each satellite will be launched separately, as is the case at present.[19]

Table XVI shows the schedule of satellite launches.

TABLE XVI

SCHEDULE OF SATELLITE LAUNCHES

| Year | Number of launches of satellites |
|---|---|
| 1968 | 4 launches (4 T1 satellites) |
| 1969 | 0 |
| 1970 | 1 launch (1 T1 satellite) |
| 1971 | 1 launch (1 T1 satellite) |
| 1972 | 3 launches (3 T2 satellites) |
| 1973 | 0 |
| 1974 | 0 |
| 1975 | 0 |
| 1976 | 1 launch (1 T2 satellite) |
| 1977 | 0 |
| 1978 | 0 |

[19] It should be noted that the orbiting of multiple satellites by using only a single launch vehicle is distinctly possible in the future. Source is Letter from F. D. Vieth, loc. cit.

These estimates of satellite number and time were derived by a linear programming problem specifying the minimum number of satellites (and therefore launches) needed to satisfy the circuit requirement of each policy year.

Notationally, the problem was to minimize the objective function as follows:

$$\text{Min } U_y = \lambda_y^1 + \lambda_y^2 + \lambda_y^3$$

where y = a year of the period of 1968 through 1978, and ranges from a value of 1 for 1968 through 11 for 1978;

$U_y$ = the total number of satellites needed over the Atlantic, Pacific, and Indian Oceans in year y;

$\lambda_y^1$ = the total number of satellites needed over the Atlantic Ocean in year y;

$\lambda_y^2$ = the total number of satellites needed over the Pacific Ocean in year y;

$\lambda_y^3$ = the total number of satellites needed over the Indian Ocean in year y.

The function was subject to the following six constraints:

(1) $\overline{C}_y \lambda_y^1 \geq R_{1,y}^m$

(2) $\overline{C}_y \lambda_y^2 \geq R_{2,y}^m$

(3) $\overline{C}_y \lambda_y^3 \geq R_{3,y}^m$

(4) $\overline{C}_y \lambda_y^1 + \overline{C}_y \lambda_y^3 \geq R_{1,y}^m + R_{4,y}^m$

(5) $\overline{C}_y \lambda_y^2 + \overline{C}_y \lambda_y^3 \geq R_{2,y}^m + R_{3,y}^m + R_{5,y}^m$

(6) $\overline{C}_y \lambda_y^1 + \overline{C}_y \lambda_y^2 + \overline{C}_y \lambda_y^3 \geq R_{1,y}^m + R_{2,y}^m + R_{3,y}^m + R_{4,y}^m + R_{5,y}^m$

$\overline{C}_y$ is the circuit capacity of any single satellite in the system, and was assumed to have a value of 1200 circuits for the four years y=1,2,..4 of T1 technology; and 6000 circuits for each year y=5,6,...11 of T2 technology.[20] $R^m_{1,y}$ is the circuit requirement accommodated only by the Atlantic Ocean satellite(s) for a given hour of London time designated by superscript m of a "typical" day in year y, where m ranges from 1 for 12:00 A.M. London time through 24 for 11:00 P.M. London time. The values of $R^m_{1,y}$ are given, it will be recalled, in Table I for all m=1,2,..24 and all y=1,2,11.[21] Likewise, $R^m_{2,y}$; $R^m_{3,y}$; $R^m_{4,y}$; and $R^m_{5,y}$ are the circuit requirements accommodated respectively only by the Pacific Ocean satellite(s) ($R_2$); only by the Indian Ocean satellite(s) ($R_3$); by either the Atlantic or Indian satellite(s) ($R_4$); and by either Indian or Pacific satellite(s) ($R_5$). Again, the requirements are for standardized hours of London time m (m=1,2,..24) of the "average" day of year y (y=1,2,..11). The values for the four types of circuit requirements $R^m_{2,y}$, $R^m_{3,y}$, $R^m_{4,y}$, and $R^m_{5,y}$ are given for all m=1,2,..24 of y=1,2,..11 in the four Tables II through V respectively.[22]

The meaning of the six constraints is as follows:

Constraints (1), (2), and (3) indicate that the capacity

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[20] Letter from Herbert Rosen, loc. cit.; and Letter from William Katt, Member, Technical Staff, Communications Satellite Corporation, Washington D.C., October 10, 1966.

[21] Supra, p. 44.

[22] Supra, pp. 45-6.

of Atlantic, Pacific, and Indian Ocean satellites must equal or exceed the circuit requirements which must be met by these three capacities respectively, for each hour m of each year y.

The fourth constraint indicates that the total requirements on joint Atlantic-Indian capacity for every m,y--i.e. requirements which must be met by Atlantic and Indian satellites, as well as those which may be met by either the Atlantic or the Indian satellite(s)--must not exceed combined Atlantic and Indian Ocean satellite capacity.

The fifth constraint indicates that the total requirements on joint Indian-Pacific capacity for every m,y--i.e. requirements which must be met by Indian and Pacific satellites, as well as those which may be met by either the Indian or Pacific satellite(s)--must not exceed combined Indian and Pacific Ocean satellite capacity.

The sixth constraint indicates that total requirements on combined Atlantic, Indian, and Pacific capacity--i.e. all requirements which must be met by one of the three types of satellite, and all requirements which may be met by one of two types--must not exceed total Atlantic, Indian, and Pacific Ocean satellite capacity.

Given the values of $R^m_{1,y}$, $R^m_{2,y}$, $R^m_{3,y}$, $R^m_{4,y}$, and $R^m_{5,y}$ from Tables I-V, and the values of $\overline{C}_y$, the solution $U_y$ to the linear programming problem followed. $U_y$ equals four (satellites and launches) for 1968 and 1969 (y=1,2); $U_y$ equals five (satellites and launches) for 1970 (y=3); $U_y$

equals six (satellites and launches) for 1971 (y=4); $U_y$ equals three (satellites and launches) for 1972 through 1975 (y=5,6,7,8); and $U_y$ equals four (satellites and launches) for 1976 through 1978 (y=9,10,11).

Thus, given the assumptions of the problem, and as indicated in Table XVI, four satellites and launches are needed at the beginning of the T1 system in 1968 ($U_{y=1}$ equals four); three at the beginning of the T2 system in 1972 ($U_{y=5}$ equals three); one at the beginning of 1970 ($U_{y=3}$ minus $U_{y=2}$ equals one); one at the beginning of 1971 ($U_{y=4}$ minus $U_{y=3}$ equals one); and one at the beginning of 1976 ($U_{y=9}$ minus $U_{y=8}$ equals one).

Given these four cost components and their method of derivation, it was necessary to make additional assumptions with respect to the way these components entered the cost function.

Original asset values were assumed to exist separately for each system. The original asset value of the T1 system was assumed to be the same for four years 1968 through 1971, and then, completely depreciated, is assumed to give way to the original asset value of the T2 system in 1972, which is assumed to be the same for the entire period 1972 through 1978.

The value of T1 satellite assets, unadjusted for the possibility of launch failure, was assumed equal to the value of all T1 asset-creating expenditures made on the components of the T1 system from 1968 through 1971, with those made after the beginning of 1968 discounted back to their present value at the beginning of 1968. Likewise, the value of T2 satellite assets, unadjusted for the possibility of launch failure, was assumed equal to the value of all T2 asset-creating expenditures made from 1972 through 1978 on the components of the T2 system, with those made after 1972 discounted back to their present value at the beginning of 1972.

Asset-creating expenditures for the six T1 satellites were assumed to be made entirely in 1968, even though they will not all be needed then. This assumption was made because comsats are a product which is made-to-order as part of a specific production run, and not produced on the kind of continuous basis by which they can be bought as needed.[23] Likewise, all four T2 system satellites were assumed to be bought at the beginning of 1972.

However, asset-creating expenditures on launches were assumed to be made as the launches are needed, and their post-1968 and post-1972 expenditure values discounted back to present value at the beginning of their respective periods in 1968 and 1972. From Table XVI above, the launches needed at the beginning of 1970 and 1971 are assumed to be purchased then rather than at the beginning of 1968, with their purchase value discounted back to the beginning of 1968 using the constant rate of return on capital of 8 percent as a discount

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[23]Six satellites of 1200 circuits each have in fact been purchased from TRW Systems, Inc. as part of one order. Source is Letter from Herbert Rosen, loc. cit.

rate. Likewise, from Table XVI, the launch needed in 1976 is assumed to be discounted back to the initiation of the T2 system in the beginning of 1972.[24] This assumption was based on the fact that the National Aeronautics and Space Administration, whom Communications Satellite Corporation as intelsat manager pays to launch its satellites, will have launch capacity available as needed, for which the Corporation will pay the marginal cost of launches.[25]

For final estimation of the original value of the orbiting satellite assets of both technologies, it was necessary to adjust the present values for each system to reflect the possibility of launch failure. Since for the T1 system it is estimated that nine of every ten satellite launches result in successful placements, the present value of T1 system assets--six satellites at $6.33 million each and six launches, four at $3.5 million each and two for which the $3.5 million spent in 1970 and 1971 is discounted back to the beginning of 1968--was divided by nine-tenths. Likewise, the present value of T2 system assets--four satellites at $3.5 million each and four launches, three at $6.5 million each

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[24]The discount factor applied to post-1968 and post-1972 asset-creating expenditures is the standard $\frac{1}{(1+\rho)^n}$, from supra, p. 81, n. 11; where $\rho$ is the rate of return on capital of .08 (from supra, pp. 77-8) and n is the difference between the year in which an asset-creating launch expenditure is made and the year of the beginning of the system to which that launch is appropriate.

[25]Letter from William Kaht, Member, Technical Staff, Communications Satellite Corporation, Washington D.C., April 13, 1966.

and one for which the $6.5 million assumed to be spent in 1976 is discounted back to the beginning of 1972--was divided by the higher probability of launch success of .95 in the T2 period.

<u>Original value of general and administrative assets</u>. Total original general and administrative asset value was derived by summing the values of all annual asset-creating general and administrative expenditures for the entire policy period 1968 through 1975, after discounting those made after 1968 into their present value in 1968 using an appropriate rate of discount.

Here the value of asset-creating expenditures for any given year was found by first multiplying total annual general and administrative expenditures--both asset-creating and non-asset-creating--by the proportion of them estimated to be asset-creating.

Total (asset-creating and non-asset-creating) annual general and administrative expenditure was found by: (1) assuming a constant general and administrative expenditure per required circuit for all policy years; and (2) multiplying this constant per circuit amount by estimated total annual circuit requirements.

The constant expenditure assumption is a simplifying one, based on lack of knowledge of the exact way in which specific general and administrative expenditures vary with number of customers and the circuits these customers require. It seemed reasonable to assume, however, that general and administrative costs increase directly with customer requirements. This constant annual total expenditure per circuit was assumed to be $1,357, from an estimate by Communications Satellite Corporation.[26]

The total annual intelsat circuit requirement for each policy year by which constant general and administrative cost per circuit was multiplied to yield total annual general and administrative cost was again the sum for all five types of satellite coverage of the peak hourly requirements of the "typical" day of each policy year.[27]

Given the value of annual total asset-creating and non-asset-creating general and administrative expenditures for each year, the proportion of the total which was estimated to result in the creation of assets--a proportion estimated to be one-tenth--was multiplied by total expenditure

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[26] Based on Letter from William Kaht, Member, Technical Staff, Communications Satellite Corporation, Washington D.C., April 13, 1966. This estimate represents the result of scaling down an original estimate by one-half to reflect the fact that some proportion of general and administrative expenses are exclusively for the benefit of U.S. communications customers served by Communications Satellite Corp. in its domestic role, and thus are not charged to the international space segment. The pre-adjusted estimate was consistent with an independent pre-adjusted estimate in Kenneth Gatland (ed.), *op. cit.*, p. 407.

[27] These total annual intelsat circuit requirements were derived from values in *supra*, Tables I through V, pp. 44-8. Their method of derivation is explained in *supra*, pp. 84-85. The resultant intelsat circuit requirements for each year are as follows: for 1968, 3684 circuits; for 1969, 4254 circuits; for 1970, 5633 circuits; for 1971, 6385 circuits; for 1972, 12,047 circuits; for 1973, 13,034 circuits; for 1974, 14,166 circuits; for 1975, 15,480 circuits; for 1976, 17,022 circuits; for 1977, 18,851 circuits; for 1978, 21,060 circuits.

for each year 1968 through 1975 in order to obtain a value for annually created general and administrative assets.[28]

Thus given total asset-creating general and administrative expenditures for each policy year, a total general and administrative asset value for all policy years 1968-1975 was found by discounting the value of all annual asset-creating general and administrative expenditures for 1968 through 1975 into their present value in 1968, and then summing the resultant values. Discounting was done by using the discount factor indicated for this asset in Chapter IV.[29]

<u>Original value of ground station assets.</u> The ground station system was assumed to consist of thirty-nine stations for the entire policy period. All ground stations were assumed to be introduced in the beginning of 1968.[30] One station was assumed for each of the thirty-seven regions 1 through 27, $28^1$, $28^2$, $28^3$, $28^4$, and 29 through 34; and an additional station was assumed for each of the two overlapping Atlantic-Indian and Indian-Pacific satellite coverage areas, to serve as a relay station for multi-satellite-using

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[28] The value of one-tenth was estimated to be a constant for the entire policy period. This is a compromise between estimates ranging from .09 to .12 for certain public utility enterprises (i.e. electric power). Source: Interview with Lionel Thatcher, Professor of Public Utility Economics, University of Wisconsin, Madison, Wisconsin, October 3, 1966.

[29] <u>Supra</u>, p. 81, n. 11.

[30] <u>Supra</u>, p. 81.

pairs.[31]

Each station was assumed to be equipped with two antennas, each of fairly large (85 foot) diameter. Large antennas were chosen rather than those of smaller diameter because smaller antennas, though feasible for lighter traffic regions, involve heavy penalty factors in terms of the satellite circuit bandwidth they require.[32] Each ground station was assumed to have two antennas so that each could receive and/or send to and/or from two satellites simultaneously.[33]

Each ground station was assumed to cost $7 million.[34]

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[31] The question of relay stations for multiple-satellite users has been dealt with previously. Supra, pp. 39-41.

[32] Communications Satellite Corporation, Memorandum from William Kaht to F.J.D. Taylor on the Question of Earth Station Penalty Factors, Washington D.C., October 28, 1965.

[33] It was assumed that traffic can be arranged by an appropriate linear programming specification so that no station receives and/or sends messages from more than two satellites simultaneously. Such a specification is beyond the scope of this paper.

[34] Letter from William Kaht, Member, Technical Staff, Communications Satellite Corporation, Washington D.C., August 9, 1966; and Communications Satellite Corporation, Memorandum from William Kaht to F.J.D. Taylor on the Size of Ground Stations Providing the Lowest Cost Communication for a Given Traffic Level Considering Various Cost per "Equivalent Voice Circuits", Washington D.C., September 29, 1965. Stanford Research Institute estimated $5 to $8 million [Stanford Research Institute, Study of International Telecommunications Policies, Technology, and Economics (Menlo Park, California; Stanford Research Institute, 1966), p. 159]. RAND Corporation estimated $2.8 million in S.H. Reiger, R.T. Nichols, L.B. Early, and E. Dews, Communications Satellites: Technology, Economics, and System Choices, RAND Corporation, Memorandum RM-3487-RC (Santa Monica, Calif.: RAND Corporation, 1961), p. 46. Lastly, a House Committee on Government Operations report estimated $7 to $9 million, in U.S. Congress, House, Committee on Government Operations, Satellite Communications (Military-Civil Roles and Relationships), 89th Cong., 1st Sess., 1965, pp. 32-3.

Thus the total original asset value for all thirty-nine stations assumed purchased at the beginning of 1968 is given as $7 million multiplied by thirty-nine, or $273 million.

In reality, it is estimated that only thirty stations will actually be built or in process by 1968, and that as many as forty-eight will be in place by 1975.[35] Thus the estimate of thirty-nine stations for 1968-1975, all costed from the beginning of 1968, represents a compromise between the 1968 estimate and the 1975 estimate.

Value of working capital asset. For the entire policy period, the value of this asset was assumed to be a fraction of the total annual expenditures arising from the other five assets of the system--i.e. the sum of the five annual capital costs, five depreciation values, and five operating expenses for each year--and could be estimated only after the fifteen annual costs associated with those five assets had been previously estimated.[36]

The fraction representing the proportion of annual working capital to total annual costs was estimated to be a constant value of one-tenth for the entire policy period. This represents a compromise between the only formal estimate with which the author is familiar, and the lower actual data

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[35]Communications Satellite Corporation, Annual Report, 1965, p. 10; and Communications Satellite Corporation, Working Paper, Supporting Material for "Global Traffic and System Planning", ICSC/T-6-51 W/6/65, June 29, 1965, pp. 1-8.

[36]Supra, p. 82.

for a sample of public utilities.[37]

Since different sets of total annual expenditures associated with the five assets were generated for each of two types of depreciation--straight line and use--two different values of the annual working capital asset were generated also, one for each type of depreciation. The values were derived by multiplying each set of total annual expenditures by the constant proportion of annual working capital to total annual costs. In the notation of Chapter IV,[38] the value of the working capital asset using straight line depreciation was as follows:

$$A_y^{j=6} = \left\{.10\right\}\left\{\rho \sum_{j=1}^{5} \left[A_y^j \left(1 - \sum_{y=m}^{y=k} \bar{D}_y^j\right)\right] + \sum_{j=1}^{j=5} \bar{D}_y^j + \sum_{j=1}^{j=5} E_y^j \right\}$$

The value of the working capital asset based on use

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[37]Kenneth Gatland (ed.), op. cit., p. 393, estimated .14. Moody's Public Utility Manual, 1964, indicates that for a sample of four utilities (Pacific Telephone and Telegraph Co., New York Telephone Co., Ohio Bell Telephone Co., and New England Telephone and Telegraph Co.) the ratio of cash to total assets was, respectively, .035, .052, .036, and .048. Figures were for December 31, 1963. Source is Moody's Public Utility Manual, 1964 (New York: Moody's, 1964), pp. 112, 102, 108, and 94 respectively. Still another source indicated that the cash/total asset ratio for all public utilities in 1957 was 3.0 percent and in 1951 was 2.1 percent. Source was U.S. Treasury Dept., Statistics of Income: 1957-1958 (Washington D.C.: Government Printing Office, 1960), pp. 31-8, 41-66. Including the value of near-term highly liquid securities as a component of working capital in these Treasury estimates would probably not raise them the three-fold or four-fold needed to get them to coincide with the Gatland estimate.

[38]Supra, pp. 75-6.

depreciation was calculated as follows:

$$A_y^{j=6} = \{.10\}\left\{\rho \sum_{j=1}^{5} \left[A_y^j \left(1-\sum_{y=n}^{y=k} \hat{D}_y^j\right)\right] + \sum_{j=1}^{5} \hat{D}_y^j + \sum_{j=1}^{5} E_y^j \right\}$$

Thus estimates of the value of working capital were assumed to vary with the value of annual cost components as well as the type of depreciation upon which many of the components were based. Working capital value could therefore only be derived after all annual cost component values were estimated as indicated in Chapter IV and in the remainder of this Appendix.

It will be recalled that the "original" values for all six assets discussed above are summarized in the first seven rows of Table IX above[39] for all policy years 1968 through 1975 in the columns of the Table. A separate set of original working capital values was calculated for each type of depreciation. Those working capital values calculated according to straight line depreciation are presented in the sixth row of the Table; and it was these values which entered total cost equation (1) based on straight line depreciation in Chapter IV.[40] Those working capital values calculated according to use depreciation are presented in the seventh row of the Table; and it was these values which entered total cost equation (2) based on depreciation according to use in Chapter IV.[41]

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[39] _Supra_, p. 89.

[40] _Supra_, p. 76.

[41] _Ibid_.

Derivation of Annual Operating Expenses

All five annual operating expenses were calculated in basically the same way.

For each of the five annual operating expense categories, and in the absence of very specific information, the assumption was made that annual operating expenses were a constant amount per required circuit, so that total operating expenses were assumed to vary with circuit requirements.

For the individual categories of operating expense, this appears to be a somewhat reasonable assumption.[42] For instance, Intelsat can be expected to expand basic continuing research and development activity at least to some extent proportionately with requirements growth over time. Also, as requirements grow, the growing complexities of central tracking, switching, and routing can be assumed to increase the annual operating expense of the command and control center in some proportion. The assumption that total general and administrative operating expenses vary proportionately with circuit requirements appears reasonable in light of the fact that greater customer requirements create the need for more

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[42] Operating expenses associated with orbiting satellites were assumed to be a constant amount per required circuit, and to increase proportionately with circuit requirements. The dollar amounts were estimated to be so negligible, however, that this operating expense was assumed to be zero for the entire policy period. This assumption was made because energy cost is slight, and the increased annual repair and maintenance cost which would ordinarily accompany increased annual utilization of any asset does not exist here since orbiting satellites cannot realistically be brought back to earth for such repair and maintenance. Further elaboration is given *infra*, pp. 251-2.

clerical, office, and related expenditures. Lastly, ground station operating expense can be expected to increase commensurately with growth in requirements, since increased system utilization over time can be expected to increase ground station wear-and-tear and thus maintenance cost.

Total annual operating expenses for each asset were then found by multiplying operating cost per required circuit by the number of circuits required. The calculation of annual circuit requirements--i.e. the addition for the "typical" day of each policy year 1968-1975 of peak hourly requirements on all five types of coverage--has already been explained and the results summarized above.[43]

The derivation of (assumed constant) operating expense per required circuit is explained in order for each of the five operating expense categories.

Annual continuing research and development expense per circuit. It was assumed necessary for intelsat as a "going concern" to stay abreast of the latest communications technology. The cost of "staying abreast" is treated as a necessary cost of doing business, an annual operating expense. From an estimate by Communications Satellite Corporation, it was assumed to be $1,066 per required circuit.[44] This is a modest estimate, admittedly made in uncertainty, which does

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[43] Supra, pp. 84-5 and p. 243, n. 27.

[44] Letter from William Kaht, Member, Technical Staff, Communications Satellite Corporation, Washington D.C., April 13, 1966.

not include continuing government research and development on boosters, satellites, or in other pertinent areas of possible benefit to Intelsat.[45] An attempt to include non-private costs in the annual estimate would have had to include non-private benefits, and such estimates are beyond the scope of this dissertation.

Annual command and control center expense per circuit. The expense per required circuit of operating the command and control center was from an estimate by Communications Satellite Corporation, and is given as $65.69.[46]

Annual costs per required circuit of operating satellites in orbit. From several authors,[47] this value was assumed to be equal to zero. Apart from very slight energy consumption,

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[45] This continuing government research and development expenditure is considerable. See U.S. Congress, House, Committee on Science and Astronautics, Hearings on 1966 NASA Authorization, 89th Cong., 1st Sess., 1965, pp. 153-5; Leonard Jaffe, "NASA Communications Satellite Developments," Astronautics and Aerospace Engineering, September, 1963, pp. 48-51; and U.S. Congress, House, Committee on Science and Astronautics, Hearings on 1965 NASA Authorization, 88th Cong., 2nd Sess., 1964, p. 1457. The topic is also a controversial one, as indicated in U.S. Congress, Senate, Commerce Committee, Hearings, Communications Satellites, 87th Cong., 2nd Sess., 1962, pp. 219-21.

[46] Letter from William Kaht, Member, Technical Staff, Communications Satellite Corporation, Washington D.C., April 13, 1966.

[47] Kenneth Gatland (ed.), op. cit., p. 389; Letter from William Kaht, Member, Technical Staff, Communications Satellite Corporation, Washington D.C., April 13, 1966; and S. H. Reiger, R. T. Nichols, L. B. Early, and E. Dews, Communications Satellites: Technology, Economics, and System Choices, RAND Corporation, Memorandum RM-3487-RC (Santa Monica, Calif: RAND Corporation, 1961), pp. 44-5.

the costs of operating satellites in orbit are bound up with the costs of operating other assets.

Annual general and administrative operating expense per required circuit. Annual general and administrative expense per required circuit was estimated to be the total asset-creating and non-asset-creating annual general and administrative expenditure per circuit from above,[48] multiplied by the proportion not expensed into asset creation. Since the proportion of business expenditure which does not result in asset creation must be operating expenditure, the operating expenditure proportion is one minus the proportion expensed into asset creation. From above,[49] one-tenth of total annual general and administrative expenditure was expensed into asset creation; so nine-tenths is the proportion which is an operating expense.

Annual ground station operating expenses per circuit. Annual ground station operating expense per required circuit was based on an estimate by Communications Satellite Corporation,[50] and it was assumed to be $10,500.

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[48] *Supra*, p. 243

[49] *Supra*, pp. 243-4.

[50] Estimate of Communications Satellite Corporation is of the *average* annual operating expense for the *average* ground station (Communications Satellite Corporation, Memorandum from William Hait to J.J.D. Taylor on the Size of Ground Stations Providing the Lowest Cost Communication for a Given Traffic Level Considering Various Cost Per "Equivalent Voice Circuits", Washington D.C., September 29, 1965) multiplied by the number of ground stations in the system, assumed here to be thirty-nine. Other estimates of average annual ground station operating expense diverged somewhat significantly. One was only

The annual value of all five operating expenses is given in rows eighteen through twenty-two of Table IX above for all eight policy years 1968 through 1975 in the columns of the Table.[51]

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(footnote 50 continued) one-third of the Corporation estimate (George E. Mueller and E.R. Spangler, *Communications Satellites* (New York: John Wiley and Sons, 1964), p. 253. Another was three-fifths of the Corporation estimate (Stanford Research Institute, *op. cit.*, p. 159). Still another was estimated to be 1.75 times as high (A.M. Rothrock, "Notes on the Costs of the United States Space Programme, *Journal of the Royal Aeronautical Society*, June, 1962, p. 156.

[51] *Supra*, p. 89.

APPENDIX D

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TOTAL HOURLY C
DEVELOPED, UNDERDEVELOPED, AND MIXED (DE
SATISFIED ONLY BY ATLANTIC

| Year | Development Level of Pairs | Hourly Circuit Requirem 12 A.M. | 12 P.M. | 1 A.M. | 1 P.M. | 2 A.M. | 2 P.M. | 3 A.M. | 3 P.M. | 4 A.M. | P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1971 | Developed | 469 | 404 | 397 | 565 | 355 | 838 | 358 | 992 | 378 | 1[illegible] |
| | Underdeveloped | 140 | 51 | 134 | 86 | 134 | 93 | 134 | 164 | 110 | [illegible] |
| | Mixed (Developed and under-developed) | 383 | 242 | 467 | 461 | 459 | 549 | 332 | 731 | 284 | [illegible] |
| 1975 | Developed | 1553 | 1453 | 1440 | 1724 | 1373 | 2329 | 1379 | 2588 | 1412 | 270[illegible] |
| | Under-developed | 248 | 103 | 237 | 160 | 237 | 171 | 237 | 288 | 198 | 28[illegible] |
| | Mixed (Developed and Under-developed) | 1789 | 1401 | 1941 | 1747 | 1913 | 2050 | 1696 | 2372 | 1510 | 2[illegible] |

XVII

REQUIREMENTS OF ALL
D AND UNDERDEVELOPED) COMMUNICATING REGIONAL PAIRS
SATELLITE COVERAGE, 1971 AND 1975

"Typical" Day (London Time)

| M. | 5 P.M. | 6 A.M. | 6 P.M. | 7 A.M. | 7 P.M. | 8 A.M. | 8 P.M. | 9 A.M. | 9 P.M. | 10 A.M. | 10 P.M. | 11 A.M. | 11 P.M. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1066 | 337 | 828 | 312 | 721 | 318 | 681 | 302 | 656 | 308 | 712 | 374 | 616 |
| 2 | 163 | 54 | 163 | 42 | 163 | 42 | 163 | 42 | 163 | 42 | 158 | 42 | 142 |
| 0 | 391 | 146 | 493 | 127 | 586 | 143 | 663 | 153 | 558 | 153 | 486 | 178 | 466 |
| 3 | 2654 | 1360 | 2207 | 1320 | 2048 | 1323 | 1951 | 1298 | 1875 | 1303 | 1987 | 1400 | 1800 |
| 1 | 287 | 107 | 286 | 87 | 267 | 87 | 286 | 87 | 286 | 88 | 279 | 88 | 253 |
| 6 | 2027 | 1232 | 1934 | 1201 | 2095 | 1215 | 2233 | 1223 | 2059 | 1229 | 1924 | 1274 | 1901 |

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TOTAL HOURLY C
DEVELOPED, UNDERDEVELOPED, AND MIXED (DE
SATISFIED ONLY BY PACIFIC

| Year | Development Level of Pairs | Hourly Circuit Requireme | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 12 A.M. | 12 P.M. | 1 A.M. | 1 P.M. | 2 A.M. | 2 P.M. | 3 A.M. | 3 P.M. | 4 A. |
| 1971 | Developed | 837 | 389 | 788 | 368 | 914 | 373 | 820 | 304 | 10 |
| | Underdeveloped | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Mixed (Developed and Underdeveloped) | 73 | 98 | 104 | 98 | 102 | 98 | 94 | 75 | 1 |
| 1975 | Developed | 3501 | 2416 | 3392 | 2421 | 3660 | 2478 | 3459 | 2375 | 38 |
| | Underdeveloped | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | Mixed (Developed and Underdeveloped) | 174 | 213 | 217 | 205 | 214 | 203 | 202 | 170 | 2 |

XVIII

REQUIREMENTS OF ALL
AND UNDERDEVELOPED) COMMUNICATING REGIONAL PAIRS
SATELLITE COVERAGE, 1971 AND 1975

"Typical" Day (London Time)

| 5 A.M. | 5 P.M. | 6 A.M. | 6 P.M. | 7 A.M. | 7 P.M. | 8 A.M. | 8 P.M. | 9 A.M. | 9 P.M. | 10 A.M. | 10 P.M. | 11 A.M. | 11 P.M. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 895 | 438 | 718 | 594 | 508 | 917 | 497 | 781 | 420 | 831 | 388 | 804 | 371 | 738 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 98 | 38 | 99 | 37 | 101 | 36 | 103 | 34 | 101 | 35 | 101 | 34 | 96 | 39 |
| 3586 | 2722 | 3244 | 3033 | 2815 | 3679 | 2738 | 3429 | 2561 | 3521 | 2459 | 3452 | 2414 | 3302 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 202 | 115 | 206 | 114 | 209 | 115 | 218 | 111 | 217 | 111 | 218 | 110 | 210 | 126 |

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TOTAL HOURLY C[illegible]
DEVELOPED, UNDERDEVELOPED, AND MIXED (D[illegible]
SATISFIED ONLY BY INDIAN [illegible]

| Year | Development Level of Pairs | Hourly Circuit Requirem[illegible] 12 A.M. | 12 P.M. | 1 A.M. | 1 P.M. | 2 A.M. | 2 P.M. | 3 A.M. | 3 P.M. | A[illegible] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1971 | Developed | 94 | 228 | 97 | 230 | 97 | 230 | 97 | 147 | 97 |
| | Underdeveloped | 10 | 45 | 13 | 45 | 14 | 39 | 14 | 39 | [illegible] |
| | Mixed (Developed and Underdeveloped) | 66 | 165 | 70 | 179 | 81 | 172 | 83 | 169 | [illegible] |
| 1975 | Developed | 1042 | 1253 | 1046 | 1254 | 1046 | 1254 | 1046 | 1120 | 1[illegible] |
| | Underdeveloped | 19 | 81 | 23 | 83 | 25 | 71 | 25 | 170 | 45 |
| | Mixed (Developed and Underdeveloped) | 163 | 323 | 172 | 347 | 188 | 334 | 190 | 229 | 246 |

XIX

REQUIREMENTS OF ALL
ED AND UNDERDEVELOPED) COMMUNICATING REGIONAL PAIRS
SATELLITE COVERAGE, 1971 AND 1975

f "Typical" Day (London Time)

| M. | 5 A.M. | 5 P.M. | 6 A.M. | 6 P.M. | 7 A.M. | 7 P.M. | 8 A.M. | 8 P.M. | 9 A.M. | 9 P.M. | 10 A.M. | 10 P.M. | 11 A.M. | 11 P.M. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07 | 93 | 93 | 103 | 91 | 103 | 91 | 236 | 91 | 231 | 91 | 230 | 89 | 228 | 113 |
| 37 | 25 | 32 | 44 | 30 | 46 | 30 | 46 | 16 | 46 | 16 | 46 | 12 | 46 | 11 |
| 49 | 106 | 127 | 110 | 111 | 120 | 111 | 167 | 73 | 167 | 73 | 166 | 71 | 164 | 71 |
| 62 | 1041 | 1041 | 1056 | 1039 | 1056 | 1039 | 1265 | 1039 | 1257 | 1039 | 1255 | 1036 | 1253 | 1069 |
| 65 | 45 | 57 | 80 | 54 | 82 | 54 | 82 | 28 | 83 | 28 | 83 | 20 | 82 | 19 |
| 99 | 224 | 263 | 232 | 238 | 247 | 238 | 328 | 175 | 327 | 175 | 326 | 173 | 322 | 174 |

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TOTAL HOURLY C
DEVELOPED, UNDERDEVELOPED, AND MIXED (D
SATISFIED BY EITHER ATLANTIC O

| Year | Development Level of Pairs | Hourly Circuit Requirem 12 A.M. | 12 P.M. | 1 A.M. | 1 P.M. | 2 A.M. | 2 P.M. | 3 A.M. | 3 P.M. | A |
|---|---|---|---|---|---|---|---|---|---|---|
| 1971 | Developed | 587 | 2225 | 587 | 2225 | 587 | 2225 | 587 | 2225 | |
| | Underdeveloped | 22 | 79 | 19 | 79 | 19 | 79 | 19 | 79 | |
| | Mixed (Developed and Underdeveloped) | 122 | 545 | 117 | 545 | 117 | 545 | 117 | 545 | |
| 1975 | Developed | 869 | 3309 | 869 | 3309 | 869 | 3309 | 869 | 3309 | |
| | Underdeveloped | 33 | 119 | 30 | 119 | 30 | 119 | 30 | 119 | |
| | Mixed (Developed and Underdeveloped) | 192 | 968 | 180 | 968 | 180 | 968 | 180 | 968 | |

XX

REQUIREMENTS OF ALL
ED AND UNDERDEVELOPED) COMMUNICATING REGIONAL PAIRS
N OCEAN SATELLITE COVERAGE, 1971 AND 1975

f "Typical" Day (London Time)

| .M. | 5 A.M. | 5 P.M. | 6 A.M. | 6 P.M. | 7 A.M. | 7 P.M. | 8 A.M. | 8 P.M. | 9 A.M. | 9 P.M. | 10 A.M. | 10 P.M. | 11 A.M. | 11 P.M. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .7 | 587 | 2147 | 645 | 1879 | 645 | 1879 | 2225 | 1879 | 2225 | 1879 | 2225 | 1665 | 2225 | 1665 |
| 73 | 19 | 69 | 29 | 66 | 63 | 65 | 70 | 65 | 79 | 65 | 79 | 41 | 79 | 28 |
| 27 | 117 | 520 | 142 | 411 | 167 | 408 | 515 | 408 | 545 | 408 | 545 | 328 | 545 | 286 |
| 4 | 869 | 3194 | 952 | 2787 | 952 | 2787 | 3307 | 2787 | 3307 | 2787 | 3307 | 2472 | 3307 | 2472 |
| 2 | 30 | 105 | 42 | 101 | 95 | 99 | 106 | 99 | 121 | 99 | 121 | 163 | 121 | 45 |
| 7 | 180 | 929 | 218 | 768 | 250 | 763 | 918 | 763 | 968 | 762 | 968 | 540 | 968 | 578 |

TOTAL HOURLY C
DEVELOPED, UNDERDEVELOPED, AND MIXED (D
SATISFIED BY EITHER INDIAN OR

| Year | Development Level of Pairs | Hourly Circuit Requirem | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 12 A.M. | 12 P.M. | 1 A.M. | 1 P.M. | 2 A.M. | 2 P.M. | 3 A.M. | 3 P.M. |
| 1971 | Developed | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Underdeveloped | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Mixed (Developed and Underdeveloped) | 4 | 14 | 17 | 14 | 17 | 14 | 17 | 14 |
| 1975 | Developed | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Underdeveloped | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Mixed (Developed and Underdeveloped) | 5 | 17 | 21 | 17 | 21 | 17 | 21 | 17 |

E XXI

T REQUIREMENTS OF ALL
PED AND UNDERDEVELOPED) COMMUNICATING REGIONAL PAIRS
IC OCEAN SATELLITE COVERAGE, 1971 AND 1975 .

of "Typical" Day (London Time)

| M. | 5 A.M. | 5 P.M. | 6 A.M. | 6 P.M. | 7 A.M. | 7 P.M. | 8 A.M. | 8 P.M. | 9 A.M. | 9 P.M. | 10 A.M. | 10 P.M. | 11 A.M. | 11 P.M. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 17 | 4 | 17 | 4 | 17 | 4 | 17 | 4 | 17 | 4 | 17 | 4 | 14 | 4 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 21 | 5 | 21 | 5 | 21 | 5 | 21 | 5 | 21 | 5 | 21 | 5 | 17 | 5 |