Date: Thu, 23 Jan 1997 09:02:44 -0500 (EST)

Subject: TWX 1961 Automation Plans

Here is another in the series of historical documents being transcribed for the Telecom Archives by Mark Cuccia.

Date: Thu, 16 Jan 1997 16:22:29 -0600 (CST)
From: Mark J Cuccia <mcuccia@mailhost.tcs.tulane.edu>
Subject: HISTORY/twx.1961.automation.plans

The following is a transcript of another historical document, of which an an original copy was recently loaned to me by one of my contacts now retired from Bellcore, who had started with Bell Labs in the 1950's. This document regards "TWX and WADS (Wide Area Data Service) Numbering Plans and Routing Patterns," and begins with a cover letter dated October 10, 1961.

The TWX (TeletypeWriter eXchange) service was started by AT&T in 1931. From 1931 to 1962, AT&T's public switched TWX service was a *manually* switched network, operator handled with cord and plug switchboards, via a *private* network, not associated with the public voice telephone network, neither in the actual switching network, nor with the numbering plan of the DDD switched telephone network. During its 'manual' days, TWX service had its *own separate* numbering plan.

In Summer 1962, AT&T 'splash-cut' TWX service from manual to dial, by 'integrating' it with the switched DDD telephone network. All TWX machines were assigned a ten-digit number, which was part of the North American Numbering Plan. The machines were also 'retrofitted' with a modem (known as a data set), a handset (actually the handle of a handset, with only the earpiece or receiver part), and a dial; also added was a set of six 'control keys' which looked like the six keys of a multi-line business phone with 'hold' and intercom buttons, which controlled the modem function tones, for answer or receive mode in addition to 'clearing' or hanging-up, as well as whether the TTY was on 'local' (offline) for basic typing or papertape punching - or on 'line' to communicate over the telephone loop/line through the central office switch.

Later TWX machines (the 4-Row keyboard Teletype Corp. Model 33) had a built in speaker instead of an earpiece, and the customer could choose whether they wanted a rotary dial or a touchtone keypad.

The AT&T TWX operator at the switchboard communicated with the customer via a teletypewriter, in both the manual days, and in the 'dial' days when they needed to dial-up a TWX assistance operator.

This is one of the documents AT&T issued regarding the plans for the automation of the switching of the TWX service by 'integrating' it into the DDD network. Most of the material discussed here actually occurred, but some of the 'future' proposals never happened, as TWX in the US was sold by AT&T to the Western Union Telegraph Company, circa 1970/71.

TWX service in Canada never existed before the automation of (US) TWX in 1962. CNCP (the telegraph company in Canada) did offer *Telex* service in that country, however. But when TWX was automated in 1962, there was a new 4-Row dial-TWX which became available in the US, and TWX was also introduced for the first time in Canada, but only with the more advanced '4-Row' service.

Even though TWX in the US was 'sold' to WUTCO in the early 1970's, the Bell System (AT&T) and the independent telcos in the (continental) US continued to maintain the TWX network for WUTCO for another ten years, while WUTCO 'marketed' the service to the business public, billed 'its' customers, repaired the terminal machines (although Teletype Corporation, a subsidiary of AT&T's Western Electric, manufactured the terminals) leased from them by the customer, and supplied (sold) paper, ribbons, etc. In the 1970's, similar to the situation where a telephone customer could begin to supply their *own* telephone equipment, instead of 'having' to lease from telco, TWX customers could begin to purchase teletype terminals from other sources as well as miscellaneous supplies (paper/ribbon/etc.)

In the early 1980's, WUTCO began to migrate the (US) TWX network switching operations away from the Bell System *telephone* DDD network, and instead onto its own WUTCO switching network used for Telex and Telegrams. When the migration was completed, as far as AT&T/Bell was concerned, Special TWX Area Codes 510, 710, 810, 910 were no longer 'assigned' on the DDD *telephone* switching network (since TWX in the US was no longer part of the DDD network), and these area codes were then available for later reassignment as geographic POTS telephone area codes. 510 was assigned to California in the split of 415 in 1991, 910 was assigned to North Carolina in the split of 919 in 1993, 810 was assigned to Michigan in the split of 313 in 1993. However, 710 was assigned to the US Federal Government almost immediately, in 1983, for its own internal "special services" (including NCS GETS).

There is a second 'document' included here - a one-page letter dated in 1980, from the Trans-Canada Telephone System to AT&T, indicating that TCTS would 'modify' its outpulsing method for routing Canada-to-US TWX calls, as TCTS would soon be interfacing with WUTCO for US TWX, rather than with AT&T. Even though 510, 710, 810, 910 were no longer recognized on the DDD *telephone* network for TWX, Canada's

TWX was still switched over the Canadian portion of the DDD network, and still needed to connect with WUTCO TWX in the US, which separate from the US portion of the DDD network, still continued to number TWX terminals with 510, 710, 810, 910.

However, in the first document from 1961, there is no mention that TWX would be available in Canada at all.

The 610 Special Area Code for TWX in Canada was also opened up to Telecom Canada's (formerly TCTS; now Stentor) "Datalink" service in the mid 1980's. In the early 1990's, 610-NXX codes also began to be assigned to competitive data/ISDN providers. On 1-October-1993, Canada's 610 for TWX/Data services was 'swapped' for 600, at the request of Bellcore NANPA, as NANPA wanted to assign the 610 (an N10 form of NPA code) to the split of 215 in southeast Pennsylvania (Philadelphia area), the split taking effect in January 1994.
Canada's "Stentor" discontinued TWX service in the Fall of 1994, since by that time, there probably were no more TWX subscribers in Canada. Now, special NPA code 600 continues to be used for ISDN and Data services, provided by both the Stentor telcos as well as competitive Canadian telecommunication carriers and entities. This 600 area code is also available for Satellite Mobile telephones, and has been made available for "caller-pays" cellular.

The 600-NXX "central office" codes are presently assigned by the Canadian national government's "Industry Canada" department to the individual carriers or assigned for specific functions, similar to the way Bellcore NANPA currently assigns 900-NXX, 500-NXX and 456-NXX codes to individual carriers and specific functions, and the way Bellcore NANPA *used* to assign (between 1985 and 1993) 800-NXX codes to carriers and functions.

As for TWX in the US, WUTCO sold TWX *back* to AT&T (although now in a 'postdivestiture' environment) in 1990/91, as well as their own WUTCO *Telex* network. AT&T operates these networks, including some of the other previously International Record Carrier domestic Telex networks, separate and distinct from the telephone network and numbering plan, however.

Some of the items and terminology/definitions mentioned in this document were 'modified' before dial-TWX actually began. I will mention such as my own notes, enclosed in square brackets [].

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[The first page is a cover letter, from Mr. C.K. Collins, Assistant Vice President, American Telephone and Telegraph Company, 195 Broadway, New York 7, N.Y., Area Code 212, EX.3-9800, dated October 10, 1961. There are also some reference codes, T.L. 543, and File Nos. 3C2.9, 3C9.4.]

In the joint Engineering and Traffic conferences on WADS, held here in June, it was stated that a detailed description of the numbering plans for WADS, and for TWX on a dial basis, would be prepared for general distribution to the Associated Companies. The attached outline covers this subject.

The numbering plan for TWX at the cutover from manual to dial service in September 1962, is the same as described in our letter of August 4, 1960. Additions to the overall arrangements have come about from two basic decisions: first, a general offering of WADS service involving connection with TWX; and second, the gradual replacement, starting subsequent to dial cutover of TWX, of the present 3-Row 60-wpm speed TWX machines with 4-Row 100-wpm speed machines.

It became apparent during the preparation of a numbering plan description that the routing patterns that will be required should be an integral part of the same document. These routing assignments, controlled of course by the numbering scheme, are presented in three phases: the first, while all WADS and TWX machines are 3-Row; the second, while there is a mixture of 3-Row and 4-Row machines; and the final arrangement, when all machines are on a 4-Row basis.

Although there are no changes required in the plans that have been under way for the past year for the dial TWX cutover, some of the Companies have been reviewing their serving office selections in view of the subsequent changes that will occur when conversion to 4-Row operation gets under way. Rearrangements in your plans in time for TWX cutover may or may not be feasible at this late time, but it may be desirable to review them in light of subsequent changes.

At the request of Messrs. Owens, Kertz, Mapes, Rast, and Damkroger, copies of this letter are included for your General Plant Manager, General Commercial Manager, Chief Engineer, Comptroller, and Marketing People. Copies are being sent to TWX Co-ordinators. Any questions regarding this letter or attachment may be referred to Mr. J.A. Ingman, Jr., 212=EX-3-2068.

(signed) C.K. Collins
Assistant Vice President

Attachment:
To all General Traffic Managers (copies included for Chief Engineers,

General Commercial Managers, General Plant Managers, Comptrollers and Marketing people. Copies sent to TWX Co-ordinators.)

Dial TWX and WADS - Numbering Plans and Routing Patterns Memorandum

GENERAL:

The numbering plan arrangements for TWX service on a dial basis are described in Mr. Collins' letter of August 4, 1960. The decisions (1) to replace 3-Row 60-wpm teletypewriter service with 4-Row 100-wpm service on a gradual basis, and (2) to inaugurate a general offering of Wide Area Data Service (WADS) following conversion of TWX from manual to dial operation, requiring additional numbering plan arrangements. This memorandum is being issued to provide information on the supplementary arrangements which will be required to interconnect these services.

The numbering plans are directly tied to necessary routing of calls within the WADS Switching Plan, within the DDD Switching Plan, for connections between these two networks, and for the insertion of speed and mode converter circuits as required during the period when both 3-Row 60-wpm and 4-Row 100-wpm machines are in use. This outline describes the necessary routing patterns to meet these conditions, as they relate to the numbering plans.

BACKGROUND:

All WADS lines will be terminated in the No. 5 crossbar offices specifically equipped for this service, and initially all traffic between WADS stations must be confined to the network of trunks connecting these offices. At some future date, it may be economically desirable to overflow WADS traffic via the regular DDD Switching Plan, but this is not practical in the early stages for technical reasons not germane to the numbering plan.

All WADS lines must have the ability for connection to and from TWX lines. TWX lines may terminate on either a WADS office or on any other dial office in the regular DDD Switching Plan which has appropriate features.

Note: The equipment being provided initially for Delta Airlines and United Airlines during the developmental phase of WADS is not compatible for communication with other developmental WADS or TWX stations. These customers' stations will be numbered and connected like other WADS customers within the WADS Switching Plan, but they will not connect to other developmental WADS or TWX stations.

At the dial conversion of TWX, all TWX stations will be 3-Row 60-wpm speed. The few developmental WADS customers at that time will also be on a 3-Row basis. It is planned that after TWX cutover, all WADS customers will be changed to 4-Row 100-wpm speed. From that time on, for a period of a

few years, the TWX stations will gradually be changed to 4-Row 100-wpm speed. Communications between 3-Row and 4-Row teletypewriters is not possible on a direct connection; yet, connection must be provided between any two stations during the transition period.

It is planned to accomplish the connection between two dissimilar stations by routing the call through a speed and mode converter circuit which can receive the communication in one "language," translate it to the other "language" and immediately retransmit it. Since these converter circuits will be quite expensive, it is proposed that they be grouped in such locations as will achieve an efficient balance between economy of the converter circuit and requirements for back haul. Present plans call for locating these groups of converter circuits in all Regional Centers and in several of the cities which have been selected to serve as TWX Assistance Operator Centers.

In order to determine which calls must be routed through a converter circuit, a numbering arrangement has been devised which makes it possible for the switching equipment to distinguish whether the called station has a 3-Row 60-wpm teletypewriter or a 4-Row 100-wpm machine. The type of originating station can be determined by the originating serving office through the use of separate originating classes of service for the two types of machines. Thus, by matching the originating class of service with the called number, the originating dial equipment has a vehicle by which it can react to cause a converter circuit to be included in the connection when required, or by-passed when not required.

BASIC NUMBERING PLAN:

The basic numbering arrangements for TWX and WADS are as follows:

3-Row TWX Stations (60-wpm):

Assign regular telephone type 10-digit ANC numbers. These numbers will be listed in the [TWX] directory as 10-digit numbers, for example:

212-242-2860

Intra-NPA calls from another 3-Row TWX may be dialed on a 7-digit basis, at the option of the Associated Company.

The entire arrangement is the same as outlined in Mr. Collins' letter to all General Traffic Managers, dated August 4, 1960.

WADS Stations:

Three Special Area Codes (SAC's) have been established for the WADS Switching Plan. These codes are 710, 810, and 910. For convenience of administration, the 710 SAC will be assigned to stations in the Eastern Area of Long Lines, 810 in Long Lines' Central Area, and 910 in the Western Area. All WADS stations will be assigned a 10-digit ANC number of the type:

910-785-3624

Such numbers must always be dialed on a 10-digit basis. All WADS stations will be assigned a number of this type initially, even though at the outset they will be operating on a 3-Row 60/100-wpm basis. (Note: Delta Airlines' stations must be changed to this type of numbering plan prior to the TWX cutover).

When the WADS stations are flash-cut to 4-Row 100-wpm operation, as the first step in the transition of teletypewriter machines to 4-Row, no WADS number changes will be required.

4-Row TWX Stations (100-wpm):

1. Where economically feasible, it is planned to terminate TWX stations on WADS offices as they are converted to 4-Row 100-wpm operation. It is expected that some 80% of all TWX stations will be located near enough to justify this treatment by direct loops or by the use of concentrators. These TWX stations will be numbered identically to WADS stations.

2. Where it is not feasible to terminate TWX stations on a WADS office (due to length of RX loop or concentrator trunks), they may be terminated on selected regular DDD dial offices which will be arranged to handle 4-Row 100-wpm TWX stations.

   These offices will be distributed throughout the United States, and should care for 4-Row conversion of another 10 to 15% of the TWX stations. An additional SAC (510) has been reserved to care for 640 C.O. codes for 4-Row stations in these offices. The numbers assigned will be 10-digit ANC of the type:

   510-622-2126

   These numbers must also always be dialed on a 10-digit basis.

3. After conversion to 4-Row 100-wpm of all stations which can be economically served by one of the above methods, there will still be 5 to 10% of the TWX stations operating on a 3-Row 60-wpm basis. At that time, this remaining 5 to 10% may then be flash-cut to 4-Row operation in the offices in which they are working, retaining their regular

telephone-type numbering (NPA-ABX-xxxx) on an ANC basis.

With this step, there no longer will be any necessity for distinguishing between 3-Row and 4-Row numbers. By changes to regular telephone-type numbers of the stations using the 510 SAC (item 2, above), that SAC could then be recovered for growth in regular telephone usage.

[What is indicated in item 3 above never actually happened. When a TWX customer who subscribed to a 3-Row 60-wpm terminal which had a ten-digit number utilizing their own geographic telephone NPA decided to upgrade to a 4-Row 100-wpm TTY terminal and class-of-service, they were assigned a TWX ten-digit number using whatever N10 Special NPA serving their TWX region, which indicated 4-Row 100-wpm TWX class-of-service. If the customer's location could be served directly from a central office on the TWX/WADS Switching Plan, their N10 would be 710, 810, or 910, depending on whether the customer was in the northeast, Midwest/southeast, or central/western region of the (continental) US, respectively. And if the customer's location could *not* be served directly from a TWX/WADS Switching Plan central office, but rather from a TWX central office which had to route via the 'regular' DDD Switching Plan, their new 4-Row 100-wpm TTY terminal and service would be indicated by the 510 Special NPA code. By the late 1970's when there were no longer any 3-Row 60-wpm TWX machines, none of the customers with 510 TWX numbers were ever cutover to TWX numbers using their own geographic "POTS" telephone NPA's.]

[However, there were (*still are*) 4-Row (ASCII) keyboard 100-wpm (and higher speed) TTY's and data terminals (and fax machines) which were *not* part of tariffed TWX service, which utilize the regular dial-up DDD telephone network, and are assigned ten-digit telephone numbers with their own geographic POTS *telephone* NPA's. Incidentally, even though the 4-Row keyboard 8-level punch code ASCII 100-wpm speed TWX terminals and service was identified by the special N10 area codes, each terminal and line also had an associated ten-digit 'telephone' number with its own geographic POTS telephone area code. The originating serving central office switch would differentiate 3-Row 60-wpm from 4-Row 100-wpm by internal class of service.]

Assistance Operator Number:

It is planned to use initially a 7-digit number for reaching the assistance operator by either a WADS or TWX (3-Row or 4-Row) subscriber. The number which has been selected is:

954-1212

This C.O. code (954) must be reserved in all telephone NPA's for this use only; i.e., it can not be used as a regular C.O. designation.

When all TWX stations are on a 4-Row basis, it is planned to dial "0" for the TWX Assistance Operator and recover 954 for regular C.O. code usage.

[This last item, too, never did occur. Sometime by the late 1960's, while AT&T still 'owned' TWX, just prior to 'transferring' TWX over to WUTCO, 4-Row 100-wpm terminals reached the TWX Assistance Operator by dialing 910-954-1212. 3-Row 60-wpm terminals could still reach the TWX Assistance Operator with simply seven-digits, 954-1212. However, the slower and older 3-Row 60-wpm TWX service *was* becoming obsolete by the mid-to-late 1970's; WUTCO also now 'owned' (US) TWX (although it was still routed/switched and numbered/dialed over the Bell System's network until the early 1980's); now 910-954-1212 would reach an 'automated' or 'computerized' assistance operator service. WUTCO did *not* change the dialing/access procedure for reaching an assistance operator (whether a live person in text/typing communication with the customer and using a cord switchboard to access the network functions, or a computerized automated operator which 'typed' prompts to the customer) from (910)-954-1212, to 'simply 0.']

Since an answer condition will be returned from the Assistance Operator for technical transmission reasons, the 954 code should be treated, where feasible, so that no charge will be recorded. Where this is not practical, the call should be recorded on an AMA tape so that the charge may be discarded in the Accounting processing. These calls should never be treated as in-band WADS calls where clock circuits are provided for measured rate service, since it is impossible to discard the clock timing with any degree of accuracy.

Information Operator Number:

Information service for both WADS and TWX customers will be provided at a centralized information center to be located in St. Louis. The WADS and TWX subscribers will reach information by dialing the 10-digit number:]

910-555-1212

The 555 C.O. code will not be available, of course, for use as a WADS central office designation within the 910 SAC.

Test Codes:
It is impractical to assign standard Plant test codes for nationwide use. Customers will report trouble and out-of-order conditions by telephone to the Telephone Company using the regular Repair Service number or some other 7-digit number where necessary. It is not contemplated that any central office code will be assigned for this purpose.

Four 7-digit ANC telephone type numbers, using an existing central office code, will be assigned in each local serving office, except in SxS, for reaching local test lines. Arrangements must be made to avoid charging customers for such calls. In SxS offices serving originating TWX on an ANI

basis, one digit codes may be used to reach these test lines, from unused first selector levels.

Seven automatic station test lines will be provided at a centralized location to test stations from several serving offices. Each line must be assigned a separate line number. These numbers may be assigned to a telephone central office code, at the centralized location, which serves no TWX stations if such a code is available. If not, a TWX central office code will be used, and local Accounting will have to line sort the code to separate the non-charge test calls. With the introduction of 4-Row 100-wpm TWX machines, as many as seven additional automatic station test lines arranged for 4-Row 100-wpm operation will be required. These lines will be assigned any unused numbers in a SAC serving central office. Local Accounting will line sort the SAC central office code to separate these non-charge test calls from the regular TWX messages.

Where a TWX or WADS central office code is used for test numbers, it would be helpful to Accounting if these test numbers are confined to a separate 1000 series.

Centralized Manual Test Centers will be provided to serve a large number of originating serving offices. Between seven and fifteen line numbers will be required for access to this test center. Assignment of numbers should follow the same principles outlined above for automatic station test lines.

ROUTING ARRANGEMENTS - GENERAL:

Routing arrangements to accomplish the necessary connection between WADS stations and TWX stations have been developed in three phases:

Phase I covers the routing patterns required while all machines are on a 3-Row basis; i.e., prior to the introduction of any 4-Row 100-wpm machines.

Phase II covers arrangements required during the transition period; i.e., when there will be both 3-Row 60-wpm and 4-Row 100-wpm machines in the plant.

Phase III covers routing arrangements necessary after all machines have been changed to a 4-Row 100-wpm basis.

Routing to and from TWX Assistance Operators involves communications which can best be covered as a separate subject. Therefore, Attachment 2 to this memorandum will discuss such routing for all three phases.

ROUTING - PHASE-I:

Phase I routing covers the period when all TWX and all WADS stations have 3-Row machines.

TWX machines will all be 3-Row arranged for 60-wpm speed. WADS stations (except those of Delta Airlines and United Airlines) will be 3-Row arranged for optional 60 or 100-wpm speed.

Connection between any two machines must be at the same speed. Hence WADS to WADS can be 100-wpm, but any call to or from TWX must be at 60-wpm. Each WADS machine has a gear shift arrangement to set it for the appropriate speed.

On a call from WADS, the attendant manually sets their machine for the proper speed: 100-wpm if to another WADS, 60-wpm if to TWX or to an operator.

On an incoming call to WADS, the gear shift is automatically set. This is accomplished by the routing pattern: WADS to WADS via the WADS trunks, TWX to WADS via the DDD network to the terminating WADS office. The incoming "trunk class" (from WADS vs. from DDD trunk) will cause appropriate ringing current distinction so as to automatically set the gear shift to the proper speed.

TWX-to-TWX (Phase-I Routing):

Calls from TWX stations to other TWX stations will be completed via the regular DDD network using standard telephone routing.

WADS-to-TWX (Phase-I Routing):

Calls from WADS stations to TWX stations will be routed directly from the No. 5 XB WADS office to the toll network. The digits of the called number are spilled onto the DDD network and the call is completed using standard telephone routing.

WADS-to-WADS (Phase-I Routing):

Calls from WADS stations to other WADS stations will be recognized by the called number structure from the SAC 710, 810, or 910, and will be completed within the WADS Switching Plan. Calls to stations in the SAC's will be 6-digit translated at all intermediate switching offices for routing purposes. Pulsing into the terminating office may be on a 4, 5, or 7-digit basis as required locally for completion of the call.

TWX-to-WADS (Phase-I Routing):

Calls from TWX stations to WADS stations will be routed via the DDD network to the terminating WADS office.

In order to do this, 6-digit translation of the 710, 810, and 910 SAC's will be required at all 4A and 4M crossbar toll offices throughout the DDD network. If current plans materialize for starting the transition to 4-Row

soon after TWX cutover, only Boeing numbers will be involved during Phase-I, so the number of 6-digit [translation punched] cards will be relatively small.

Upon leaving the originating office, the 3-digits of the SAC will cause routing up the line to the nearest 4A or 4M office. At that office, the 6-digit translation will cause routing to or towards the 4A or 4M farthest along the DDD chain towards the terminating WADS office.

If the 4A or 4M "farthest along the chain" has a toll switch trunk directly to the terminating office, only 4 or 5 digits need to be pulsed onto such a trunk.

If the 4A or 4M "farthest along the chain" does not have a direct toll switch trunk group, it must pass the call to another type of toll switching office in language that can be understood by that office, without inclusion of the SAC.

a. If the C.O. code of the WADS number matches the telephone C.O. of the serving office, the SAC can be deleted, and if the office to which the call is being passed is not in the same telephone NPA as the terminating office, the regular telephone NPA can be substituted.

b. If the C.O. code of the WADS number does not match the telephone C.O. code of the serving office, the call in this case must be delivered to a toll switching office in the same telephone NPA as the serving office. In that case, both the SAC and the WADS C.O. code are deleted, and the regular telephone C.O. code substituted. An example will best illustrate this situation:

   Assume the terminating WADS office is in Grand Rapids, where the toll dial office is crossbar tandem. Assume the WADS office, when serving telephone customers, has the C.O. code 345. But WADS customers served in that office are listed as 810-568-xxxx. A call from TWX to that WADS customer would be routed, using 6-digit translation, within the DDD network to Chicago, the 4A office "farthest along the chain." The Chicago 4A office, upon 6-digit translation of the WADS number, would select a trunk group to the crossbar tandem in Grand Rapids, would delete 810-568, and would substitute instead 345, so that the number received in Grand Rapids would be 345-xxxx.

TWX or WADS to Information Operator (Phase-I Routing):

Both TWX and WADS stations will reach Information by dialing the 10-digit number 910-555-1212.

From offices serving TWX only, calls to Information will be routed to the DDD network, where 910-555 will be 6-digit translated and routed toward St. Louis. The St. Louis 4A will also 6-digit translate the 10-digit number

and route the call to direct manual type trunks terminating at the TWX Information office.

Offices which serve both TWX and WADS stations, or WADS stations only could during Phase-I route all calls to Information via the WADS Switching Plan to the St. Louis WADS primary office. The St. Louis WADS primary office will route Information calls to a group of trunks with direct access to the TWX Information office. However, during Phase-II, it will be necessary to route Information calls from 3-Row TWX stations via the DDD network in order to insert a speed and mode converter circuit into the connection. Thus it would appear desirable to use the DDD routing from all TWX during Phase-I in order to be consistent with the necessary routing pattern when we enter Phase-II. Also, it will mean that all 910+ traffic from a TWX class-of-service can have a common 3-digit routing out of the originating office.

ROUTING - PHASE-II:
Phase-II routing covers the arrangements required to connect 4-Row 100-wpm TWX and WADS stations with each other, and with 3-Row 60-wpm TWX during the transition of all stations to 4-Row 100-wpm operation. This transition period may last for several years. [3-Row 60-wpm TWX machines existed until the late 1970's.]

Upon the initial introduction of 4-Row 100-wpm machines, the WADS stations will be "flash" cut to these new machines. Some TWX stations may be converted to 4-Row 100-wpm operation simultaneously with the WADS "Flash" cut. The Information positions in St. Louis will also be "flash" cut to 4-Row 100-wpm operation coincident with the WADS stations.

Within the outline hereafter, the following terms will be used as a matter of convenience:

WADS - In addition to WADS stations, per-se, this term will also include 4-Row TWX stations which are terminated on a WADS office and numbered like WADS. [SAC's 710, 810, 910]

4R-TWX - Those 4-Row TWX stations (numbered 510) which are terminated on a regular (non-WADS) telephone office.

3R-TWX - All 3-Row TWX stations, whether they happen to be terminated on a WADS-equipped office, or on any other regular telephone office. These will continue to be numbered with regular telephone NPA's.

The type of the calling station (3-Row vs. 4-Row) can be recognized in any office by its originating class of service or equivalent segregation by line groups. The type of the called station can be recognized by whether it has an SAC code (e.g., 910, 510, etc., designating 4-Row) or a regular telephone NPA (designating 3-Row). By matching the class of service with the called area code, the calling office can determine whether the call

involves like-to-like stations and hence does not require the insertion of a converter circuit; or the call is between dissimilar stations and requires routing through a converter circuit.

Attachment 1 is a schematic illustration of the routing patterns during Phase-II. [In the original, this is a graphical illustration, and is color-coded. It will not be included in this ASCII transcription.]

From 3R-TWX (Phase-II Routing):

All calls from 3R-TWX stations will be routed onto the regular DDD network with no change in the called number structure.

To 3R-TWX (Phase-II Routing):
The telephone-type numbering of the called 3R-TWX stations will cause completion within the DDD network like a telephone DDD call. No converter circuit would be inserted.

To 4R-TWX (Phase-II Routing):
The 510 SAC of the called 4R-TWX station will cause the call to be routed to a 4A toll office equipped with speed and mode converters. At the converter-equipped 4A toll office, the 510 SAC will cause routing to the 3-Row/60-wpm to 4-Row/100-wpm converter circuit, and also code conversion of the 510 to 015. This pseudo area code, 015, must be 6-digit translated in all 4A and 4M offices for completion on the DDD network. At the last 4A or 4M before the call is delivered to a toll switching office in the telephone NPA in which the terminating 510 office is physically located, the 015-NNX may be code converted to the telephone central office code of that terminating office. This is the same principle employed in Phase-I routing of TWX calls to WADS stations.

To WADS (Phase-II Routing):
The N10 SAC, such as 910, of the called WADS station number will cause the call to be routed on the DDD network to the toll office equipped with speed and mode converters. At the converter-equipped office, the SAC, such as 910, will cause routing to the 3-Row/60-wpm to 4-Row/100-wpm converter circuit and code conversion of the SAC to an 'arbitrary' 01N code, such as 019.

To Information Operator (Phase-II Routing):
Calls to Information will be routed to a converter office and thence to the nearest WADS primary office as any other call to a 910 SAC office. Once the call has entered the WADS Switching Plan, the code 910-555 will cause routing to St. Louis and the TWX Information Operator.

From WADS (Phase-II Routing):
Calls from WADS stations will be routed on either the WADS Switching Plan or the DDD network, depending on the location of the called station.

To WADS (Phase-II Routing):
Recognition of the 710, 810, or 910 SAC will cause routing of the call on the WADS Switching Plan as previously described for a Phase-I WADS to WADS call.

To 3R-TWX (Phase-II Routing):
The telephone-type numbering of the called 3R-TWX station indicates to the serving WADS office that a converter circuit will be required. A single digit "0" will be prefixed to the called number and the call routed onto the regular DDD network. The newly created initial three digits, 0N1 or 0N0 [from the 0+ telephone area code, of the N0X/N1X form], will cause routing on the DDD network to the nearest 4A or 4M office equipped with converter circuits. At the converter-equipped office, the 0N1 or 0N0 code will cause routing through a 4-Row/100-wpm to 3-Row/60-wpm converter circuit. At the same time, the 0N1 or 0N0 code will be converted to a 2-digit code, N1 or N0 [of the telephone area code, of the N0X/N1X form], to eliminate the "0" prefix. The call will, therefore, re-enter the DDD network as the original called number and will be completed as any telephone DDD call. (Arrangements are being made to clear all of the sixteen 0N1 and 0N0 codes [where they have been used as local toll-office routing codes, to now be used] for purposes described here).

To 4R-TWX (Phase-II Routing):
Calls to 4-Row 100-wpm stations not terminated on the WADS Switching Plan can be recognized by the SAC 510. Calls to these stations do not require routing to converter circuits and may, therefore, be completed on the DDD network by the most direct route consistent with standard routing arrangements. The code 510 will be code-converted to 015, and the call would then be routed directly to the DDD network. The call would then be routed toward its destination using the same arrangements previously outlines for a 3R-TWX/60-wpm to 4R-TWX/100-wpm call after it has been speed converted.

To Information Operator (Phase-II Routing):
Calls to Information are routed the same as described in Phase-I for WADS calls to Information.

From 4R-TWX (Phase-II Routing):

Calls from 4R-TWX will be completed over the DDD network or over a combination of DDD network and WADS Switching Plan.

To 3R-TWX (Phase-II Routing):
Completion of calls to 3R-TWX stations will be identical to that described for Phase-II WADS to 3R-TWX calls.

To 4R-TWX (Phase-II Routing):
Completion of calls to other 4R-TWX stations, recognized by the 510 SAC,

will be identical to that described for Phase II WADS to 4R-TWX calls.

To WADS (Phase-II Routing):
Calls to WADS stations can be recognized by the 710, 810, or 910 SAC of the called number. The SAC will be code-converted to an 01N (017, 018, 019) code and the call will be routed to the DDD network. The 017, 018, or 019 code will route the call toward the nearest WADS primary office. [*No* speed/mode conversion is done, as both the 4R-TWX and WADS terminals are both operating on 4-Row 8-level ASCII at 100-wpm.] As the call is delivered to the WADS primary office, the 01N code will be code-converted back to the original 710, 810, or 910 SAC code. Within the WADS Switching Plan, the call will be completed as any WADS to WADS call.

Transmission considerations require that there be no more than three links between a Class-4 DDD office and a WADS primary office for handling this traffic, including the link into the WADS primary office. This means that there must be a final trunk group to a WADS primary office from every Class-1 office (Regional Center), and also from every Class-2 office (Sectional Center) which has a Class-3 office homing on it. Direct groups, either high usage or final, are also permissible from any lower ranking DDD office (Class-3 or 4) where economies dictate.

To Information Operator (Phase-II Routing):
Calls to Information are handled just as any call to a number assigned in the 910 SAC. Such routing is described above for 4R-TWX to WADS calls.

ROUTING - PHASE III:

Phase III routing covers the arrangements required after all TWX stations have been converted to 4-Row 100-wpm operation. At this time, there will no longer be a necessity for including converter circuits in any condition. Therefore, prefixing "0", or code-conversion of codes [N10 <=> 01N] will not be required. Routing will, in general, be on the WADS Switching Plan for calls between stations terminated on WADS serving offices, and on the DDD network for calls between stations terminated on other than WADS serving offices. Calls from stations on the WADS Switching Plan to stations terminated on the DDD network will be routed from the originating WADS office directly onto the DDD network, and thence to the proper terminating office. Calls from stations served by offices not on the WADS Switching Plan to stations which are on the WADS Switching Plan will be routed to the nearest WADS primary office and completed from that point on the WADS Switching Plan.

The 6-digit translation and routing of code 015 must be replaced by 6-digit translation of 510 in the 4A and 4M machines. Routing of codes 019, 018, and 017 will also be discontinued. Codes 710, 810, and 910 will be arranged to route calls on the DDD network to the nearest WADS primary office rather

than to a converter office as outlined for Phase-II routing. For this latter situation, the transmission considerations outlined for 4R-TWX to WADS in Phase II will still apply.

Codes of the 01N and 0N0/0N1 types may be released for system TTC codes [back to what they were prior to the automation of TWX service in 1962].

The 510 SAC will gradually serve fewer and fewer customers as stations with 510 numbers are discontinued, moved, etc. New stations on the DDD network will be assigned regular NPA type numbers. Eventually, 510 may be discontinued as a SAC for TWX.

[Much of what is described for Phase-III occurred in the fact that 3-Row 60-wpm TWX Service became obsolete. The 01N and 0N0/0N1 codes described above were indeed reclaimed from TWX service and back to being used as system routing codes or toll-office codes. However, at the same time, TWX Service in the U.S. had become 'owned' by WUTCO; then by the early 1980's, WUTCO 'transferred' US TWX Service off of the Bell System network and onto its own WUTCO telegraphic switching network. The 'distinction' of 510 no longer had the meaning it did back in the Bell System days. As a matter of fact, as far as WUTCO was now concerned, the other N10's (710, 810, 910) as used on 'exclusively' WUTCO's TWX Service didn't need any more geographic meaning anymore. Even the central office code portions of the ten-digit TWX number didn't have any traditional Bell System geographic meaning anymore. WUTCO even began to assign such 'central office' codes from the N0X and N1X format, in addition to the older NNX format; they even began to assign such 'central office' codes from the 0XX and 1XX format! i.e., under WUTCO's switching network, a ten-digit TWX number could be of the format: N10-XXX-xxxx, rather than N10-NNX-xxxx. The N10, however, remained only of the 510, 710, 810, 910 set. But is wasn't a problem, as TWX in the U.S. was no longer a part of the 'integrated' Bell System network anymore, but rather part of WUTCO's own switching and routing network.]

SOME GENERAL CONSIDERATIONS:

1. Prior to the time that WADS stations are changed over from 4-Row but starting _at_ the TWX cutover date, routing from TWX to WADS requires 6-digit translation of the three WADS SAC's -- 910, 810, and 710 -- at all 4A and 4M offices. There should be relatively few C.O. codes involved at that time.

2. Once 4-Row is introduced to WADS, 6-digit translation of the WADS SAC's will be discontinued in the DDD network.

3. Once 4-Row TWX is introduced into offices on the DDD network, using the SAC 510, 6-digit translation of the arbitrary code 015 will be required in all 4A and 4M offices in the DDD network. For rate-band discrimination purposes, 6-digit translation of 510, in addition to 910, 810, and 710, will be required in all WADS offices.

4. Each of the SAC's (910, 810, 710, and 510) can accommodate 640 central office codes. To the extent possible, a code should be associated with a rate center for ease of rating TWX originated, or out-of-band WADS originated calls. Where the number of rate centers exceeds 640 per SAC, some central office codes will require that determination of the rate center be obtained from the [thousands digit of] the line number. This arrangement complicates Accounting rating procedures, and results in additional usage of accounting machines. Also, determination of rate centers from originating and/or terminating line numbers is both cumbersome and costly for Traffic on T&C calls. In all cases, however, a code must include only stations which are within the same state or substate for WADS rate-band discrimination.

   In addition, due to equipment limitations, all stations served by a given WADS office must be assigned the SAC in which the serving office is located - regardless of whether or not the station is physically located in the same SAC as the serving office.

5. It will be noted that offices in the DDD network which serve only 3-Row 60-wpm TWX do not require prefixing of the digit "0", nor code conversion. These features are required, however, in all WADS offices, and in any telephone DDD office which serves 4-Row 100-wpm TWX on an originating basis.

   Where No. 5XB with LAMA is used to serve the 4-Row 100-wpm TWX, such prefixing and code-conversion will be performed in the originating office. Where 4-Row 100-wpm TWX stations are served from ANI offices, the code-conversion and prefixing required will be accomplished in the serving CAMA office. The combination of the incoming trunk class-mark at the CAMA office and the called number structure will indicate to the CAMA office if code-conversion or prefixing is required.

6. The code-conversion requirements of this plan are such that a code conversion frame is not necessarily required in the No. 5 crossbar serving offices. Codes have been selected which lend themselves to conversion by utilizing digit deletion and options to prefix a specified two-digits plus an arbitrary digit. This prefixing arrangement is sometimes referred to as the "11 prefix" option, even though the specified two-digits need not be "11". This arrangement may be provided (using the specified digits "01") where a code-conversion frame is not otherwise required.

   A recapitulation of the code-conversion arrangements, where required, will illustrate how this plan works:

	OBTAINED BY:		
Code as dialed By Customer:	Requires Conversion to:	Specified '01' Digits	Arbitrary + Digit (*)

910	019	01 + 9
810	018	01 + 8
710	017	01 + 7
510	015	01 + 6
954 (Asst.Opr.)	014	01 + 4

(*) the arbitrary digit being a function of the original 3-digit code as dialed by the customer.

[Note: while TWX for Canada isn't mentioned in the original document, their TWX SAC NPA was 610. Certain TWX calls from the US to Canada would require that the 610 SAC be code-converted for routing in the switching network to the 016 'pseudo' area code, to indicate the need for speed and mode conversions (US 3R-TWX to Canada 4R-TWX), or at certain times, to *prevent* routing through a speed/mode converter (US 4R-TWX to Canada 4R-TWX).]

[At the time TWX was first offered in Canada (circa 1962), its routing and switching arrangement was similar to 510 in the US (i.e., via the 'standard' DDD network). However, later on 610 became a part of the TWX/WADS Switching Plan. As for TWX calls originating from Canada, it appears from the 1980 document which will follow later, that there was *no* conversion of 610 to 016 on intra-Canada TWX calls; also, on Canada to US TWX routings, the code-conversion from N10 to 01N (or using a prefix of 0+ to the telephone-style NPA for Canada 4R-TWX calls to US 3R-TWX), was done *only* in certain 'gateway' offices, right before the routing of the call would access a trunk into the US portion of the AT&T network, rather than the code-conversion being done at the originating local serving offices in Canada.]

[However, as the 1980 document will indicate, when TWX in the US was 'removed' from the Bell System network and rather placed onto WUTCO's own switching and routing network, AT&T now wanted to 'reclaim' 510, 710, 810, 910 SAC's from being any assigned/reserved 'TWX' status codes, and rather now have those codes as 'unassignable', to be later assigned for future use, maybe as 'telephone' area codes. So Canada began to do code-conversion of the dialed US (WUTCO) TWX 'N10' area code to a psuedo 01N code, in the originating TWX central offices on such Canada-to-US TWX calls. However, this would appear that 015, 017, 018, 019 couldn't be used as 'toll center' routing codes in Canada's 'telephone' NPA's, until Canada's TWX was eventually discontinued.]

ADMINISTRATION OF SPECIAL AREA CODES (SAC's):

The 710, 810, and 910 SAC's will cover the geographical area served by the Eastern, Central and Western Long Lines areas, respectively. The assignments of central office codes within the SAC's will be co-ordinated by the Long Lines Area Traffic Engineer for the area involved. The 510 SAC serves the Continental United States (except Alaska). Assignment of Central

Office Codes within the 510 SAC will be co-ordinated by the Long Lines General Traffic Engineer.

[And, while Canada is not mentioned in the original 1961 document, it would appear that TCTS and its member Canadian telcos administered the 610 SAC's NNX 'central office' codes from the very beginning.]

[In the original document, Attachment 1 follows, which is a 'graphical map' indicating the Phase-II routing, switching, numbering. It is a color-keyed chart, but unfortunately it will not be included here. It does give a good descriptive and graphical representation of what had been described in "Phase-II", above]

ATTACHMENT 2 - Routing Patterns - 6A (Assistance Operator) Switchboards:

ROUTING TO 6A SWITCHBOARDS:

In the main memorandum, it was stated that a TWX or WADS customer will reach the Assistance Operator by dialing the code 954-1212.

This code must route the call to the particular switchboard which has been engineered to handle the traffic from the territory in which the originating office is located. In addition, during the period when there are both 3-Row 60-wpm and 4-Row 100 wpm machines in the plant, the call must be routed to a position which is equipped in the same manner (3-Row or 4-Row) as the calling station.

Note: The equipment being provided for Delta Airlines and United Airlines does not permit communication with TWX Assistance Operators.

The locations of the 16 proposed 6A Switchboards, together with the territory (NPA's) which each will serve, were outlined in the attachment to Mr. Collins' letter of April 13, 1961. The routing from WADS offices, or from other dial offices serving TWX stations, will be obvious in some NPA's. In other cases, the problems and their routing solutions may not be readily apparent. The purpose of this discussion is to point out the problems and to offer suggested solutions. It will be necessary for each Associated Company to examine the conditions in each of its offices to determine the proper routing pattern.

[In the July/August 1962 issue of {Bell Laboratories Record} magazine, there is an article on pages 232-237 called "TWX Goes Dial". A map of the (continental) US in the article identifies the sixteen switchboard location cities as Boston MA, New York City NY, Philadelphia PA, Washington DC, Pittsburgh PA, Cleveland OH, Chicago IL, St. Louis MO, Atlanta GA, Jacksonville FL, Jackson MS, Dallas TX, Denver CO, Los Angeles CA, Oakland CA, Portland OR. However, the actual geographic NPA territory is not indicated on the map in the article.]

Where a WADS or TWX serving office is located in or near the same city as a 6A Switchboard, direct trunks will be provided where required, or where economically feasible. Such trunks (on a final group basis) will be obligatory from WADS primary offices or from secondary offices equipped for tandem switching as discussed later on. From other offices, such direct trunks may be provided on either a high usage or final basis as economic or service considerations may dictate.

For routing from offices not near a switchboard location, suffice to say here that traffic from WADS stations will generally be routed over the WADS Switching Plan, while calls from TWX stations will always be routed over the DDD network.

Note: The term WADS, as just used here and throughout the remainder of this attachment, is also intended to include those 4-Row TWX stations that are numbered like WADS and terminated on WADS offices. Also, the terms 3R-TWX and 4R-TWX will apply to 3-Row and 4-Row TWX stations respectively which are terminated on other offices.

As a matter of convenience, the problems will be discussed in two facets -- calls from WADS stations on the one hand, and calls from TWX stations on the other hand. As was done in the main memorandum, the problems will be discussed for three situations:

Phase-I - The period when all machines are on a 3-Row basis; i.e., prior to the introduction of any 4-Row 100 wpm machines.

Phase-II - The transition period; i.e., when there will be both 3R/60-wpm and 4R/100-wpm machines in the plant.

Phase-III - The period after all machines have been changed to 4R/100-wpm.

From WADS:

In order to route traffic from one WADS office to another, and thence to a switchboard, the last office must be equipped for through switching. This feature will be available, of course, in WADS primary offices. Several of the switchboards will be in cities where there will be only a WADS secondary office. Consideration should be given to equipping such offices for through switching in order to handle WADS traffic _to_ switchboards. (The feature can also be used for handling traffic _from_ switchboards equipped with 4-Row machines, as discussed in a later part of this outline.) It will be assumed in subsequent discussion here that some secondary offices will be so arranged.

Reference to the Appendix to this Attachment illustrates the varying conditions that may be encountered. In all situations, WADS offices S1, S2, S3, and P1 must have their operator traffic routed to their serving switchboard, SW-1; and WADS offices S4 and P2 must have their operator

traffic routed to SW-2.

During Phase-I:

During this period, the operator traffic could be routed on the WADS Switching Plan as will be described for Phases-II and III. However, it is probable that only a relatively small part of the network will be in operation. Furthermore, it is expected that there will be relatively few WADS stations, all of which will then be 3-Row with 60 and 100-wpm speed option. It is recommended during this phase that routing be via the DDD network, the same as for TWX stations. In any event, the attendant must manually set their machine for 60-wpm speed when attempting to reach the operator.

During Phases-II and III:

The routing patterns will be identical during these periods. During Phase-II, any trunk group from a WADS office directly to the switchboard must be directed to positions that are equipped with 4-Row machines. Once the time of Phase-III is reached, all positions will be 4-Row.

When operator calls are passed from one WADS office to another, the number 954-1212 will be passed along as received.

[The Appendix to Attachment 2 is a graphical chart, which I am unable to transcribe in "ASCII-art". I will try to describe the three possibilities which are displayed in this Appendix, which further text will refer to.
In all three possible "situations" shown in the Appendix:
S1, S2, S3 S4 are "secondary" switching centers,
P1, P2 are both "primary" switching centers,
SW-1, SW-2 are both Assistance Operator switchboard centers.
S1, S2, S3 and P1 are in the geographic territory to be served by SW-1,
S4 and P2 are in the geographic territory served by SW-2.
The final (non-operator-assisted traffic) trunk homings are:
S1, S2 to P1 (all in the SW-1 geographic territory),
however S3's final (non-operator-assisted traffic) trunk homing is to P2,
and while P2's originating operator-assisted traffic is to SW-2,
S3's originating operator-assisted traffic *must* somehow route to SW-1.
Likewise, S4's final (non-operator-assisted traffic) trunk homing is to P1,
and while P1's originating operator-assisted traffic is to SW-1,
S4's originating operator-assisted traffic *must* somehow route to SW-2.]

Referring to the schematics in the Appendix, it will be seen in ...

"Situation-1" that WADS primary offices are located in the same cities as the switchboards. Operator traffic from S1 and S2 can be routed over the final groups to their home primary, P1, and together with operator traffic originating in P1, can be routed on a direct trunk group from P1 to SW-1. Operator traffic from S3 must also be directed to SW-1. It should be

offered to a high usage group to P1 if there is such a group, but it cannot follow the normal final routing pattern via its home primary, P2, because such traffic would end up at SW-2. Three alternatives are available for the overflow traffic from the S3 to P1 high usage group:

(1) augment the group and "bottle up" the operator traffic, similar to what is done for some cross-boundary homing arrangements in DDD;

(2) alternate route onto the DDD network, treating the call identically as one from a 4R-TWX station from an office in the same NPA; and

(3) route the overflow via P2 utilizing code conversion to a special routing code to keep the traffic separated.

Operator traffic from S4, which homes on P1, must be routed to SW-2. This is the same condition as S3 to SW-1; it should be offered to a high usage group to P2, etc.

"Situation-2" portrays a case where the WADS office in the city with SW-1 is a secondary office, S2, equipped for through switching. Operator traffic from S1 may be offered to a high usage group to S2, then overflowed via the normal final route via P1. Operator traffic from P1 is routed on the final group to S2. Operator traffic from S3 may be offered to a high usage group to S2, then to a high usage group to P1, and then any overflow handled as in Situation-1.

"Situation-3" also portrays a case where the WADS office in the city with SW-1 is a secondary office, S2, but in this case S2 itself may be handled on a direct trunk to SW-1, but operator traffic from P1, S2 and S3 cannot be routed via S2. There are two possibilities for handling traffic from these offices. If P1 is near enough to SW-1 and the traffic volume is sufficient, a direct group may be warranted from P1 to SW-1. In that case, operator traffic from S1 may be routed on the final group to P1, and from S3 on a high usage group to P1 as in Situation-1. But if a direct group from P1 to SW-1 cannot be justified, then all operator traffic from P1, S1 and S3 must be routed onto the DDD network, treating the traffic from each office identically as operator calls from 4R-TWX stations in each of the respective NPA's involved. Operator traffic from S4 to SW-2 is the same as in Situation-1.

From 3R-TWX:

The term 3R-TWX will include 3-Row TWX stations which happen to be terminated on WADS offices.

The routing patterns will be the same during Phases-I and II; there will be no longer any 3R-TWX at the time that Phase-III is reached.

The operator code, 954-1212, will be outpulsed onto the DDD network and

passed along from office to office as required until the call reaches the toll switching office in the city where the 6A switchboard is located. At that office, the code will cause selection of a trunk group to the 6A switchboard. During Phase-II, this code must select a group that terminates on positions equipped with 3-Row 60-wpm machines.

In some cases, the normal DDD high usage and final routings can be used all the way from the originating office to the toll switching office in the 6A switchboard city. In other cases, however, the normal routing chain would be through a CSP [Control Switching Point] in an NPA whose serving 6A switchboard is different than that of the originating city in question. In this situation, measures must be taken to keep the traffic properly separated. Examples will best illustrate the conditions:

Example-1:
Operator traffic from Connecticut (NPA Code 203) is to be handled on the 6A switchboard at New York City. The final route chain from any point in Connecticut to New York would pass only through NPA's which also should route operator traffic to New York. Hence, normal high usage and final DDD routing can be used from Connecticut to New York.

Example-2:
Operator traffic from the 517 and 313 NPA's in Michigan is to be handled at Cleveland. Any high usage groups from any offices in these NPA's are usable, but the normal final DDD route is via Pittsburgh. Traffic coded 954-1212 reaching Pittsburgh would be routed to the 6A switchboard in that city, which is not permissible. There are two possible solutions; augment the Detroit-Cleveland high usage group and "bottle up" this item of traffic on that group as its final possible route; or route from Detroit to Pittsburgh by code converting to an arbitrary routing code which will cause final routing from Pittsburgh to Cleveland.

From 4R-TWX:

The discussion here will apply not only to all operator traffic from 4R-TWX stations, but also to operator traffic from WADS stations when the latter must overflow onto the DDD network as described earlier in this outline.

The routing patterns will be identical to that for 3R-TWX. During Phase-II, however, the code 954-1212 as dialed by the customer cannot be passed along the DDD chain because it would cause selection of a trunk group to 6A switchboard positions equipped with 3-Row machines. To circumvent this condition, the code 954 will be code-converted to 014 at the originating office, or at the originating CAMA office when CAMA ANI is employed, and hence the code 014-1212 will be passed along the DDD chain. This will be routed identically to 954-1212 until the call reaches the toll switching system in the city where the 6A switchboards are located; at that point,

the code 014-1212 will cause selection of a trunk group to 4-Row positions.

ROUTING FROM 6A SWITCHBOARDS:

Operators at the 6A switchboard will be required to complete calls to:

1. TWX and WADS stations.
2. Other 6A switchboards; e.g., to establish certain conference calls.
3. The centralized TWX Information Bureau.
4. Possibly, to certain telephone operators if the operating practice should so require.

To TWX or WADS Stations:

It is the intention that completion of calls to TWX and WADS stations will be by dialing of the 10-digit number onto a tandem trunk. During Phase-I, all 6A switchboard positions will be equipped with 3-Row machines, and during Phase-III all positions will be 4-Row. During these periods, all traffic to TWX or WADS stations could be directed to tandem groups either to the DDD network or to the WADS Switching Plan. However, during Phase-II, 3-Row positions will have received traffic only from 3R-TWX stations, and 4-Row positions will have received traffic only from 4R-TWX or WADS stations. Yet, either position must be able to complete calls to 3-Row and 4-Row machines.

From 3-Row Positions:

A tandem group should be provided to a suitable toll switching office in the DDD network, preferably to the highest ranking (Regional Center or Sectional Center) that is feasible. By dialing the called number onto this group, it will be routed thereafter as dialed by a 3R-TWX customer: direct DDD completion to another 3R-TWX stations; or via a converter circuit if to WADS or 4R-TWX.

This tandem group may also be used for handling traffic to other operators, as described later.

From 4-Row Positions:

A tandem group should be provided to a suitable WADS office for completion of calls to TWX or WADS stations. By dialing the listed number, it will be treated as though dialed by a WADS customer: without insertion of a converter circuit if to WADS or 4R-TWX; but via a converter if to 3R-TWX. The WADS office will do the code conversion or prefixing required.

The tandem circuit to a WADS office (operator junctor) can be provided only if the WADS office is equipped for through switching. This will be the case at WADS primary offices. Some 6A switchboards will be in cities where there is not a WADS primary office. If the WADS secondary office in that city is

equipped for through switching, a tandem group to that office can be used. This possibility was discussed earlier for traffic from WADS to 6A switchboards. If the nearest WADS office is not equipped for through switching, it will be necessary to provide a trunk group to a WADS primary office in another city.

It will be necessary also to provide a tandem group from 4-Row positions to a DDD toll switching office for completion of traffic to other operators, as described below.

OPERATOR-TO-OPERATOR CALLS:

To Other 6A Switchboards:

Interconnection from one 6A switchboard to another will be required for various reasons; e.g., on certain conference calls. Although these inter switchboard connections could in some cases take advantage of the narrow band WADS trunks, the volume of such calls will be small and it is proposed to always route them via the DDD voice network. During Phase-II, it will be necessary that 3-Row positions route only to other 3-Row, and 4-Row only to 4-Row. To achieve this, two codes are proposed (130 for 3-Row, and 140 for 4-Row), each to be preceded by the telephone NPA of the city of the desired 6A switchboard. Thus as examples:

212+130 would route over the regular DDD network to New York City, where 130 would cause selection of a trunk group to 3-Row 6A switchboard positions.

617+140 would similarly route to Boston, and 140 to 4-Row positions.

To Centralized Information:

The 6A switchboard operator is expected to use the same codes as TWX or WADS customers: 910-555-1212. The 3-Row position operator will complete such calls over her tandem trunk to the DDD network, while the 4-Row operator will complete such calls over her tandem group to the WADS Switching Plan.

The centralized Information Bureau has been equipped so that incoming calls can be handled on a voice basis from 6A switchboard operators. If it should become desirable to adopt this practice later on, a special routing code code be assigned for completion over the DDD voice network.

To Telephone Operators:

Handling of such calls from the 6A switchboard is not currently contemplated, but if this should become desirable, these calls would be completed via the DDD network using standard telephone operator routing codes.

[The Appendix to Attachment 2 follows in the original. It is a graphical map showing various possibilities of operator routings. It will not be included here in this ASCII text transcription. I have tried to do my best in indicating what S1, S2, S3, S4, P1, P2, SW-1, SW-2 indicate, as well as the original text has tried to describe these as well.]

[end of 1961 TWX document]

[What will now follow is a one-page letter dated 1980, from Trans-Canada Telephone System to AT&T regarding the changes in Canada-to-US TWX routings, as WUTCO would be handling TWX in the US, completely separate from AT&T.]

TransCanada Telephone System
Reseau telephonique transcanadien
410 avenue Laurier Avenue West/ouest
Ottawa (Ontario)
K1P-6H5

Tel: 613-560-3000
TWX: 610-562-1911

T.C. 660.23

1980.05.01

[to:]
R.J. Cooper
American Telephone and Telegraph
295 North Maple Ave.
Basking Ridge, N.J. 07920

Subject: TWX Numbering Plan

This informs you of our plans concerning the TWX Numbering Plan when the TCTS network interconnects with the Western Union network in April 1981.

As you are aware, Western Union have used the same numbering plan in their TWX network as used in the AT&T network. The need to identify TWX calls that required speed and code conversion resulted in the procedure of converting the TWX NPA's 510, 710, 810 and 910 to pseudo codes 015, 017, 018 and 019. This is done today in primarily our sectional centres before outpulsing over the TCTS <-> AT&T-LL trunk groups.

[The Class-2 Sectional and Class-1 Regional toll switching offices in Canada at that time which would have been handling Canada <-> US TWX, and as such would have interfaced with the AT&T Long Lines network in the US, would have been located in Vancouver BC, Calgary AB, Regina SK,

Winnipeg MB, Toronto ON, Montreal PQ. There were also Canadian Class-2 Sectional Centers in Quebec City PQ, St. John NB and Corner Brook NF at that time, but these offices would probably not have had any direct interfacing with the AT&T Long-Lines network in the US for Canada <-> US TWX connections. Regina SK and Montreal PQ are both Class-1 Regional Toll Offices; all the other mentioned above are Class-2 Sectional Toll Offices.]

Coincident with our interconnection with the Western Union network in April 1981, we will implement this code conversion in the Class-5 TWX serving [local] offices or serving toll machines using TWX class-of-service screening. These pseudo codes will then route over the TCTS network to one of three switches: Vancouver, Toronto and Montreal, that will interconnect with Western Union over dedicated facilities. This method will allow for the recapture of codes 510, 710, 810 and 910.

We will advise you formally in 1981 when we have completed the necessary changes in the TCTS network to clear these codes for reuse.

[signed] P.Eng., for

L.W.H. de Launay
Assistant Director
T/C Fundamental Planning

Copy: W.R. Middleton

[end of 1980 TWX document]

some additional final notes/comments of mine:

The two historical TWX documents go into great details regarding the various routing possibilities of TWX calls, as there were different types of terminals and operating formats, as well as 'telephone network' routing situations which could be encountered.

Some questions and assumptions still do remain in my mind, however. Maybe someone might have some explanation or answers ...

In the 1961 document, Canada is not mentioned. But I would assume that Canada did have (4R) TWX Assistance Operators from the beginning. I *assume* that there were operator centers in Montreal, Toronto, Vancouver, and Regina. I have seen reference to the fact that Canadian TWX subscribers did dial (610)-954-1212 to reach an assistance operator. TWX in Canada also had its own Information (Directory) center, at (610)-555-1212. I don't know where the Information center for Canada would have been located, however.

In the late 1970's (after 3R-TWX in the US had been discontinued), and throughout the 1980's and into the early 1990's, I had seen reference to the routing code 014 as "TWX - Canada". The 1961 planning document does

mention that 014 was to be used when a 4R-TWX had dialed 954-1212 for the TWX Assistance Operator, but routing had to 'leave' the TWX/WADS Switching Plan and rather 'spill over' onto the 'general' DDD network -- i.e., the routing would be 014-1212, so as to identify to the final switch which connected to the TWX Assistance Operator that the calling TWX was a 4-Row terminal and could be connected to a TWX Assistance Operator at a 4-Row machine herself, and not to connect to a 3-Row TWX Assistance Operator. I don't know if "014 - TWX, Canada (only)" had anything to do with reaching *their* TWX Assistance Operator, during the 1970's (and later), the time when (US) TWX was being transferred from AT&T to WUTCO.

I have also seen reference to a 013 system routing code for TWX in some code lists of the late 1970's. However, I can't find anything explaining what 013 would be used for. I understand that 013 was *NOT* 'associated' with the reserved 310 TWX NPA SAC (310 will be described in the next paragraph), but maybe it was used for calls from 3-Row/60-wpm TWX to their 3-Row TWX Assistance Operator, when the 'high-usage' trunks were not always available from the 3-Row TWX customer's city to the *specific city* with a 6A TWX Assistance Operator to serve that originating 3-Row TWX customer, thus when the DDD routing needed to route over 'final' trunk homing to a city which had its own *different* 6A TWX Assistance Operator. However *that* city's TWX Assistance Operator wasn't supposed to serve the city of the originating customer, so the switch in that 'tandem' city had to route 'back' to the city with the TWX Assistance Operator which was supposed to serve the originating customer, using a converted 'arbitrary routing code'. This is described earlier, in the 1961 TWX document, in Attachment-2, regarding 6A TWX Assistance Operator Switchboard Routing Patterns - Routing *to* 6A Switchboards - from 3R-TWX, Example-2. Could the 'arbitrary routing code' mentioned have been 013? Would the string 013-1212 MF keypulsed over the 'final choice' routing cause a selection in the 'tandem' city to route 'back' to the proper 6A switchboard city?

As for SAC 310, sometime in the late 1960's or early 1970's, AT&T (Bell) 'reserved' Special NPA code 310 for use with TWX. From what I have been told, this 'reserved' 310 was never used on the Bell System's routing and switching of TWX during the 1970's (the years when Bell/AT&T still maintained US TWX service, although US TWX was now actually 'owned' by WUTCO), but it was frequently counted as a 'reserved SAC' in some listings of NPA and SAC codes. However, after (US) TWX had been fully 'removed' from the US Bell/AT&T DDD network, and thus now *completely* switched by WUTCO's *own* network, 310 was then being used for calls from WUTCO (US) TWX subscribers, directly to *telex* subscribers of WUTCO as well as the additional IRC (International Record Carrier) 'domestic' networks (TRT, RCA, ITT, WUI). One would *dial or DTMF* the number (but *not* 'type' the requested number) to place a call to a (US) *telex* machine, from a WUTCO (US) *TWX* machine as: 310, followed by the complete *telex* number. If the desired telex number was that of the 'domestic' network of IRC's other than WUTCO, you would dial or DTMF the listed number. The first digit of that number indicated *which* IRC 'domestic' network to route to:

1xxx... for TRT
2xxx... for RCA
4xxx... for ITT
6xxx... for WUI

If the call from the WUTCO (US) TWX machine were to a WUTCO domestic telex, you would dial/DTMF 310, followed by a '0' and then the WUTCO domestic telex number. Within the WUTCO domestic telex network, numbers could begin with any possible digit from '1' through '9', and the length of such a WUTCO telex number could be anywhere between four and six digits long.

Maybe the reserved 013 Bell System 'TWX' routing code had to do something with the above mentioned reserved 310 TWX SAC?

I am also looking for some additional TWX numbering/routing information; if someone might have such, I'd appreciate a copy. I'm still trying to find a complete compiled list of the Central Office Code NNX assignments of each of the TWX SAC's, 510, 610, 710, 810, 910, as they were assigned back in the 1960's and 70's, when TWX was still routed and switched over the Bell System. Some of this information would be included in a document of AT&T Long Lines Dept., known as the Traffic Routing Guide. TWX routings were included in Sections 12 through 16 of the Traffic Routing Guide back in the 1960's and 70's. If anyone might happen to have a copy of this, I would be interested in a copy.

TWX may have had a rigid operational method, but the establishment of dial automated TWX service in 1962, by integrating it with the DDD telephone network shows how the Bell System was able to adapt and evolve its routing and switching network, and the numbering and dialing plan, to include new technologies and services. Of course, TWX doesn't exist anymore as an integral part of the telephone network; and for *most* purposes TWX (and telex) as they were being utilized through the early 1980's has been obsoleted, first by general use of FAX, and now by email and the Internet.

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