

Bell System Switching Technology

A Chronology 1887-1979

Bold face numbers refer to
page numbers in this book

- 1887 No. 2 PBX with third party addition capability **520**
- 1893 Original main distributing frame concept **388**
- 1897 PBX using off-premises multi-station lines (N.Y. World) **521**
- 1903 No. 2 PBX containing basic key telephone switching **539**
- 1903 No. 2 PBX with hold features and night service **520**
- 1903 No. 3 PBX with hotel features **520**
- 1907 Traffic: invention of graded multiple **96**
- 1907 First 505 cordless manual PBXs introduced **539**
- 1913 Patent applied for coordinate switch **8**
- 1915 Introduction of service observing **361**
- 1915 550 PBX introduced, including tie trunk feature **520**
- 1915 May: Crossbar: basic patent issued **59**
- 1916 Early crossbar linefinder for step-by-step PBX **59**
- 1916 Semi-standardization of 700A step-by-step PBX **521**
- 1917 First adoption of dial PBXs **521**
- 1919 Decision to go to full automatic operation **8**
- 1919 Step-by-step (Automatic Electric produced), WE installed until 1926 **22**
- 1919 Decision to adopt step-by-step for single and small multioffice cities **22**
- 1919 March: Began development of 300 panel line finders **14**
- 1920 Traffic: Molina's grading approximation **98**
- 1920 April: Panel: semimechanical metropolitan tandem cutover (New York City) **8, 20**
- 1920s Use of the multiplexed order wires, precursor to CCIS (Philadelphia, New York City) **432**
- 1920s First standard step-by-step PBX 700C **521**
- 1920s Furnished switchboards for telephone answering service **553**
- 1921 Panel: cutover, first 2-digit office code system (Omaha, Nebraska) **11**
- 1921 Coordinate switch: exploratory model built **59**
- 1921 First private mobile radio system (Detroit, Michigan) **295**
- 1922 Panel: first 3-digit office code system (PENnsylvania) **12**
- 1922 Coordinate switch: first partially equipped model completed **59**
- 1922 May: First trial of 300-point panel line finders (Paterson, New Jersey) **15**
- 1923 Coordinate system: completed design and test **9**
- 1923 March: First standard installation of 300-point panel line finder (Seattle, Washington) **15**
- 1924 Panel: first power rotary sender links **15**
- 1924 Publication of first line finder traffic tables **15**
- 1925 Dial telephones exceed independents' **8**
- 1925 Manual: first straightforward operation **36**
- 1925 Panel decoder and large multicontact relay developments **12**
- 1925 Panel: major improvements **11**
- 1925 Step-by-step: design improvements **23**
- 1925 First WE-engineered step-by-step office **23**
- 1925 Panel: first attempts at automatic long distance dialing (Seattle, Washington) **52**
- 1925 Composite signaling: extended range first introduced **52**
- 1925 Coordinate system: ready for commercial manufacture **61**
- 1925 March: First installation of 400-point panel line finder (Philadelphia, Pennsylvania) **15**

- mid-1920s Introduction of No. 100 key equipment **540**
- 1926 First production of step-by-step equipment **22**
- 1926 Step-by-step tandem: first operator distance dialing (AB toll) (Los Angeles, California) **29**
- 1926 Trial of 350A step-by-step CDO (Sinking Springs, Pennsylvania) **33**
- 1926 Step-by-step: first line finder developed **27**
- 1926 Coordinate system development canceled **9**
- 1926 Manual alternate routing **174**
- 1926 First automatic alternate routing proposed **174**
- 1926 Cordless switchboard trial with 740A step-by-step PBX **515**
- 1926 March: First power rotary sender links **17**
- 1927 Toll: first combined line recording operation **54**
- 1927 Panel: cost reduced by 60 percent **11**
- 1927 Panel: first panel sender links **17**
- 1927 No. 3 toll switchboard: first cutover (over 50,000 positions installed in 35 years) (Reading, Pennsylvania) **36**
- 1927 January: Step-by-step system cutover: (Springfield, Massachusetts) **23**
- 1927 July: First 350A step-by-step CDO cutover (San Clemente, California) **32**
- 1928 Cordless switchboard: wire toll switching first proposed **78**
- 1928 T. C. Fry's book on probability and traffic published **116**
- 1928 First No. 2 order turret introduced **560**
- 1928 Improvements in cordless manual switchboards **515**
- 1929 First 360A step-by-step CDO cutover **33**
- 1929 Panel: ground cutoff type, 600,000 lines shipped and installed **20**
- 1929 Step-by-step: first trial of tandem switching (Connecticut) **32**
- 1929 Panel: first battery cutoff office **20**
- 1929 Network of fourteen 350A step-by-step cutover offices (southern California) **33**
- 1929 Panel: completion of cost reduction and improvement phase **63**
- 1929 No. 2 step-by-step call distributor developed **373**
- 1930 First manual mass announcement and distribution system, introduced with time-of-day announcements **42**
- 1930 First manual switchboard senders introduced (Detroit, Michigan) **50**
- 1930 Prepayment coin operation introduced **356**
- 1930 October 1: Bell System acquired Teletype Corporation **578**
- 1930 October: Panel: crossbar sender link development started **64**
- 1930 December: Crossbar switch design of new unit switch started **63**
- 1930s Broadcast network switching service provided to 175 radio stations **587**
- 1930s First key telephone equipment on customer premises **540**
- 1930s Wiring plans used for customers with a number of extensions and lines **540**
- 1931 December: 14-type local test desk: first cutover **40**
- 1931 No. 12 manual switchboard developed **39**
- 1931 Step-by-step tandem standardized (Los Angeles, California) **32**
- 1931 January: First panel sender tandem office cutover **11**
- 1931 November 21: First public offering of two-way teletypewriter service **578**
- 1932 370A & B step-by-step CDO: first cutover **33**
- 1932 740AX step-by-step PBX introduced **445**
- 1932 No. 3 order turret introduced **562**
- 1932 July: Crossbar: first satisfactory design tested **64**
- 1933 Introduction of 15A and 23A key equipment units **542**
- 1933 Third quarter: Crossbar switch: study application to PBX tandem and toll switching **67**
- 1934 Crossbar system: study completed; proceeding with final development **64**
- 1934 Crossbar tandem first proposed **74**
- 1934 No. 1 crossbar development funding provided **68**
- 1934 Systems engineering: founded with move of D&R Department from AT&T **92**
- 1934 First patents on AMA **92, 135**
- 1935 Crossbar inward toll call distribution: first Bell System application of crossbar switches (New York City) **39**
- 1935 Step-by-step intertoll system: first cutover; at peak maximum 800 in service **54**
- 1935 380 crossbar CDOs, development started **78**
- 1935 4-wire crossbar switching first proposed **81**
- 1935 554B and 554C secretarial switchboards for telephone answering service introduced **555**
- 1935 745A crossbar PBX development started **78, 446**

- 1935 November: Crossbar toll concentrator and call distributor: first commercial application of crossbar switches (New York City) **39**
- mid-1930s Standardized telephone answering arrangements, called secretarial service, introduced **553**
- 1936 Operator and long distance dialing **11**
- 1936 U- and Y-type relays first developed **66**
- 1937 3B switchboard: improved toll tandem operation **39**
- 1937 September: No. 1 crossbar: precut testing started, 350,000 calls (Brooklyn, New York) **68**
- 1938 No. 2 crossbar development started **76**
- 1938 Electron beam switching tube invented **88**
- 1938 Combined 300-type telephone set included multiple buttons for 1A key telephone system **543**
- 1938 First crossbar PBX: 755 introduced **445**
- 1938 February: No. 1 crossbar: first cutover (Brooklyn, New York) **20, 68**
- 1938 July: No. 1 crossbar: first large installation cutover with added features **72**
- 1939 355A step-by-step CDO: first of 3500 installations totaling 4 million lines (Batavia, Ohio) **34**
- 1939 Magnetic tape recorder first used with weather announcements **42**
- 1939 745A crossbar PBX cutover (Philadelphia, Pennsylvania) **78**
- 1939 Step-by-step automatic ticketing: development started **92**
- 1939 Crossbar traffic studies by C. A. Lovell
- 1939 Traffic: Kittredge and Molina formula for crossbar networks proposed **102**
- 1940 3C switchboard: first introduced including 3CF package **38**
- 1940 Panel maintenance improvements **22**
- 1940 No. 2 crossbar lab model in operation **76**
- 1940 Step-by-step senderization development started **76**
- 1940 380 crossbar CDO cutover (Jonesville, New York) **78**
- 1940 Motorelay exploratory development **93**
- 1940 Traffic: dial tone delay measurement **106**
- 1940s Renewed study of call wire signaling **432**
- 1941 Crossbar tandem: first service **74**
- 1941 Electronic frequency-division switching proposed **88**
- 1941 Traffic: analysis of holding time measurements **104**
- 1941 No. 3 step-by-step call distributor developed **373**
- 1941 No. 6 order turret, first installation (Chicago, Illinois) **563**
- 1941 First 81-B-1 automatic teletypewriter switching system cutover (Cleveland, Ohio) **579**
- 1941 Air raid warning system developed (North Atlantic coast) **572**
- 1941 April: Crossbar tandem: first inter-zone tandem with remote control zone registration (New York City) **76**
- 1942 Traffic control: network management established (New York City) **108**
- 1942 First studies of electronic time-division switching **201**
- 1943 No. 5 toll switchboard: first cutover in association with No. 4 crossbar (Philadelphia, Pennsylvania) **83**
- 1943 Multi-zone coin service introduced using panel sender tandem **356**
- 1943 October: No. 4 toll crossbar: first cutover (Philadelphia, Pennsylvania) **83**
- 1944 January: First cutover of step-by-step automatic ticketing system (Los Angeles, California) **92, 133**
- 1945 Crossbar switch and relay contact studies and improved protection development **113**
- 1945 No. 5 crossbar simulator developed **108**
- 1945 First area code map **124**
- 1945 Ring translator invented by T. L. Dimond **161**
- 1945 Establishment of 10-digit nationwide numbering plan with area codes **370**
- 1945 October: Start of No. 5 crossbar development **157**
- 1946 Robot operator: exploratory development **94**
- 1946 First switching school organized **112**
- 1946 Design of 385 crossbar CDO **201**
- 1946 Studies of gas tube and semiconductor crosspoints **201**
- 1946 First standard 3-channel mobile radio system in service (St. Louis, Missouri) **295**
- 1946 April: 380 crossbar CDO removed from service (Jonesville, New York) **78**
- 1947 First 356 step-by-step CDO cutover **34**
- 1947 Trial of AMA central office recording (Washington, D.C.) **139**
- 1947 First Bell Labs branch laboratory (Allentown, Pennsylvania) **170**
- 1947 First crossbar tandem with toll features **190**
- 1947 Proposal for zero for dialing **308**

- 1947 First use of 2-letter, 5-number office codes **370**
- 1947 First trunk group usage equipment developed **400**
- 1948 Information theory formulated by C. E. Shannon **110**
- 1948 Wrapped solderless connections introduced **115**
- 1948 Start of out-of-band ac signaling **129**
- 1948 First AMA accounting center (Philadelphia, Pennsylvania) **139**
- 1948 First trial of pushbutton dialing (Media, Pennsylvania) **170, 336**
- 1948 555 manual PBX introduced **448**
- 1948 607A and B multiple manual PBXs introduced **449**
- 1948 October: 81-C-1 teletypewriter switching system first cutover, including SOTUS **580**
- 1948 July 11: First No. 5 crossbar (Media, Pennsylvania) **164**
- 1949 First course in switching presented by A. E. Ritchie (MIT) **112**
- 1949 Operator AMA studied **307**
- 1949 Introduction of No. 12 service observing desk **361**
- 1949 September: Communication development training program started **113**
- 1950 3CL switchboard first introduced **39**
- 1950 Panel: last new office (New York City) **20**
- 1950 Crossbar tandem CAMA development started **144**
- 1950 No. 5 crossbar dial tone marker **159**
- 1950 First A4A crossbar system (Albany, New York) **180**
- 1950 Built small time-division research switching system **202**
- 1950 Line scanning proposed **203**
- 1950 No. 23 crossbar call distributor developed **373**
- 1950 Customer premises answering machines introduced in New York and Cleveland **557**
- 1950s First proposal for cordless toll switchboard **308**
- 1950s Automatic trunk test circuits developed for crossbar tandem and toll systems **337**
- 1950s Dual-tone multifrequency pulsing developed **337**
- 1950s First proposals for expanded mobile telephone service **368**
- 1950s Studies show that by 1970, 15 metropolitan areas would need more than one 4A crossbar office **421**
- 1950s 520 PBX developed for civil emergency reporting system **569**
- 1950s Air route traffic control 300 and 300A developed **577**
- 1950s No. 2 telegraph service board cut-over **584**
- 1950s Technical operating centers for television networks provided **588**
- 1950s Special air defense communication system developed **577**
- 1950s Step-by-step: universal 7-digit dialing **26**
- 1950s R. L. Peek proposes magnetic latching reed contacts **245, 286**
- 1951 First book on switching circuit design published (Keister, Ritchie, Washburn) **112**
- 1951 Traffic control bureau: first network management bureau (New York City) **108**
- 1951 Crossbar tandem: first multifrequency senders **190**
- 1951 Beginning of DDD **221**
- 1951 Start of systems engineering study of ESS **203**
- 1951 Improvements in cordless manual switchboards **515**
- 1951 No. 6A order turret introduced **564**
- 1951 November: Trial of DDD (Englewood, New Jersey) **165**
- 1952 No. 5 crossbar system tandem features **144**
- 1952 Start of in-band signaling **129**
- 1952 ECASS research switching system **201**
- 1952 Transistor switching system **203**
- 1952 Automatic line insulation test developed **397**
- 1952 Coin junctors concept introduced in No. 5 crossbar **356**
- 1952 First increase of initial local coin call charge from 5 to 10 cents **357**
- 1952 Redesign of 1A key telephone system known as 1A1 **545**
- 1953 Automated time-of-day announcement system first introduced **42**
- 1953 Crossbar: detached contact schematics and standardized sequence charts **113**
- 1953 Traffic: C. Clos discovers non-blocking multistage arrangements **102**
- 1953 Operating engineers training program **113**
- 1953 No. 5 crossbar wire spring relay trunk circuit **167**
- 1953 Exploratory development of remote line concentrator started **214**
- 1953 First studies of diode logic and scanning **222**
- 1953 Magnetic drum sender exploratory development **222**
- 1953 Multizone coin service introduced using crossbar tandem offices **356**
- 1953 81-D-1 teletypewriter switching in service **580**

- 1953 Concentrator identifier telephone answering arrangement introduced **556**
- 1953 Panel and No. 1 crossbar systems modified for toll diversion **496**
- 1953 First installation of 508 PBX for dispatch and emergency service **567**
- 1953 March 29: First 4A crossbar card translator (Pittsburgh, Pennsylvania) **183**
- 1953 July: Lab models built of functional parts of electronic central offices **225**
- 1953 October: First No. 4A traffic usage recorder cutover, No. 4A crossbar (Newark, New Jersey) **401**
- 1953 November: First cutover of crossbar tandem CAMA (Washington, D.C.) **189**
- 1954 Development started on first CAMA **145**
- 1954 No. 5 crossbar wire spring relay marker and other control circuits **167**
- 1954 DIAD research switching system **201**
- 1954 First application of junction transistors (remote line concentrator) **224**
- 1954 April: First switching engineering prospectus on electronic switching **211**
- 1954 May: Start of laboratory organization to develop electronic switching **225**
- 1954 June: W. Keister proposes use of storage in place of logic for control in ECO **225**
- 1954 July: First development authorization for ECO **213**
- 1954 Fourth quarter: Electronic switching lab moves to Whippany **225**
- 1955 Traffic: C. Y. Lee's application of linear graph theory to switching networks **102**
- 1955 Traffic: first switching network simulation on electronic computers by W. S. Hayward and J. Bader **110**
- 1955 Traffic: Wilkinson peaked traffic model proposed **99**
- 1955 First issue of Notes on Distance Dialing **180**
- 1955 Research studies of data link transmission **210**
- 1955 First proposals for central office control of PBX units **228**
- 1955 Magnetic drum translator proposed for 4A crossbar **220**
- 1955 Morris, Illinois chosen for field trial location of first ECO **227**
- 1955 Application of higher voltage to crossbar switch operation **382**
- 1955 Foreign area translation in No. 5 crossbar **371**
- 1955 Introduction of the 6A magnetic drum recording system for announcements **360**
- 1955 557A and 557B telephone answering switchboards introduced **555**
- 1955 Automatic protection switching for spare TD2 radio systems provided **589**
- 1955 April: Field trial model of ECO authorized **225**
- 1955 June: W. A. Budlong proposes to use stored program as the control technique for ECO **225**
- 1955 September: Decision to use stored program control in ECO **226**
- mid-1950s 83-A-1 and 83-B-1 teletypewriter switching systems in service **584**
- 1956 Traffic: automatic photographing of traffic registers **104**
- 1956 Second issue of Notes on Distance Dialing **180**
- 1956 Reauthorization of exploratory development includes stored program control **227**
- 1956 Arranged for trial of operator AMA **309**
- 1956 No. 5 crossbar intermarker group operation developed **382**
- 1956 Toll features added to crossbar tandem systems **371**
- 1956 756 crossbar PBX introduced **453**
- 1956 Crossbar tandem CAMA for step-by-step areas: first cutover (San Diego, California) **144**
- 1956 March: Exploratory development of electronic PBX started **228**
- 1956 September: First application of direct inward dialing to PBX: 195 Broadway (New York City) **497**
- 1957 5C and 5D switchboards: 4-wire switchboards provided for the military **83**
- 1957 Panel and No. 1 crossbar: first auxiliary senders **191**
- 1957 Report favoring the introduction of direct inward and identified outward dialing to and from PBXs **497**
- 1958 Magnetic tape announcement: recorded announcements for service conditions, first introduced **43**
- 1958 Panel system peak deployment: 3.8 million lines, 510 entities **20**
- 1958 No. 5 crossbar CAMA features **144**
- 1958 First cutover of E-type signaling **130**
- 1958 Establishment of ESS switching systems engineering **257**
- 1958 Feasibility established for a military version of ESS (UNICOM) **262**
- 1958 Morris system working in laboratory **248**

- 1958 First No. 5 crossbar arranged to act as an outward class 4 toll point **371**
- 1958 No. 5 crossbar automatic cross-connection check features added **366**
- 1958 6A key telephone system introduced **547**
- 1958 First use of No. 5 crossbar as a PBX: start of Centrex concept (Colorado Springs, Colorado) **346, 501**
- 1958 First group alerting system installed (Garden City, New York) **571**
- 1958 First commercial installation of direct inward dialing to PBXs (Wilmington, Delaware) **500**
- 1958 January: Trial of all-number calling (7 numerical digits) (Wichita Falls, Texas) **370**
- 1958 March: Development of No. 1 ESS authorized **249**
- 1958 March 18: First call placed through pre-Morris SPC ECO lab system **228**
- 1958 September: Development of EPBX authorized **229**
- 1958 Second half: Trial of microfilm directory (Washington, D.C.) **373**
- 1959 First No. 5 crossbar CAMA cutover (Newhall, California) **144**
- 1959 Announced concept of permanent magnet twistor memory **240**
- 1959 Ferreed crosspoint proposed **246**
- 1959 No. 5 crossbar 4-wire design for NORAD/Air defense command started **266**
- 1959 Trial of operator AMA in two No. 5 crossbar offices (New York City/ Poughkeepsie, New York) **309**
- 1959 Coin zone features added to No. 5 crossbar **356**
- 1959 Improved magnetic drum announcement systems introduced in 9A **360**
- 1959 First tri-company committee formed for TOUCH-TONE introduction **339**
- 1959 First commercial cutover of Centrex service on No. 5 crossbar (Detroit, Michigan) **346**
- 1959 Technical trial of TOUCH-TONE in No. 5 crossbar office (Elgin, Illinois) **337**
- 1959 Technical trial of TOUCH-TONE in step-by-step office (Hamden, Connecticut) **337**
- 1959 701B step-by-step PBX introduced **502**
- 1959 Early applications of No. 5 crossbar used as a PBX (Midland, Michigan/ New York City) **502**
- 1959 June: First switching branch lab (Columbus, Ohio) **170**
- 1959 June: Bell System enters agreement with Signal Corps to be principal contractor on UNICOM **262**
- 1959 December: Design choice decisions on ferrite sheet call store permanent magnet twistor **257**
- 1960 First ANI B trial on the panel system (Newark, New Jersey) **150**
- 1960 Trial of distributed line concentrator (Syosett, New York) **216**
- 1960 All major hardware components of No. 1 ESS selected **251**
- 1960 Defense Communication Agency establishes worldwide 4-wire telecommunications network **266**
- 1960 54.4 percent DDD **336**
- 1960 Direct police emergency service available **354**
- 1960 No. 5 crossbar common control switching arrangement introduced **358**
- 1960 Further technical trial of TOUCH-TONE on step-by-step office (Cave Spring, Virginia) **337**
- 1960 Further technical trial of TOUCH-TONE in No. 5 crossbar office (Hagerstown, Maryland) **337**
- 1960 800A ferreed switch PBX introduced **472**
- 1960 Field trials of 756A PBX with direct station selection by attendant **516**
- 1960 Name Centrex adopted for direct dialing to and from PBX extensions **502**
- 1960 Use of TOUCH-TONE in 701B Centrex-CU by attendant **529**
- 1960 Switched loop idea for PBXs conceived **460**
- 1960 First standard use of 701B PBX for Centrex-CU service (New York City) **502**
- 1960 82-B-1 teletypewriter switching system in service (U.S. Navy) **584**
- 1960 January: Separate electronic switching development division started **257**
- 1960 April: First 4A crossbar CAMA (Albuquerque, New Mexico) **189**
- 1960 June 1: First SPC central office part-time service begun (Morris, Illinois) **4, 237**
- 1960 November 11: Full-time electronic switching service begun (cutover at Morris, Illinois) **4, 237**
- 1960 Second half: First No. 5 crossbar packaged installation (Portland, Connecticut) **168**
- 1960s First studies of automatic intercept **322**
- 1960s Participated in studies of common channel signaling in CCITT **321**
- 1960s Studies of TSP on 4A and No. 5 crossbar systems **312**
- 1960s Study of ANI for Centrex-CU Service **346**

- 1960s Exploratory and engineering studies of associated CCIS **432**
- 1960s 4-wire 758 crossbar PBX developed for special- and general-purpose applications **577**
- 1960s Introduction of PBX feature package series **526**
- 1961 First ANI B: (No. 1 step-by-step) (Stamford, Connecticut) **150**
- 1961 Third issue of Notes on Distance Dialing **180**
- 1961 Circuit switched automatic network (U.S. Army) in service **266**
- 1961 Standard remote line concentrator **218**
- 1961 Separate division established for ESS development **258**
- 1961 WATS service introduced **342**
- 1961 Trial of film stick directory (Brooklyn, New York) **375**
- 1961 Marketing trial of TOUCH-TONE (Findlay, Ohio) **337**
- 1961 Marketing trial of TOUCH-TONE (Greensburg, Pennsylvania) **337**
- 1961 First No. 1A crossbar remote line concentrator cutover (Gulfport, Mississippi) **384**
- 1961 608 cordless PBX introduced **457**
- 1961 February: First standard ANI B (Seattle, Washington) **148**
- 1961 June: Peak of 434 electronically switched lines, 654 telephones connected (Morris, Illinois) **237**
- 1961 June: First installation of No. 5 crossbar Centrex-CO for multiple customers (Chicago) **504**
- 1961 July: Proposal to use No. 101 ESS for small central offices **296**
- 1961 September: First CAMA on step-by-step intertoll (Steubenville, Ohio) **145**
- 1961 December: Switched circuit automatic network (SCAN): first commercial application (U.S. Army) **359**
- 1962 Traffic: first simulation of traffic through a hierarchical network of offices with alternate routing, generalized as NEASIM **110**
- 1962 Traffic: M. C. Paull explores re-switching in switching networks **102**
- 1962 First Centrex service through No. 5 crossbar **276**
- 1962 WE receives initial manufacturing information on ESS **258**
- 1962 Line link pulsing on No. 5 crossbar: first cutover (Michoud, Louisiana) **349**
- 1962 60,000 teletypewriter stations with 100 manual switchboards in service **584**
- 1962 757A crossbar PBX introduced **459**
- 1962 Introduction of 761A PBX for hotels and motels **523**
- 1962 Protection switching system 400A standardized **589**
- 1962 January: ESS trial completed, equipment removed from service (Morris, Illinois) **238**
- 1962 August 31: Introduction of public automatic teletypewriter switching service included new 6A manual assistance switchboard and 2A remote concentrator **586**
- 1963 Centralized location test desk first introduced **40**
- 1963 Step-by-step: first forwarding of permanent signal calls **34**
- 1963 Traffic simulation demonstrates interdependence of trunk groups and switching systems **108**
- 1963 NORAD/air defense command special No. 5 ESS in service **266**
- 1963 No. 2 ESS 2-wire proposed for Bell System use **296**
- 1963 First No. 1 ESS installed **260**
- 1963 Invention of TSPS concept **313**
- 1963 Centrex-CO service first available on No. 101 ESS **346**
- 1963 Improved magnetic drum announcement systems introduced in 11A **360**
- 1963 Increased capacity of No. 4A crossbar system **382**
- 1963 Combination of details concept for computerized directory assistance **375**
- 1963 Technical trial of custom calling services on No. 5 crossbar (Columbus, Ohio) **365**
- 1963 CCSA for NORAD **359**
- 1963 First TOUCH-TONE calling on PBXs (No. 101 ESS) **466**
- 1963 No. 5 crossbar line link pulsing to Centrex-CU **505**
- 1963 SS400 crossbar system introduced **459**
- 1963 February: Cutover of federal telephone system (FTS-CCSA) **359**
- 1963 March: Final report on Morris **251**
- 1963 March: Field trial of 101 ESS started (New Brunswick, New Jersey) **252, 446**
- 1963 August: System test of No. 1 ESS underway **252**
- 1963 September: Development authorized for 4-wire No. 1 ESS for AUTO-VON **267**
- 1963 September 30: First call placed through No. 1 ESS lab **259**
- 1963 October: First calls placed through UNICOM test model **265**

- 1963 October: Advanced installations of TSP on crossbar tandem (Manhattan and Forest Hills, New York) **310**
- 1963 Third quarter: First public offering of TOUCH-TONE **339**
- 1963 November: First trial of traffic data recording system (TDRS) **403**
- 1963 November 30: No. 101 ESS first time-division SPC system cutover (Cocoa Beach, Florida) **4, 466**
- 1963 December: Second switch unit for 101 ESS placed in service (Cocoa Beach, Florida) **253, 467**
- 1963 Branch laboratory extended to all crossbar developments (Columbus, Ohio) **170**
- 1964 UNICOM project curtailed to test model only **265**
- 1964 All switching systems modified to accept 0+ dialing with area codes similar to office codes **371**
- 1964 Tandem office modified to outpulse called numbers for paging and mobile radio service **367**
- 1964 Study begins leading to a standard form of CCS (CCITT) **432**
- 1964 1A2 key telephone set introduced **547**
- 1964 First application of TOUCH-TONE to step-by-step PBX (East Moline, Illinois) **532**
- 1964 No. 101 ESS used at New York City World's Fair **466**
- 1964 Modifying SS400 PBX for PICTUREPHONE at New York City World's Fair **532**
- 1964 Eight-station PICTUREPHONE network using modified SS400 crossbar PBX **532**
- 1964 January: First ESS training course for craftspeople **261**
- 1964 January: System test of No. 1 ESS begins in Succasunna, New Jersey **260**
- 1964 July: Smaller ESS development started for AUTOVON (4-wire No. 2 ESS) **268**
- 1964 August: Standard TSP on crossbar tandem (Cleveland, Ohio) **310**
- 1965 First transistorized multifrequency receiver (No. 1 ESS) **128**
- 1965 47.9 percent DDD with ANI **336**
- 1965 Enclosed-housing telephones for emergency outdoor and public locations **352**
- 1965 New main distributing frame for ESS **388**
- 1965 First AIOD-A1 equipment cutover (Princeton, New Jersey) **346**
- 1965 2A switch unit for No. 101 ESS introduced **469**
- 1965 Trial of 2A telephone answering system (Wilmington, Delaware) **559**
- 1965 January: First ANI C cutover (South Sioux City, Nebraska) **152**
- 1965 March: First installation of compatible TOUCH-TONE in step-by-step (Kokoma, Indiana) **339**
- 1965 May 27: Dedication ceremony of first commercial SPC central office **4, 260**
- 1965 May 30: Cutover of first No. 1 ESS: commercial service begun for 4000 customers (Succasunna, New Jersey) **260**
- 1965 Third quarter: Field trials of 800A ferreed PBX (Philadelphia/New York City) **477**
- 1965 December: First cutover of automatic identified outward dialing (AIOD) (Newark, New Jersey) **510**
- mid-1960s Fraudulent schemes detected for bypassing accounting equipment **432**
- 1966 Start of smaller crossbar switch development **168**
- 1966 First studies of increased capacity for No. 1 ESS **328**
- 1966 Development of magnetic tape recording to replace paper tape AMA **379**
- 1966 Intrastate INWATS introduced **342**
- 1966 New family of dial long line circuits **368**
- 1966 First trial of dial-tone-first service in No. 5 crossbar office (Hartford, Connecticut) **358**
- 1966 First trial of dial-tone-first coin service in No. 1 crossbar office (New York City) **358**
- 1966 Marketing trial of custom calling service in No. 5 crossbar (Sioux City, Iowa) **365**
- 1966 Marketing trial of custom calling service in No. 5 crossbar (Wellesley, Massachusetts) **365**
- 1966 3A switch unit for No. 101 ESS introduced **469**
- 1966 January: Second No. 1 ESS placed in service (Chase, Maryland) **260**
- 1966 May: Four 4-wire No. 1 ESS AUTOVON systems cutover **268**
- 1966 July: Electronic switching division established, Indian Hill, Illinois lab (Naperville, Illinois) **170, 269**
- 1966 October: Field trial of Unigaug concept (Rockford, Illinois) **369**
- 1966 December: Development stopped on 4-wire No. 2 ESS for AUTOVON **297**
- 1967 IDDD trial of No. 5 crossbar **192**
- 1967 Northern Electric manufacturing first of 8 No. 1 ESSs (Canada) **269**
- 1967 No. 1A automatic intercept system

- development started with time-division network **324**
- 1967 Nonconvertible TOUCH-TONE in step-by-step to use crossbar link **342**
- 1967 DATAPHONE 50 service started (No. 5 crossbar) **350**
- 1967 Interstate INWATS introduced **342**
- 1967 Standard dial-tone-first coin service available in No. 5 crossbar **358**
- 1967 2000-line 4A switch unit for No. 101 ESS introduced **469**
- 1967 4000-line 4A switch unit for No. 101 ESS introduced **469**
- 1967 January 8: First No. 1 ESS with generic CC1 program cutover (Los Angeles, California) **261**
- 1967 February: First No. 101 ESS 4A switch unit cutover (Naperville, Illinois) **256, 469**
- 1967 March: First new subscriber senders (No. 1 crossbar) **191**
- 1967 December: No. 1 ESS in service in 11 Bell Operating Companies and Bell of Canada **269**
- 1968 First No. 5 crossbar using smaller crossbar switches (Blue Island, Illinois) **168**
- 1968 Crossbar tandem peak: 34 local and 213 toll **190**
- 1968 Fourth issue of Notes on Distance Dialing **180**
- 1968 2-wire No. 2 ESS in operation (Indian Hill) **297**
- 1968 Adopted CCITT signaling system No. 6 **321**
- 1968 Standard dial-tone-first coin service available in No. 1 crossbar **358**
- 1968 Computerized directory assistance simulation trial (East Orange, New Jersey) **375**
- 1968 First field installation of traffic data recording system cutover (Washington, D.C.) **403**
- 1968 10 PTT administrations agree to participate in CCITT signaling system No. 6 trial **432**
- 1968 Proposals to FCC for high-capacity mobile radio telephone system **368**
- 1968 January 14: First cutover of No. 1 ESS Centrex-CO (Philadelphia, Pennsylvania) **346, 510**
- 1968 January 15: Announcement of 911 emergency calling **354**
- 1968 March 2: First service of No. 1 ESS office with signal processor **272**
- 1968 November: First No. 1 ESS with local tandem feature (Nashville, Tennessee) **328, 371**
- 1969 No. 1 crossbar: last new terminating marker group installed (Philadelphia, Pennsylvania) **73**
- 1969 First cutover of F-type signaling **130**
- 1969 No. 101 ESS arranged for main-satellite operation **256**
- 1969 First studies of electronic community dial office (ECDO) using integrated circuit technology **330**
- 1969 Call-waiting feature added to No. 1 ESS **411**
- 1969 No. 23 crossbar call distributor modified to improve reliability and for use as AIS concentrator **373**
- 1969 Developed wideband switching on No. 5 crossbar system for PICTURE-PHONE service **362**
- 1969 First No. 5 crossbar automatic call distributor cutover **373**
- 1969 First commercial use of larger No. 4A ESS switch unit at Mayo Clinic (Rochester, Minnesota) **471**
- 1969 Field trial of 810A ferreed PBX (Denver, Colorado) **487**
- 1969 January 19: Cutover of first TSPS (Morristown, New Jersey) **315**
- 1969 February: First and only No. 1 ESS ADF cutover (New York City) **278**
- 1969 April 20: First cutover of No. 4A crossbar ETS: new office (Grand Rapids, Michigan) **319**
- 1969 June: First standard Unigauge No. 5 crossbar office cutover (Dubuque, Iowa) **369**
- 1969 June 1: First cutover of No. 4A crossbar ETS (Los Angeles, California) **319**
- 1969 December: No. 1 ESS Centrex placed in service, 17,000 lines **277**
- 1960s Late 1960s: Local integrated circuit switching proposal by H. S. McDonald **202**
- 1970 16-type local cordless test desk introduced **40**
- 1970 Traffic: Feiner and Kappel extend network analysis to include control as well as switch cost **102**
- 1970 First No. 5 crossbar trunk link frame with smaller crossbar switch (Port Huron, Michigan) **168**
- 1970 13,600 directory assistance positions in service **373**
- 1970 Application of multiparty service in No. 1 ESS **382**
- 1970 Study of possible SPC modification of electromechanical switching systems **365**
- 1970 Beginning of New York City service crisis **385**
- 1970 558A manual PBX introduced **486**
- 1970 Over two million Centrex telephones in service **573**
- 1970 January: Decision (by W. H. C. Higgins) that digital time-division network will be developed for No. 4 ESS **422**

- 1970 March: Extension of IDDD (additional No. 5 crossbar offices) **192**
- 1970 March: No. 4 ESS digital time-division network expanded from 65,000 to 107,000 terminations **425**
- 1970 April: No. 1 crossbar peak deployment: 7.25 million lines, 325 terminating entities **73**
- 1970 April: No. 1 crossbar: last originating marker group installed (Chicago, Illinois) **73**
- 1970 April: First service link network No. 1 ESS (Chicago) **274**
- 1970 June: AIOD-A2 cutover (Wilmington, Delaware) **346**
- 1970 June 11: Development of 1A processor authorized **292**
- 1970 September 13: First cutover of No. 1A AIS (Hempstead, New York) **324**
- 1970 October: Standard dial-tone-first coin service available for step-by-step (Cheyenne, Wyoming) **358**
- 1970 November 28: First cutover of No. 2 ESS (Oswego, Illinois) **297**
- 1971 No. 5 crossbar call waiting trial (Upper Arlington, Ohio) **168**
- 1971 Customer switching lab established (Denver, Colorado) **170**
- 1971 Start of No. 5A crossbar development **169**
- 1971 First IDDD on No. 1 ESS (New York City World Trade Center) **193**
- 1971 Growth procedures standardized for adding signal processor to No. 1 ESS offices **274**
- 1971 Peak of 45 4-wire No. 1 ESS in service (including 3 in Canada) **269**
- 1971 Bell System proposes cellular mobile radio telephone system **296**
- 1971 First use of integrated circuits in No. 1A SPC on TSPS **316**
- 1971 Computerized directory assistance live traffic trial (Oakland, California) **375**
- 1971 770A crossbar PBX introduced **482**
- 1971 April: First application of minicomputers to assist in central office maintenance and administration (COMAS) (New York City) **398**
- 1971 April 4: No. 1 ESS: first 32,000 core stores in service (Alton, Illinois) **282**
- 1971 August 29: First cutover of No. 2 ESS Unigaugue office (North Madison, Connecticut) **346**
- 1971 September: Field trial of 805A crossbar PBX introduced **482**
- 1971 October: First cutover of double size No. 1A-AIS (Cleveland, Ohio) **327**
- 1971 November: Technical trial of improved call waiting on No. 5 crossbar (Upper Arlington, Ohio) **365**
- 1972 2B automatic call distributor smaller crossbar switches **168**
- 1972 Subscriber loop multiplexer with smaller crossbar switches **168**
- 1972 Trial of switching control center for ESS (Chicago, Illinois) **289**
- 1972 First trial of mini COMAS (Manchester, New Hampshire) **398**
- 1972 USITA informed of plans for employing CCIS **438**
- 1972 Field trial of PBX-CO using No. 1 ESS (Seattle, Washington) **513**
- 1972 January: First standard COMAS cutover (Boston, Massachusetts) **398**
- 1972 July: Development of Quick tests for No. 5 crossbar **399**
- 1972 August 30: First cutover of No. 5A crossbar (Portville, New York) **169**
- 1972 August 31: Start of No. 3 ESS development **330**
- 1972 November 5: First cutover of No. 2A ESS (Sun Valley, Nevada) **298**
- 1972 December: 812A PBX with smaller crossbar switches, first cutover **168, 487**
- 1973 No. 5 crossbar lines exceed number of lines of step-by-step **34**
- 1973 Step-by-step over 24 million lines **11**
- 1973 No. 4A crossbar: smaller crossbar switches **168**
- 1973 SMAS No. 3 with smaller crossbar switches **168**
- 1973 Type 300 special switching system with smaller crossbar switches **168**
- 1973 First service with Centrex console 50A **277**
- 1973 No. 1 ESS original call capacity objectives met **276**
- 1973 Computer system main interconnecting frame (COSMIC) developed **388**
- 1973 Introduction of more precise supervisor timing **380**
- 1973 First standard installation of mini COMAS cutover (New York City) **398**
- 1973 About 100 offices of ELMMSs installed (New York Telephone Company) **382**
- 1973 Studies started on other uses for the CCIS network **438**
- 1973 2B automatic call distributor introduced **566**
- 1973 March: First cutover of ANI-D (Van Dyne, Wisconsin) **153**
- 1973 April: Local step-by-step peak deployment 20 million lines **11**
- 1973 April: Step-by-step peak deployment, 24.4 million lines **34**
- 1973 June: First cutover, remreed trunk link network for No. 1 ESS (Detroit, Michigan) **288**

- 1973 August 20: No. 1 ESS trial of charging on usage basis of custom calling features (Trenton, New Jersey) **411**
- 1973 September: First phase 2 No. 5 crossbar call distributor cutover (Omaha, Nebraska) **373**
- 1973 October: First engineering and administrative data acquisition system cutover (Kansas City, Missouri) **405**
- 1973 November: First peripheral bus computer on No. 4A crossbar (Akron, Ohio) **321**
- 1974 First remreed line link network in production and service **288**
- 1974 Extension of TSPS remote unit operating over 200 miles (Texas) **317**
- 1974 Automatic main distributing frame project started **389**
- 1974 First CAMA-C for crossbar tandem and No. 4A crossbar cutover (Cincinnati, Ohio) **379**
- 1974 First TOUCH-TONE D cutover (Montevideo, Minnesota) **342**
- 1974 Trial of improved emergency 911 service (Philadelphia, Pennsylvania) **355**
- 1974 February: Second generic program (EF-1) for No. 2 ESS: first cutover (Naperville, Illinois) **300**
- 1974 March: Charging for directory assistance starts (Cincinnati, Ohio) **378**
- 1974 June: First No. 3 crossbar cutover (Howells, Nebraska) **169**
- 1974 June: First No. 1 ESS SCC cutover (Miami, Florida) **290**
- 1974 July: First centralized status alarm and control system (CSACS) cutover (Atlanta, Georgia) **399**
- 1974 August: Last installation of crossbar tandem system (Twin Falls, Idaho) **190**
- 1974 October: First No. 1 ESS arranged to act as an outward class 4 toll point (Wichita Falls, Texas) **371**
- 1975 Doubled size of No. 3 crossbar **169**
- 1975 Fifth issue of Notes on Distance Dialing **180**
- 1975 Bell System given go-ahead for field trial of cellular mobile systems by FCC **296**
- 1975 IDDD available through TSPS **316**
- 1975 Addition of on-and-off office network dialing for CCSA **372**
- 1975 Availability of Quick tests for No. 1, No. 4A, and tandem crossbar **399**
- 1975 Introduction of flexible route selection for CCSA **359**
- 1975 First cutover of remreed trunk link network (Brooklyn, New York) **371**
- 1975 No. 5 crossbar ACD addition of CAMA feature **380**
- 1975 Switched access remote test system (SARTS) developed **389**
- 1975 First commercial service of CSS 201S DIMENSION 400 PBX **390**
- 1975 January: First introduction of improved 23-type call distribution concentrators (Marietta, Georgia) **361**
- 1975 February 27: Serious fire at 204 Second Avenue central office building (New York City) **409**
- 1975 March: First AMA recording center (AMARC) cutover (Buffalo, New York) **380**
- 1975 March: First LAMA-C for No. 5 crossbar system cutover (Buffalo, New York) **379**
- 1975 April: First cutover of Centrex-CO service in No. 2 ESS (Naperville, Illinois) **300**
- 1975 April: First use of integrated circuit memory chips in No. 1 SPC (Macon, Georgia) **317**
- 1975 July: CCS 201VS DIMENSION PBX 100 introduced **494**
- 1975 August: First 2A file subsystem for No. 1A AIS cutover (Hammononton, New Jersey) **327**
- 1975 September: First engineering and administration data acquisition system (EADAS): network management system cutover (Milwaukee, Wisconsin) **405**
- 1976 200 No. 2 ESS, 1 million lines in service **297**
- 1976 3A CC used for transaction network **300**
- 1976 Start of use of common channel interoffice signaling (CCIS) **436**
- 1976 SPC network concept adopted **438**
- 1976 More than 400 million dollars spent on No. 4 ESS development **423**
- 1976 135 features now available for DIMENSION 400 PBX **491**
- 1976 CCS 201L DIMENSION PBX 2000 introduced **494**
- 1976 Transaction network in service (Seattle, Washington) **586**
- 1976 First No. 4 ESS and 1A processor cutover (Chicago, Illinois) **294**
- 1976 January: First No. 4 ESS as a selective routing tandem (Chicago, Illinois) **372**
- 1976 January: First automatic trunk analysis (ATA) for No. 5 crossbar (Warren, Michigan) **399**
- 1976 February: First No. 2C ESS in service (Acworth, Georgia) **299**
- 1976 February: First cutover of No. 1 ESS universal trunk frame (Salt Lake City, Utah) **290**

- 1976 April: Last of 182 No. 4A crossbar offices (Bell System) plus 20 (Independents) cutover (Madison, Wisconsin) **180, 321**
- 1976 April: Toll CCIS becomes operational **322**
- 1976 May: First cutover of TSPS: RTA and 2A position subsystem uses smaller crossbar switches (Utica and Syracuse, New York) **168, 319**
- 1976 June: First No. 2B ESS in service (Elgin, Illinois) **299**
- 1976 Second quarter: First automatic trunk analysis (ATA) for No. 1 crossbar (New York City) **399**
- 1976 July: First cutover of No. 1A service evaluation system (Dallas, Texas) **362**
- 1976 July 31: First No. 3 ESS placed in service (Springfield, Nebraska) **331**
- 1976 August: First concentrated range extension in service on No. 2 ESS (North Madison, Connecticut) **300**
- 1976 October: Remreed network serving 6 million lines and 3 million trunks **288**
- 1976 October: First cutover of No. 1A ESS (Chicago) **294**
- 1976 At year end: 180,000 (OUT)WATS lines in service **342**
- 1976 At year end: 108,000 INWATS lines in service **344**
- 1976 At year end: 22 AMARCs in service **380**
- 1976 At year end: 6.5 million Centrex telephones (70 percent Centrex-CO) **346**
- 1976 At year end: 74 percent of numbers are ANC **370**
- 1976 At year end: 911 in use in 600 areas serving 50 million people **354**
- 1976 At year end: TOUCH-TONE available to 70 percent of lines and subscribed to by 30 percent of their customers **342**
- 1976 At year end: Three of 10 signaling regions established; 700 CCIS trunks in service **436**
- 1977 Manufacture discontinued of No. 2 ESS processor **330**
- 1977 Application of 3A CC to 2B ESS **330**
- 1977 Application of 3A CC to No. 5 crossbar ETS **331**
- 1977 Application of 3A CC to transaction network **330**
- 1977 First application of HiLo transmission **329**
- 1977 Development started on HiLo transmission through No. 1 ESS **329**
- 1977 13A announcement system using magnetic bubble memory introduced **361**
- 1977 AIS No. 1A served 40 percent of the lines (3.3 million calls per day) **361**
- 1977 Field test of loop switching system **384**
- 1977 First switching control center for electromechanical switching cutover (Clinton, Michigan) **400**
- 1977 H. E. Vaughan receives IEEE medal of honor **422**
- 1977 April: First retrofit of 2B processor in service (Northbrook, Illinois) **300**
- 1977 April: First No. 1 ESS 4-wire HiLo (Sioux Falls, South Dakota) **291**
- 1977 April: Remote maintenance and traffic system (RMATS) for PBXs introduced (Minneapolis, Minnesota) **493**
- 1977 July: First 1A ESS semiconductor memory in service (Wilmington, Delaware) **295**
- 1977 July: National control center cutover (Bedminster, New Jersey) **406**
- 1977 August: Network operator trouble information system No. 2 in service **388**
- 1977 August 6: Third generic program (EF-2) in service on No. 2 ESS (Seattle, Washington) **300**
- 1977 September 9: First cutover hotel billing information system (Boston, Massachusetts) **316**
- 1977 October: First cutover of No. 5 crossbar ETS (Tarrytown, New York) **366**
- 1977 November: First no. 2 ESS DCT in service (Lake Villa, Illinois) **300**
- 1977 November: First TSPS ACTS (Phoenix, Arizona) **319**
- 1977 At year end: All 10 signaling regions in service with CCIS **436**
- 1978 January 20: First 1A processor retrofit (San Francisco, California) **294**
- 1978 Second quarter: Remote switching of television facilities introduced using SCOTS **588**
- 1978 July: First cellular mobile radio service with No. 1 ESS in service (Oakbrook, Illinois) **296**
- 1978 July: Trial of expanded 911 service starts (Alameda County, California) **355**
- 1978 August: Peak deployment of community dial offices, 4.8 million lines **34**
- 1978 October: No. 5 crossbar peak deployment, 28.5 million lines **170**
- 1978 December: Start marketing trial of high-capacity cellular mobile radio-telephone (Chicago, Illinois) **367**
- 1979 Conversion to all number dialing completed **125**