

**From Tabulators to Early Computers
in the U.S. Life Insurance Industry:
Co-evolution and Continuities**

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From Tabulators to Early Computers in the U.S. Life Insurance Industry: Co-evolution and Continuities

Introduction

While the computer technology that emerged after World War II was revolutionary in its core technology, from the point of view of information-intensive commercial users such as firms in the life insurance industry, it was not a wholly new phenomenon, emerging suddenly and without precedent, but a generational transition in information or data processing. The life insurance industry had been a major user of the most direct commercial predecessor of computers, punched card tabulators, since before the beginning of the twentieth century.¹ For that industry, the processing of data was not ancillary to the production of goods: information was its only product and information processing was the production line of the firm. Thus it is not surprising that this industry was also one of the first and largest adopters of computer technology beginning in the 1950s. It makes an interesting user case study to focus on in exploring the transition from the tabulator era to the computer era.

By looking at this transition through the lens of a user industry, moreover, we shift focus from the technology itself to the evolution, appropriation, and use of that technology. Studies of the advent of computers tend to focus on the technology itself, and its inventors and vendors, with the user organizations as minor or even peripheral players, except in studies that focus on the workers whose jobs are affected by computerization.² My focus

¹ See, for example, Arthur L. Norberg, "High Technology Calculation in the Early 20th Century: Punched Card Machinery in Business and Government," *Technology and Culture* 31 (1990), 753-779; James W. Cortada, in *Before the Computer: IBM, NCR, Burroughs, & Remington Rand & the Industry They Created, 1865-1956* (Princeton, NJ: Princeton University Press, 1993); Martin Campbell-Kelly "Punched-Card Machinery," in William Aspray, ed., *Computing before Computers* (Ames, Iowa, 1990); and JoAnne Yates, "Co-evolution of Information Processing Technology and Use: Interaction between the Life Insurance and Tabulating Industries," Sloan School Working Paper #3575-93, CCS WP#145, forthcoming in *Business History Review*.

²For focus on inventors, see, for example, Nancy F. Stern, "From ENIAC to UNIVAC: A Case Study in the History of Technology" (dissertation for SUNY Stony Brook, August, 1978); for focus on labor, see, for example, U.S. Department of Labor, *Studies of Automatic Technology* Number 2, "The Introduction of

is, first, on the user firms and their industry and the ways in which technology constrained and enabled them; and, second, on the ways in which they influenced the technology and the industry it spawned. In recent years researchers such as Eric von Hippel in management of innovation and Ross Thomson and Christine MacLeod in economic history have highlighted the role of users in shaping technical innovations.³ Indeed, in earlier work I have shown that life insurance played a major role in shaping, as well as being shaped by, the tabulator era of information technology.

Before and during the first generation of computerization, this co-evolution⁴ of technology and its use in this industry continued, although perhaps less intensively. In the mechanical era, for example, some insurance firms engaged in direct innovation, while at this time, the added scientific knowledge of electronics and larger scale of R & D needed to

an Electronic Computer in a Large Insurance Company" (Bureau of Labor Statistics: October 1955). One of the few authors who has paid some attention to the market for the advent of computers is Cortada, *Before the Computer*.

³ In the current literature on innovation, Eric von Hippel, in *The Sources of Innovation* (NY: Oxford University Press, 1988) and other work has highlighted the role of lead users in innovation. In economic history, Ross Thomson has studied the "learning by selling" process by which users influence ongoing technological innovation ["Learning by Selling and Invention: The Case of the Sewing Machine," *Journal of Economic History* 47 (June 1987): 433-45; *The Path to Mechanized Shoe Production in the United States* (Chapel Hill, NC: North Carolina University Press, 1989)]; and Christine MacLeod has examined the innovation and diffusion practices of machine makers and machine users, finding that users played a more important role in innovation and makers in diffusion ["Strategies for Innovation: The Diffusion of New Technology in Nineteenth Century British Industry," *Economic History Review* 45:2 (1992), pp. 285-307]. Of course, studies of the social construction of technology have also shifted focus from the individual inventor to the broader social system influencing innovation, in which users may be considered one of the relevant social groups [e.g., Wiebe E. Bijker, "The Social Construction of Bakelite: Toward a Theory of Invention," in Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch, *The Social Construction of Technological Systems* (Cambridge, MA: MIT Press, 1987), pp. 159-187.

⁴ As explained in my earlier paper, I do not use *co-evolution* in the same biological sense invoked by Edward W. Constant ("On the Diversity and Co-evolution of Technological Multiples: Steam Turbines and Pelton Water Wheels," *Social Studies of Science* 8 (May 1978), 183-210); rather, I use it to denote the contemporaneous and interacting developments of a technology and its use, and of the vendor and user industries. In particular, many of the developments are the conscious actions and reactions of managers, inventors, or other individuals or groups involved. Since writing this paper, I have discovered a group of researchers in technology and innovation management who have recently introduced what seems to be a similar use of the term. See, for example, Lori Rosenkopf and Michael L. Tushman, "The Co-Evolution of Technology and Organization," and Joel A.C. Baum and Jitendra V. Singh, "Organization-Environment Coevolution," both forthcoming in J.A.C. Baum and J. V. Singh (eds.) *Evolutionary Dynamics of Organizations* (NY: Oxford University Press).

innovate in computers made them less likely to get involved on that level.⁵ Moreover, war and post-war military and governmental users played a much more significant role in shaping some of the early core technology.⁶ Still, during this period, individual insurance companies and industry bodies interacted with vendors directly and indirectly, explaining their needs in order to influence the development of the hardware, especially the peripherals, and the medium for input, output, and storage. Again, their need for large-scale generation of transactional documents more than for actual computations was influential in shaping the technology and the technology marketplace. But another form of co-evolution, that between a major user industry (in this case, insurance) and the vendor industry, was also evidenced in this period. Here, we see the influence of the tabulator era on the computer era. The relationships and dependencies of the tabulator era affected the choices firms in this large user industry made and thus the competitive dynamics of the early computer industry.

What follows is organized into three main sections. First, I summarize the interaction between the life insurance industry and the tabulating technology and industry. Then I discuss some of the earliest post-war interactions between insurance representatives and the potential vendors of computing equipment, interactions which shaped both the technology and the life insurance industry's view of the potential uses of that technology. Finally, I discuss the period of initial adoption of first generation, vacuum tube computers by insurance companies in the mid-1950s. The conclusion highlights the themes of co-evolution of technology and users, and the influence of one generation of information processing technology on the next.

⁵ This point is made in the context of another technology and for an earlier period in Paul Israel, *From Machine Shop to Industrial Laboratory: Telegraphy and the Changing Context of American Invention, 1830-1920* (Baltimore: The Johns Hopkins University Press, 1992), p. 3.

⁶ See, for example, Stern, "From ENIAC to UNIVAC"; and Kenneth Flamm, *Creating the Computer: Government, Industry, and High Technology* (Washington, D.C., The Brookings Institution, 1988).

Insurance and the Tabulator Era

As I have explored in an earlier paper,⁷ the life insurance industry, as represented by its firms and its industry organizations, exhibited an early and enduring interest in punched card tabulating beginning in 1890, the year in which Herman Hollerith's still-primitive tabulating system was first used to tabulate results of the U.S. Census. Early tabulating technology included electromechanical or mechanical equipment for recording structured data on punched cards, sorting and counting them by fields, and adding amounts in a designated field. The largest insurance firms, especially, needed a better way to handle their voluminous (some firms already had over one million policies in force by that time) and long-held (life insurance policies were often in force for many decades) records. Thus they were among the very first commercial adopters of the technology, as well as among the most important user-groups (though by no means the only one) shaping the technology as it evolved.

Initially, the insurance firms adopted tabulating technology to speed up manual processes of sorting, counting, and adding numerical data, and directly and indirectly encouraged developments that improved those functions. Indeed, in 1895, an actuary for Prudential Life Insurance Company invented the innovative Gore sorter, which improved on any sorting technology Hollerith had to offer at that point, and which certainly made clear to Hollerith one area in which improvements were needed (and may even have given Hollerith ideas for how to improve it).⁸ Moreover, in 1901, in spite of Hollerith's sporadic marketing efforts, the Actuarial Society of America chose to use the Prudential's Gore sorter rather than Hollerith equipment for a multi-company mortality study scheduled for the following year. These developments and various other market signals by other insurance firms seemed to put pressure on Hollerith to develop and improve his sorting

⁷This section is summarized from Yates, "Co-evolution of Information Processing Technology and Use," where each development is documented in detail.

⁸ This device served the Prudential for many years, though the firm allowed itself to become congealed into use of an incompatible and static technology for three decades (see Marcie J. Tyre and Wanda J. Orlikowski, "Windows of Opportunity: Temporal Patterns of Technological Adaptation in Organizations," forthcoming in *Organization Science* for discussion of congealing patterns in technological adaptation).

technology, and a few months after his rebuff by the Actuarial Society, he introduced his own sorting device.

Except for actuarial calculations of experience and risk, most insurance functions ultimately involved less calculation and more creation of documents: various reports for internal use, and bills, receipts, and policies to go to external parties. From around 1910 on, through a variety of actions, insurance firms and industry groups encouraged Hollerith and his competitors in their development of printing capability. Insurance firms were among the earliest and most enthusiastic purchasers of the competing Powers printing tabulator when it came on the market around 1915. Even earlier, Metropolitan Life Insurance Company, by then the largest insurance firm in the world, contracted with an independent inventor, J. Royden Peirce, to develop customized printing tabulator equipment for that firm. Hollerith's successors were forced to play catch-up, developing printing capabilities by around 1920. With the ability to print numbers--both lists of the numbers punched into the cards and totals and subtotals of these numbers--insurance could produce many internal reports, from actuarial reports to lists of policies managed by a given sales agent.

These early printing tabulators, however, could only manipulate and print numerical data. By its nature, insurance information included alphabetic items such as names and addresses. Thus both sorting by and printing alphabetical items was highly desirable to insurance firms. In the teens and twenties, insurance users made clear this desire by backing new developments competing with Hollerith's successor firm.

Metropolitan Life's contracted inventor, Peirce, had a vision for a system with a master card for each policy that would drive all operations, generate other cards as needed, and create all documents for the normal handling of that policy, including producing and addressing bills and receipts for insurance premiums at regular intervals. He worked on his customized alphabetical tabulating equipment for over a decade, though his weaknesses in

machine technology and shop management blocked realization of his vision.⁹ Meanwhile, the largest British life insurance firm (the Prudential Assurance Company, unrelated to the American firm, the Prudential Insurance Company) bought up the British Powers agency and worked with it to develop alphabetical tabulating and printing capability. This development, which was soon modified and introduced by Powers in America, once again gave Powers the edge, and once again Hollerith's successor firm, which was by 1924 the core of IBM, had to catch up. This time, to provide it with a patent base on which to compete, it hired Peirce and bought his alphabetical tabulating patents. By the end of the twenties IBM had caught up with and surpassed Powers, by then a part of Remington Rand, to stay safely ahead (with a sales advantage of about eight to one) through the rest of the tabulator era.

With this new alphabetical power, tabulators could be used to accomplish, and, in a few cases, to integrate a wider range of insurance functions. Listings of all policies handled by a specific agent could now be listed by name rather than by policy number, making weekly at-home collection of premiums for industrial insurance much easier. For policies billed on a monthly or quarterly basis, addressing bills by punched cards proved more difficult, since it involved much more alphabetical information and the ability to print it on three lines. From 1928 into the 1950s incremental improvements of various sorts continued, allowing the use of alphabetical printing with a wide array of continuous forms (often with carbon sets) to achieve a range of internal and policy-holder documents. By the late 1940s and early 1950s, the vision of generating, if not all documents relating to a policy, at least the periodic premium bills for ordinary life insurance had been realized by a small but increasing number of firms.

While other industries and user groups--including railroads, utilities, state governments, and the accounting profession--also shaped the development of tabulating technology, life insurance certainly was shaped by as well as playing a significant role in

⁹ In any case, his complete customization of hardware to Metropolitan Life's products and processes at a single point in time would have made this equipment of questionable value in the long term.

shaping, this technology. Thus life insurance use of tabulating equipment may be said to have co-evolved with tabulating technology. In addition to shaping technology design and use, the on-going interaction between this major user industry and the technology vendors shaped both industries. IBM had reached its dominant advantage over Remington Rand by responding technically to repeated competitive challenges; by investing in manufacturing, marketing, and management¹⁰; and by learning to work closely with major user industries such as insurance. This earlier era set the stage for the transition to computing.

Early Insurance Involvement in Computers: Immediate Post-War Era

Insurance interest in computers, like that in tabulators, started early. Even before World War II, during which the developments in this area were radically accelerated by war needs, hints of this interest had appeared. As early as 1936, for example, the *Journal of the Institute of Actuaries* carried an article arguing that actuaries should switch from a base-ten system to octal or binary, in order to allow use of electronics in their calculations.¹¹ During the war many mathematically-trained actuaries and other insurance employees worked on military projects involving early computer developments. After the war, the life insurance industry grew rapidly and was faced with shortages in clerical labor and rising costs. Between 1948 and 1953, according to a Bureau of Labor Statistics study, the number of insurance policies in force (a better measure of volume of data processing work than value of insurance in force) rose over 24%, and total employment in the life insurance industry grew almost 14%, as compared to just under 12% for total non-farm employment in the U.S. ¹² It also noted that insurance firms had faced recurrent labor shortages in lower

¹⁰ Alfred D. Chandler, Jr., *Scale and Scope: The Dynamics of Industrial Capitalism* (Cambridge, MA: Harvard University Press, 1990)

¹¹ E. William Phillips, "Binary Calculation," *Journal of the Institute of Actuaries* 67 (1936), 187-203.

¹² U.S. Department of Labor, *Studies of Automatic Technology* Number 2, "The Introduction of an Electronic Computer in a Large Insurance Company" (Bureau of Labor Statistics: October 1955). The quote is from p. 15. Figures are either given or computed from those given in the report.

levels of clerical jobs since 1940. With an already high level of use of pre-computer punched card tabulating equipment, a growing volume of information to handle, growing labor costs of information handling, and the exposure of some to the new technology, the insurance industry's interest in computing developments was not at all surprising.

Two sets of immediate post-war developments illustrate early interactions between insurance and developing computer technology, demonstrating the life insurance industry's interest in and influence on these technological developments: in 1946, the Prudential's Edmund Berkeley initiated serious discussions on technical requirements for insurance applications, and in 1948 the Society of Actuaries established a committee to examine insurance applications of the new technology.

Berkeley and the Prudential Shape Technological Developments

Edmund C. Berkeley joined the Prudential in the Actuarial Department in 1938.¹³ As early as 1941 Berkeley, then Assistant Mathematician for the Prudential Insurance Company, was studying computing software and hardware and their potential uses in insurance. In a series of memos and reports to Prudential Assistant Secretary H. J. Volk in 1941-42, Berkeley explored possible applications of symbolic logic to the Prudential's work.¹⁴ These included, for example, developing a symbolic algebra to aid in determining the optimal sequence of tabulating operations and tabulating machine wiring to accomplish a complicated insurance function. He and a few others from the Prudential, Metropolitan Life, and Equitable Life Insurance Company, along with representatives from Bell Telephone Labs and IBM, held occasional meetings in New York to discuss symbolic logic and its possible applications to punched card tabulating.¹⁵ This activity was a

¹³Obituary for Edmund Callis Berkeley, *Annals of the History of Computing*, 10: 3 (1988), pp. 216-7.

¹⁴E.C. Berkeley to H. J. Volk, 26 May 1941, 7 November 1941, 26 January 1942, etc., Box 3, Folders 34-35, Edmund C. Berkeley Collection, Charles Babbage Institute University of Minnesota, Minneapolis [hereafter Berkeley Coll. 3: 33-5, CBI].

¹⁵E.C. Berkeley to H. J. Volk, 29 Apr. 1942, Berkeley Coll. 3: 34, CBI.

predecessor to computer programming, making use of the logic of Boolean algebra but applying it to the electromechanical processes of punched card tabulating.

During the same period, he was also engaging in discussions with Bell Labs about its electrical relay computing machine and General Electric about the "electric network calculating machine" it was experimenting with.¹⁶ His reports from these contacts indicate that these potential vendors were learning about market needs from him, at the same time that he was learning more about the technology. For example, in his report of the visit to General Electric's labs in Schenectady, NY, he recorded:

The first part of the discussion consisted of an explanation to the General Electric technicians of the kinds of problems which we were interested in solving by new machines. ...[T]hese men first wanted to know how we thought their machines might solve problems for us. I explained that my present purpose was to search out the correspondence between mechanical operations, abstract operations, and the operations taking place in an insurance company, with a view to a variety of applications of machines and abstract systems to insurance company problems. ...Mr. Kuehni inquired if we would be willing to pay from \$100,000 to \$250,000 for the development and production of a new machine. I said that, depending on clerical and other savings computed on reasonable assumptions, we would be willing, and that we were now paying an amount of that order in each year for punched card machines and equipment.¹⁷

Further discussion centered on specific examples Berkeley provided of insurance tasks, such as classifying underwriting risks. In the ensuing discussion of coding and sorting rules, Berkeley pointed out the need, for such applications, of a machine that handled discontinuous, Boolean algebra, rather than an analog machine such as GE's electric network calculating machine. So even in this early period, Berkeley, as a representative of a large potential user base, was providing market information to possible vendors (in this case, perhaps, discouraging their entry into that market).

Berkeley spent the period from 1942-46 serving in the Naval Reserves, stationed for part of that time at Harvard, where he worked with Howard Aiken on constructing the

¹⁶ E.C. Berkeley to H. J. Volk, 10 Nov. 1941, Berkeley Coll. 3: 34, CBI; E.C. Berkeley to H. J. Volk, 9 Feb. 1942, Berkeley Coll. 3: 35, CBI.

¹⁷ E.C. Berkeley to H. J. Volk, 9 Feb. 1942, Berkeley Coll. 3: 35, CBI.

Mark II automatic sequence controlled calculator.¹⁸ When he returned to Prudential in 1946 as a Methods Analyst, his investigations into new computing technology were an even greater part of his activities. For example, he reported that from August 1 to December 31, 1946, he engaged in a total of 60 visits with individuals or groups to discuss applications of the new computing technologies to insurance.¹⁹ As a result of these activities, he wrote a series of reports including one entitled "Sequence Controlled Calculators for the Prudential - Specifications - First Draft, November, 1946."²⁰ This report represents his first of many attempts to formulate and communicate his firm's needs proactively, rather than waiting for the nascent computer industry to come up with its own products. Many of his tentative specifications would turn out to be simple to meet and exceed with the new electronic technology, as will be seen below, while others would not be met for decades (e.g., his demand for unattended overnight operation of the machine). This draft illustrates that Berkeley had complete faith that new "large scale calculating machines" or "sequence controlled calculators" would soon be introduced into business and "become indispensable." Significantly, he closed the report with the following interesting "specification":

There should be close cooperation at all stages between the manufacturer and the Company [Prudential], in regard to the design and development of the machine and other features, so as to make the fullest use in the Company of all applications of devices developed for the machine, etc.

In this passage he revealed the importance he placed on the interaction between user and technology developer.

¹⁸ E.C. Berkeley to H.J. Volk, C.B. Laing, E. F. Cooley, 13 Jan. 1947, Berkeley Coll. 8: 52, CBI. See also Biography of Edmund Callis Berkeley by Pat Hennessy and Bruce H. Bruemmer in the collection guide to the Berkeley Coll., CBI.

¹⁹ E.C. Berkeley to E.F. Cooley, 6 Jan. 1947, Berkeley Coll. 3:51, CBI.

²⁰ E.C. Berkeley to H.J. Volk, 5 Nov. 1946, Unisys Coll. Accession 1825, Box 78, Hagley Museum and Library, Wilmington, DE (hereafter Unisys 78, Hagley.)

Moreover, on December 6, Berkeley ran what he claimed to be the first insurance problem ever to be run on a sequence controlled calculator, a problem which involved a complex set of table look-ups and computations to compute the costs for a change of policy, using the Bell Laboratories general purpose relay calculator.²¹ He went on to explain that "The purpose of this trial was to prove beyond the shadow of a doubt that a sequence controlled calculator can easily perform an insurance company calculation with many successive steps," a goal he achieved.

During the first half of 1947, Berkeley worked on two fronts towards his goal of having one of the new devices developed for the Prudential: educating those in insurance about the technology and communicating with potential vendors about the Prudential's needs. On the educational front, he continued to write reports and memos educating his superiors in the Organization and Methods Division and up the corporate hierarchy about the nature of the rapidly evolving technology and its potential applications to insurance, as well as possible methods of paying for development.²² In listing potential insurance applications for a sequence controlled calculator, he included a wide range from actuarial problems involving complex calculations but limited outputs to routine operations with little calculation but lots of input and output, such as the premium billing process.²³ He also considered various modes of financing development, from cooperating with other insurance companies or government agencies to doing it alone, spelling out advantages and disadvantages of each.²⁴

²¹ E.C. Berkeley to H.J. Volk, C.B. Laing, E. F. Cooley, 28 Jan. 1947, Berkeley Coll. 8:53, CBI.

²² See, for example, E.C. Berkeley to H.J. Volk, C.B. Laing, E. F. Cooley, "New Machinery to Handle Information - Path of Development. Report No. 2: Finding and Studying Applications," 17 Feb. 1947, Berkeley Coll. 8:53, CBI.

²³ Stern ("From ENIAC to UNIVAC") asserts that changes in the Geurtin Law requiring the re-computation of life experience tables pushed Prudential's investigation into computers; Berkeley's papers from this period, however, do not even mention this application, but focus on a wider range of applications, especially premium billing.

²⁴ E. C. Berkeley to H.J. Volk, C.B. Laing, E. F. Cooley, 18 Feb. 1947, "New Machinery to Handle Information - Path of Development, Report No. 3: Paying the Cost of Development," Berkeley Coll. 8:53, CBI. He concludes, at least initially, that the government has already funded much development, and that

He extended his educational efforts outside of the Prudential into the broader insurance community via a paper presented to the Society of Actuaries in May, entitled "Electronic Machinery for Handling Information, and Its Uses in Insurance."²⁵ In this paper, he described what he referred to as "mechanical brains" by analogy to calculators and punched card tabulators, connected in series, with a pre-set sequence of operations, and requiring no human movement of information from one to the next. He asserted that the current cost of such machines, \$100,000-\$125,000, was much less than that for a comparable tabulating set-up and its operators, and described the range of possible insurance applications, from actuarial to operational. He ended with a sweeping statement calculated to generate enthusiasm for the new technology:

In conclusion, I think it is safe to say that we are at the threshold of a new development that will reduce materially the present clerical work going on in life insurance companies. It will transform the numerical work for many actuarial calculations, and enable actuaries to do many things they now only dream of doing.

He mentioned the two key motives that insurance companies would continue to cite for getting computers: reductions in clerical labor (although, as discussed below, in the 1950s firms only reduced the *growth rate* of clerical labor, not overall numbers of clerical employees) and the ability to undertake calculations not feasible in the past.

In addition to the educational missions he took on, Berkeley also began talking seriously to potential vendors about developing a sequence controlled calculator or computer for the Prudential, soliciting and receiving a series of proposals responding to his initial draft specifications and conversations. Engineering Research Associates, Inc. (ERA), for example, proposed that the Prudential, possibly in conjunction with Metropolitan Life with whom ERA was also talking, sponsor the development of such a sequence controlled calculator or a more special purpose insurance calculator. Proposals

expecting a single manufacturer to finance the rest of the development will result in slow, uncertain, and costly development. Thus an association of large potential purchasers of such equipment would be most advantageous.

²⁵ E.C. Berkeley, "Electronic Machinery for Handling Information, and Its Uses in Insurance," "presented to the Actuarial Society of America at its Meeting May 8, 1947," in Berkeley Coll. 8:54, CBI.

also came from Raytheon, Electronic Control Company, soon renamed Eckert-Mauchly Computer Company (EMCC) and others.²⁶ Of the potential vendors, EMCC seemed to lead both in the specificity of its proposal and in the extent of its relationship with Berkeley. In addition to the detailed formal proposal, there was on-going informal correspondence between Berkeley and John Mauchly to discuss details of the proposal.²⁷ By May 16, Prudential had received a second proposal from EMCC, taking into account this informal correspondence.²⁸

If Berkeley clearly favored EMCC, he even more clearly rejected IBM as a potential supplier of these new types of machines. In a confidential memo and notes for a meeting that Berkeley wrote a few days before receiving the second EMCC proposal, he laid out his objections to IBM.²⁹ He argued that because of IBM's stake in current tabulating equipment, "it would be excessively costly to IBM to quickly introduce more modern machinery using electronics and magnetic tape instead of relays and punched cards." Indeed, "IBM has a record of long delay (or suppression) in the introduction of new devices." He criticized IBM reliability and engineering design as well, specifically pointing to problems Aiken had experienced with the IBM-built Mark I, causing him to completely redesign the relays for Mark II. Finally, he noted IBM's policy of secrecy about new developments until devices were ready for the market. All in all, he judged that "there is no prospect of modern electronic machinery from IBM before the next four or five years

²⁶ 31 Mar. 1947, Raytheon to Prudential, "Proposal for an Automatic Digital Calculator for the Prudential Insurance Company," Berkeley Coll. 8:54, CBI; 18 Feb. 1947, Electronic Control Company, "Proposal for the Construction of a Group of Electronic Sequence Controlled Calculators," Berkeley Coll. 8:53, CBI.

²⁷ E.g., J.W. Mauchly to E.C. Berkeley, 26 Feb. 1947, Berkeley Coll. 8:53, CBI.

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²⁸ The two-part report is described in a memo from Berkeley to F. B. Gerhard, C. B. Laing, R. W. Cobb, and E. F. Cooley [24 May 1947, Berkeley Coll. 8:55, CBI] as having two parts. The first part, my focus here, is "Application of High Speed Computing Machines to Certain Problems of the Prudential Life Insurance Company" by Electronic Control Company, 16 May 1947, located in Accession 1825, Unisys Records, Box 48, in Hagley Museum and Library, Wilmington, DE [hereafter Unisys 48, Hagley].

²⁹ "Confidential Memorandum," E.C. Berkeley to C. B. Laing, R. W. Cobb, and E. F. Cooley, 13 May 1947, Berkeley Coll. 3:56, CBI; also "List of Some Questions for Discussion at Meeting Called for May 14, 1947... in Mr. F. B. Gerhard's Office," 13 May 1947, by E.C. Berkeley, Berkeley Coll. 8:55, CBI.

elapse and probably much longer."³⁰ While his indictment is damning, a list of questions and issues he wrote out for himself in preparing for his meeting with a vice president and other superiors indicated that his superiors were also considering additional factors, including "possible decline in the value of our investment in IBM" and "possible pull by IBM at the time we approach the Board of Directors for authorization." Similar issues probably came up in other insurance companies, as well, since as very large users of tabulating equipment, insurance firms had many connections with IBM at all levels, and as large investors, insurance firms were very likely to hold IBM stock.

To return to EMCC's second proposal, Arthur Norberg has noted that this proposal demonstrated that "Eckert and Mauchly evaluated the Prudential's tasks and designed ways that their machine could handle them more efficiently, and how the machine could be modified to do so."³¹ The proposal illustrates the issues where the Prudential was applying (and would continue to apply) pressure on developments. In one section, EMCC used a two-column format to display Berkeley's specifications against EMCC's ability to fulfill them. On most computational issues, EMCC's specifications already surpassed those proposed by Berkeley.³² For example, where Berkeley required that "The time for reference to the number in any register should not exceed 20 milliseconds," EMCC stated that access time would be less than 2 milliseconds. (Only in his desire for rapid random access to stored tables did Berkeley's computational desires exceed what EMCC felt it

³⁰ While his assessment of the time frame was not far off (IBM issued its 701 scientific machine in 1953, 6 years later), he was implicitly assuming that other firms (especially EMCC) would develop commercially available machines more rapidly than they did. It was, in fact, at least that long before any computers were available for other than government or university use.

³¹ Arthur L. Norberg, "New Engineering Companies and the Evolution of the United States Computer Industry," *Business and Economic History*, 22: 1 (Fall 1993), p. 186.

³² Stern states that Prudential was not initially interested in a general purpose high-speed central processor--only in high-speed input and output equipment. With the added materials provided by the CBI's Berkeley Collection, we can see that this is a misreading of Prudential's position. Berkeley was clearly interested in a general purpose central processor, as we can see from his specifications. Realistically, however, he knew that for the type of work insurance needed, having processing speeds that greatly exceeded input-output speeds was useless. To apply a computer to the transactional aspects of the insurance business, such as premium billing, required millions of very short sets of computations or manipulations followed by output of an almost equal number of documents.

could easily deliver. There, the problems of searching sequentially read tape posed problems.) Berkeley's desires in the area of input and output, however, caused definite difficulties for EMCC. For example, Berkeley wanted an auxiliary machine for translating data and instructions into some special medium readable by humans as well as by machine (he suggested punched paper tape) to allow checking of input. At this point, Eckert and Mauchly envisioned direct entry of policy information onto magnetic tape via keytape recorders, and they saw this tape as the sole storage medium. They noted that magnetic tape was not readable by humans, but it could be sent through a printer and printed out for checking. However, the passage went on to suggest:

Proof-reading by visual methods and other methods which involve human scanning of the entire data for detection of errors are not in general to be recommended. More efficient methods of detecting and correcting errors can be devised for use with this equipment.

The input issue arose again in the section on insurance applications. In this section, Eckert and Mauchly also considered how their machine could handle three types of problems the Prudential (and other insurance firms) faced: those involved in premium billing, mortality studies, and group insurance. Of these, they noted that the premium billing application was the largest, the most interesting, and the most likely to generate cost savings. Implementing such an application would, of course, require a large up-front conversion. While they saw direct entry onto magnetic tape as the probable method of a one-time conversion, they also noted that the Prudential, which had not yet converted its premium billing to tabulating equipment, "could start now to convert the information onto punch cards with IBM or Remington Rand punch machines. The information on these punched cards could then be converted onto the tape by readers at a later date." This may have been the beginning of the firm's realization, which would grow rapidly in the next two years as EMCC interacted with more commercial firms, particularly insurance companies, that direct entry and the abandonment of all cards would not come easily. Berkeley was more accepting of magnetic tape than most others in the insurance industry, but even he wanted a visible form, as well. As the Society of Actuaries study described in

the next section suggested and subsequent history confirmed, most firms were loath to give up the visible punched holes on cards for the invisible electric charges of magnetic tape. Most insurance firms would not abandon cards as a mainstay of their data operations for almost two decades, and some continued to use them for limited uses until quite recently.³³ EMCC and its successor, the Univac Division of Remington Rand, would have to develop card-to-tape and tape-to-card devices.

A few days after receiving EMCC's second proposal, Berkeley wrote his superiors recommending that the Prudential inform EMCC of its intent to sign a development contract with that firm.³⁴ He based his support of the proposal on several factors. He argued that "Success [was] Very Likely," "Saving Very Great," and "Purchase Price Low." In fact, he claimed, "This whole purchase cost [ignoring a one-time conversion cost] is less than 1/2 year's annual rent paid to International Business Machines for the punch card equipment used in the Company." Moreover, adding another argument against IBM, he argued that such a contract would provide salutary "Competition for IBM": "At the present time we have a very great dependence on IBM punch card machinery. A contract with another supplier (1) will decrease this dependence, and (2) may in addition cause a reduction in costs from IBM." Such arguments would later be made by some other companies in support of their decisions to go with computer vendors other than IBM.³⁵ In addition, Berkeley argued that EMCC had not only the scientific knowledge to create such a machine, but also the best "understanding of our problem as a business problem instead of a scientific problem" of the firms working to develop such machines at that time: "For example, they alone of our prospective suppliers wished to come and survey in a day or

³³Oral history interview with Ed Kelley of IBM Marketing, conducted by JoAnne Yates and Bob Hancke, August 6, 1993.

³⁴E.C. Berkeley to F. B. Gerhard, C. B. Laing, R. W. Cobb, and E. F. Cooley, 24 May 1947, Berkeley Coll. 8:55, CBI.

³⁵For example, Henry Roberts, of Connecticut General Insurance Company, described the need for competition to IBM as one of the factors behind its move to RCA in the early 1960s. Oral history interview of Henry Roberts by Herbert Kramer, 1981, CIGNA archives.

two our typical problems at no cost to us, saying it would be very valuable to them to know if their machine could not handle our problems." While IBM would be better known for its industry-oriented development and marketing efforts in subsequent years, at this point EMCC was more proactive in its approach to this representative of what would be a major market segment for the computer industry.³⁶

Berkeley evidently carried his point, for within two weeks, Prudential assured EMCC that it intended to enter into a contract, and started a series of negotiations that resulted in a development contract for what would become the Univac.³⁷ Berkeley left the Prudential shortly after this achievement, leaving others to carry on his work, though none as knowledgeable and committed as he. The contract had a series of developmental milestones but an option rather than a commitment to buy a machine after the development phase. Over subsequent months EMCC constantly missed milestones and renegotiated them with the Prudential.³⁸ In spite of these delays, in 1948 Prudential signed a contract to purchase a Univac, which was to be delivered in June of 1950.³⁹ Interestingly, the contract included card-to-tape and tape-to-card devices, indicating the Prudential's decision not to go solely with direct entry to magnetic tape and forcing EMCC to develop such devices. An earlier report from EMCC to the Prudential had noted,

It is agreed that it is desirable for Prudential to be able to convert data stored on punched cards into data stored on magnetic tape, should the UNIVAC System be installed. It would be inefficient to have any reasonably large amount of data transferred by means of a human operator and keyboard. The logical solution therefore is to design and construct a device which will read the holes punched on

³⁶Of course, this proactive approach may have been undertaken more for its marketing value than out of a substantive desire to change their product.

³⁷There were significant contract drafts starting 9 June 1947, and by 5 August 1947 a contract dated 4 August had been signed. This is in the form of a letter from J.W. Mauchly to J. Presper Eckart, Jr., to the Prudential Insurance Company, in Berkeley Coll. 3:56, CBI.

³⁸JWM [Mauchly] to JPE [John Presper Eckert), GMC, JRW, ILA, 28 April 1948, summarizes several of the missed revised deadlines (Unisys 81, Hagley). An example of the constantly updated contracts is dated 19 November 1947, in Unisys 80, Hagley.

³⁹An undated draft of this purchase agreement may be found in Unisys 78, Hagley. Stern (*From ENIAC to UNIVAC*, p. 286) asserts that it was signed on Dec. 8, 1948.

the cards, translate this into electrical impulses, and then record these pulses on magnetic tape.⁴⁰

Delays continued from the purchase contract in 1948 through 1950, when Remington Rand purchased EMCC.⁴¹ Soon Remington Rand, recognizing that the Prudential's \$150,000 contracted price was much too low, tried to renegotiate and in 1951, by threatening an expensive and protracted lawsuit, ultimately succeeded in canceling its contract with Prudential (and with another early backer, A.C. Nielson),⁴² leaving Prudential ready to look elsewhere.⁴³

While Prudential did not ultimately install a Univac, and in fact was not one of the first insurance firms to computerize, as a later section will indicate, through the activities of Berkeley it clearly played an important role in early exploration of applications for computers and conveyance of much information on insurance applications to the embryonic computer industry. When Berkeley left the Prudential, he moved out of insurance forever, becoming a major popularizer of computers. When he was still at the Prudential, he had started the Eastern Association for Computing Machinery, which became the ACM. In 1949 he published *Giant Brains, or Machines that Think*, the first full-length popular account of computers, and in 1951 founded *Computers and Automation*, a major monthly journal in the area.⁴⁴ Thus he is better known for his work with computers than with insurance. Although Berkeley was quite advanced in his understanding, his early

⁴⁰ "Report to Prudential Insurance Company of America on the Possibility of Constructing High-Speed Card-to-Tape Converters," 12 March 1948, Unisys 81, Hagley.

⁴¹ Stern, *From ENIAC to UNIVAC*, pp. 295-6.

⁴² Stern, pp. 297-299. The development money was, of course, refunded.

⁴³ Interestingly, during 1951 EMCC, then a Division of Remington Rand, produced a pamphlet detailing a study conducted jointly with Prudential on "Premium Billing and Dividend and Commission Calculation," in which they detailed a consolidated application similar to that of the Consolidated Functions Plan. (Doc. #5109825, Smithsonian Air and Space Museum Archives. Prudential also claimed later to have done a trial run of the premium billing application on the Univac in that year.

⁴⁴ CBI Biography of Berkeley.

interactions with computing technology on behalf of the Prudential still illustrate many broader patterns in the mutual shaping of the two industries.

He demonstrated some of the factors insurance firms would find important in the decision to obtain computers, what to use them for, and which to obtain. His early movement away from actuarial and towards large operational applications was the first instance of a common movement, reflecting his and the insurance industry's desire to reduce growth in clerical labor. Although new, previously impossible actuarial calculations were intriguing, that was not where the largest initial gains lay for the firms. His rare technical understanding of the operation of the new machines, based on his experience with the Mark II, gave him an advantage; nevertheless, he, like executives of other insurance firms, initially thought more about speeding up existing processes than reconfiguring them totally. And in spite of his well-argued rejection of IBM as a possible vendor, he was at least forced to deal with the problems faced by many other firms similarly facing dilemmas of technical superiority versus long-term institutional relations and interests.

He also served as a good representative of the life insurance industry in some but not all respects in his efforts to shape the technology. He was more willing to move directly to magnetic tape than many other insurance executives would prove to be, but he, too, saw the need for some *visible* medium to supplement the invisible magnetization. The Prudential certainly put EMCC on notice, via the contract to purchase a Univac, of EMCC's need to develop and make available card-to-tape and tape-to-card converters for those firms that wanted to hedge their bets and maintain their card files. Moreover, he shifted the emphasis from internal computation, useful in scientific and defense firms that had previously been the most important users and potential users, to input and output devices, forcing EMCC to confront these essentials for insurance and many other commercial (as opposed to military) uses. He raised, also, the need for random access to files that would bedevil the systems dependent solely on sequentially read tape.

The Society of Actuaries Initiates Industry Study of Computing

Shortly after Berkeley returned from his war-time service to start his studies of new electronic information technologies, the industry as a whole also undertook a joint study of the potential of the new equipment on the horizon.⁴⁵ In 1948 the Society of Actuaries constituted a Committee on New Recording Means and Computing Devices, composed of two representatives of Metropolitan Life Insurance Company (Malvin E. Davis, Vice-President and Actuary, who served as committee chair; and John J. Finelli, Assistant Actuary), one from Connecticut Mutual Life Insurance Company (William P. Barber, Jr.), and one from Equitable Life Assurance Society (Walter Klem, Vice-President and Associate Actuary).⁴⁶ In 1952 this committee presented a report of its activities and conclusions to the Society of Actuaries and to a Special Meeting arranged by the society but including some outside vendors or potential vendors (p. v). This latter meeting included an exhibit of materials and equipment by IBM, Remington Rand (which by that time had bought up the financially ailing and poorly managed EMCC) and the U.S. Bureau of Standards, which had built a one-of-a-kind computer, called SEAC, for the Air Force.⁴⁷

This report, which was produced in written form for distribution, reveals some of the life insurance industry's interaction with the computing industry and the early evolution of its thoughts about how insurance might use this new machinery during this key period before the first computers would actually be ordered in 1953 and delivered to firms in

⁴⁵ Interestingly, Berkeley never became involved in this effort, though it is not clear why. Perhaps he felt that his own specialized knowledge from his war-time experience put him too far ahead of the others for him to benefit from it. Alternatively, perhaps the fact that he was by this time not in the Actuarial Department but in the Organization and Methods Division may have left him uninformed about this effort. This committee was not the only industry effort at this time, but it is the best documented. The Life Office Management Association also established such a committee during the same period. In general, this industry tended to be very open in sharing information on computing technology. Many joint efforts emerged during this era.

⁴⁶ Malvin E. Davis, William P. Barber, Jr., John J. Finelli, and Walter Klem, "Report of Committee on New Recording Means and Computing Devices," Society of Actuaries, September 1952. Unless otherwise indicated, all quotations in this section come from this report, with page numbers given in parentheses in the text.

⁴⁷ Charles and Ray Eames ("By the Office of ..."), *A Computer Perspective: Background to the Computer Age* (Cambridge, MA: Harvard University Press, 1990), p. 159.

1954. As Metropolitan Life's Malvin Davis, chairman of the committee, explained in his part of the report,

We are not going to build this equipment. There are many manufacturers very much better qualified to do that. What we can do is to know our job well enough to be able to tell about it in terms that the manufacturers can use.(p. 25)

Thus this effort, during which they worked closely with at least two of the firms selling computing machinery (internal evidence indicates that they were IBM and Remington Rand's Univac Division, though they remain unnamed), educated both vendors and the insurance community on the possible uses of this new technology.

In describing why the committee was established, the chairman of the committee explained why the actuaries undertook this investigation of the new computing devices that had emerged from the war, and why they chose to do so jointly:

Now one part of the insurance business where more than elementary arithmetic is applied is in the actuarial part of the business, so naturally actuaries began to wonder whether such computers could be of assistance to them. How was an actuary to find out? When he tried to do so, he quickly learned that life insurance people and electronic engineers were two groups who did not speak each other's language. He found electronic engineers quite willing and anxious to have their ability and experience applied to the changes necessary to take computers out of purely laboratory work and into the business world, but they were lacking an adequate picture of the kind of facilities the business world needs. On the other hand, actuaries and others in the life insurance field were also lacking a sufficient understanding of the type of equipment which it would be reasonable to expect for insurance use. It became apparent that some medium was necessary to bridge the gap between the two.

It would obviously be undesirable and unnecessary for each of us who might be able to make use of such equipment to start from scratch and separately begin to build up the necessary knowledge; the preferable approach seemed to be through some joint effort. Accordingly, four years ago the Society of Actuaries appointed a committee to examine into the new recording means and computing devices which were becoming available and to report when it felt that such devices had been developed sufficiently for business use so that life insurance companies could consider their possible employment. (p. 4)

During the next four years, this committee undertook extensive investigation both of developments in equipment and in possible applications of that equipment to life insurance work. At the time of this report, Davis noted, these machines were no longer

...purely computing machines capable only of a large amount of arithmetic. In recent years, some very important improvements have converted them into machines capable of a wide variety of operations. Nowadays we must think of them

as *information processing machines* with computing representing just a part of their total capabilities. (p. 5)

Davis's overview of the committee's activities included some simplified explanations of how some of the new technologies worked, including, for example, magnetic tape and mercury delay tubes, before turning to its central topic, insurance applications. The report did not name specific vendors and tried to avoid favoring one type over another, particularly important because both IBM and Remington Rand were in the audience. However, after mentioning that there were 25 to 30 electronic computing machines in existence, mostly of the punched card type,⁴⁸ the explanations of the technology covered primarily the new elements, especially magnetic tape as a potential medium. Here, as in Berkeley's studies, they focused on input-output issues, as well as on the problems of sorting with a sequential medium such as tape. The input problem clearly seemed best addressed through card-to-tape converters, available by 1952, rather than by direct entry. The output issue was more problematic, but they felt it was on its way to a solution:

Today to convert answers which are in punched card form there exists the regular line of tabulators which are very rapid printing mechanisms. A corresponding high speed printing machine to read answers from magnetic tape does not exist. Magnetic tape information must be converted to readable copy by a slow one-character-at-a-time typewriter which is actuated by a magnetic tape reading mechanism and, because of the relatively high printing cost involved through use of such a machine, it does not appear to be very useful on a large volume of such work. Higher speed printers operating from tape, however, are in a very advanced state of development, so much so in fact that for our purposes we can practically regard them as an accomplished fact. (p. 12)

Sorting was another problem that concerned them, especially since at this point they still thought in terms of the separable sorting, counting, and calculating steps of tabulator operations. In fact, they noted that computers using magnetic tape "are most efficient when the amount of sorting involved is kept down to a minimum" (p. 12).

⁴⁸ He may be including in this number machines such as the IBM type 604 Electronic Calculating Punches, which were just one step above the types 402 and 403 electric models and cannot be considered computers, in spite of a storage capacity of 50 positions. For a description of this device, see Metropolitan Life's in-house methods publication, *Ways and Means*, 4:4 (August 1948), p.2, Metropolitan Life Archives.

After this brief consideration of the technology itself, Davis also summarized the Committee's considerations of possible insurance uses of the new computers to explain why the rest of the report focused on a particular application set (pp. 15-16). Not surprisingly, this committee of actuaries started by considering computation-intensive actuarial investigations such as mortality studies and financial analyses. While these applications were attractive to them and could certainly be handled by the technology, investigation convinced the committee that such work was not large enough in volume to keep a computer busy and to make it pay for itself. They then turned to operational applications, first focusing on the more computational area of policy settlements (i.e., computing and paying out death settlements), but again finding that the volume was not high enough and the amount of table storage needed for the computations was not yet available.

More compelling was the concept of maintaining a large electronic file of policy information that could be stored compactly, updated electronically, and used to look up information on any policy. Since large firms had literally millions of policies, electronic rather than paper or card storage of policy records could save enormous amounts of space, as well as time. Here the Committee encountered two main problems. First, the technology at this stage simply did not support efficient random access to policy information. Searching would have to be sequential and thus too slow. Furthermore, there were significant issues concerning the legal standing of such records, especially in magnetic tape form, to the various state insurance departments and the courts as the primary records on policies:

For one thing, how do we know, for example, how long it would take for policy records which are recorded on magnetic tape to be acceptable to the various Insurance Departments? It has only been within the last few years that some State Insurance Departments have accepted a printed form of annual statement. Microfilm copies are still not acceptable in some courts. How acceptable a completely invisible magnetic tape record would be to the business community at large certainly is a very important question and one that is not likely to be resolved in a short time. We concluded, therefore, that regardless of how excellently magnetic tape might substitute for existing kinds of policy records we would probably need a visual record of the account with the policyholder which would be generally accepted by

the courts and regulatory bodies--at least until wide use of tape has become commonplace. (p. 16)

Thus the Committee rejected this application, as well.

Ultimately, like Berkeley, the Committee concluded that the real gains to be made with electronic computers were in the areas of routine operational processes, especially premium billing. This task involved computing dividends and loan payments on policies, as well as sending out notices of premiums due and statements of values. Thus it focused its attention on figuring out how best to use computers, of both punched card and magnetic tape varieties, in such work. The Committee established several principles or "guide posts" for such computer applications:

1. *An electronic computer should be applied to the whole job, not to some separately departmentalized piece of it. [...]*
2. *Small jobs should be combined with others. [...]*
3. *Source records should be consolidated. [...]*
4. *Make all calculations at one time. [...]*
5. *Use a self-checking machine. [...]* (pp. 22-23)

The first principle was important in its implications for firm structure. Clerical tasks in high volume operations were quite subdivided, and tabulating equipment, though itself often in a centralized tabulating department, had in some ways exacerbated that subdivision, since it handled only one sorting or counting or adding task at a time. Different departments handled each aspect of servicing a policy (e.g., policy loan payments, though part of the premium billing process, were generally handled by a separate department than that figuring the premiums). The Committee recommended handling such jobs as a whole, as well as consolidating source records and different small jobs.

The centerpiece of the Committee's work was what it termed the Consolidated Functions Plan, which was intended to be a general plan applicable to both card- and tape-based computers, and which was worked out and tested based on the procedures of one firm (clearly Metropolitan Life). In his section of the report, John J. Finelli described it as it would work on one small-sized, card-based computer (which he identified in a later article

as the IBM Card Programmed Calculator⁴⁹) and one tape-based computer (the Univac). Ironically, while this plan consolidated several previously separated insurance tasks, as described above, it separated sorting and output from the actual computing, delegating them to different machines and, in the case of magnetic tape computers, to different media. In both cases, input was in the form of two eighty-column cards (one with the address visibly typed on it, as well), though these were converted to magnetic tape via a card-to-tape converter for the latter computer. In addition to retaining punched cards, the plan also included one typed "history card" with a history of premium payments and other facts. These three cards consolidated what had previously been 10 different cards or files of various sorts. It is clear from the description that much of the gain in performance came from this consolidation of files and processes before the actual "computing," not from the computer *per se*.⁵⁰ Finelli provided a justification for the Committee's extremely conservative stance of retaining the humanly readable history cards:

We just do not believe that the time has yet come to completely dispense with readable card records of this kind, and we do not have to in order to realize substantial economy with electronic computers. (p. 41)

Moreover, he justified retaining the punched cards even with the magnetic tape computer by objection to putting processes completely at the mercy of such new and not always dependable machines:

To avoid to the degree possible a complete dependence on the operating effectiveness of such complicated equipment, complete compatibility with punched card systems seems to be an almost essential requirement. (p. 46)

The output procedures for both types of computers were designed to be independent of the computer itself. For the card-based computer, an innovative photo-electric scanning system was to be used for printing name and address information from the

⁴⁹J.J. Finelli, "A Report on the Electronic Activities of a Large Life Insurance Company," *Transactions of the 15th International Congress of Actuaries* (1957), pp. 13-14. The Committee worked out the procedures for the much larger IBM Selective Sequence Electronic Calculator first, but then found that the results from the smaller and less expensive electronic punched card calculator, the CPC, were nearly as good.

⁵⁰ See also Bashe et al, p. 177, on this issue.

address card, saving the addition of two or three more cards with that information encoded on punched cards. The rest of the information (amount of premium, any dividends or loan payments, etc.) would be printed by the high-speed printers used in conjunction with non-electronic tabulating machines. For the tape-based computer, Finelli noted that current printing capabilities were quite slow but that high-speed printers are well along the development process and would soon be available. This development was undoubtedly spurred by the demands of Berkeley, the Committee, and others in life insurance and other industries for the better output capabilities needed by information-intensive businesses, in contrast to the minimal output capabilities demanded by defense and scientific work.

This insurance industry report highlights several issues in the continuing interaction between it and the information processing industry. While many insurance firms awaited off-the-shelf models before actually purchasing a computer, the industry was not waiting passively. Although Berkeley's actions might be attributed to idiosyncratic factors, the Society of Actuaries Committee clearly represented the large players in the industry, who were determined both to stay informed and to make potential vendors aware of their interest and needs. EMCC's successor Univac Division of Remington Rand was exhibiting equipment and probably had representatives sitting in the audience at the Special Meeting of the Society of Actuaries where the report was presented. Univac clearly needed to attract some such large business users and seems to have cooperated fully with the committee to give them information on the tape-processing machine. IBM had an enormous stake in the insurance industry and was clearly monitoring the Committee's work and cooperating, even though its technology was considerably behind at this stage. Both vendors and others are learning more about the industry's needs, especially for rapid sorting and high-speed input and output. Many years later, Paul Chinitz, an individual working with Univac during this period, assessed the importance of the Society of Actuaries study as follows:

The insurance industry had a forum, early, for the use of large computers. They had the actuarial society committee studying that for many years so that the concept

and the results of that evaluation spread out on all the insurance companies. So I think that the concept of the computer as an important [tool] by the insurance industry was generated from within on that. I rather suspect that for a large number of other industrial companies, the concept of going to a computer, or at least investigating the thing, came by an osmosis from the publicity that was generated not only by the election, but also by major insurance companies acquiring systems and [using them successfully].⁵¹

Thus he saw leaders in this industry as taking a proactive role in exploring computers and their possible uses in insurance, and in spreading the word throughout that industry and ultimately beyond to industrial companies.

The Society's report also revealed the life insurance industry's progress from seeing computers as actuarial devices to seeing them as operating workhorses such as tabulating equipment had been. Further, we see that much of the gain from the new process the Committee designed came from their reconfiguration of their own processes; some, but at this stage less, of the gain is attributable to the new electronic technology. The Committee's work suggested that these machines were at a stage of being useful and cost-effective for large firms, and might be shared by smaller and medium sized firms. The Committee did not use Berkeley's inflated rhetoric of "Giant Brains," but saw them as an important but incremental improvement in current processes. The Committee was, if anything, ahead of much of the life insurance industry. It saw the need for reconfiguring processes or, as Davis put it in one paper, "a basic reengineering of present procedures"⁵² to take advantage of the equipment, but did so incrementally, not radically. It was cautious in its estimates of the potential savings from reducing clerical labor. It anticipated a savings, but only a gradual reduction in the clerical workforce, usually by attrition. In fact, no actual reduction in headcount would emerge in the next decade, but a slowing of rapid growth.⁵³

⁵¹Paul Chinitz, in *The Univac Conference*, Charles Babbage Institute Oral History #200, Organized by the Charles Babbage Institute, the Smithsonian Institution, and Unisys Corporation, Conducted 17- 18 May 1990, Smithsonian Institution, Washington, D.C.

⁵²M.E. Davis, "The Use of Electronic Data Processing Systems in the Life Insurance Business," *Proceedings of the Eastern Joint Computer Conference*, Dec. 8-10, 1953 (NY: The Institute of Radio Engineers, Inc., 1953), p. 17.

⁵³The growth rate for office staff (who comprise 70-75% of all insurance employees) declined from 4.2% to 2.4% a year in computerized companies between 1954 and 1964, according to a Labor Department study.

Finally, it was cautious about any abandonment of punched cards and even of cards on which facts were typed or posted by accounting machines. This conservatism would appear frequently in the early years of insurance computing.

The 1950s: The First Generation of Computing in Life Insurance

The two industries, life insurance and computers, were carrying on the interaction described above from just after the war, but the 1950s were pivotal for turning talk into actual orders for and, starting in 1953, delivery and use of computers. From that year through to the end of the 1950s, insurance firms one after another bought their first (and in some instances their second and third) computers. Initial applications were not always ambitious, but the new machines were not yet very powerful and much had to be learned about using them.

Univac as the Initial Computer of Choice for Insurance Companies

The Univac Division of Remington Rand was targeting the business world in general and the insurance industry in particular in the early 1950s. In 1950, Remington Rand hosted the "Remington Rand Forum on the use of Electronics in the Insurance Industry," produced jointly with four different insurance organizations.⁵⁴ This forum included one set of presentations by the Univac representatives, including John Mauchly himself, covering the nature of the Univac, how it could be applied to office procedures in general, how it related to punched card accounting, and most specifically, how it related to the insurance market. After the computer industry view came a panel of life insurance

Because of high business growth, the overall growth rate of employment in insurance during this decade was 32%. United States Department of Labor, Bureau of Labor Statistics, Bulletin No. 1468, "Impact of Office Automation in the Insurance Industry," (U.S. Government Printing Office, 1966), pp. 5, 2.

⁵⁴ Kenneth M. Hills, *Insurance Data Processing* (Philadelphia, Chilton Company--Spectator, 1967), pp. 137-8. The four associations were Life Office Management Association, Insurance Accounting and Statistical Association, Insurance Accountants Association, and the Association of Casualty & Surety Accountants and Statisticians. Interestingly, the Society of Actuaries was not involved.

representatives, including someone from the Prudential, which still had a contract with Univac at that time, discussing that firm's experimentation, and someone from Metropolitan Life, discussing the application of electronic computers to life insurance, a subject which it was studying both independently and in conjunction with the Society of Actuaries study. According to an insurance industry source, this meeting was a turning point:

It was at this forum meeting that the Univac computer system was first introduced and its operations explained to representatives of the insurance industry and the leaders of the various industry associations had an opportunity to outline their ideas on data processing applications for the electronic computer in the life, casualty, and fire segments of the insurance business. The results of this meeting made the industry well aware of things to come and many of the larger companies organized staff committees to make feasibility studies with respect to the desirability of using a computer system for their data processing work.⁵⁵

Because Remington Rand had canceled the Prudential's under-priced contract for a Univac in 1951, Metropolitan Life was the first insurance company to take delivery of a Univac. In the spring of 1954, it received the ninth Univac built, and only the second to go to a commercial company.⁵⁶ It was followed in December of that year by Franklin Life Insurance Company, which received the fifteenth Univac built. The importance of insurance as a Univac customer is revealed by analysis of Univac sales in its first few years. The first eight Univacs, delivered from 1951 through 1953, all went to government agencies (e. g., Bureau of the Census and Army Air Comptroller), universities, and a Univac demonstration and sales center. In 1954, however, Remington Rand shipped eight Univacs, only two of which went to government agencies. Of the remaining six, two went to U.S. Steel, one to DuPont, one to General Electric, and two to life insurance companies. Insurance firms thus accounted for one quarter of the Univacs delivered that year. In the following year, two more insurance firms (John Hancock and Pacific Mutual) bought Univacs, again accounting for one quarter of Univacs delivered.

⁵⁵Hills, p. 139.

⁵⁶ From an unsigned typed list of "Univacs Completed to Date," 8 Feb. 1956, Unisys Coll., probably 1956 chronological file, Hagley.

A closer look at the first two life insurance firms to buy Univacs reveals factors in these companies' decisions to computerize, their choices of the Univac, and their uses of the computer. The two firms contrast sharply on some of these dimensions, providing a wide range of motives and uses for computers.

Metropolitan Life, as we saw earlier, was central to the activities of the Society of Actuaries Committee on computing devices. It is particularly interesting that Metropolitan was so conspicuous in this joint effort and was the first purchaser of a Univac, since a 1948 EMCC internal memorandum assessed Metropolitan Life as an unlikely early customer for the Univac. In this memo, Mauchly described a conversation with the Metropolitan's J. Everett Rowe that included reference to that firm's independent--and ultimately counterproductive--development effort with Peirce in the tabulator era:

He said that they were very much interested in the development of electronic equipment but were not going to spend any money in experimental work or development. [...] He said that their company once spent one and a quarter million dollars in the development of special IBM equipment. They paid a man named Pierce [sic] to do this development, and when it was finished, IBM bought it out. I gather that Mr. Pierce made something out of this, but that Metropolitan didn't. Apparently they are not anxious to spend any money on a project which might appear to their Board of Directors to have any similarity to this earlier experience.⁵⁷

Although this experience obviously did not stop Metropolitan Life from tracking and investigating developments in computers and their possible applications, nor from actually buying the first Univac purchased by any insurance company, it may have prevented them from engaging in the type of developmental contract the Prudential made with EMCC. By the time Metropolitan ordered its Univac in 1953, several were already in operation in government agencies and universities, and Metropolitan had tried one out as part of the Society of Actuaries study. Moreover, the tabulating experience may have made Metropolitan Life more interested in cooperating with other firms through the Society of Actuaries Committee rather than working independently, and it may have been behind Malvin Davis's insistence, as described in his section of the Committee's report, that the

⁵⁷ 31 March 1948, memo from Mauchly to long list of individuals identified only by initials, Unisys 81, Hagley.

Committee focus not on speculative, yet to be developed equipment, but on equipment already available and testable.

Metropolitan Life's motives for buying a computer were simple. First, both its own accounts and a labor department study note that it had suffered from intermittent labor shortages since before the war, leaving it chronically short-staffed.⁵⁸ Thus it was interested in any form of automation that would reduce its large and still growing demand for clerical labor. Furthermore, as the world's largest life insurance firm, it certainly had the volume of clerical work necessary to make such equipment pay, if any insurance firm did. It felt compelled to keep up with such developments in technology, both through the Society of Actuaries committee and through its own parallel in-house committee.⁵⁹

Through its work on those committees, it tested both the Univac and IBM's electronic calculators, clearly seeing the superiority of Univac's technology at this time. Much later, John J. Finelli, a key member of Metropolitan's computer study committee, as well as a member of the Society of Actuaries committee, would claim, with some hyperbole, that "Maybe the biggest push Metropolitan gave the whole electronic development was the decision to buy the Univac. It put IBM in motion and you know what a significant force they became..."⁶⁰ In fact, IBM's account suggests that the push came much earlier, in 1949, with Prudential's Univac order and the knowledge that Metropolitan Life was talking to other vendors.⁶¹ Nevertheless, Metropolitan's order was an important

⁵⁸ U.S. Department of Labor, Bureau of Labor Statistics, "The Introduction of an Electronic Computer in a Large Insurance Company," *Studies of Automatic Technology*, No. 2, 1955.

⁵⁹ William Bell, *A Management Guide to Electronic Computers* (NY: McGraw-Hill Book Company, Inc., 1957), Case History No. III, "Actuarial Operations, Metropolitan Life Insurance Company," p. 281-2.

⁶⁰ Memorandum from John Finelli to Joe Winter, 29 March 1981, Box 19 03 01, *Electronics Installations 1952-59 #2*, Finelli Anthology, Metropolitan Life Archives (hereafter Box 19 03 01, Finelli, Metropolitan Archives). An attached, handwritten note on the stationery of Herman Seltzer addressed to R.J. Conlan, dated 6-12-84, notes that "John's ego ran away with him somewhat," and questions, "Does he really believe that he provided the impetus to drive IBM, NCR, etc. into the computer business?"

⁶¹ Bashe et al, p. 194.

one, and by 1956 it had ordered two more machines, providing lots of publicity and significant impetus to the Univac.

Ironically, Metropolitan Life's actual use of its first Univac was far short of the Consolidated Functions Plan it had been so instrumental in developing. It did not even start with the basic premium billing operation, but with the even more limited actuarial application, rejected towards the beginning of the Society of Actuaries Committee work. They would use it to compute the statistics needed for company financial statements and to calculate insurance experience.⁶² Finelli explained the reasons for this choice as follows:

1. Since the equipment was as yet untried on any commercial application, this area of work (which embraced primarily the production of business statistics not directly affecting policyholder service) was one in which delays could be better tolerated if the machinery did not live up to its early indications.
2. Since this actuarial work was highly mechanized and had recently been redesigned to make the punched card operation a very efficient one, it would give the electronic machinery a severe test.
3. Since this actuarial work involved keeping basic cumulative totals on magnetic tape and adjusting them to reflect current status regularly, it was felt that this experience would yield a significant indication of some of the risks involved in committing basic Company records to magnetic tape in invisible form.
4. Although previous studies had indicated that such equipment could be gainfully employed in many areas of Company work and that many separate areas could well be integrated, it seemed necessary to establish the dependability and effectiveness of the equipment as a matter of fact before embarking on an extensive program of consolidating existing procedures.

This conservative course still made financial sense as a starting point for Metropolitan. While actuarial applications were a relatively small part of total clerical operations in an insurance firm, in one as big as Metropolitan Life (with 44.5 million policies having a value of \$66 billion, Metropolitan Life was the biggest insurance company and even the biggest financial institution in the world at this time⁶³) this work occupied IBM punched card tabulating equipment that rented for \$225,000 a year.⁶⁴ Finelli figured in advance and

⁶²J.J. Finelli, "A Report on the Electronic Activities of a Large Life Insurance Company," *Transactions of the 15th International Congress of Actuaries* (1957), pp. 15-16.

⁶³John Diebold & Associates, Inc., "Univac Applications in Two Insurance Companies: Franklin Life Insurance Company; Metropolitan Life Insurance Company," *Automatic Data Processing Service Methods Report* (Chicago: Cudahy Publishing Company, 1956), p. 16.

⁶⁴Finelli, "A Report on the Electronic Activities ...," p. 15. Material in the rest of this paragraph comes from pp. 20-21.

reiterated two years into the experiment that the savings in equipment and clerical labor for this application would pay for the computer in four years. No layoffs were required: attrition and reassignment easily handled the displacement of clerical workers.

With this first experience progressing fairly well, Metropolitan Life made organizational changes and ordered two additional Univacs for other applications. In 1955, the original Metropolitan Life computer committee (which had run parallel to that of the Society of Actuaries) gave up control of the company's Univac to a new Development Division created to handle all aspects of introducing and establishing computers in other parts of the company, including installation, procedures, programming, and so on.⁶⁵ The programming would be particularly important, since much computer time during the first year's operation was devoted to programming work. In 1956, Metropolitan Life also acquired two additional computers, this time to handle insurance operations. One of them would handle the premium billing application, and "will later be expanded to embrace related functions up to the limit of the available machinery."⁶⁶ Thus even at this second stage, the full Consolidated Functions Plan would only be achieved if the computer had adequate capacity for it.

In contrast to Metropolitan Life, Franklin Life, the second insurance firm to take delivery of a Univac, was a medium-sized firm with roughly 1% the number of policies held by Metropolitan.⁶⁷ Thus it seems an unlikely candidate for such early computerization. But when it ordered its Univac, Franklin Life was in a period of phenomenal growth, having increased its insurance in force 1100% between 1939 and 1952 (with sales growing at over five times the industry growth rate). The company continued to grow, doubling in size between 1952 and 1956. Its management thus felt that the new technology was

⁶⁵ Ibid., p. 22.

⁶⁶ Ibid.

⁶⁷ Computed from Diebold et al, 1956, p. 26. Other facts in this paragraph come from the same source, pp. 3, 13

necessary to keep up with its demand. Moreover, it felt that the computer would allow it to delay a major new building expansion.

The relatively small size of Franklin Life, in relation to Metropolitan Life, both required and allowed it to apply the computer much more innovatively, consolidating operations well beyond what the Society of Actuaries committee had recommended:

A general survey indicated that to justify economically the equipment, a medium-size company -- such as Franklin Life -- would have to use the equipment for many applications. Included in Franklin's applications are premium billing, premium accounting, dividend accounting, agency commission accounting, and valuation of reserves (once annually).⁶⁸

Using the computer, Franklin consolidated twelve separate files of documents and punched cards, operating from one master file and one address file for each policy. These files were maintained on magnetic tape, without the punched card back-ups Metropolitan Life and so many other insurance firms were unwilling to give up. The consolidation of so many files was enabled by having 240 character master files for each policy, which would have required three 80-column cards each.⁶⁹ Interestingly, Franklin Life, like Metropolitan Life, estimated a four-year payback period, though subsequent savings per year were estimated to be quite high.

This comparison highlights one of the drawbacks faced by the largest companies: the size of their applications. At this period and later, sheer quantity of policies in comparison to the size of available machinery and the time within which a particular application had to be run limited the amount of creative consolidation these firms could undertake. Moreover, the possibilities for easy paybacks from simply speeding up individual applications may have deterred these firms from pursuing more complex "reengineering" of processes to make the largest gains. Medium-sized firms such as Franklin Life, on the other hand, had the capacity and flexibility to try more innovative applications of their computers. This pattern was continued in the initial Univac

⁶⁸ Ibid., p. 5.

⁶⁹ Ibid., p. 8.

applications of Pacific Mutual and John Hancock, the next two insurance firms to receive Univacs. John Hancock, the fifth largest insurance firm (though only about one third as large as Metropolitan Life⁷⁰) initially used its Univac for premium billing of ordinary life insurance, which would become a standard early application for many firms.⁷¹ Pacific Mutual, another mid-sized firm, which dated its interest in and knowledge about computers from the meeting at which the Society of Actuaries study was presented, implemented a system relatively close to the Consolidated Functions Plan presented by the Committee.⁷²

Univac continued to cultivate and work with insurance firms over subsequent years and subsequent generations of computers, but it was at the height of its market share among insurance firms in 1954. While in 1955 Pacific Mutual and John Hancock received their Univacs and others ordered them, a Bureau of Labor study of computers in the insurance industry which showed 2 computers installed in 1954 (the 2 Univacs just discussed) showed over 20 installed in 1955, of which only 2 were Univacs.⁷³ Moreover, in the market as a whole, according to one source, IBM was already turning around Univac's lead by the end of that year.⁷⁴ Univac sales continued, but did not dominate the computer scene in numbers as they did, at least until the early 1960s, in technical capabilities. In 1956, for example, Metropolitan Life ordered two more Univacs, and in 1957 New England Mutual Life ordered its first computer, a Univac II.⁷⁵ But meanwhile, IBM was making inroads in the market. As during the tabulating era, Remington Rand

⁷⁰ By asset size, Metropolitan Life had about 3.6 times the assets of John Hancock in 1949, and 2.9 times in 1959, according to statistics from *Flitcraft Compendium* (Oak Park, Illinois, 1950, 1960).

⁷¹ "Univac performs at John Hancock," *Journal of Machine Accounting* 7:5 (May 1956), p. 22.

⁷² D.K. Swinnerton, "Installing a Daily Cycle Data Processing System," *Proceedings of the Insurance Accounting and Statistical Association*, 1956, pp. 97-98.

⁷³ United States Department of Labor, Bureau of Labor Statistics, Bulletin No. 1468, "Impact of Office Automation in the Insurance Industry," (U.S. Government Printing Office, 1966), Chart 1, p. 10.

⁷⁴ Flamm, *Creating the Computer*, p. 83.

⁷⁵ "Univac Contract Signed by Pres. Anderson; 'Giant Brain' Ordered," *Spinning Wheel* 100 (April 1957), p. 1 From New England Mutual Life's archives.

(which became Sperry Rand in 1955) initially moved ahead in technology but within a few years IBM caught up and surpassed it. The next section explains some of the factors in this exchange of competitive positions.

IBM: the easier and ultimately the more popular choice

While Eckert and Mauchly led the way in commercial computers, and had the clear technological advantage during this period, IBM certainly had many advantages of its own with insurance firms (as well as with other potential computer customers). First, it had the enormous installed base of its punched card tabulating equipment, which it was continuing to upgrade, including adding electronics to some models. Its customers were comfortable with punched cards, but many were suspicious of magnetic tape. Based on this tabulating equipment, IBM also had a long-standing relationship with the firms on multiple levels, from the marketing force's contact with decision makers to the service personnel's contact with operators and their managers. Moreover, extrapolating from the Prudential's situation, we may speculate that many insurance firms probably had investments in IBM stock and some probably had connections at the Board of Directors level. Moreover, no matter how rapid the computerization of insurance firms, the reasonably large ones would still need tabulating equipment for many purposes for many more years. One of Berkeley's memos from the late 1940s explored the implications for buying another vendor's computer of Prudential's current tabulating equipment contract with IBM.⁷⁶ In it Berkeley noted, for example, that the contract did not allow the use of IBM equipment for experimental work or when connected to machines made by other firms, except with explicit permission. The contract could be canceled for actions such as attaching IBM peripherals (e.g., high speed printers, which Univac still lacked at that time) to other vendors' equipment without explicit permission.

⁷⁶E.C. Berkeley to F.B. Gerhard, C.B. Laing, R.W. Cobb, and E. F. Cooley, 25 July 1947, Berkeley Coll. 3:56, CBI.

Whether for these reasons or out of general conservatism, many insurance firms were not ready to jump to the Univac by 1954. At the end of that year, IBM shipped the first of its smaller and less powerful, card input and output, 650 magnetic drum computers.⁷⁷ This computer was announced at a monthly rental of \$3250 with 1000 words of memory and \$3750 for 2000 words, a much more accessible price than the \$1.5 million that Metropolitan Life spent on its second and third Univacs in 1956.⁷⁸ Bashe et al explained its success later as follows:

It was very competitive, not only in performance and price, but also in its concept as a small, reliable machine offering the versatility of a stored-program computer in a punched-card environment. This last consideration was important to prospective customers whose data processing requirements were not large enough to justify trading the convenience of the familiar punched card for the vagaries of magnetic tape.⁷⁹

Indeed, insurance firms enthusiastically embraced this machine. Even large companies that bought Univacs often expanded their capabilities (and perhaps protected their standing with IBM) by buying 650s as well. John Hancock, the fourth insurance purchaser of a Univac, was also the first company (insurance or otherwise) to take delivery of a 650.⁸⁰ A glance through the 1956 program for the Electronics Session of the Proceedings of the Insurance Accounting and Statistical Association provides a clear picture of the 650's immediate popularity in the industry. There were two papers on Univac applications and seventeen on 650 applications, indicating that much of the insurance industry was taking the easy and comfortable approach of growing into computing incrementally with IBM. Similar evidence comes from an early 1959 consultant's publication on computers in all types of insurance, which lists 7 Univac Is or IIs and 15

⁷⁷Bashe et al, pp. 170-172.

⁷⁸"2 More Univacs for Metropolitan Life," *The New York Herald Tribune*, May 10, 1956.

⁷⁹Bashe et al, p. 171.

⁸⁰Ibid.

Univac 60s and 120s (evidently a small computer from Univac) in service in insurance firms, but 57 IBM 650s and 16 IBM 705s.⁸¹

Even Prudential, the earliest Univac enthusiast, had not burned its bridges with IBM, and after Remington Rand broke its contract, could easily return to the fold. On May 29, 1947, just over two weeks after Berkeley's damning indictment of IBM, and at about the time when Berkeley informed EMCC of Prudential's intention to negotiate a development contract with that firm, Berkeley also (perhaps as a price that his superiors exacted for giving him his way with the EMCC contract) initiated contact with IBM about future developments. In a memorandum addressed to three high-level IBM officials, Berkeley explained the Prudential's program to investigate the use of modern technology and suggested that he was initiating such a discussion with IBM.⁸² While Berkeley was not happy with this discussion, since IBM insisted it would reveal no developments before public announcements, Prudential continued to work with IBM throughout the period of the Univac contract, converting its premium billing operation to tabulating equipment as a step towards eventual conversion to computer.⁸³ After the break with Univac, Prudential did not act on the computer front for another two years, but in 1953 when IBM announced its 702 Tape Processing Machine, a larger machine than the 650, Prudential placed an order to rent one when they became available, and when the 705 was announced soon after, ordered it, as well.⁸⁴

⁸¹R. Hunt Brown, *Office Automation: Insurance* (NY: Automation Consultants, Inc., 1959), pp. xiii-xvii.

⁸² E.C. Berkeley to C.A. Kirk (Exec. VP), E. F. Douglas (VP), and J.C. McPherson (Chief Engineer), 29 May 1947, Berkeley Coll. 8:55, CBI.

⁸³ Prudential's ordinary premium billing operation is described in H.W. Schrimpf and C.W. Compton to E.C. Berkeley, 23 May 1947, Berkeley 8:58, CBI. (Ordinary insurance, not the Prudential's biggest line, consists of relatively large policies on monthly, quarterly, or yearly billing cycles; in contrast, its large industrial insurance line, consisting of small policies for which premiums were collected door-to-door weekly, was already handled in part by tabulating equipment.) A July 1964 article in a Prudential in-house magazine records that ordinary premium billing was converted to punch card system in the late 1940s. See also *Business Week*,

⁸⁴ James A. Daley, "Conversion to and Installation of IBM 705 Systems at the Prudential," *Proceedings of the Insurance Accounting and Statistical Association*, 1958, pp. 365-66..

The decision to go with IBM was much easier than this in some firms. For example, an automation consultant described the selection of an IBM 650 by the mid-sized Equitable Life Insurance Company of Iowa as follows:

The data processing equipment of different manufacturers was not compared because it is company policy to use only one make of equipment, such as one make of typewriter, one make of adding machine, one make of punched card equipment. The selection of the IBM 650 was justified on the basis that it would replace IBM punched card equipment, either installed or on order, with an approximately equivalent monthly rental.⁸⁵

Early Applications of Computers in Life Insurance

If choice of vendor was influenced by a pattern established in the tabulator era, choice of applications was also, at least in part, a continuation of an earlier pattern. Premium billing operations, either by themselves or consolidated with other functions such as premium and loan accounting operations, appeared frequently in early accounts of applications, such as those of Prudential, John Hancock, Pacific Mutual, and Franklin Life. As late as 1964, a major industry-wide survey indicated that in the life insurance business, the most common application area was still premium notice billing, with premium accounting a close second.⁸⁶ By this time, these and other related applications were more often consolidated than independent, but the basic transactional operation of billing, just beginning to be automated at the end of the tabulator era, was still central to computer applications 15 years later.

Premium billing was by no means the only application during the first few years of computerization in insurance. As we have seen, Metropolitan Life started out with an actuarial application. Other firms used computers for applications such as processing mortgage and policy loans, payroll, agents commissions, and group insurance policies.⁸⁷

⁸⁵ R. Hunt Brown, *Office Automation: Insurance*, p. III D4-1.

⁸⁶ "EDP Applications in Life Insurance Companies," Automation Report No. 10 (NY: Life Office Management Association, February 1965), p. 4, 8.

⁸⁷ R. Hunt Brown, *Office Automation: Insurance*, p. III D1-D18.

As noted above concerning the first Univac applications, consolidated applications were initially more common in mid-sized firms than in large ones.⁸⁸ In these early years, however, the applications were almost always either direct conversions to computers of applications already handled by tabulating equipment or the combination and consolidation of several such applications.

Conclusion

This paper has briefly surveyed early interactions of insurance as a user industry with vendors of computing equipment during the period from the end of the war into the mid-1950s, when first generation computers were adopted by many insurance firms. The transition of life insurance from tabulating to computing technology illustrates at least three themes:

- **Co-evolution of technology and its use:** During the tabulating and early computing eras, data processing technology enabled new activities and uses by insurance firms, including much more rapid handling of existing processes, the slowing of growth in number of clerical employees and the consolidation of applications that had long been handled separately, eliminating much repetition of data and steps. But the development of the technology was also affected by the uses to which insurance firms wanted to put it. In particular, insurance firms had greater need for rapid input and output, including output of millions of transactional documents such as premium bills, than many scientific and government users. While insurance firms were not the only users with these needs, they were quite significant as a proportion of business users. In 1955, for example, a Bureau of Labor study cited insurance as making up one third of the commercial customers for computers.⁸⁹ Large firms such as the Prudential and

⁸⁸ See also, for example, the observations of a British insurance manager on the difference between computer applications in larger and smaller U.S. insurance firms: "The larger ones have been quite happy as a first step to secure significant cost savings on individual large-volume jobs and to think about integrating them in the future, while the smaller companies, who have been forced to use large and fast machines in order to compete with their larger brethren have had to go further in unifying their procedures in order to justify the cost of the large machines." R. G. Jecks, "Computers in Insurance," *Computer Bulletin* 6 (March 1963), p.114.

⁸⁹ "The Introductions of an Electronic Computer in a Large Insurance Company," *Studies of Automatic Technology* No. 2 (U.S. Department of Labor, Bureau of Labor Statistics, October 1955), p. ii.

Metropolitan Life seem to have pushed Univac's development of high-speed printing capability. Similarly, insurance significantly influenced the long survival of cards as a medium for input, output, and storage.

- **Co-evolution of user industry and vendor industry:** Both the user industry and the vendor industry were affected by interactions between the two. The technology and the choices insurance firms made with relation to technology affected their outcomes and capabilities. In both the 1920s and the 1950s, however, life insurance was expanding, so the interaction did not typically affect the survival of insurance firms. But user firms and industry bodies also shaped, perhaps more critically, vendor firms and industries. Orders from large firms like the Prudential and Metropolitan Life affected the future especially of new-comers to the data processing industry such as EMCC, but also of old-timers such as IBM. While the Prudential did not ultimately purchase a Univac, its early funding of development, along with that of A.C. Nielson and the Bureau of Standards, enabled Eckert and Mauchly to survive a critical time period.
- **Influence of the tabulating era on the early computing era:** Finally, we can see that events and choices in the tabulator era affected events and choices in the early computer era. In its core technology, the computer may have marked a point of discontinuity with what came before, but it clearly demonstrated continuities in many other areas. For example, the punched card as an input, output, and storage medium, along with many peripherals using this medium, carried over from one generation of information technology to another, making the transition easier for many firms.

Market relations represent another area of continuity. IBM's close operational and sometimes financial relations with insurance firms during the tabulator era--relations which many insurance firms were reluctant to break too rapidly or completely--bought it time to catch up technologically. Staying with IBM technology, even if it was less advanced, was in many ways an easier decision for insurance firms than starting a new relationship with another vendor. Mistakes made by insurance firms in the earlier period often shaped their actions in the later period, as well. Metropolitan was determined not to make the same mistake of pouring money into development that might never pay off. Thus it waited until it could order an actual product that already existed and had been tested.

Finally, there was continuity in application areas, as in the case of premium billing. The trend from single functions to combined functions was beginning in the late tabulator era with the automation of premium billing (which was previously composed of several separate functions), and it continued, although slowly, into the early computer era. In both eras, insurance moved from using the technology primarily to compute, as in actuarial applications, to using it to generate the transactional documents (such as premium bills) that enabled the firm to function.

Of course, there were differences between the two eras, as well, but those are often noted. This view of the transition to computing from the perspective of one major user industry highlights some of the underplayed continuities, as well as the importance of user firms and industries in shaping data processing technology and the technology vendor industry.