I.B.M.'s $ 5,000,000,000 Gamble

by T. A. Wise
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The decision by the management of the International Business Machines Corp. to produce a new family of computers, which it calls the System/360, has emerged as the most crucial and portentous—as well as perhaps the riskiest—business judgment of recent times. The decision committed I.B.M. to laying out money in sums that read like the federal budget—some $5 billion over a period of four years. To launch the 360, I.B.M. has been forced into sweeping organizational changes, with executives rising and falling with the changing tides of the battle. Although the fact has largely escaped notice, the very character of this large and influential company has been significantly altered by the ordeal of the 360, and the way it thinks about itself has changed, too. Bob Evans, the line manager who had the major responsibility for designing this gamble of a corporate lifetime, was only half joking when he said : "We called this project `You bet your company.' "

Evans insists that the 360 "was a damn good risk, and a lot less risk than it would have been to do anything else, or to do nothing at all," and there is a lot of evidence to support him. But despite the fact that I.B.M. claims that the 360 is a great success, and hails it as a commercial triumph, it is still far too early to say whether the decision to press on with it was a thoroughly sound one. A long stride ahead in the technology of computers in commercial use was taken by the 360. So sweeping are the implications that it may be ten years before there is enough data to evaluate the wisdom of the whole undertaking.

The new System/360 was intended to obsolete virtually all other existing computers—including those being offered by I.B.M. itself. Thus the first and most extraordinary point to note about this decision is that it involved a challenge to the marketing structure of the computer industry—an industry that the challenger itself had dominated overwhelmingly for nearly a decade. It was roughly as though General Motors had decided to scrap its existing makes and models and offer in their place one new line of cars, covering the entire spectrum of demand, with a radically redesigned engine and an exotic fuel.

The computer is recognized as the most vital tool of management introduced in this generation. It increasingly affects not only business corporations, but government and education as well. There are now perhaps 35,000 computers in use, and it has been estimated that there will be 85,000 by 1975. I.B.M. sits astride this exploding market, accounting for something like two-thirds of the worldwide business—i.e., the dollar value of general-purpose computers currently installed or on order. I.B.M.'s share of this market last year represented about 77 per-cent of the company's $3.6-billion gross revenues, and probably accounted for about the same share of I.B.M.'s profits, which totaled $477 million.

Several separate but interrelated steps were involved in the launching of System/ 360. Each one of the steps involved major difficulties, and taking them all meant that I.B.M. was accepting a staggering challenge to its management capabilities. First, the 360 depended heavily on microcircuitry, an advanced technology in the field of computers. (See "In Electronics, the Big Stakes Ride on Tiny Chips," FORTUNE, June.) In a 1952 vacuum-tube model of I.B.M.'s first generation of computers, there were about 2,000 components per cubic foot. In a second-generation machine, which used transistors instead of tubes, the figure was 5,000 per cubic foot. The System/360 model 75 computer, using hybrid microcircuitry, involves 30,000 components per cubic foot. The old vacuum-tube computer could perform approximately 2,500 multiplications per second ; the 360 model 75 was designed to perform 375,000 per second. The cost of carrying out 100,000 computations on the first-generation model was $1.38; the 360 will reduce the cost to 3 1/2 cents.

The second step was the provision for compatibility—that is, as the users' computer requirements grew, they could move up from one machine to another without having to discard or rewrite already existing programs. Limited compatibility had already been achieved by I.B.M., and by some of its competitors too, for that matter, on machines of similar design but different power. But it had never been achieved on a broad line of computers with a wide range of powers, and achieving this compatibility depended as much on developing compatible programs or "software" as it did on the hardware. All the auxiliary machines—"peripheral equipment" as they are called in the trade—had to be designed so that they could feed information into or receive information from the central processing unit; this meant that the equipment had to have timing, voltage, and signal levels matching those of

the central unit. In computerese, the peripheral equipment was to have "standard interface." The head of one competing computer manufacturing company acknowledges that at the time of the System/360 announcement he regarded the I.B.M. decision as sheer folly and doubted that I.B.M. would be able to produce or de-liver a line that was completely compatible.
Finally—and this was the boldest and most perilous part of the plan—it was decided that six main units of the 360 line, originally designated models 30, 40, 50, 60, 62, and 70, should be announced and made available simultaneously. (Models at the lower and higher ends of the line were to be announced later.) This meant that all parts of the company would have to adhere to a meticulous schedule.

Up in manufacturing, down in cash

The effort involved in the program has been enormous. I.B.M. spent over half a billion dollars on research and development programs associated with the 360. This involved a tremendous hunt for talent: by the end of this year, one-third of I.B.M.'s 190,000 employees will have been hired since the new program was announced. Between that time, April 7, 1964, and the end of 1967, the company will have opened five new plants here and abroad and budgeted a total of $4.5 billion for rental machines, plant, and equipment. Not even the Manhattan Project, which produced the atomic bomb in World War II, cost so much (the government's costs up to Hiroshima are reckoned at $2 billion), nor, probably, has any other privately financed commercial project in history.

Such an effort has already changed I.B.M.'s nature in several ways:

- The company, which was essentially an assembler of computer components and a business-service organization, has now also become a major manufacturing concern as well. It is the world's largest maker of integrated circuits, producing an estimated 150 million of the hybrid variety annually.

- After some ambivalence, I.B.M. has abandoned any notion that it is simply another American company with a large foreign operation. The view now is that I.B.M. is a fully integrated international company, in which the managers of overseas units are presumed to have the same capabilities and responsibilities as those in the U.S. The company's World Trade subsidiary has stopped trying to develop its own computers; instead, it is marketing the 360 overseas, and is helping in the engineering and manufacturing of the 360.

- The company's table of organization has been restructured significantly at least three times since 1960. Several new divisions and their executives have emerged, while others have suffered total or partial eclipse. An old maxim of the I.B.M. organization was that few men rose to line executive positions unless they had spent some time selling. Now a new group of technically oriented executives has come to the forefront for the first time, diluting some of the traditional power of the marketing men in the corporation.

- I.B.M.'s balance sheet has a new look. In 1963, about 27 percent of the company's assets were in the form of cash or marketable securities. By the end of 1965 assets of that kind were down to 18 percent, and the balance sheet showed $173 million less cash than it had two years earlier. Last spring the company called on its shareholders for .$371 million of equity capital to help finance the new computer family.

The missionaries and the scientists

Oddly enough, the upheaval at I.B.M. during the past two years went largely unnoticed. The company was able to make itself over more or less in private. It was able to do so partly because I.B.M. is so widely assumed to be an organization in which the unexpected simply doesn't happen. Outsiders viewing I.B.M. presume it to be a model of rationality and order—a presumption related to the company's products, which are, of course, instruments that enable (and require) their users to think clearly about management.

This image of I.B.M., moreover, has been furthered over the years by the styles of the two Watsons. Tom Watson Sr. combined an intense devotion to disciplined thinking with formal, rather Victorian attitudes about conduct, clothes, and courtesy. The senior Watson's hostility toward drinking, and his demand that employees dedicate themselves totally to the welfare of the corporation, created a kind of

evangelical atmosphere. When Toni Watson Jr. took over from his father in 1956, the manner and style shifted somewhat, but the missionary zeal remained—now overlaid by a new dedication to the disciplines of science. The overlay reinforced the image of I.B.M. as a chillingly efficient organization, one in which plans were developed logically and executed with crisp efficiency. It was hard to envision the company in a gambling role.

The dimensions of the 360 gamble are difficult to state precisely. The company's executives, who are men used to thinking of risks and payoffs in hard quantitative terms, insist that no meaningful figure could ever be put on the gamble—i.e., on the odds that the program would be brought off on schedule, and on the costs that would be involved if it failed.

Outsailing the boss

At the time, it scarcely seemed that any gamble at all was necessary. I.B.M. was way out ahead of the competition, and looked as if it could continue smoothly in its old ways forever. Below the surface, though, LB.M.'s organization didn't fit the changing markets so neatly any more, and there really was, in Evans' phrase, a risk involved in doing nothing.

No one understood this more thoroughly, or with more sense of urgency, than one of the principal decision makers of the company, T. Vincent Learson. His entire career at I.B.M., which began in 1935, has been concerned with getting new products to market. In 1954 he was tapped by young Tom Watson as the man to spearhead the company's first big entry into the commercial computer field—with the 702 and the 705 models. His success led to his promotion to vice president and group executive in 1956. In 1959 he took over both of the company's computer development and manufacturing operations, the General Products Division and the Data Systems Division.

Learson stands six foot six and is a tough and forceful personality. When he is managing any major I.B.M. pro-gram, he tends to be impatient with staff reports and committees, and to operate outside the conventional chain of command; if he wants to know why a program is behind schedule, he is apt to call directly on an executive at a much lower level who might help him find out. But he often operates indirectly, too, organizing major management changes without his own hand's being visible to the men involved. Though he lacks the formal scientific back-ground that is taken for granted in many areas of I.B.M., Learson has a reputation as a searching and persistent questioner about any proposals brought before him ; executives who have not done their homework may find their presentations falling apart under his questions—and may also find that he will continue the inquisition in a way that makes their failure an object lesson to any spectators. And Learson is the most vigorous supporter of the company's attitude that a salesman who has lost an order without exhausting all the resources the company has to back him up deserves to be drawn and quartered.

Learson's personal competitiveness is something of a legend at I.B.M. It was significantly demonstrated in this year's Newport-to-Bermuda yacht race, in which Learson entered his own boat, the Thunderbird. He boned up on the history of the race in past years, and managed to get a navigator who had been on a winning boat three different times. He also persuaded Bill Lapworth, the famous boat designer, to be a crewman. Learson traveled personally to California to get one of the best spinnaker men available. All these competitive efforts were especially fascinating to the people at I.B.M. because Tom Watson Jr. also had an entry in the Bermuda race; he had, in fact, been competing in it for years. Before the race Watson good-humoredly warned Learson at a board meeting that he'd better not win if he expected to stay at I.B.M. Learson's answer was not recorded. But Learson won the race. Watson's Palowan finished twenty-fourth on corrected time.

When Learson took over the computer group he found himself supervising two major engineering centers that had been competing with each other for some time. The General Products Division's facility in Endicott, New York, produced the low-priced 1401 model, by far the most popular of all I.B.M.'s computers—or of anyone else's ; to date something like 10,000 of them have been in-stalled. Meanwhile, the Data Systems Division in Poughkeepsie made the more glamorous 7000 series, of which the 7090 was the most powerful. Originally, I.B.M. had intended that the two centers operate in separate markets, but as computer prices came down in the late 1950's, and as more versions of each model were offered, their markets came to overlap—and they entered a period in which they were increasingly penetrating each other's markets, heightening the feeling of rivalry. Each had its own development program, although any decision to produce or market a new computer, of course, had to

be ratified at corporate headquarters. The rivalry between the two divisions was to become an element in, and be exacerbated by, the decision to produce the 360.

Both the 1401 and the 7000 series were selling well in 1960. But computer engineers and architects are a rest-less breed ; they are apt to be thinking of improvements in design or circuitry five minutes after the specifications of their latest machines are frozen. In the General Products Division, most such thinking in 1960 and 1961 was long term ; it was assumed that the 1401 would be on the market until about 1968. The thinking at the Data Systems Division concerned both long-range and more immediate matters.

A $20-million Stretch

One of the immediate matters was the division's "Stretch" computer, which was already on the market but having difficulties. The computer had been designed to dwarf all others in size and power, and it was priced around $13,500,000. But it never met more than 70 per-cent of the promised specifications, and not many of them were sold. In May, 1961, Tom Watson made the decision that the price of Stretch should be cut to $8 million to match the value of its performance—at which level Stretch was plainly uneconomic to produce. He had to make the decision, it happened, just before he was to fly to California and address an industry group on the subject of progress in the computer field.

Before he left for the coast, an annoyed Watson made a few tart remarks about the folly of getting involved in large and overambitious projects that you couldn't deliver on. In his speech, he admitted that Stretch was a flop. "Our greatest mistake in Stretch," he said, "is that we walked up to the plate and pointed at the left-field stands. When we swung, it was not a homer but a hard line drive to the outfield. We're going to be a good deal more careful about what we promise in the future." Soon after he returned the program was quietly shelved; today only seven of the machines are in operation. I.B.M.'s over-all loss on the program was about $20 million.

The Stretch fiasco had two consequences. One was that the company practically ignored the giant-computer field during the next two years—and thereby enabled Control Data to get a sizable headstart in the market. (See "Control Data's Magnificent Fumble," FORTUNE, April.) The market's customers are principally government and university research centers, where the most complex scientific problems are tackled and computers of tremendous power are required. Eventually, in 1963, Watson pointed out that his strictures against overambitious projects had not been meant to exclude I.B.M. from this scientific market, and the company is now trying to get back into it. Its entry will be the 360-90, the most powerful machine of the new line.

A second consequence of the Stretch fiasco is that Learson and the men under him, especially those in the Data Systems Division, were under special pressure to be certain that the next big project was thought out more carefully and that it worked exactly as promised. As it happened, the project the division had in mind in 1960-61 was a fairly ambitious one: it was for a line of computers, tentatively called the 8000 series, that would replace the 7000 series, and would also provide a limited measure of compatibility among the four models projected. The 8000 series was based on transistor technology, and therefore still belonged to the second generation ; however, there had been so much recent progress in circuitry design and transistor performance that the series had considerably more capability than anything being offered by I.B.M. at that time.

The principal sponsor of the 8000 concept was Fred Brooks, head of systems planning for the Poughkeepsie division. An imaginative, enthusiastic twenty-nine-year old North Carolinian with a considerable measure of southern charm, Brooks became completely dedicated to the concept of the new series, and beginning in late 1960 he began trying to enlist support for it. He had a major opportunity to make his case for the 8000 program at a briefing for the division's management, which was held at Poughkeepsie in January, 1961.

By all accounts, he performed well: he was relaxed, confident, informed on every aspect of the technology involved, and persuasive about the need for a change. Data Systems' existing product line, he argued, was a mixed bag. The capability of some models overlapped that of others, while still other capabilities were unavailable in any model. The 8000 series would end all this confusion. One machine was already built, cost estimates and a market forecast had been made, a pricing schedule had been completed, and Brooks proposed announcing the series late that year or early in 1962. It

could be the division's basic product line until 1968, he added. Most of Brooks's auditors found his case entirely persuasive.

Enter the man from headquarters

Learson, however, was not ready to be sold so easily. The problems with Stretch must have been on his mind, and probably tended to make him look hard at any big new proposals. Beyond that, he was skeptical that the 8000 series would minimize the confusion in the division's product line, and he wondered whether the concept might not even contribute to the confusion. Learson had received a long memorandum from his chief assistant, Don Spaulding, on the general subject of equipment proliferation. Spaulding argued that there were already too many different computers in existence, and that they required too many supporting programs and too much peripheral equipment; some drastic simplification of the industry's merchandise was called for.

With these thoughts in mind, Learson was not persuaded that Brooks's concept was taking I.B.M. in the right direction. Finally, he was not persuaded that the company should again invest heavily in second-generation technology. Along with a group of computer users, he had recently attended a special course on industrial dynamics that was being given at the Massachusetts Institute of Technology. Much of the discussion had been over his head, he later recalled; but from what his class-mates were saying he came away with the clear conviction that computer applications would soon be expanding rapidly. and that what was neaded was a bold move away from "record keeping" and toward more sophisticated business applications.

There was some direct evidence of Learson's skepticism about the 8000 series. Shortly after the briefing Bob Evans, who was then manager of processing systems in the General Products Division, was dispatched to Poughkeepsie as head of Data Systems' planning and development. He brought along a number of men who had worked with him in Endicott. Given the rivalry between the two divisions, it is not very surprising that he received a cool welcome. His subsequent attitude toward the 8000 concept ensured that his relations with Brooks would stay cool.

Evans made several different criticisms of the concept. The main one was that the proposed line was "nonhomogeneous"—that is, it was not designed throughout to combine scientific and business applications. Further, he contended that it lacked sufficient compatibility within the line. It would compound the proliferation problem. He also argued that it was time to turn to the technologies associated with integrated circuits.

Blood on the floor

For various reasons, including timing, Brooks was opposed, and he and Evans fought bitterly for several months. At one point Evans called him and quietly mentioned that Brooks was getting a raise in salary. Brooks started to utter a few words of thanks when Evans said flatly, "I want you to know I had nothing to do with it."

In March, 1961, Brooks had a chance to make a presentation to the corporate management committee, a group that included Tom Watson, his brother, A. K. Watson, who headed the World Trade Corp., Albert Williams, who was then president of the corporation (he is now chair-man of the executive committee), and Learson. Brooks made another effective presentation, and for a while he and his allies thought that the 8000 might be approved after all.

But early in May it became clear that Evans was the winner. His victory was formalized in a meeting, at the Gideon Putnam Hotel in Saratoga, of all the key people who had worked on the 8000. There, on May 15, Evans announced that the 8000 project was dead and that he now had the tough job of reassigning them all to other tasks. In the words of one participant, "There was blood all over the floor."

Evans now outlined some new programs for the Data Systems Division. His short-term program called for an extension of the 7000 line, both upward and downward. At the lower end of the line there would be two new models, the 7040 and the 7044. At the upper end there would be a 7094 and a 7094 II. This program was generally noncontroversial, except for the fact that the 7044 had almost exactly the same capabilities as a computer called Scamp, which was being proposed by another part of I.B.M. It

would obviously make no sense to build both computers; and, as it happened, Scamp had some powerful support.

Scamp was a small scientific computer developed originally for the European market.. Its principal designer was .John Fairclough, a young man the was then thirty) working in the World Trade Corp.'s Hursley Laboratory, sixty miles south-west of London. The subsidiary had a sizable stake in Scamp. It had been trying for ninny years to produce a computer tailored to the needs of its own markets, but had repeatedly failed, and had therefore been obliged to sell American-made machines overseas.

But Scamp looked especially promising, and the subsidiary's executives, including Fairclough and A. K. Watson. were confident that it would meet American standards. It had previously tested well and attracted a fair amount of attention in I.B.M.'s American laboratories. Evans himself came to Hursley to look at it, and was impressed. But its similarity to the 7044 finally took Fairclough and some associates to the U.S. to test their machine against a 7044 prototype.

Mere equality won't do

As things turned out, Scamp did about as well as the 7044 --but, also as things turned out, that wasn't good enough. Evans and Learson were resolved to stretch out the 7000 line, but opposed to anything that would add to proliferation. In principle, A. K. Watson, who had always run World Trade as a kind of personal fiefdom, could have stepped in and ordered the production of Scamp on his own authority. In practice, he decided the argument against proliferation was a valid one. And so, in the end, he personally gave the order to drop Scamp. Fairclough got the news one day soon after he had returned to England, and he found himself with a sizable staff that had to be reassigned. He says that he considered resigning, but instead worked off his annoyance by sipping Scotch and brooding much of that night.

Evans and Learson had also agreed that Data Systems should try its hand at designing a computer line that would blanket the market. The General Products Division was asked to play a role in the new design, but its response was lukewarm, so the bulk of the work at this stage fell to Data Systems. The project was dubbed NPL, for new product line; the name System/360 was not settled on until much later. To head the project, Evans selected his old adversary Brooks—a move that surprised a large number of I.B.M. executives, including Brooks himself.

Still smarting over the loss of the 8000 project, and suspicious that the NPL was just a "window-dressing" operation, Brooks accepted the job only tentatively. To work with him, and apparently to ensure that NPL did not end up as the 8000 under a new name. Evans brought Gene Amdahl, a crack designer whom the company had called on to work on several earlier computers. However, Amdahl's influence was offset by that of another designer, Gerrit Blaauw, a veteran and past supporter of the 8000 project. Brooks's group received enough money to show that the company took NPL seriously (the first-year appropriation was $3,800,000), but Amdahl and Blaauw disagreed on design concepts, and the project floundered until November of 1961.

Even to the trained eye I.B.M.'s main divisions appeared to be in excellent health in the summer of 1961. The General Products Division, according to Evans, was "fat and dumb and happy" in the lower end of the market, selling the 1401 at a furious rate, and still feeling secure about its line through about 1968. The World Trade Corp. was growing rapidly, although it had suffered its third major setback on getting a computer line of its own. The Data Systems Division was ex-tending its old 7000 line to meet the eontpetit ion, and working on the NPL.

The proliferating products

But it was around this time that Tom Watson and Learson ---then a group executive vice president, and nominally at least working under Albert Williams, the company president --developed several large concerns. There was the company's persistent difficulty in grappling with the new technology and with the expanding demands of the market. There was the absence of any clear, over-all concept of the company's product line; fifteen or twenty different engineering groups scattered throughout the company were generating different computer products, and while the products were in most cases superior, the proliferation was putting overwhelming strains on the company's ability to supply programing for customers. The view at the top was that I.B.M. required some major changes if it expected to stay ahead in the computer market when the third generation came along.

Between August and October, 1961, Watson and Learson initiated a number of dialogues with their divisional lieutenants in an effort to define a strategy for the new era. By the end of October, though, neither of them believed that any strategy was coming into focus. At this point Learson made a crucial decision. He decided to set up a special committee, composed of representatives from every major segment of the company, to formulate some policy guidance. The committee was called SPREAD -- an acronym for systems programing, research, engineering, and development. Its chairman was John Haanstra, then a vice president of the General Products Division. There were twelve other members, including Evans, Brooks, and Fairclough.

Haanstra the hammer

The SPREAD committee was conducted informally, but with a good amount of spirited discussion. For some purposes it broke up into separate committees, such as one on programing compatibility. Haanstra, as one member put it, acted as a hammer on the committee anvil, forcing ideas into debate and demanding definitions. Still, there was some feeling that Haanstra was bothered by the fact that the group was heavily represented by "big machine" oriented men.

The progress of the committee during November was steady, but it was also, in Learson's view, "hellishly slow.., Suddenly Haanstra found himself promoted to the presidency of the General Products Division and Bob Evans took over as chairman of SPREAD. The committee meetings were held in the New Englander Motor Hotel, just north of Stamford, Connecticut. In effect, although not quite literally, Learson locked the doors and told the members that they couldn't get out until they had reached some conclusions.

While Evans accelerated the pace of the sessions somewhat, Fred Brooks increasingly emerged as the man who was shaping the direction of the committee recommendations. This was not very surprising, for he and his group had had a headstart in thinking out many of the issues. By December 28, 1961, the SPREAD committee had hammered out an eighty-page statement of its recommendations. On January 4, 1962, the committee amplified the report for the benefit of the fifty top executives of the corporation.

Brooks was assigned the role of principal speaker on this occasion. The presentation was split into several parts and took an entire day. The main points of the report were:

- There was a definite need for a single, compatible family of computers ranging from one with the smallest existing core memory, which would be below the 1401 line, to one as powerful as I.B.M.'s biggest—at that time the 7094. In fact, the needs were said to extend beyond the I.B.M. range, but the report expressed doubt that compatibility could he extended that far.

- The new line should not be aimed simply at replacing the popular 1401 or 7000 series, but at opening up whole new fields of computer applications. At that time compatibility between those machines and the new line was not judged to be of major importance, because the original timetable on the appearance of the various members of the new family of computers stretched out for several years.

- The System 360 must have both business and scientific applications. This dual purpose was a difficult assignment because commercial machines accept large amounts of data but have little manipulative ability, while scientific machines work on relatively small quantities of data that are endlessly manipulated. To achieve duality the report decided that each machine in the new line would be made available with core memories of varying sizes. In addition, the machine would provide a variety of technical and esoteric features such as "floating point arithmetic," "variable word length" and a "decimal instruction set" to handle both scientific and commercial assignments.

- Information input and output equipment, and all other peripheral equipment, must have "standard interface” --so that various types and sizes of peripheral equipment could be hitched to the main computer without missing a beat. This too was to become an important feature of the new line.

Learson recently recalled the reaction when the presentation ended. "There were all sorts of people up there and while it wasn't received too well, there were no real objections. So I said to them, 'All right, we'll do it.' The problem was, they thought it was too grandiose. The report said we'd have to spend $125 million on programing the system at a time when we were spending only about $10 million a year for programing. Everybody said you just couldn't spend that amount. The job just looked too big to the marketing people, the financial people, and the engineers. Everyone recognized it was a gigantic task that would mean all our resources were tied up in one project—and we knew that for a long time we wouldn't be getting anything out of it."

Considering the fact that shipments of System,360 machines have been moving well--some 4,000 to date, with an estimated 20,000 on order—Learson's "go ahead" decision, which led to so huge a commitment, would seem indisputably to have been the wise one. But the validity of some of the critics' points was proved with company-shaking accuracy when I.B.M. turned from planning to production, financing, and selling.