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Ahead Of His Time

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fast could be kept occupied! The then President, Mr. Coutts, felt it necessary to encourage the author to pursue his idea despite "any cold water thrown on it this evening."

Jumping forward a quarter-century—

(1) In January 1962, the Institute was told that the Phillips apparatus that had been on display that 1936 evening had come to occupy a place of honour in the South Kensington Science Museum, where it may be seen to this day.

(2) In November 1964, Mr. Phillips was awarded the Institute's Gold Medal for his life of accomplishments. That 1936 paper was described as his outstanding achievement, marking him "many years ahead of his time."

(3) In a letter published in the *Sunday Times* (London) in September 1965, William Phillips described the mental processes, extending through more than twenty years, that had brought him to the idea that he had unveiled that evening in 1936. Said he:

"After completing actuarial examinations in 1913 I turned back to boyhood interest in (Charles) Babbage's 1834 dream of an Analytical Engine, a self-operating, self-recording calculating machine . . . and during the 1914-18 war I was still thinking (of this) in terms of gear wheels. Then began the chain that led to the idea of the binary electronic computer.

"1919 to 1924: connected existing ideas with punched card accountancy—two rival systems then of 'reading' the holes, i.e., electric contacts or spring-loaded pins—but why not rays of light? . . .

"Normal denary scale uses digits 9 down to 0, but binary arithmetic uses only digit 1 and 0 ('hole' or 'no hole'). Whole multiplication table consists only of $1 \times 1 = 1$.

"Snag! Though multiplication simple, addition devilishly difficult. In binary scale $1 + 1 = 0$, and carry 1 (as in denary $9 + 1 = 0$, and carry 1). Death of grand idea?

"Half asleep in deck chair on transatlantic liner, 1925, suddenly 'saw' a worked-out binary 'long multiplication' turn of *its own volition* anticlockwise through an angle of 45 degrees—a diamond-shaped area of as-

sorted 1's and 0's. Solution of 'carry' problem: alternately add simultaneously on all even-numbered columns while 'carrying' to the odd-numbered columns.

"How to add electric pulses? What is wanted is a flip-flop, something which shuttles form 'off' to 'on', and from 'on' to 'off', in the latter case simultaneously sending a 'carry' pulse to next column. Still thinking in terms of mechanism until in 1928 or 1929 learned that in 1919 Eccles and Jordan had demonstrated that a thermionic valve could be in either of two stable states, and made to change with the speed of light.

"1931: Wynn-Williams produced designs for electronic valves as counting units—all the binary electronic computer needed was a battery of such 'counters.'

"1934: plan of electronic computer working in binary, but with octonary (digits 0 to 7) input and output completed to make the human operator's task easier. Babbage's 1834 sleeping beauty had awakened—after the proverbial hundred years."

(4) William Phillips died in March 1968 at age 75. His obituary in *J.I.A.*, Vol. 94 spoke of his "creative faculty which flows from the ability to see the familiar from an unfamiliar angle." It mentioned also his characteristic directness of expression which "did not always commend him to his listeners."

This example was cited:

"Who present (at a Staple Inn Hall discussion, not about the binary system, when Phillips had been an *F.I.A.* only eight years and wasn't yet thirty) can forget his rebuke to a very senior member who had displayed difficulty in accepting statistical evidence counter to all his experience. . . . The gasp at the actual words (of which no printed record remains) can be remembered, with relish, after nearly half a century."

This account of Phillips' tenacious pursuit of an idea may—indeed is intended to—encourage actuaries when they find that the way of the innovator seems, at the time, to be as hard as that of the reformer. And to warn the rest of us to be cautious about haste in dismissing, or deriding, an absurd idea.

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W. RULON WILLIAMSON

An Appreciation by James E. Hoskins

The recent death of Bill Williamson, shortly after his ninety-first birthday, impels me to offer comments about him of a more personal nature than the formal obituary that will appear in the *Transactions*.

When I entered temporary employment at The Travelers in the summer of 1914, Bill immediately took me under his wing, showed me the workings of company life, and introduced me to a small group who frequently lunched together. Bill had become a specialist in pensions and group insurance, but although my assignment was to individual life insurance I had the occasional opportunity to work under his direction.

Bill was fond of outdoor life, and I frequently joined him on hikes and an occasional canoe trip. After he moved to the Washington area, almost all my visits there resulted in a hike along the Potomac or to some historic site. On those occasions, and in my visits to his home after his marriage, I learned that he read widely, and often interjected an appropriate quotation into the conversation. And I remember that when I expressed curiosity about a detail of a painting on a Christmas stamp, Bill promptly sent me an account of the work and its artist.

His foremost avocation was mountaineering. He was an avid member of the *Appalachian Mountain Club*, and took part in establishing some national trails. I recall his telling of climbing some lesser known Alpine peaks which he regarded as more difficult than some that were more famous. When asked why he nevertheless climbed one of the popular mountains, he replied that it was easier to climb it than to explain why he hadn't done so.

When The Travelers was asked to recommend an actuary to help set up the fledgling Social Security system, Bill's experience and temperament made him the logical nominee. Those who knew him only later, when his writings and public statements had a distinctly conservative tinge, may be surprised to learn that in those early days he was regarded as a liberal.

The last part of his career was devoted largely to urging changes in the Social Security system which he came to feel

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Global 2000

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- people added that year compared with 75 million in 1975. And 90% of this growth will be in the poorest countries.
- While gross national product per capita will rise substantially in some third world countries (notably Latin America), it will remain below \$200 a year in the enormously populous nations of South Asia. The large economic gap between rich and poor nations will widen.
- World food production will have increased but the bulk of the increase will have gone to countries already having high food consumption levels. The less developed countries (L.D.C.'s) of South Asia, the Middle East, and Africa will scarcely improve, or even decline below present inadequate levels. Meantime, real food prices will have doubled.
- Arable land areas will expand by only 4%. Projected higher yields will therefore depend on fertilizers, pesticides, power for irrigation and fuel for machinery—all of which depend heavily on oil and gas whose availability is not assured.
- For the one-quarter of humankind that depends on wood for fuel, the outlook is bleak. Needs will exceed supplies by 25% before 2000.
- The quarter of the world's people that inhabit industrial countries will continue to absorb three-fourths of all mineral production, but will become increasingly dependent on imports from the L.D.C.'s. Demands from the L.D.C.'s for a New International Economic Order (i.e., for more) will determine availability and price.
- The world's forests are disappearing at the rate of 18-20 million hectares a year (half the area of California), mostly in the tropics. By 2000, 40% of the remaining forest cover will be gone.
- Regional water shortages will become more and more severe, as demands double in half the world, and deforestation makes supplies erratic. Water and air are the two substances most fundamental to the existence of man, to life itself.

- World agricultural soils are deteriorating. An area the size of Maine becomes barren wasteland each year.
- The era of readily available cheap fossil fuels is closing. A whole new energy resource base requiring long lead times must be developed, and fuel use restraint will become ever more imperative.
- Atmospheric concentrations of CO₂ and ozone-depleting chemicals are increasing steadily as more coal and fossil fuels are burned and forests (which remove CO₂) destroyed. Acid rain is damaging lakes, soils, crops. Radioactive and other hazardous materials are accumulating.
- Hundreds of thousands of species—perhaps 20% of all species on earth—will be irretrievably lost by 2000, as their habitats vanish.
- Grim as this picture is, it may understate the impending problems, due to its taking insufficient account of the interaction among its parts.

Yet there is reason for hope, states the report, since its projections are based on unchanged present national policies and trends. Policies are beginning to change, as reforestation and soil conservation, for example, are getting more emphasis, and alternative energy sources are attracting more research funds. But these encouraging developments are far from adequate.

An Actuary's View

The study is presented as "no more than a reconnaissance of the future." Perhaps its most striking aspect is what it omits. A severe picture of the world at the turn of the century is presented, but there's not much reference to what lies beyond the year 2000—a period of great concern to actuaries. Time will not stop, and the processes of deterioration will not suddenly be arrested in twenty more years. With unforgiving relentlessness, whatever continues from this century's trends will go on into the next century, further affecting mankind's living standards and economics. No country will be able to insulate itself from these effects. Nor is any allowance made for the potential effects of war, even though the world is presently spending \$1.5 billions *each day* on weapons and defence, and directing one-half of all scientific research to this field.

As actuaries, we must consider this long-term outlook, and weigh the realism of expecting reversal or cessation of its negative aspects, and the chances that enough new positive developments will arise to offset them. Further, we must project and translate all of this well into the next century, in terms of inflation, productivity, demographics, and the wisdom of promising vast programs of benefits, some of them indexed without limits.

With a report such as this to ponder, one that is broadly in agreement with other global studies, one must consider very carefully, for example, the opening statement in the Report of the 1979 Advisory Council on Social Security that "all current and future Social Security beneficiaries can count on receiving all the benefits to which they are entitled." Perhaps, a future Council will give thought to the source from which all these benefits must come, and the ethics of unlimited indexing, using a hyped-up index, in the context of the potential lowering of material living standards so clearly foreshadowed in the Global 2000 report.

To be considered also is the widening gap between society's treatment of (a) employees covered by civil service pension plans similarly indexed without any limits, far into the next century, but supported by funds having cavernous unfunded liabilities, and (b) those who pay taxes but have no pension coverage at all, or non-indexed pensions. In the context of Global 2000, this difference may reach epic proportions. Should we be silent about this? □

How far are we, as actuaries, able to contribute to the "stronger capability to project and analyze long-term trends" called for by this government report, and perhaps even to the solution of certain of the major problems which it lays before us all? □

Rulon Williamson

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had expanded unduly beyond its original concept. Without rancor against those who disagreed with him, he pursued his crusade as long as his health permitted.

Bill's interests were too wide for me to cover properly. But I can confidently say that our profession will remember him with respect, affection and pride. □