

DEDICATION OF THE
*Roy Nutt Mathematics, Engineering
& Computer Science Center*

FRIDAY, MAY 18, 2012



Trinity College
HARTFORD CONNECTICUT

On January 20, 2012, the Board of Trustees unanimously passed a resolution to rename the Mathematics, Computer Science & Engineering Center, originally dedicated in 1991, as the Roy Nutt Mathematics, Engineering & Computer Science Center.

This rededication acknowledges the significant role that Ruth and Roy Nutt '53, P'85 played in the realization of this important academic building, and honors Roy as a distinguished alumnus, inventive faculty member, and national figure and business leader in computer science.

As we honor Roy's legacy, his achievements and entrepreneurial spirit will serve as an inspiration to future generations of Trinity students.

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Program

Welcome

JAMES F. JONES, JR.
*President and Trinity College
Professor in the Humanities*

Mathematics, Engineering, and Computer Science at Trinity College

RENA FRADEN
Dean of Faculty and Vice President for Academic Affairs

Tribute to Roy Nutt '53

PAUL E. RAETHER '68, P'93, '96, '01
Chairman, Board of Trustees

Response

MICAH NUTT '85

Ribbon Cutting and Commemorative Tree Planting

Members of the Nutt family are invited to come forward to join program participants

Tours of the building are available preceding the ceremony.
A reception will immediately follow the program.

Biography of Roy Nutt compiled by Micah Nutt '85.

Roy Nutt was a computer pioneer and businessman who co-founded Computer Sciences Corporation. He wrote the first industry-wide accepted symbolic assembly program (SAP), was a co-creator of the first FORTRAN compiler, and was the architect and chief programmer of the FACT language for the first-ever custom built compiler. Thus, Roy Nutt was instrumental in starting and influencing three important computer programming language streams: Assembly (SAP), Scientific (FORTRAN), and Business (FACT). He was also a charter member of SHARE, the first computer user group.

Early Life

Born on October 20, 1930, in Marlborough, Massachusetts, Roy Nutt grew up in Glastonbury, Connecticut, after the family moved there in 1941. Roy was the eldest of four children. His father, Charles, was a World War I veteran, serving in the Navy. After his tour, Charles worked his way through Harvard, majoring in Fine Arts. Charles tried to make a living as a professional artist, but The Great Depression put this pursuit on hold. Instead, he took a job in a box factory, and sold insurance on the side to support his growing family. Charles eventually settled in as a records supervisor for a variety of companies such as Pratt & Whitney. Since childhood, Charles aspired to be an artist: sketching, painting, carving and casting.¹ Roy's mother, Marjorie Pratt, was a grade school teacher with a degree from Boston University. She later earned a master's degree from the University of Hartford.² Continuing the work of Charles's father, who wrote comprehensive genealogy books, Marjorie compiled thorough genealogical documents for both the Nutt and Pratt family lines.³

Many of Roy's lifelong avocations developed during his youth in Glastonbury. Like many other struggling families during the depression and subsequent war years, the Nutts had a large victory garden. The garden consisted primarily of vegetables but there were flowers as well. Roy's love for gardening, particularly cultivating roses, would carry on throughout his life. The family also kept chickens. After many years raising chickens, Roy fancied himself quite the farmer. He was convinced he could determine their sex early on. One year they had four chicks. Roy confidently named them Ike, Spike, Mike, and Mary. He was wrong on all

accounts. Young Roy enjoyed being outdoors nurturing the garden and working in the local orchards and tobacco fields. He also had a fondness for hiking and camping. He was a Boy Scout and proud member of the Order of the Arrow.

Roy also loved to sing. As a young man he sang with his brother and father in Glastonbury's Nayaug Male Chorus. As an adult he sang with the local church and supplemented the local temple's choir during High Holy Days. His resonant bass voice could always be clearly heard.



A young Roy Nutt with his parents, Charles and Marjorie; taken in 1932 by C.F. Robinson, Natick, MA.

During high school, Roy was determined to learn to type. He took a typing class which focused more on composition than anything else. Roy was more interested in typing well and typing fast. He only received a C in his typing class, but he could type over 100 words per minute. Intensity and concentrated commitment were integral to him.

In high school, Roy was the business manager of the school yearbook and manager of the varsity basketball team. Academically, he distinguished himself at Glastonbury High and was awarded the school's Rensselaer medal, which is presented to the senior achieving the highest average in mathematics and science over four years. Roy, at 16, was the youngest graduating member of his high school class.

With the intent of majoring in electronic engineering, 16-year-old Roy enrolled at the Worcester Polytechnic Institute with a full scholarship. College did not go as smoothly as high school. His academic performance was miserable. He failed his first semester.

¹ Charles S. Nutt was active with the Glastonbury Art Guild and utilized an outbuilding, next door at Mosley's colonial-era farm, to run "Second Mile Studio."

² Teachers College of the City of Boston, 1926. Hillyer College, 1960.

³ Charles's father also wrote history books and various biographies.

His father wrote to him, “I place the responsibility for this term failure squarely upon your childish philosophy. You want to have a good time. You devote weekends and vacations to that purpose, and for all we know part of your week-days wasting time. If you fail a second term your college opportunity is gone. We cannot send you anywhere else.” Roy barely scraped by the second semester and finally was dismissed after failing the third. Because he could not afford an alarm clock, Roy was chronically late to or completely missed his morning classes. At WPI classroom doors were locked as soon as the period started and no absences were excused. Roy also felt he did not quite fit in at WPI, perhaps in part because of his young age.⁴ Roy was embarrassed about his failure at WPI and without informing his family he proceeded to enroll in classes at Boston University. But there, too, he performed poorly. Ashamed, he returned home and resigned himself to life as a field hand working in the orchards. It was a local resident and family friend who was a professor of mathematics at Trinity College, a small liberal arts school in neighboring Hartford, who convinced Roy to take a look at Trinity.

Trinity College (1950-1953)

The initial plan was to take some classes at Trinity and then transfer back to Boston University. Trinity, however, suited Roy well and after the fall semester he applied for admittance to the school. Trinity accepted him and he matriculated in February 1951.

The majority of students at Trinity lived on campus. As a “townie,” Nutt joined the Brownell Club, which was a social organization for non-resident students.⁵ Roy spent much of his free time playing bridge with other students for a penny a point. He had to put himself through college and said the bridge pennies helped. He did manage to save enough to buy a 1941 Buick, which was of great assistance since he commuted from home. When one of his younger brothers, Charles, obtained a driver’s license, he asked to borrow the car. Roy obliged. His brother hit a post. Charles said, “He was angry of course—but he didn’t berate me very much or for very long. And after he got the car fixed he didn’t even let me offer to pay the deductible. Roy said he let me use the car and therefore the risk was his, too. And besides—I would need the money for college next fall.”

At Trinity, Roy studied mathematics with the aspiration to one day teach. However, during his junior year he enrolled in an experimental evening study program offered to upperclassmen. The program proved a pivotal point in his life, turning him away from thoughts of teaching and towards a career in applied computational mathematics. This two semester course, “Numerical Mathematical Analysis and Machine Methods,” was organized and taught by two

visiting faculty members: Stuart Crossman and Walter Ramshaw from United Aircraft Corporation’s Research Department Computing Laboratory in East Hartford. The program consisted of lectures by the United Aircraft staff given at Trinity and access to computing machines at the United Aircraft laboratory.⁶ The course was one of the first of its kind and perhaps the first-ever such class at a small school, offering students the opportunity to have hands-on access to a state-of-the-art “Card-Programmed Calculator.”⁷ Roy spent the following summer working at UAC’s research lab, feeding punch cards into the calculators. He familiarized himself so well with binary coding he could read the punch cards by sight. Roy continued to work full time at United Aircraft through his senior year. By the fall he had orchestrated a night shift at the lab and by graduation he had become the night shift supervisor with eight other Trinity students reporting to him.



Ruth and Roy (bottom left) with friends on their first date, 1952.

In 1951 Roy Nutt’s personal life took an important turn as well. He asked Ruth Heagle to Trinity’s winter formal dance. The Heagle and Nutt families had been local Glastonbury friends for some years. Roy and Ruth had known each other since elementary school. The couple would eventually marry in 1955.

Nutt graduated from Trinity in 1953 with a bachelor’s degree in mathematics, but not without some problems. Due, in part, to his computing obsession he fell behind in his studies and was put on academic probation in January of his senior year. In order to fulfill his academic requirements, he had to sacrifice properly preparing for some classes.⁸

⁴ At this time, GIs returning from World War II were resuming their educations and thus the age of many college students was several years older than normal.

⁵ While not exactly a fraternity, the Brownell Club provided a room on campus as a retreat for members.

⁶ At this time, the “laboratory” was an old airplane hangar.

⁷ The CPC was a general purpose computer which only performed, in sequence, arithmetical operations coded on standard 80-column punched cards.

⁸ French and physics. He ended up with an “incomplete” for physics.



Roy Nutt in 1953.

United Aircraft Corporation (1953-1959)

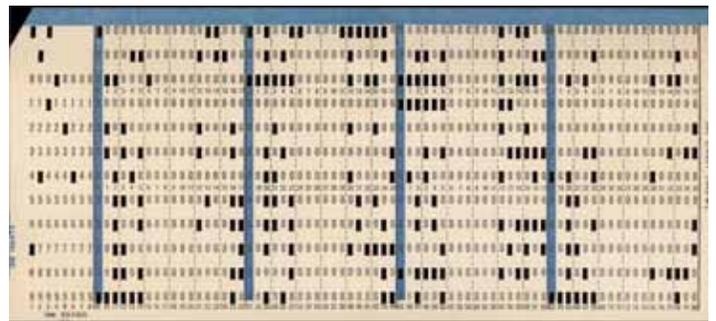
Upon graduating from Trinity, Nutt was offered and immediately took a job with United Aircraft in Ramshaw's research department. He was so embarrassed about the amount of his first paycheck he did not want to show his father the pay stub. The starting salary of \$450 a month was more than his father had ever earned and enough incentive to delay any post-graduate study plans.

In 1953 IBM released the first-ever computer with electrostatic storage, the IBM 701 mainframe known in its development stage as "The Defense Calculator." This machine came with 2,048 36-bit words of internal memory which could be expanded to 4,096

words. United Aircraft purchased the ninth of 19 manufactured. At United Aircraft, Roy Nutt wrote utility programs of mathematical functions for the laboratory's in-house program library for use by aeronautic engineers and other computer analysts. He also developed programmer tools to aid in the manipulation of computer hardware, program loading, and debugging. These programs were written in crude machine language or, alternatively, the higher-level Speedcode language.⁹ Speedcode, developed by John Backus at IBM, was an interpreted language.¹⁰ A set of Speedcode input/output routines would bring Nutt to the attention of John Backus at IBM who would put together a team to design a new language.

One tool at United Aircraft that Nutt single-handedly crafted was the Symbolic Assembly Program (UA-SAP) for the IBM 701. At the time, programs were often written in numeric machine language. Speedcode improved the programmers' efficiency but much code was still written in machine language by necessity. A symbolic assembler would provide the ability to write computer code much faster and in a more readable and maintainable way. Instead of the cryptic numbers of machine language, three-letter mnemonics were employed to correspond to the native machine's operation codes. The mnemonics freed the programmer from having to remember numerous numeric codes; "ADD," for instance, could be used in place of the machine code "11." Whereas SAP was not a macro-assembler in that it offered only a one-to-one correspondence of operators and operands to the outputted machine code, Nutt did introduce many pseudo-operation codes to make the programmer's task even easier.¹¹ Some of these innovations are still in use today.¹² SAP was a powerful tool which increased programmer productivity.

Roy Nutt had become a highly respected, well-known programmer throughout the industry in a very short time. Walter Ramshaw later said of Nutt, "Basically, the guy was so good—he was humiliating to be around."



UA-SAP code circa 1955.

⁹ Higher-level meaning the language was symbolic in nature as opposed to the low-level numeric values of machine code.

¹⁰ An interpreted language is one that requires an interpreter program to be run in order to execute the source code. That is to say, the source program runs simultaneously on top of the interpreter. Speedcode supported floating-point numbers, which were not native to the IBM 701.

¹¹ A pseudo-operator is a symbol used by the assembler but is not known to the native target machine.

¹² Among SAP's pseudo-operations were ORG (for the "origin" starting location in memory of the program's first executable instruction), EQU (for "equating" a symbol name to an expression (e.g., "5" or "N+1") that could later be used instead of the expression itself), and BSS (for "base started by symbol" to name and define the start of a segment of data memory).



Roy and Ruth at their wedding, 1955.

Marriage

In 1955, when Roy Nutt married Ruth Heagle, who was finishing up at nursing school, his United Aircraft coworkers placed bets as to whether or not the work-obsessed programmer would take his briefcase on the couple's Bermuda honeymoon. He did not, but apparently it was not an easy decision. Instead of rice, the bride and groom were showered with the chads from computer punch cards. The oily bits of cardboard could never be completely removed from the interior of his car.

Both the Nutt and the Heagle clans were avid game players. Ruth was no exception, and excelled at bridge. She was a serious player, and a complementary partner. Roy described her play as "cutthroat." Any misplay or mismanagement of a hand by an opponent would be capitalized upon. Her favorite saying was "a peek is worth a thousand finesses." At home, after work, the couple would routinely play a few games of cribbage. The two seemed equally matched. Then, all of a sudden, Ruth started to win every game. After a couple of weeks of continuous defeat, Roy finally realized their shiny new toaster was to blame.

SHARE

When the IBM 701 came into use, the handful of companies with the machine realized they would all benefit by pooling their knowledge. Technical staff from some of these

companies occasionally met informally to exchange information. IBM was due to release a new mainframe with a more advanced instruction set, built in core memory, and floating point numbers. The IBM 704 would be the first computer ever to be mass-produced. The companies planning on purchasing the 704, even though many were in direct competition with each other, decided to form a cooperative in order to share programs and set industry programming standards.

Roy Nutt became, as United Aircraft's delegate, one of nineteen individuals from seventeen large companies and government agencies to form the first computer user group which would be known as SHARE.¹³ The first SHARE meeting was held in Los Angeles in August 1955. It was through SHARE, during this period, that Nutt met Fletcher Jones, North American Aviation's representative. Jones, as secretary of the group, became its national spokesman and their working relationship would later result in a successful business partnership. What the companies founding SHARE had in common were the IBM 701 and 704 mainframes which were delivered, in all practicality, without software. Along with the operator's manual, the only programs that came with the hardware were a crude assembler, a non-linking loader, and a few utility subroutines. At the time the focus by the manufacturers was primarily on the hardware. In fact, the term "software" would not come into use until 1958. There was little concept, then, even of an operating system. Computer users were left to their own devices to make the machines run. SHARE would go on to distribute to its members programming standards guidelines, libraries of subroutines, debugging tools and eventually develop its own SHARE Operating System.¹⁴

One of the first important issues needing resolution on SHARE's agenda was to adopt an assembler for standard use and distribution. SHARE endorsed Nutt's United Aircraft assembler as their assembler of choice for the IBM 704 mainframe over four others proposed: General Electric's "Compiled & Assembled at General Electric," Los Alamos Scientific Laboratories "Symbolic-Regional" assembler, and two of IBM's own internally competing assemblers.¹⁵ UA-SAP was rewritten for the IBM 704, adopted by SHARE, renamed the SHARE Assembly Program, and used for years throughout the industry. In 1956 it was estimated that SAP saved SHARE members a total on the order of \$1.5 million during its first year of use.¹⁶ SAP is today seen as the grandfather of modern assemblers and is considered to be the most successful individual programming effort of the 1950s. The cover sheet for SAP's user manual cheekily declared "the probability that undetected bugs remain in this program differs from unity by the reciprocal of a googolplex."¹⁷

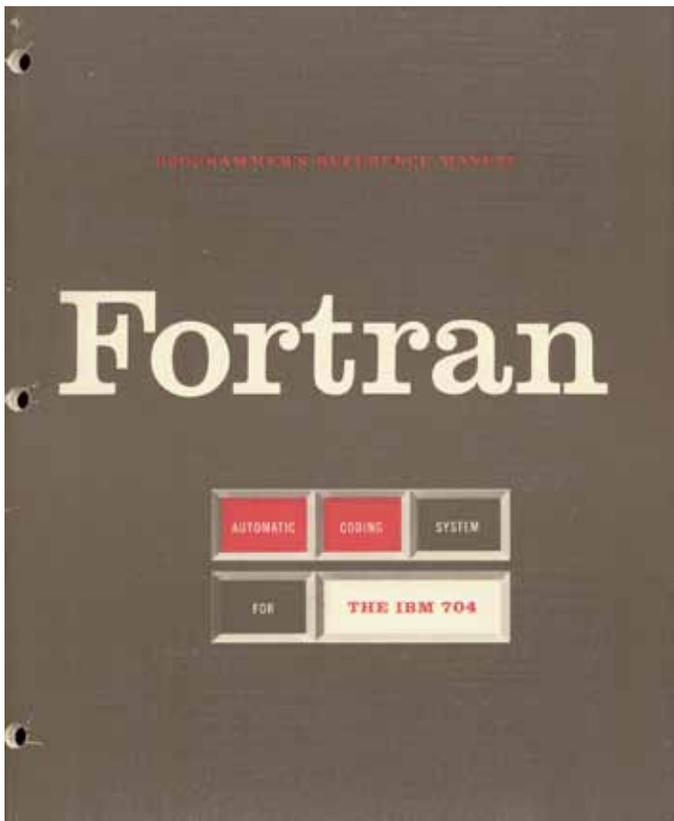
¹³ SHARE is not an acronym.

¹⁴ Owen Mock and Donald Shell created the SHARE OS for the IBM 709 casually known as the "MockDonald" Multiphase System because of the "Execution, Input, Output" acronym "EIO."

¹⁵ CAGE by Don Shell. S-R by Louis Gatt. NYSAP and the Regional Assembler.

¹⁶ And not all SHARE members used SAP.

¹⁷ Program RN019 at United Aircraft.



1957 FORTRAN Programmers Reference Manual.

Besides contributing SAP, Roy Nutt provided SHARE members with many of his United Aircraft subroutines and programs. Because the IBM 701 was instruction set-wise incompatible with the IBM 704, yet still used for many years in those laboratories which had them, Nutt wrote a program to run on the 701 which took 704 SAP source code and simulated 704 execution.¹⁷ Nutt also was a member of SHARE's 709 committee which would produce the SHARE Operating System.

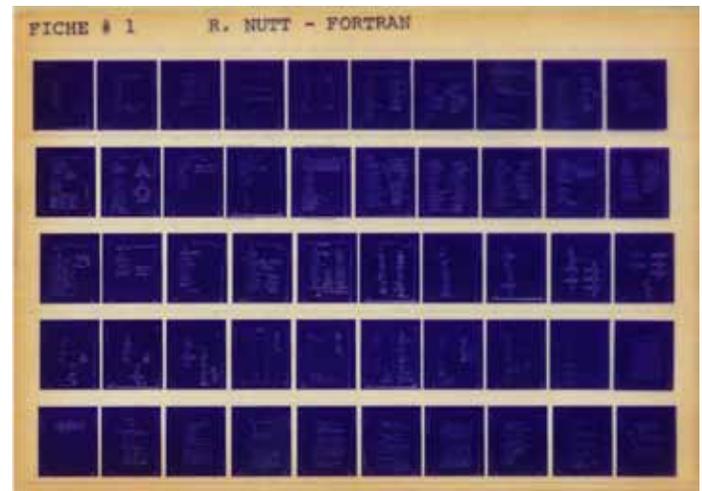
FORTRAN (1955-1957)

A pioneer in the fledgling software industry of the 1950s, Roy Nutt was a major contributor in the creation of IBM's FORTRAN (Formula Translator) compiler, the first high-level scientific and engineering programming language.¹⁸ At IBM, in New York, John Backus was designing a compiled language as an extension of his own Speedcode interpreted language. A program run indirectly through an interpreter is inherently slow.

Furthermore, as such a program mandates both the source and the interpreter be concurrently resident, precious computer memory is more likely to be exhausted. A compiled program, on the other hand, if the machine code is generated efficiently, could run fast and also be small in order to fit in the computer's memory.

Backus headed IBM's FORTRAN group and he wanted United Aircraft to loan Nutt to his new project several days a week. Backus, as mentioned, had, early on, become impressed with some of Nutt's Speedcoding, but, in particular, he wanted Nutt's expertise on code generation. As early as December 1953, United Aircraft had been considering writing their own compiler. On a visit to MIT, Nutt had seen an interesting interpretive system being developed.¹⁹ "By the time John Backus suggested cooperation on FORTRAN we had begun to realize how big a job it would be, and folded our own embryonic effort." UAC complied with the condition that Nutt had to keep up with his full work load at United Aircraft. Nutt hence became the only non-IBM member of the original FORTRAN project (something quite unprecedented for IBM) and commuted to New York two or three days a week from Hartford.

Backus wanted Nutt to bring his innovative assembler skills and data input/output knowledge to FORTRAN. As part of the FORTRAN team, Nutt was responsible for developing part of the input/output subsystem.²⁰ His "FORMAT" statement was a core component of this section of the compiler.²¹ Nutt also architected and coded the "backend" of the compiler which subsequently generated the outputted machine code.²²



FORTRAN fiche, 1957.

¹⁸ A compiled language takes a source code program as input and generates a stand alone executable program which can then be run independently of the compiler in order to produce output.

¹⁹ "A Program for Translation of Mathematical Equations for the Whirlwind I," by J.H. Laning Jr. and N. Zierler.

²⁰ Section 1 of the FORTRAN compiler.

²¹ "FORMAT" was the mechanism by which data were inputted to the program and outputted to display results. The FORTRAN "FORMAT" statement should not be confused with the early microcomputer command which prepared discs for use.

²² Section 6 of the FORTRAN compiler.

SAP was adapted for this use and so the FORTRAN Assembly Program (FAP) was created. The “backend” assembled the final program into a relocatable binary executable; it could also, conveniently, output SAP-compatible source code. By utilizing features of the programs it assembled, FAP-generated code was about ten times faster than SAP.

In the summer of 1956 Nutt took part of the FORTRAN system to United Aircraft.²³ The partial FORTRAN compiler was used productively there until the complete FORTRAN system was released in 1957.²⁴ What started out as a one-year loan ended up being over two years.

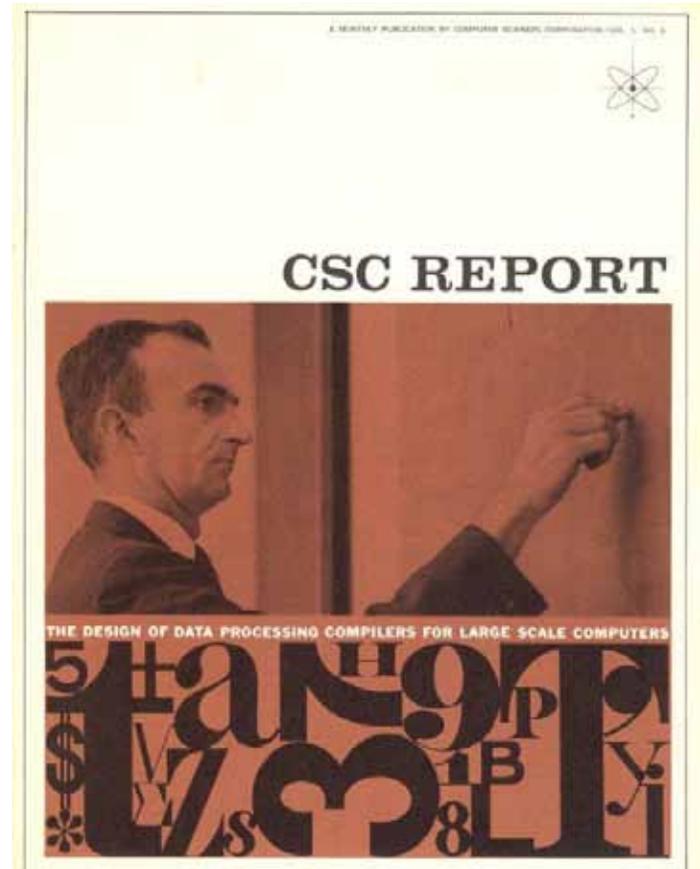
FORTRAN was a phenomenal success and a milestone in the evolution of computer languages as well as that of compiler construction. The language allowed programs to be written more quickly and to be smaller source code-wise. As the FORTRAN grammar was closer to natural language, these programs were inherently more readable and reasonably maintainable. At a national computing conference in 1982, Tony Hoare distributed a card which stated, “I don’t know what the language of the year 2000 will look like, but I know it will be called FORTRAN.”²⁵ He may not have been entirely correct, but FORTRAN is still in use today and every subsequent computer language and compiler has some root of FORTRAN.

Most programmers at the time relied on the creation of visual diagrams called flow-charts and then wrote out code by hand before keypunching the program onto a binary card. Nutt had an aversion to flow-charts, considering them unnecessary, and usually a waste of his time. His concentration was so intense and his visualizations so clear he did not have to resort to props. John Backus recollected that Roy Nutt “was known to just sit down at a keypunch machine and keypunch in a program that would run.”

CSC (1959-1988)

During his tenure on the FORTRAN team, IBM had been courting Nutt to come work permanently for them. IBM pursued him after the project as well, but Nutt wanted to start something of his own. The National Security Agency had also tried to recruit Nutt as a “Black Hat” cryptologist. Nutt was flattered but more intrigued by the innovative work evolving in the private sector. Furthermore, as Nutt’s bosses at UAC found out early on, he was not a 9 to 5 person. Often, coworkers would arrive for work the next day only to find Nutt still there as he had worked through the night. He kept his own hours, but this very often resulted in him being absent from a morning meeting with clients. In an attempt at getting Nutt to work on time, one of his bosses, Stu Crossman, started going to Nutt’s home on his way to work to pick him

up. This just had the effect of making both of them late. Through SHARE, Nutt met with many of the other notable industry stars in the hopes of finding a partner with whom to branch out. “The problem was I was talking to people who were too much like myself.” Many companies were beginning to realize that producing software was often much more time consuming, expensive, and technically involved to produce than expected. These companies



Roy Nutt on the cover of CSC Report Vol. 1 No. 6, 1963.

were not, after all, in the computer business but in some other line of work. Software was a means to an end, but, by way of necessity, these companies were expending resources writing code because there simply was not any software available to do what they needed. Roy Nutt saw there was the need for custom computer software and believed he could fill this void.

On Friday, March 27, 1959, Nutt received a phone call from Fletcher Jones. The two had met through SHARE in 1955 and kept in touch at meetings and through various committee correspondences. Jones put forth the proposition they form their own company. Jones had obtained a verbal contract from Richard Clippinger, at

²³ Sections 1, 2, and 3 and the part of section 6 which produced SAP output.

²⁴ The first FORTRAN program executed outside of IBM was at United Aircraft in mid-January 1957. The program, which consisted of a single mathematical equation, produced an error message: “SOURCE PROGRAM ERROR. THIS ARITHMETIC STATEMENT IS TOO LARGE. IT SHOULD BE MADE INTO TWO STATEMENTS.”

²⁵ Tony Hoare invented the innovative “QuickSort” algorithm in 1960.

the Minneapolis-Honeywell Corporation's Datamatic Division, for the design and implementation of a custom compiler for their H-800 computer. On Saturday, the two headed to Boston to meet with Honeywell. Nutt, after consulting more with his wife, Ruth, responded to Jones with his answer that Sunday night. He was quite easily reemployable, as was Jones, if their venture failed. Nutt submitted his resignation to United Aircraft on April 9, after receiving the formal contract from Honeywell's lawyer. The compiler was to do for business-oriented processing what FORTRAN had done for science and engineering. When Jones first approached Honeywell he guaranteed them Roy Nutt was on board and, based solely on Nutt's reputation, Honeywell agreed to a contract. Unbeknownst to Honeywell, Jones had not consulted with Nutt about the venture. Most likely, Jones was feeling out the situation before approaching Nutt. The initial Honeywell contract was for \$328,202.50. Papers for incorporation were drawn up on April 13.

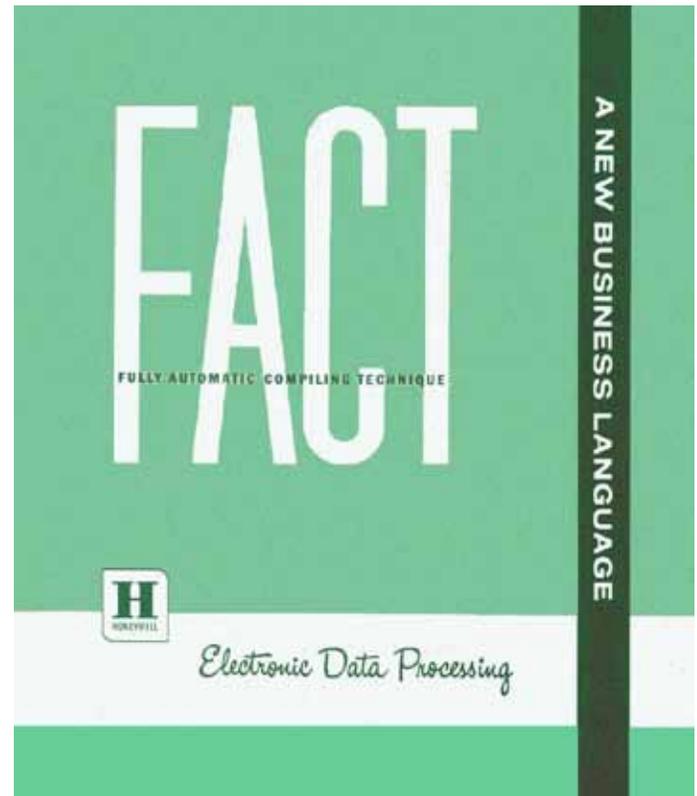
Roy Nutt had become a widely known and respected computer programmer when he left United Aircraft in 1959 to team up with Fletcher Jones. Together they established one of the first independent software services companies: Computer Sciences Corporation.²⁶

The original model for the organizational structure of the company was to have three respected individuals from the software industry. Jones, a manager from North American Aviation, would run the business and marketing end of the company. Nutt would provide the technical expertise as system architect and chief programmer. And Bob Patrick would fill the role of office and performance manager.²⁷ Patrick was a noted technician, and while working for General Motors had become acquainted with Jones and Nutt, beginning in 1957, through SHARE meetings. At the time of CSC's inception Patrick was running a large service bureau at CEIR in Arlington, Virginia.²⁸ The legend of CSC is that the company was started with the founders pooling \$100. In reality, however, as neither Nutt nor Jones had enough ready cash to subsidize such an endeavor, it was Bob Patrick who was able to secure a bank loan by using some of his GM stock as collateral.

After spending three months in Boston, acquainting themselves with the Honeywell hardware, defining the scope of the compiler and negotiating the terms of the contract, the three moved to Los Angeles to more strategically locate the company. They worked out of a two-room suite at the Hyatt Hotel, near the Los Angeles airport, for a few days before moving into the entire second floor of an office building across from the Hollywood Park race track. It may seem that the East coast was the obvious choice to set up

shop. After all, that was where their client was. However, exciting programming advances were taking place in Los Angeles, which was the hub of the aerospace industry. L.A. was chosen as the base because not only was that where many potential clients were but also because there were plenty of talented programmers there who might be persuaded to come work for CSC. Bob Paul was brought on immediately, as the first employee. Paul had worked as an analyst under Jones at North American and it took little persuasion to convince him to join.²⁹ A secretary, Margaret Moucheron, was also hired. Margaret proved indispensable and basically did everything but run the company.³⁰ As the pace for the newly formed Computer Science Corporation was frantic, the wives were, for the most part, left to pack up, move west, find houses and move in.

The early days of CSC were turbulent for the three founders. At one point both Roy Nutt and Bob Patrick actually quit with plans to reorganize and take the Honeywell contract with them. Fletcher Jones had incorporated the company and had divided it 70-15-15 with himself having the lion's share. He had, after all, obtained the



FACT manual circa 1960.

²⁶ Preliminary Articles of Incorporation had been prepared with the name "Computer Services Corporation."

²⁷ Paul Armer from the Rand Corporation was originally desired to provide the management skills. It is unclear if Armer was ever approached or if he declined the invitation.

²⁸ The Council for Economic and Industrial Research.

²⁹ Fletcher Jones was fired from North American Aviation when one employee, Owen Mock, reported Jones to superiors for trying to recruit him. Mock turned Jones's offer down. Several years later Mock would join CSC.

³⁰ Margaret would become Roy's executive secretary until his semi-retirement in the early 1980s.

contract. As the Honeywell project proceeded, Jones was seen less and less in the office. When it came to the attention of Nutt and Patrick that Jones was using company money for personal interests, Nutt and Patrick became furious and ousted Jones.³¹ Honeywell was willing to work with any two of the three—as long as Nutt was one of the two. The handful of CSC programmers were tersely informed of the regime change and instructed to carry on as usual. This happened on a Friday in late August. Nutt headed to Boston immediately for meetings scheduled during the next week with Honeywell. Jones was devastated and determined to salvage his place in the company. Unbeknownst to Patrick and the stunned CSC staff back in California, Jones took a flight on Saturday to follow Nutt to the East coast where the two met and discussed the future of the company. At 3:00 AM on Monday morning the two reconciled deciding Bob Patrick was the bigger problem and promptly reformed without him. Much of the newly hired staff had been rubbed the wrong way by Bob Patrick. He was perceived as arrogant with micromanaging tendencies; his instituting an overbearing code of office dress and conduct did not help matters.³² Nutt and Jones also resolved an agreement for a more equitable partnership. The startup loan Patrick had obtained was repaid to him and, by determining the current value of the company, his 15% stake was bought back for \$939.60. Jones, who held quite a grudge, proceeded to erase Bob Patrick from the company's history. Patrick was immediately hired by Clippinger at Honeywell, as a consultant, where he programmed acceptance tests for the CSC compiler.

The contract with Honeywell gave Computer Sciences profitability and viability within the industry. Nutt was responsible for designing and building the natural language-based compiler to be known as the Fully Automated Compiling Technique (FACT).³³ FACT was the first custom-built commercial compiler ever produced. It was not, however, Roy Nutt alone who coded FACT. The task of building such a compiler was complex. The project grew and it was evident more analysts were needed. Jones took advantage of his former post as SHARE's secretary and his comprehensive list of contacts to lure many of the brightest programmers of the time to CSC. The move promised the chance to rub elbows with Roy Nutt on a bold endeavor.

When the Department of Defense organized the "Conference on Data Systems Languages" (CODASYL) to prod the computer industry into designing a business compiler, FACT was pitched by CSC. Jones and Nutt courted the government's intermediate term committee, which soon resolved with a vote of 15 to 1 to adopt FACT as the model for the language.³⁴ Unfortunately, for CSC, the short-term committee, which had been much farther along in their independent performance research, was quite agitated with this unilateral decision and was already pressing the executive



Roy Nutt at his desk, 1962.

committee to accept Grace Hopper's design for the proposed new language. This language would become the Common Business Oriented Language (COBOL). Hopper was a renowned computer scientist, the creator of the early-on A-0 compiler and later the FLOW-MATIC language. She had many government and military friends on the CODASYL executive committee, as she was a former Naval officer. Nutt had been good friends with Hopper, but her subsequent decisions not to implement many of Nutt's ideas into the language's initial grammar forever put a rift in their relationship. FACT was in many ways superior to COBOL and many of FACT's language and database innovations were later incorporated into COBOL. David Ferguson, an early CSC systems programmer, said, "FACT influenced COBOL more than any other language." FACT had features novel for the time which would become standard paradigms for compilers and database management systems. FACT provided variable type conversion, automatic explosion/implosion of file data which eliminated redundant file data, dynamically allocated memory, and had the first software implementation of virtual storage. FACT also provided the most sophisticated report generator of the time.

Even though FACT was eventually delivered to Honeywell in 1961, the CODASYL decision not to use FACT as the basis for COBOL essentially killed the language. CSC would, nevertheless, become known as "The House that FACT Built."

CSC's second contract was from Univac to develop a FORTRAN compiler for the Livermore Automatic Research Computer (LARC). This compiler was the first non-IBM built FORTRAN compiler. CSC also delivered, to Philco, the very first COBOL

³¹ Bob Patrick said Jones allegedly had the intention to pay back the company before anyone found out.

³² From Bob Paul's "CSC Stories."

³³ The initial name of the compiler was "Transdata."

³⁴ Richard Clippinger, who happened to be on this committee, removed himself from the room when it became known to him that Honeywell's own compiler was being pitched. Clippinger also abstained from the vote.

compiler. Nutt oversaw CSC's technical direction and made the company a major force. In 1961 CSC entered into the space industry by obtaining a contract to support NASA's Jet Propulsion Laboratory's Flight Operations Facility. With contracts to produce complete system suites (operating systems, compilers, report generators) for companies such as Univac, CSC became a powerhouse of custom software development. Many Department of Defense contracts followed. Some of the experts who now worked for CSC were Owen Mock, considered the "father of the operating system," Louis Gatt, who wrote the Los Alamos assembler which competed with SAP, Jules Schwartz, who created JOVIAL the de facto computer language for the military, Michael Busch, who as an undergraduate at MIT helped develop BASIC, Charles Swift, the principal developer of the system software for the National Bureau of Standards Eastern Automatic Computer (SEAC) introduced in 1950, and many others.

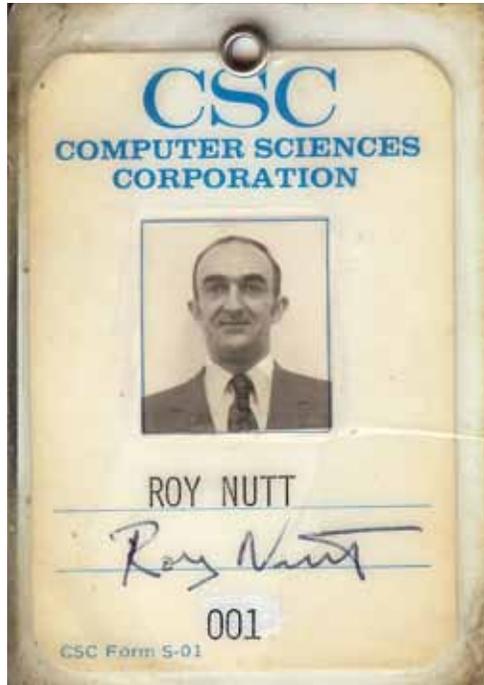
The company moved their main offices to quarters above a bakery in Palos Verdes' Malaga Cove Plaza in 1960. This location was more convenient for Jones and Nutt who both lived nearby. Other offices were then scattered in Palos Verdes, neighboring Redondo Beach, and throughout Los Angeles's South Bay. When a bid for larger space fell through on a Northrop complex, also in Palos Verdes, Jones learned of a building under construction in El Segundo. CSC consolidated its branches, moving into the first three floors of this building, over Labor Day weekend, in 1962. The building was ideal and coincidentally about 100 yards from their original space at the Hyatt. By working with the architect who designed and decorated their new offices, the space was made tasteful, functional and ultra-modern. Jones was meticulous in his attention to detail. The new CSC headquarters was awarded "Office of the Year" by Administrative Management magazine.

Later, when CSC's executive offices were moved from El Segundo to Century City, Roy decided to keep his office in El Segundo where the programmers were. He felt he could be of more use to the company if he could interact with the technical staff on a daily basis and stay tuned-in to the ongoing projects. This decision was much appreciated by the analysts. It was rare Roy could not be found in his office. He had an open-door policy and was always receptive to technical questions, a "chalk-talk" or to have ideas bounced off of him. He was not interested in management and the business side of the corporation.

Roy never wanted to be president of a company. When asked about his managerial style he said he "managed by delegation through procrastination." Basically, by not making a decision someone else would be forced to figure out how to get the task at hand done.

Throughout the years, back at United Aircraft, whenever the staff had to perform the semi-annual purge of extraneous papers in the company's file cabinets they could never bring themselves to discard one item: Roy's resignation. Nutt's former colleagues were proud to have worked side by side with him and they kept track of his career and success. Eventually United Aircraft returned Nutt's resignation to him with a fond note putting the responsibility for discarding the resignation letter on his own shoulders.

Computer Sciences was not the first software company (Computer Usage Company was formed in 1955), but within four years of its founding CSC became the largest software company in the U.S., served every major hardware manufacturer, and took their business public with an IPO listed on the American Stock Exchange in 1963. In 1968 CSC was listed on the New York Stock Exchange. They were the first independent software company listed on a national exchange and had operations throughout Europe and Canada. The 1960s were a period of rapid growth for CSC. The company's focus would shift through the decade towards a more government contract oriented business. After 10 years in business, CSC had 4,000 employees and \$65 million in revenue.



1970s CSC ID Badge.

In 1970 Roy Nutt participated on a panel for the National Academy of Sciences to discuss computer security and the feasibility of protecting data banks.³⁵ The National Security Agency, which happened to be peripherally involved, was particularly interested in if it was possible to have a "safe computer." That is to say, they wanted to know if a computer could be safe from any and all security breaches. Nutt told them categorically it could not be done. There would always be a security risk. Neither physical protection nor the prevention of electronic eavesdropping could be guaranteed. Therefore, even if a computer's data were encrypted it was still possible information could be intercepted and eventually deciphered. Nutt was amused by the naivety of the panel and never cashed his consultation checks.

Fletcher Jones tragically died while piloting his private plane from Los Angeles to his ranch in Santa Barbara in 1972.³⁶ Nutt was

³⁵ Out of the 23 members on the panel only two were in the computer field: Roy Nutt and John Pierce from Bell Telephone Laboratories.

³⁶ Jones had a successful race horse breeding business: Westerly Stud Farms.

devastated by the loss of his partner and fellow visionary. Even though Jones had passed the corporate reins to Bill Hoover in 1969, Jones had still been guiding the company with his and Nutt's early ideals. Unfortunately, Hoover's direction for the company would become more and more conservative to the increasing disappointment of Nutt.

CSC's "time sharing" branch, INFONET, was growing and by the mid-1970s would be a 100,000 mile network, connecting 125 cities and virtually every U.S. government agency.³⁷ Time sharing allowed multiple remote computer users concurrent access to computing resources.³⁸ Although time sharing was a successful endeavor, Roy Nutt saw it as only a temporary solution for computer connectivity. He also believed computers would soon become small and affordable enough for the general public. While time sharing was advancing, microcomputers were being experimented with, and Roy Nutt saw the possibility of returning CSC to its roots of compilers and operating systems. Nutt had met with Dennis Allison, who had just written a BASIC interpreter which was up and running on a do-it-yourself microcomputer kit.³⁹ CSC had, four years earlier, incorporated BASIC as a feature of INFONET. As there was very little memory, the early microcomputers presented the same challenges to the programmer as did the mainframes of the 1950s. Nutt was excited and ardently pitched this potentially new market to Hoover and the rest of CSC's board. The financial stability of the company was of primary concern to Hoover and Nutt's ideas were rejected. This was a crushing blow. Bob Paul recalled that Nutt was "very vocal in his concerns that CSC had to be vigilant in following the progress of the computer manufacturers." CSC was now a large company subsisting on government contracts and the idea of producing consumer based software must have seemed like a regression.

Roy Nutt was enthusiastic about Bill Hoover when he joined CSC in 1964.⁴⁰ Over the years, though, it became evident the two had divergent philosophies. Bob Paul, who witnessed Nutt's frustration at the time, said Nutt "believed strongly in this goal of software leadership as a key to the future, and tried to press this point whenever he was able." Struggling with the company's trend away from proprietary development, Roy Nutt was slowly shuffled out of the decision-making policies. Compilers and system software for microcomputers would be left for entrepreneurs such as Bill Gates and Steven Jobs.⁴¹ At the same time, there was a renewed interest in database management theory. Bob Paul sat in on a presentation, given by CSC colleague Bob Miner, on relational database modeling techniques. Paul was excited about the discussion and shared his enthusiasm. He was amazed at how closely Miner's model mirrored the non-redundant database implementation of

FACT. As with the ideas pitched for microcomputer software, the database system was of no interest to CSC. Bob Miner would leave CSC and go on to co-found Software Development Labs, which would be renamed Oracle.⁴²

Beginning in the early 1960s, CSC had had a long relationship with NASA. In 1981 Nutt was privileged to attend the first launch of the space shuttle. He witnessed the event from Firing Room #4, which was the closest allowable point for civilian observation. Nutt had been invited in 1969 to the Apollo 11 launch and moon landing but declined in order to allow someone from CSC who had actually worked on the Saturn V rocket software to attend.



NASA space shuttle badge, 1981.

The 1980s were a period of expansion for CSC, with many acquisitions. Nutt's involvement slowly declined as he eased into retirement. Missing the change of the seasons, Roy and his wife, Ruth, bought a home in Connecticut, where they spent springs and falls.

Roy Nutt was Executive Vice President of Computer Sciences Corporation until his retirement in 1988 and chairman of the Board of Director's executive committee until his death.

Today CSC is a worldwide company with major offices in Europe, Asia, and Australia, 98,000 employees, clients in over 90 countries, and revenues of \$16 billion.

³⁷ INFONET was conceived of in the mid 1960s and became operational in 1969.

³⁸ INFONET was developed concurrently to ARPANET which would evolve into the Internet.

³⁹ The MITS Altair 8800 with an Intel 8080 CPU and 2k of RAM.

⁴⁰ Prior, Hoover was chief of computer applications and data systems at the Jet Propulsion Laboratory.

⁴¹ Bill Gates and Paul Allen would shortly write a BASIC interpreter for the Altair 8800 and launch Microsoft.

⁴² Co-founded with Larry Ellison and Ed Oates in 1977 and renamed Oracle in 1979.

Other Life

Trinity College was an important part of Roy Nutt's life. He credited his experience there, and his supportive professors, as providing him the opportunity to actualize his potential. During the 1957-58 school year, he joined the Trinity faculty, as a visiting professor, to teach some advanced mathematics classes (while still maintaining his United Aircraft job). In 1967 he set up an endowment fund for a fine arts professorship to honor his father. He also donated money in the 1980s to assist in the construction of the college's engineering and computing facility. A humble man, when in the late 1960s Trinity offered him an honorary doctorate he declined because he did not feel he had earned it. When asked about his occupation he more often than not responded with "mathematician." He felt honored to serve on Trinity's board of trustees. In 1988, at his 35th Reunion, Trinity awarded him the Eigenbrodt Cup, which is given to "an alumnus/a of national or international prominence, who has rendered unusual and significant service to the College." Roy Nutt made arrangements for several charitable remainder trusts naming Trinity College as the beneficiary.

One act of which Roy Nutt was particularly proud was the arrangement of an important endowment, through the Jones Foundation, to establish the "Fletcher Jones Professor of Computer Science" at Stanford. Renowned computer scientist Dr. Donald Knuth received the first chair. Although Jones had not been a particularly charitable person throughout his life, in an effort to avoid estate taxes, he created a charitable foundation, which would be his primary beneficiary. Jones did not, however, expressly designate a program for how funds should be distributed. Fletcher Jones, Roy Nutt and Jones's lawyer were the original trustees of the foundation.⁴³ Jones had expressed some interest in supporting education and thus, upon his death, the Jones Foundation's fundamental goal became supporting colleges and universities in California.



Roy and Ruth with son, Micah (center), at his graduation from Trinity in 1985.



Roy and Ruth at Roy's 35th Reunion at Trinity College, 1988.

Although aware of the importance of his contributions as a pioneer of the computer software industry, Roy Nutt, for the most part, shunned the public limelight. He always believed he was just in the right place at the right time. Unaffected in manner by his professional success, he never took more than \$50,000 salary from CSC, believing his stock in the company was more than reasonable compensation and that the money of an executive salary could be put to better use by the company. Success and wealth came quickly to Roy Nutt and Fletcher Jones but whereas Jones purchased a 40-foot yacht shortly after forming the company, Nutt waited a couple of years for his first splurge: a new car for his parents. He did not allow himself to think he was successful until late 1961 when a competitor, Planning Research Corporation, offered \$3 million for the company. Nutt and Jones were both 31 years old. The two entrepreneurs took the offer seriously. Roy Nutt said, "We thought long and hard before turning it down. We realized that with a little more work, we could make CSC worth a lot more than that." Nutt's hope in 1959 had been to, one day, be able to employ 100 programmers. The juxtaposition of Jones's "custom-made, custom-painted, money green Cadillac convertible" and Nutt's beat up Volkswagen Bug stuffed with punch cards and print-outs flanking the entrance to CSC's corporate headquarters perfectly symbolized how different the two men were. Jones was a flamboyant visionary and Nutt was a soft-spoken introvert. Jones and Nutt were drawn in contrast, and yet they perfectly complemented each other. Owen Mock said "Roy brought a sense of adventure – an intellectual excitement to CSC" while "Fletcher gave the place an aura of quality and class."

Roy Nutt died of lung cancer in Seattle, Washington, on June 14, 1990.

A scholarship without restrictions for financial aid to needy students was created at Trinity College in his memory and funded by gifts from his wife, Ruth, family, and friends. Ruth later served as a trustee of the College and continues his legacy of giving.

⁴³ Lawyer John Pollock.



- A. Roy with his children (L-R) Bob, Micah, and Sarah, 1963.
- B. The Nutt Family at Lake Arrowhead, 1970.
- C. The Nutt Family, 1972.
- D. Ruth and Roy, circa 1985.
- E. Roy with Micah at his graduation from Trinity.



The Roy Nutt Mathematics, Engineering & Computer Science Center, 2012.



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