

Interviews

Rolf Skår

Editor: David Walden

Rolf Skår was one of three cofounders of the Norwegian computer company Norsk Data. During his many years with Norsk Data, he worked in various phases of the business including software development and sales and marketing. His final position with the company was as president and CEO. As a renowned businessman in Norway,

after Norsk Data he has served in positions of leadership and innovation in government agencies and business consulting and has represented Norway in the European Space Agency.¹

David Walden: Please tell me a bit about your youth.

Rolf Skår: I was born at Skår, Karmøy, on the west coast of Norway. My father was a fisherman in the winter and a small farmer for the rest of the year. When I reached the age of 12, he bought his first car and a year later a tractor. I come from a large family with 71 first cousins; most of the male cousins either became fisherman or ship captains. My youth was dominated by “child labor,” working with my father on the small farm and being paid to drive the tractor and other work for other nearby farmers. I was financially independent of my parents by age 14, earning my spending money while at home and paying all expenses for attending university.

Walden: You went to college at NTH (Norwegian Institution of Technology²). Had you already developed an interest in technology and science as a youth?

Skår: Technical interest came early as I repaired my father’s farm equipment and cars. In the summer I was 13 years, we had a visit from one of my first cousins who was an engineer, and I became convinced that I should study engineering at the NTH in Trondheim.

Walden: Please tell me about your college years.

Skår: Before being allowed to study engineering at NTH, it was mandatory to have one year of work in an industrial environment. I spent this year at a metal smelter in Sauda, where I worked in the repair shop. At NTH I was privileged to study control engineering and cybernetics under Professor Jens Balchen. I took all the computer lectures given at NTH and started to write programs in Algol for a Danish computer called GIER.

My later career was significantly shaped by the three summers jobs I had during my NTH years. In 1963 I worked in Switzerland for an electrical products manufacturer and came to know and love the country. The next summer I had a “dream summer job” at CERN in Geneva, working with digital technology. There I met Lars Monrad-Krohn who invited me to come to the Norwegian Defense Research Establishment (NDRE)³ and take my diploma there. I also arranged for a girl I had met in Trondheim, Signy, to get a job near Geneva. We met often in Geneva and this resulted in a happy marriage, now in its 47th year. My next

Background of Rolf Skår

Born: 13 May 1941, Skår, Karmøy.

Education: NTH (Norges Tekniske Høgskole), MS (cybernetics), 1966.

Professional Experience: Electric Furnace Products Company, trainee, 1960–1961; Sprecher & Schuh AG, student summer job, 1963; CERN, student summer job, 1964; NATO Saclant Anti-Submarine Warfare Research Center, student summer job, 1965; Norwegian Defense Research Establishment (NDRE), compulsory military service, 1965–1966; NDRE, research engineer, 1966–1967; Norsk Data, 1967–1989; Royal Norwegian Council for Scientific and Industrial Research (NTNF), director general, 1990–1993; Norconsult International, president, 1993–1998; Norwegian Space Center, director general and head of Norwegian delegation to

European Space Agency (ESA), 1998–2006; European Space Policy Institute (ESPI), permanent resident of founders, 2006–2008; ESA, industrial ombudsman, 2010–2012; Norwegian Space Center, senior adviser, 2008–2009 and 2013–present.

Honors and Awards: Leader of the Year (Årets leder), Norway, 1984; Royal Swedish Academy of Engineering Sciences, member, 1984; Norwegian Academy of Technical Sciences, member, 1986; Cybernetics Society of Norway, honorary member, 2000; International Academy of Astronautics, member, 2005; NASA International Cooperation Award, 2006; Norwegian Academy of Technical Sciences, honorary member, 2008; Royal St. Olav’s Order, Knight of the First Class, 2010.

summer job was even better, working for NATO Saclant in La Spezia, Italy. At NATO Saclant, I did software development for computing how sound waves would travel depending on salinity, temperature, and currents, which is relevant for hiding and detecting submarines.

Returning from Italy, I started my compulsory 18 months military service in the Royal Navy. I was privileged to do my thesis work (for my Siv. Ing degree⁴ from NTH) at NDRE under the supervision of Lars Monrad-Krohn. NDRE had an advanced 24-bit digital computer called SAM, with a program-controlled graphical display station that cost US\$100,000. My thesis was to show any formula with x and y displayed either in a logarithmic scale or linear. A good example is $y = \sin(x)/x$. The major part of the thesis work involved translating formulas into machine readable code (such as Fortran).

Walden: After finishing your thesis work, you stayed on at NDRE?

Skår: After finishing my graduate work with a diploma in April 1966, I continued my military service at NDRE and almost immediately got involved in software development for a new 16-bit minicomputer that NDRE developed for the Tromsø Satellite Station. This computer, called SAM-2, was the second computer in the world to use the new integrated circuit technology (Intel TTL logic circuits).

I soon became responsible for software development for the SAM-2, most importantly, developing the assembler for translating user instructions into binary machine code. I greatly enjoyed working with computers, and I have never regretted leaving my formal education area of control engineering.

Walden: What led NDRE to develop its own computer?

Skår: After World War II, the Norwegian government gave priority to developing NDRE into the leading research institute in Norway, particularly in all kinds of electronics. It had a policy whereby its qualified researchers could visit the world's leading universities for one year with full pay plus a scholarship from the Research Council. A truly brilliant engineer, Yngvar Lundh, went to the Massachusetts Institute of Technology and participated in the development of the famous TX-0 early transistorized computer. When Yngvar returned to NDRE, he designed Norway's first computer called Lydia, which is

used to analyze sounds, or noise, from propellers of Russian submarines patrolling the northern Norwegian coast.

After the Lydia, Lundh built the SAM, an advanced 24-bit computer with a programmable graphical display. Some of the junior designers on the SAM were Lars Monrad-Krohn and Per Bjørge.

NDRE had the capability and political support to develop computers more advanced than those commercially available. NDRE's practice was to use the newest, most advanced components available, and SAM used silicon transistors (not germanium). TTL ICs were expensive when the decision to use them was made, but fairly soon they became the obvious and most cost-effective choice.

Walden: Did the idea for starting the computer company Norsk Data Elektronikk come out of the SAM-2 work being done at NDRE?

Skår: The work on SAM-2 had started in August 1966 when Per Bjørge returned from his one-year stay at MIT. SAM-2 was scheduled to be delivered in the summer of 1967. By organizing two teams for testing and debugging and working round the clock, SAM-2 was finished early. Per led the day team working from 10 a.m. until midnight, and Svein Strøm led the night team working from 10 p.m. until noon the next day.

Lars, Per, Svein, and I took the SAM-2 computer on a tour visiting the research institutes in Norway. Our first discussion was at the Christian Michelsen Research Institute in Bergen in April 1967. The people we met there encouraged us to start our own company and so we did. In June 1967, Per, Lars, and I gave notice that we would leave NDRE as of 18 September. We did not prepare a business plan. We simply believed we had a very competitive computer.

Walden: How closely related to the SAM-2 was Norsk Data's first computer?

Skår: At NDRE we had already started on an improved version of SAM-2 called SAM-3 for ballistics calculations for the Norwegian military. The SAM-3 was to have a 48-bit floating-point arithmetic in hardware, but it was otherwise backward compatible with SAM-2.

The Nord-1 was a direct continuation of the work we had done for SAM-3. Some of the printed circuits boards were actually designed before we left NDRE. No one

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objected that we took with us our experience and our work when we left.

We started working at Norsk Data on 19 September 1967, and the Nord-1 became fully operational in the spring of 1968.

At that time, the Nord-1 was the most advanced 16-bit computer available. The nearest competitor was Scientific Data Systems' Sigma-2. The Nord-1 had floating point in hardware, a full 16-bit memory address, a typical cycle time of 1 or 2 microseconds, and a floating-point multiply of two 48-bit numbers of about 10 microseconds. It had a rich instruction repertoire with seven registers, including both an index and base register, permitting reentrant code.

Walden: How was Norsk Data organized?

Skår: We had difficulties in funding the startup. Our aim was to raise NOK 600,000 (US\$90,000), but we ended up with only NOK 194,000. Some potential shareholders withdrew on the day of the constitutional shareholders meeting after seeking advice from IBM. My classmate and my first man when Signy and I were married, Terje Mikalsen, invested NOK 100,000. A friend of Lars and I, Tor Lingjaerde (a CERN employee), also invested NOK 30,000. The rest was from us and our family and friends; I had only NOK 8,000 to invest. Lars, Per and I paid the same price for the shares as the outside investors; there was not any venture capital available, nor any tradition of those with the know-how paying a lower price.

Our initial roles were easy to decide. Lars was the president and responsible for sales and marketing, Per was head of hardware development, and I was head of software development.

Walden: Who were the customers for the Nord-1 computer?

Skår: The launching customer for our first Nord-1 was the Taimyr Project, funded by the NTNF (Royal Norwegian Council for Scientific and Technological Research). The Norcontrol Company, whose managing director was also the first chairman of Norsk Data, led this project. The Nord-1 was the first computer to be installed on a commercial ship with the ship's radar connected to the computer as an anticollision system. Terje Mikalsen was already a Norcontrol employee, and one of his first jobs was to develop the interface between the radar and the Nord-1 computer. This project was successful, and Norsk Data soon became the

world leader in the sale of computers for ship automation.

The next customers were research institutes: the Sentral Institute in Oslo and Christian Michelsen Institute in Bergen. The first customers developed their own applications, using the computer's assembler and the Sintran operating system.

Out of sheer necessity, we had to make profit from the start and did. Receiving one-third prepayments from customers was key to our survival in the first years.

Walden: When I knew Norsk Data in 1970 and 1971,⁵ there was much effort going into building a new machine, the Nord-5, despite what appeared to be a tight financial situation.

Skår: Norsk Data was always short of money and in desperate need of prepayments. In 1971 the Norwegian Metrological Institute (MI) had funds of NOK 5 million authorized to replace their vacuum-tube computer. Norsk Data proposed a new 32-bit computer, Nord-5, called a satellite computer because it was controlled by a Nord-1 and had shared memory with the Nord-1. We agreed to deliver a turnkey system for running Fortran programs in high speed. Without that prepayment, Norsk Data might have gone bankrupt in 1971.

The system was developed in record time, and upon acceptance on 12 March 1972, it was the most powerful computer developed in Europe, able to multiply two 64-bit floating-point numbers in approximately 1 microsecond. Per Børge led the development team, and I was his assistant and wrote the software necessary to control and test the Nord-5. Our small project team worked 14- to 16-hour days (though not weekends) for about six months before acceptance.

After the Nord-5 development was finished, the company was in deep financial crises and this led to a change of management. Kolbjørn Johansen who had been recruited as a new financial officer became president. Many of the staff working on the Nord-5 team were told to help with sales as we really needed new orders.

This time, the company was saved by some new software. I learned that a truly brilliant software developer, Bo Lewendal, might be interested in coming to Norway. Bo was part of the team in the early 1970s that was developing the world's largest time-sharing computer at a startup company called Berkeley Computer Corporation (BCC).

I was able to get Bo to come to Norsk Data. His first job was to transfer the QED text editor to the Nord-1. Bo saved the company by single-handedly developing the Nord TSS, a time-sharing system for a 16-bit minicomputer with up to 16 simultaneously users.

With this system, we were able to penetrate the market in Sweden with TSS sales to the Universities of Umeå and Luleå. Many Norwegian technical schools followed.

Walden: MIT, then Lewendal... connections outside of Norway seem to have helped.

Skår: Without the NDRE and Research Council policy of sending young scientists to the world's leading universities, I am certain that there would have been no computer industry, nor any advanced electronics industry, in Norway. MIT, in particular, was the key to computer development in Norway. We learned there how to design computers and their software. We were not afraid of pushing the state of the art in minicomputer design, which was what we did with the SAM-2 and even more so with Nord-1.

Walden: In time, Norsk Data became something of an international company.⁶

Skår: The CERN contract Norsk Data won in December 1972 was the difference between bankruptcy and success. For their project, CERN had decided to use the PDP-11 and had already purchased two PDP-11s. Because of political pressure, the three key decision makers at CERN visited all potential European suppliers. During their visit, I took them to the Institute of Atomic Energy in Halden where we demonstrated two important applications: how computers were used in the control of a nuclear experimental reactor, and the TSS operating system for software development. They were impressed and later told me that returning to their hotel, they toasted with each other for having found a potential alternative supplier.

I was responsible for the Norsk Data proposal to CERN. I also drafted a proposal based on using PDP-11s (I had access to their price list). Our offer was priced 10 percent lower than the PDP-11s, and we offered the not-yet-developed Nord-10 with a guarantee to ship enough Nord-1s until the Nord-10 could be delivered.

At tender opening, the verdict was, "The Norsk Data offer was by far the best and the cheapest."

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We had won the largest minicomputer contract in Europe, involving 24 minicomputers. At that point, I moved to Geneva, Switzerland, for two years as project manager for all CERN business. We opened our first foreign office, and I started to argue with management in Oslo that we should aim for Norsk Data to become "the European computer company." This was achieved.

The CERN contract led to financial golden years. From 1973 to 1986, we had a compounded growth rate of 40 percent annually both in sales and in profit calculated as earnings per share. Our share price multiplied by approximately 1,000 times. Between 1975 and 1985, Norsk Data had the best performing listed share in the world, with 55 percent annual compounded growth.

I returned to Norway in 1975 to become vice president of R&D and also helped sales in situations with large business potential. In 1986, I became vice president of marketing and sales, emphasizing to the technical staff that success in sales is key for growth and that sales work is okay even for the technical staff.

I became president and CEO on 1 January 1978, having had almost that much influence on decision making since returning from Geneva. I had the confidence of all staff and had proven myself both in software development, in sales responsible for CERN, and for defining the strategy for our future.

During my time as CEO, the company grew from around 200 to 4,400 staff, with offices in many European countries and in the US. Sales were truly worldwide with a particular strength in sales to nuclear research institutes (coming through the CERN network of scientists).

Our largest customer was the US Department of Defense through Singer Link for all

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flight simulators for the F-16 fighter aircraft. Each simulator had approximately 10 Norsk Data computers. Every country using F-16s got their simulators for pilot training with our computers.

Our sustained profitable growth made it possible for Norsk Data to get listed on the London Stock Exchange in 1982 and the NASDAQ in 1983. From 1982 to 1984, we raised NOK 800 million in new equity through one share offering in London and two in the US.

We had a policy that all the staff could become shareholders, offering staff shares at a truly deep discount. For several years most staff were making additional profits, called share bonuses, equivalent to a year's salary.

There was little tradition for entrepreneurial startups in Norway, and we could not raise equity in Norway. Thus, when our share price multiplied by 1,000, only the employees and the initial investors profited.

Walden: In time, the company's business declined. What happened?

Skår: Our best year was 1986, with total sales of NOK 2,576 million and operating profit of NOK 475 million, or 18.4 percent profit margin; the market capitalization was around NOK 10,000 million with a share price around NOK 260 for most of that year.⁷

Norsk Data followed what we saw as the IBM pricing policy—pricing computers based solely on their value for our customers—what the market would bear. We made a lot of profit, and for many years, we were perhaps the most profitable minicomputer company in the world.

Then something happened in 1987 and 1988 that, in effect, killed all minicomputer companies over the next few years. It was a

combination of new technologies, in particular the Unix/Linux operating systems, becoming available almost for free and Apollo Computer and Sun Microsystems offering powerful workstation computers running Unix at a fraction of minicomputer prices. We simply could not compete in our largest market segment.

A little later the Intel 386 32-bit microprocessors became available with easy-to-use software. This finished off the minicomputer companies.

Walden: Norsk Data continued with ever reducing sales and operations for several additional years,⁸ but you left the company in 1989. Please tell me a bit about your activities since then.

Skår: I decided to leave Norsk Data in the summer of 1989. Being responsible for the company's growth, I was not motivated to be responsible for its inevitable change to a smaller and different company.

On my last day, 7 August 1989, I got a telephone call from the Norwegian secretary of industry asking me if I would be willing to lead and change NTNRF (Royal Norwegian Council for Industrial and Technological Research) to make it more useful and more relevant. (As a bonus, the government appointed me a part-time position as the Norwegian Space Center's chairman of the board.) I see my three years at NTNRF as my best professional years. I was able to change NTNRF as mandated, using the management skills I had developed at Norsk Data.

After NTNRF, I accepted an offer to become president of Norconsult International, the largest and the leading engineering consultancy company in Norway. The job took me to many interesting places, and I fell in love with Africa, in particular with the Kilimanjaro part of Tanzania and its nearby national parks. As my part-time hobby, I became a tour leader for climbing Kilimanjaro.

To work with space challenges was my dream from my first years at NTH. Thus, I was pleased to become the managing director of the Norwegian Space Center in 1998 and get to work full time in the field. As chairman since 1993, I had already become the Norwegian participant to the Long-Term Space Policy Committee of the European Space Agency (ESA) and responsible for proposing new rocket policies.

I worked closely with NASA while at the Norwegian Space Center, and together with

NASA, we developed Svalbard with its Svalsat becoming the world's largest ground station for data reception and commands to and from polar orbiting satellites.

After retiring from the Norwegian Space Center, I was asked by the ESA to join the European Space Policy Institute (ESPI) in Vienna as the permanent resident of its founders. During two wonderful years (2006–2008), I was able to continue my thinking about alternative rocket designs, including an idea that has been taken up by Virgin Galactic.

After returning from Vienna, I continued to work for the ESA, where I just retired at age 71 as one of their two ESA industrial ombudsmen. Now I work as a consultant to the Norwegian Space Center. I enjoy always having something to do.

Walden: Your career path from the farm through pioneering computer technology to space technology has been extraordinary.

Skår: I believe several characteristics have been important in shaping my life. My childhood involved a lot of work and learning to take responsibility for everything I did. I am a quick learner. I am always willing to go

my own way, with a strong belief that my ideas will succeed. And finally, I always have been a businessman.

Walden: Thank you very much for taking the time to participate in this interview.

References and Notes

1. This interview was done over email in September 2012. The original 6,000 word interview was reduced to the length of this article by the interviewer with the approval of the interviewee.
2. Norges Tekniske Høgskole in Norwegian.
3. Forsvarets Forskningsinstitutt, or FFI, in Norwegian
4. The Sivilingeniør degree is issued in Norway to graduates of technical universities.
5. N. Liaaen and D. Walden, "Remembering the LFK Network," *IEEE Annals of the History of Computing*, vol. 24, no. 3, 2002, pp. 79–81.
6. T. Olav Steine, "The Founding, Fantastic Growth, and Fast Decline of Norsk Data AS," *History of Nordic Computing*, Springer, 2010, pp. 249–257.
7. In 1986 the NOK to USD exchange rate was about 7.4 to 1.
8. "Tore's Norsk Data Site," "http://toresbe.at.ifi.uio.no/nd.

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