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**Online Before
the Internet**

Early Pioneers Tell Their Stories

by

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In 2003, many — indeed most — people think the word “online” means the Internet. But there was an “online” before the Internet. In this space and for succeeding months, we will explore the genesis of the first online industry, which surfaced in the late 1960s, and served primarily information scientists; documentation experts; government researchers in educational, scientific, technical and medical fields; and librarians.



Online pioneers: Roger Summit, Dick Kollin, and Carlos Cuadra.

We believe the small but vigorous market that developed around early online technology paved the way for the phenomenon of the World Wide Web in the mid-1990s, and that many of the issues intertwined in the growth of early online presaged those that later exploded with the Web. We don't think those individuals and companies that ignited information access through the Web learned much from the development of the first online — indeed, we doubt that many, if any, were particularly aware of it — but we do think there are lessons to be learned from an examination of the growth of the early online industry. This series presents the stories of some of the important individuals who produced the first online wave.

Part 1: In the Beginning

The technology of early online was a confluence of systems, databases, and people. Although they worked together to grow a new industry, the individuals and companies instrumental in early online also competed with each other. The two systems that became virtually synonymous with the term “online” in the 1970s and 1980s were Dialog and ORBIT. Both systems owed their early growth to the persistence of individuals in scientific and technical enterprises. Dialog came out of the Lockheed Palo Alto Research

Laboratory, and ORBIT started within System Development Corporation, a spin-off of the RAND Corporation.

In the early years of development within these large government contractor companies, and subsequently during the first years of fledgling commercialization, both enterprises were headed by strong individuals who, though they did not work alone, are generally acknowledged to be the fathers of the respective systems.

Therefore, it was an historic occasion in April 2000, when Roger Summit (Dialog) and Carlos Cuadra (ORBIT) met for a day to talk about the early days of their rival projects. The meeting took place in the home of Dick Kollin, the creative genius behind several online innovations (the Pandex database, Magazine Index, Telebase, and EasyNet). The conversation was initiated and guided (to a small degree) by Stephanie Ardito and Susanne Bjørner. [Dick Kollin had suffered a stroke and was assisted in interpretation by his wife Sandy.] It was a day of reminiscence, revelation, contradiction, corroboration, commiseration, disagreement, surprise, and laughter. Excerpts from the story that unfolded that day are offered in this installment. We focus on areas of interaction among these early online giants, highlighting the evolution and marketing of the systems. Individual stories regarding the development of their independent companies — and others — will follow later in this series.

TIMELINE

Key Dates in the Development of Orbit and Dialog

(Despite our attempts, we could not firmly confirm and reconcile all dates mentioned by participants and the literature. The authors welcome evidence and recollections from readers to help us verify events and revise the timeline.)

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| <p>1960: Roger Summit starts a summer job at Lockheed, assigned to computer simulation and information retrieval projects.</p> <p>1963: Summit writes MATICO, a program to print catalog cards.</p> <p>1964: Lockheed sets up Information Sciences Laboratory and purchases one of the first IBM 360/30 third-generation computers.</p> <p>1965: Summit visits Mel Day at NASA in Washington; writes unsolicited proposal for a demo project on NASA's 300,000 item database.</p> <p>1966: NASA awards parallel funding to Lockheed, for an in-house installation, and to Bunker-Ramo, for a dial-up service, to automate the NASA database.</p> <p>1967: NASA issues an industry-wide RFP for NASA RECON; Lockheed wins the contract, retains rights to Dialog software created.</p> <p>1968: System Development Corporation (SDC) builds CIRC and COLEX for Wright-Patterson Air Force Base; contracts with USOE for research and dissemination of educational information (ERIC); does a "road show."</p> <p>1969: SDC creates ELHILL, a retrieval program, for the National Library of Medicine (NLM); tests software first with a Parkinson's disease database, and then with 150,000 medical journal articles (AIM TWX).</p> <p>1969: Lockheed installs systems at ESRO, for NASA RECON, and at the Atomic Energy Commission, for Nuclear Science Abstracts; contracts with USOE to provide leased-line service to ERIC at Stanford.</p> <p>1970: NLM tests the teletype—instead of leased lines—for low-cost, low-speed information delivery.</p> <p>1971: SDC creates ORBIT, written in PL/1; NLM runs ORBIT in-house and expands AIM TWX into MEDLINE; an SDC computer backs up NLM's installation of ORBIT.</p> <p>1971: SDC loads ERIC database and offers SDC/ERIC publicly.</p> | <p>1971: Roger Summit and Dick Kollin negotiate online pricing for Pandex database, at the ASIS national meeting.</p> <p>1972: Threatened with loss of the NLM backup contract, Carlos Cuadra surveys the commercial market for online services (survey results indicated there was no market).</p> <p>1972: Cuadra struggles to get CA Condensates database loaded onto ORBIT.</p> <p>1972: At Lockheed, Roger Summit offers Dialog as a commercial online service with NASA RECON, Nuclear Science Abstracts, ERIC, and Pandex databases.</p> <p>1973: January: Cuadra takes SDC Search Service "on the air."</p> |
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Later Corporate History

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| <p>1978: Carlos Cuadra leaves SDC and forms Cuadra Associates.</p> <p>1981: Dialog Information Services, Inc. becomes a subsidiary of Lockheed Corporation.</p> <p>1987: Robert Maxwell (Pergamon Press) purchases Orbit, renaming it Pergamon Orbit Infoline.</p> <p>1988: Dialog Information Services, Inc. acquired by Knight-Ridder, Inc.</p> <p>1989: Robert Maxwell purchases Bibliographic Retrieval Services (BRS); Orbit and BRS renamed Maxwell Online.</p> <p>1991: Roger Summit retires from Dialog.</p> <p>1994: French online host Questel purchases Orbit; names the composite company Questel-Orbit.</p> <p>1995: Dialog becomes Knight-Ridder Information, Inc. (KRII)</p> <p>1997: M.A.I.D. plc acquires Knight-Ridder Information, Inc.; forms The Dialog Corporation.</p> <p>2000: The Thomson Corporation purchases the Information Services Division of The Dialog Corporation.</p> | |
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The Interview Begins

Today we want to concentrate on the industry. We're intrigued with the development of what we are now calling the "first online" industry. Since there are so many people who think the Internet started online, one of the goals of this series is to show people that there was an online before the Internet. We also want to appeal to the practitioners who lived through the first online industry in various ways. So, we're looking at it from a business point of view: How does an industry get developed? How did it come to be called "online"?

Please describe how you each separately got into online. We know that you worked within defense companies. Describe the funding and original purpose of the projects from which online systems eventually evolved.

Cuadra: The point where I can remember noticing a beginning to our being in the online business at SDC was when we did an experiment for the Federal Technology Division

at Wright-Patterson Air Force Base in Ohio. We had built for them something called a Centralized Indexing and Reference Control system (CIRC). It was mostly manual, kind of automated, and they liked it. Then somehow we came to the idea of doing an experiment with a system that was more interactive. That led to the second project, called COLEX — the CIRC OnLine EXperiment. All this was government-funded. Then, about the same time, in 1968, we got a contract with the Department of Education to conduct some research on their ERIC centers, to write a book, and to prepare brochures on dissemination and use of information.

ERIC and MEDLINE

Cuadra: As part of that contract or maybe a follow-on, we were asked to do a road show to demonstrate online retrieval to the educational community. Two people from my staff did that. They carried around a teletype — teletype

machines were so big then, they had to be shipped in two boxes! Fortunately, one of the staff members was large and strong. They took this around to different cities and demonstrated online searching at something between six and 10 characters a second. Clunk, clunk, clunk, clunk, clunk.

About the same time, we were asked by the National Library of Medicine to test some new software we had developed, using a Parkinson's disease database. We demonstrated the database, and in May 1970, that project led to the start of a service called AIM TWX that we ran for NLM. The name stood for Abridged Index Medicus, which is a publication, and Teletype Writer eXchange, which is a service. The idea was to provide service to medical libraries, teaching hospitals, and other health professionals using a database of 130,000 records that were a subset of the MEDLARS database.

The ORBIT Software

Cuadra: In 1971, we completed a version of new software called ORBIT. It was SDC-funded and was written in PL/1, which our programmers tell me was regarded as an exotic new language at the time. We had a lot of fuss with SDC management to get them to let us use it. NLM licensed a version of this new software, which they referred to as EL-HILL (to honor Senator Lister Hill, a major NLM supporter), and used it to start a service called MEDLINE (MEDLARS On Line) that provided access to the full range of documents in the MEDLARS database. A few months later, they began providing MEDLINE service on SDC's computer as a backup. NLM allowed SDC to provide access to this backup MEDLINE service to members of the Pharmaceutical Manufacturers Association (PMA) because the PMA companies were doing some indexing for NLM, and as the quid pro quo, they got this access. So commercial companies as well as health professionals were now searching MEDLINE.

The response to MEDLINE was very good. When there was too much load, people could get to MEDLINE on SDC's computer. I think the PMA companies at that time used only SDC's MEDLINE.

Going Commercial

Cuadra: In late 1971, even before we started our MEDLINE service for NLM, some of us got the idea of selling other databases, too. The one we picked was ERIC, because we knew so much about it from the work we'd done for the U.S. Office of Education. I'm not sure whether we bought it or got permission.

Summit: It was free.

Cuadra: It was free. So we loaded that database and started selling access to it under the name SDC/ERIC, and this was the beginning of our commercial online service.

Summit: When was that? 1971, do you think?

Cuadra: Late 1971. There are two reasons why I think it was 1971. One of our programmers found a brochure, the back of which shows a little code that says '71. So the brochure was done in 1971, though I can't remember when

we actually sent it out into the world. Also Ted Brandhorst wrote a chapter in the *Annual Review of Information Science and Technology* (volume 7, 1972), where he said, "SDC inaugurated in late 1971 an online commercial search service, SDC/ERIC." He followed that with, "At this writing," which was in 1972, when he was reviewing the literature of 1971, "DIALOG is implementing plans to 1) offer the public online retrieval services against the ERIC database on a commercial basis and 2) add natural language text searching."

The First Market Research

Cuadra: Sometime in 1972, I believe, NLM notified SDC that it no longer needed to use the SDC computer as the backup for MEDLINE. So, the funding for that service was going to stop. During that year, I think, I surveyed about 7,000 users of information from NTIS. I got the list from NTIS, and sent out a very simple survey form — two pages — trying to explain what "online" meant, because most people weren't using the term then, and asking questions such as, "If this thing were to exist, and you could use it, would you find it useful?" And I may have asked what they would pay for it.

Summit: You didn't.

Cuadra: OK, I guess I didn't. I got about a 1 percent response — 70 or 72 returns. Most of them said, "I don't know" or, "Ho-hum." A few said, "That might be nice." In effect, considering the 7,000 survey returns and looking at the results, it said, "There is no business here." I looked at the data for a while and thought, "Maybe my survey's dumb." I was a Ph.D. psychologist and I thought I knew how to do surveys. But I finally decided that my survey was wrong, or the respondents were wrong. I decided, "Once we do it, they'll want it." So I put the survey away — locked it in a drawer — and went to management and said that we had to start an online retrieval service. We started almost by accident.

Summit: Just to comment on that survey, because it was a very important thing. We at Lockheed had been doing all the NASA RECON system development; we had the Atomic Energy Commission (AEC) contract, and we had ERIC up and operating under a contract from the U.S. Office of Education for the ERIC facility. We got the thought, very quietly, that by golly, maybe there's a commercial application here. One of the defense contractors asked us if they could search AEC/RECON, or AEC, which was known as Nuclear Science Abstracts (NSA) at that time. We struggled with the Lockheed folks on the issue of having a nongovernment entity accessing and searching the database — that had to be about 1970 or 1971. We did a contract with them — I think it was General Dynamics in San Jose — and they were really our first nongovernment customer.

The Survey Comes to Lockheed

Summit: But what happened then was this: Lockheed of course was an NTIS user, so our library received a survey, and our librarian brought it in and said, "Hey, look at this." I looked at it and it was a survey from one Carlos Cuadra,

whom we didn't know and had never heard of, at SDC, and I thought, "Oh, shit. Somebody else has this idea." We clearly had the idea of commercializing, and we felt we were going to leapfrog over the other SDI services that were around, spinning a lot of tape. So that survey really stimulated me into action with our management. I said to them, "We have to get this...."

Cuadra: You used this as an excuse!

Summit: You bet! I said "We have to get this thing going. We have an edge now, because there are no services out there. But here this guy down at SDC is going to start a commercial service...."

Was that really the first time you heard of Carlos Cuadra?

Cuadra: Well, I knew of Roger's name because some of our people had gone to a conference on the man/machine interface, or the machine/user interface, and Roger was there; I think he was a speaker.

Summit: Well, I'm sure I did know Carlos.

Cuadra: I was the editor of the *Annual Review* at that time.

Summit: So, I knew Carlos, but I didn't know what he was up to. But at that point, I could go to management and say that this guy down there has proved there might be a business, so we have to get going. They said, "Fine. Go for it."

Dr. Cuadra, do you have the original survey?

Cuadra: Nope. I don't have any paper from SDC. We were not a very visible part of the company, so I doubt that it's in an archive. In fact, I wasn't even running SDC's MEDLINE service then. That was done by other staff members.

A Go-Ahead from Management

Cuadra: To finish the sequence of SDC getting into commercial operations.... I went to management and said that we ought to start an online service. They were aware that the funding from the NLM contracts for us to run this computer as a backup was going to go away. The only other database we were offering at that time was the ERIC database. We were kind of piggybacking. Since the software was available, all we needed to do was add other data that were relevant to other people. So with no NLM funding, we had to either fish or cut bait — forget the whole thing or move ahead and create something. I argued for moving ahead and creating something, and I was given an OK to start it up to see what we could do — in 3 months.

Just 3 months???!/

Cuadra: Yes, and you remember how long it took to get people online and doing things. Management also tied my hands by saying they wanted to make sure that people didn't just fool around with our computer; they wanted to get at least \$500 a month, so customers would have to commit in advance. I said customers wouldn't do that, and management said, "They'll have to." SDC worked for the Air Force and they were used to issuing contracts for a million dollars, \$50 million, \$80 million — big invoices for the work of hundreds of programmers. The idea of picking up \$23.89

for a search was totally foreign. So they wanted to make sure they got money up front.

It took 3 months before I convinced them that their rule was getting in the way of starting up. The librarians we went to had no idea of what they were going to do, had no idea how much they were going to spend, didn't want to have a terrible surprise, and just wanted to get started and try the service out. So eventually that \$500 number dropped out of the picture.

So the flat-rate price that was indicated at that point may have worked if it was tiny, but it was way too high?

Cuadra: Yes, it was way too high for people who were just getting started.

Summit: Was that price ever publicized? Did you try to start the service with that \$500 charge, or did you get it turned off before you started?

Cuadra: We started with it.

Summit: This ties into one of Dialog's philosophies, and you may have been the trigger for that. What I said was, "No minimums, no monthly fees."

The First ORBIT Databases

Cuadra: Yes, you have to get them hooked first. When we first went on the air, we had to decide what databases to provide. We couldn't use the NLM MEDLINE database, because we didn't have the rights to it. We were using a copy that belonged to PMA as their quid pro quo for their indexing work, and I think NLM wouldn't agree to leave it on our computer to serve a commercial market. So that disappeared, and we had only this piddling little ERIC database. That was it!

Bjørner: That's the reason I originally went online, I will tell you parenthetically — ERIC.

Summit: On SDC or Dialog?

Bjørner: BRS. [Laughter]

Summit: That was later.

Cuadra: Interview's over, right?

Converting CA Condensates

Cuadra: So, the fun part of this, I think, is how we survived the first acid test. In late 1972, when we got the OK, a journeyman programmer was assigned to write a program to convert the data. We chose, as our first major commercial database, Chemical Abstracts Condensates. The programmer worked on it for a little over a month, and his program converted about 4,000 records an hour. I did the computations — I think we had a half a million records to go — and realized that we had no way to do the conversion. We were out of business before we even started because our computer center charged us commercial rates!

What we're talking about here is the program that would convert the data from Chemical Abstracts Condensates into ORBIT's database. It ran on a mainframe and converted record, record, record, record, record. It was primarily header information, some brief indexing, and I don't recall whether

or not it had abstracts at the time.

Summit: No. Well, we were never able to get abstracts from the devils.

Cuadra: Yes, I remember. I went home as depressed as possible. I sat there at the dinner table with my head in my hands, with my two sons and my wife, talking about this disaster; the thing that I wanted to start was doomed. And one son, who was 19 at the time, said, "Well, maybe I could do something." He had just learned to program, had been at it for maybe a year, and I said, "If you can do that, I'll reward you." I built a matrix at the dining room table, and it was based on the number of days to write the program and the rate of database loading. If he took one day and his program was able to load 50,000 records an hour, he would get a Mercedes Benz. At the other end, if he took 10 days and it loaded only 6,000 records an hour, he would get a Matchbox car. And it turned out somewhere in the middle. He wrote a program that converted 20,000 records an hour; he did it in about 6 days; and I had to buy him a Toyota.

He saved SDC's search service. If he had not done that, it never would have started. So we got past that day. I paid him myself; SDC didn't.

Adding Databases

Cuadra: So that's kind of how we started and then we, like Dialog, later began adding databases. We'd ask each group of customers, for example — the pharmaceutical folks — "What do you need next? What would make this service more useful?" Then we'd go out and track it down. But that's the start; that was in late 1972, and I think we went on the air in January 1973, plus or minus a few days.

Now we want to see what was happening in parallel over at Dialog.

Summit: I went to work as a summer hire for Lockheed in 1960. I was doing my Ph.D., between the orals and the dissertation, and I needed a summer job. I was assigned two project areas. One was computer simulation and the other was information retrieval. I worked on those for about 4 years, until 1964. I was working mainly in simulation, because that's where my dissertation was, and taking some management classes.

Then in 1963 or 1964, we were doing some small information retrieval experiments. I wrote a program called MATICO, which was Machine-Aided Technical Informa-

Who's Who: Key People

Brandhorst, Wesley Theodore (Ted) — Assistant director of the NASA Scientific and Technical Information Facility from 1962 until 1969. In 1970, became the director of the ERIC Processing and Reference Facility, the centralized database processor for the U.S. Office of Education's Educational Resources Information Center (ERIC).

Burchinal, Lee — Deputy head, Division of Educational Research, U.S. Office of Education, 1965. Established the ERIC Clearinghouses in 1966.

Day, Melvin Sherman — 1946: Joined the Atomic Energy Commission (AEC) at Oak Ridge. 1958: Director of the Technical Information Division of AEC. 1960: Deputy director, Office of Technical Information and Education, NASA. 1962: First director, Technical Information Division. 1971: Head, Office of Science Information Service, National Science Foundation (NSF). 1972: Deputy director, National Library of Medicine (NLM).

Luhn, Hans Peter — Worked for IBM from 1941 until his retirement in 1961. In 1958, Luhn's interest in applying machines to literature data processing led to his development of Key Word in Context (KWIC) indexing and selective dissemination of information (SDI). He died in 1964.

Marron, Harvey — Chief, Educational Research Information Center (ERIC), in the late 1960s and early 1970s.

tion Center. I thought it was cataloging, but really it was a little program so that you could put in the data once and print all the catalog cards that you needed for the card catalog. So, I started getting involved in information retrieval at that time.

Retrieval was very crude in those days; it was all done by batch processing, tape spinning. You'd have a bunch of retrieval queries on punched cards and your database on tape, and you'd start processing that tape one record at a time and matching against the queries that were on cards.

Early "Alert" Services

Summit: Let me go back a little bit. That was the way retrospective retrieval was done, but more important were SDI services, Selective Dissemination of Information, as we called it then. Later it got called "alert...."

Cuadra: Now it's "push technology"!

Summit: Right. SDI was invented, or developed, by Hans Peter Luhn, in 1960 or so. At least he formulated the idea. There were several universities that were offering services internally on certain of the tapes. Luhn was at IBM, and he was doing SDIs within IBM; I think they were on their internal literature and maybe some journal articles. We talked our management into setting up the Information Sciences Laboratory at the time the IBM 360 was announced (1964). The 360 was so-called third-generation technology. What I was describing before was second-generation technology, the tape-spinning stuff.

We looked around at the batch retrieval activities of the day. We couldn't get in, we couldn't get a paper accepted, we couldn't seem to get admission into the information retrieval clique at the time. I'm talking about meetings such

as ASIS or the American Documentation Institute, as it was called then. I remember feeling very frustrated about that. They weren't interested; they had an information focus, not a computer focus. I can't say we tried real hard, but I remember having the feeling that we were outsiders.

Third-Generation Computers

Summit: My feeling about the third-generation computer technology was — we can leapfrog this whole business and provide access in a way it hasn't been provided before. So, we got Lockheed to buy an IBM 360/30 computer. We got the third such computer that IBM manufactured. We set it up, and I was in charge of the information retrieval experiments. The Information Sciences Laboratory was to examine the different opportunities that existed with third-generation hardware in the area of information.

Cuadra: Was all this Lockheed-funded?

Summit: It was all independent research-funded. The largest database I knew about was the NASA database, which was 300,000 citations — no abstracts — just citations and indexing. Mel Day was well known for his work in developing the NASA database. He has a history of contact with most all the government information activities of the time. He later was at the National Library of Medicine and then at NSF (the National Science Foundation). He really made the rounds.

The Road to NASA Funding

Summit: I went to see Mel Day in Washington and said, "We have this new technology that's really great." And he said, "Look, Roger, I have a couple of dozen people a week come in here and tell me their computer programs can do everything but read my mind in terms of information retrieval. You have to demonstrate something to me."

So, I went back to Lockheed. I wasn't discouraged, because we had a prototype operating then on a small database. I wrote an unsolicited proposal to NASA to do a pilot demonstration of online information retrieval using the NASA database. That had to be about 1965 or 1966. The reason I did this is because there were a lot of what we called little toy databases around that people were doing things with. But, if retrieval was going to mean anything, it had to be done on a very large database. I figured, if we could demonstrate on a 300,000-citation database, then the technology we were using would be extendable.

Mel went for that. When we submitted our unsolicited proposal, Mel said it was fine, but then he said, "Oh, by the way, Bunker-Ramo's going to do a parallel project." So Bunker-Ramo also received an award from NASA to do a prototype.

We installed a terminal in NASA headquarters, but NASA specified a dial-up teletype protocol for Bunker-Ramo. After 2 years, the Bunker-Ramo experiment proved unfruitful and NASA dropped it. So, the Bunker-Ramo project died, and we survived.

Then in 1967, NASA came out with an industry-wide RFP for the NASA/RECON System and specified 20 system requirements. Dialog included, at that time, 19 of those requirements. Consequently, we were able to bid quite reasonably on that contract. I remember going to the proposal briefing conference. All the big companies were there ... the Computer Sciences Corporation and others. We bid against probably six or eight companies, and then won the development contract for NASA/RECON. We wrote a Rights and Data clause in that contract, which said that we would hold the rights to use the software we developed. NASA started up with their database on the system that we installed.

Then, also in the 1967 time frame, we negotiated a contract with ESRO, the European Space Research Organization, to install a similar system in Europe with the NASA database, which we did, probably in 1968 or 1969. We called it Dialog, but they called it NASA/RECON. They had to do that for political reasons, to get the NASA database. We also installed a system at the Atomic Energy Commission, using the Nuclear Science Abstracts database. They were running the Dialog retrieval system in their facility, on that database.

ERIC and the Services Business

Summit: I read about the ERIC database, and thought, "This is a natural." They were doing some investigations on whether they could automate access to the ERIC database. So, I went back and talked with Harvey Marron and Lee Burchinal at the U.S. Office of Education. I said, "Look, you don't have to fool around with this yourselves; we have a system that will run your database." I wasn't aware, not consciously aware, of just where SDC stood on the ERIC database.

Cuadra: This was around the same time that we did our road show (1969) demonstrating the ERIC database.

Summit: I think we had it online at that time. We were going to do the same thing that we did with AEC and with ESRO and with NASA. I said, "We'll install the system on your computer and then you can run the ERIC database." And they said, "We don't want to mess around with computers. You put it on your computer, and then we'll pay you to operate it on your computer, to access it from our clearingshouses around the country." They preferred to have us run the computers. DIALOG did leased lines then. Our first installation was at Stanford, which was kind of easy. That must have been in 1968 or 1969. A fellow named Don Combs was in charge of the Stanford center.

And then ERIC said, "Well, we want to expand the access centers. We want a terminal headquarters in Washington and also up in Pennsylvania." ERIC was really a milestone for us because it moved us out of the systems development and installation contracting kind of business into the services businesses, and we saw how sweet that was. With a contracting business, you die a thousand deaths. Each time a contract term concludes, you have to go out and get reborn again. But with the services business,

WHAT'S WHAT: Names, Acronyms, and Abbreviations

AEC — Atomic Energy Commission. In operation from 1947 until 1975. Replaced by the Energy Research and Development Administration (ERDA). In 1977, ERDA was integrated with the Federal Energy Administration and other federal energy functions to create the U.S. Department of Energy.

AEC/RECON — REmote CONsole: Atomic Energy Commission's online bibliographic system, used to create the Nuclear Science Abstracts (NSA) database.

AIM TWX — *Abridged Index Medicus*; Teletype Writer eXchange. Online bibliographic system developed for the National Library of Medicine by SDC.

ASIS — American Society for Information Science. Founded in 1937 as the American Documentation Institute (ADI). Name changed to ASIS in 1968 and to the American Society for Information Science and Technology (ASIST) in 2000.

CIRC — Centralized Indexing and Reference Control. Online bibliographic searching system, developed by SDC in 1966 for the Federal Technology Division at Wright-Patterson Air Force Base.

COLEX — CIRC OnLine EXperiment. Second version of CIRC developed by SDC.

Dialog — 1972: At Lockheed, Roger Summit offered DIALOG as a commercial online service. 1981: Dialog Information Services, Inc. became a subsidiary of Lockheed Corporation. 1988: Dialog was acquired by Knight-Ridder, Inc. 1995: Dialog became Knight-Ridder Information, Inc. (KRII). 1997: M.A.I.D. plc acquired Knight-Ridder, merging to form the Dialog Corporation. 2000: The Thomson Corporation purchased the Information Services Division of the Dialog Corporation.

ERIC — The Educational Resources Information Center (ERIC). National information system providing access to education-related literature. Established in 1966, ERIC is supported by the U.S. Department of Education's Office of Educational Research and Improvement and is now administered by the National Library of Education (NLE).

Information Access Corporation (IAC) — Company founded by Dick Kollin in 1976. 1980: Ziff-Davis acquired the company. 1994: IAC and Predicasts consolidated under the IAC name. 1995: Thomson Corporation bought IAC. 1998: Gale Research, IAC, and Primary Source Media merged to form the Gale Group under the Thomson umbrella.

Lockheed — The Lockheed Corporation was formed in 1932. Lockheed Corporation and Martin Marietta Corporation merged in 1995 to form the Lockheed Martin Corporation. In 1968, NASA contracted with the Lockheed Missile and Space Company to manage large data files. The following year, Lockheed's Information Sciences Laboratory demonstrated an interactive retrieval service. See **Dialog**.

MEDLARS — Medical Literature Analysis and Retrieval System. Computerized bibliographic system, originally used in the National Library of Medicine (NLM) and named by NLM's Frank Rogers and Seymour Taine in 1960. MEDLARS was designed by General Electric, which completed the system in 1964. MEDLARS II was designed and developed by SDC, which completed the system in 1974.

MEDLINE — MEDLARS on LINE. Online system of indexed journal citations and abstracts developed for users outside the National Library of Medicine (NLM) in 1971. MEDLINE is the major component of NLM's PubMed database, now searchable via the Internet.

NASA — National Aeronautics and Space Administration. Established in 1958, from the earlier National Advisory Committee for Aeronautics (including three major research laboratories — Langley Aeronautical Laboratory, Ames Aeronautical Laboratory, and Lewis Flight Propulsion Laboratory — and two smaller test facilities).

NASA/RECON — REmote CONsole. NASA's "first multi-site" online bibliographic system, created in 1968.

NLM — National Library of Medicine. Organized under the U.S. Department of Health, National Institutes of Health (NIH). For more than 100 years, the Library has published the print *Index Medicus*, a guide to journal articles. See also **MEDLARS** and **MEDLINE**.

NSA — Nuclear Science Abstracts. Collection of international nuclear science and technology literature for the period 1948 through 1976, including scientific and technical reports of the U.S. Atomic Energy Commission (AEC) and the U.S. Energy Research and Development Administration (ERDA) and its contractors, other agencies, universities, and industrial and research organizations. NSA is the precursor of the Energy Science and Technology Database.

ORBIT — In 1969, the System Development Corporation (SDC) created the ELHILL retrieval program for the National Library of Medicine (NLM). ORBIT, a commercial offshoot of ELHILL, became publicly available in 1972. Robert Maxwell (Pergamon Press) bought ORBIT in 1987 and renamed it Pergamon Orbit Infoline. In 1989, with Maxwell's purchase of Bibliographic Retrieval Service (BRS), the entire group was renamed Maxwell Online. In 1994, Questel,

the French-based online host, bought Orbit and named the composite company Questel-Orbit.

Pandex — In 1971, Pandex was the first commercial, nongovernmental database made publicly available by an online search service (Dialog in 1971).

PL/1 — Programming Language 1. Third-generation programming language developed in the early 1960s as an alternative to assembler language (for low-level computer processing functions). PL/I was an antecedent of the C programming language, which basically replaced it as an all-purpose programming language.

PMA — Pharmaceutical Manufacturers Association. Former name of the Pharmaceutical Research and Manufacturers of America (PhRMA). Founded 1958.

SDC — System Development Corporation. Evolved out of the Systems Development Division of the RAND Corporation. The Division was spun off in 1957 and became the nonprofit company System Development Corporation. In 1968, SDC became a for-profit operation, acquired by Burroughs Corporation in 1980.

SDI — Selective Dissemination of Information. Automatic method to provide current awareness services. Brainchild of Hans Peter Luhn, who introduced this “business intelligence system” in 1958.

Teletype — An early data and record communications interface system. Developed by the Morkrum Company in 1906. 1929: Morkrum changed its name to the Teletype Corporation. 1930: Teletype was purchased by the Bell System and became a subsidiary of Western Electric. 1984: the divestiture of the Bell System resulted in the replacement of the Teletype name and logo with the AT&T name and logo.

TWX — Teletype Writer eXchange. Early data network, started by AT&T in 1931. The teletype switching service placed calls automatically to other teletype machines. The first computer time-sharing was conducted in the mid-1960s over the TWX network. AT&T sold TWX to Western Union in 1972.

Tymshare, Inc. — Company that created the commercial TYMNET computer network in 1971.

U.S. Office of Education — Created in 1868, operating under different titles and housed in various government agencies, including the U.S. Department of Health, Education, and Welfare (now the U.S. Department of Health and Human Services). In 1980, the current U.S. Department of Education was formed. ❖

once you get folks hooked on it, there's continued, recurring revenue.

Pandex and Pricing

Summit: We had three databases then...NASA, Nuclear Science Abstracts, and ERIC. And then I met Dick Kollin at that famous 1971 ASIS meeting; he had something called the Pandex database.

Kollin: Pandex was a general science database of 1,200 serials, very similar to SciSearch.

Summit: I remember Dick telling stories of using garment carts to wheel the big tape reels up and down the streets of midtown Manhattan. I forget why they had to be transported, but it gives you an idea of how humongous they were.

Is that where you two met? Or just where you two came up with online pricing? [Laughter]

Summit: It could have been both, because I knew of the Pandex database before that meeting.

Kollin: We were sitting on a set of bleachers...

Summit: ...a stairway...

Kollin: ...long into the night, talking about doing it by the drop or by the bucket.

Summit: That's right! I wish I could remember the details of that negotiation. I think Dick wanted to get paid by the item, and I wanted to get paid by elapsed time, because that was the way we billed our service. It was kind of a consignment thing: We'll take the database on and we'll pay you a percentage or so much per hour that we collect from our customers. There's no risk associated with that. With Lockheed, I had to be very risk-adverse, as opposed to going to them and saying, “I want \$50,000 to lease this database for a year,” which I never could have gotten. So that kind of set the stage for online pricing; we didn't charge for citations until years after that.

Kollin: I set it up by wall time.

Summit: Wall time. Clock time. So that was your idea, Dick?

Kollin: Yes.

Summit: Bad news. Okay, I can blame Dick now.

[Laughter]

So you adopted this pricing plan for the Pandex database when you put it onto Dialog?

Summit: Yes, and we kind of take the year of 1972 as the birth date of all of that; it was largely because Tymshare had set up a telecommunications network and we could get away from the leased lines. We could have a much broader service than with our leased line service, which was continuing by contract. With leased lines, we didn't charge by the hour; we just had a contract of so much per month.

The Teletype Network

Cuadra: There is another point to make about AIMTWX. In May 1970, NLM decided not to follow the model that

Roger and others were using of the dedicated leased lines and fancy terminals. They were thinking of providing information to libraries and teaching hospitals and health professions, who didn't have much money to buy information. NLM wanted to test the acceptance of low-cost, low-speed information delivery. The teletype became their way of testing the waters.

Summit: Yes. Teletype was a network ... way back when, over the railroad lines ... it was really the only network that was around. The point I was going to make — there was, again, risk-aversion. We had all these contracts, NASA and so on, and an ERIC contract that paid the bills. We were able to go into commercial business on an incremental basis because we had all our costs covered in our fixed contracts with these government agencies. So we thought, "Well, let's try it."

Cuadra: Does that mean you could use the computer they were paying for to generate income?

Summit: Yes.

Cuadra: That's what we couldn't do.

Summit: But they weren't paying for the computer; they had a contract that said, "Lockheed Dialog will load and maintain your database...."

Cuadra: They were subsidizing you, in effect. You had the computer and you were using it.

Summit: Well, no, they weren't subsidizing — that's a bad word. We had a contract with them, and we had a price on that contract. Yes, we paid our computer costs out of that price, but it wasn't that they were paying computer charges per se. It was a fixed price contract.

Cuadra: It didn't prevent you from using the very same box to do other things.

Summit: As was your case. We had a real advantage at the gate, price-wise and cost-wise, because this computer helped. This computer was "independent research" and it was still owned by Lockheed. So the revenue we were getting was just contract revenue coming into Lockheed.

It really was a different management philosophy.

Summit: Totally different. It was just circumstances. That was the way it happened to be set up. The key was that we got Lockheed to buy this computer on independent research for the Information Sciences Lab, and we were simply generating revenue from this Lockheed-owned computer.

The Corporate Culture

Now we're at the stage where there are two systems out there (Dialog and ORBIT) beginning to go public and hoping for revenue and more customers. You're still talking about big organizations that are involved and could afford the costs —

Cuadra: Elements of big organizations.

Summit: Very *small* elements of very *large* organizations. We were just kind of set aside. We were in a closet somewhere, and nobody paid much attention to us. We didn't have to make a profit, but if we ran some revenue in, they were happy. I knew that we had to get off independent research — that's why I wanted to go out and get these con-

tracts early on. Lockheed didn't know what information retrieval was. They were used to banging metal and things like that. I knew if I could get government contracts — they knew what government contracts were — that would rationalize the business.

Cuadra: SDC understood information retrieval in the sense of radar returns, plots of flights crossing the country, handing over data from one air defense sector to another — they didn't understand retrieval in terms of text. Documents, serials, publications.

It is very interesting that these systems that contained real information, not data — text and so on — came out of that environment. It seems in spite of them, rather than because of them.

Cuadra: Yes, and SDC Search Service wasn't the first real text-retrieval system. For at least 6 or 7 years before that, there were various researchers who were playing with things. One wrote a program called Proto-synthes that provided access to the Golden Book encyclopedia. Years later, the corporate secretary, in a fit of pique or in a fit of cleanup, threw out 50,000 cards, which were the only source code to this program. I still cringe.

Summit: We had some corporate support. There was an executive vice president, Herschel Brown, who read the report on the automation of the Library of Congress, which we refer to as the Red Book. He said, "Ah, automating the Library of Congress is the kind of task that a company like Lockheed could take on." So he backed us in the Information Sciences Lab, and it wasn't a total out-sell. We had support from him until he died. He was very important.

I won't speak for Carlos, but I think this is true for both — it isn't that Lockheed was interested in information retrieval or that System Development Corporation was interested in information retrieval; it was that Carlos Cuadra was interested in information retrieval and Roger Summit was interested in information retrieval. We each saw some future to it, and then we had to figure out how to encapsulate that business within these vast bureaucracies.

Next issue, the conversation among these online pioneers continues, addressing issues of competitors and colleagues, the database race, marketing and building the industry, and business vs. government. ♦

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