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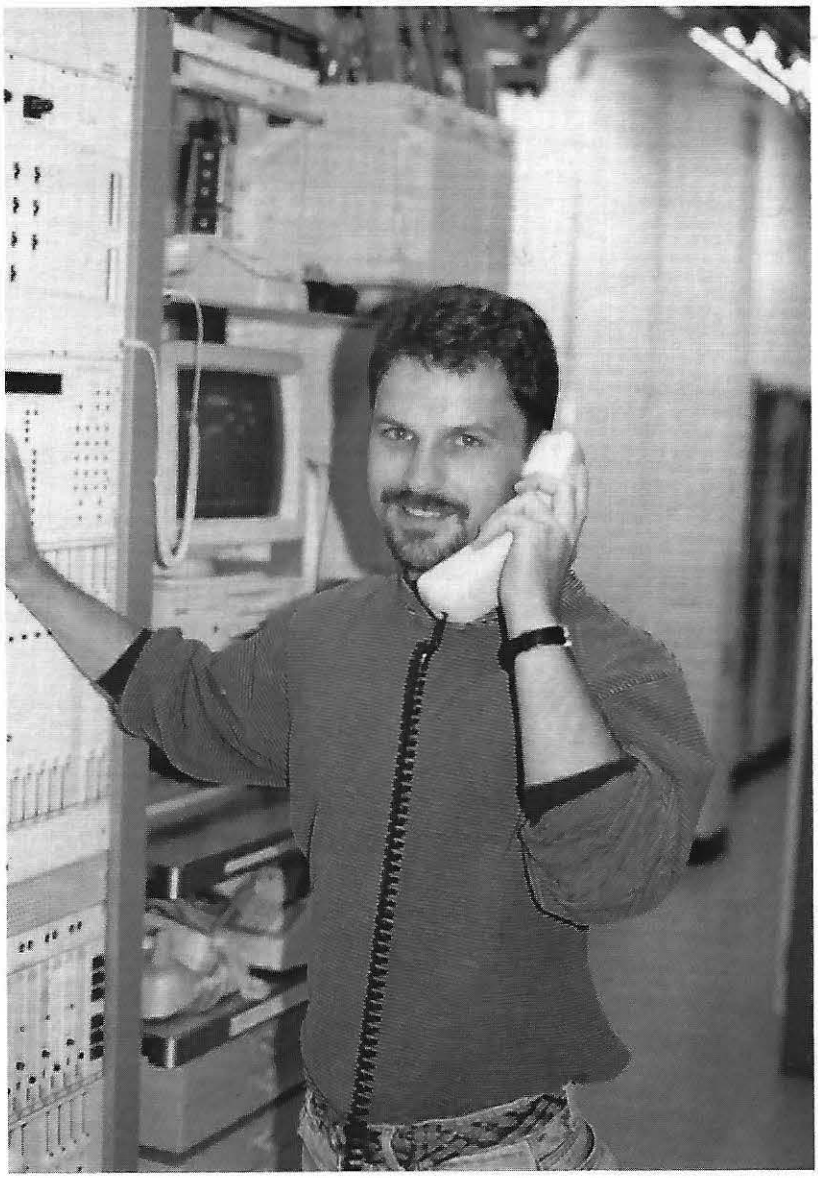
Alexander Graham Bell

private line

a journal of inquiry into the telephone system



CABLE STATION OPERATIONS

CANADIAN TELECOM, PART 2

DIGITAL TELEPHONY BILL UPDATE

MICROWAVE PROPAGATION BASICS

DEF CON III REVIEW

INDEX TO PRIVATE LINE, VOLUME 2

About the front cover: AT&T Communication Technician Mark Cavalli on the HAW4 order wire phone.


Alexander Graham Bell

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a journal of inquiry into the telephone system

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etext.archive.umich.edu
/pub/Zines/PrivateLine

privateline.com may be online when you read this. You can get the back issue files there and the magazine list by e-mail in uncompressed form. Turn to page 158 for a few more details.

Thanks to Stardust for the help.

Rambling Thoughts; private line On The Move

Greetings once again! This issue contains a greater variety of topics than in issues past and I'm excited by that. On the other hand, the articles are shorter, easier to digest and perhaps less useful. What would you prefer to see? *private line* may expand to 36 pages next year. This extra space would allow me to run both longer, in-depth pieces and to cover more subjects at the same time.

The whole family enjoyed Def Con

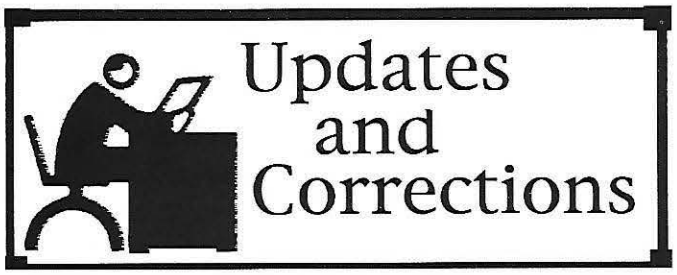
Little Sheeba has given me my marching orders. Out! Out! Out! I don't blame her. Good-bye, Carmichael. I am relocating to the Sacramento Delta as this edition goes to print. Expect stories on crawdads, catfish and the annual Rio Vista Bass Derby to follow. My phone and fax numbers will change but I'll keep my Carmichael post office box for a while.

This issue features a reprinted article on cable station operations. John Cavalli's warm description of life, work and community in a small coastal town puts a human face on the corporate personality that most associate with AT&T. There's also information in this issue on submarine cables. Cable stations, submarine cables and fiber optics all work together to now carry the majority of overseas data and voice traffic.

"Some Factors Affecting The Propagation of Microwaves Over Point to Point Radio Systems" is the best explanation of its topic that I have read. The article is over forty years old but propagation basics are well settled. Point to point is used by telcos, cellular carriers, long distance companies, local TV stations and many others. Distant cell sites, for example, are often linked to the mobile telephone switching office by point to point systems instead of by optic fiber cable. I intend to have something on radio, by the way, in every issue from now on. Why? The future *is* wireless, especially in the local loop. Your editor, in fact, no longer assumes a corporeal form. I exist, instead, as a burst of frequency shift keying in the 12 meter band. . .

I'm getting impatient with the time it's taking to get *private line* better known. Yes, I know that I would be totally overwhelmed if the magazine's circulation doubled or tripled tomorrow. I know it's best to have problems discovered and corrected at an earlier, slower time than have everything fall apart quickly from success borne details and chaos. At times, though, especially when someone hasn't subscribed for a few days, I am tempted to say "Bring on the Chaos! Bring on the phone calls and the overflowing mailbox and the fax machine running out of paper – I'll deal with it." At other times I want to hunker down, cut off newsstand copies and go to subscription only. Sigh. I'll tell you what happens. Best of luck,

Tom Farley



Muchos apologies to ***Nuts and Volts.*** I've been giving out a phone number for them with an old area code. Here's the correct number and current information on them:

Nuts & Volts Magazine
430 Princeland Court
Corona, CA 91719
(909) 371-8497
(909) 371-3052 FAX
1-800-783-4624 (Subscription orders)
E-mail to 74262.3664@compuserve.com.

12 times a year. $19 a year mailed third class in the United States. $50 a year first class to the U.S., Canada or Mexico. $100 for foreign subscriptions via air mail or $50 if mailed at the surface rate. A sample is free by bulk mail. Shawn Vander Ploeg of *Nuts and Volts* is working on getting the magazine better distributed. You should be able to find it at Tower Magazines now and chain stores like Barnes and Noble in the future.

Two good catalogs and one great one. Jensen has scrapped their small but stylish format and gone to a conventional 8.5 x 11 inch format. You should take a look: (800) 426-1194 or (602) 968-6231 or 7815 S. 46th Street, Phoenix, AZ 85044-5399. Why the change after so many years? I'm not sure but Stanley now owns Jensen Tools. They may want a bigger, better looking product to compete with Specialized Products Company which sells similar stuff. SPC's new catalog is absolutely gorgeous. 338 pages of four color photographs compared to Jensen's 240. (800) 866-5353 or (214) 550-1923 or 3131 Premier Drive, Irving, TX 75063. Yes, both catalogs feature hideously expensive tools and accessories. But they're good places to look at some exotic equipment like, in the case of the SPC catalog, optical loss test sets, hot melt termination kits, color LCD portable digital oscilloscopes, and telephone line simulators with Caller ID. And they are free. The great catalog, though, is the one from PHONECO, Inc.

PHONECO's catalog is as rough looking as the two other catalogs are polished. And therein lies the charm. It does have a glossy cover but its 28 pages of old phones, parts and memorabilia are laid out on yellow newsprint, with fuzzy photographs, old line drawings and photocopied pictures as illustrations. It is a very honest looking publication and I would rather have one catalog like this than ten Jensen like productions. What's in it? Bakelite and steel phones of the 30's and 40's. Magneto phones. Automatic Electric 3 slot coin phones with DTMF keypads. GTE Communication System Handbooks and much, much, more. I had as much fun looking through this as when I got my first Edmund Scientific catalog as a teenager. They'll send you a free catalog by bulk mail if you call or write: PHONECO, Inc., 207 East Mill Road, P.O. Box 70, Galesville, WI 54630. (608) 582-4124.

I wrote in the March/April issue (*private line* number 5) that you couldn't beat the anonymity a **prepaid calling card** provided when you called from a payphone. That's still true. What's happening now, however, is that more and more people use these cards from their homes or a friend's home to place long distance calls. That may be a problem. Marketing types now collect phone numbers delivered to a debit card switch. They then run lookup programs using reverse directories to get a street address. Presto! You are on another mailing list or subject to a telemarketer's telephone call if they can't get your address. Or both things may happen.

Your telephone number gets sent to a switch via **ANI** each time you place an 800 call, provided, of course, that the switch operator pays the telephone company to send them. Most do. It's up to the switch provider to collect those numbers or discard them once the call is completed. The trend is to collect them, in fact, a company may want you to call their 800 number just to get *your* number. MCI recently ran a big contest on FOX. "Use our 800 number to complete your call. You'll be automatically entered in our contest. The winner gets animated with the Simpsons!" Yeah, whatever. Everyone who used 1-800-COLLECT for several weeks in August and September unknowingly gave MCI their home phone number. And their street address if they weren't unlisted. MCI gets a huge new list of names to sell. Or they can pester those people themselves. How do you avoid this? Dark Tangent places *all* 800 calls from his place through an operator. He says that they can't charge extra for operator handling because the call is toll free. But certain phone companies pass along your ANI, even through an operator. You may need to call 1-800-MY-ANI-IS to see if your number is read back. The chief drawback to avoiding ANI pass through is that many call centers and order desks won't accept a call without a valid ANI. Calling cards are still great but I think they're best from someone else's phone.

Speaking of phone scams, can you believe **the latest FCC decision?** They just implemented the first rule of many to control telemarketers. The FCC stated on August 16, 1995 that these people commit 40 billion worth dollars of fraud every year. That's a full 10% of that industry's billings. "Some telemarketers are a lot like cockroaches," Wisconsin Attorney General James Doyle said. "When you chase them out of one location, they run somewhere else." I'll repeat something from the last issue: the whole picture of telephone fraud needs looking at, not just a focus on the lone hacker.

The FCC concluded last year that conventional toll fraud costs the telecommunications industry between 1 billion and 5 billion dollars. That includes PBX fraud, cell fraud and so on. But that doesn't include

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the huge fraud committed by long distance companies when they slam customers. That's in yet another category. Telemarketing fraud gets put into yet category. A hacker by definition does not make money from his inquiries. Mitnick didn't steal a dime. A hacker does not set out to bilk an elderly person out of their life savings. He does not bother 100 people in order to sell 3 of them a product. But many telemarketers do. Oh yes, I know. Not all telemarketers are alike. One can't judge them all by the actions of a few. Okay. Then don't judge hackers, either, by the actions of a few.

The telemarketing business dumps billions of dollars into telecom each year. They buy equipment, lease lines, and employ people. That gives them the right, I suppose, to bother you while you are in the shower, eating dinner or waiting for a really important call. It's legal. And it's rife with thieves. I suggest that law enforcement and industry prioritize on jailing those who are do the most damage through the phone system – the corrupt telemarketers and long distance companies – not some kid with a redbox or a couple with a cloned phone or someone poking around the net in some place he shouldn't be. Do you really think the **Secret Service** should create bulletin boards like Celco51 in New Jersey in order to run a sting operation? Why doesn't the S.S. just turn in their badges and get some SPA/CTIA identity cards? At least we'd know their true intentions. Can you imagine the reaction if hackers caused 40 billion dollars in damage? We'd all be in a debtors prison, a penal colony or a torture chamber. Even *private line's* technical editor was targeted in the Celco51 operation.

Damien first learned of the sting from the Def Con mailing list. (This same information is in the September 12, 1995 edition of the *Wall Street Journal.*) Six people from across the country were arrested for supposedly stealing hundreds of valid ESN/MIN pairs from the databases of several cellular carriers. Damien and I talked on September 15th about how life might get interesting for him, his board *Hacking Online*, and its parent company, Phoenix Rising Communications. I asked him what he had heard on the net. He said, "Two copies of the article were posted to the Def Con mailing list; that's how I heard about in the paper. I've been sending e-mail to the guy who spent nine months and over 16 e-mail messages trying to get me on that bulletin board. He must have been an informant. I went on once, traded accounts with him. He leached a bunch of accounts from my system, I leached a bunch of files from their system, buffered some of their message bases to text files and never looked at them. Till now. It's kind of funny. I feel betrayed. Not that I did anything illegal. It's kind of creepy."

Creepy indeed. The S.S. sets up a board for hackers, follows a few messages that seem to involve stolen property and then steers those involved toward an arrest by posing as people interested in buying the goods. It's unknown how many honest hackers and legal sysops like Damien that they aggressively solicited to get online with their service. They even offered an 800 number for a long time, an expensive and unusual practice for a local board. This must have encouraged hundreds or perhaps thousands of people to try out the board when they wouldn't have ordinarily. And, of course, the Feds were sitting on the other end of the line, collecting telephone numbers and running down street addresses. Nine months of this nonsense. Maybe they could have helped catch the Unabomber with that much time and money and investigative skills.

Speaking of nonsensical, have you seen Airtouch Cellular's new mascot? It's at the lower left. They call it the **Airtouch Fraud Cop** and it's on every one of their calling plan pamphlets. I suggest they drop that strange symbol and replace it with one of my two suggestions at the bottom.

Canadian Update. Want the good news or the bad news? First, the good news. NorthwesTel has put up an excellent web page with terrific information. I wish you all could see it. The home page features a cartoon of an igloo with a satellite dish on it. There's a time line of communications in the North that's simply great. Here are a few examples from it:

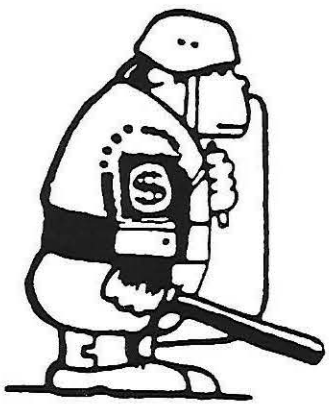
1901- The telegraph connection between Yukon and southern Canada is completed. Whitehorse gets Canada's first successful automatic telephone exchange.

1943- The American Army Signal Corps completes an open-wire communications line from Edmonton, Alberta to Fairbanks, Alaska.

1969 - On June 13, fire destroys a temporary telephone exchange at Faro, Yukon.

1971- a tropospheric scatterwave system links Whitehorse and Inuvik; Inuvik becomes the communications hub for oil and gas exploration activity in the Beaufort Sea."

please see page 167→



LETTERS, E-MAIL, FAXES . . .

Dear Tom,

Thanks for your letter and magazines. You're doing a fine job, but you sure picked a field where there are very few potential advertisers, so it's obviously a labor of love.

The telephone part doesn't interest me all that much, but video over the Internet also suggests ways can be developed for sending it over amateur radio, where we have similar bandwidth problems. Most non-phone company people who are interested in phone technology seem to be hackers and on the shady side of the law. But Steve Jobs got started selling blue boxes, so?

My interest would be in what phone answering machines are available and what they can do. What kind do I need to work with the switch at my office? How about the new 220 MHz phone service that's going in to replace cellular? What cellular phones are best? Where can I get the best price? How can I find out the cheapest way to access the Internet? How about these phone companies running pay phones where they are sticking the customers? What's my best way to deal with hotel phone systems when I want to access the Internet or maybe just contact my office? What will we run into in foreign countries when we want to access the Internet or connect to a home BBS? Where can we get good BBS software? Etc.

Several years ago I started a magazine called *Tele*. The aim was to provide business people with information on communications products and systems. There is still no publication covering this field. It was to include such communications needs as business BBS systems, paging systems, the many telephone switches, answering machines, faxes, security systems, cellular phones, other radio systems such as business radio, CB, cellular, direct satellite systems, and so on. There's almost endless material. Now it would include a page on the Internet.

The readers loved the magazine. I had no problem finding advertisers. What I didn't have was a good circulation department to build the circulation, so I iced the project after a few issues, hoping to build a better support staff and get it going again. I tried a half dozen circulation people, but never found anyone who would follow instructions, so I finally gave up. Also, this was mainly a commercial project, so I really didn't care enough to make it go. I've a bunch of ideas for commercial magazines that would do well, but I tend to be drawn to projects that are aimed at helping new technologies develop.

Now, are you (and your readers) out to beat the phone company? Have you polled your paid readers to find out what they want from you? What they like best? What least? And ditto your newsstand readers, as a separate group? Have you tried to find out why early subscribers didn't renew? Maybe called them? It may be that you need more focus. Best regards.

Wayne Green

Editor, 73 Amateur Radio Today
Peterborough, New Hampshire

Thanks for all the great suggestions. Anyone like to comment? I'll leave the internet connectivity articles to Boardwatch. Teleconnect *covers business telecom but it's all for medium to large firms. I might be able to cover business systems for small outfits, say, one to ten people in size. And I am polling my readers as their subscriptions come up for renewal – I consider their comments vital. By the way,* 73 Amateur Radio *is a great magazine. They recently celebrated their 35th anniversary. Subscription information is at 1 (800) 677-8838 or 1 (609) 461-8432*

Dear private line,

Tom, thanks for responding to my subscription request so promptly! I got the package in my post office box on Saturday. (I found issue #7 at a great little book store here in Eugene, Oregon, the same place I found my first issue of 2600. :) Some people would think I'm crazy to pay $4.50 for a 28-page black & white magazine but quality telco information is hard to come by these days, and I'm willing to pay the price. I appreciate your offer to explain any unidentified telephonic objects I may have (which are numerous, indeed), and I'm sure I'll take advantage of it. In fact, I think I might have some pictures on hand to send to you. I'll see what I can find, and get an envelope. If I have doubles of any of them, I'll indicate that, and you're welcome to keep any of those for your magazine, or whatever else.

I read OSP Part II right after I sent that letter to you. Indeed, shorter than part I, but it still had some good information. I believe I've found a CEV in my area. I've never seen any telco trucks near it, but my sister said she saw some US West trucks there, and there were some workers climbing down some sort of ladder-type thing that came up out of the panel on the ground. I've walked by it many times, and wondered what it was. It wasn't until I talked to my sister about it that I realized it was telco-related. I used to think it had something to do with a gas pipeline. Anyway, it has a metal door on the sidewalk that's about 4 feet square, and two vent hoods that are about 6 inches wide and maybe 4 inches high – they sorta look like large, mutated mushrooms. You can hear a fan or something down below, and if you put your hand under the vent at the right, you can feel air blowing out. There's a single, large padlock on the door, and it doesn't look all that well weatherized (no gaskets or sealant around the edge of the door. Anyhow, I'll get a picture of that sometime and send it to you –maybe you can figure it out. If I had a fiber-optic camera, I could fish it down one of the vents and see what was down there, but I don't have one. :(Oh, by the way, I noticed at the bottom of your letter, it said "privateline.com is here!" Is it true?

Brian Cochrane brideb@efn.org

Sounds like a controlled environmental vault to me. They don't have to be too weatherproof since exhaust fans are constantly running. The computer that serves as the e-mail responder for privateline.com has been on and off line at different times. Damien and I are working on the problem. And we are trying

please see page 172→

Def Con III Review and Road Trip Log


Def Con III

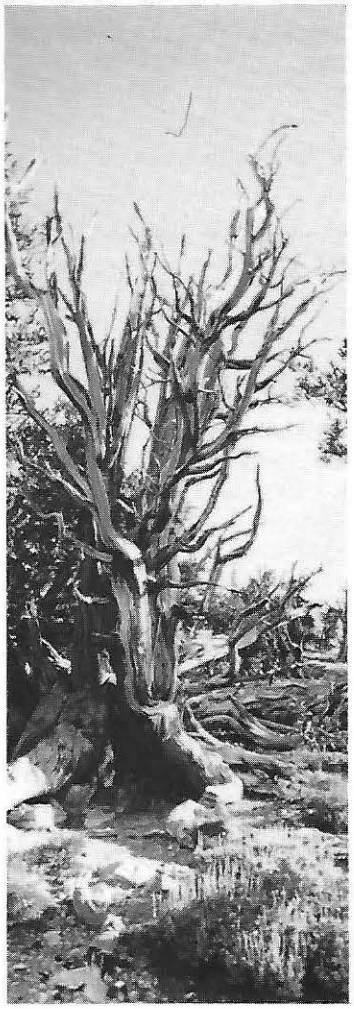
Welcome to DEF CON III

3rd ANNUAL SPOT THE FED CONTEST

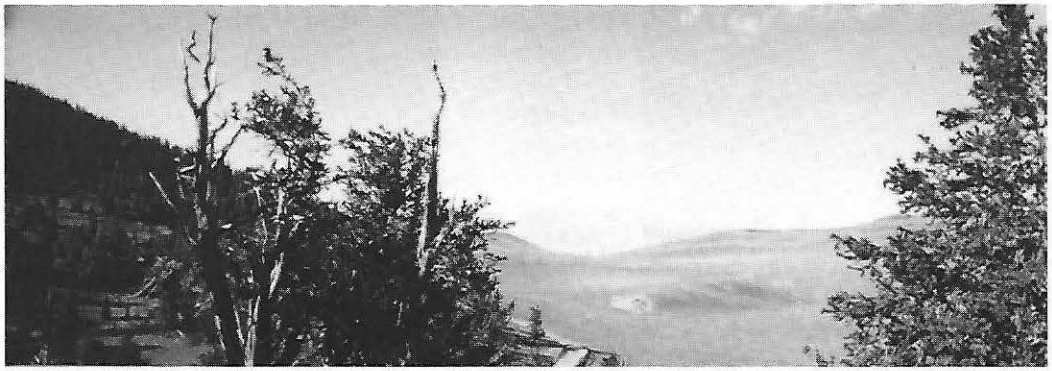
Spot the fed, win the shirt

Def Con III was held on August 4, 5, and 6 at the Tropicana Hotel in Las Vegas, Nevada. This meeting of the computer underground drew over 400 people from all over the world. We talked, we drank, we listened. It felt good to be among kindred souls. But Def Con, to me, is not just an isolated event held on a weekend. It is also something to look forward to and something to have fun traveling to. I thought Def Con II was great. I had just started the magazine when I went to it. I lingered in the background at the Sahara and checked out the scene. The trip was really productive, editorially speaking, because I met Damien Thorn. I wrote a long, positive article on Def Con in *private line* number 3 and I encouraged people many times after that to go the next year. I looked forward, therefore, all year to another fun event and a chance to meet some readers face to face. In addition, I didn't take any time off in 1995. Def Con III promised a chance to get out of town and do something different.

I left Carmichael on the 2d. I rushed to Def Con last year and I did not want to do so again. My goal this time was to see the Bristlecone pine forest along the way. They're a scattered grove of ancient trees (the oldest in the world) in the isolated White Mountains, just above Bishop. I used the same route the first day as I did the year before: I crossed the Sierra on Highway 88 and then drove south on Highway 395 to Big Pine, my overnight destination. The weather was perfect in the High Sierra and the lakes were full and the meadows still green from a very wet winter the season before. I arrived at about 4:00 in the small town of Big Pine. It serves as a gateway to Nevada over Highway 168, the Bristlecone Pine Grove, and to northern Death Valley. I checked into the Big Pine Motel; the expanse of the hotel's lawn, complete with white gazebo and a family of concrete deer looked very appealing. After settling in I decided to drink beer at Rossi's Bar until the Italian restaurant next door opened at 5:30. Dinner took about two hours since I ate everything on the menu as well as dessert.



I fueled up my borrowed Thunderbird with premium the next morning and headed into the mountains on Highway 168. 26 miles of rally like roads after the Bristlecone turnoff brought me to the visitor's center at Schulman Grove at 10,100 feet. Precipitously perched picturesque pines populated profusely. (Sorry about that.) It turned out that the oldest trees, such as Pine Alpha and Methuselah, 4,000 years old and 4,723 respectively, required walks of one to four miles to see. I didn't have the time for that. I walked around, instead, for about half an hour on some short trails, getting the feel of the area and taking pictures. It is a peaceful moonscape with gnarled trees set here and there among the talus. Any Bristlecone of even a few feet is at least several hundred years old. Dead ones are appealing, too, as you can tell by the photo at the right. Or as the pamphlet says, "When all life ceases, the snags stand as elegant ghosts for a thousand years or more. They continue to be polished by wind driven ice and sand. The dense wood is slowly eroding away rather than decaying." The bottom photo shows the Sierra as seen from the White Mountains. ***please see page 174→***



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AT&T
Point Arena
Undersea Cable Terminal Station

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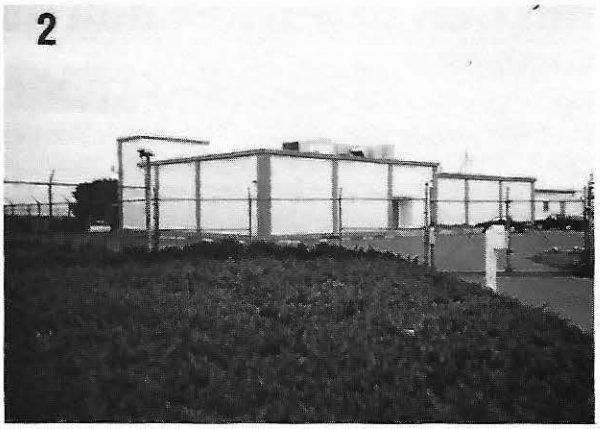

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SOUND SQUARE
country market
& hardware

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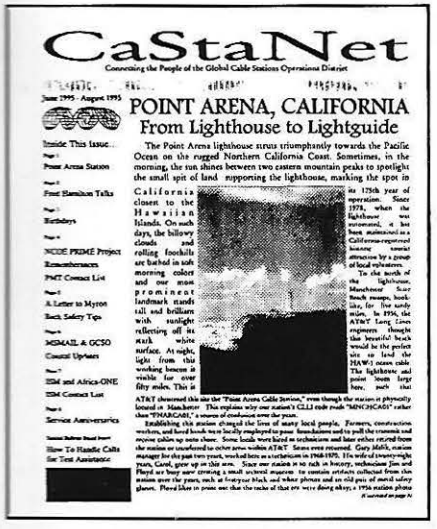
PIRATE'S
COVE
DRIVE IN
OPEN


CaStaNet

Connecting the People of the Global Cable Stations Operations District

June 1995 - August 1995

POINT ARENA, CALIFORNIA
From Lighthouse to Lightguide

Inside This Issue...

Point Arena Station

Fred Hamilton Talks

Birthdays

NCDE PRIME Project

Remembrances

PMT Contact List

A Letter to Myron

Back Safety Tips

MSMAIL & GCSO

Coastal Upstars

ISM and Africa-ONE

ISM Contact List

Service Anniversaries

How To Handle Calls for Test Assistance

The Point Arena lighthouse struts triumphantly towards the Pacific Ocean on the rugged Northern California Coast. Sometimes, in the morning, the sun shines between two eastern mountain peaks to spotlight the small spit of land supporting the lighthouse, marking the spot in California closest to the Hawaiian Islands. On such days, the billowy clouds and rolling foothills are bathed in soft morning colors and our most prominent landmark stands tall and brilliant with sunlight reflecting off its stark white surface. At night, light from this working beacon is visible for over fifty miles. This is its 125th year of operation. Since 1978, when the lighthouse was automated, it has been maintained as a California-registered historic tourist attraction by a group of local volunteers.

To the north of the lighthouse, Manchester State Beach sweeps, hook like, for five sandy miles. In 1956, the AT&T Long Lines engineers thought this beautiful beach would be the perfect site to land the HAW-1 ocean cable. The lighthouse and point loom large here, such that AT&T christened this site the "Point Arena Cable Station," even though the station is physically located in Manchester. This explains why our station's CLLI code reads "MNCHCAOI" rather than "PNARCA01," a source of confusion over the years.

Establishing this station changed the lives of many local people. Farmers, construction workers, and hired hands were locally employed to pour foundations and to pull the transmit and receive cables up onto shore. Some locals were hired as technicians and later either retired from the station or transferred to other areas within AT&T. Some even returned. Gary Malik, station manager for the past two years, worked here as a technician in 1968-1970. His wife of twenty-eight years, Carol, grew up in this area. Since our station is so rich in history, technicians Jim and Floyd are busy now creating a small archival museum to contain artifacts collected from this station over the years, such as first-year black and white photos and an old pair of metal safety glasses. Floyd likes to point out that the techs of that era were doing okay; a 1956 station photo shows many 1957 automobiles.

Surrounding the station are the grassy bluffs and park lands of Manchester State Beach, resplendent now with wildflowers. Long rows of driftwood are casually strewn about by the ever changing tides on this stretch of beach, home to some of the best surf fishing on the West Coast. At one time this beach was proposed as a site for a nuclear power plant, but our proximity to the San Andreas earthquake fault nixed that idea. The San Andreas meets the ocean one quarter mile north of the station, at Alder Creek. The proposed nuclear power plant was then built down the coast at Diablo Canyon. Ironically, that location was later determined also to be near an earthquake fault.

The towns of Point Arena and Manchester, each with a population of just over 400 townsfolk, are six miles apart. We receive our U.S. mail at our P.O. Box in Manchester and we purchase many of our supplies in town at its only market, the S & B Country Market and Hardware store. To get gasoline for the company truck, we travel into Pt. Arena (no gas station in Manchester). This newsletter is published at Arena Press in Pt. Arena.

In 1988, the advent of fiber optic ocean cables rejuvenated our station with the installation of AT&T's second SL280 system, the HAW4 cable. The land radio towers were dismantled (forfeiting bandwidth), their associated gray equipment were removed, and the handful of existing analog circuits were regroomed to provide ample room for the new blue and white

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POINT ARENA, CALIFORNIA
From Lighthouse to Lightguide
by John Cavalli, Paula Buckner & Dan Sitts

This article first appeared in the June-August 1995 edition of the CasStaNet, an excellent, engaging newsletter produced by technicians John Cavalli, Paula Buckner and Dan Sitts at the Point Arena Cable Station. It is not for public release. The photographs and sidebar pieces are mine; the text of the article belongs to the authors.

Cavalli began the CaStaNet on his own two years ago in order to "Connect The People of the Global Cable Stations Operations District." It reports on AT&T cable station activities worldwide as well as covering the work of other groups which support or relate to their operation. I wish this publication and other internal AT&T newsletters were made available to the public – I think they present a better corporate image than press releases or advertisements.

About the Opposite Page

1 & 2. Outside the gate. The facility itself, decked out in white with blue trim. Very AT&T.
3. The Point Arena Lighthouse at the very edge of the point itself.
4. The wild Manchester beach, facing nearly square to the north.
5. Highway 1, dropping and curving as it does throughout Mendocino or *Mendo* county. The terrain changes from open country to dense brush.
6. The only market in Manchester. I got questioned severely by the owner for taking this picture, even though I was across the street.
7 & 8. Pirate's Cove.

equipment bays to carry thousands of digital circuits through to Sacramento. Management was realigned under IOD and three additional technicians were hired to accommodate 24-hour/7-day coverage. The kitchen was remodeled, a Merlin phone system was installed, the office flooring was replaced, and we received our first computer (an AT&T 6300).

In 1992, the TPC4 cable system tripled the calling capacity of the station. Two Alcatel 560 systems were added, along with various mux and DACS equipment, increasing the work load and responsibilities of the station personnel. With its 56 RC48DF shelves and associated NCOE, the TPC4 system carries 36,456 channel-level circuits.

Abalone (a large, indigenous mollusk, highly prized for its meat and shell) season is now in full swing and eager divers abound at Manchester State Beach campground and at our other next door neighbor, the KOA Kampground. Our tech, Floyd, lives in his deluxe RV at the KOA during his work week, and commutes home to Fremont, California on his days off.

Since Ray Spor departed recently to work in Bandon, Oregon, taking his 21 years of Pt. Arena Cable Station experience with him, our techs Dan and Jim have now assumed "old man" status, each with eight years service here. Pt. Arena personnel have varied AT&T backgrounds, including ATTIS, WECO, TIRKS engineering, marine-land radio, building maintenance, microwave tower engineering and construction, private line, switch, and facilities.

The staff has an active community spirit. Dan and Jim are volunteer firemen in their little communities of Albion and 6 Sea Ranch, respectively. Kyle coaches football, basketball, and track at Point Arena High School. John is attending College of the Redwoods in Fort Bragg, California, and will graduate Phi Theta Kappa in December. Floyd regularly visits the Pirate's Cove coffee shop where much of the local politics are discussed and debated. Paula and George, being new to the station, are not so firmly planted yet, but are kept busy with OJT and with various AT&T training trips. Gary, has been busy fund-raising for Point Arena High School's Sober Grad Night with activities such as a dunk tank and a community abalone feed.

Today, in 1995, we still enjoy the same farmlands and surroundings that were here in 1956, when the office was noisy with the analog and radio technology of the day. Now, via lightguide, we quietly transmit thousands of voice and data calls under the shadow of the landmark Pt. Arena lighthouse.

About the Opposite Page

1. Part of the AT&T SL 280 system for the Haw 4 cable. The first bay houses the multiplexer, the second the line terminating and muldex monitor and the third contains the demultiplexor. The fourth bay contains the maintenance panel.

2. Close-up of the maintenance panel. This equipment can run a variety of self diagnostic routines on the system automatically. It provides reports in plain English on the display above the keypad.

3. More equipment! Channel banks for the TPC4 cable. The 56 RC48DF shelves are in the background.

4. Close-up of the cards in the shelf of an RC48DF. Each one is bar-coded.

5. Order wire phones for the TPC4 cable. Canada and Japan lie on the other end of those phones.

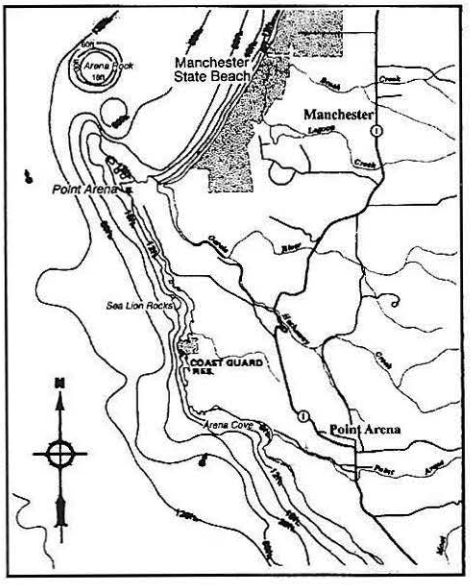
6. Heavy duty round cell battery. AT&T favors these for their equipment's power supply.

Point Arena, a long level plateau about 50 miles northwest of Fort Ross is the first prominent point on the California coast north of Point Reyes. Navigating north from Fort Ross, boaters will first pass the mouth of the Gualala River, which intersects the coast 15 miles southeast of Point Arena, Mendocino County, famous for its scenery, art colonies, and exotic lifestyles, begins here at Gualala River.

In the summer, small pleasure and fishing boats can anchor at Bourns Landing, a mile and a half northwest of the Gualala River, or at Havens Anchorage, 12 miles southeast of Point Arena.

The closest anchorage to Point Arena is Arena Cove, 2.5 miles to the south east. This slight indentation, with a high yellow cliff on its south head, affords shelter to small vessels in northwesterly weather. A wharf, a three ton hoist, plus gas, fuel, water and groceries are available at the cove. The town of Point Arena is a mile to the east. Point Arena Light, at the western end of Point Arena, is in a white tower with a black gallery 155 feet above the water. Arena Rock is 1.4 miles north of the lighthouse. Although it is covered by 13 feet of water, navigators can usually mark the presence of Arena Rock by the breakers that form over it except in very smooth weather. Stay well outside of Arena Rock in thick weather, since shoaling can be abrupt in those conditions.

NYNEX Boaters Directory, Northern California Edition, 1988

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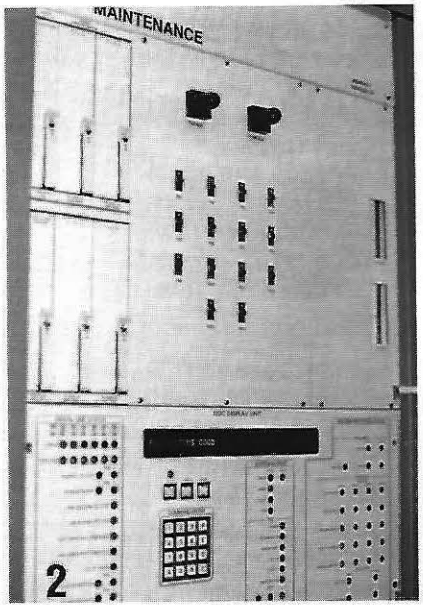

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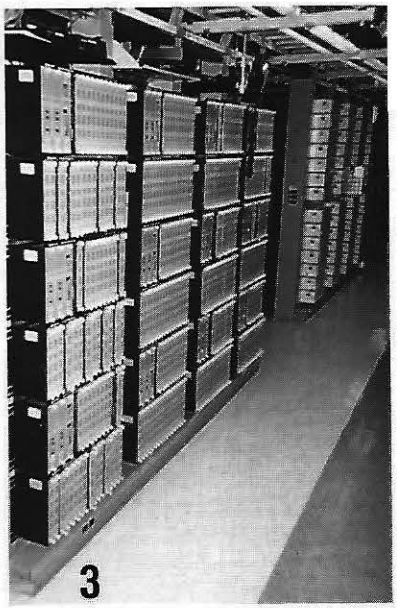
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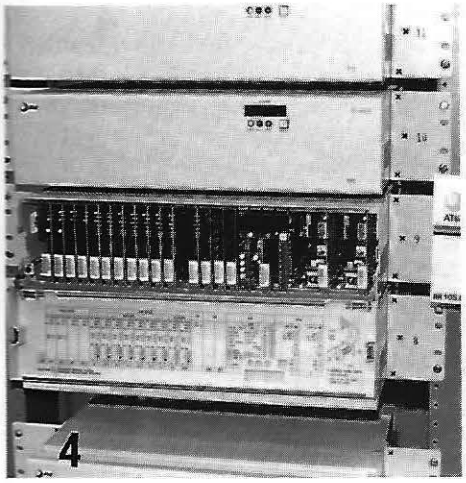
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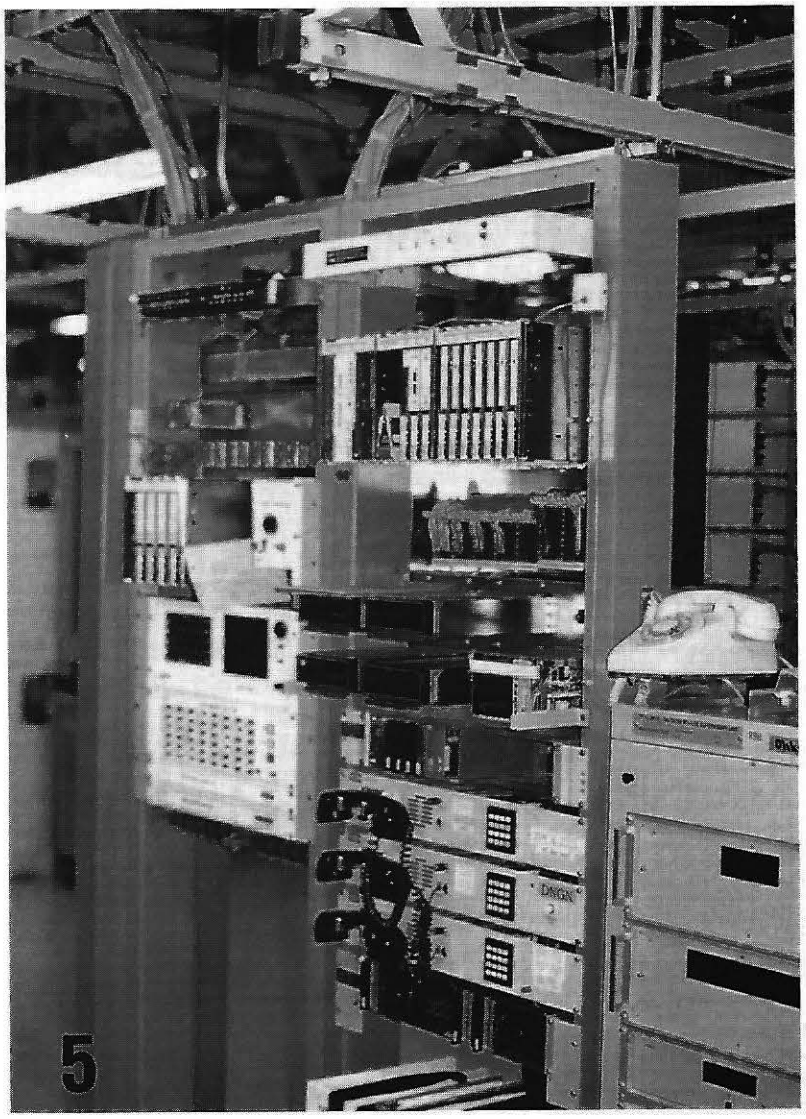
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Submarine System International (SSI)

- Cable Administration and Interconnect
- Cable Systems Installation and Test
- Global Cable Station Operations (GCSO)
- Installation and Maintenance Technical Support
- International Maintenance Agreements
- International Maintenance Financials
- Marine Operations
- Systems Maintenance Engineering
- Transoceanic Cable Ship Company

AT&T's worldwide undersea cable company is an enormous organization. Cable stations are just one part. In addition to the above divisions or *districts*, SSI also has a sales and marketing force, called Submarine Systems Supply. SSI installs and maintain systems, in whole or in part, for themselves or for others. For example, AT&T and KDD are building the FLAG project (Fiber-optic Link Around the Globe) but they will not be co-owners of the system, nor will they maintain the cable or the network. HAW4, on the other hand, the cable that runs from Hawaii to Manchester, was built by AT&T and is maintained by them. In this case, MCI and Sprint are co-owners.

AT&T Cable Station Locations

Bandon, Oregon
Battery Pratt, Panama
Green Hill, Rhode Island
Jamaica
Keawaula, Hawaii
Makakaha, Hawaii
Manchester, California
Manahawkin, New Jersey
Puerto Rico
San Luis Obispo, California
Shirley, Long Island, New York
Saint Thomas, U.S. Virgin Islands
Tanguisson, Guam
Tuckerton, New Jersey
Tumon Bay, Guam
Vero Beach, Florida
West Palm Beach, Florida

An Interview With Stephen J. Novotny Jr., District Manager, Global Cable Stations Operations

Thanks to Elizabeth Park of AT&T for arranging this interview. Stephen J. Novotny Jr. graciously allowed me to conduct this telephone interview with him, despite the fact that he and his people were directing communication relief efforts at the time for St. Thomas and the Virgin Islands after Hurricane Marilyn.

Could you tell me about your current job and background?

I'm the District Manager for Global Cable Stations Operations. [GCSO] I'm in charge of all of the cable stations that AT&T is responsible for. I've got 45 years with AT&T. I came up through Long Lines and I actually started as a janitor. I've held just about every position with AT&T.

How many stations does AT&T operate worldwide?

We have 17 stations and we are trying to build the 18th in St. Croix and, of course, with the hurricane, I'm not sure what we're going to do [in the near term]. The newest station is Bandon, Oregon and that goes on line next year. That's built right now and we have some equipment in it already. That station is built for TCP-5, the Trans-Pacific 5, the new cable.

What exactly is a cable station?

A cable station is the landing point for undersea cable that provides the link for those owners of the cable to whatever they want to hook it to, i.e., the domestic network for AT&T, MCI's network, Sprint's network, in whatever their agreement calls for. It hooks that cable to the domestic link or a link to somewhere else. It usually handles domestic links or long distance traffic for them coming from overseas.

Are calls switched at the station or routed elsewhere?

Calls are routed to the nearest toll center, the nearest POP, depends on what the situation is. MCI will, for example, build a building right next to the cable station. Part of the agreement is that another company can't be in the AT&T building, generally, even if they are a part owner of the cable. They'll build a small interface right on the premises and we then provide an interconnect to their cable.

How many calls does a cable station pass every minute?

We don't look at that but I'd say 35,000 or more per minute. What we look at are the facilities. The job of a cable station is to keep the facility working. So they really don't know what traffic is going over that unless they provide a private circuit. We're the facilities' provider so we really don't have any idea of the numbers of calls that go over it.

AT&T seems to use a lot of Alcatel equipment. Any reason?

Let me tell you how equipment gets established for a cable system. When there's a decision to put a cable in and the owners have agreed to put that cable in, part of that agreement, the Cable and Maintenance Agreement, determines which equipment will be used. AT&T doesn't determine it. It's the owners of the cable system who determine whether we use Toshiba, Alcatel, KDD Nippon equipment, whatever it may be. It's usually the best solution from the viewpoint of the owners for what they're trying to accomplish with the system they're putting in.

Like the SL 2000 systems, – we're using the Alcatel DACS for the interface because the owners felt it was the best thing to go with. They were the ones that could deliver a DACS that we needed to meet the requirements of that system, because that is an SL 2000 system. Toshiba was awarded the contract for the restoral equipment, the Network Provisioning Equipment, because it was felt, based on →

Mid 1970's Bell System ad showing the relative difference in call carrying capacity between twisted pair cable and fiber. Metallic undersea cables use coax and not twisted pair, however, the huge difference between copper and glass remains. A single fiber optic thread, no larger than 20 pound fishing line, can carry tens of thousands of calls simultaneously.

KDD's involvement in TCP5 and a couple of the other cables, that they would be the best provider of that equipment. So that's the way equipment gets put in – anything from NEC to Alcatel to KDD, it depends on the system and the requirements of that system.

The article I'm reprinting contains many acronyms peculiar to cable stations. What, for example, is the ITMC?

That's our international test center. We have one in Conyers, Georgia and one in Denver. Those are the centers that actually do the testing and the restoral work should there be a break in the cable.

What is the ITSC?

That's the service center that does the provisioning.

What is an RC48DF shelf? Line cards?

That's basically what they are. They're the interface equipment required by the FCC for us to do a connection between our circuits and others.

Is a channel level circuit the same as a voice grade circuit?

No. Channel gets back to the facility. As in channel banks. It's better than voice grade because we transmit all sorts of data over it. It's a higher grade. That's the actual facility and what it's geared to.

I know you're working on some problems in the Caribbean right now. Are most cables in that area glass or coax?

You've got a combination. The newest cables, the America's and the Columbus cables [Puerto Rico to Brazil and Puerto Rico to Europe, respectively] are glass and most of the older cables, the Tina Carib and some of the others are coax.

What kind of hurricane problems do you have in Saint Thomas?

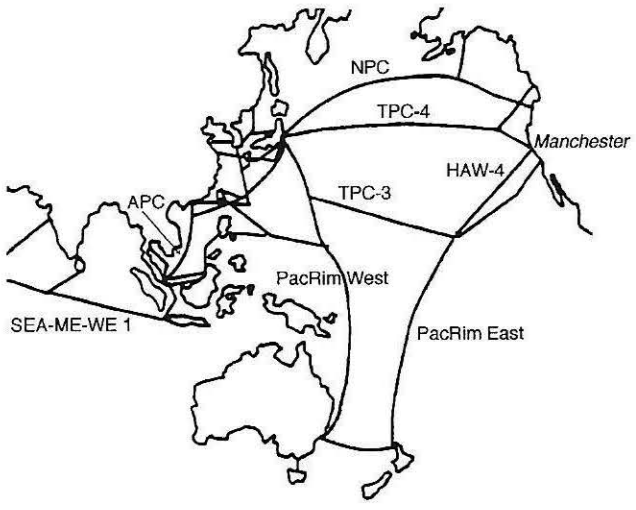
The cable stations have no problems. The cables are up and running. It's the links to the shore end. For instance, AT&T's link was a microwave tower from the station up to the POP. That got taken out. All of ITELCO's land lines are down, too.

What are you doing to restore service?

We've got a bunch of things going on. The first thing we did was to get together with the president of ITELCO over the weekend. They had a fiber they were putting up to one of their local offices. What they agreed to do was to basically unroll that fiber for us. They're splicing it now. We've brought it in through a window at the cable station and we're in the process of hooking it up for long distance service using emergency gear we flew in last night on chartered aircraft.

In the meantime we're doing some other things. We've still got some communications with Puerto Rico. We took Puerto Rican dial tone and extended it out to the gate of the station, 'cause we can't have people in there. We've hooked up six phones where they can make long distance calls over our lines. I was just talking to the station a few minutes ago. There's a thousand people lined up out there right now to make their calls.

Thank you for your time.



Asia-Pacific optical fibre cables 1985-1995. Diagram from Thorton and Lily, appearing in Submarine Fiber Optic Newsletter, July, 1995.

THE FIRST TRANSATLANTIC TELEPHONE CABLE

John Brooks

Editor's Note: This excerpt is from John Brook's Telephone: The First Hundred Years, *a wonderful Bell System history published by McGraw Hill in 1976. Cleo Craig, by way of introduction, was AT&T's chairman from 1951 to 1956 . . .*

The most spectacular technical advance of the Craig regime was the successful installation of a transatlantic telephone cable – an accomplishment no more striking in itself than in the fact that it had been long so delayed. Transatlantic telegraph cables had been in reliable operation since the 1850's; why then had a century – and the most scientifically innovative century in the history of the world – gone by without the accomplishment of the logical and seemingly simple step of the adaptation of submarine cables to telephone use?

The answer is that the step was not simple; rather, it proved to be one of the most delicate and complex problems in the whole technical history of telephony. The heart of the problem was that the use of submarine cables to carry voice over great distances requires enormously greater amplification than is needed to transmit telegraph signals. The capacity for such amplification was simply unavailable before the invention of the vacuum tube and its application in telephone repeaters. With the overland repeater in hand, Bell engineers early in this century set about developing one for undersea use. But many problems remained, and above all, that of maintenance. Repairing a repeater strung between telephone poles or buried shallowly in the earth was one thing; raising one from two or three miles under the sea to replace a part was another. The engineers calculated that the process of locating a single defective repeater, raising it from the ocean floor, repairing it, and putting it back in place would impair service for a long time and cost about $250,000.

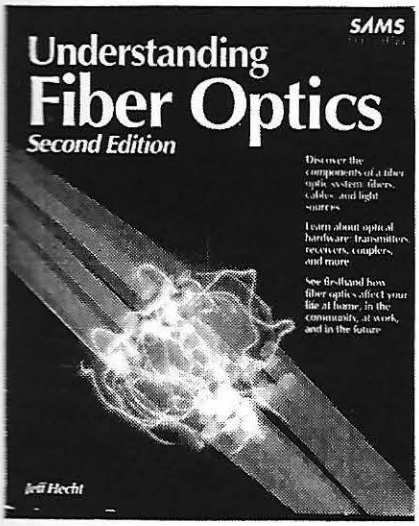
The urgency of developing a submarine cable was lessened by the coming of transatlantic telephone service by radio in 1927, and then further set back by the Depression and World War II. But overseas radio telephony by pre-satellite long-wave transmission was intrinsically noisy and unreliable, and in the late 1940s, Bell Labs undertook the task of developing what came to be called "the perfect product" — a submarine repeater that could be counted on to perform without repair for twenty years and would thereby make a submarine telephone cable economically feasible. The design for such a product came off the Bell Labs drawing boards in the early 1950s. It would be a torpedo-shaped object about three feet long and eighteen inches in diameter, weighing five hundred pounds, containing five thousand miniature parts, and costing about one hundred thousand dollars; connected into submarine cables at intervals of ten to forty miles, it would, presumably, carry voices over any distance. As early as 1950, a prototype repeater-assisted submarine cable was put into trial service over the ninety miles between Miami and Havana, Cuba. In the 1953 Annual Report, before the perfect product was in production, Craig felt enough confidence in it to announce plans for the transatlantic cable system: it was, he said, to be jointly owned by AT&T, the British Post Office, and the Canadian Overseas Telecommunications Corporation; it was to consist of two cables, each carrying messages in a single direction over the two thousand nautical miles between Newfoundland and Scotland, at depths of up to three miles; it would cost thirty-five million dollars and take three years to complete, and when finished it would be able to carry thirty-six separate conversations at a time.

The Hillside, New Jersey, shops of Western Electric began shipping the first completed submarine repeaters in January. That June 22, the cable ship *Monarch* left Clarenville, Newfoundland, to lay the cable. It was a bizarre and romantic operation. As the *Monarch* steamed along toward Scotland, paying out two-inch diameter cable and much larger repeaters from huge reels on her stern, like a spider spinning a web, men on shipboard talked constantly to shore over the evolving cable, to be sure no breaks had occurred and all was well so far. Craig himself was aboard the *Monarch,* in fog-shrouded waters off Newfoundland, when the first repeater was lowered. Although it was past midnight, everyone on board was up and watching, in an atmosphere of high tension. The repeater safely on bottom, the cable tested out to shore; it worked, loud and clear. All but those on duty went to bed, and the *Monarch* steamed on.

On September 26, the *Monarch* and its now empty reels reached Oban, Scotland. The one-way amplified cable worked, the job was half done. There remained the return journey to complete the circuit. It was made in the summer of 1956, and completed on August 14, when the *Monarch* arrived at Clarenville and the last section was spliced to shore-end cable. There followed a little more than a month of adjusting and testing; then, on September 25—six days after Craig had resigned as president—the transatlantic cable was opened to commercial service by a three-way call between Craig, and FCC Chairman George C. McConnaughey in New York, British Postmaster General Charles Hill in London, and Canadian Transport Minister George C. Marler in Ottawa.

On September 26, the first full day of commercial service, 588 completed calls passed over the cable — 75 percent more than the average traffic by radio over the ten previous days. By December, traffic over it was averaging 870 completed calls a day, and it had become an accepted part of the Atlantic community's life. Its final cost had been $42 million, a 20 percent overrun of Craig's estimate. As to the perfect product, it has lived up to its billing; twenty years later, no submarine repeater has ever had to be raised for repair.

REVIEWS



Understanding Fiber Optics is an excellent introduction to fiber optics for the intermediate telecom enthusiast. Jeff Hecht writes well and gives plenty of information in this strongly organized work. The 23 chapters cover everything from fundamentals to mobile and military applications. Each chapter ends with a quiz on the material just covered. A teacher could easily use this as a textbook. A beginner could profit from it as well, although there is a lack of easy to learn, practical examples. Refractive index, for instance, is a basic term to fiber optics. Hecht explains it this way:

"The most important optical measurement for any transparent material is its refractive index (n). The refractive index is the ratio of the speed of light in a vacuum to the speed in the medium

$$n = c_{vac} / c_{mat}$$

Light always travels more slowly in a material than in a vacuum, so the refractive index is always greater than 1.0 in the optical part of the spectrum. In practice, the refractive index is measured by comparing the speed of light in the material to that in air rather than in a vacuum. The refractive index of air at atmospheric pressure and room temperature is 1.00029, so close to 1.0 that the difference is insignificant."

Huh? Is that formulae necessary? And why aren't there any real examples for this elementary term? Why not tell us what the refractive index of a typical fiber is? And why not give the index of another material such as plate glass so we can compare the two? That might help ground the theory. Hecht is a real expert in his field but *Understanding Fiber Optics*, like Fike's *Understanding Telephone Electronics*, fails to reach out to the person just starting.

On the positive side, there are lots of wonderful details on interesting topics. The chapter on Long Distance Communications, for example, goes into the history and design of submarine cables. One nice quote: "Britain laid the first submarine telephone cable with an underwater repeater in 1943 between Holyhead and Port Erin. The first such cable in North America – and the longest operating – was laid between Key West and Havana, Cuba in 1950; it operated until 1989. The first transatlantic telephone cable, the TAT-1 (TransATlantic-1) cable between Britain and Canada, began operation in 1956."

The book is indexed and well documented. $26.95 in the U.S. and $33.95 in Canada. $4.00 for shipping and handling. Write to SAMS Publishing at 201 W. 103d Street, Indianapolis, IN 46290 to order or call 1(800) 428-5331. ISBN No. 0-672-30350-7.

UPDATES AND CORRECTIONS

Continued from page 157

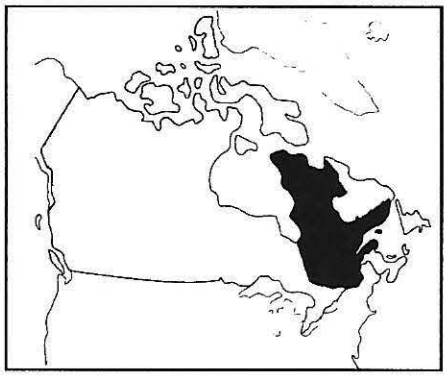
Isn't this information great? The web address is http://www.wimsey.com/yukon/business/nwtel. No net access? How about a book? ***In Direct Touch with The Wide World*** by Diane Green is all about telecom in the North. I found it a great read and I'll have a review next issue. It's available through Northwestel for $17.95 plus $3.00 shipping and $1.46 GST. That's a total of $22.41. Sales benefit the Pioneers:

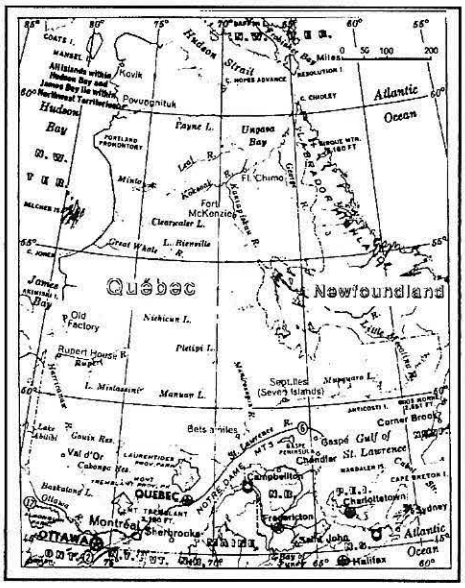
Telephone Pioneers of America
C/O Northwestel
P.O. Bag 2727
Whitehorse, Yukon Territory
Y1A 4Y4

Checks payable to: Telephone Pioneers of America. They can also bill you. Bruce Mogridge is the contact person for the book if you have questions. He's with Northwestel at (403) 668-5457.

The bad news? The major Canadian telcos have been **laying people off and retiring them** at a furious rate. Bell has offered a voluntary separation program for its 46,000 employees. They intend to reduce their work force by 10,000 over the next three years. Similarly, BC Tel is now talking to its union about ways the company can reduce its operating costs by $100 million between now and the end of 1996. That means eliminating approximately 2,000 jobs by that time. "Although BC TELECOM had a record year in 1994, BC TEL, the core part of our business, did not," said the head of the company. BC TELECOM now employs about 14,500 people, of which 12,200 are union. I have a question about this.

How can telephone companies offer the most advanced services in the coming years while laying off so many talented craft people? ISDN and frame relay and ATM installation are all services that need to be engineered, not just programmed from a console. So what gives? A GTE lineman at Def Con said the answer was simple. The telco will simply add more people when needed or use union subcontractors to fill in. But, he asserts, hiring levels will continue to drop for all telecom companies. Which brings me to a slightly irrelevant point. My dumpster diving friends may find new places to search by ferreting out these subcontractors. Cunningham Engineering, for example, does quite a bit of subcontracting for Pacific Bell in my area . . .





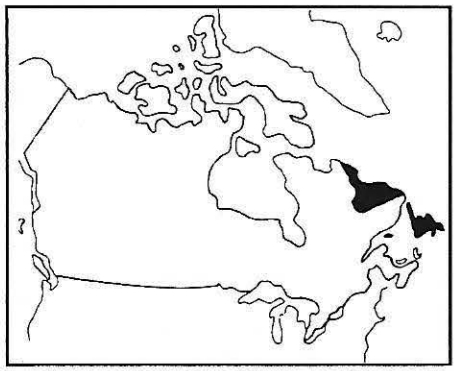
Quebec Telephone

Serves parts of lower Quebec

"Founded in 1927 to provide telephone service, Quebec-Telephone today asserts its competence in the broader field of modern telecommunications. The Company strives to continuously improve the quality and increase the range of its portfolio of voice, video and data transmission services. This confirms the Company's commitment to fully integrate its ultramodern network with the infrastructure of the national information highway.

The territory served by Quebec-Telephone covers an area of 272,000 square kilometers representing 40 per cent of the inhabited area of the province. This territory comprises 308 municipalities located around Quebec City, in the lower St. Lawrence, in Gaspisie and on the North Shore having a combined population of 550,000. To serve these customers, Quebec-Telephone employs some 1,700 people. The Canadian Radio-television and Telecommunications Commission (CRTC) has jurisdiction over most of the services offered within the 135 telephone exchanges of the Company."

Newfoundland Telephone



Serves the province of Newfoundland and Labrador

"Newfoundland Telephone will be the dominant supplier of reliable, high-quality telecommunications services in Newfoundland and Labrador. We will be the best service organization in the eyes of our customers and will earn their trust and their business."

Newfoundland Telephone Company Limited, a wholly-owned subsidiary of NewTel Enterprises Limited (NEL), owns and operates a public-switched network providing local and long distance voice, data and image services to the people of Newfoundland and Labrador. Newfoundland Telephone has 1,800 employees and provides over 255,00 network-access services. The Company is federally regulated by the CRTC.

In 1993, Newfoundland Telephone completed the provincial fibre network linking Newfoundland to the Stentor national fibre network. This effort was complimented by an agressive technology deployment program which now provides 80 per cent of customers with local digital-based services.

As a result, Newfoundland Telephone continues to roll out new and enhanced digital-network services and features, and works directly with customers to ensure that these services fully support their requirements in an often unique operating environment."

The New Brunswick Telephone Company, Limited (NBTel)

Serves the province of New Brunswick

"NBTel is the major supplier of telecommunications services in New Brunswick, providing more than 300,000 customers with a wide range of leading-edge products, services and systems. NBTel Mobility is also the industry leader in cellular service, with 31,000 customer province-wide.

With more than 500,000 network accesses in service, NBTel reached a major milestone in its 106-year history in November 1993, when it completed North America's first fully digital provincial switching network. NBTel has also undertaken an aggressive fibre-optics program, with the entire province now circled by a fibre-optic ring which is connected to a national fibre-optics system – including a link across Canada. Known as an innovator and pace setter in the industry, NBTel has had many "firsts" to its credit. For example, NBTel was the fist telephone company in Canada to introduce 911 service, community calling service and call display (calling line identification). TalkMail, a universal voice-messaging service provided to customers along with their basic local telephone service, and CallMall, a joint venture with Northern Telecom that provides customers with access to home-based banking and shopping, are both world firsts. NBTel provides self-serve activation of calling features from customer's telephones and will begin providing switched interactive multimedia broadband services to New Brunswick homes, schools and businesses early in 1996.

NBTel works closely with the provincial government to establish New Brunswick as a leader in developing the electronic highway. Known as centre of excellence in the telemarketing industry, businesses which have chosen to locate telemarketing operations or call centres in the province -- generating 3,000 new jobs -- include Federal Express, Camco, VIA, Xerox, Canada Trust, Royal Bank, CP Express & Transport, Purolator, Northern Telecom Canada, UPS, CP Hotels, MEDITrust, DMS Marketing, Connect North America, Unisys and Canada Post.

While modernizing its network and introducing innovative new services, NBTel has made major strides in improving its basic services. Individual-line (one-party) service is available to all customers, the company has the highest penetration of touch-tone service in Canada (90 per cent of its customers) and a number of calling features, including call return and three-way calling, are automatically installed on telephone lines as part of basic service.

Long-distance service continues to be a major source of NBTel's revenue with customers making more than 170 million long-distance calls in 1994. Reducing its prices significantly in recent years, NBTel's long-distance rates are currently among the lowest in Canada. Its local rates are also among the lowest in the country. Of particular benefit to business customers in New Brunswick, there is no provincial sales tax on 800 service. Headquartered in Saint John, NBTel is open for business province-wide 24 hours a day, seven days a week. The company has approximately 2,300 employees located in 32 communities throughout New Brunswick, with an annual payroll of more than $100 million. NBTel has been listed in both editions of "One of the Best 100 Companies to work for in Canada", published by the Financial Post."

1971 New Brunswick becomes the first Canadian province to have dial service for all customers.

BUSY SIGNALS TO TAKE ON A NEW SOUND IN NEW BRUNSWICK

To save its customers time and to remind them they don't always have to put up with the frustration of trying to reach busy phone numbers, NBTel is making a change to the busy signal we've all come to know. Starting February 15, New Brunswickers who reach a busy phone number may be given three choices: to send a TalkMail message, to be notified as soon as the number becomes free, or to hang up and try again later.

NBTel's manager for the new busy signal, Michelle Steele, said NBTel is pleased that it will soon be offering these alternatives to its customers. "People reaching busy numbers in New Brunswick will be able to choose whether they would like to keep trying those numbers themselves or if they would prefer to let our services do the work for them," she said. Ms. Steele said the new busy signal will be introduced first to customers in the Upper St. John River Valley -- namely those in the Woodstock, Perth-Andover, Grand Falls and Edmundston areas. It will be available province wide by the end of April.

Instead of the usual "beeping" tone, callers reaching the new busy signal will hear a voice prompt which will tell them the number they are trying to reach is busy. The voice will also provide callers with three options: To send a TalkMail message to the person they were calling by pressing "2" on their touch tone telephones. To hang up and activate Call Return - Busy, a service which monitors busy phone numbers and then uses a special ringing tone to tell people when those numbers become free. To use this service, callers need only hang up and press *66 on their touch tone phones. After hearing the special ringing tone, they may pick up their phone receivers and their calls will go through automatically. Or, to hang up and keep trying the number until it becomes free. Ms. Steele said people will only hear the new busy signal when they call busy numbers within New Brunswick.

Marine Telephone and Telegraph (MT&T)

Serves the province of Nova Scotia

"Maritime Tel & Tel (MT&T) is the principal supplier of telecommunications to the people of Nova Scotia, providing a wide range of services. These include local and long distance voice, data and image services, as well as cellular and paging services through its wholly-owned subsidiary MT&T Mobility. MT&T is also the majority shareholder in The Island Telephone Company Limited.

Formed in 1910 and headquartered in Halifax, MT&T employs nearly 4,000 people serving more than 500,000 network-access lines throughout the province. In 1993, the company invested more than $180 million in digital switches, fibre optic transmission and systems for its network.

As a result, MT&T's network recently achieved a number of milestones – including 100 percent digital service in the Halifax-Dartmouth metropolitan area, the largest urban area in Nova Scotia. In March of 1993, residents of this same region had access to a North American first – Name Display, as part of the Call Minder family of services. In addition to displaying the number of the incoming caller, the name of the person who has that number is also displayed.

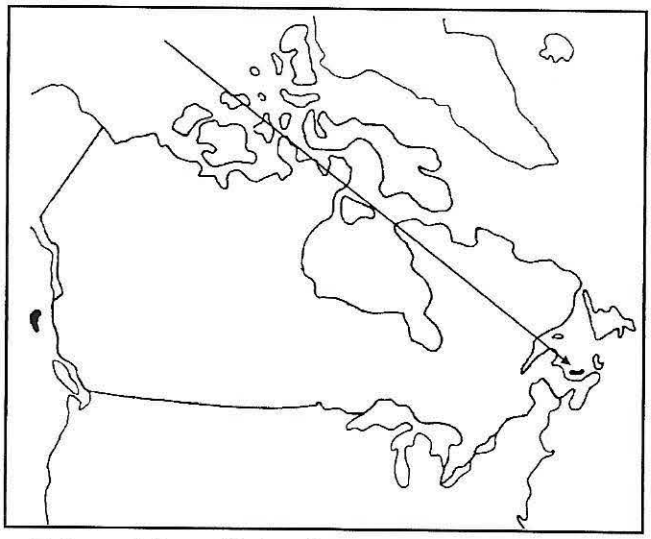
MT&T is also the first telecommunications company in the world to develop and market a Televoting system. The system has been used by political party leadership conventions in Nova Scotia and British Columbia. In 1993, the company created a new wholly-owned subsidiary, MT&T Technologies Inc., to develop and market new applications of Televoting."

Island Tel (The Island Telephone Company)

Serves the province of Prince Edward Island

"To provide the best for our customers in everything we do." A subsidiary of MT&T, the Island Telephone Company (Island Tel) owns and operates a world-class telecommunications network, incorporating state-of-the-art digital switching and fibre optic transmission. Island Tel is federally regulated by the CRTC.

From its head office in Charlottetown, Island Tel has more than 350 employees serving more than 71,000 network-access lines. The company also provides superior quality and Island-wide coverage for cellular, paging and private mobile trunked radio services through its subsidiary, Island Tel Cellular.



Prince Edward Island

Island Tel completed the final link of Canada's CellNet Network with the introduction of cellular service on Prince Edward Island in 1991. Island Tel Cellular, a cellular market leader on Prince Edward Island, surpassed its 1992 year-end objective six months ahead of forecast with the connection of its 2,000th network subscriber.

In recent years, Island Tel has expanded its fibre optic network and installed several new switching centres to meet the needs of business and residence customers throughout the 90's and beyond. The single-party development program is an excellent example of the expansion's success. In 1992, 2,400 customers converted to single-party service.

In cooperation with its parent company, MT&T, Island Tel recently completed an underwater fibre optic link joining Prince Edward Island with Nova Scotia, its mainland neighbour. That submarine cable was one of the final links in Stentor's coast-to-coast fibre optic highway, and supplies access to digital-switching technology to over 80 percent of Island Tel customers."

EDITOR'S NOTE:

I covered six Canadian telcos last issue. Most of the writing was my own and I included 17 references. It also took up 11 pages, an amount of space that was impossible to provide this time. This issue, by comparison, covered 5 telcos, has no references or original writing but it only takes up four pages. What do you prefer? I do intend to cover Canadian telecom history but it will have to wait until next time. I'll also have something on the independents in the next issue.

HOW PRIVATE LINE IS DONE

This article describes how I produce *private line*. This article may promote controversy, in that there are as many ways to create a magazine as there are ways to produce a painting, a piece of sculpture or a new song. Everyone has their own approach and their own opinions. I find that people advocate the method that they have invested the most money, time and effort into, not necessarily because they've experimented with different techniques. I'm not enamored with this particular method myself, indeed, I would only recommend it for an 8 or 12 page newsletter. I started the magazine with this approach and I am simply continuing on with it.

I do all my word processing and page layout in Word 6.0.1 for the Macintosh. Each page is saved as a separate file. Most desktop publishers create their text in a word processing program and *then* import it to a page layout program. A two step process. My approach is simpler but slower. Who's to say, though, that the magazine couldn't be done faster and quicker with Aldus Pagemaker? Or QuarkExpress? But who's free to compare programs on a regular basis? I have a deadline every two months. The idea of dropping $600 on a new program and then learning it while I go makes me very nervous, no matter how enthusiastically someone else likes it. In addition, I must keep from getting distracted.

private line's layout is simple. It's supposed to be. I could make it a mess of different font sizes, watermarked images in the background, text wrapping around pictures at weird angles and so on. But that's not the point! The point is to get out the information in the most readable form I can. That means simplicity. Everything else fights against that goal.

Word's biggest drawback is its sloth like speed, especially on older machines like my Mac IIsi. Microsoft keeps adding features to the Macintosh version but the never streamline the overall program. Word 6.0 runs much faster on a 386 PC than it does on a Mac. The program is also a memory hog. Word 4.0 came on one diskette just a few years ago. About 671k as I remember. Today's *update* from Word 5.0 to 6.0 comes on 15 diskettes and the complete program will grab 30+ megs on your hard drive if you install all the options.

There are always restrictions with page layout programs. I played with Pagemaker 4.0 about two years ago when I first started the magazine. It couldn't do what I needed. Word automatically changes footnotes. That's important to any researcher. Let's say you need to add three notes to the middle of a long article. Word instantly changes the existing footnote or backnote numbers to accommodate your changes and creates the right amount of space at the bottom of each page or at the back of the article. It's kind of neat to watch 18 footnotes get redone in a few seconds. For all I know, Pagemaker can now do this. But it wasn't available when I started. The bottom line is to make sure your favorite word processing feature is supported in a page layout program. Some newer programs try to combine the features of both types. I did a little experimenting with Nissus, the best example of such a combination, but I found it confusing.

Graphics are manipulated by Photoshop LE 2.5 after they are scanned in on a Microtek ScanMaker II, a flatbed that most of my graphics begin life on. This Limited Edition version does everything the full blown version of Photoshop does except for some color functions which I don't need. Every thing needed for line art and grayscale manipulation, however, is available. Brand new graphics are most often created using Superpaint. I'll sometimes use one program with the other.

Images are placed inside empty frames which Word produces on demand. Word can place an empty

frame of any size at any point on a page. Frames can be re-sized to any degree. Thus, I can shrink or enlarge a graphic to fit where it needs to go. Scanned photographs can also be inserted, however, halftoned photographs need to be dropped in at exactly the size they were created, since a halftone is a field of precisely spaced black and white dots that don't like their relation upset. Originals are run off on my HP 4P 600 dpi laser jet printer. I take these originals to the printer and they do the rest. Essentially, they take a photograph of my artwork and develop a printing plate from their film.

Original photographs, by the way, are given to the printer for placement and not scanned in. Scanning is best for photographs and illustrations that come from previously printed sources. Scanning will actually improve the look of some art work but it cannot usually hope to duplicate the resolution an original photograph possesses. A printer may charge only $8 to $15 for each original photograph put into a black and white publication. That's a lot better than scanning in the photograph, manipulating a 5 meg file, printing it out on the laser jet and then having the printer photograph this low res image.

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to bring about a live internet site for both of our projects.

Dear private line,

I want to thank you, both for entertaining my phone call so early in your morning (I didn't realize I was calling California) and for rushing me issue #8). It contains, in part, precisely what I was hoping to find: information on cellular telephone operation. I don't own a cellular phone – I honestly haven't made up my mind on the entire cellular issue (By the way, what about all the press on cellular related brain tumors?). Here in South Florida, cellular crimes are an everyday occurrence. Recently I attended a Law Enforcement seminar during which a detective demonstrated an ESN reader. We surmised that one day of standing on the overpass of a busy highway at rush hour should be enough to fill the 99-number (read 99 ESNs verses 99 digits) buffer and theoretically keep a cloner in free calls for the equivalent of eight years. Wow!

I am also very curious about the emerging digital cellular systems. How do they work? What's the essential difference between the digital and analog systems? What's the advantage to the cellular consumer? What is the advantage to the cellular companies? Needless to say, the technology interests me, and I believe your publication is right up my alley. Keep up the good work.

A.V.F.

Key West, Florida

I won't settle the cellular health debate here. The American National Standards Institute (ANSI) released a report in 1982 after five years of study. It recommended that handheld VHF and UHF radios should be kept 1 to 2 inches away from the forehead and that power should be limited to no more than seven watts. An 800 megahertz signal has a very short wavelength. Its tiny size approximates the length of some internal organs and glands. Continued transmission of a high frequency signal at power may cause an organ to resonate, resulting in unknown consequences. Most cell phones produce less than three watts. My feeling is that cellular safety is a minor issue, however, I won't put down anyone for being concerned.

TDMA is a hybrid scheme of analog and digital techniques. It uses the AMPS protocol to set up calls and then digitizes the conversation once a connection is established. (Read private line number 5 and 6) It is "more digital" than AMPS, however, it is not totally digital like CDMA. Digital service will eventually allow carriers to provide cell phones with the same features and options that landline phones enjoy under CLASS and System 7: call return, calling number delivery, call trace and a wealth of other options. The customer will pay a premium for all of these services. I don't have a problem with analog transmission. A voice may fade or become filled with static but you can usually understand what's being said. A digital conversation often just breaks apart or results in a grating chirp.

Dear private line:

Here is a little note from your Dutch subscriber. I told you I would write a little story about GSM. Well I did. And here it is. I could tell you much more about the modulation techniques and things like that. But I think that would be far too difficult. Hell, I don't even understand all that shit about QPSK, maybe Damien does? I'm not a mathematicus. Pay attention to the pictures. These took some time for me. They are very complete. Well, I hope it's useful for you. So I get my free subscription for the next year. If you're not going to use it, just let me know. I'll pass it to Phrack or whoever.

Erwin Zuurhout "Listerique the Phreak"
The Netherlands

Send it to Phrack. This guy volunteered to write an article for months on GSM. I never pressured him for it since I know how difficult it is to write. He submitted an article that, except for four or five sentences, is a direct copy of the chapter on GSM in Cellular Radio by Macario, a book that I've recommended several times. He even scanned in, apparently, Macario's diagrams and called them his own. And do you know I helped this guy get an article published in Blacklisted!411? Some thanks. This is a good place, though, to say thanks to Radar who submitted some original, honest writing on page 179. Want to write for private line? Try 750 words. just like Radar. Fill up a page with whatever experience you have. Only two original pieces have been submitted in nine issues so I'd say your chances of getting published are very good. . .

Dear private line:

I've got No. 5, 6 and 7. Sure would like copies of the rest; an excellent read. Regarding the review of *Old Time Telephones* in issue 7; the book has numerous inaccuracies. The publisher has agreed to omit my name from the credits, if it goes into a second printing. I have had a major falling out with Dr. Myer over this. Your suggestion that the *Switcher's Quarterly* be copied on ledger sized paper; my suggestion is that SQ be merged with *private line* and become a by monthly. (Food for thought.) Regarding the telephone repair column; back in 1988 I had a service guide printed when I was in the single line phone business. It is 100% original, except for the drawings. It is quite accurate. Feel free to use it in whole or in part. I can also write columns of low tech apparatus (pre-digital age, pre-electronic phones, i.e. "my" era.)

Bruce Crawford
P.O. Box 1000
Cargill, Ontario N0G 1JO

Bruce produces the Switcher's Quarterly, a great newsletter for people who own a working switch. Dr. Myer informs me that a second printing of Old Time Telephones went to print in March. It can be identified by a reference to the back cover to an endorsement by the Antique Telephone Collectors Association. He says there were some corrections made.

Service Guide: Single Line and 1A2 Business Phones is an excellent read. Send a few dollars for it. The 12 page guide covers service for the 500 set and 1A2 Key Telephones. It has diagrams of connections for the 500, the 300 and type 564, a typical 6 button rotary dial key set. Plus a nice glossary of common technical terms with a slightly Canadian twist.

Card Phones in China

"Liaoning PTA has targeted credit card public pay phones as a business growth area. In 1994, the province invested a total of 36 million RB (US $4 million) on card pay phones, installing 1340 such pay phones by the end of the year. Sales revenue from magnetic phone cards in 1994 alone reached 35.4 million RMB, recovering their investment in the same year. Encouraged by the market demand, local PTAs in the province installed a total of 1780 card pay phones in the first four months of 1995 while sales of phone cards has reached 15 million RMB." *China Telecom Newsletter*, July 1995.

Swiss Payphones in the Ukraine

"Pay phones from Ascom of Switzerland are being installed in major cities of the Ukraine – Kiev, Odessa, Lvov, Dnepropetrovsk, Ouzhgorod and Chernovtsy – where automatic international communications switching stations are already operational. The program is run by the Ukrainian Ministry of Telecommunications and the Ukraine–Switzerland joint–venture company Ascom Astel. The company investigates the Ukrainian telecommunications market, installs equipment service centers in the cities and only then supplies the equipment to the customer. The pay phone equipment servicing centers are already put to operation in Kiev and Lvov." *Russian Telecom Newsletter*, June 1995.

Russian Pay Phone Production

"The Telta joint-stock company, based in Perm, Northwest Russia, started pay phone production. The pay phone construction was designed by the Telta factory research labs on the order of joint-stock company Moscow Local Telephone Network and Telekom of Russia. The first lot of production, 200 pay sets, was issued in Spring 1994. By end of 1994, the volume of production increased to 3000 pay phone sets. The planned annual volume of production is of 20,000 pay phone sets. One pay phone costs $700. Pay phone cards are manufactured by the joint-stock company Voskhod of Kaluga in Central Russia. Annual volume of pay phone card production is 1500." *Russian Telecom Newsletter*, June 1995.

A Translating Telephone

"KDD [Japan] and Korean Telecommunications will start experimenting with an automated translation telephone whereby words spoken by a caller are automatically translated in to the receiving party's language. The two firms have been jointly developing the system over the last several years and now feel the voice recognition functions and translation accuracy are at levels acceptable to begin field trials. The experiments will be conducted using actual long distance telephone calls." *Japan Telecom,* July 31, 1995.

Indian Telephone Service Today

"The most-recently available figures indicate that 40 million calls a day are completed on the Indian public telecom network. The network is composed of about 15,000 local exchanges and 750 trunk long distance exchanges and contains a variety of switching systems, with manual and crossbar systems still in use. Less than seven percent of local-exchange lines, but more than 70 percent of trunk facilities are digital. many trunk routes employ fiber optic cables, while coaxial cables, analog and digital microwave and digital UHF are used for rural communications. Satellite communications are being deployed in more remote areas of the country and for setting up government and business data networks." *India Telecom,* July 1995.

New African Submarine Cable

"Africa-One was a hot topic at the seminar, [The KMI Submarine Systems Symposium held June 7-9 in Puerto Rico] with a number of presentations touching on the subject. The project is based on the concept of regionalization, where many poor countries together pool resources to purchase equipment in volume, creating economies of scale. AT&T continues to maintain they are building the network for Africa, not for AT&T. It has recently signed Memoranda of Understanding (MoUs) with Rascom and Patu to make them administrators of the cable system and the satellite restoration facilities. The next phase will begin drafting MoUs with individual countries for feasibility studies. AT&T's own studies describe traffic growing in Africa at an annual pace of 13 percent, justifying the cable. AT&T claims that they are having an easy time raising capital for the network and have begun pre-selling capacity. Half of the money raised from pre-sales goes into financing the construction of the network.

The network will devote a 2.5 Gbps stream to each participating country. This is achieved through the use of wave division multiplexing (WDM). WDM allows for greater network security, as each country on the network sees their own traffic and no one else's on the ring. If a country fails to pay their bill, the stream can be shut down or assigned to another user. This is not a cheap network, as the price has risen to $2 billion now and may rise further as construction draws nearer." *Submarine Fiber Optic Communications Systems (SFOCS),* July 1995.

UPDATE TO THE DIGITAL TELEPHONY BILL

The digital telephony bill is now both dead and alive. Two thirds of that bill dealt with spending $500 million to turn the entire public switched telephone network into a giant listening post for law enforcement. That part seems dead. The other third of the DTB dealt with changing Title 18. Those changes tightened the regulation against cloning, prohibited cordless phone monitoring and, seemingly, banned certain kinds of scanners. That part is alive. People are now being prosecuted, for example, under 18 U.S.C. 1029 as revised by the digital telephony bill. So why is one part alive and the others are not? Money. The changes to Title 18 required no additional funding – new laws were simply added to the books. Making every central office and remote wiretap compatible, however, would cost the government a half billion dollars. The bill became law, the funding was authorized, but the money was never actually *appropriated.*

The digital telephony bill became law in August, 1994. It passed at the wrong time. It was voted in by a house and senate controlled by Democrats. Its funding phase, however, came up months later during the time of budget cutting Republicans. In November, 1994, Republicans gained the majority positions in both the House and Senate. Every committee chair changed hands, including the Appropriations Committee, through which every bill must pass to get funded.

Congressional Republicans started work on getting the Contract With America completed in the first three months of 1995. Other bills got stalled. I wrote the Digital Telephony article in March. It wasn't clear then what would happen. But it was on the books and I feared that the Republicans would get it funded. I was wrong. Even the Oklahoma City bombing, which occurred just after *private line* Number 6 hit the newsstands, failed to provide enough motivation to get the money for the wiretap provisions.

The Federal Budget for 1996 is still the prime focus for legislators, even as I write this in October. Every agency and every program in the government is getting scrutinized. The DTB has little priority since it never has been funded and it doesn't have an established bureaucracy to fight for it. Law enforcement wants it but they know that even their budgets are getting cut. In addition, it turns out that support for the DTB was fairly thin. Many who voted for it weren't enthusiastic about it. And many of those who were enthusiastic are no longer around. Many probably voted for it while expecting its funding to die in committee. The DTB lies crippled, with no money to carry out its wiretap provisions. No enabling regulations have been drafted since there is no program to put in place. It is still law and still dangerous and still reflective of law enforcement dreams. But it is nothing without money.

Def Con III Review and Road Trip Log Continued from 159

The paved road ends here at Schulman Grove. 13 more miles of dirt road takes you to the Patriarch Grove at 11,200 feet. You can actually walk from its parking lot to the summit of White Mountain Peak, at 14, 246 feet, the third highest summit in California. Maybe next time. I drove back, instead, to 168 and headed east to Las Vegas. I really like 168. It is marvelously empty and full of wide open vistas. Very comforting. The only disturbing part of the drive were two loud thumps from under the T-Bird's hood, during a long, slow climb up a steep grade. Turned out those thumps were sonic booms from a pair of F-16s, following the road near the California Nevada border at about 250 feet. I enjoyed watching them race overhead.

168 ends at Nevada Highway 95, which in turns runs south all the way to Vegas. Awful. I got into the Tropicana on that Thursday afternoon. Many people arrived a day early. The Tropicana has a beautiful pool, the rooms were very close to the conference hall and the garage is as much a mess as the Sahara. The drinks were also very high priced, perhaps accounting for the mellower atmosphere this time, compared to the year previous in which dollar Heinekens were consumed constantly by everyone.

The speakers started on Saturday. I dropped in and out of the hall, listening to a bit of one speech and then another. Bruce Schneier, author of *Applied Cryptography*, gave a fascinating talk that I could barely understand. Robert Steele talked about the value of hackers and the irresponsibility of corporations who don't follow basic security. He also said that *Wired* squashed an article he submitted. They told him it would make their advertisers nervous. (Kind of confirms what we all thought about *Wired*, doesn't it?) Winn Schwartau was there with his information warfare shtick. I don't know all about that; I enjoyed Cambell's talk on Area 51 more. Speculating about UFOs seems more plausible than speculating about Wall Street being shut down.

What I most enjoyed about Def Con was meeting people. I spent some time manning a table in the second convention hall. I passed out over a hundred copies of *private line* and got to discuss the publication with many of my readers. Some subscribed on the spot and others bought the few back issues I took along. I did not go to Def Con to sell, however, I was happy to oblige people. It felt good. Dark Tangent should be congratulated for pulling off another successful Con. I'm not sure what date he's got set for the next one, however, the numbers and info remain the same:

Def Con, 2709 E. Madison #102, Seattle, WA 98112. Or dtangent@defcon.org. Or (206) 453-1006 or FAX to (206) 453-9567. And 0-700-TANGENT

Some Factors Affecting THE PROPAGATION OF MICROWAVES Over Point-to-Point Radio Systems

[This article was first published in the *Lenkurt Demodulator*, Vol. 3, No. 6, June 1954. The author is unknown. Bold faced type is of my own doing, Ed.]

Reliable communications can be obtained over point to point radio systems, just as easily as a wire-line system is made reliable by engineering the system to compensate for predictable variations in line losses, a radio system can be made reliable by engineering the system to compensate for predictable variations in propagation losses.

In this article, the important factors which affect propagation of radio waves are discussed and some of the methods of utilizing them or compensating for them are described.

In the outside telephone plant, wire and cable have long been the standard transmission facilities for toll and exchange routes. Until after World War II, no extensive use of radio was made in the telephone industry. It was normally used only where land lines or submarine cables were impractical. This situation has now changed. Radio equipment designed specifically for telephone toll plant usage is presently available. Operation and maintenance of this equipment is fully compatible with normal telephone practices. Because of its many advantages, radio is finding wide application for expansion and replacement of existing outside plant wire lines and cables.

While much public attention has been given to national microwave networks for the transmission of hundreds of telephone channels and several television channels, the recent development of radio and channelizing equipment for light to medium traffic routes has made the use of point-to-point radio economically practical for expansion and extension of toll and exchange facilities. Many telephone companies are now finding that microwave has a definite place in their outside plant. Numerous installations already made have demonstrated that microwave systems can be engineered to be equally or more reliable than conventional wire lines or cables.

To engineer a wire line system requires a knowledge of the transmission characteristics of wire lines at the frequencies used. In the same manner, to engineer a microwave system requires a know ledge of the propagation characteristics of radio waves at microwave frequencies. Fading, a phenomenon encountered in radio links, is comparable to increased attenuation under severe weather conditions, a basic factor in wire line engineering. Fading is caused by the effect of air and terrain on radio wave propagation. **Radio waves at microwave frequencies and light waves have many of the same characteristics.** Since the behavior of light waves is well known through the science of optics, and since radio waves and light waves have many of the same properties, certain optical principles are useful in describing radio wave propagation. The most important of these are reflection, refraction and diffraction.

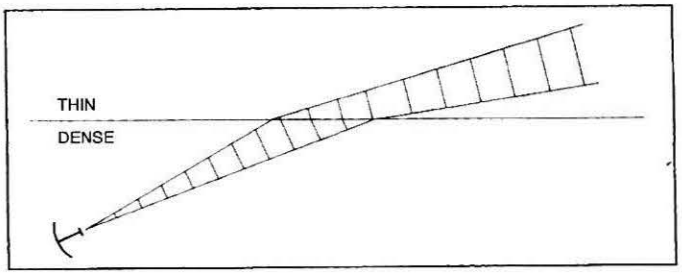
Optical Properties

Because they behave like light, radio waves can be reflected from smooth conducting surfaces and focused by reflectors or lenses. When radio waves pass from one medium to another (such as from dry air to moist air) they are bent or refracted in the same manner as light waves are bent by a lens or prism. Radio waves tend to bend around large obstacles in their path by a process known as diffraction. They also are scattered by small particles such as rain and snow. Each of these properties can cause variations in the received signal strength. They must be considered and allowances made for their effects when engineering a radio system.

Reflection

Very short radio waves are usually focused by dish-shaped metal reflectors. Such reflectors concentrate all the energy into a relatively narrow beam that can be directed like a light beam of a searchlight. This concentration of radio energy allows transmission over longer paths with much less power than would otherwise be required with non-directional antennas. (See *Demodulator*, Vol. 1, May, 1952.) While the ability to reflect radio waves is very useful for focusing them into a beam, reflection is also a primary source of received signal variation. Reflections occur when radio waves strike a smooth surface such as water or smooth earth. If both reflected and direct waves reach the receiving antenna, it is possible for the two waves to cancel each other and reduce the received signal strength. Depending on the length of the reflected path compared to the direct path, the reflected wave may arrive at the receiving antenna either in phase, out of phase, or partially out of phase with the direct wave. Where the reflecting surface is very smooth and the reflected wave and direct wave are exactly out of phase at the receiver, the reflected wave may temporarily almost completely cancel the direct wave and cause a very deep fade in received signal strength. Cancellation is worst when the reflecting surface is a calm body of water, smooth moist earth or the thin layer of hot air that lays just above the surface of desert sand in the daytime. In general, reflected waves are undesirable. Changes in the →

FIGURE 1. Refraction at a boundary between air at different densities. The speed of radio waves is slower in the denser medium.



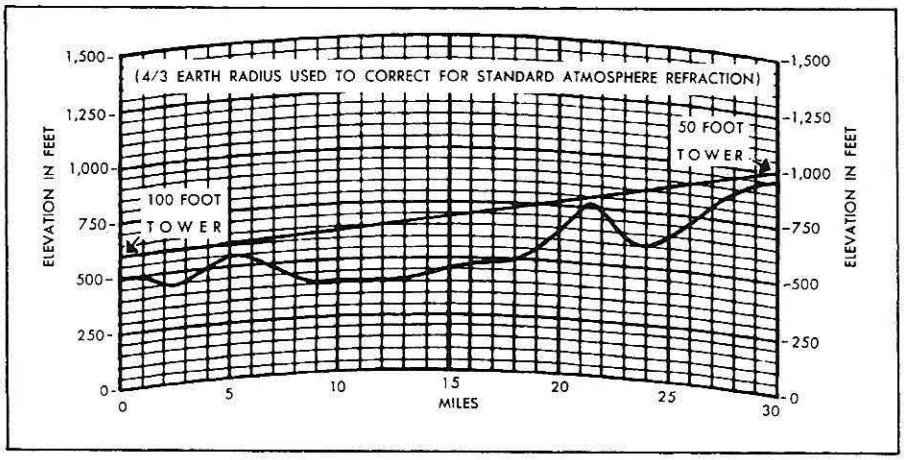


FIGURE 2. Profile charts are often prepared with 4/3 true Earth's radius to allow for normal atmospheric refraction. Charts prepared with true Earth's radius are also widely used. True Earth's radius provides a more conservative method of system engineering.

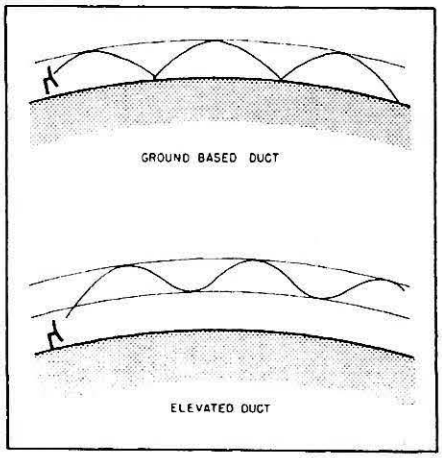


FIGURE 3. Ducts formed by stratification of the Earth's atmosphere. Ducts tend to trap radio waves and guide them around the Earth's Surface.

refractive qualities of the air cause the point of reflection to shift and the reflected and direct waves pass in and out of phase with each other causing wide variations in received signal strength. Rough terrain, such as a rocky or wooded area, is generally a very poor reflector of radio waves. Such terrain either absorbs much of the radio energy or scatters it so that little reflected energy reaches the receiving antenna. For this reason, radio paths with reflection points in rough terrain have very little interference from reflected waves.

Refraction

Refraction occurs because radio waves travel with different speeds in different media. In free space (a vacuum) the speed is maximum. In any other medium, how ever, radio waves travel slower. As shown in Figure 1, when radio waves pass from dense air to thin air, their direction is changed. As the upper part of a wave front enters the thinner air it starts traveling faster than the lower portion which is still in the dense air. The result is that the path of the waves is bent or refracted.

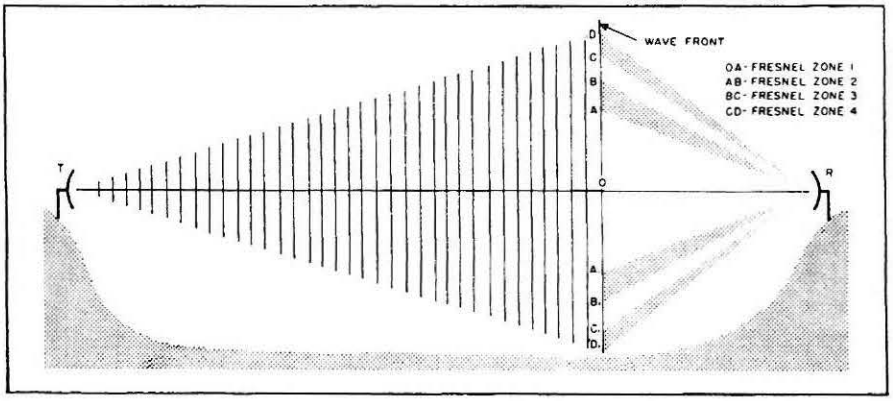
When considering refraction of radio waves through the Earth's atmosphere, it is usually assumed that under normal conditions the atmosphere is densest at the Earth's surface and becomes thinner at higher altitudes. This variation in air density above the Earth causes radio waves near the surface of the Earth to travel more slowly than those considerably above the surface. The result of these different velocities is a bending of the direction of wave travel which causes the waves to tend to follow the Earth's surface.

Because curved paths through the atmosphere are difficult to represent graphically, it is customary to draw profile charts of the Earth's surface with the Earth's radius represented as 4/3 actual size. The use of this fictitious radius approximately compensates (under average conditions) for the bending of the waves by the Earth's atmosphere and permits the illustration of radio paths on a profile chart as straight lines. An example of a profile chart with 4/3 Earth's radius is shown in Figure 2. Simple refraction causes no great difficulty in the engineering of radio routes. Occasionally, however, refraction effects can seriously disturb the transmission of signals over line-of-sight paths. Under unusual conditions, the atmosphere becomes stratified with definite boundaries between layers of different densities. This causes the path of the radio waves to be bent first down and then up so that the waves become trapped in a layer of dense air. As a result the waves are guided along the air layer in much the same manner as microwaves travel in a wave guide. **Layers of dense air that trap radio waves are commonly referred to as ducts.** The existence of a duct may either increase or decrease the received signal strength depending on whether the duct guides the waves toward or away from the receiving antenna. Ducts are more frequent near or over large bodies of water and in climates subject to frequent temperature inversions (stratification of air). **While ducts may cause fading, their most important effect is that they some times guide radio waves well beyond the optical line-of-sight so that they are detected by distant repeaters of the same system.** This type of interference can be avoided by changing transmitted frequencies at repeaters and locating repeater stations along a zig-zag path. Examples of two common types of ducts are shown in Figure 3.

Diffraction and Fresnel Zones

Ordinarily, radio paths are selected so that there is a direct line-of-sight between the transmitting and receiving antennas. However, a direct path between transmitting and receiving antennas is not necessarily a sufficient condition for good radio transmission. If a radio wave passes near an obstacle such as a hilltop or a large building, part of the wave front will be obstructed, and the amount of energy received will differ from that received if no obstacle were there. The cause of this difference is known as diffraction. A simplified physical explanation of diffraction is shown in Figures 4 and 5. In Figure 4 a succession of unobstructed radio wave fronts are shown progressing from the transmitter to the receiver. The whole surface of each individual wave front contributes energy to the receiving antenna. However, energy from some portions of the wave front tends →

FIGURE 4. Energy contribution from a wave front to a receiver. The dark areas are out of phase with the light areas.



to cancel energy from other portions because of differences in the total distances traveled. The shaded areas in Figure 4 show the paths of energy that cancel some of the energy transmitted by the paths shown unshaded. The cancellation is such that half of the energy reaching the receiver is canceled out. Most of the energy that is received is contributed by the large unshaded central area of that portion of the wave front that is closest to the receiver. If an obstacle is now raised in front of the wave so that all of the wave front below the line of-sight is obstructed, (this is shown in Figure 5) half of the broad central area is obstructed and a greater loss of energy occurs. Under this condition the radiated power reaching the receiver is reduced to one fourth normal or by 6 db. If the obstruction is lowered (or the receiving antenna raised) so that all of the central zone is exposed, the power received by the receiving antenna is even greater than it would be if the obstacle were not there. This is shown in Figure 6.

The various zones of the wave front that contribute either in-phase or out-of-phase energy are called Fresnel zones after their discoverer Augustin Jean Fresnel (1788–1827). The large central zone is called the first Fresnel zone and zones farther removed from the line of sight are called the second, third, fourth zones, etc. If the obstruction is such that the first zone is above the obstruction, the radio path is said to have first Fresnel zone clearance. In general, first Fresnel zone clearance is considered to be very desirable, although clearance of only one half the first zone is adequate. Of course, clearance greater than first Fresnel zone is also adequate. Paths without adequate clearance are not desirable because refraction by the atmosphere may change. If a path just clears an obstacle under normal conditions, a change in refraction may cause the path to be obstructed. Careful construction of a profile chart and visual examination of the proposed route should show whether adequate path clearance is available.

Absorption and Scattering

Because no transmitting media other than free space is perfect, some radio energy is absorbed from a wave when traveling through the Earth's atmosphere. In clear weather, absorption is very slight for radio waves of less than 10,000 megacycles frequency. Rain, snow, and fog, however, can absorb or scatter large amounts of radio energy, especially at the higher microwave frequencies. Below 1000 megacycles, however, reduction of received signal strength by scattering and absorption by fog or precipitation is not a serious problem over paths of the usual length.

Radio Route Considerations

Each of the factors that affect radio propagation must be taken into consideration when planning a radio route. In many cases, visual examination of the route topography and a knowledge of weather conditions along the route are sufficient to determine the feasibility of proposed transmitter, repeater, and receiver locations. Where there is a doubt, profile charts can be used to determine more precisely the transmission conditions to be expected. In exceptional cases it may be desirable to make propagation tests. Where visual examination indicates that the radio path is completely or partially over smooth terrain or water, the point of reflection from the terrain of the transmitted wave should be determined from a profile chart. The reflection point is located where the angle the transmitted wave makes with the Earth's surface is equal to the angle of the reflected wave.

If the reflection point is found to be on a smooth surface such as a flat field or water, relocation or a change in height of the transmitting or receiving antenna may be desirable. Often one of the antennas can be located so that it is masked from smooth ground or water reflection but still in line of sight to →

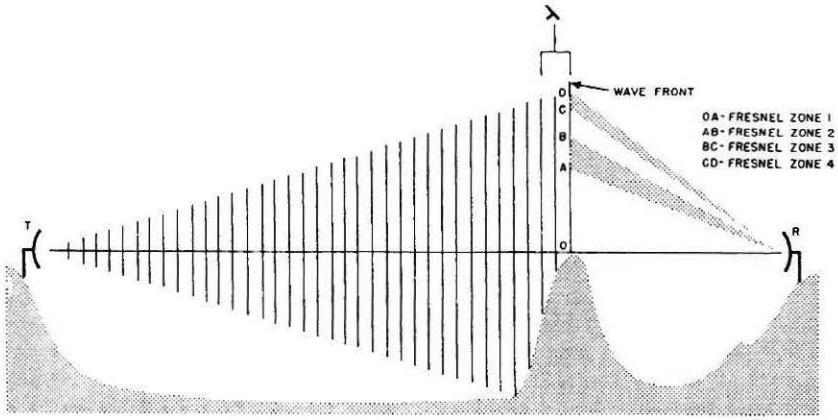


FIGURE 5. When an obstacle is raised in fron of a receiver to the line of sight, the wave front is obstructed and the received signal strength is reduced by 6db.

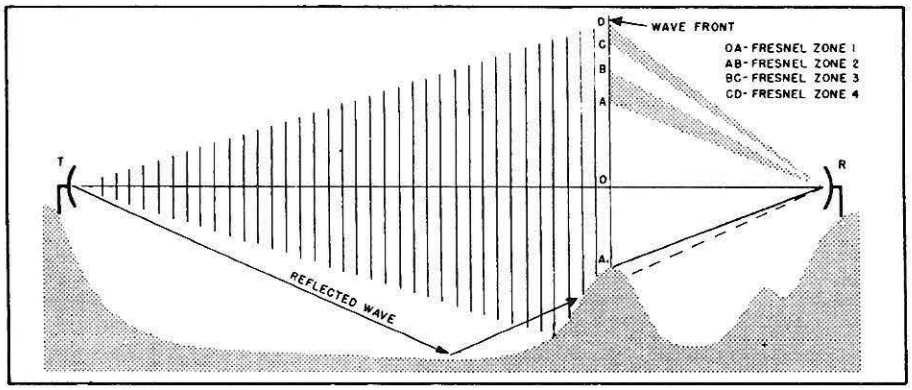


FIGURE 6. When the obstruction is lowered (for the receiving antenna raised) until all of the first Fresnel zone is exposed, the received signal strength is greater than if the obstruction did not exist.

the other antenna. An example of using nearby terrain to mask unwanted reflections is shown in Figure 6.

How Bad is Fading?

Fading can only be determined absolutely over a particular path on the basis of experience just as the ice or frost attenuation of an open wire line must be learned absolutely by experience. It is the combined effects of all the various factors described above that can cause variation in received radio frequency signal strength. Observations of fading over practical systems operating at frequencies below 1000 megacycles have shown that fade margins above normal space losses of 0. 5 to 1. 5 db per mile (depending on the terrain) will provide satisfactory transmission for 99. 9 percent of the time. The 0.1 percent of time that transmission quality is below standards of such systems amounts to only 9 hours per year; which compares favorably with the performance obtained from many wire line and cable systems. In most cases a well planned system can be expected to be completely out of service due to excessive fades for less than 1 hour per year.

Conclusions

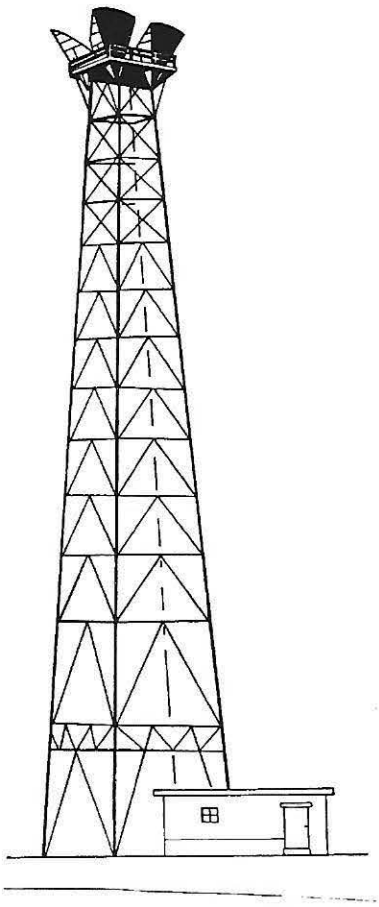
The factors affecting radio propagation over line-of-sight paths, while differing greatly in details, have much the same effect on transmission quality and reliability as do weather and temperature changes on open-wire lines and cables. The problems created by these factors are as amenable to solution as are the transmission problems of conventional wire and cable.

Each of the factors affecting the propagation of radio waves contributes somewhat to variations in received signal strength. However, by understanding the way in which each factor affects propagation, by engineering the radio system to minimize their effects, and finally by allowing a sufficient margin for unavoidable fading, very high quality circuits can be obtained with maximum reliability and reasonable cost.

RESOURCES

Want to know more? A lot has changed since 1954. The newest systems, for example, use digital transmission and not analog. The easiest to read microwave book that I've found is Michael Wang's *Metropolitan Microwave Network: Design and Implementation,* published by Prentice Hall in 1990. Its ISBN number is 0-13-579723-3. It also covers network fundamentals such as T1, digital signal processing, channel banks and a good deal more. A nice chapter on microwave communications is in *Encyclopedia of Telecommunications*, published by Academic Press and edited by TRW's Robert Myers. It was published in 1989 and the ISBN number is 0-12-226691-9. The author of that chapter is U.S. Berger, formerly of Bell Labs. His writing on microwave history is really good. Got a fax machine? Call CYLINK at 1-(800) 735-6614 from your machine's handset and request document #318. Their fax-back service will send you some interesting diagrams showing how straightforward it is to connect distant offices, say 15 to 30 miles apart, with a T-1 span over microwave. Yes, 24 channels with no more toll charges. This technology has been solidly in place for well over a decade.

There are no industry magazines on microwave that I would recommend to beginners. I think you'd get discouraged if you read them. Or call, for example, *Microwaves and RF* at (216) 696-7000 if you don't believe me and request a sample. I would tell you, instead, to look at the avalanche of information produced by people and groups in amateur radio. *Now You're Talking*, available at most Radio Shack stores, has a pretty good chapter on propagation. It's published by the American Radio Relay League. Their annual handbook is also fairly informative. You can get information on these books and ham radio by writing to the ARRL Educational Activities Department at 225 Main Street, Newington, CT 06111. Or try (203) 666-1541.



A Portable Video Phone
by Radar

Have you ever walked down the street and seen someone talking on a portable phone? I know you have. Ever seen someone with a Newton or a Magic Link? What about combining them and making a "portable" video phone? It's quite possible that in the near future you'll have a device close to what I have just described. These days in stores everywhere you see video phones that could almost pass for regular phones, you see video conferencing on the Internet all the time and there is also computer conferencing going on via regular telephone lines and through Integrated Services Digital Network or ISDN lines.

Each method of transferring data has different advantages. Bandwidth, for instance, determines the clarity and fps of the picture. CU-SeeMe can be an effective way of communicating due to the fact that nothing but the parties' hardware limits the clarity and fps of the picture due to the fact that there is currently no limits or restrictions on the amount of data you send over the Internet at any given time. The disadvantage of currently using CU-SeeMe over the Internet is that it is currently B&W, a problem that will be soon rendered as modems become more efficient and companies upgrade from fractional T-1 to T-1 or from analog phone lines to dedicated ISDN lines.

Other popular alternatives include the video phones made by AT&T which still work on regular phone lines but tend to be jumpy due to low fps averages and grainy due to poorly made cameras. The other problem is that these phones require that person on the other line also have a AT&T video phone. A few major companies adopted this technology when it came out but most have found that either satellite communication or using video over the Internet where much more efficient for the amount of the cost. Video conferencing via satellite has been the choice for most "large" corporations, generally ones who already have the satellites in place for other reasons or see a need either in the present or in the future for large amount of video traffic.

As I started this article with, portability has always been an issue but in the past you had to sacrifice quality for size. These days computers phones and other equipment is being shrunk, and with no loss in quality, just a heftier price tag. It is not unlikely that as you see video conferencing become standardized, like all "high tech" industries, PIM's (Personal Information Managers) or perhaps even specialized device's will be introduced that will allow you to not only talk to but see your colleagues at the office, while your on an island paradise, of course, and discuss those blueprints that came in right after you left.

Radar

More Info on C-U-See Me

"CU-SeeMe is a desktop videoconferencing product for person to person or group conferencing over Local Area Networks (LAN) or Wide Area Networks (WAN) that support the TCP/IP network protocol. CU-SeeMe can be used over the Internet to make connections to any other desktop using CU-SeeMe in the same fashion as email, except that with CU-SeeMe you can have a real-time meeting with video, audio and written messages.

CU-SeeMe does not use any hardware compression/decompression (Codec) boards. Low bandwidth Internet connections are achieved, instead, through software-only video algorithms that reduce data transmission. Modems connections using SLIP or PPP are supported as well, however it is recommend that you have at least a 28.8k baud connection.

CU-SeeMe uses a unique protocol to manage and receive video and audio data. The protocol was developed specifically for TCP/IP networks and the Internet; it is capable of running over ISDN networks with TCP/IP network support. Person to person, group conferencing, and large audience broadcasting over TCP/IP networks are all possible with CU-SeeMe technology -- with little or no added cost for making connections.

White Pine will introduce commercially enhanced versions of CU-SeeMe for resale, OEM and licensing. Cornell will maintain a version for free distribution as well as access to the source for research, development and non-commercial use. White Pine's enhanced versions will include add-on applications for extended functionality such as whiteboard, rolodex, and application sharing."

In other words, CU-SeeMe is a videoconferencing software program that you can download a free version from White Pine to experiment with. A $100 Connextic camera is most often used. You need a direct connection to the net like PPP, not through AOL or Delphi or some other "front end" service. Download the version you need or get more information by going to the White Pine web page at: http://www.wpine.com

They also produce a marketing newsletter in hardcopy. Write to: White Pine Software, Inc. Attn: Newsletter Editor, 40 Simon Street, Nashua, NH 03060-3043

Forrest Milkowski, Director of Product Marketing and Tracy Wemett of Public Relations are both at 603-886-9050.

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1. Articles cited in *private line* appear in quotes.
2. *private line* articles are in bold face type and in quotes.
3. Newsletters, magazines and book titles are written in italics.
4. Books can be distinguished by the inclusion of an author's name. Thus,

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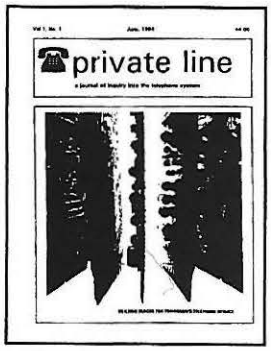

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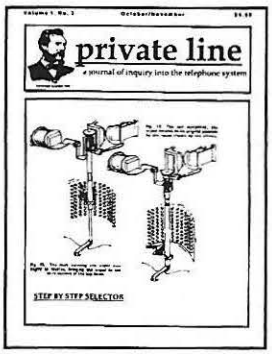

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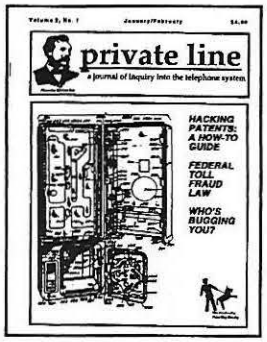

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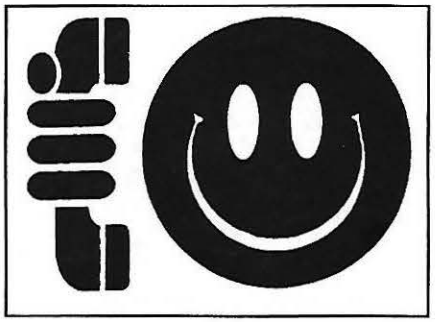

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