



**COOP'S
SATELLITE
DIGEST**



FEBRUARY 1983

APOLLO™ ZX

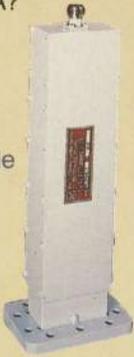
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TOP OF THE MONTH

BITS and pieces. Lest we forget that 'our roots' began in the garage workshops of North America, a timely reminder. Several CSD contributing authors make this issue something of a 'gadget month.' It fits. Winter time is an excellent period to spend some time in your own workshop thinking about things that don't work just as they should, trying to figure out a better way to accomplish some TVRO terminal task.

BIG time garage inventions are rare. But most 'big' ideas come from small concepts; you take the first step, make something new work, and then discover an entirely new concept opening up before your eyes. Once started, it is difficult to stop. That kind of energy is unbeatable; no amount of corporate muscle and R and D can match it. It is the stuff that America (all of America) is made of.

WE also look at LNAs and Reuters in this issue. For Reuters, there will be much more to come. For LNAs, there is new promise of a major breakthrough in yet another plateau of noise temperatures; perhaps late in 1983.

IN the mainstream, the Las Vegas STTI show is coming up in mid-March. Is the industry getting too big a head, and, too big for its britches? **Las Vegas?** Are we really there, yet? It's sometimes difficult to maintain your objectivity when you are 'on the inside'; a subject to be addressed in the March CSD. In the meantime, plan to go to Vegas; we'll see you there!

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OUR COVER — Timing. It's been below freezing for days, perhaps weeks. The roads are closed by a blizzard and your polar mount installations are frozen up all over the countryside. Is that what's bugging you, matey? TEL-VI's Rich Potts (left) and INTERSAT's Guy Davis prepare to 'sink' a perfectly good satellite receiver in the warm waters of the Caribbean, on Providenciales this past November. Potts (and Mrs. Potts, to far right), Davis are today wishing they were back on this beach. Provo's weather today? Low of 72, high of 85; sunny and light breeze. And that's guaranteed!



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COOP'S SATELLITE COMMENT

- PUBLISHER Integrity
- INTERNATIONAL Update
- DSB HYPE Begins

THE ZONING Squabble

We reported a couple of issues ago that a few of the more aggressive cable firms had talked their local city/town councils into totally forbidding, or severely restricting the installation of (home) TVRO antennas. The cable firms, I now learn, are working under the direction of a national organization to put the kabash on home TVROs by going into the city fathers and scaring them to death.

Let me share with you some of the arguments that the cable folks are floating to the city fathers:

- 1) **If home TVROs proliferate, the city loses money.** That one says that cable firms pay cities a 'franchise fee'; something between 3 and 5% of their annual gross. Cable operators consider this a 'business license tax' and the city justifies the fee for two reasons; they have given the cable firm their 'permission' to use public easements to string their cables and mount their amplifiers, and, the city has to 'regulate' cable and regulation costs money. So if bunches of people buy satellite terminals, dis-connect from cable, and cable dries up and blows away, the city gets less money to squander on parks and roadways. A good argument. But not very bright. A counter argument is that city's should accept that modern technology cannot be stopped by dumb laws that inhibit free access to media, and if the city is worried about losing revenues, let them charge individual TVRO owners a \$25 annual fee to 'regulate the zoning' that goes with home TVROs. If the average home spends \$15 a month for cable (that's a good national average, these days), they give the cable firm \$180 per year. Five percent of that is \$9 a year. So if you counter that the city charges a 'zoning fee' of \$25 a year for home TVROs, the city actually makes **more money** if everyone gets off of cable and buys a home TVRO. Go get 'em!
- 2) **Home TVROs are pirates.** That's a strong pleading. The best answer here is to recite SPACE, chapter and verse, pointing out that **no court** at any level anyplace has found individual home TVROs to be in violation of anything relating to Section 605 violation or piracy or anything resembling piracy. Point out that **this** is a federal matter, pre-empted by federal legislation, or in the worst case, a matter for civil suits in a competent court of law. In no event is abridgement of the first amendment rights of a homeowner (i.e. access to media) a matter for local councils.
- 3) **Home TVROs look terrible.** This is primarily an argument presented to zoning boards or city councils seeking to modify their existing zoning regulations. Case law on aesthetic zoning is replete with virtually no victories for people who try to tell a neighbor what he can and cannot do on his own property. That does not stop municipal entities from trying to stop people from raising chickens on their front lawns or keeping boats in their attic. But even after councils **adopt** regulations telling people they can't do this, or that, on their property, when those cases go to higher courts, invariably the zoning folks lose. These laws only stick when the person getting zapped gives up after a local decision.
- 4) **OK, let them have a TVRO. BUT - keep them 'small'.** This is one of those back slapping, "Boy, are we clever . . ." moves.

Figuring that if they adopt a local law that simply **prohibits** TVROs, they will lose on court appeal, the smarter foes are urging the municipalities to **allow** TVROs **but limit the size** of the antenna. Some recent examples allow 2 foot, or 3 foot or even 4 foot antennas. But nothing larger. This may be a tough one to handle. The nearest legal history we have to this one involves ham and CB radio operators. Many sub-divisions, developments and cities have regulations on the books restricting **outside** antennas. Some tell you that you can't have an outside antenna of **any** type. The cable folks helped write that one. Others restrict the physical size (usually defined as height above ground) of 'antenna systems'. Many of the regulations that bother hams won't allow antennas more than 20 or 30 feet above ground; or more than 5 feet above the top of a roof. It turns out that for many types of amateur radio (or CB) operation, such regulations directly affect how far, or when, or how reliably, the ham or CBER can talk with his radio. We can all appreciate that a 'tall' transmitting (and receiving) antenna 'works further' than one that is stuck 5 feet above the chimney. So many (hundreds, actually) of hams and a few of the (brighter) CBERs have challenged such restrictions in court and have actually won the right to higher antennas. They have been able to prove, **with competent counsel and learned expert opinion** and testimony, that when a city tells them that their antennas can only be 20 feet high or five feet above the roof, that the city is really regulating their (free) speech. The courts have always been quite protective of freedom of speech and that helps.

This is a pretty complex issue to explain to a city zoning commission, a city council (on appeal), or a relatively low level court. You have to show them, in lay terms, that shortwave transmission and reception depends upon incoming and outgoing 'angles of radiation', ionospheric conditions, sun spot cycles, and antenna system design. You usually lose them about the start of the second sentence. The skillful who have done this report they kept it very simple, and hammered on the freedom of speech issue.

The case for TVRO antenna 'size' is far easier to explain. Most everyone can understand that a bigger antenna works better than a smaller antenna. Bigger is not the same as higher, so the analogy is not direct with ham and CB antennas. One fellow told us he took a copy of **CSD** to a zoning commission meeting and marked every page with antenna advertisements in it for the commission to glance at. What they quickly saw was that there are no 2, 3 or 4 foot antennas for sale. Then he explained that in some parts of the country, an 8 foot would work. In other parts it required a 12 foot antenna. They understood that. Then he asked that if they were bound and determined to adopt restrictive regulations, that they not open up the 'first amendment can of worms' by telling people that they could not have access to "all 100 channels of satellite TV that are available". He won and the city decided to turn a lemon into lemonade and collect some fees for home TVRO "antenna

variance permits".

I know that SPACE is working on a booklet to distribute through members to those city fathers who might be encouraged by local cable types of adopt restrictive or prohibitive zoning regulations. I'm not sure that the national scope of SPACE, with all of the federal problems we have facing us, is the correct forum to handle this one. **Ed Grotsky of Arunta Engineering** in Phoenix tells me that he and some others have formed what may well be the first **state TVRO dealer/distributor organization**. Ed ran into a problem when he put a TVRO into a relative's home in a town adjacent to Phoenix. After the installation, they discovered that the city fathers had very quietly adopted a '3 foot maximum TVRO antenna size' zoning regulation. As he dug into this, he found dozens of other Arizona cities and towns, working under the encouragement of Arizona cable TV operators, debating similar zoning restrictions. Ed called an emergency meeting of TVRO dealers, and a state TVRO association was formed. Now they are all working together to share experience, arguments, and legal expertise (plus funding) to head off this very real threat.

SPACE can certainly find the time to crank out a booklet that summarizes their legal recommendations in this tricky area. But there is no way that SPACE can bounce back and forth all over the USA representing the industry before city councils and zoning commissions. Not with the limited SPACE budget available, and, at the fees of Brown & Finn charge!

I'd suggest that every dealer and distributor reading this contact Ed Grotsky at Arunta Engineering in Phoenix (602/956-7042) to get some pointers on how Arizona is handling this problem. Arizona has a very strong, very savvy, very well funded state cable TV association. Their state cable association also has a nearby 'Quik Print' franchise and a postage machine. Right now, today, they are cranking out legal memos and 'advice' to the other 49 state cable TV associations telling them how to put a stop to home TVRO growth in their own areas. Even if your state's cable operators are not yet banging on municipal doors to get regulations adopted to shut **you** down, they will be soon. If you wait to circle your wagons until the cities start adopting regulations, you will have a much tougher battle to fight.

Get yourself up to speed with the Arizona situation, and then contact every other dealer and distributor in your state. This is a serious problem and it won't stop at the city or town level. With the new state legislature season coming up on us (it has already begun in many states), we can expect to see some efforts to get state wide regulations (read — laws) passed in this area. You may be able to handle a handful of towns in your area by yourself; to handle a threat of **state** legislation, you'll need the help and cooperation of every guy in your state in the TVRO business.

I'm sorry fellows, but you did this to yourselves. You sold too many terminals, you got too many newspapers and magazines to write about you, and you attracted too much attention. Now the foes are out in the open and they have far more experience in handling 'upstarts' like us than we have in handling 'pros' like them. It will be another interesting year for the industry.

ROBS

This is an official announcement of an industry gathering scheduled to take place in Las Vegas, Nevada during the forthcoming STTI shindig in mid-March. It will not make a great deal of sense to those who are not yet a part of ROBS.

ROBS, or, (the) **Royal Order (of) Blood Suckers**, will have a breakfast meeting at a location to be selected on the **second full day** of the STTI conference. Among the items on the agenda will be selection of a slate of officers for ROBS, an official motto, and an official insignia. There is some loose talk that Jon Spisar may be named 'patron saint' for ROBS but formation committee chairman David McClaskey refuses to confirm or deny the rumor. Guy L. Davis is in charge of the selection of a meeting site for this 'second organizational meeting' and all interim members of ROBS are urged to contact Guy **after** arriving in Las Vegas to learn where they should be for the spring '83 meeting, on the second day of the STTI conference.

PUBLISHING Integrity

Whenever one magazine prints something disparaging about another publication, you should also be suspect that the real motive for the 'attack' is hidden behind a flurry of 'holier-than-thou' words. I

know I am. I, of course, live a tad closer to the publishing world than most **CSD** readers so my skin can be expected to be thinner and I can be expected to be alarmed sooner than most readers. And I subject what I write to the same scrutiny I give what others write, as a matter of practice.

This is all by way of saying that I do **not** enjoy trying to come in after the fact to clean up another publication's mess. First of all, I dis-like giving publicity to something in print that is bad. There is an old saying "**I don't care what they say about me as long as they spell my name right!**". Many people will subscribe to a magazine just because they enjoy looking for publisher errors, or errors in publishing judgement. I suspect that virtually everyone in North America reading this already subscribes to **SatGuide/Orbit** and therefore there is little likelihood that anything I might say will build their circulation.

Let's set the stage just a tad.

David Wolford is not your everyday publisher. He came to visit me in my home in Arcadia, Oklahoma along about 1979 or so. He had recently sold out his Idaho cable TV systems for a big (big!) chunk of change, to a Texas multi-system cable operator, and Wolford was tired of laying around watching his money accumulate in the bank. He had his own private TVRO, and he thought he would try his hand at publishing. He came to me for various reasons, including I suspect my reaction. He wanted to provide a '**TV GUIDE**' for satellites. Naturally I thought it was a good concept, although he was hardly the first person to work it out. I cautioned him that if he had to rely upon the premium service folks (such as HBO) **directly** to get his listing information, he would probably find them less than cooperative if he made any play for individual, as in home, TVRO terminal readers. He agreed and said that he hoped to work that out by 'subscribing' to one of those large computer listing firms that will spit out for you listings on their computer, virtually ready for magazine paste up, for a fee. All you need to tell the computer service is what services you want in your 'mix'.

Early in 1980 Wolford brought out **SatGuide** and we carried a small, 1/8th page advertisement in **CSD** for it. We also applauded the effort editorially since at that point in time you had to subscribe to a wide variety of regional and state '**TV GUIDES**' to get anything approaching a semi-complete listing of all available satellite services. Having an Albuquerque guide for WOR and WTBS, and a New York City Guide for HBO and a Miami Guide for Showtime (etc) was a giant pain in the neck. Wolford made life simpler for all of us and when you compared subscribing to four or five regional editions of '**TV GUIDE**', and the expense of same, to subscribing to **SatGuide**, you came out ahead.

Not too many months after **SatGuide** started, Wolford dropped his 1/8th page advertisement in **CSD** claiming that HBO was threatening to cut him off from their listings if he 'continued to promote to home terminal readers'. I didn't buy that argument at the time, but if David wanted to tell me that was his reason, that was fine also. That he was taking 'heat' from HBO et al because most his guides were going into private terminal hands was **not** in question. That HBO was in a position to do anything to him, because of this 'quirk' in his distribution, was in question. I finally decided that since David was a recently retired cable TV system owner, and a wealthy one at that, that he still had some cable TV loyalties and perhaps some friends whom he couldn't face directly as long as HBO was mad at him. If you watch David 'working' at a show, you quickly realize that he is very concerned about his appearance, and what others think of him. Some people get that way after suddenly acquiring a large bank account.

As **SatGuide** grew (the most recent 'official' publishing statement, which must be printed to satisfy Post Office regulations annually, shows it has just under 12,000 paid subscribers), David's image of the importance of his publication changed. This fact was driven home to me during the Atlanta STTI show when several members of the SPACE Board of Directors got into a discussion concerning the newly formed 'SPACE Technical Standards Committee'. The discussion went something like this:

"**We have three months** to get a set of standards for receivers, LNAS and antennas. Three months or sort it all out and put it down in black and white".

END BROKEN JACK SCREWS

Contributing author Comallie deals with the problem of determining when your dish antenna (with a continuous, **non-indicating** motor drive mechanism) may be at or approaching either upper or lower limits of travel.

The 'Outer Limits Detector' provides a simple but unique solution to the possible crashing of your highly tuned satellite antenna with a motor drive attached into limit stops at the upper and lower ends of dish travel. Several other features are inherent in the design. Once you understand how the limiter works you will realize that it will be difficult not to accept the challenge of mechanization, and employ the system for many different purposes.

In the standard positioning system a DC voltage is polarity switched to a reversible DC motor to change the direction of dish travel; see figure one. However, if the dish is not stopped from moving in time, the drive motor can run the jack screw into its own internal limit stops and the mass of the dish plus the speed of the motor can carry the lead screw into its mechanical or friction clutch limits. And this can cause severe mechanical stress to the motor clutch and the dish trunnions.

By merely cutting the two wires in your existing drive system, leading to the motor drive at the dish, and 'splicing in' the 'Outer Limits Detector,' we eliminate this problem. See figure two.

As shown in figure two, the limit detector consists of two mercury switches (Radio Shack part number 275-27 at \$1.19 each and two diodes, 3A at 400 V, Radio Shack part number 276-1144 at \$.60 each).

The two mercury switches need not be at opposite ends of the dish mount system. They could be placed inside of a small box, with the diodes, mounted so that opposite ends of rotation cause the mercury to move and the switch to close. The 'sense' of the tilt or turn on/ turn off angle is preset by the user at the time of installation. When the tilt of the motor drive reaches the desired region just ahead of the limit of travel for the dish jack screw drive, the switch should 'open' with the flow of mercury. This shuts off the drive to the dish, further, in that direction since the drive voltage to the jackscrew motor is wired through the mercury switch.

Now when the polarity of the up/down switch is reversed, switch two is bypassed by diode two and the current may flow to drive the antenna in the opposite direction. The dish will continue to drive until the antenna reaches the pre-set position of the other mercury switch. This, again, blocks the voltage in that direction and the dish stops moving. By this point the angle of the first switch has become such that the mercury has closed the switch and you may again go back in the opposite direction.

The mercury switches may be set to stop the dish at the upper (F4 presently) and lower (F3R or F5 presently) satellite locations. The dish

by Leo B. Comallie
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Alamogordo, NM 88310

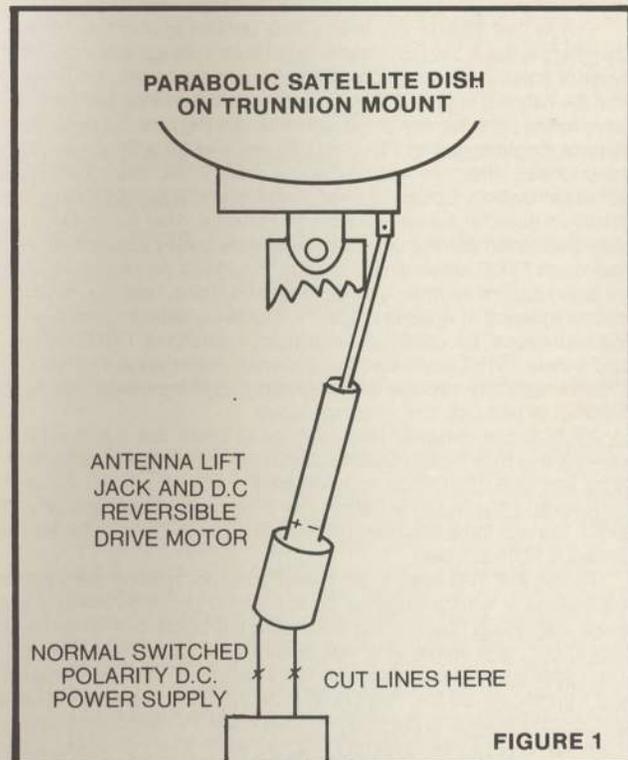


FIGURE 1

will then automatically stop at these 'limits' which gives an automatic stop control for at least a pair of the satellites. Switches could also be added for other satellites as well, such as preventing motion of the dish to F4, with a 'bypass switch,' to keep children from accessing some of the programming one finds in the evening time on (say) F4.

As the mercury switches are sealed in glass and the diodes can be

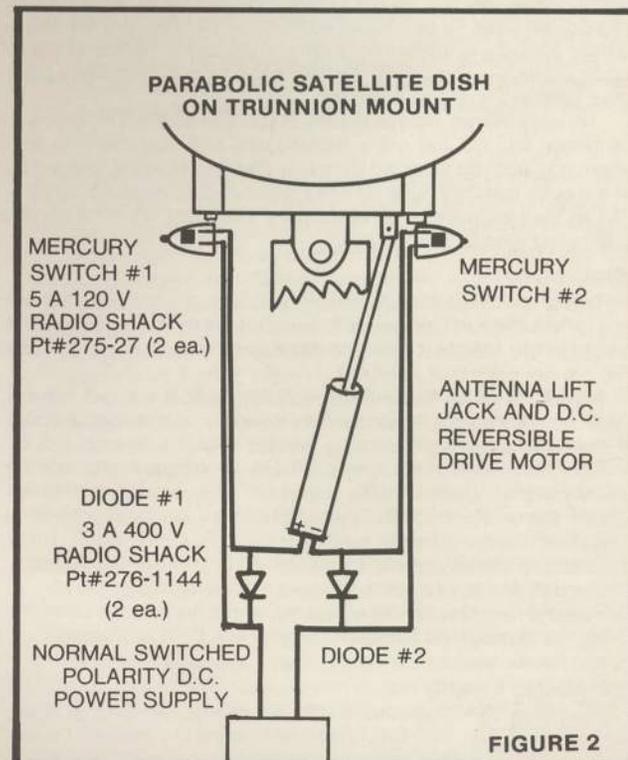


FIGURE 2

covered with a suitable shrink tubing product or silicone rubber, no moisture or mechanical wear should affect operation for many-many thousands of 'cycles.' Finally, it should be remembered that you started out on this quest to insure that your motor drive system does

not force itself against jack screw limits on either end and by employing a system such as this you should add many useful years of life to your jack screw drive system by cutting down any chance of unusual stresses on the drive system.

RETROFITTING A 33 FOOTER IN GUYANA

It should be noted at the outset that the author has no particular electronic training or background. There is, to the best of my knowledge, no other TVRO installation in Guyana (although one assumes that my results will spur many others to try!). I was able to construct and make 'play' my own TVRO armed with nothing more than four months worth of CSD, a copy of **Coop's Satellite Operations Manual**, a series written by Coop back in **Radio Electronics** (1979), and, a good friend who is a surveyor. In spite of these limitations, I judge that I have achieved some quite good first time results although some may marvel that any results at all were forthcoming.

Guyana is on the northern coast of South America, east of Venezuela. This is not an area of suspected high footprint levels and while I knew from CSD that some of the transponders from W4 were being received slightly east, and south of my location, I had no assurance that the signals would indeed be available here.

Like any TVRO installation project, mine began with the dish. It is not the sort of dish one would expect to find in TVRO service. First of all it is quite large by North American standards; 33.5 feet to be exact. Before you assume that an antenna that big has got to do something, let me note that this dish was a surplus 900 MHz telephone parabola used for 'scatter' communication circuits. The accuracy of the dish members is not good, by 4 GHz standards, and the surface was replaced with a great deal of 1/8th inch galvanized (steel) mesh surfacing. I have no way of making even an educated guess as to the effective real-world 'size' of the antenna but I would be surprised to find that it had the gain of any antenna larger than perhaps 18 to 19 feet. It is, in spite of its size, not a truly 'large' antenna when it comes to collecting weak satellite signals.

The three ton(!) monster dish was never designed to track satellites. In spite of this, I was able to achieve my first signals (F4) within 45 minutes of final hook up and turn on of the equipment. I do not have an ideal antenna mounting system; as the dish (with help) is moved westerly towards the more abundant satellite belt, the less the look angle to the equator became. To compensate it was necessary to keep raising the 'south end' of the dish. Once I got the hang of making all of those adjustments, it really worked quite well. But one does not simply push a button and see the dish track across the sky with this arrangement!

After finding F4 (barely watchable on the **only** visible transponder, TR8) I found some excellent (by my judgment) signals on Westar 4. From CSD I had been alerted that the vertical transponders on W4 should be the strongest signals in this part of the world, from a North



TELECOMMUNICATIONS in much of South America is so poor that nobody could ever depend on it to stay current with stock market variations. That was before FNN became available on W4. Their '15 minute delayed' set back is no problem to us; we are accustomed to '15 days delayed'!

American domestic bird. On W4, those (vertical) are the even numbered transponders. What surprised me was that while the vertical transponders are very good (either just slight sparklies or at-threshold level no sparklies), the horizontal (odd-numbered) transponders are better than the vertical.

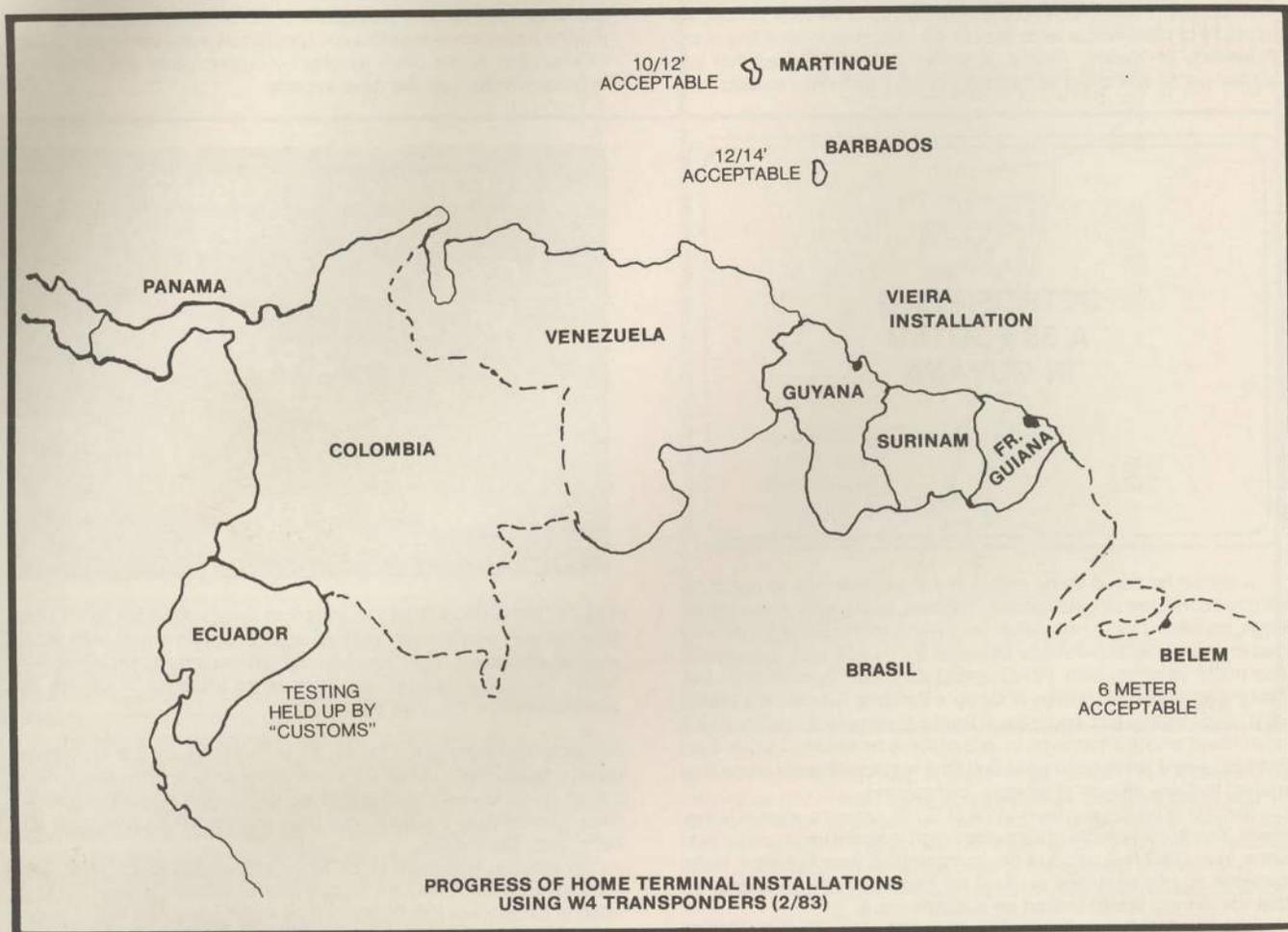
My system, in addition to the 33.5 foot resurfaced 900 MHz dish, consists of an AVCOM COM 3 dual down conversion receiver, an LNA rated at 87 degrees Kelvin, and a feed which I acquired from Spacecoast in Florida.

I have read from past CSD's that receiving terminals located in South America often experience sudden enhancements and degradations in received signal levels at random, or cyclic times. I can add to this that my own experiences are similar, especially in the evening hours. I refer to this as 'drift' and it usually occurs around 7 to 9 PM (EST). I have not noticed this change in signal level during other hours of the day. I recall from CSD that Mario Yepes' experience in



MAJOR US network news is one of the primary joys of satellite reception in Guyana. Following world events as they happen is a very enlightening pastime!

by A.J. Vieira
Versailles Estate
West Bank, Demerara
GUYANA



Colombia included improved reception during the nighttime hours. I can verify that this is **also** the case here in Guyana, but the change is not significant; perhaps 6 to 7 microamperes on my COM 3 receiver meter. I have chalked this up, here, to perhaps a change in the ionization of the intervening layers of the lower ionosphere at night, and, a lowering of the ambient temperature of the LNA since it does cool off here after sundown. Longer term observations are certainly called for!

My 'drift' situation is, however, an entirely different effect. The picture will 'drift' almost completely out of the sparklies and then within a few seconds it will start to show the sparklies once again. I have heard that others in South America, dealing with extremely weak signals (well **below** threshold) will on occasion, in the evenings, see brief 'flashes' of perfect or near perfect signals (indicating signal increases of 5 to 6 dB). Once I got my antenna around to W4 and have had such good results, I am reluctant (given the amount of work taken to get this far) to let the system sit on a weaker satellite (such as F4) for long enough to observe whether this situation does indeed occur there as well.

Logic tells me that abrupt changes in the satellite's attitude, of this nature, are very unlikely. A satellite 'jerking around' in the sky like that would not, I suspect, stay in the sky very long. A signal enhancement of 5 to 6 dB suggests more than a minor attitude correction in any event since it effectively places me as much as 2,500 miles closer to 'boresight' than I really am. It would appear to have the earmarks of a propagation anomaly but the known propagation modes would not account for it according to my research to date. I do believe it might be very interesting to be able to observe two (or more) weak level satellites **simultaneously** from a location in South America, when this 'flashing' or 'drift' situation is occurring. Would both satellites have the **same** enhanced signal at the **same** point in time? Or, would there be a

'pattern' where the signal enhances first on one and then on the other by some 'patterned period of time'? The questions are many and more observations as well as close coordination between observers is called for. Perhaps others in South America will join with me to establish some type of logging and monitoring system for this occurrence.

Some explanation of my off-screen photos is called for; I sent to Coop a videotape of my reception (1/2" VHS) and he in turn photographed the videotaped reception on a monitor in the Turks and Caicos islands. The point is that the reception has been degraded by the 1/2" videotaping process and allowance should be made for that factor.

Results: (Westar 4 at 42 degree elevation angle)

- 1) Odd numbered transponders (horizontal polarization), transponders vary between 32 and 50 (50 is adjusted on the COM-3 for just **above** threshold reception) during the daylight hours.
- 2) Even numbered (vertical) transponders average between 29 and 41 on the same meter during daylight hours.
- 3) Odd numbered transponders average between 37 and 50 (+) during the after-sundown hours (an average improvement of 5 microamperes).
- 4) Even numbered transponders average between 30 and 45 during the after-sundown hours (an average improvement of 4 microamperes).

In addition to the 'flashing' and 'drift' phenomenon, there is also a fluctuation in levels which in some ways corresponds to the older Westar (1, 2, 3) and Comstar (D1, 2, 3 and 4) 'spinner' birds I have read of. This fluctuation, almost like a 'pumping action,' sounds very similar to the rotating junction between the bird antennas and the RF wave-guide sections which one finds on the older 'spinner' birds. For



Open New Doors in Multiple-Receiver Systems With the DX Receiver

Now DX Technology makes multiple-receiver mini-systems cost effective. The DSA 642 is a commercial quality satellite receiver that features dual, **block downconversion** through the DSA 541 down-converter. This makes possible interference-free reception in systems serving from 2 to 20 or more TV sets with one antenna. Furthermore with a coaxial switch it gives full 24-channel selection on each receiver.

The unit is housed in a handsome woodgrain-finish cabinet which measures approximately 2½" × 17" × 12". The large, easy to read signal strength meter, lockable audio tuning dial and video fine tuning dial give complete control and the "hi-tech" look blends attractively with the surrounding decor.

DX also provides line amplifiers, power dividers and other accessories compatible with the DSA 642 to complete the

system design.

DX, having pioneered the development of 12 GHz satellite reception, is one of the most respected names in satellite television reception systems in Japan and throughout the world. For more information, contact us today.

DX Marketing Group. C. Itoh & Co. (America) Inc., 270 Park Avenue, New York, NY 10017 (212) 953-5217. Manufactured by DX Antenna Co., Ltd., Kobe, Japan.



example, the meter will pump or fluctuate between 45 and 50 on transponder 23, or between 30 and 35 on transponder 22 (etc.). What is unusual is that this effect is only noticed on certain transponders and then only at certain times; usually, at night just after dusk. It happens on both vertical and horizontal transponders. Once again, more observations and detailed record keeping needs to be applied to the situation.

In closing I would like to emphasize that prior to becoming in-

terested in this type of activity, I had no electronics background and was totally unprepared for the tasks involved. Yet I did get pictures, surprisingly good pictures within 45 minutes of turning everything on, with a dish that does not track and can only be moved with considerable effort. Based upon this I would encourage others who think they may not be up to the challenge to jump right in; the water is fine, and having real world television for the first time is absolutely superb!

FIND THEM EASIER WITH TRS-80

Traveling about North America, or the world, inspecting potential satellite terminal locations, sounds very exotic. One of the first things you learn to be prepared for is that inevitable first question. It usually comes just as you are stepping onto the grounds and surveying the local skyline situation. "How many satellites can I receive?"

Tired of educated guesses, and attempting to explain that it will depend upon the look angles, trees, buildings and so on. I decided to investigate programming the recently introduced Radio Shack TRS-80 Pocket Computer for its abilities to provide a large amount of potentially useful satellite location data, in a small package that could be tucked into a briefcase or overnight bag.

The program shown here may be used directly in a PC-1, or adapted as necessary for most of the personal computers available. The rules for use are as follows:

- 1) **Northern latitudes** are entered as positive numbers; southern latitudes are negative numbers. Western longitudes are entered as negative numbers, eastern longitudes are entered as positive numbers.
- 2) **Degrees and minutes** are utilized rather than decimal values.
- 3) **The signal strength** (carrier to noise ratio) portion of the program assumes values typical for TVROs. Experience shows it comes out close for a wide variety of installations. I have also used the program to 'expose' certain equipment as being sub-standard, as well as revealing equipment which operates in a superior manner (i.e. if, after installation, a system operates below projected computer levels, I suspect the equipment; if it works better, I also suspect the equipment!).

The PC-1 is a very handy tool and it goes right in my 'kit bag' along with my compass and inclinometer. There is plenty of memory to add other important information, such as cable attenuation at various frequencies or conversion from noise temperature to noise figure. If several of these additions are made to the basic program, there are space savings which could be made in the primary program. You are, truly, only limited by your imagination!

By Bill Miller
Technical Manager
PROMAR
P.O. Box 22133
Tampa, Fl. 33622

PROGRAM FOR TRS-80 POCKET COMPUTER PC-1

Runs in "DEF" mode. Hit shift A

```

15: "A" PRINT "SATELLITE TV NUMBERS"
16: INPUT "ENTER ANTENNA GAIN DB"; D
17: INPUT "ENTER ANT NOISE TEMP"; N
18: INPUT "ENTER LNA NOISE TEMP"; T
19: INPUT "ENTER EIRP FROM CHART"; E
20: INPUT "ENTER SITE LAT + DEG"; X: LET B = DEG X
21: INPUT "ENTER SITE LONG-DEG"; X: LET A = DEG X
22: INPUT "ENTER SAT LONG-DEG"; X: LET C = DEG X
24: LET M = D - 10 * LOG (N + T): LET S = M + E - 42.6: LET G = ACS
    (COS (A - C) * COS (B))
26: LET Y = A + .01
28: GOSUB 300
29: BEEP1: PAUSE "STILL COMPUTING"; BEEP2
40: GOSUB 400
42: USING: "####.##": BEEP1
44: PRINT "CNR STRENGTH IS"; S; DB
50: LET X = DMS Y: PRINT "POLAR MT ANG IS"; X; "DMS"
51: LET X = DMS V: PRINT "SAT ELEV IS"; X; "DMS"
52: USING "####.##"
53: LET X = DMS Z: PRINT "SAT AZ IS"; X; "DMS TRUE"
54: END
300: LET Z = 180 + ATN (TAN (A - C) / SIN (B))
301: LET R = (1818590000 - 536950000 * COS (G))
302: LET V = -90 + ACS ((R * R + 40538000 - 1778000000) / (12734 * R))
303: RETURN
400: LET L = ACS (COS (A - Y) * COS (B))
402: LET R = (1818590000 - 536950000 * COS (L))
403: LET Y = -90 + ACS ((R * R + 40538000 - 1778000000) / (12734 * R))
404: RETURN

```

CIRCLE THE WORLD / SEE EVERY BIRD IN THE SKY!

Twelve days have passed since I boarded my first plane in Miami on November 29, 1982. In this short time I have circled the globe, met heads of states, experienced different cultures, and at times felt like I had gone back in time more than 200 years.

All of this gives me a great feeling of achievement because four years ago when I installed my first TVRO I felt sure that this technology could be used to bring people closer and help to make this world a nicer place to live in. We as a company have done our part in spreading the technology all around the world with pioneer installations on

The Paraclipse EarthStation

When you own a Paraclipse High Performance Satellite Television System you gain a whole new perspective on the World. Paraclipse gives you access to more entertainment and information than you ever thought possible. Movies, Sports, Specials, Music, News and Educational television like you've never seen before.

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every continent; the most recent 'pioneering' installation coming in the Phillipines just a short 12 days ago. Well, let me start at the beginning of a most unforgettable 12 days.

This installation came about because of a big golf tournament which was played in Manila on December 2. It is called the President Marcos International Golf Tournament, in honor of the head of the Phillipines. This meant that this project had to meet two requirements:

- 1) It had to work perfect.
- 2) It had to be in operation before December 2, 1982.

We were contacted two weeks prior to the 'due-date' by **Will Bone** of Bone and Company. He asked us if we would be interested in doing the project for him. I said we would and it was decided that he would send me some pictures of the site and all requirements for the job. When the pictures arrived I realized that this was not going to be our typical 6 meter 'world-class' installation. The site was one mile from the hotel and the President's home, which meant very long cable runs. We had to come up with a complete **wireless** remote control that would position the antennas, rotate the feed, change the channels, and tune the audio. Plus a low power TV transmitter to deliver the signal to the three prime sites. No small project, and it had to get done in less than a week!

I called several industry sources to see if anything was available off the shelf that would do **all** those functions. I quickly realized that to interface everything together we would have to build it ourselves.

I decided we would use a TV transmitter in the 220 MHz range to feed the signal to the three locations, and a radio link on 450 MHz with touchtone pads to control all the different functions at the antenna site. All this was going to take at least a week to build, and Thanksgiving weekend was coming which meant two days lost of that week. Will and I decided to send Gary Willhoite from our company ahead with him,



HOW DO YOU move a 20 foot dish to the top of its support stand in the Phillipines? Build a **MAHOGANY** ramp!

by
Bob Behar
 Hero Communications
 Hialeah, Fl. 33012

That intrepid 'satellite traveler' has topped himself again. Off on a 12 day 'around the world jaunt', starting off with a private TVRO installation for the President of the Phillipines, **SPACE President Behar** did something perhaps nobody has ever done before. By circling the globe, stopping several times to watch television on 6 meter terminals manufactured by his Florida concern, Behar actually saw and recorded television transmissions from **each** of the world's operating 4 GHz satellites! You may never install a terminal for the President of a country, or a Shiek or a Crown Prince. You may never circle the globe watching satellite television from dozens of 4 GHz birds. But you'll never find out if you could handle such an assignment if you **stay** on your duff in Ottumwa or Abilene wondering how much lower LNAs may drop next month!



and they would start assembly of the antenna as well as trying to select a site closer to the hotel. Meanwhile, I would stay behind and work closely with Bob Brown from our engineering staff to build up all the equipment in case a closer site was not found.

Once in the Phillipines with the antenna, Gary had the antenna all built and mounted. He found a site **only** 1000 feet from the hotel which made the cable runs easier to compensate for.

When I arrived Gary was carrying on about how the local help had built him a ramp made out of **mahogany** with which you could 'walk' the antenna up to the mount. As a matter of fact, you could have probably turned the ramp upside down and sailed it back to Miami!

After my 30 hour plane ride followed by an unforgettable 90



CONTINUED / page 17

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Just demo it once, and you'll agree.

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The prices of our Satellite TV Reception Systems are extremely competitive.

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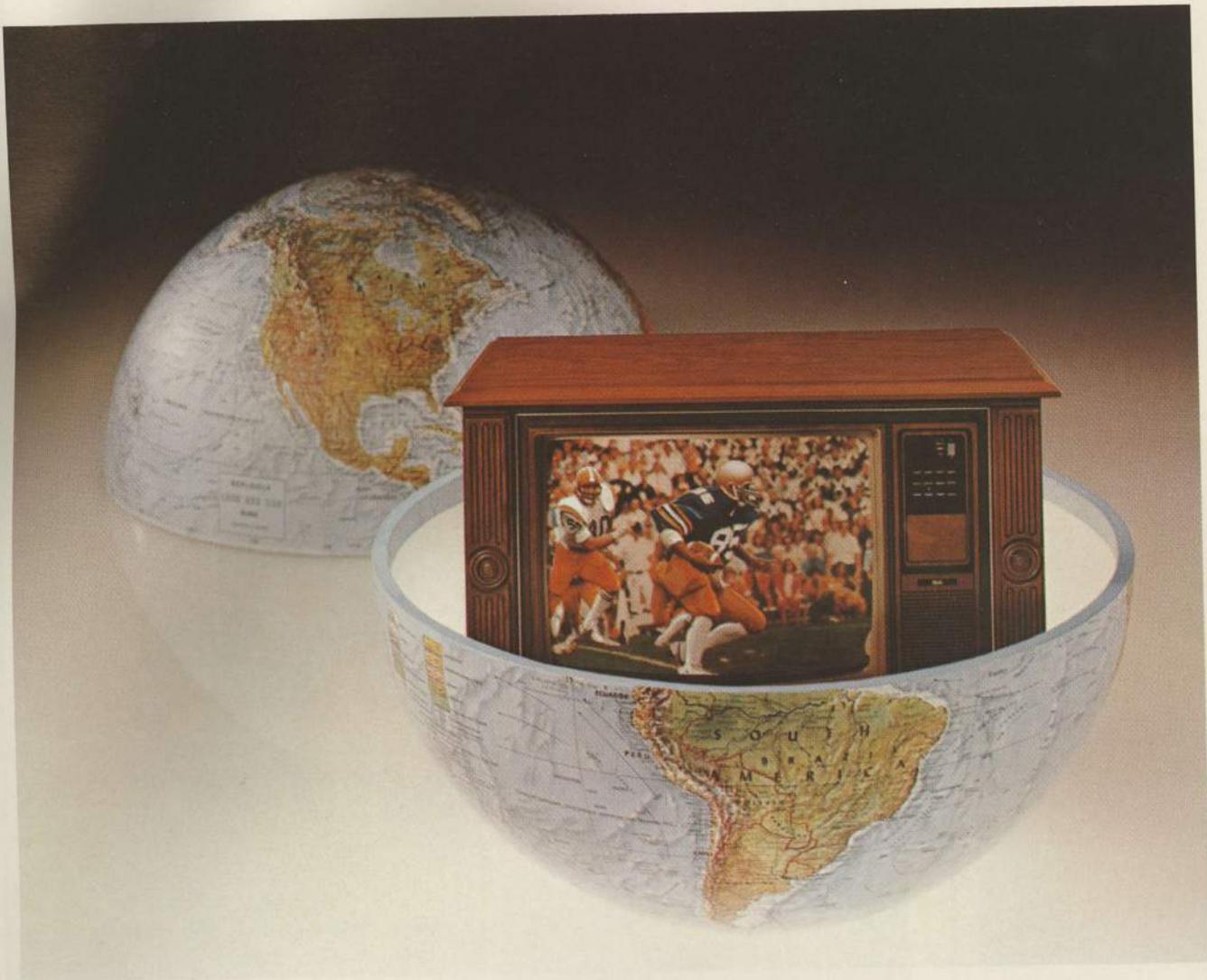
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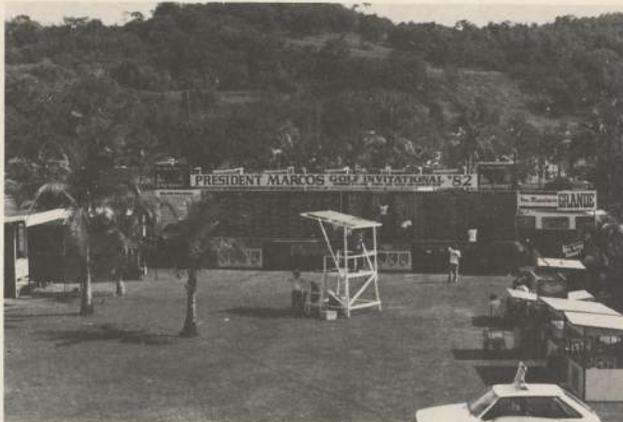
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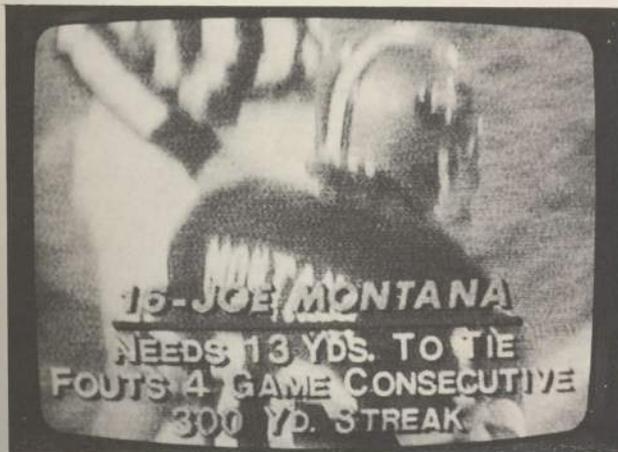
minute bus ride to the site during which about three times I thought I would never make it, **all I wanted to do was to go to sleep.** Yet I had lost one day by traveling and another one when I crossed the International Date line so it was December 1, 1982 and this system had to be up and working by that **same** day!

Gary had the antenna aligned and **all** that was left to do was to mount the transmitting antenna for the TV link to the President's home and out to his club house, and, run 1000 feet of 12 conductor cable and RG11 from the site to the equipment room. No small job to accomplish in less than 12 hours.

I met Will and Gary for lunch after I had deposited my luggage in my cottage, and we decided that each one of us would take some of the local help and divide the work up. By 10 PM everything was in and operating. The modulator was feeding satellite signal to the complete hotel compound two hours ahead of our deadline.

We were all very tired and called it a night. The next morning I went to the President's home to install his receiver and a **7 standard** (!) TV monitor which I had brought from our office. The transmitter was seeing the signals from **Palapa** and was achieving a 48 dB signal to noise ratio, which is what its specs say it will do. After lunch Gary and I decided that it was time to go 'people hunting' on the satellite and we took off across the entire orbit belt. The results in that part of the world were good and as we arrived at the Intelsat that sits over the Pacific carrying the two Australian TV services on a separate transponder, I saw some traces of CBS TV logo!

By that time, Will and John were in the equipment room with us and I could sense Will's thoughts. "**Boy, if this picture could be made**



"WE WOULD LIKE to go shopping." And a helicopter was at our disposal!



PRESIDENT MARCOS (center, light shirt) arrives at the site.

usable, what a market!" John was saying the pictures we were getting were only possible from a 'big' dish; not a six meter. I always get a big pleasure when I work with an 'old timer' in satellite transmission systems. Their minds have been brainwashed by the manufacturers into believing that you must work with lots of margin and that Intelsat reception requires a minimum of 11 meter of antenna.

John set up the Phillipines **domestic** satellite systems so he came with the idea of everything having to be **big**. He said to Will that the **CBS** signal would require at least an 11 meter dish to make it useful. I like challenges, so I told Gary to pick up a pair of walkie-talkies, and handful of different manufacturers' LNAs, **and**, the **circular adaptor** for the Chaparral feeds. After two hours of thorough step by step comparing of LNAs and alignment of antenna, we had a picture that was very useful. John made the statement, "**You have made a believer out of me.**" With that behind us, and **CBS TV** being pumped to the hotel, the clubhouse and the President's mansion, Will, his lovely wife, John and myself started discussing marketing plans. Will has the right ideas on how to market in that part of the world. He knows the market very well because of all his other companies in the area. He is also teaming up with a **very** influential partner and with John taking care of the technical end, he has put together an unbelievable team.

The people we worked with made this installation one I will always remember as being one of the nicest installations I have had the pleasure to be involved with. For example, I mentioned that I would like to do some souvenir shopping in Manila, and the next thing I knew we were being transported by **helicopter** to Manila! For Gary, his



CBS HALF WAY around the world. Now courtesy of AFRTS, all three networks are available worldwide!

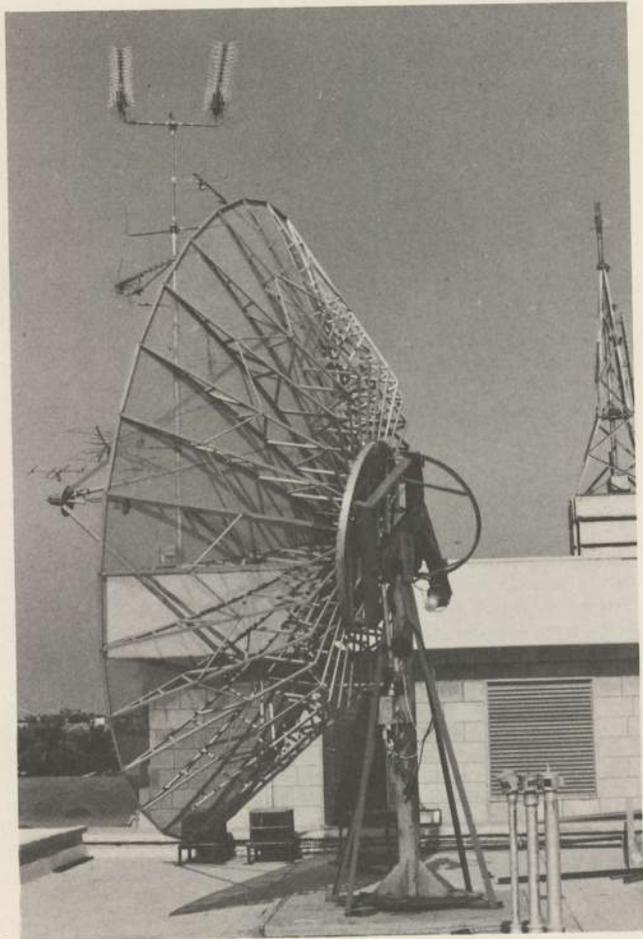
'reward' was his trip home was rerouted via Hong Kong for a weekend of rest and relaxation, before returning to Miami.

We are now in the process of shipping 7.5 meter antennas to Will in the Phillipines so he can make the CBS service perfect. The extra 1.8 dB of signal over the 6 meter will make that picture just snap out and grab you.

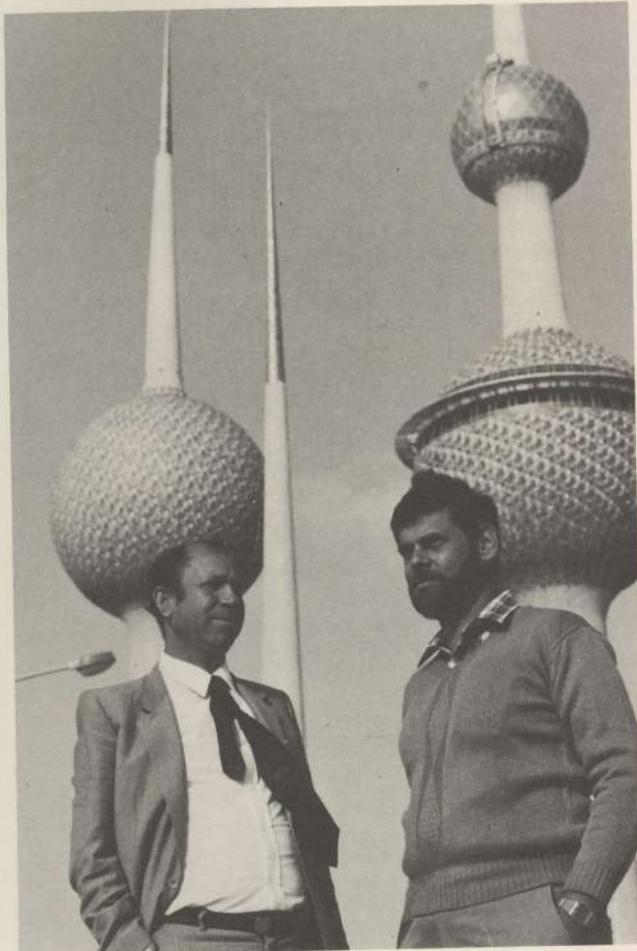
With the success of the Phillipines behind me and Gary in Hong Kong, it was time for me to leave this tropical paradise we were in and travel to Kuwait. We had installed a system there for one of the Sheiks and he had plans he wanted to discuss with me about marketing, and, the legality of the whole venture(!). It was also an opportunity for me to install in his system our new modification to the polar mount which allows for correction of the drift of the Intelsat, Symphonie, and Gori-zont satellite. After spending three days playing with them I can tell you they do drift alot.

I arrived in Kuwait at 4:00 A.M. Sunday, December 5, 1982, and as in the Phillipines I was met at the plane by 'officials' and customs there was no trouble at all. The engineer I had my original dealing with in Paris, Mr. Ahmad Asaad, was waiting for me. On my way there and over breakfast, I was brought up to date on their plans, and they were very big. I slept for six hours, and in the afternoon I was escorted to the Sheik's palace. I met with him and found myself enjoying the conversation pertaining to how they perceive this technology to be used, and their marketing ideas. It was 4:00 P.M. and he left for his office and I proceeded to his suite to see how the equipment was performing.

Unlike the Phillipines where we had satellite signals all day long, in Kuwait there are only a few signals available before 7 PM. I found out that the dish was not tracking the belt properly, and I was told by one of



KUWAIT / Atlantic, Indian Ocean and Pacific birds are available here.



ENGINEER AHMAD ASSAD (left) led the planning task force for the Sheik. Not your typical downtown Miami skyline!

his servants that they were sometimes moving the base (!) to get a 'better' picture. This bit of information told me the satellite drifting problem was real and my modification would solve that.

We were told to stay for dinner at the palace, and after dinner we set out a plan to add the modification the next morning. The next morning I was taken to the palace at 9:00 AM where we worked welding the new motor on the base, and added some extra bracing for high wind and sand storms.

After lunch I was given a tour of the palace. Well, my conception of what being rich was changed rapidly with every new part of the palace I was shown! When we passed the movie theatre, the gym, and the bowling alley, I thought that was neat. Everything in the guest quarters was done beautifully with nothing but the best in decoration. Then came the tour of the garage and there was where I was really impressed — a complete machine shop! On premises was one garage where he keeps his favorite cars. When I say cars I mean cars. There were 22 in that area plus all the others that were not kept under cover. Then they showed me the stand-by generator room. You could run the city of Hialeah with it. Then came the yards and so on. My definition of being rich has taken on new meaning.

We finished the modification and that evening after dinner I showed the Sheik how his new control operated. Together, we stayed up until 1:00 AM watching the different services and studying how much the satellites drift.

The next morning I met the Sheik at one of his other palaces where we will be putting in another system for him. After that meeting I went shopping for four-standard monitors and recorders. I had about

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Let's face it, all dishes pretty well look alike, have similar features, and often offer the same quality of reception. So what's the difference between other dishes and a Fullview dish? Quite simply, our price. And that really does make a difference when you consider that at Fullview Satellite Antenna Co. we are not only concerned with price, but also with quality and performance.

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- A mesh dish that adapts beautifully to the environment
- The ball-bearing actuator is at chest height for easy operation
- Every set is complete so there are never any surprises when you open the box

And because of our low prices you will enjoy maximum profits. There's no question that with the Fullview dish—if you've seen one dish you haven't seen them all.

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THE SHEIK'S BEDROOM controls include five separate television receiver hand-held remotes.

12 different stores to go to so walking was the simplest way to get around. Just as the Sheik owns so many cars, so did all Kuwait residents and you can't find a parking place in this city.

I looked at many brands and selected the ones with the most features for the price. The prices of electronic equipment there is about 10% to 20% **lower than** in the U.S.

That evening during dinner at the palace I received a phone call from a Mr. Elias Elias requesting I meet him in Saudi Arabia. I told him I was preparing to go home and that I didn't have a visa for Saudi. He answered, "**My friend, if you say yes, everything will be taken of and we will pay all expenses you incur.**" I said yes, and within a few hours I was receiving a call from the Saudi Embassy. They were sending a car for me to pick up my visa! I quickly realized that I was on my way to see a very influential person in Saudi Arabia. You don't receive a visa for Saudi Arabia unless you meet a series of strict requirements, **and**, someone sponsors you.

I finished my conversation with the Sheik and asked him if he shared my ideas for marketing system in the area and if he felt pleased with his service. Both answers were a resounding yes. As I was saying good-bye he presented me with a beautiful watch to show his appreciation. The next morning at 8:00 AM I received a call from Mr. Elias

and he said all arrangements had been made for my flight and for me to be at the airport at 3:00 PM. I said to him that I was tired and needed to be home by Friday at the latest. He said I would be having a meeting with **Prince Abdul Ben Aziz** and that I could meet with him on Thursday afternoon and leave on a flight that night. Knowing how these meetings are I had my office in Miami read me off all the different travel arrangements I could make to reach New York by Friday afternoon.

I **arrived in Saudi Arabia** at 5:30 PM, and quickly realized that I had traveled back in time 200 years. Their culture is the most strict of the Arab world. No women on the street unless they are completely covered with black, **including** face and hair, No liquor, no night clubs, no intermingling of the sexes. Total and complete censorship on video tapes, magazines and pictures that are brought into the country. No **women secretaries — they aren't even allowed to drive!**

I was taken to the Prince's palace and was given a tour. Again, I **was** impressed. The Prince arrived at 9:30 PM and was full of questions about the technology. We had a pleasant meeting that lasted until 11:30 PM. By that time I had missed **both** the direct flight to New York **and** the one via London, so the ticket was rerouted via Frankfurt to New York to Miami.

As a result of this globe circling trip, I had the opportunity to view **every** 4 GHz service that is currently operating around the world! From the Phillipines, we worked with 2 Russian Gorizonts, 2 Palapas, 2 Indian Ocean Intelsat and the 2 Pacific Intelsat. From Kuwait, 4 Gorizonts (2 over the Atlantic, 2 over Indian Ocean), 2 Intelsat over the Indian Ocean and 3 over the Atlantic. From the US all the domestic satellite plus the 3 remaining Intelsats over the Atlantic.

This is (I suspect) the first time that someone has **seen and recorded** all the services around the world. This information will prove very valuable in the worldwide marketing of private TVROs. It also has personally given me some understanding about how people in **very** high positions of power around the world view the US, our capacity to provide them with new technology, and how they make use of it by not changing their way of life or culture for it but by making it fit into their way of life.

I am now on the last leg of my trip — New York-Miami. My luggage and the three TV sets are lost somewhere between Saudi Arabia and New York. Let's see how many days it will take to find them, if at all! I must say that clearing customs without any luggage in New York was a pleasure but it could turn out to be an expensive one.

I have enjoyed the trip and all the people I had the pleasure to meet and work with. Yet after 12 days and the 24 hour plane ride, it will be nice to be home again.

TRACK FIGURE 8 BIRDS

Contributing Author Drew suggests a novel method of 'tracking' those Intelsat/Ghorizont/Symphonie birds which defy geo-stationary orbit logic and drift north and south of the equator in a 'figure 8' pattern (see **CSD** for December 1982; page 19).

Some readers may be wondering why a sane person would want to adjust the declination of a TVRO dish. Reference is made to the December issue of **CSD**, page 19, for a report by English engineer Steve Birkill for the logic behind such apparent lunacy.

It is true that a properly installed polar mount will, indeed, track all of the geostable satellite positions to within a small fraction of a degree. However, some commercially available antenna systems happen to have a fixed declination offset of approximately 4.5 degrees and in states that are not located in the mid-section of North America, performance can be improved by a small adjustment to the declination as the dish is moved through the satellite belt.

Perhaps an even more important use of a declination adjustment for a polar mounted antenna system is to track those strange offset satellite birds that do **not maintain** absolute location integrity precisely above the equator. One of the worst offenders in this area that I have observed is the Symphonie bird with a 3 degree offset, and the Ghorizont bird at 14 west which may have as much as a 2 degree 'offset.' In addition to these two birds, there are some Intelsat older series birds that wander about abit and the only way to keep signal levels 'up' with such birds is to track their location north (and south) of the equator proper. Otherwise you are limited to accessing these birds only during that portion of their 'orbit' day when they are at or near the equatorial 'crossing' point. And as your TVRO antenna becomes larger (and more sensitive) the otherwise 'small' north and south wanderings becomes more and more of a problem since your antenna beamwidth is compressed and you are less able to follow the bird

by John Drew
51 Canterbury Rd.
Mystic, Ct. 06355

SATELLITE TV SPECIALISTS

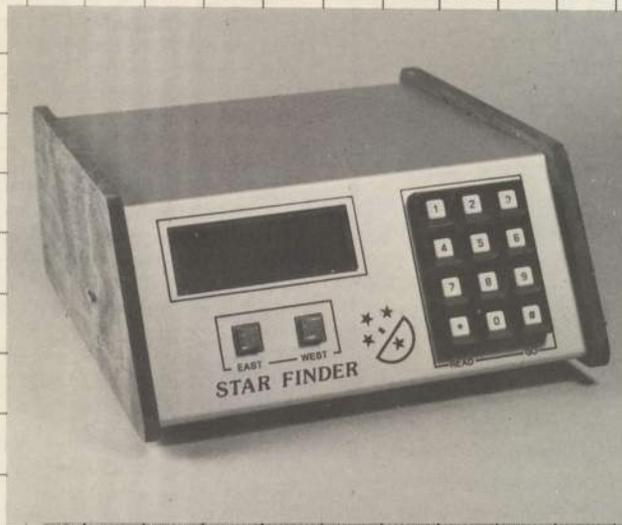
Features

The Star-Finder Satellite Antenna Remote Control. The micro-processor memory Star-Finder can pin-point each satellite and move your dish at the touch of your command. Check out this value, you'll get the picture...

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away from its perfect above-equator location.

If you think you would like to steer your polar mounted dish with an 'extra declination adjustment,' there are many mechanical ways to do this. However it has been my experience that adding jack screws, modifying dish mounting systems, and allowing for the extra tracking equipment may be more effort than most of us would like to tackle. A simpler method of accomplishing this 'offset tracking' is to **move the feedhorn!**

One possible instant concern is that if you move the feedhorn away from the focal point, the gain of the antenna goes down. Published information (reference no. one) allows you to calculate this loss. Experience with multi-horn or multi-feeds by SMATV antenna suppliers, however, suggests that the losses are very manageable. The loss is a function of distance the feedhorn is moved, the frequency of operation, the dish size and the f/D ratio of the antenna proper. A loss that is not unreasonable to accept is one dB. Remember, that if the bird is moving several degrees north or south of the equator, your **losses for bird movement** are far more than the 1 dB loss which you might design for by offset-moving the feed to track the bird proper. The following table will help you determine just how much your losses might be, and what you will gain by following this approach:



FEED SUPPORT in use by author for movement of the feed position to allow feed-tracking of the figure 8 birds.

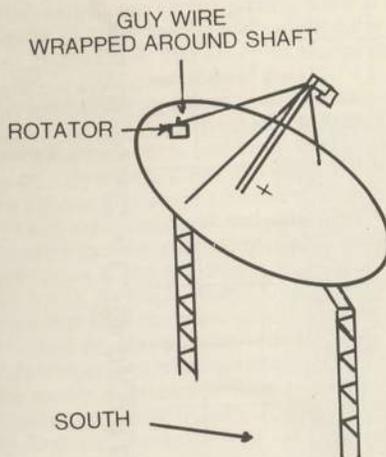
To move the feed antenna, a tried and true Alliance U100 rotor with the mechanical stops removed winds or wraps the top guy wire around a short shaft moving the feedhorn in the proper path to steer the dish \pm approximately 4 degrees in declination.

The rotor mechanical stop has been removed to allow more than a single rotation turn of the rotator. This is done quite easily by removing the screws holding the two halves of the castings together and then lifting out the small piece of metal captured between the castings. In fact, this piece can fall out when the two half sections of the casting are separated. At the controller unit, wire number 4 is connected **with** a 15 ohm resistor in series. The **addition** of the 15 ohm resistor stops the follower pointer from moving to the new position of the positioning knob (i.e. the knob becomes an 'up' and 'down' declination adjustment 'switch' as modified). Still, you retain a 'soft' click-click noise that reassures you that the motor out on the dish is winding, or unwinding the control cable on the feed positioner.

This adjustment now allows me to track Ghorizont very well at any time of day or night, and has given a small but measurable improvement on the two hemispheric feeds for Brazil on the Intelsat at 21.5 west and the feed for Venezuela on Intelsat at 27.5 west. All in all, this is a very worthwhile improvement for tracking of wandering figure 8 birds, and for those who may be having some difficulty getting their fixed-declination adjustment dishes to track over the full domestic arc, it could also be a worthwhile improvement.

Reference:

- 1) Silver; Microwave Antenna Theory and Design, Radiation Laboratory Series, Vol. 12, McGraw-Hill, N.Y. (pg. 488), 1949.



ADJUSTING FOR FIGURE '8' BIRDS WITHOUT CHANGING ANTENNA ELEVATION

f/D Of Dish	Dish Diameters				
	8'	12'	16'	20'	25'
.25	3.6	3.0	2.0	1.5	1.3
.30	5.4	4.5	3.0	2.3	2.0
.35	6.3	5.2	3.5	2.6	2.3
.40	11.7	9.8	6.5	4.9	4.2

In using this table, you are measuring or calculating the maximum distance you can move the feed for offset tracking and still stay at or below the 1 dB 'offset loss' parameter established. As you can see, dishes with larger f/D's are more tolerant of offset movement, while larger dishes have the opposite effect.

The feedhorn should be moved in such a way that it is maintained at a constant distance from the dish surface at the center point of the dish. This suggests the feed must move in an 'arc' that parallels the dish curve proper. My 16 foot dish has its feedhorn mounted on a mast that is guyed in three places 90 degrees apart as shown in **figure one**. A fourth guy wire going toward the lower point of the dish (the 'missing' 90 degree angle) was not required at **my** New England location since the gravity forces kept the feed 'hung in the right place' anyhow. People in more southern locations would have to configure a spring tensioned guy or other support for the lower (southern) edge of the dish if a system similar to that described here was employed.



ROTATOR mounted to allow 'wrapping up' the tension line for the feed support system, bringing the feed into a tracking inclination for figure 8 birds.

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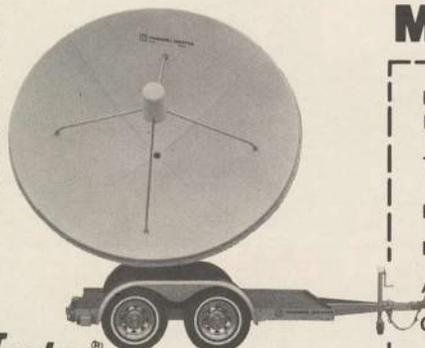
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A LOOK AT
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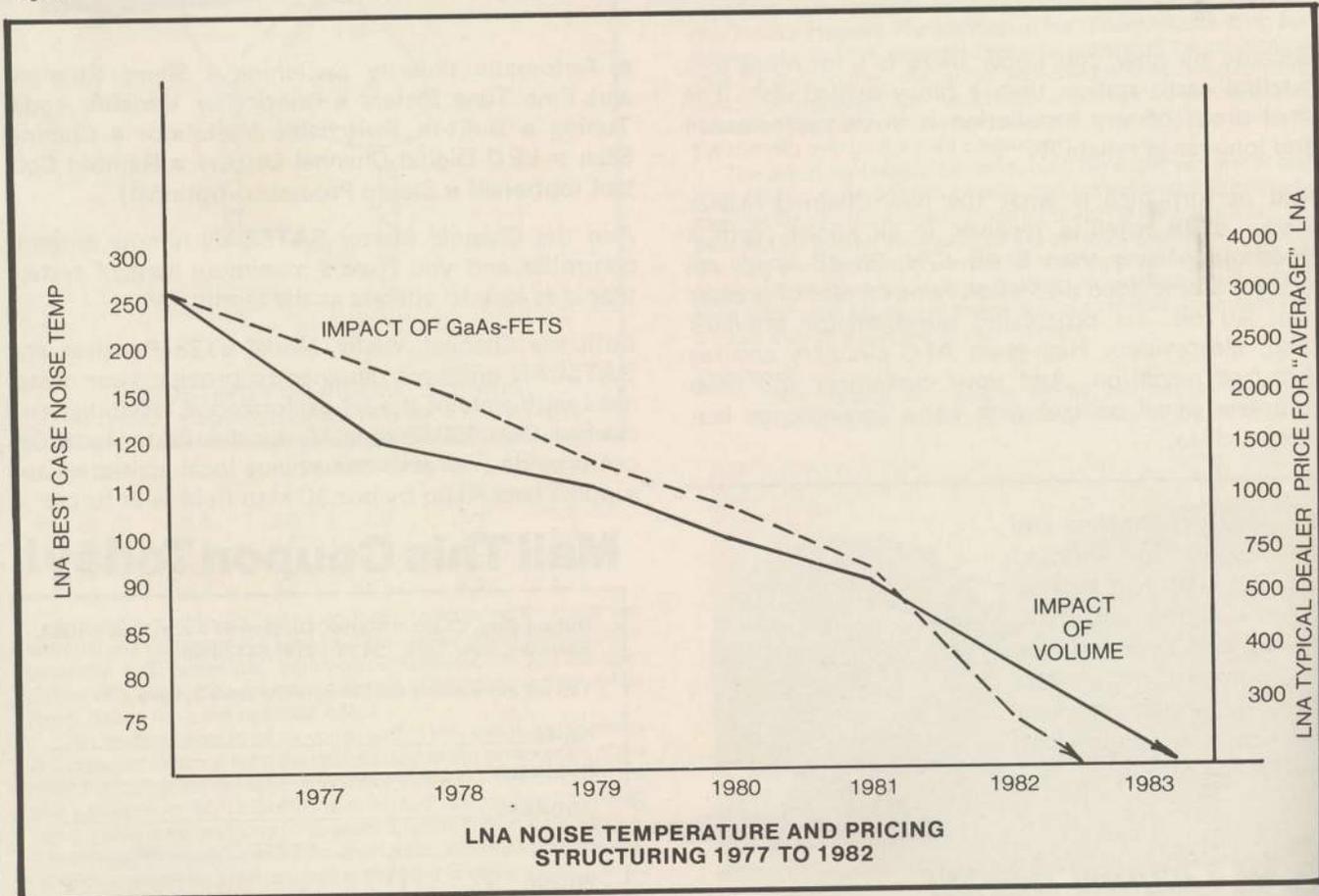
How Low Is Low?

A brief visit to the past. The time is 1976. The first commercial cable TVROs are being installed by Scientific Atlanta. A few months down the road, Andrew would join the marketplace and nearly a year later in would come Microdyne, US Tower, TerraCom and others. A cable system TVRO, usually 10 meters in antenna size, cost around \$120,000. That bought the cable system one Az-EI 10 meter antenna, one receiver and a pair of LNAs. The LNAs were generally noise figured rated between 270 and 300 degrees Kelvin. The extra LNA was a backup. It was hard to divide out the parts in those days, but if you could get a 'firm' quote on a 270 + LNA, it was in the \$4,000 region.

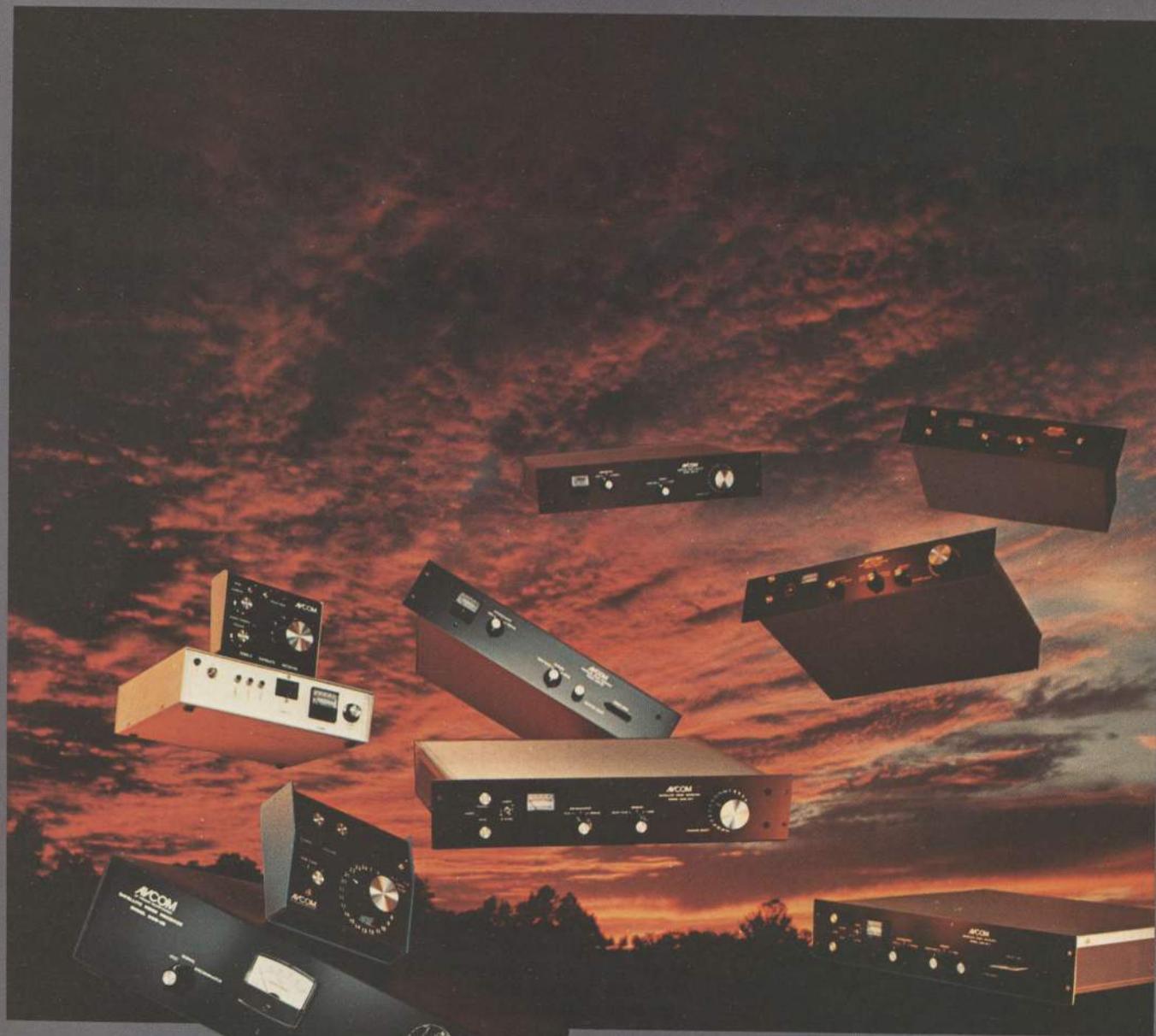
were just starting to come out of the laboratory. They were a curiosity, and, they were expensive. A single GaAs-FET cost the LNA builder upwards of \$600. There was a safer, cheaper way to go. They were called 'bi-polar' transistors. The very (very) best bi-polar transistors could achieve circuit noise figures in the 300 degree Kelvin range, at 4 GHz, but tedious amounts of hand selection, and, circuit tweeking was required. What the early cable TVRO systems couldn't buy in LNA noise temperature they made up with antenna size.

Jump ahead now two years. It is the fall of 1978. Some guy named Cooper has just written and published a short article in **TV GUIDE** telling 20,000,000 readers how with a private, 'home', TVRO they can watch Johnny Carson in unedited form, beaming its way from the Burbank studios to NBC in New York, how on a weekend there are a dozen or more pro football contests on the satellite, and how firms such as HBO transmit movies to cable systems. By 1978 cable firms are spending not \$120,000 for an average ten meter dish installation, but rather \$22,000 for an average 4.5 meter dish installation. LNAs are now 'down' to 120 degrees Kelvin and a few people claim they have 'seen' noise temperatures as low as 100 degrees. Such claims are usually lightly regarded since the 120 degree LNAs are now selling for \$1,900 each and those reported but never seen 100 degree units are quoted in excess of \$5,000.

It is now the fall of 1979. Somewhere out there a group of crazy fellows are trying to start a 'home TVRO terminal' business. We know this is so; we watched NBC's Tom Snyder with Jack Perkins in Oklahoma interviewing attendees at the world's first 'Satellite Private Terminal Seminar.' The big news there, according to Perkins, is the way the price is falling. One sign at the first 'seminar' advertises a complete do-it-yourself package (a 15 foot antenna 'kit', a 30 dB gain, 150 degree LNA, and a receiver from International Crystal) for \$3995.



A new transistor technology had just been born. GaAs-FETs or Gallium Arsenide Field Effect Transistors (and hence GaAs-FET)



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Video Section									
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No Fine-Tune Necessary	●			○	○			○	
Automatic Polarization With Chaparral Polarotor	●			○	○				
Video Invert	●	○	○	○	○		○	○	○
Two Scan Speeds	●								
LED Channel Display	●	○							
Audio Section									
Four Programmable And Tuneable Audio Systems	●								
Mono 1, Mono 2, Direct Stereo, Matrix Stereo	●								
Dynamic Expansion	●								
Dolby Noise Reduction	●								
Infra-Red Remote Control									
Direct Access Any Transponder With Chaparral Polarotor	●								
Automatic Polarization (Polarotor)	●								
Select Any Preprogrammed Audio System	●								
All Audio Systems Infra-Red Tuneable	●								
Fine Tune Polarization (For Satellite Skew)	●								
Down Converter									
Dual Conversion	●			LNC	LNC			○	
Total Features	16	2	1	3	4	0	2	4	2

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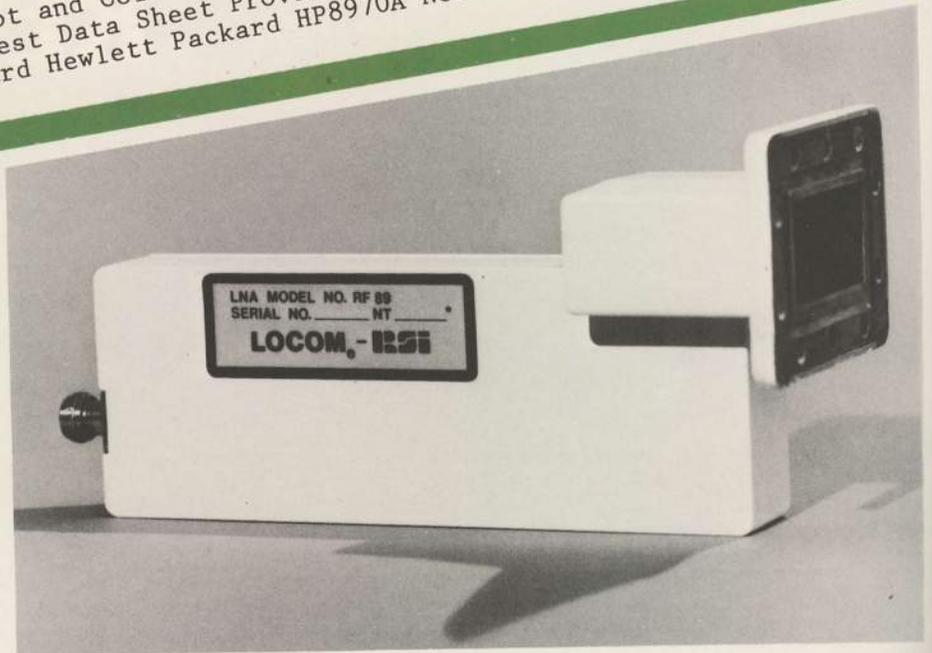
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CARE AND FEEDING OF LNAs

--- Insure you have sealed, water tight cable. See the June Coop's Digest on what 'worms' can get into your cable, connectors and LNA, if you don't seal your cable.

--- Gold plated connectors have less loss and less degradation over time than cadmium plated connectors.

--- For climates with salty air or high humidity, a "Microwave Window" with rubber gasket should be used (many people find that cellophane, e.g. Saran Wrap, is effective). Anything in the path of the RF waves will have some insertion loss. Insertion loss from any source before the LNA will directly degrade the signal (carrier to noise ratio) and thus in salty air or high humidity a lower temperature LNA can be considered.

Noise Figure Measurement Repeatability and Accuracy

A very troublesome noise figure measurement problem is repeatability. For example, a vendor's system may not measure the same noise figure as his customer's. This is much less of a problem with the 8970A. Using randomly selected 8970A's, 346B's, mixers, and local oscillators, superimposed plots of a single DUT are routinely within 0.1 dB of each other.

The 8970A internal circuitry is so accurate and linear that instrumentation uncertainty is less than ± 0.1 dB. With the ± 0.1 dB ENR uncertainty of the 346B at most frequencies, and the uncertainties due to mismatch, total root-sum-square measurement uncertainties of less than ± 0.25 are easily attainable. --HEWLETT PACKARD, 1982

The fact that the HP 8970A is self calibrating, including the noise source, makes it much more accurate as a system, and much more repeatable from vendor to customer, than any other noise figure system in use.

RADIO SEMICONDUCTOR LNAs

FEATURES

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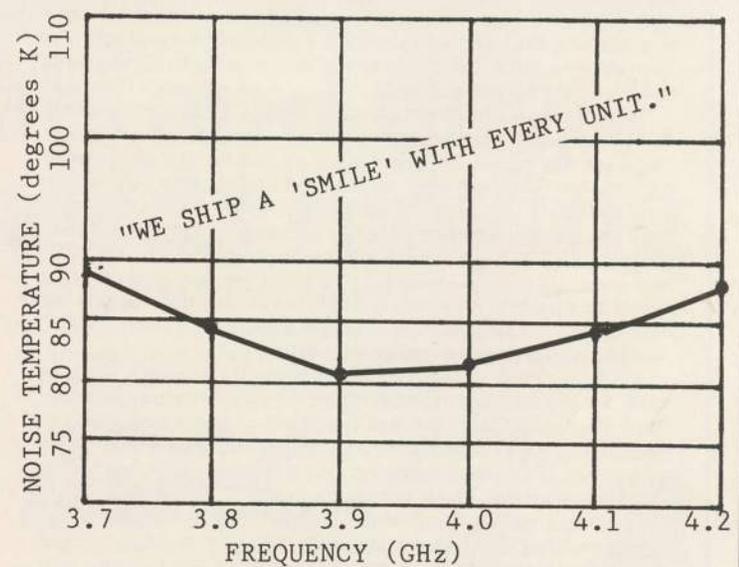
-- STATE OF THE ART DESIGN. State of the Art GaAs FETs and the lowest possible insertion loss ferrite isolators are used.

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-- RUGGED CONSTRUCTION. This design features rugged construction throughout. The entire circuitry/transmission lines are bolted directly to the housing. Units are fully temperature cycled and re-tested on an AQL basis as part of our on-going Quality Control program. Polyurethane paint is used for its durability; it "gives" rather than "chips," and it also provides a redundant seal.

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The \$4,000 price barrier is broken. Tom Snyder asks Jack Perkins if he has received his own 'home TVRO Christmas gift' from NBC yet. Perkins laughs; NBC executives do not. Some confusion has entered the LNA world in the fall of 1979. Some of the new home industry suppliers are telling buyers they don't need 50 dB gain LNAs. They insist that with their particular 'balanced gain' receiver packages, 30 dB is enough. Others, following the more traditional school, stick to the 50 dB requirement. LNA prices, meanwhile, have broken the \$1,000 barrier for 120 degree units but they are scarce at any price. The strange world of 'short supply/dropping prices' has begun. Nobody understands it, and it is just getting started. The real 'bottom' has yet to fall out of the pricing structure. By now you can actually hold a 100 degree unit in your hand, at a trade show. But you can't walk away with it; it is 'chained' to the booth! The price? Around \$3,000.

Leap ahead now to the fall of 1982. LNA prices have continued to drop; plummet would be a more apt word. If you buy from the right sources, 120 degree units are at or below \$300 in the dealer quantity category. The 'premium' 100 degree units have dropped also; down to the \$450 region, if you shop around. Some people are advertising 80 to 90 degree units for 'only a few hundred dollars more'. If you have followed this telescoped history this far, you probably are wondering when the LNA suppliers will start including 0 degree LNAs as premiums with every box of cracker jacks!

Each student of this history would probably arrive at his own conclusions as to what the key steps were in creating such a wide reduction in price, and such an advantageous improvement in performance, in a relatively short period of time. There is no one single reason for this sequence of events, except of course that capitalistic trademark; volume.

Back in Miami, Florida at the second 'seminar', representatives from Avanteck and Dexcel appeared on the program to discuss LNA pricing, and performance. Both agreed \$1,000 was about the end of the line for LNA prices although Dexcel felt that the day might come when 100 degree units would be standard; at that price. Dexcel was betting quality would get better, but price would not. Avanteck was betting on none of the above. Six months later 120 degree units would appear at the San Jose 'seminar' for \$750 and if you shopped carefully you could shave another \$100 from that.

To understand the strange world of LNAs, you need to know a little something about what they do and how they do it. It will help you to be a better prognosticator of what may eventually happen in the LNA field.

LNA; Low Noise Amplifier. Until 1978, LNAs were the exclusive province of microwave high technology (hi-tech) firms. For good reason. Every LNA that was shipped had to be **hand** tweaked, after **hand** selection of parts that went into the individual LNA, by highly paid technicians sitting in front of \$30,000 piles of test equipment. The LNA manufacture process was ideally suited to firms that didn't move very fast, who 'documented' everything they did with cross checks and 'repeatability tests' using equipment which was 'NBS' (National Bureau of Standards) 'traceable'.

NBS traceable equipment is test equipment which spends almost as much time at a 'certification center' as it does on a work bench. Large sums of money are spent to insure that the test equipment's performance "can be traced, by standard and accepted test equipment certification procedures" directly back to the official US government test standards center; the National Bureau of Standards. When you own a \$30,000 test station like this, and you send it in for 'certification' every six months, or even more often, you will in short order spend as much money keeping it certified as 'accurate' as you will have originally spent on the test station itself.

Why would anyone bother with this?

Well, you have to consider who the major customers were, in 1978, for microwave equipment; quality, 'hi-tech' microwave equipment. There were two. The Bell Telephone systems, and, the U.S. Government. Bell insisted, before taking delivery, that anything they bought had guaranteed operating characteristics. That touched on receivers, antennas, LNAs, waveguides parts . . . the whole system. They wanted no 'fresh out of the box' field failures and they had engineered their complete communications system, on paper, to rigid, non-flexible equipment standards. If you sold to Bell (or other telephone firms), you played the game 'their way'; or, no way at all.

The U.S. Government was just as nasty; perhaps more so. The 1978 version of Sidewinder Missiles were, as are the 1983 versions, loaded with microwave and UHF communications equipment. The military does not feel it can take a chance of getting a missile into the air, and then losing contact with it as it wings its way towards the target, just because the receiver front end in the missile's control system has a high noise figure. To say that a wandering missile, out of control because it blew its front end of its receiver, could be an 'international incident', is an understatement.

Since these two buyer categories were 99% of the microwave market, everyone who tried to function in that market played the game by these rules. And it should be obvious to you that when you have a hi-tech 'technician' spending hours checking, tweaking, and cross-checking his or her measurements on an LNA, to be dead-certain that the noise figure really is what the spec sheet says, you have a few bucks tied up in both time and the equipment in use. And when you tear the equipment down, sending it off to be 'certified' every three or six months, lose use of the equipment while the re-certification process is going on, and then re-install and start all over with the test station after it comes back . . . well, it all adds up.

If you understand why this **was** the way things were done, in 1978, you are beginning to get a grasp on why Dexcel and Avanteck, at the Miami 1980 SPTS could stand in front of the crowd and state "The price will not come down below \$1,000". The labor and equipment involved in the manufacture and test alone would insure that.

Let's get away from the manufacturing process for just a paragraph or two, now, and look at the component parts inside of the LNA. Remember that the 'secret' to the LNA is something called (the) GaAs-FET.

Transistors are hardly new anymore. They were first created in a Bell Lab way back in 1947 or so. It took them almost ten years to get out of the Lab and into the street at 'reasonable' prices. If you only began learning about electronics since say 1970 or so, you may wonder what the world did before transistors. They had something called 'tubes'. A tube is a small, medium, or fairly large glass envelope with a 'vacuum' inside. That's the whole name; 'vacuum tube'. A tube had a finite life. There are 8,760 hours in a normal year so a 10,000 hour rated tube would last just over a year. But its 'rated performance' was not 10,000 hours. A tube would begin to 'lose' performance rating the minute it was plugged in and turned on. It worked best for less than 1,000 hours and it gradually lost its performance characteristics as the electrons boiled away the rare earth materials inside of the vacuum.

Transistors, certainly today's transistors, have an obvious advantage in that they are virtually 'lifeless'; meaning, they will go on and on forever. True, some of the early transistors did slowly deteriorate in performance as they ran and ran and ran. But transistor manufacturers talked in terms of 20 year lifetimes; not one year lifetimes.

Tubes use lots of power. A simple receiving tube in a 1955 version of a television receiver used more power (AC power from the power plug in your home) than many of the modern satellite receivers.

Tubes are bulky. This is a double edged sword. Their size meant bigger packages. Their power use meant the power 'supply' to run them also had to be big. And both the tubes and the power supplies generated heat; lots of heat. Too much heat shortens the life cycle of tubes, so designers design even **larger** boxes to vent or conduct the heat away from the tubes proper.

Transistors are small (some today are only slightly larger than the head on a pin), use very little power, create very little or no heat (because . . . they use so little power) and they last almost forever. Transistors are neat.

But transistors are very expensive to create, originally. Long after the Bell Labs discovery of the first transistors, scientists learned that certain rare earth elements made better transistors than other elements. They also learned that the 'purity' of the material used to make the transistors was very important. Even a small amount of contaminant in the basic material(s) could degrade or destroy the 'operating properties' of the transistors. Eventually they discovered that some man-made elements, or 'chemical mixes', had even better electrical properties than rare earth elements. And that is when the 'explosion' in transistor technology was born.

Along about 1978 a few firms began to concentrate on the 'limiting properties' of a relatively new type of transistor; the GaAs-FET. It was



It's raining cats and dogs, and the dish needs moving.

That could mean a soggy trek out to the backyard. But not if you equip your earth station with the ADEC microprocessor-controlled actuator system. This new actuator system lets you change dish positions easily and accurately, without ever setting foot outdoors!

The system's electronic control panel can be programmed for pinpoint targeting on all present and future domestic satellites—up to 50 positions in all! And it operates at a low 36-volt D.C. level. For installation, the ADEC actuator system comes complete with 175 feet of specially engineered direct burial cable. And waterproof quick-lock connectors eliminate the need for hand wiring.

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known, by then, that a GaAs-FET transistor had some very desirable qualities. It was a very good 'amplifier' at frequencies in the TVRO band (4 GHz), and it was good primarily because in the process of amplifying the signals it did not add much of its own internal noise to the weak, noise riddled, satellite signal. But, it did add **some** noise.

There were two reasons why GaAs-FETs added noise. One is very elementary. Anything that 'moves' creates noise. Electricity flowing through an amplifier moves electrons. And when electrons move, they create noise. Minute amounts of noise, to be sure; but noise none the less. It was about in 1978 that some more scientists at Bell Labs discovered that deep-deep space creates its own noise; around 4 degrees Kelvin of noise. Even deep space is not totally quiet because even deep space has motion. Not much, to be sure, but some.

The second reason the GaAs-FETs created noise was because of the device itself. The 'purity' of the gallium arsenide, plus the internal structure of the transistor, were both limiting factors. How to tame those factors?

Improving the purity of the chemical mixes that went into the 'raw' transistors was one front to attack. Dexcel, one of the early LNA 'houses' that combined the manufacture of the GaAs-FETs themselves with the design and creation of the end product, the LNA, was an early pioneer in this area. AvanteK was another.

The internal structure of the GaAs-FET was another matter. All of the major (three) 'circuit elements' inside of the GaAs-FET have physical size. They have length, and thickness, and width. It had been discovered early on that the dimensions of one of the internal elements (the 'gate') had a direct bearing on the performance of the GaAs-FET. Making the 'gate' smaller seemed to result in more repeatable, lower, noise temperatures. But there were apparent limits to shrinking the 'gate lead.' Why?

Well, by 1978 or so scientists had perfected techniques to allow them to build a GaAs-FET with a 'gate dimension' of 1 micron. A micron is 1/1000th of a millimeter, and a millimeter is 0.03937 of an inch. If you can visualize a 'part' of a transistor 0.03937 of an inch in dimension, you have a rough concept of the manufacturing tolerances worked to.

You obviously don't whack up pieces of gold plated metal to 'stick' into a transistor with a pocket knife or pair of dykes when you are after precise lengths of 0.03937 of an inch. You also don't 'trim', repeatedly, such lengths to 0.0295275 of an inch (.75 micron) using 'standard' production techniques. Yet, the 'key' to radically lower noise figures, using the best and most pure base GaAs material available, was in getting the gate dimension smaller.

The truth of the matter is that a 1 micron gate was just about the best that man could accomplish in 1978-79. Anything more (that is, less!) was clearly beyond human ability. But the challenge was there.

Between 1979 and 1982, gate dimensions shrunk, slowly, a fraction of a micron at a time. The trick was not in doing it once; but in doing it precisely the same way, over and over and over again.

Enter now the latest in GaAs-FET technology. It comes from Japan where precision control of very (very!) small parts is now pretty standard stuff. This one sets a new standard of achievement however.

The Japanese producer doesn't tell us how they do it, but they are already shipping the 'parts' that resulted. **California Eastern Laboratories** (3005 Democracy Way, Santa Clara, Ca. 95050; (408) 988-3500) is now shipping their model **NE673** and **NE710** series of GaAs-FETs with **0.3 micron** gates! Impressed? No? Well, the performance may mean something to you. Using a technique they describe as 'proprietary' (that's a fancy word for "we know how to do this, nobody else does . . . and we'll charge you an arm and a leg for the product, until, somebody else figures out how to do it!") the NE673 has a device (i.e. transistor) noise temperature of 36 degrees Kelvin while the NE710 has a noise figure of 42 degrees Kelvin. **Now** you are impressed, right!

Now before you run off telling the world that 35 to 40 degree LNAs are coming, let's back up a bit to look at what happens between a 40 degree Kelvin transistor and the LNA that it ends up 'powering'.

An earlier series in **CSD**, this past fall, talked about how when a GaAs-FET is taken out of the special container and placed into a circuit, the noise temperature of the **circuit** will always be higher than the noise temperature of the **GaAs-FET**. That is a law of physics not lightly dismissed, and even having 35 to 40 degree GaAs-FETs to

work with will not change that scenario.

Different LNA sources quote you different numbers for 'degradation'. That's their word for what the LNA designer 'loses' when he builds something with a GaAs-FET. To make a GaAs-FET amplify, with low noise, requires some other bits and pieces. The transistor has to mount onto a support material (called a substrate) and etched (as in inscribed or painted on, etc.) on the substrate are actual circuit 'elements'. Attaching those circuit elements to the transistor leads are powering circuits, tiny, very special, microwave rated capacitors, tiny-tiny resistors and a handful of other exotic parts. When electricity flows through any of these parts, electrons move . . . and, noise is created. There is an entire sub-science to creating parts for the amplifier, **other than** the GaAs-FET, which do their job without generating excess noise. In spite of the best technology, **some noise** is created by these parts.

And, the GaAs-FET must be 'matched' to the circuits around it. Match? Well, that's a designer term that describes making certain that all of the available signal coming into the transistor stage actually goes into the stage; and all that comes out goes on to the following circuits. The designers 'match' (as in correlate) the operating parameters of the GaAs-FET stage to the antenna (in front of the stage) and the secondary 'stages' or levels of amplification (after the first amplifier 'stage'). No matter how well they do, some of the incoming power to the first transistor is 'lost' because no match has ever yet been 'perfect'. That lost signal is gone forever, and engineers equate the amount of loss in terms of 'degraded noise performance' of the amplifier itself, figuring that if some of the incoming power is lost due to 'mis-match', it is the same as having a slightly higher noise temperature.

So what is a rule of thumb? Well, for discussion let's assume that if you start off with a 70 degree **GaAs-FET**, you will do very well under the best and most carefully controlled circumstances to end up with a 90 degree **LNA**. There is a premium of about 20 degrees at the 70 degree level, due to extraneous circuit noises and 'match loss'. That premium can be considered a hard number (i.e. it will average close to 20 degrees), or, you can look at it as a 'percentage of the transistor noise figure (i.e. about a 30% degradation at 70 degrees). Different engineers have differing viewpoints on the proper way to degrade the GaAs-FET in practical, real-world service. Let's assume that with the new 36 to 42 degree series transistors there is insufficient experience using these hot-shot new devices yet to really know just what the degradation will be. But if it is 30%, then the 36/42 degree devices will become 47/55 degree LNAs. And if it is a flat 20 degree premium, then 36 will become 56 and 42 will become 62 degrees Kelvin.

Now the noise temperatures quoted here for the new NE673 and NE710 devices are at our present 4 GHz band. That, friends, is not what the Japanese **really** have in mind with these devices. They have their real attention trained on 12 GHz. There, the NE673 has a noise temperature of 110 degrees. Impressive? Well, it could mean that those folks promising to deliver DBS signals to 4 foot dishes with medium power transmitters in orbit (30 watt level) can now back down to around 24 inch dishes. Since **we** have only a passing (although perceptive) interest in 12 GHz **at the moment**, our interest in what it does at 12 GHz is in the 'fall out region'. Fall out?

That means that if some major supplier really gets excited about building 12 GHz DBS gear with the new 0.3 micron devices, the manufacturing quantities will rise sharply. And that will bring the price down, rapidly, for the same devices for our 4 GHz service. None of this will happen overnight, but it is a major breakthrough in GaAs-FET technology and it offers the hope that before the end of 1983 we will see some extremely high quality solid state LNAs being offered in the marketplace.

Did all of this just 'shrink' the dish size required for 4 GHz terminals? Are four foot dishes here?

Hold on; there is more to this, at 4 GHz, than mere LNA noise temperature. Much more.

The 'subject' gets very 'what-if' conscious in a hurry. We'll look at it in some detail in a later issue. For now, just to insure that nobody runs off half cocked shouting "the sky is falling . . . the sky is falling . . ." let's touch just the top of the new incoming 'wave' (front).

1) **LNA temperature is important.** But **system temperature** is what really counts. System temperature has never been widely

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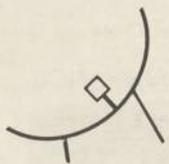
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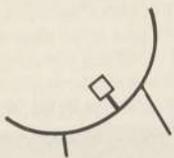
written about or discussed in the home TVRO field up to this point, simply because the noise temperature of the LNA alone always had more to say about the performance of the system than did the combination of 'antenna noise temperature', and, LNA noise temperature. With LNAs available with noise temperatures lower than say 70 degrees, that will change.

- 2) Perhaps the best way to describe system noise temperature is to use an illustration. The earth has a noise temperature of its own. It is almost 300 degrees Kelvin. Obviously you don't want an antenna system that intercepts very much of this 'earth noise' or you will have a system noise temperature created or established not by your LNA, but rather by your earth noise reception. An antenna that has poor sidelobe control picks up some amount of earth noise. It is a general, educated, **presumption** that most 10 and many 12 foot antennas have a 'noise floor' of their own in the vicinity of 70 degrees, at **lower** look angles. The truth is that very (very) few of the home TVRO industry antennas have been carefully tested to determine what their 'noise temperature' contribution might be to 'system noise temperature'. That will obviously have to change as some truly low(er) noise LNAs become available. Why is this true?

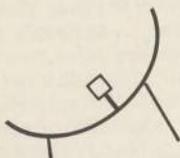
Well, if you have an antenna that has a noise floor significantly higher than it should (or could) be, then you waste your money and your time changing out LNAs for lower noise temperature LNAs. If the 'system noise temperature' (the combination of the antenna, the feed, and the LNA plus the receiver) is 'limited' by the antenna noise temperature contribution, you will quickly reach a point (perhaps as early as a 100 degree LNA) where any improvement in LNA noise temperature will not be seen, or measured; **the antenna noise** simply washes out the advantage of the lower noise temperature LNA!



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So, as the really high grade LNAs become available, there will be yet another period of adjustment ahead; a period that will teach many of us just how 'poor' in performance our antenna systems have been all along!

Having made that point, which hopefully will prevent those who understand only the basics (or not even the basics) from running off shouting 'Eureka' and 'Fantastic . . . four foot dishes are coming!', let's move on with our look at LNAs. In particular, let's look at a new firm in the LNA field. LOCOM.

LOCOM is a Division of Radio Semiconductor, Inc. (315 Benner Pike, State College, Pa. 16801; 814/238-2133). They are often confused with another State College firm called Locus. The names are similar, and there are other similarities as well.

LOCOM LNAs are relatively new in the market place. They won't reveal how many LNAs they have produced through the first of 1983 but let us assume there are fewer than 2,000 in the field at this point. That is not a significant number of LNAs. But then LOCOM LNAs have only been available for not-yet a year so while the number is unimpressive there is a start up period in any new business.

What interests us about LOCOM is that you don't simply open up an LNA manufacturing facility in a converted laundry and start cranking out quality product. Most of the LNA folks have locations or direct ties to the famous California 'Silicon Valley'; that region around San Jose and Santa Clara where almost everything microwave seems to germinate. State College, Pennsylvania is a long-long way from Silicon Valley. So why should an unheard of firm tucked away in the mountains of central Pennsylvania have any abilities which would make their products worthy of note, or even qualify those products for special reporting?

LOCOM has an interesting family tree. First there is Locus, a firm few have heard of outside of the upper echelons of military and government communications although it is a sizeable firm with substantial (military) contracts. Locus skates in the same league as Microwave Associates and Hughes but it attracts far less attention. Locus makes 'spook electronics' equipment; military counter-measure hardware that is developed inside of glass vaults protected by security badges, electronic entry codes and a ring of hush-hush security. Over the years, Locus with plants in Pennsylvania and in the outskirts of Washington, DC has kept alive by doing things for the government which the government does not want done by larger, more diversified firms. In the process of building military microwave and (and radar related) communications equipment, Locus has acquired a certain level of expertise. That happens to include the ability to build, under contract, low noise amplifiers for a variety of space age, missile and weapons hardware systems.

One gets the feeling, in talking with the principals at Locus, that the government deals with them **because** they are devoted almost exclusively to military communication system needs, and, because they don't attract much attention. In short, they stay out of the commercial bright lights and glitter running a combination advanced communications think tank and system design shop in the Pennsylvania hill country.

One also gets the feeling that sooner or later as you operate such a company you see sizeable commercial markets for products which you make for military applications rise and fall, and you wish (on occasion) that you had more 'freedom' to jump into some of these commercial fields.

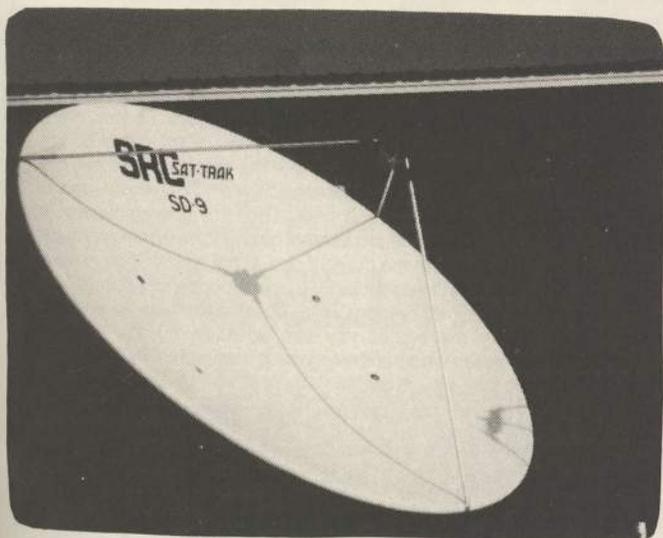
Radio Semiconductor was formed to allow technology which Locus has developed in military fields to 'surface' in commercial fields. The ownership of Radio Semiconductor, its LOCOM division, and Locus is closely related one suspects.

Locus is not totally devoid of commercial products, although that is a close approximation of their normal operating policy. For example, about one year ago they brought out a commercial grade low noise amplifier for the 3.7 to 4.2 (TRVO) band, and slanted their sales and advertising approach towards the cable (and related commercial) industries. It would appear that after a six to eight month market-entry period, complete with some trade advertising in **CATJ** magazine, Locus may be selling around 100 LNAs per month to cable field firms. Not an insignificant number in **that** marketplace.

The introduction of the Locus CATV commercial grade LNA (at CATV commercial type pricing) preceded the entrance of the LOCOM version LNA by a short span of time. The two share the same basic cast housing format and as we shall see, they also share the same technology roots.

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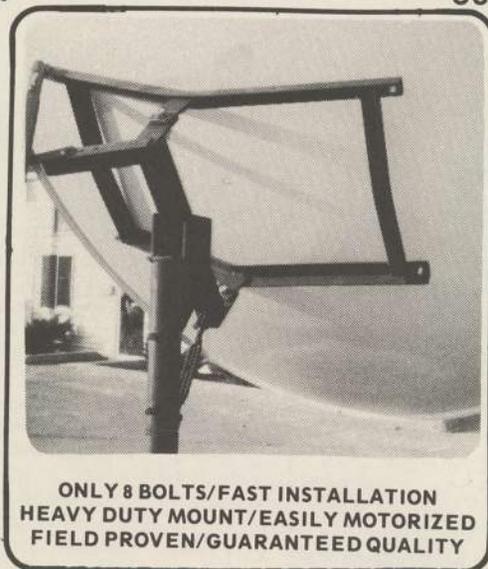
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LOCOM is not an impressive facility, at this stage of their development. Flanked in a store front location by retail shops that have not yet made it to the big time neighborhood full scale shopping center, it is easy to miss their small sign and mistake their facility for a donut shop. That is not a degrading observation, rather it will later prove to be an interesting sidelight to a firm that puts far more emphasis on the quality of their techniques, and their product, than they do on the impressiveness (or lack thereof) of their facility.

There are two names that you should know at LOCOM. Number one is **Kingsley N. Hastings**, a large man who talks with such animation and speed that you need to follow him around with a cassette deck recording everything he says; to later play it back at 'half speed' so you can figure out what he **really** said! Kingsley has come up through the ranks of communications and microwave technology and he has both a proud and protective approach to explaining LOCOM Products and their integrity. The second name to know is **Joe Ray**, who came to LOCOM from a firm barely across the highway from their store front location. Ray spent more than a decade helping a pioneer cable TV electronics firm, also headquartered in State College (C-COR) get high quality products out the door, on time. C-COR is a multi-multi million dollar producer of cable hardware these days and Joe Ray helped them get there by being in charge of approximately seventy of their floor production people. Ray has high marks far outside of State College where former colleagues in the cable industry recall him as bright, exacting, and dogged in his determination to get the job done, right.

Kingsley and Ray are part of a team of people put together to make LOCOM LNAs, using technology licensed to Radio Semiconductor by Locus. In other words, Locus figures out how to build something

(LNAs in this case) and then they authorized LOCOM to make that product for a specific market or application, for a fee. It is sort of a royalty arrangement; the more LOCOM LNAs shipped, the more money Locus makes out of the deal. The fact that Locus principals have a vested as well as one assumes an invested interest in LOCOM product success does not hurt either. And in the process, Locus's LOCOM investors see their hard won military communications knowledge reach a broader, perhaps ultimately more lucrative market.

State College, Pennsylvania is not easy to get to. Locally, they say you can fly 'west' (to Pittsburgh) around ten times a day on a local airline. You go east only with great difficulty, as we found out when visiting there in December. With Coop was Universal Electronics' **Tom Harrington**, PatMar's **Peter Sutro** and Paradigm's **David Johnson**. Why the four ended up in State College together is not fodder for this report; suffice to say that there are distinct advantages to traveling with these three for Coop, and by allowing Coop to accompany them in their travels, the trio ended up in some spots which they might not have otherwise visited.

State College is one of those strange, laid back communities which seems to have several distinct identities. First there is 'the college'. Some 23,000 or so students swell the local population base by nearly 100% for about nine months of each year. Then there are the coal mines, or what used to be coal mines. They say unemployment in the mines is over 25% and **the area** has a nearly 20% unemployment factor. Clearly, scratching in the mud for coal is not all that it once was. Finally there is the electronics industry there. Nobody is yet suggesting that State College is 'Silicon Valley/East' but there is enough electronic industry there that you are amazed by the literally thousands in the region who build everything from cable TV hardware



JOE RAY (left) and **Kingsley Hastings** with 'dueling LNAs.' Ray came to LOCOM from cable manufacturer C-COR and is in charge of production. Hastings seldom slows down long enough for a static photo!

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to microwave hardware and man-pack communication sets. It, electronics, is not the type of industry one expects to find in a coal mining town tucked away in the hills of Pennsylvania.

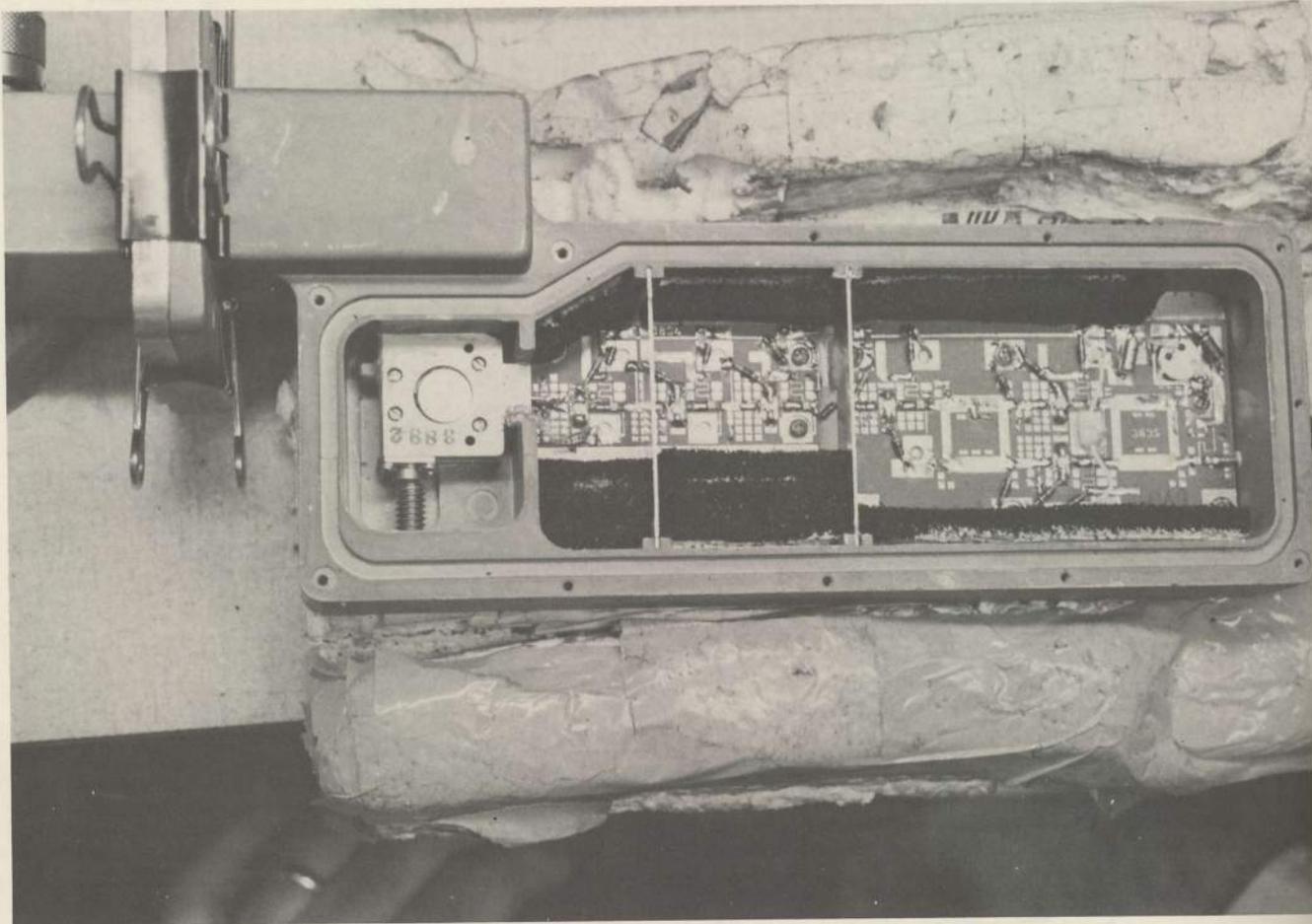
This scenario is important because the failing coal mining industry coupled with the continued growth in electronics in all areas has fueled the attention of state and federal people whose job it is to track unemployment, and then figure out how to put productive people back to work again. Kingsley Hastings has tapped that 'resource' in a most unusual way; he has the State of Pennsylvania funding a training program for LOCOM which will turn out about a dozen new bench certified and qualified assembly people, and a couple of new 'microwave technicians', every couple of months. A representative of the government agency funding and coordinating this training program was in LOCOM when we arrived. We got the distinct feeling he spent a fair amount of time there watching the students progress. Joe Ray, in particular, was very high on the process and when you tour the facility you find clusters of people engaged in blackboard sessions led by an instructor. There the 'trainees' learn the basics of soldering, more about how LNAs work than the average TVRO dealer will ever assimilate, and why even fractional inch intolerances are strictly taboo in microwave work. Ray notes that out of perhaps a dozen applicants, three get into the course and between 1 and 2 will finish and go to work at LOCOM. Obviously not everyone, out of work coal miner or otherwise, is suited to the close tolerance work required.

Kingsley Hastings is 'hyper active', as noted, and while your first intuition is to chalk off his enthusiasm as self-administered sales hype pouring from his pores, you eventually figure out that he is so excited about what LOCOM is doing and how much progress they have made in a relatively short period of time that everything about him is genuine. Even the product.

LOCOM first began selling into the home TVRO market by arranging for distribution of its products through distributors such as **J.V. Electronics**. That attracted some interest, but perhaps no more nor no less than their at-the-time modest production schedule could handle. As total production climbed into the hundreds and then into the low thousands, word of mouth started to come into play. We talked with several of the distributors who presently handle the product since Kingsley was telling us, in almost excruciating (and boring) detail, about **each of the six** (6) units that had failed, in the field, for any reason. Six out of 60 is not impressive. Six out of 600 is more impressive and six out of approaching 2,000 is decidedly impressive, for a new firm from the coal fields of Pennsylvania.

Kingsley told us that one unit (of six) had failed for an internal electronic part failure. That five had failed because of a water problem that involved some improperly sealed LNA containers. We found one more in the field, on its way back to LOCOM, which has apparently also suffered an electronic part (or circuit failure). The distributors we talked with were universally high on the low failure rate. So far, so good.

What attracted the initial interest of the industry was perhaps that LOCOM was advertising the 'ready availability' of 80 to 90 degree range LNAs. What we found while visiting LOCOM was that they have just about eliminated 120 degree (or 110 degree) units from their production flow. Whereas there are some firms, in Japan in particular, who would **like** to see their noise figures improve so that they can ship something **other than** 120s, LOCOM seems to have such a good handle on getting top-tweaked performance from its production flow that 120s are rare indeed. We ran through a stack of hand completed data sheets for a representative quantity (about 25) of LNAs in 'burn in' (active test). The worst case we saw in this sampling was in the 100



LOCOM LNA at test station. Input is on left (nearly square device with round center circle is isolator / matching device) **with initial GaAs-FET stages progressing from left to right; bulk gain, higher noise figure stages are to far right.**

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(101) degree range while the best was in the 78 degree range.

It would be good to talk about test data sheets briefly here. Many of the LNA suppliers presently ship, with each LNA, a 'test data sheet'. This is a sheet prepared at the time of product tweek and test that purports to tell you just what the LNA noise temperature is. It is the tradition at the manufacturing level to look at a 'curve' (a plot between 3.7 and 4.2 GHz of the noise figure at three, four or five points 'within' the band) and find the worst-case (highest noise figure) on that curve. If the LNA is found to have a measured noise figure of 92 at 3.7, 90 at 3.8 and 3.9, 87 at 4.0 and 91 at 4.1 and 93 at 4.2 (GHz), the manufacturer will rate the LNA as 93 degrees (K). In the eyes of the manufacturer, the LNA is rated at its '**worst-case**' in band (between 3.7 and 4.2 GHz) noise temperature. If the manufacturer packs a test sheet with the LNA, and you as a dealer end up with the test sheet, you have a relatively good 'claim' for what the true noise temperature characteristics of the LNA are. It should be noted that some distributors have at one time or another 'reviewed' these data sheets and some have been known to look **not at the worst case, but at the best case** noise figure. Thus an LNA which the **manufacturer** sells as a 93 might be re-sold by a less than 'fair' distributor as an 87 degree device (or whatever the '**lowest number**' on the curve happens to be). If you, as a dealer, are paying a 93 degree price for what the distributor presents as an 87, that's not totally dishonest. But if you are being charged a premium because the low end number is lower-than the high end number, and the price you are paying is based upon the low end number, well . . . you are getting the wrong end of the swizzle stick.

One might ask why the noise temperature does vary across the band. That's a good question and if you understand what happens inside of the LNA, and just how much care has to go into the tweeking exercise to achieve the lowest possible noise figure numbers, you will be a better informed user of the product.

The LNA has multiple individual stages of transistor gain. Some of those stages, the ones closest to the antenna (i.e. called 'the front end') are GaAs-FET transistors. In **some** versions of LNAs there are three stages of GaAs-FETs, followed by a couple of 'stages' of less expensive, higher noise figure 'bi-polar' transistors. This is not to be frowned upon; the noise temperature for your LNA, and therefore for your system, is established by the 'front end' GaAs-FET stages. If you create the LNA noise temperature 'up front' then you can achieve the additional 'signal gain' you need by tacking on a few less expensive transistors afterwards.

Most LNA designs split up the front end gain process so that if there are three stages of GaAs-FET low noise gain 'up front', **each** of the individual stages is tuned to cover just a **portion** of the 3.7 to 4.2 GHz band. As illustrated here, stage one might cover 3.85 to 4.05 GHz while stage two could cover 3.70 to 3.9 GHz and stage three might cover 4.0 to 4.2 GHz. Those are approximations; any number of 'division' combinations are employed. If we have three GaAs-FET stages, each covering a **segment** of the band, and if we never have two **identical** GaAs-FET transistors (we don't), it is easy to see how

one might be slightly better than **another** resulting in slightly superior performance in the **portion** of the band covered by the '**hotter**' transistor.

Plus, and this is more important than individual transistor variations, there is an overlapping of coverage (ie. portions of the band covered) between stages. In our example we have two stages working in the 3.85 to 3.9 and 4.0 to 4.05 GHz segment of the band. The overlapping is traditionally in the center of the band, for obvious reasons, and that helps the noise temperature in **that portion** of the 500 MHz band.

There are other factors also at work here; the integrity (or 'flatness') of the 'isolator' or matching device that precedes the first stage, and the tuning of that isolator device; the tolerance of the chip capacitors and tiny resistors that make up a single stage, and last but hardly least, the skill and care administered to the tweeking of the product by the technician charged with the responsibility of making the unit the very best he (and she) is capable of achieving.

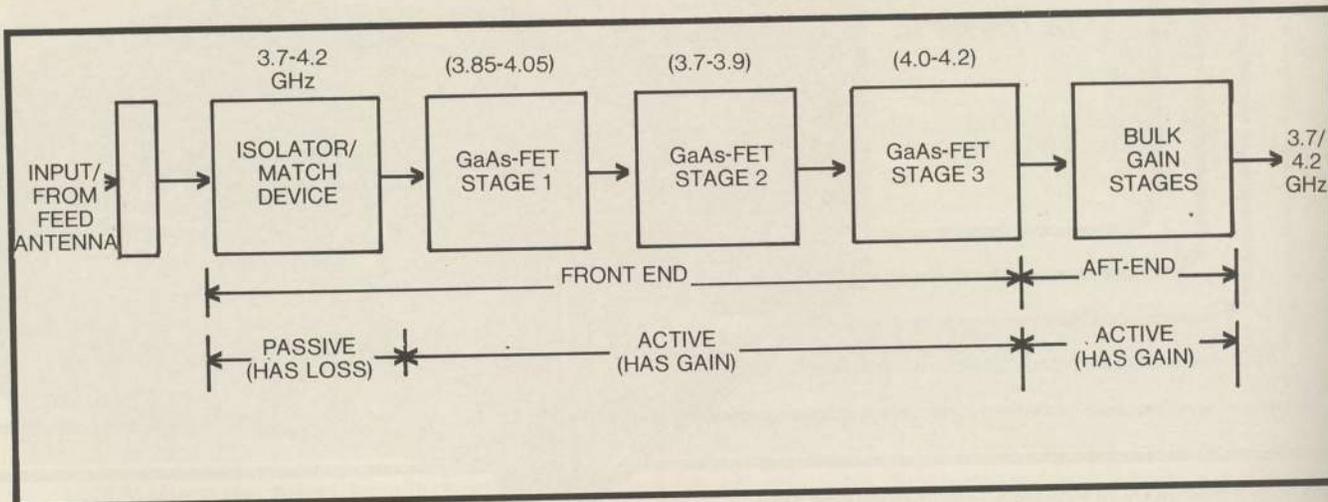
It all, really, starts back on the production floor; which at LOCOM one finds in a rapid state of growth. After getting a decent start during 1982 by selling directly to dealers and distributors, LOCOM has worked out some sizeable purchase/sale agreements with some of the industry's larger marketeers of TVRO product. While our quartet of interlopers were in State College inspecting the facility, we found LOCOM busy readying another next-door bay for expansion. Kingsley kept referring to a group of trainee/students as '**Intersat people**', meaning that they would become a production line to build under contract a sizeable number (10,000 initially ordered) of LNAs for the St. Louis firm during 1983.

While the tolerances inside of the GaAs-FETs are mind staggering, the tolerances on the LNA circuit boards are not exactly in a 'slouch' class. A careless misplacement of a chip capacitor, by three or four microns, can severely degrade the quality of the LNA. Joe Ray, fresh from more than a decade of close tolerance CATV amplifier production, seems to know that as you watch him hop from wiring station to wiring station peering at work being done.

There is a considerable amount of cynicism in the dealer end of the industry these days concerning noise figure test data or LNA test data sheets. Many people we talk with seem to feel that somebody in the marketing department sits at the order desk with a blank pile of 'data sheets' in one hand and the telephone in the other. We have had dealers swear to us that they 'know' that the manufacturer sits there filling out test data sheets to conform to their order as they phone them in. That suggests two things going on in dealer minds:

- 1) **They don't believe** that manufacturers really test their LNAs for true noise figure, and,
- 2) **They do believe** that manufacturers are apt to assign any numbers to data sheets they wish, to 'meet the terms' of the customer's order.

This attitude, or feeling, is on the surface patently absurd. First of all, when an LNA comes off the production line and goes into its housing for test, it barely works at all. Kingsley showed us how a fresh



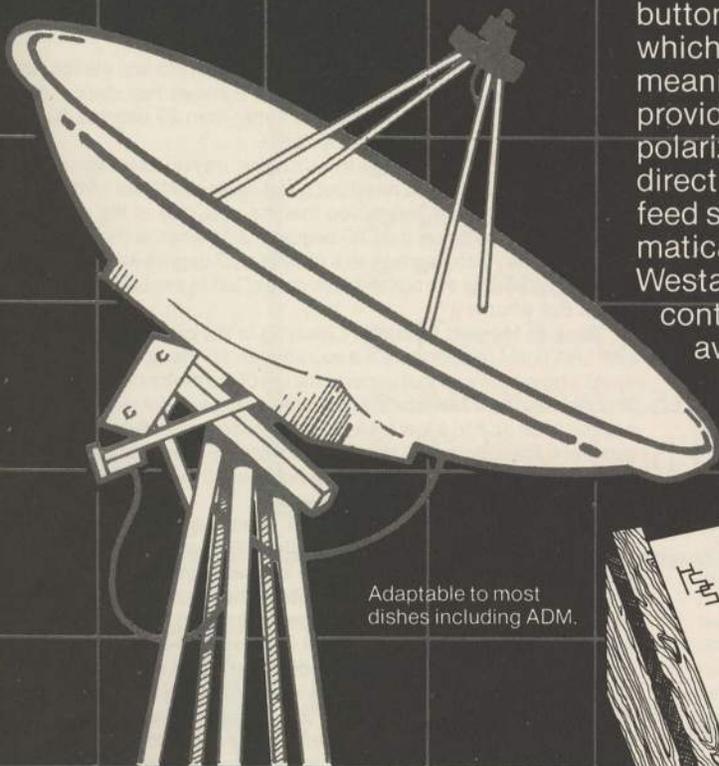
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LNA, just off the floor, could barely achieve a 420 degree noise temperature when first turned on. Some may be better than that, down to 300 degrees, but in no case are they ready to ship after soldering is completed.

Anyone who spends even a few minutes inspecting an LNA, or alternately an LNA production facility, must quickly realize that the skills required for parts selection and assembly aside, **the real LNA is born** under the skillful attention of an alignment and test technician.

Which brings us to a more important question. If test data sheets are done by the test technician as the LNA is finally tweaked to peak performance, why does the user find himself noticing subtle or not too subtle performance variations between two LNAs that seem to have very similar 'test data sheets'?

A favorite game of dealers is to compare LNAs. That's understandable; you simply pop one from the feed mount and stick on another one, and 'see' which picture is better. Whether LNA manufacturers realize it or not, there is a constantly operating 'underground' network of data exchanged, between dealers and distributors, as to 'which LNAs are hot', and not so hot. If you plotted the 'reports' of this grapevine, you could also probably plot the **sales performance** of the various LNA brands in the marketplace.

When a dealer sticks an LNA on for 'test', finds its performance is not so good, and he compares it to another unit (of a different brand) that seems better, he is then 'convinced' that the first data sheet (and its supplier) 'lied'. That's the fodder for the underground 'network'.

Manufacturers, of course, shudder at the thought of some guy in Fargo starting a story that their brand of LNA is not all it is cracked up to be. The manufacturer immediately assumes a lofty perch to explain in technical terms why such tests cannot be considered valid. The dealer, if he is listening, shakes his head and walks away muttering "I know what I see . . .".

Is there any truth to data sheets being untrue?

Kingsley Hastings. "**Anyone can make a mistake. A guy had a fight with his girl friend, or he is thinking about what he is going to do that weekend**". Peter Sutro. "**I would, if I could, never buy an LNA made on a Monday or a Friday!**".

They used to say the same thing about Detroit cars. On Monday's you find the remains of 'wild weekends' tucked away in your fender wells. On Friday's you find absent minded sex oriented doodles under your front seat.

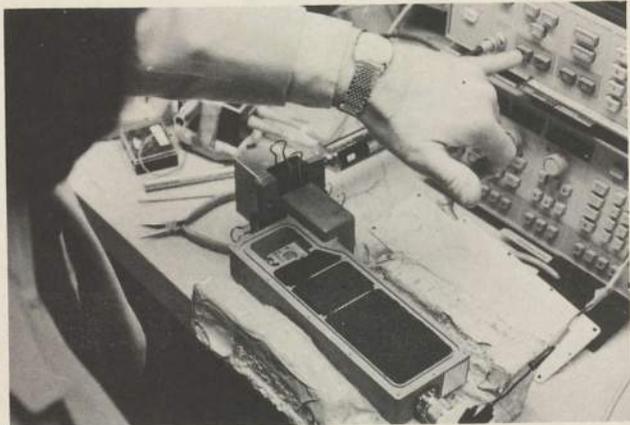
Kingsley Hastings again. "**The truth is that the whole game of noise temperature boils down first to the guy operating the 'machine', and second to the machine itself**". There is more than a little pride in Kingsley's voice when he takes you to a test station equipped with a **Hewlett Packard Model(s) 8970A/346B** 'automatic noise figure test meter and broadband noise source.' How's that again?

The art, science in reality, of measuring the noise temperature of an LNA has been pretty static for years. The traditional approach has been to use a system called a 'hot and cold noise source.' Remember how often microwave equipment must be 'certified' by a 'traceable' standards station? A 'hot and cold' noise source comes up for re-certification more often than almost any other piece of precision microwave test gear around. AIL makes these test sets and the cost around \$20,000 or so per test station. AIL for years has suggested that their hot and cold noise sources were with great care in operation good to perhaps 20 degrees Kelvin accuracy; in real world terms. There are two things to think about when it comes to noise temperature 'accuracy'; absolute and repeatability.

Absolute noise temperature. That means that when you see a data sheet that states the noise temperature is 93 degrees at 4.1 GHz, you know that you can take that amplifier to another test facility and indeed measure 93 degrees at 4.1 GHz. No way. And that brings us to repeatability.

If you measure 93 degrees at 4.1 GHz at LOCOM, and you take the LNA say to Amplica or AvanteK and they measure it, and it doesn't read 93, then what? That tells you something **not about** 'the blankety-blank' equipment at LOCOM, but rather something about a persistent problem with **all** microwave noise temperature measurements; repeatability between different test station systems.

Let's look at the two possible variations here. First let's assume that both test stations have the precise same AIL hot and cold test



RF SHIELDING in place (black fibrous cover over LNA) **Joe Ray demonstrates how the H-P 8970A system can dial up gain and noise temperature measurements for any discreet frequency between 3.7 and 4.2 GHz. Final test data sheets are prepared by the lab technician after he has 'optimized' the LNA utilizing a test station similar to this one.**

sources and analyzers, both have the exact same cables and connectors, and that the same person performs both measurements. How close will one 'station' track to the other? AIL suggests within 20 degrees Kelvin.

Now let's look at the LNA on an AIL hot and cold test station, and then look at the same LNA on a Hewlett Packard test station. Now what might the 'repeatability' be? No better than 20 degrees Kelvin. Any closer than that is pure coincidence.

Humm. Yet here **you** are, a dealer, paying premium dollars because **you** believe **you** need not a 100 degree LNA but a 90 degree LNA. And here we are telling you that the accuracy of the measurements may be no better than 20 degrees! Just what, in the world, are you paying for? Ten degrees as a slice of a 20 degree inaccuracy???

Clearly there is still some 'black magic' left in the LNA microwave world. But what is it?

Back to Hewlett Packard. Listening to the problems associated with LNA noise temperature measurements, HP decided to see if they could 'shave' some of that uncertainty out of the measurement results. They wanted to achieve better 'absolute' numbers, but most of all they wanted to be able to allow LNAs to be tested on one piece of (HP) test gear, and then moved to another identical (HP) test station and find that the results were better than the hot/cold 20 degree Kelvin 'range' number. The H-P 8970A was the result.

Kingsley. "**There are several reasons why we married ourselves to this new instrumentation. First of all, unlike the hot and cold noise source, which the operator of the system must constantly calibrate, the H-P is automatic. It is self calibrating. I have seen people spend 45 minutes calibrating a hot/cold source for a three minute measurement. I have also seen LNA suppliers that only calibrate their hot and cold sources at random or occasional intervals. I vowed LOCOM was not going to get tied up in that mess**". End of commercial for HP. Now just what did HP achieve with their \$11,000 noise figure meter and noise source? First of all they packaged it so that for LNA testing, speed is a major product. With an optional sweep oscillator and RF plug in (another \$10,000 per test station) the technician can dial or punch up spot frequencies within the 3.7 to 4.2 GHz band and instantly **see** a digital read out of the noise temperature at that frequency. As the tech tweaks on adjustments, moves parts around on the board a micron or two at a time, he sees instantly what the noise temperature change may be. Punch up five frequencies or six frequencies representing the full band and bang-bang-bang (etc.) there are the test results for the whole band. Meanwhile, on the swept oscillator display in front of the tech is the 'gain' parameter displayed. Noise figure or temperature numbers 'flit' by at programmed intervals, the gain is represented by a line on a display tube and with each part adjustment or movement the

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impact on that movement on both parameters is quickly evident.

For all of this technology, HP ends up with the claim that if you move an LNA from one 8970A test station to another 8970A test station, you will have total variations of +/- 0.25 dB.

dB? Doesn't that relate to gain? What about noise temperature?

The old school in noise temperature measurements still likes to use a 'different scale' to recite noise temperature. They call it 'noise figure' and it is expressed in dBs rather than degrees Kelvin (noise temperature). Amplica test data sheets, for example, still reference to noise figure dBs. **A table here** sorts all of that out for you.

So, 0.25 dB, + or - that amount. How does that translate to noise temperature variations? Let's take a benchmark number we can play with.

A noise temperature of 120 degrees Kelvin is equivalent to 1.50(8) dB (noise figure). If H-P wants to build a super modern machine and still quote their numbers in dBs, that's their problem. Ours is to make those dBs relate to **our world** of Kelvin.

At 120 degrees Kelvin/ 1.50(8) dB noise figure, a +/- 0.25 dB accuracy variation would (in dBs) give us an accuracy region between 1.25 dB (or, 96 degrees K) and 1.75 dB (144 degrees K). Humm. That is not so 'hot' (pardon the pun). **And this is the best that can be expected?**

Let's put this back into perspective again.

This is the worst case example for your taking an LNA tested on one HP 8970A and testing it on **another** HP 8970A. An LNA that the first 8970A says its a 96 degree unit could, given this set of numbers, measure as a 144 degree unit at another test station. But these are not **absolute** numbers. These are station to station **repeatability numbers**.

Now let's look at making two or more measurements on the **same** test station. We'll assume the test station has been recently enough 're-certified' to be within standards calibration.



LNA on bench before him, display indicates that at 3700 MHz (3.7 GHz) this LNA has been adjusted to give 56.28 dB of gain (center readout) with a noise temperature of 90 degrees (far right display).

Here H-P tells you that the noise figure instrumentation uncertainty is +/- 0.1 dB. Let us put that back into noise Kelvin. If we select the same 120 degree/ 1.50(8) dB benchmark to begin with, +.1 dB gives us 1.6 dB noise figure or about 129 degrees Kelvin. And -.1 dB gives us 1.4 dB noise figure or about 111 degrees Kelvin. Now we have a +/- 9 (10) degree Kelvin 'swing.' That is our reference for absolute

Amplica, Inc.

LNA TEST DATA SHEET

NOISE TEMP vs NOISE FIGURE

T°K	NF (dB)
10	.148
20	.220
30	.429
35	.496
40	.563
45	.628
50	.693
55	.757
60	.819
65	.881
70	.942
75	1.002
80	1.061
85	1.120
90	1.177
95	1.234
100	1.291
105	1.346
110	1.401
115	1.455
120	1.508
130	1.613
140	1.716
150	1.816
200	2.284
250	2.707
270	2.865
300	3.092

MODEL NO.: ACD305329 SERIAL NO.: 1562
 POWER: +15 to +25 VOLTS D.C. @ 1/5 MA

FREQ. (MHz)	GAIN (dB)	INPUT VSWR	OUTPUT VSWR	GAIN COMP. @ +10 dB OUTPUT	NOISE FIGURE
3700	52.8	≤1.25	≤1.43	LO.1	1.20
3800	52.7				1.17
3900	52.2				1.15
4000	51.8				1.19
4100	52.2				1.22
4200	52.3	↓	↓	↓	1.26
SPEC. LIMITS	50 dB MIN. ±.5 dB FLAT MAX	1.3:1 MAX	1.5:1 MAX	1 dB MAX	<u>1.3</u> dB MAX

TEST: T-7 DATE: 9-27-82
 INSPECTION: (Signature) DATE: 10-1-82

Ex. 1

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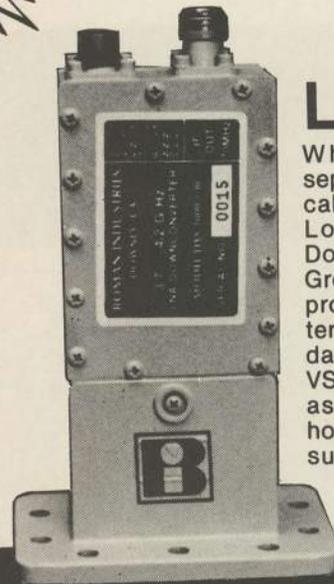
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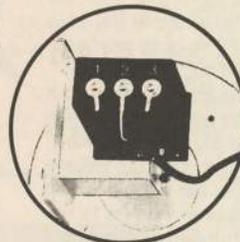
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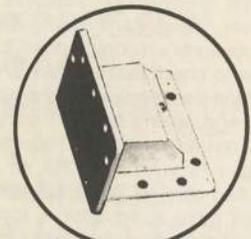
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accuracy; the establishing of what the true noise figure / temperature may be for that LNA. This is the number which one must compare directly to the ± 20 degree Kelvin hot / cold noise source accuracy that **was** the industry standard for so many years. (In truth, the H-P 8970A is still so new that many of the LNA suppliers are still found using ALL hot / cold noise sources for testing. **We'll leave it up to you, the dealer, to determine which noise test procedures are in use, by whom.**)

Alas, even given this ± 10 degree Kelvin swing, we are asking a great deal from anyone supplying us with LNAs when we ask them to grade out for us 90 degree LNAs rather than say 100 degree LNAs. Or are we?

Suppose you sat down with a huge stack of LNAs; say two dozen. And you proceeded to plug in, one after another, to measure the gain and noise temperature across the 3.7 to 4.2 GHz band. You are using the **same** cables and the **same** connectors for each LNA tested; the noise figure test set (regardless of whether it is a hot / cold test set or an 8970A test set) is the **same** for all tests. As you zip through the two dozen LNAs, it quickly becomes apparent some are indeed better than others. If you are a tad foolish and like to live dangerously, you might even form some opinions as to **how much better** one is than another.

Can you do this and walk away, having 'graded' the LNAs, knowing **which** of the two dozen is the best, and **which** is the worst? Probably, with a high degree of accuracy.

Can you relate the numbers plotted to the original data sheets packed with the LNAs? No, probably not at all.

If you had two sets of data sheets, one that reflected the original manufacturer's measurements, and the second that reflected your own measurements . . . and if you then sorted the data sheets so that the best LNA data sheet coming from a manufacturer was on top of one pile, and the best from our own measurements was on another pile . . . could you flip through the data sheets and find **the same LNAs** in the **same order** in both piles? Let's put it this way; if you checked 24 LNAs and found the same one was best as the manufacturer said was best, and the next 23 were in the **same order** on your checks as the original manufacturer checks, you should immediately fly to Las Vegas and gamble your life savings at the poker table. You are one very fortunate, and very lucky, fellow! Cash in on that luck while the streak holds.

So what good are measurements afterward? Is this whole exercise just more 'hype' to sell product? Are you getting anything at all for your extra \$50 or \$150 when you specify a 90 degree LNA over a 100 degree LNA?

Good questions.

We'll come back to that 'good question(s)' shortly.

What is often overlooked by dealers who like to slip LNAs on and off feeds is that the whole LNA's performance 'turns upon' the way their antenna (**feed**) delivers signal to their LNA, and the way they 'feed' power to their LNA. For example, take the powering consideration.

Not all LNAs operate best at the same input voltage. Many receivers supply a +18 VDC source for LNA powering, through separate receiver terminals or duplexed via the coaxial cable line from the receiver / down converter to the LNA proper. What about the LNA manufacturer's recommended 'LNA voltage level'? You say you never bother to check that? "**They are all alike?**" Not so.

LNAs that require a higher voltage (such as +25 volts) than your receiver suppliers are NOT going to achieve their rated gain or noise temperature at a **lower** voltage. What about going the other way? Using +18 volts to power an LNA that has an operating voltage specified of +12 VDC? **No problem.** Internal to the LNA is a little gadget quite a regulator; it **lowers** the LNA supply voltage to the appropriate voltage to operate the LNA. But, unfortunately, regulators only regulate 'down'; not up. If the voltage is higher than required, no problem (**up to the maximum** operating voltage specified in the data sheet). If the voltage is lower than the minimum specified, you won't get the LNA performance.

LNAs, by brand, have differing concepts of how the antenna collected TVRO signals are funneled into the first GaAs-FET stage. You may have heard the term 'isolator.' If you understand what an isolator does, you appreciate that there are circumstances where the



TWEAKING on the LNA adjustments, gain reduces slightly (56.24 dB) while the noise temperature drops 4 degrees at 3.7 GHz.

various signals created within a TVRO receiving system must be kept out of the antenna portion of the circuit. Isolators, for example, are used when two or more single conversion receivers are connected to the same antenna, to insure that the (local) oscillator in one receiver does not create interference with the other receiver(s). **The LNA also has an isolator.** It is the first real 'circuit' which the TVRO signal sees after entering the mouth of the LNA.

In the LNA, the isolator's primary function is to transfer the energy from the antenna (feed) into the electronic circuits. It is, in truth, a 'matching device,' matching the 'impedance' of the antenna (feed) to the impedance of the (first) GaAs-FET amplifier stage. When an isolator is designed for this purpose, some assumptions are made by the designer about the 'impedance' characteristic of the **feed antenna** that bolts onto the front of the LNA. The isolator is designed for a particular feed impedance from the feed antenna, or a 'range' of feed antenna impedances. You may not understand what impedance is (few do) but you can appreciate that if impedance match is important (it is), that if the LNA designer assumes the feed antenna will have a **certain range** of impedance, and the feed ends up having a **different impedance** (range), then the TVRO energy being transferred from the feed antenna to the first GaAs-FET stage may not occur properly.

That is what you are up against in the field when you swap out LNAs for testing. The feed you select should be a feed which has the proper impedance range to match the isolator input to the LNA. Generally speaking, feed suppliers know that people are out there swapping feeds, and they want their feeds to match the input impe-

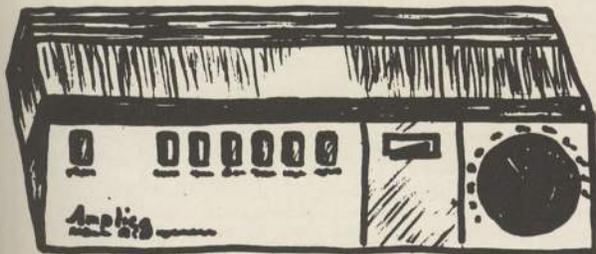
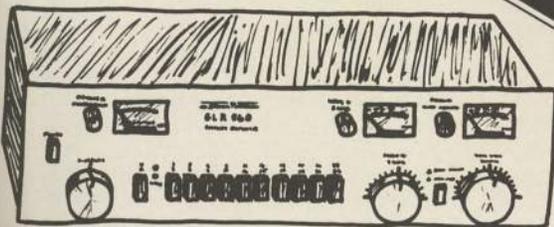


MEANWHILE, at the opposite end of the band, LNA has 54.36 dB of gain at 4200 MHz (4.2 GHz) but the noise temperature jumps to 112 degrees. Production units attempt to maintain a peak to valley variation of 6 to 8 degrees between worst and best case noise temperature across the band.

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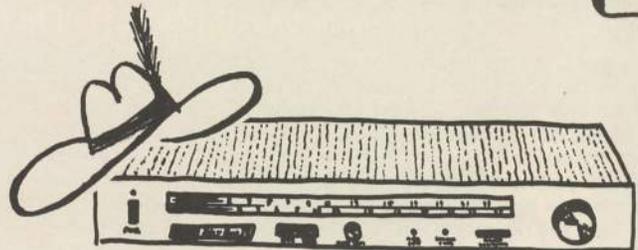
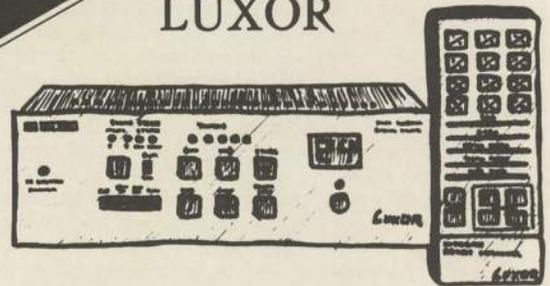
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dance of the LNAs just as badly as the LNA folks want their isolators to match the output of the feed antenna. **That should keep everybody 'honest.'** Unfortunately, a dealer who is not careful in selecting his system components may well end up with a mis-match here and the mis-match can invalidate any meaningful LNA swap-testing he may be engaged in. If you have any doubts in this area, talk with the designer of the LNA about the feeds you intend to use; they are very conscious of this field problem and are anxious that you not determine their LNAs are bad, simply because you stuck a 'strange' feed on the LNA.

Having dealt with two field variables over which the LNA supplier has no real control (except to warn you about problems), let's go back to the question of measured specifications for LNAs. Just what good are these measurements, anyhow, if there are ± 10 or ± 20 degree 'ranges' of accuracy in the initial **factory** measurement procedures (best case)?

There are short term and long term measurement verification 'errors' to be dealt with. Short term could be 'same day measurements,' or even same week measurements. Long term would be same week or same month. Same year is certainly 'long term'!

Kingsley Hastings. "I feel very comfortable with 'grading' of several LNAs on the same test station in the same day, or even the same week. We may, in all honesty, have a ± 10 degree variation from an absolute known noise temperature, but from LNA to LNA we can certainly determine, accurately, which ones are 'hottest.' And isn't that the name of the game; finding the 'best' LNAs for those applications where extremely low noise temperature is the requirement?"

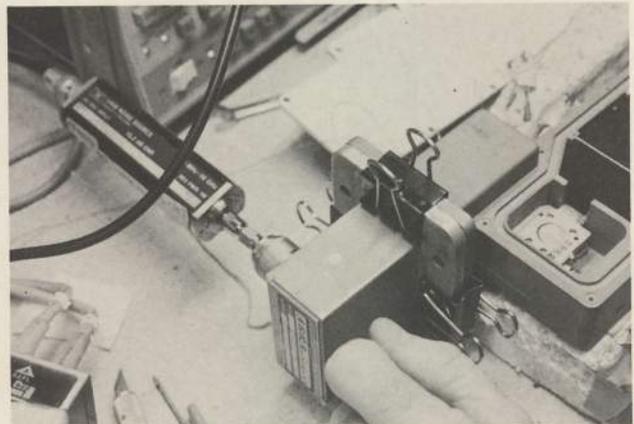
LOCOM technology-parent Locus has an illustrative story. RCA needed four LNAs with noise temperatures in the 70 degree region. RCA had the ability to **verify** 'absolute' noise temperature numbers. Locus, to meet the terms of the purchase order, had to meet those numbers. The LNAs don't pop off the production line with 70 to 75 degree noise temperatures. You find a 'super hot one' every now and again.

Kingsley Hastings again. "We may go weeks without one that has a worst case noise temperature below 80 degrees. We may even go months. They are not routine at all!" But they can be found, and with very-very extra careful selection of the initial GaAs-FETs the odds of finding them can be improved. Joe Ray. "If you know that you have a specific requirement to meet, you can go all the way back to the individual component part tolerances; the chip caps, the resistors, the PC board, and of course the GaAs-FETs. Everything has a pass, no-pass tolerance range. But within that range, you do have variations. If you 'tighten up' your acceptable range, to just the 'middle' of the region that you normally pass for LNA construction, you reduce those very small variations in tolerances to an even smaller 'window.' The end result is that while it costs far more dollars, in time and grading, to hand select everything going into an LNA, you can improve your odds of getting extra-ordinary noise temperatures."

When you do this, tighten up tolerances for a hand selected unit, can you be assured of success? Kingsley. "Sometimes it works, sometimes it does not work. The truth is that you can never be sure of the integrity of all of the parts, or sure that what you are measuring is every factor that you should be measuring to insure optimized performance. There is still some black magic here!"

What LOCOM has done is to tighten the tolerances they will accept, on a routine basis, to in effect 'grade-out' prior to production LNAs that generally fall between 100 and 120 degrees. Kingsley. "Competing head to head with Amplicon or Avantek or Dexcel for the big volume market of 110 and 120 degree LNAs was not our entry philosophy to the marketplace. We knew we were just getting started, that our output would be low by their standards, and we decided to take the Locus technology we were licensed to use and put it to work with LNAs that were a premium grade unit."

That was 1982. As Kingsley spoke, the first steps towards creating a far more expansive LOCOM production facility were evident throughout the building; new classes training new assembly and test personnel, new test equipment stations arriving, chalk marks on a concrete floor indicating where partitions would be installed, how materials would flow from station to station.



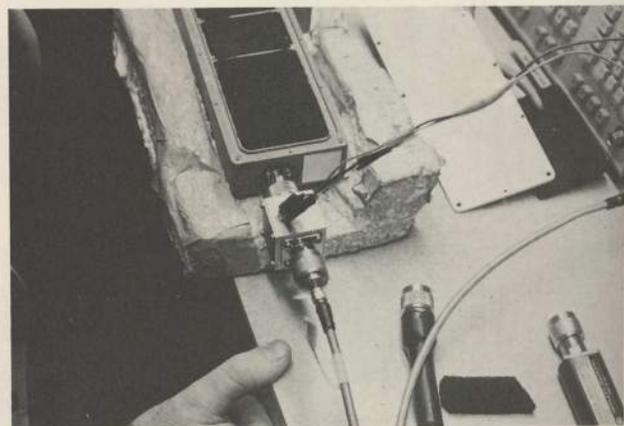
GOES-INTA. Noise and swept frequency response sources from H-P 8970A 'machine' couple into the LNA under test through a coax to waveguide transition system.

Key question. 'LOCOM is turning out a high quality LNA product. Suppose it turns out that you have been able to do this because you have kept the volume low. What happens when you double and then double again your production volume? Isn't that likely to become a factor in your holding your low noise temperature integrity?'

Kingsley Hastings. "I think we can do both; have good volume and good quality. I am not at liberty to discuss the terms of our order from Intersat, for example, but it would not be out of line to assume that we could be producing 110 degree units, or 100 degree units, in areas dedicated to that noise temperature range in one part of the building, where larger volume is the main factor, while at the same time continuing to build 80 to 100 degree units in another part of the building. The two approaches to product quality do not have to be counter-forces tugging at each other."

A number of people who like to be on the leading edge of this new technology have looked closely at the present generation of LOCOM products. Down in the Turks and Caicos, we have a true 80 (true in the sense that it has a worst case factory spec of 80 degrees) and a true 90 installed. Both have been in service for several months. The 80 degree unit is on our largest dish, a 20 foot HERO. We originally had a 100 degree Dexcel on this antenna; the feed is a modified Chaparral Polarotor designed for circular plus linear polarizations. We measured a one-plus dB improvement in carrier to noise ratio when we swapped the LOCOM for the Dexcel. Again, to not miss the point, one was a 100 and the other an 80.

The 90 degree unit initially went onto our test Harris Delta Gain 10 footer. It subsequently came off and went onto our Paracclipse 12



GOES-OUTA. Output from LNA is fed into analysis equipment that separates the gain and noise temperature test signals for purposes of comparison and display.

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footer since we wanted the LOCOM LNA out in the open (the Harris feed 'shrouds' the LNA from the weather) to determine what the environment (salt spray, heavy sun) might do to the unit. We did only one swap test with the LOCOM 90 degree, against an Amplica 100 degree unit. The Amplicas have been good performers for us down here and we have good feelings about their product integrity and the reliability of the units. The LOCOM 90 is perceptibly better (to the eye) than the 100 degree unit and it measures around .4 dB improvement in carrier to noise ratio. That is close to what you would expect.

LOCOM is here. Their products work and from what we have been able to glean from talking with the industry at large, and after inspecting the facility in State College, we expect they will grow and become a force within the LNA field. There were even hints of other TVRO

related product concepts (if not development) when we were in State College. Until we visited the factory and talked with the principals behind the firm, we had a difficult time accepting that somebody headquartered in State College (Pa) could make a significant dent in the home TVRO industry. If you measure 'dents' by the volume of their production, it may be some time before that dent is noticed by Amplica, Avantek, Dexcel or M/A Com. But the potential is there and for now, if you as a user have need for LNAs in the 80 degree region, LOCOM is, we judge, a viable supplier.

Tom Harrington, as we drove back towards Newark from State College said it all. "**Can a small firm from a small coal mining town in the hills of Pennsylvania make it in the big world?**" Our apology to that old radio soap opera 'Our Gal Sunday'!

DIRECT INTELSAT LINK USA/AUSTRALIA

Commercial station ATN, channel 7 in Sydney, is now installing equipment for a direct satellite link from the USA and an associated studio in the Los Angeles area. The link is expected to be operating on a permanent basis by this month (February). There is a 'twist' however to the way the system will operate and for those terminals located within range of the Pacific relay Intelsat, you may notice some unusual video parameters in use.

ATN claims that the present (NTSC) video format, adapted to satellite use from terrestrial microwave circuits, is not 'optimum' for the wideband satellite modes being used. COMSAT, in the USA, has experimented with a new technique developed by Thompson-CSF. COMSAT claims that the technique, 'Vidiplex', will result in an improvement in carrier to noise ratios by as much as 2.3 dB. The system developed by CBS Labs for satellite use 'alternates between two fields of two video inputs to multiplex them into a single video field'.

The battle to link the Australian continent with the USA via direct satellite connection has been a rocky road. Earlier this year the Australian Overseas Telecommunications Commission (OTC) had announced plans to install a TV receive only ground station close to Sydney. ATN would have taken its USA service from that ground station. However, the Australian Minister of Communications opposed the plan. Finally, the Department of Communications issued a license to ATN to construct **their own** receive only terminal.

The only other TV station is the world reportedly with a full time satellite TV transponder to its use is channel 9 in Sydney, TCN. A US firm, Downlink, has been working with TCN to build that system.

The new ATN terminal will consist of a pair of 12 metre antennas, ATN claims that by using the new COMSAT/CBS transmission technique, they will have performance from a 12 metre antenna system which others normally have from 18 metre antennas.

In the USA, ATN is now completing a studio and network facility at Century City near Los Angeles. This facility is to fed with 24 hour per day programs via terrestrial microwave. The full day will be made up

from programs originating at **NBC Burbank** and from **CNN**, via a ground terminal at Pasadena. The CNN signal will include both the CNN video channel, the CNN audio radio channel, and a cue channel. The **two** signal sources, NBC programs and CNN, will be **multi-plexed** onto a **single** transponder by alternating between fields the two separate input signals.

The link from Century City to the Santa Paula (Ca) COMSAT uplink site will be through a four hop (hot standby) microwave circuit. Control and status signals of the microwave link will be available at both Century City, and in Sydney, in the vertical interval portion of the transmission. At Santa Paula, COMSAT will use a 13 metre transmit antenna to send the transmission through Intelsat IV-A (a 'spare Pacific basin satellite').

The ATN ground station at Epping near Sydney will **combine** the received RF signals from the **two** 12 metre dishes to improve the carrier to noise ratio and the reliability. Each dish has standby LNAs and dual polarization frequency reuse feeders capable of operating with the new Intelsat V birds. One LNA from each of the two dishes will feed one of the two STR combiners. The two identical combiner outputs will then be downconverted. One will be selected and fed via a 500 metre fiber optic cable to the station's control room. The signal will then be demodulated and deprocessed, the extra audio and data channels removed, passed through a digital noise reducer and then onto two identical Vidiplex decoder units. At this point the two video signals (one NBC, one CNN) will be standards converted from the incoming NTSC format to the Australian PAL-D format.

WARMER THAN NEPAL

Does anyone know which satellites are available for viewing to the residents of Venezuela? I have tried researching this, contacted many trade magazines, but no one seems to know enough to give me a concrete answer. One of my customers is extremely interested in purchasing dishes for resale in Venezuela, but first we have to find out what, if anything, there is to see, and sell, there.

Sylvia Portier-Blonder
LINKS, Inc.
630 Pleasant Street
Norwood, Ma. 02062

In Venezuela, at least in the Caracas area and elsewhere along the Caribbean shore, you can install a good quality six meter terminal and walk away with perfect or near perfect pictures on between 6 and 12 of the F3R transponders, and a like number on W4. A few of the F4 transponders will be of similar quality and as there is more and more use of F4 in the coming months, it may ultimately turn out to be a very good source of programs for that region of South America. Additionally, the same terminal, if equipped with a circular polarization adapter and a Polarotor, will have excellent service from two Brazilian (Rede Globo) channels, the Venevision (Caracas) service and the Argentine service. Bob Behar at Hero Communications (305-887-3203) is one contact with experience in that region of the world, using his Hero dishes. Another with experience, using ADM 20 foot and other dishes, is Bill Miller of Promar (4912 W. LaSalle/P.O. Box 22133, Tampa, Fl. 33622).

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REUTER'S TR18 SERVICE PROBLEMS?

IS There Something Here?

The weekday grinding out of non-video data on F3R's transponder 18, by the people at Reuters, interests few people in the home TVRO business. You cannot watch it (well, you can watch it, but it is not very entertaining nor is it very educational in its video form!), it apparently won't help you sell TVRO terminals, and it occupies a transponder which is universally weaker than most. So what good is it?

Most of us are aware that Reuters, an international news and commodity and stock pricing reporting firm with headquarters in the United Kingdom, puts up on transponder 18 that strange video pattern. Few of us are aware of the real purpose for that service.

Reuters is in the information business. They sell data, hot scoops, current information of a wide and varying nature. They make very good money selling information and their clients are scattered all over the globe. They do not command the attention of AP or UP(I) as a news service within North America, but throughout much of the free world and even into the Communist countries their various news and information services are highly regarded and widely quoted.

When Reuters took occupancy of a transponder on F1 (just days after the cable industry moved from F2 to F1 back in 1978) the cable industry figured they were up to something akin to the present day CNN (or CNN-2) service. Nobody could figure out **why** somebody would pay big dollars just to transmit stock market quotations around the country. There were already plenty of people doing that, using relatively speaking 'narrow band' transmission circuits. Why would anyone really need high speed, 'wide band' circuits for such a service? What the cable industry did not realize is that Reuters wished to 'batch' or marry not only their North American stock market quotations but their world wide stock market quotations, their commodity market reports, their 'Singapore Rubber Future' reports and a hundred and one other special reporting services into one massive wideband transmission program. They could not do this with existing narrow band, telephone grade circuits because the amount of data they needed or expected to transmit was simply too great to be accommodated on narrow band circuits.

Reuters has so many different stock and market quotation specialized services available that very few of their customers take anything approaching 'the full service.' A man in Ohio following corn prices has little interest in South African diamond prices. A man in Los Angeles following Zurich gold prices cares little about Chicago sow prices. Reuters operates a number of 'regional' distribution centers, out of cities such as Dallas and Los Angeles and Chicago where **all** of the data, from the full many-faceted transponder 18 service, is 'dumped' via satellite. Then 'local' customers, many within direct local dial-up range with their telephones or within local land link connection distance, are interconnected just to those segments of the full Reuters service which is of interest to their business operations.

When you consider how much it would cost Reuters to transmit all of that data, from a central location such as New York City to regional distribution centers using a multiplicity of dedicated long-line circuits, the expense of taking a full satellite transponder suddenly becomes by comparison a considerable savings. Plus, by having a 'full' satellite transponder bandwidth to work with, Reuters has been able to add

dozens of new, specialized services to their national service for a fraction of the cost of constantly adding new dedicated land line narrow band circuits. Reuters, it would appear, made an excellent decision back in 1977 or so, to lease a full satellite transponder for their services.

But why did they select a transponder on what was then, and what would ultimately stay, 'the cable TV bird'? Back in 1978 or so, Reuters felt that ultimately, one day, they might create a new market for their services if they could get some of the cable firms to add the Reuters satellite signal to their cable carriage lines. Reuters had a concept that suggested that one day, perhaps by the early 1980's, many of the new services they planned might be 'saleable' into individual homes at 'stripped down prices.' Would not a man who follows Swiss Dollars in his office also like to have that reporting service on the screen of his living room or den television receiver? Reuters hoped he would, and gambled that sooner or later the cable system operators and Reuters would be 'partners' in bringing specialized news and market information into the home.

Things in this department have perhaps not moved as fast, or gone as far, as Reuters initially hoped. Some cable systems, notably those in and around New York City, do carry the Reuters service. But cable firms have been faced with an entertainment channel explosion, thanks largely to the growth of satellite delivered video services, and the competition for 'cable carriage channels' has become very fierce indeed. A cable system with a mere 30 channel capacity, for example, has to look at **each** programming option very closely and select those programming services that offer maximum appeal to the broadest possible range of potential cable subscribers. In a phrase, cable firms are learning to 'maximize their revenues' by 'maximizing their viewing appeal.' Reuters has a very small segment of the population interested in their services, so their appeal ends up largely in areas where stock and commodity brokerage houses operate. Ashtabula, Ohio is not one of those places.

With all of this in mind, four of those attending the November **Provo Satellite Retreat** decided to pay a formal visit on the Reuters operation in New York City to meet with a trio of Reuters people. **David Johnson** (Paradigm), **Peter Sutro** (Patmar Technologies), **Tom Harrington** (Universal Electronics) and Coop dropped in to see Reuters to discuss how the private, or small-business TVRO industry might make itself part of the Reuters sales and marketing scheme.

We came face to face with several issues. We did not resolve all of those issues in the first meeting, but felt that we had at least broken the ice and perhaps opened the door a crack for future meetings.

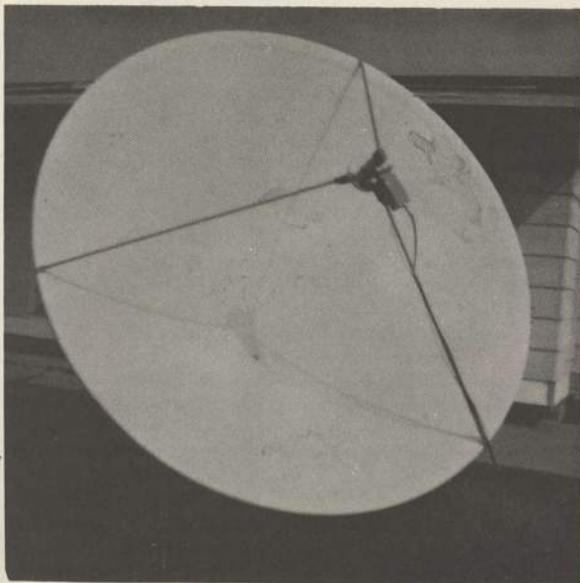
Reuters operates with typical British resolve. They carry concerns about **who** they are, **what** they do, and there is a certain element of mystery about their operations. Their service is delivered universally via satellite (as well as land line circuits) in North America but they are very defensive about how their Reuters' manufactured terminal (i.e. decoder) equipment performs. They manufacture their decoders in their own facility, and obviously are not very keen on the prospect that



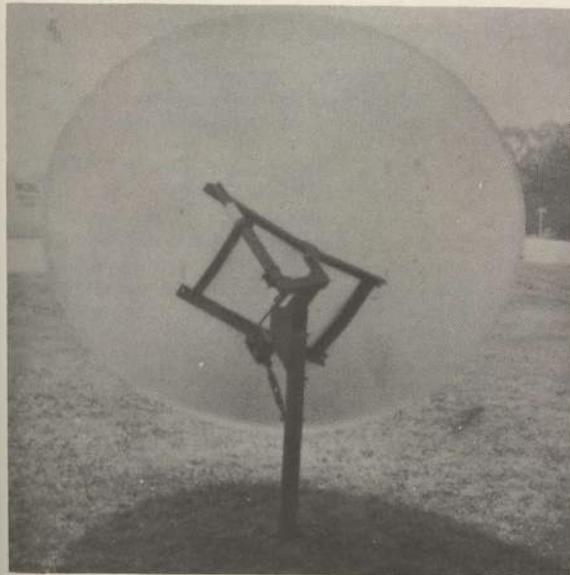
PARADIGM'S DAVID JOHNSON pondering how many 12 foot Paraclype antennas might be sold if the industry can reach accord with Reuters.

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somebody out there in their garage workshop might figure out what they are doing, and how they are doing it, and 'copy' their box for a pittance. Our quartet attempted to belay those fears but we were probably not terribly successful. A good portion of the cable industry does, after all, still refer to us as pirates and thieves and since Reuters has some close associations with the cable market, it is understandable that they might believe some of this 'noise.'

They are also very cautious. For example; the day we visited them, they were in the process of turning on their own brand new uplink out on Long Island. For years they have been uplinking through RCA at Vernon Valley (NJ). One of the trio we met with mentioned the new uplink about to fire up. Another, equally high company executive, expressed some surprise that they were doing that (i.e. installing and turning on an uplink) 'without his knowledge.' The explanation he got from another Reuters man tells the tale. "We are in a bit of a hush hush information business, you know. We felt it best not to make any public announcement what with the terrorists groups out there just looking for some likely communications facility to dynamite . . ."

Their caution, and this is not by way of being critical but simply by way of explaining to you what any TVRO dealer will be up against when attempting to work with Reuters, extends to their hardware system installations. We were given a lengthy, quite technical demonstration of their many hundreds of different services available, and then we got into an area that fascinated Peter Sutro and Coop; **error rates.**

In the data business, an error is anytime a specific letter or number is originated at the transmitting end, and it does not arrive at the receiving point. Many types of data transmission systems will transmit an 'erroneous character' when the transmission circuit becomes garbled. For example, let's say the price of Warner Amex stock was \$47.00 a share at that moment. Some data transmission systems sending \$47.00 might print or display \$87.00 at a receiving terminal that did not have the ability to recognize an 'error.' Obviously a man sitting there in his living room sipping on his second cup of coffee, holding a thousand shares of Warner Amex stock, might get pretty excited if he saw his favorite stock had jumped \$40 in a matter of minutes!

Enter British reserve. Not the financial kind.

Reuters will not print an error. After each bit or batch or line of data, a special bit of data is transmitted which in effect 'checks' the previously transmitted data. If the original data received, and the 'check data' received are not **exactly the same** in every way, what happens? Well, if the two do not conform, then the Reuters system simply skips that line and prints nothing. They feel it is far better (i.e. more conservative, safer, etc.) to 'skip' that data for a single 'pass' than to cause that guy in his living room to spill the second cup of coffee into his bathrobe pocket.

It turns out that for most of the various services available, and in particular the constantly moving and changing stock and commodity pricing sub-services, there is a 'fresh pass' to the receiver every few seconds. That means that if the first pass has an error in the Warner Amex stock quotation, in about four seconds time here will come another (updated perhaps) pass and with any luck at all, it will check itself correctly and print out on the screen.

Peter Sutro had gone to Reuters last fall with the clear intent of developing a sales package for Patmar Technologies built around offering the Reuters service to Patmar affiliates. Peter was, however, frustrated. Reuters engineers did not like Peter's plan to install what Reuters felt were too small dishes and inadequate receivers to recover the highly complex Reuters waveform. "**You will have too many errors and the service quality will be sub-standard**" they told Peter. We wanted to find out why they felt this way since a test terminal installed by Peter in nearby New Jersey seemed to be performing in a very satisfactory manner.

Reuters attempted to explain it to us. "**There is a built-in error rate test system in the transmission service**" they noted and punched up on their office display the appropriate keyboard entered code to bring out the test signal analysis. "**See that 120 on the third column from the left** (it actually read T00120)?" We did. "**That tells us that there are no errors in the transmission**" (well that might be so; we were looking at a 'hard wired' direct feed from another section of their facility!). So, a key question. "**OK, how much lower than 120**

25-0		NYSE TICKER	
OLIN	1s 23 1/2N + 1/4	AUTO D P	39s 36 1/2N + 1/4
AMSTAR	2s 26 1/2N + 1/4	BRISTOL MY	13s 69 1/2N - 1/4
DET ED	1s 13 1/2N	P SUC NM	6s 25 N - 1/4
HEIL BREW	5s 35 1/2N	EAST AIR	5s 8 1/2N
CATERPILAR	3s 38 1/2N - 1/4	NABISCO	7s 38 1/2N - 2 1/4
BOISE CAS	1s 36 1/2N + 1/4	JBSN+JBSN	1s 48 1/2N - 1/4
PFIZER	3s 76 1/2N + 1/4	BAKER INTL	10s 22 1/2P + 1/4
>		WILLIAMS	10s 11 1/2N - 1 1/4
HUGRS TOOL	9s 19 1/2N + 1/4	DOW CHEM	2s 24 1/2M + 1/4
BEATRICE FD	21s 24 1/2N	DISNEY	5s 64 1/2X + 1/4
S CAL EDI	2s 34 1/2N + 1/4	HOSP CP AM	5s 58 1/2M - 1

WEDNESDAY DEC. 8, 1982 15:41 SEE 0-12

LATEST NYSE ticker display is but one of hundreds of services available to a full 'commissioned' terminal location. Basic package, news plus stocks, is approximately \$100 per month, Reuters gear included.

can that number be, and still produce an error rate of 0?"

There was no simple answer. It boils down to the speed and repetition and format of the data being sent. There was nothing that would guarantee you that (for example) everything below 115 was going to be garbage.

"What we **have** determined is that there are certain minimal terminal standards which must be met or there are too many errors for satisfactory service" one of the trio explained. And what might those standards be?

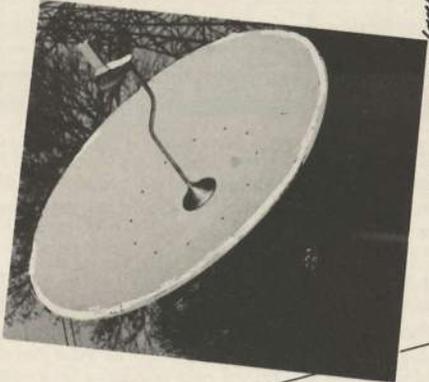
"We have tested virtually every commercial receiver on the market. We like the Scientific Atlanta receiver. We think the CNR (carrier to noise ratio) must be at least 12 dB, and that number tells you what type antenna to install. In this part of North America, for example, anything smaller than a 4.5 meter is inadequate and a six meter may be required." That didn't excite Peter Sutro very much since he was at that time connected to a Harris 3 meter Delta Gain antenna.

"Have you looked at any of the receivers in the 'home' TVRO field?" we asked. "Yes, and they all work very poor." Sutro asked specifically about the new **DX** double conversion, block, down conversion receiver. He was having excellent results with it on the test 10 foot Reuters installation but lacked a 'professional appraisal' of the unit. Reuters had not tried that one. "**Actually, we determined quite early that only the Scientific-Atlanta receivers and antennas would perform for us**" was the response.

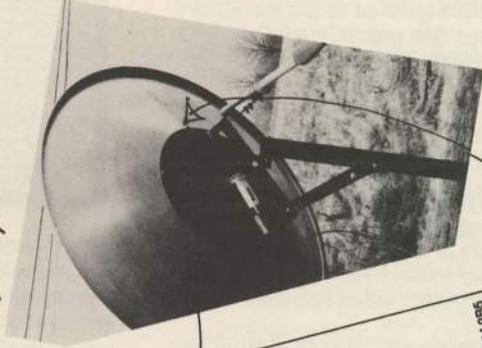
Tom Harrington started to tell them about an S-A 15 footer installed by a major satellite broadcaster in North Carolina, taken out recently after one of David Johnson's Paraclypse antennas beat the socks off of it to the satisfaction of the uplink operator's engineers; and then backed off. We were there **to learn**, not to antagonize or get into arguments. If this guy liked S-A, that was fine. Sid Topol probably took him to lunch once!

C00000	I14490	T00120	C00000	I14490	T00120	C00000	I14490	T00120
C00000	I14490	T00120	C00000	I14490	T00120	C00000	I14490	T00120
C00000	I14490	T00120	C00000	I14490	T00120	C00000	I14490	T00120
C00000	I14490	T00120	C00000	I14490	T00120	C00000	I14490	T00120
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C00000	I14490	T00120	C00000	I14490	T00120	C00000	I14490	T00120
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C00000	I14490	T00120	C00000	I14490	T00120	C00000	I14490	T00120
C00000	I14490	T00120	C00000	I14490	T00120	C00000	I14490	T00120

ERROR-LESS display shot on monitor at Reuters office in New York City. Every part of it means something in analyzing errors but if you can remember the T00120 count as indicative of the signal to noise ratio present, you have it made.



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Dear TVRO Dealer/Distributor... Trouble is, the high cost of this "in" (something the boy discovered years ago!) most of us at ALUMINUM dish is going to be one of the success stories of the year. And here's why:

- * **INEXPENSIVE** Computer-assisted efficiency equal to many 10' and 11' antennas! Complete kits, in about the same space as 2 'briectors'.
- * **RESIZES** Computer affords efficiency equal to many 10' and 11' antennas! Complete kits, in about the same space as 2 'briectors'.
- * **SHIPS EASY** One-to-in business! You're in business! Perfect on rooftops and other difficult locations! We can ship 10 complete kits, in about the same space as 2 'briectors'.
- * **QUICK ASSEMBLY** You're in business! Perfect on rooftops and other difficult locations! We can ship 10 complete kits, in about the same space as 2 'briectors'.
- * **LIGHTWEIGHT** Of course, we're not the only people building spin dishes. But our spin dishes are 'hus' and 'them'... 'chuck'! Because most of not all spin dishes are 'hus' and 'them'... 'chuck'! Because most of not all spin dishes are 'hus' and 'them'... 'chuck'!

First, the spinning tooling, they can't produce goods not all spin dishes are 'hus' and 'them'... 'chuck'! Because most of not all spin dishes are 'hus' and 'them'... 'chuck'!

But our spin dishes are 'hus' and 'them'... 'chuck'! Because most of not all spin dishes are 'hus' and 'them'... 'chuck'!

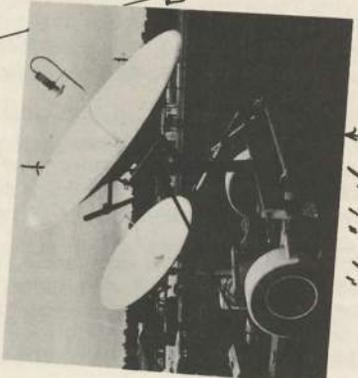
Our unique ID-3500... 488 Rathkelle Street, Mississauga, Ontario L5M 2B5



the price is right!!

has shown 30 minutes!

"the key" to our success!



our "demo" trailer!

David Sproule

you can carry up to 20 dishes at one time!

* dealer price - includes bucket, bucket & potter mount!

call us to find out how you can get me free!

The group, representing on an ad hoc basis the private TVRO industry, offered to bring to the Reuters Long Island facility a representative sampling of home TVRO products for Reuters to analyze. We felt that one of the first things we had to do was to convince them that 4.5 to 6 meter antennas and S-A receivers were not required; or, since we were being very open minded about all of this, have them convince us that this was 'the package' that was required! They were interested but fearful of being inundated with a truckload of antennas, LNAs and receivers. Coop had a suggestion.

"Peter Sutro is close by and he has a testing facility. You have already provided him with a test package of your equipment and he is already swapping equipment about to determine which pieces work, how well they work, and what might make a good package for Reuters information recovery. Let us, through Peter's nearby test installation, sift through the dozens of receivers, antennas and LNAs available and then bring to you just those that seem superior, and by Peter's tests, adequate for private terminal licensed-by-Reuters use." They liked the idea and that program is now underway.

What we did get was the information that for right at \$100 per month, it is now possible for a private home owner, an office or whatever to take the basic Reuters service that includes stock and news information. Additional 'packets' of data, in specialized areas, can be added for approximately \$25 per month. That price includes a pile of Reuters hardware since you must have a Reuters decoder tacked onto the video output from your TVRO receiver to recover the immense amount of data present on the transponder, and display it on a screen. We all agreed that there were plenty of business firms and stock investors and commodity market followers out there who would gladly fork over \$100 a month to have this service available in their home or office. Not everyone, after all, lived nearby to a regional Reuters distribution center and a private TVRO was the answer. Provided.

Provided we could come up with a package which seemed to have a sufficiently low error rate that (1) the customer would not be confused or intimidated or frustrated by all of those (skipped) 'blank lines' which represented erroneous information, and, (2) the price of such a package was not out of reason for normal private, home, terminal installations.

Having heard from Sutro about the results he was having with his own Reuters test installation, it was obvious that since we were all nodding our heads in agreement with Peter as he recounted his results, it might be a good idea if we saw a first-hand demonstration. A trip into nearby rural New Jersey followed.

Patmar has been handling the Harris ten foot Delta Gain antenna for nearly a year now. Unlike Coop, Peter Sutro is not bothered by the unusual product launch Harris gave to this product and finds it to be a very good antenna system for semi-commercial installations. On it was a 100 degree LNA and connected to the dish and LNA was a new **DX Block Down Conversion** receiver. We checked the 'error rate.' The screen told us it was (T00)105 to (T00)115. The average was in the 110 region; substantially lower than the Reuters man had indicated they found acceptable.

Now what about the results; the news or stock or commodity quotations? How many missing numbers / letters / words (i.e. lines of data) would we find with this type of 'error rate'? We crowded around the monitor watching. The only blank line was the line that was being received and printed (indicated by an > mark) at the time. So where were the errors?

We didn't see any. And we were **looking** for them.

Undoubtedly they were there. Perhaps the data was being updated so often that we were simply not noticing the errors? We had a hard time finding anything erroneous with the service which we felt a potential customer would complain about or ask that the service be removed, because of.

Apparently we were still miles apart from what Reuters considered 'adequate reception' and what we considered 'sufficiently clean to warrant selling to TVRO customers.' But a dialogue had been begun and some agreement had been reached relating to some lower-cost services which private terminal dealers could be selling as 'field agents' for Reuters.

Harrington and Johnson summed up the visit quite nicely. **"We**

```

COI126 I13364 T00109 COI206 I13284 T00109 COI169 I13321 T00114
COI187 I13303 T00109 COI182 I13308 T00112 COI163 I13327 T00113
COI204 I13286 T00110 COI280 I13230 T00105 COI149 I13341 T00107
COI173 I13317 T00112 COI150 I13340 T00108 COI162 I13328 T00114
COI157 I13333 T00113 COI174 I13316 T00110 COI180 I13310 T00108
COI141 I13349 T00113 COI019 I13471 T00109 COI092 I13408 T00108
COI091 I13399 T00112 COI198 I13292 T00109 COI149 I13341 T00107
COI151 I13349 T00110 COI166 I13324 T00111 COI142 I13348 T00104
COI191 I13299 T00105 COI272 I13218 T00108 COI209 I13281 T00110
COI127 I13363 T00111 COI144 I13346 T00110 COI096 I13394 T00111
COI175 I13315 T00114 COI191 I13299 T00108 COI126 I13364 T00104
COI143 I13347 T00107 COI183 I13307 T00113 COI114 I13376 T00113

```

NOT-ERROR-LESS display, shot from monitor screen at the Patmar Technologies test site in New Jersey on a ten foot dish. Warner-Amex should have been selling for 47 cents if all of those errors account for something!

didn't convince them that we are not pirates?" "No, but they didn't convince us that Scientific Atlanta knows something that we don't know either!"

"The market here is as obvious as the palm of your hand. A professional man, whether he is a doctor or a lawyer or an investor, can see both real benefits and real tax savings when he purchases or leases a terminal that offers him this type of optional service. It would make selling or leasing terminals so much easier if we could get across the message that during the daytimes they could use the terminal to follow their investment portfolio, and at night, having 'written off' the terminal (for tax purposes) in the daytime, they could become just another quiet American family hung up over on F4 watching the Playboy Channel!"

The door is open a crack; the project is now underway.

THE ROOTS OF TVRO (Part 6)

Senator Edward C. Johnson was one of the early advocates of color. Some have said of the Senator, *"Johnson wanted to get television in Denver (a city without television when the freeze hit) and he viewed the color matter as an obstacle to getting television for his constituents. Consequently, he was quick to jump on anything the FCC did which threatened to put off television for his Colorado."* Later, because

Johnson ran for (and was elected as) Governor of Colorado, others would say in looking over his record that "*Johnson wanted to run on a platform that he brought television to Colorado.*" Whatever his reasons, he was (it appears in historical perspective) mostly *nettlesome* to the Commission and did not have a profound effect on television in the country (or his state) until years later when he *was* Governor Johnson.

Still, in the summer of 1949, Senator Johnson was *already* fed up with the color indecision (*it had hardly begun!*). So he urged that the influence-free high scientific community, represented by the highly esteemed National Bureau of Standards, select a committee of experts to study the subject. The Senator said he wanted a "*comprehensive and unbiased report from an independent group, so the public can be supplied, as soon as possible, with a true picture of what we have in color and can expect in the future*". There was some low level scratching to form such a committee for a few weeks, but it eventually drifted into oblivion.

Early in the fall of 1949, the FCC got its color TV show on the road. It had decided *it would be* the unbiased expert panel, all but itself, *without any help* from the National Bureau of Standards thank you!

Held in the Commission's session room in the Department of Commerce Building, reams of evidence and testimony were taken from virtually every area of electronics. Just as the hearings got under way, CBS did a razzle-dazzle bit of one-upmanship and staged a private demonstration of its color system in the Armory in Washington. The demonstration was attended by in-

itation only, and guess who one of the invitees was! *Right—Senator Edward C. Johnson.* Immediately after seeing the demonstration, Johnson drafted a letter to FCC Commissioners Robert F. Jones and Paul A. Walker, in which he said:

"...the color show was magnificent and utterly convincing proof that color TV is here now, and that all that is necessary for it to sweep the nation is for the FCC to remove the roadblocks and promulgate standards for its operation."

Then the Senator added a postscript to his letter and noted:

"However, the reluctance to show the FCC the facts by those who know the most about color and who can most effectively demonstrate its development disturbs me."

The Senator from Colorado was upset, after writing his glowing report to two FCC Commissioners, *why CBS had not made such a presentation* to the Commission. Apparently, he realized after-the-fact that he may have been *had* by CBS.

Several days later FCC Commissioner Jones wrote CBS President Frank Stanton:

"Your zeal appears to have been tarnished; you insist on trying to promote your color system outside of the FCC hearing rooms; apparently because this Commission has taken the initiative in this matter. Your action in this matter might well lead one to the conclusion that while your company is anxious to transmit color TV, it is reluctant to permit others to operate color video receivers to appraise what you have transmitted. We must know whether laymen can operate the receivers, and we can learn this only by allowing laymen to operate the receivers under as many diverse conditions as are common in black and white."

The gauntlet was down. The FCC had challenged CBS to "show off its

color". After all, the Commissioner reasoned, the FCC had begun hearings and was taking testimony. *They would decide* the fate of color. So show *them* the color; back up the testimony and claims!



INDUSTRY AT LARGE

CORRESPONDENCE, NOTES, REBUTTALS AND CHARGES . . .

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SQUARING THE RECORD

Here is an update on our TVX-1 rack mounting ten watt transmitter package which CSD wrote up in the November issue. The TVX transmitters are now available on VHF channels 3, 4, 5, and 6 as well as 7 and 8. We are working now with the Motorola MHW613 (ten watt) power module, which is used in the amplifier stage, to see if we can push it beyond channel 8.

The 'hams' have not channelized as you depicted on page 24 of CSD November. We have agreed to avoid frequencies which would interfere with weak signal narrow band communications and by selecting your suggested 426 to 432 MHz (channel 'B') we find that the audio sidebands on 431.75 are too close to the 'universal' 432.00 MHz frequency to allow really weak signal, narrow band work there. We also avoid the full range from 432 to 436 MHz, because of the OSCAR (amateur) satellites which have some priority in this range. Typically, east of the Rockies 439.25 is the common video carrier frequency while in the west and in foreign countries 434.0 MHz is used. The 426.25 MHz frequency is the most popular 'second' channel. For amateur television repeaters, 421.25 MHz is the most popular 'output' frequency since all repeaters use interdigital filters and can operate there with a 439.25 MHz input frequency. You wrote that the PSF438-ATV interdigital vestigial sideband filters were apparently only available for the 438 to 444 MHz 'channel'. Actually, these lower sideband filters can be supplied by Spectrum International for any video carrier frequency between 420 and 450 MHz for \$132.45 each. VHF single channel filters are available from Microwave Filter Company in E. Syracuse, New York (1-800-448-1666).

On another topic mentioned in the November issue, I was somewhat surprised to see that New York City-ite Ken Schaffer given credit for 'putting the whole package together' for the Canadian Mount Everest Expedition (covered by ABC television in October, until the equipment quit). The **accurate** story is that I **personally** built the portable transmitter for the operation and matched it up with a Hitachi VKC1000 MOS camera. The portable antenna was one of the KLM six element broadband yagis. The transmitter was built up from the same 'modules' which you are using in the Turks and Caicos Islands, installed in a Hammond 1590D diecast aluminum box. The operating frequency was 434.0 MHz. I got a telephone call from the Everest View Hotel which was the head end of the link to the Katmandu Hilton, and they reported they had a signal that was more than 20 dB stronger than full (AM) noise free 'quieting' from the base camp which was some 23,000 feet above sea level and over a path of 14 or so miles.

But then the 'dummy' left the battery plugged in and the

switch on!

They were not able to get a fresh battery to the climbers for the final ascent, but we still have the 'highest' land record under our belts! Incidentally, these guys used quite a bit of 'ham' gear on the climb including some Kenwood handheld units and two meter (144 MHz) for the climbing team, as well as Yaesu FT-One units on 80 and 40 meter SSB nad FM from base camps to the hotels.

Tom O'Hara
P.C. Electronics
2522 Paxson Drive
Arcadia, Ca. 91006

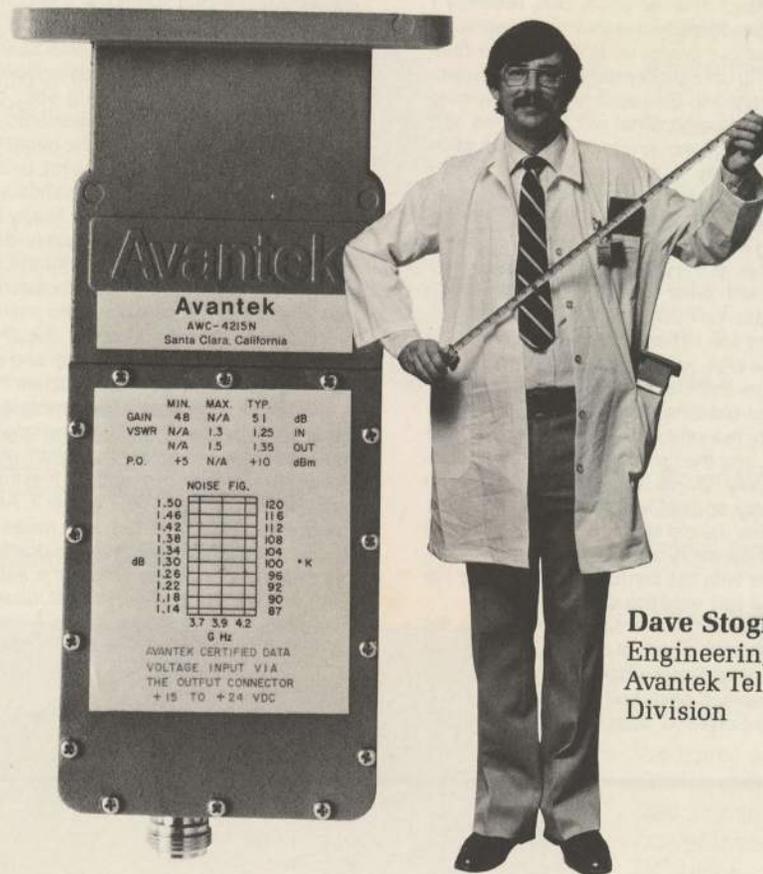
We were all very disappointed when we heard the ABC report that they had 'forgotten' to turn off the equipment after the initial ascent tests. It was a magnificent effort and for the record Ken Schaffer first heard about the attempted climb from a news note in CSD last spring. At that point, Canadian Nelson Ethier was considering being a team member to coordinate attempts to haul live TV equipment to the top of Everest. Schaffer's role was to take the concept and 'sell it' to ABC. That 'sale' provided the bucks for the equipment and if nothing else, Kenny got a trip to Nepal out of the deal!

STAY ALIVE

I regret that Wally and I could not attend your Satellite Retreat to see the many familiar faces and to tell you personally that things are going well for us here in Western Canada. With an active partner in Wally Baydala, I am free to concentrate on the manufacturing process and the end product. So far we are building nothing but our ET 3.66 antennas. The original ET 3.66 down in Monee, Illinois was something of an albatross; costing us almost as much to fabricate as the larger ET 4.85. The Canadian ET 3.66 costs substantially less to make, is being profitably sold, and is easy and fast to install. Installation time is approximately 4 hours or a total of six man hours with no crane required. The surface now has 24 versus the original 20 panels and its performance at 12 GHz should be close to the theoretical limits. A microprocessor controlled drive system is now under development. I hoped to be home for Christmas but there is also the chance that I will be in Papua New Guinea to follow up on your excellent report appearing in the September issue of CSD!

Jim Fines
Baydala AudioCom Systems Ltd.
15606-116 Avenue
Edmonton, Alberta
T5M 3S5, Canada

DOES YOUR LNA MEASURE UP WITH THIS MAN?



Dave Stogner
Engineering Manager
AvanteK Telecommunications
Division

Bring your LNA to the Las Vegas National Satellite Opportunities Conference (NSOC) and have it tested free.

An AvanteK factory engineer will be in our booth to test the accuracy of the noise figure specification of your LNA. He will test any LNA—just bring it with you to the show. And while you're there, ask for AvanteK's engineering publication on noise figure vs antenna size.

See us at Booth 627. March 15th through March 17th. Stop by and get tested.

AvanteK

481 Cottonwood Drive, Milpitas, California 95035 (408) 946-3080

The Vine's antenna surfaces have always been excellent. As Jim will be the first to relate, his selection of operating partners has not always been as good as his surfaces!

I BLEW IT

I'm one of those strange creatures that the good Lord made from a slightly different pattern. You probably know me, big time, high volume, and take real pride on the high volume of this exotic equipment that I sell and ship week after week. I test it, and really attempt to study market needs, new products, and specialize in doing what I say, and giving everyone a good product at a fair price. **But, recently I blew it.** We all have pressures, deadlines and problems to deal with, and how we handle this area of our business is usually the final determining factor if we continue to do it successfully. Manufacturers have problems, real problems, trying to outguess nearly everything and everyone, where the market of going, what will be needed and wanted months and years in the future, and how to get that product on the market at a price customers will pay, and still squeeze out a profit to pay the bills. Dealers and installers have their own set of problems, some of them closely parallel the manufacturer's problems, with the added pressure of having the end user standing over his shoulder, not seeing payday unless it really does all the brochures say it does, and having to live in the same town with them after the sale. They can't refuse to return the customer's calls, he'll come right through the door. Distributors have their problems too. They are not any worse or tougher to deal with than anyone else, just different. Each morning I face those problems, all the usual business tasks, the orders to be filled, the shipping deadlines, the ordering tasks, the profit and loss sheet; **and those phones!** On the other end of all those rotary numbers are the manufacturers, and the dealers. Sometimes it really feels like orchestrated squeeze play. My job is to juggle it all. I have to buy it at the best price in the country, and sell it lower than anyone else, keep it all in stock, but never have the old stuff, give every caller the hottest LNA in the house, and know every circuit in every magic box. No complaints here, that comes with the territory, and it's why I'm supposed to earn more than the guy washing cars.

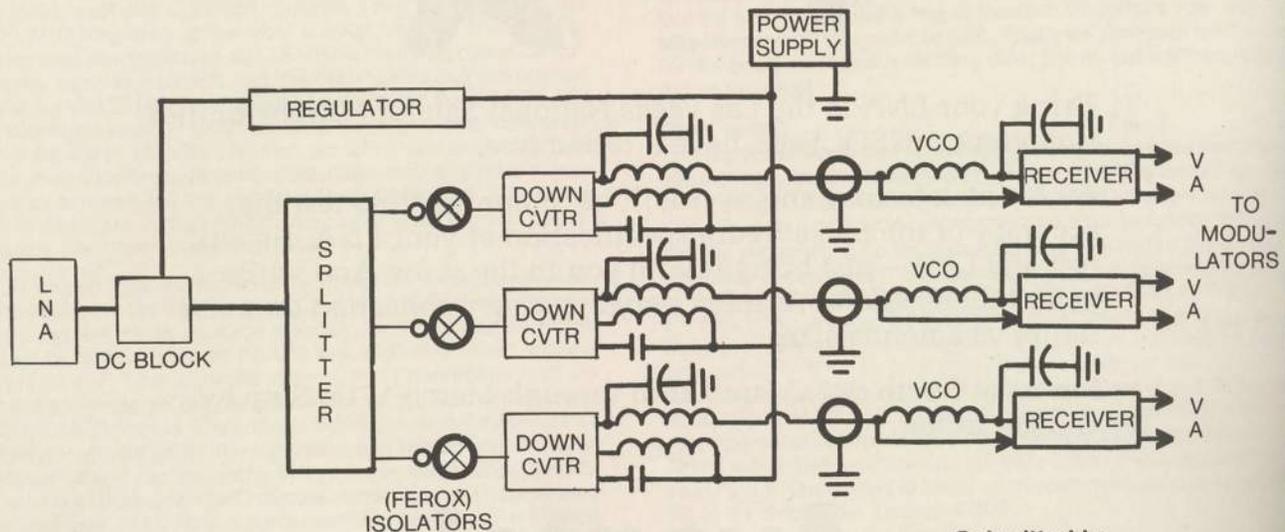
But some days you just can't win. Some days you feel like the soldier on the front lines that has just run out of bullets. **It starts like this:** you have a good inventory of the latest widget, and you sell eight here, nine there, and four someplace else, and reorder before you deplete your stock. Six more are ordered, then three, and then the

phone rings and someone buys 100. No problem, a good sale, ship them right out. Then order more. You normally never allow the stock to get that low, but who could tell that somebody was going to buy 100 of the most expensive "bells and whistles" laden model? The calls keep coming in, and you honestly tell them that you are low but more are on the way (they always have been before). But they don't come. The manufacturer had the same kind of week.

You beg and plead, ask for favors, cry "emergency", but he can't ship you what he doesn't have. You mean to get back to your customer and give him this good news, but the phones are ringing again, and those shipping deadlines are there, and the hundred and one other pressing tasks, and somehow you don't get around to that call. The customer (dealer) is waiting, confident, (your service has **always** been reliable and timely) and tells his customer . . . "it'll be here in a few days". **But it doesn't arrive.** Now the end user is disappointed and mad, the dealer is ringing your chimes, and that untarnished reputation is getting a little green around the edges. Who blew it . . . why the dealer did of course, he ought to buy them **ten** at a time and keep it in stock (they expect me to), or the manufacturer did, that's his business to consult his crystal ball daily and know that this is coming. No . . . the problem is not really in any of these areas. Those dealers are struggling to put their business on the map, and let's not forget that those "little guys" still account for the bulk of our "massive volume" and pay our bills. And the manufacturers would be glad to sit you down and fill you in on all the behind the scenes problems that eat into their profits, raw materials sources, shipping schedules etc. Sometimes they really do tell you they'll ship and don't, and it causes real problems, but that's not the real problem here. **This time, I blew it.**

No, I can't forecast when some high roller will come along and clean the warehouse shelves, and I may not know when the manufacturer goes into a backorder situation, **overnight**, but there is one thing I can do . . . just call him and tell him the situation. But although this is what I always do, this time I blew it. And all my tremendous volume, low prices, and all the rest don't mean a thing to that dealer when he has an angry end user breathing down his neck. We have to remember that most of us are selling the same products, and all we really have to market is service; honest, timely, congenial service. This is a crazy business, and sometimes I wish I was flipping pancakes or growing ferns, but that probably holds true for most occupations. Today I just have to face it . . . I blew it. I should have called. That's no way to run a business.

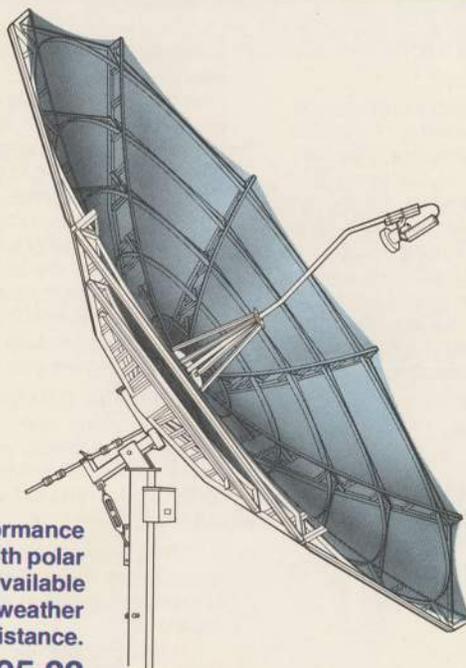
Lament of being a TVRO distributor. Anonymous.



Submitted by
Mike Utsey
P.O. Box 177
Harleyville, S.C. 29448

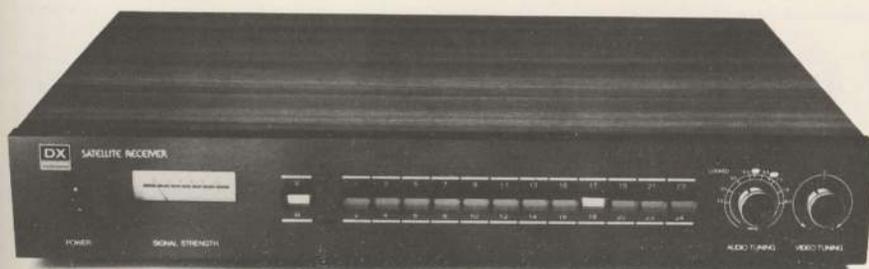
PROVEN TVRO PRODUCTS... PATMAR TECHNOLOGIES

Patmar has been working with the hotel industry for many years now — marketing, installing and servicing the latest in earth station technology. We are ready to put that experience to work for everyone who's excited about TVRO.



The Paraclipse High Performance Satellite Television System (with polar mount) captures all the available signal and reduces wind and weather resistance.

Featured at \$895.00



Now DX Technology makes multiple-receiver mini-systems cost effective. The DSA 642 is a commercial quality satellite receiver that features dual, block downconversion through the DSA 541 downconverter. This makes possible interference-free reception in systems serving from 2 to 20 or more TV sets with one antenna. Furthermore with a coaxial switch it gives full 24-channel selection on each receiver.

Featured at \$1,122.00

Here's a partial listing of what's available now through Patmar Technologies

Call for our special low prices on:

Antennas

Harris 10' delta gain antenna
Prodelin 10' parabolic antenna
Paraclipse 12' aluminum mesh antenna with polar mount

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DX with blockdown converter
Automation Techniques, Inc.
Intersat Corp.
Earth Terminals

LNA's

Locom
Amplica

Polar Mount

South River Metal Products

Power Actuator

Tel-Vi

Stereo Processor

Arunta

Feeds

Chaparral Polarotors

We carry a complete line of MATV equipment from Blonder-Tongue as well as microwave supplies such as power inserters, power dividers and DC blocks.

We also carry the sensational COAX-SEAL which protects fittings and connectors from moisture and corrosion.

So, whether you're just getting into TVRO or are an old pro, contact Larry James at Patmar Technologies for our special prices. And make our experience part of the excitement.

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6 Claremont Road
Bernardsville, New Jersey 07924
201-766-4408

SIX FOOT?

I just returned from a visit to Vancouver (BC, Canada) and saw a six foot dish by Scandu in operation. The system I saw operating produced good quality pictures. Why is it that we in the northeast are forced to use a ten foot or larger antenna to get good pictures when out in Vancouver they get by with a six footer?

William Fitzgerald
Box 171, Ore Bed Road
Schuyler Falls, NY
12985

As we reported in the December CSD, a six footer will produce good quality pictures on some of the newer 8.5 watt (or 11.5 watt in the case of ANIK D) transponders, provided the terminal is located in a location where the full effect (or center) of the boresight footprint prevails. Remember that all satellites have 'directional' antenna coverage patterns, for North American coverage, and while most of the satellites try to center their strongest signals into the central portion of the USA, some also direct their center portion to other parts of the continent. That is why you see folks in Kansas getting excellent pictures on 8 foot dishes. Take the same terminal to Florida or Maine and you might find only a couple of excellent pictures, and a whole mess of not so hot pictures!

BUILD A FACTORY

I am the mayor of a small town in Northeast Missouri, located on the Mississippi River. We are interested in having a manufacturing plant locate here and we have a number of inducements to offer:

- 1) Either a 50 or 100 acre tract of land, with up to \$5M in industrial revenue bonds available;
- 2) Major railroad spur;
- 3) Four lane major north/south highway;
- 4) Immediately adjacent to Mississippi River;
- 5) 150,000 people within 30 miles;
- 6) A trained (Motorola) cadre of workers;

- 7) A county that ranks in the bottom 5% for city and county taxes;
 - 8) An 8,500 person work force available immediately!
- If anyone is looking for an ideal location, a willing and cooperative local government, and a central USA location, we have it!

Mayor Jerry Brandt
City of La Grange
La Grange, Mo. 63448
(314-655-4301)

While we would much prefer that people considering building new plant sites move to the Turks and Caicos Islands (don't laugh; after the Provo Satellite Retreat there are several firms now working on doing exactly this), we can understand the benefits which La Grange offers. If you get to La Grange after this opportunity is gone, contact Coop at CSD about coming to Provo. We can offer \$1.25 minimum wage, no taxes, ever, on anything, complete government cooperation for duty free import of raw parts and export of finished products, low water freight and overnight air freight service, the ability to ship into Canada (for example) at far-far less than the cumulative 54% import and fee tax charges which now plague US suppliers to Canada, and 365 days a year when the temperature stays between 68 and 90 F. Think about that the next time you look out the window and see it snowing!

AN AVERAGE CSD Reader

The following letter, arriving at CSD without benefit of the writer's full name or address, was forwarded by Transifier, Inc. VP Elmer Pegram. The handwritten letter contains a considerable amount of TVRO wisdom and warning for others who may be in the same boat so we share it with you.

"This letter will be too long for my company note paper so here goes on an 8-1/2 by 14 legal pad! I am sure after Cooper's article in his November Digest you will receive alot of 'strange' mail. This should top the list.

"I own and operate the world's funnest cable system. It started three years ago with a Betamax VCR and 200 feet of cable. I had a neighbor who wanted to see my tapes sent down from the states and

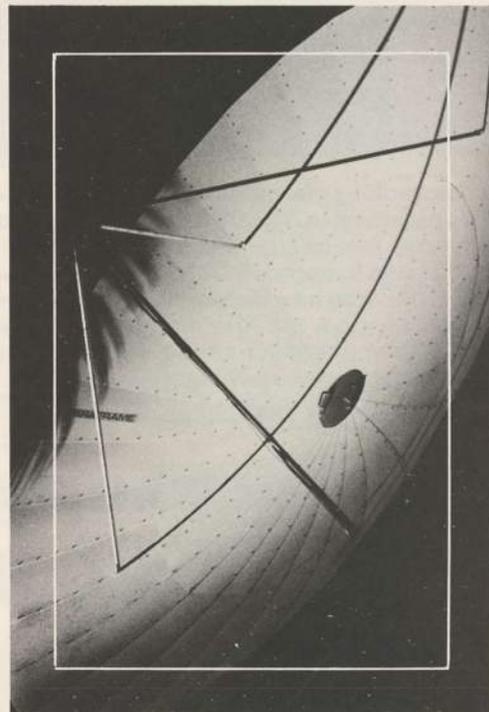
RUGGED HIGH GAIN TVRO ANTENNAS

BUILT FOR RELIABLE WEAK SIGNAL PERFORMANCE

- 4.85, 6.00, 7.46 metres.
Larger sizes built to order.
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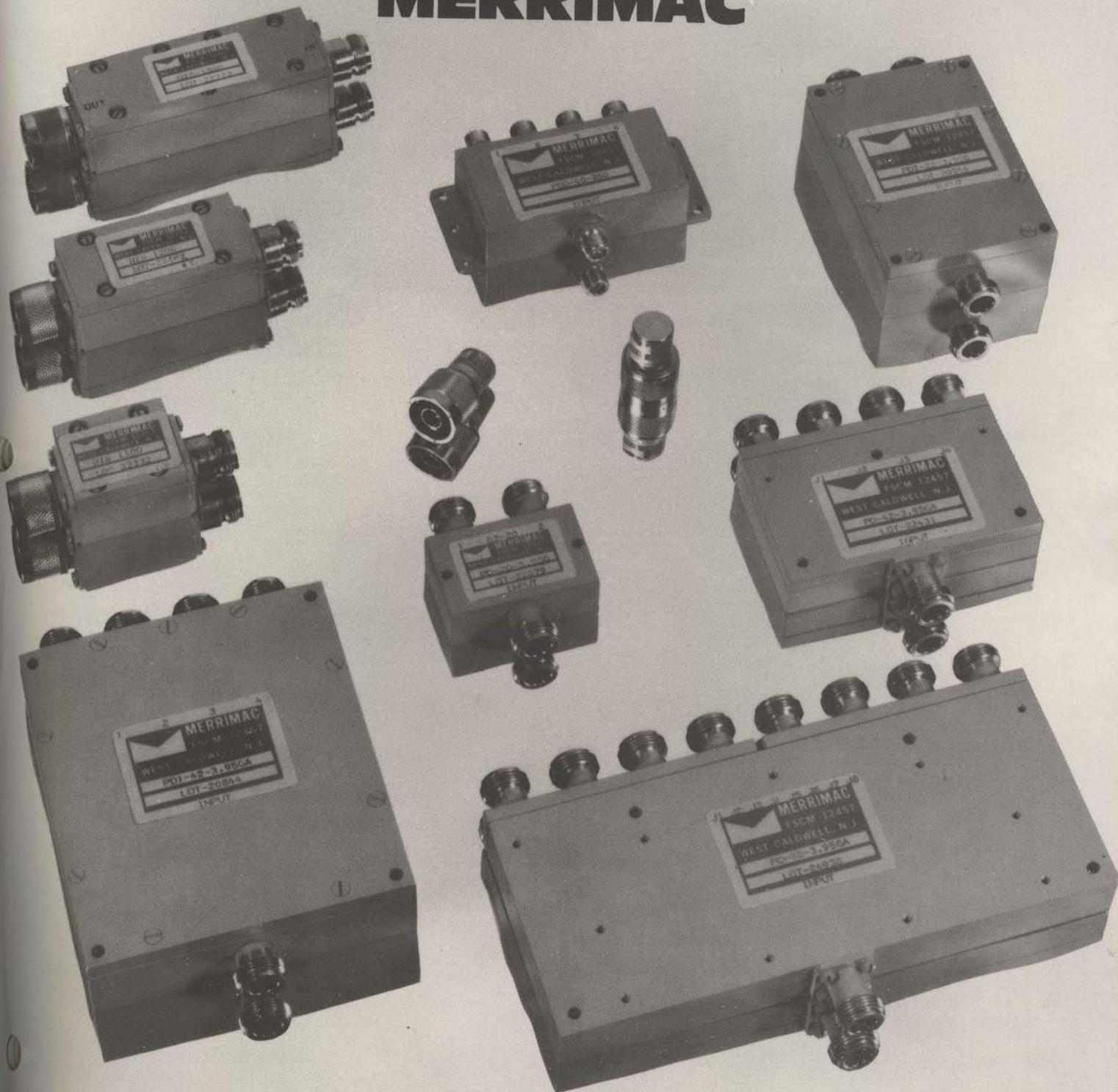
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so I said let's hook you up! Then I bought a full 1,000 foot roll of RG-59/U and a signal booster and hooked up four more homes. Then another roll, and another booster and on and on until I had 30 homes wrapped around a 9 hole golf course all watching my cable service five nights per week! It turned out to be the world's worst logistics problem and I ended up using about three times as much cable as one would for a 'city' installation.

"After a year and one half of operation, my wife decided she liked a little house on the 3rd Tee better than the home we built above the first green. So we moved! I now had a mile or so of cable that used to run 'right to left,' that now ran 'left to right.' All of my boosters were in the wrong places and I was tired of the whole thing so I shut it down.

"Even with the cable system shut down, I did keep working on an antenna for TVRO. And believe me, I knew a hell of a lot more about sheet metal than I did about electronics!

"My second design worked and this past spring I found myself in the position of having so much money invested in the 'project' that I had to reopen the cable service to be able to get some of my dough back. And to make a long story short, the cable system is not working anywhere as well as it should be.

"After six months of hard work, it finally all fell into place. First I got a consultant out of Guadalajara who told me that the 30 buck modulator was for one TV set and not designed to drive a cable TV system! Then I read Coop's article about connecting up neighbors.

"Obviously I need a quality modulator. Don't be shocked if you get a call from Mexico if I don't hear from you in a couple of weeks! Thanks for the help."

'Bob'
(Someplace in Mexico)

We trust that by now 'Bob' has gotten himself a decent modulator with sufficient output to drive a thousand feet of cable or so before he needs another 'booster.' If you are out there, still, someplace Bob, drop us a line with an update!

HIGH On Provo

Please consider this a reservation for your 1983 Provo Retreat.

Marjorie and I had a fantastic time along with a great learning experience and the free exchange of ideas among the many attendants. Provo is certainly an ideal spot in this harried world to sit back and assess our industry and to make plans for the future. This seems to be impossible in the busy work day and almost impossible during the trade shows. It was scarcely a week after we returned from Provo before I had the opportunity to speak on the telephone with most of the attendees. The entire group was most enthusiastic about the Retreat and all are looking forward to returning in 1983. I certainly do thank you, Susan, Tom Humphries, Kevin and Tasha for making our stay on Provo the highlight of our year.

Tom Harrington
Universal Electronics, Inc.
1280 Aida Drive
Reynoldsburg, Ohio 43065

We'll ALL remember the first Retreat with a special fondness. Future gatherings may be a tad (but no more than a tad) bigger but they will certainly not be any better!

USA AID In Sudan

We are a small community of Americans living in Juba in Southern Sudan, East Africa. Our location is approximately 31° 37' east by 4° 50' north, on the Upper Nile. Local television is of very poor quality and we have been discussing the possibility of our own satellite dish and cable distribution system. Coop has been recommended as the foremost authority in this field (indeed, our Director subscribes to CSD and passes it around), and we are writing for some help in determining the feasibility of the project. We have just finished reading the November issue which discussed areas such as ours, and that suggests that there may be some hope for such a system. We need to know what European satellites might be available, and what US programming might be on them. Would those who connect to such a cable system be required to have a multi-standard receiver, such as NTSC/PAL? Could someone recommend a complete list of the equipment required, and the approximate cost, to connect up five homes to a central antenna?

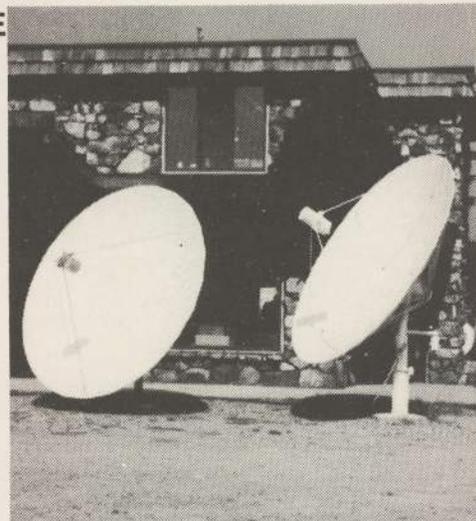
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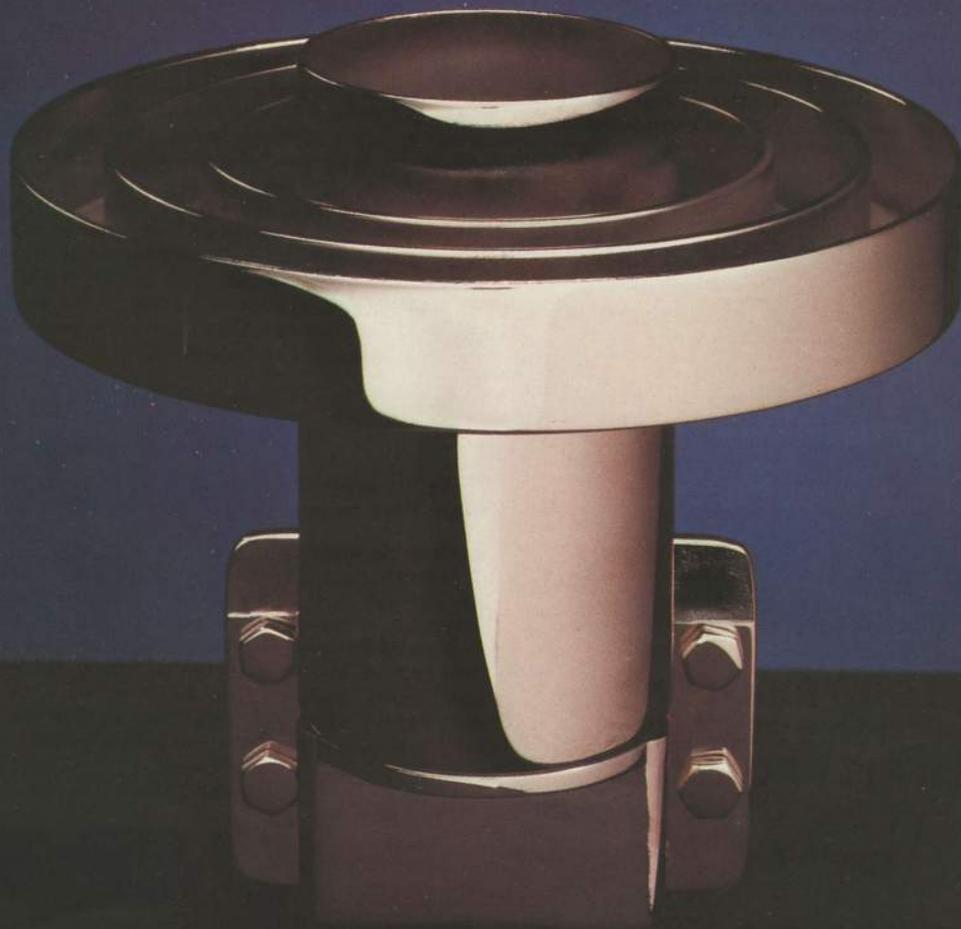
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CHAPARRAL

Scot J. Covert
GSO Field Support
USAID Area Office
Juba, Sudan

This is a far more complex subject that it may appear. Let's try to hit the most important points. Today, February 1983, there is not much US programming on any satellite that you can 'see' (i.e. receive) in Sudan on a regular basis. Events such as Bowl Games seem to go world wide now. But Mork and Mindy or Three's Company won't get to Sudan. Transmissions from the USA, through Atlantic Ocean Intelsat birds, could be received in the Sudan but they will be on Global antenna patterns which means a 20 foot dish minimum, and, one of the AVCOM special Intelsat receivers. Programs relayed via Intelsat from London (news and sports primarily) can be on hemispheric beam patterns and while it will still take an AVCOM type Intelsat receiver, you might squeeze by with a good quality 14-16 foot dish because of the stronger antenna pattern. If you insist on full color (when sent in color), your

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receiver(s) would have to all be capable of tuning in the appropriate color standard of the originating uplink station. If it came all the way from the USA, NTSC would be the format. If it came from the UK, PAL B would be the format. On the other hand, an NTSC only receiver will still produce high quality black and white even from PAL B transmissions. You'd need to adjust the vertical linearity a tad to make the people the right proportions if you were a real perfectionist or you could leave it alone and accept slightly tall and skinny people. Costs? Someplace between \$15,000 and \$30,000 FOB stateside (not cheap!) using existing hardware.

POPULAR Satellites / Illustrated?

I would like to see CSD print drawings to full scale of some of the new items being developed for the industry. For example, how about a cut away drawing of the new Chaparral cassagrain feed for an antenna with an f/D of .3? The top curve looks like it may be similar to the Luly feed. It looks something like a pie or pizza pan turned upside down. I would also like a drawing, cut away, of the new Boman Polar-Matic ultra feed, and, the new Chaparral Polarotor. There are alot of people out here like me who, once they see something and how it is built, can copy it very easily. I just like to build things although I can also purchase them. The fun is the building! If CSD had published a cut away drawing, to scale or full size, of the first Chaparral Super Feed it would have saved me alot of time since I had to build four models after carefully studying the photographs in CSD before I got it to work.

Francis C. Lebeda
2514 White Eagle Trail SE
Cedar Rapids, Iowa 52403

By not publishing the cut away drawing of the Chaparral Super Feed we gave you four times as much fun!

MOBILE Terminal?

Wife Annie snapped this photo when I was moving a dish at our San Andreas ranch. I have tried to come up with a caption with the assistance of the family and there are six that come out on top. Perhaps CSD readers can think of a better one. So far the best are (1) Have been working on a new, rural installation, (2) Annie is making me clean up the ranch, (3) Must be something in the hydraulics, the picture keeps fading, (4) OK low riders, eat your hearts out, (5) Listen Coop, you got me into this . . . and (6) Don't ask . . .

Taylor Howard
San Andreas, Ca.



How about "Maybe I can move the dish closer to the bird and get a stronger signal!"

INSUFFICIENT Data

I was very displeased with the way you handled the report on the Atlanta STTI Show. I was not there to see all of the equipment on

Johnny Cash



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display but I do subscribe to CSD and I do expect it to be fair and informative. That is what I am displeased about. You said that one 8 foot antenna gave excellent pictures. Wouldn't it have been more fair and professional to also tell us what value LNA was in use on these 8 foot dishes, what type of receiver, and what the bandwidth was of the receiver? I am trying to put together a home system but do not know how to figure out the LNA I need or what size dish I need.

James Magnussen
2951 S. Webster
Seattle, WN 98108

Most everyone now uses 100 degree LNAs since they have become so price competitive with 120 units. It is our judgment that virtually any 'brand name' receiver you see advertised in CSD is going to deliver about the same performance in area within CONUS (continental USA). If you find a good quality 10 foot dish, 100 degree LNA and brand name receiver, you can't go far wrong in Seattle.

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SPACE SHUTTLE Aussie?

An Australian may be aboard the Space Shuttle in July of 1985 when the first of the AUSSAT (domestic Australia) satellites is launched. The American Space Agency, NASA, has offered to take an Australian 'flight specialist' on the flight. Consideration is now being given to selecting Australia's first Astronaut. He will train with NASA and be a member of the flight crew.

Terry L. O'Conner
Riverwood, NSW
Australia

No wonder Australia selected the Space Shuttle over Ariane. Very few astronauts return from Ariane launches!

CARSON In The Raw

I need some help in tuning in the TONIGHT Show with Johnny Carson. I read that the show is beamed live and uncut to New York City where it is edited and then beamed to the commercial affiliates at 11:30 PM eastern. Can you tell me what transponder and what satellite is used for the live feed from LA?

Art Baker
924 Leland Avenue
Dayton, Oh. 45407

That's an old (old) story. Way back in 1976-77-78, Carson was indeed sent 'live' via satellite from Burbank to NYC. They warmed up about ten minutes to 8 eastern and usually took about two hours to do the (then) 90 minute show. The cameras and mikes ran hot for the whole period and when they broke for commercials or whatever one could witness the 'star' and his 'entourage' in their more natural state. Unfortunately when Coop wrote about having a private terminal in the fall of 1978, in TV GUIDE, NBC saw the report that people like Coop were watching the transmissions and Carson people got very uptight over this. The next week they took the show off the bird and have since then kept it on landline microwave. More recently the editing and production has been moved to Burbank so there is no need to send it 'east' for editing anymore. Once each year, when Carson has his anniversary show, you can catch them typically on WESTAR 4 or F2 or F4 (or all three) warming up for the show about 15 minutes early. McMahon gets the audience all fired up and it's a good time to be running your VCR. Any other night of the year the 'out takes' end up on the cutting room floor.

AN OLD Friend

All is well here on Gibson's used car and cheap movie company lot. We have eight (8) used cars in the driveway. I need them for a flick we are currently doing; at least that is what I keep telling Barbara! Most of them should be gone by February when we expect to be done with the wild and crazy trip into movieland madness. Then we can get back to some serious TVRO stuff.

Stephen Gibson
Hollywood, Ca. 90038

Gibson, a pioneer in the satellite business and author of the 'Gibson Satellite Navigator Manual' from STTI, developed his own wild and crazy technique for creating 3D movies and 3D television. When he found selling the (patented) technique difficult he was forced to go into the movie production business to 'prove' that his technique had commercial possibilities. For the past year or so Steve has been up to his eyeballs and earlobes in movie scripts, camera types, film editing and production. In the not too distant future we will all have the opportunity to see his 3D technique, and his movie producer talents, on a screen near us. Give us a distribution 'title' and release date as soon as you know it, Steve!

COLLUSION Is A Crime

At the November Provo Retreat I mentioned that we must all be mindful of meeting with competitors and in our enthusiasm falling into a violation of antitrust law. With the industry gearing up for another round of seminars and what have you, I thought it might be an excellent idea to alert manufacturers, distributors and dealers of some "Do's and Don't's" of the antitrust world. These I credit to one of the largest manufacturers of marine electronics in the world, although I

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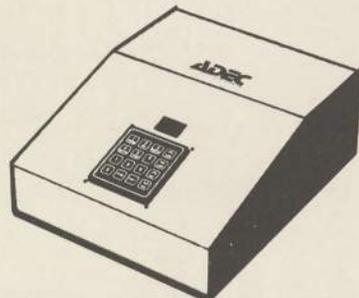
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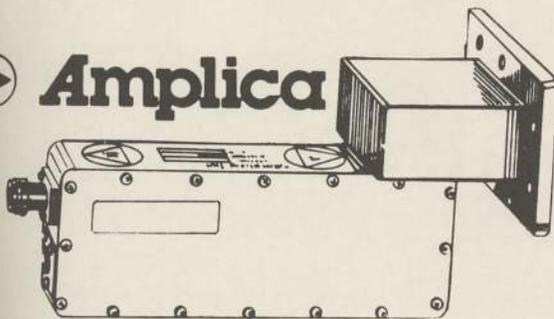
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point out that the warnings apply to anyone in any type of business.

- 1) A trade association can be a most useful source of information for a small company. However, it can also lead to inadvertent breaking of the law.
- 2) There are certain things that you **never** discuss (not in meetings, private conversations, correspondence or over the telephone) with others who could be construed to be in competitive postures to your own business.
- 3) Violations can lead to fines as high as \$100,000 for individuals, \$1,000,000 for corporations, as well as jail terms up to three years in length.
- 4) Here is a list of topics to avoid:
 - A) Current or future prices (the only safe policy is to avoid **any** mention of prices, even past pricing);
 - B) **Any** discussion of what constitutes a 'fair profit';
 - C) **Any** discussion relating to the conditions of sale including discounts, markups and credit terms;

- D) Production or purchasing '**quotas**';
- E) **Any** allocation of '**markets**';
- F) **Boycotts** of certain customers or suppliers;
- G) **Blacklisting** of a supplier because of the supplier's pricing or distribution policies;
- H) **Marketing plans**, such as discussion of offering uniform (more than one supplier) warranties.

This is a young industry and while we are maturing fast, there are many in the industry who do not have the proper experience to stay out of trouble. Sometimes, in our enthusiasm, we run afoul of a law that we may not even know exists. When in doubt, in antitrust matters, the best policy perhaps is to even avoid meeting with competitors privately, and when we do so, always have at least one attorney versed in antitrust law present to 'moderate' the discussion.

Bill Miller
PROMAR
P.O. Box 22133
Tampa, Fl. 33622

"... First we take all of the attorneys outside and shoot them..."

CERTAINLY CHEAP ENOUGH!

Just for drill, I recently dismantled the metal top or cover on a backyard 'beach umbrella,' outfitted it with a broom handle center support, an LNA and feed and laid the metal umbrella on its side. Then, by moving the 'antenna' (and that is a loose term!) around on the ground I found real, live satellite signals. I won't tell you they were great; but I could watch them and the audio was clean. I am not suggesting that anyone consider \$19.95 metal umbrella antennas for serious home reception, but on the other hand it does show what a person could do if he was desperate to watch satellite TV.

Steve Crowe
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Los Angeles, Ca. 90004

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THERE may be a 'battle' of satellite shows coming up in Europe this summer and fall; the latest to announce is the '**Satellite TV and Cable Television Show**' to be held July 5 to 7 at the Alexandra Pavilion at Alexandra Palace in London. The site is fitting; it was the first location for the first BBC television transmission centre in the late 1930s. It may not be a suitable site for live satellite reception, **however**, because of the 'dense' London skyline nearby and the terrestrial interference from the primary microwave links in London.

COMSAT is attempting to raise the capital it needs to launch DBS by offering up to one million shares of its stock to the public, from treasury. If all of the shares offered sell, they would **still** need more than \$100 million to get their DBS program even started.

NASA is serious about developing and testing a 'mobile' satellite telephone type service and is asking for permission from the FCC for a test program to begin in 1987 using the 11.65 to 11.70 GHz region. The initial tests would be with Canada, using a **Canadian satellite**. The service would go from rural areas directly into terrestrial mobile-tel repeaters so vehicles equipped with units could communicate directly, with their nearby terrestrial repeater, through the satellite to the world's telephone communications system.

THE State of Nevada, through its Public Service Commission, has assumed 'jurisdiction' of SMATV systems that offer 'distant super stations', such as WTBS et al. The state already regulated CATV systems in the state.

SATELLITE builder Ford AeroSpace wants to become satellite operator Ford AeroSpace. The firm has applied to the FCC for permission to build three 'heavy duty US domestic satellites', and launch two of them by 1987. Ford wants to lift a new version of satellite with cross-intra-satellite connection between 4 and 12 GHz into a pair of orbit spots. Ford did not specify the **two** spots it wanted, but said **one** would have to be at 119 west so that all 50 states could be served. The other, Ford said, could be between 83 west and 99 west. Under the present 4 degree spacing, the FCC has no room for **either** of the proposed Ford satellites. However, with three (or two) degree spacing likely, additional orbit spots would open up. The birds would have 8.5 watts power on each of 24 C band (3.7 to 4.2 GHz) transponders and 20 watts of power at Ku band.

SBS, best known for its 12 GHz early business satellites, has completed plans to link via Intelsat to Italy with the equivalent of a full transponder of high speed data and narrow band voice communications. Using an existing Intelsat transponder, possibly at 12 GHz, the service will go from the east coast of the USA to Italy near Rome.

TRDSS, the 'advanced Westar' satellite communications system which has been a strange 'hybrid package' combining super secret military communications and commercial (such as video, data and telephone) communications, won't be as planned after all. TDRSS number one, scheduled to be launched late in January, will now be strictly a military communications machine as will the remainder of the five in the advanced program. The TDRSS has been something of a sore subject with the military since it started off as an \$800 million program and ended up now in the \$2.5 billion region. The birds will have the unique 4/12 GHz ability to 'talk directly' with one another,

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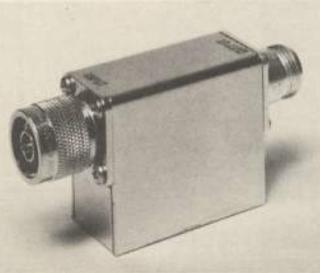
The Tenth consecutive Satellite Television Technology Seminar/Trade Show will be held at the Riviera Hotel in Las Vegas, on March 15, 16 and 17, 1983. This tremendous private satellite terminal event will once again bring together all the leading manufacturers, distributors and dealers to set the stage for a booming 1983. The show will be titled STT's National Satellite Opportunities Conference.

There will be 150-plus exhibit booths and over 75 operating antennas in every size from eight to twenty feet. At the seminars there will be three days of hard-hitting private terminal training for newcomers to this field. Attendance fee for all three days is only \$35.

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across the earth as it were, rather than relying on up/down/up multiple hops back to the ground again. Three will be in orbit, in the best of Arthur C. Clarke fashion, and three more will stay on the ground as spares. The first bird is to go at 171 west, over the Pacific while the second, due to launch in June of this year will go at 41 west over the Atlantic. In any event, you won't find Mork and Mindy from either.

INTELSAT must see the handwriting in the sky, having now approved the smallest official class of terminals yet considered for 'authorized' Intelsat use. A new 'Standard E' terminal may be as small as 3.5 meters in size (or 5.5 or 7.5 meters). The new smaller standard terminals are still not 'cheap'; Intelsat sources say they will vary between \$150,000 and \$500,000; as compared with \$10,000,000 for top of the line 'Standard A' terminal. Primary 'market' will be 12 GHz spotbeam service business customers.

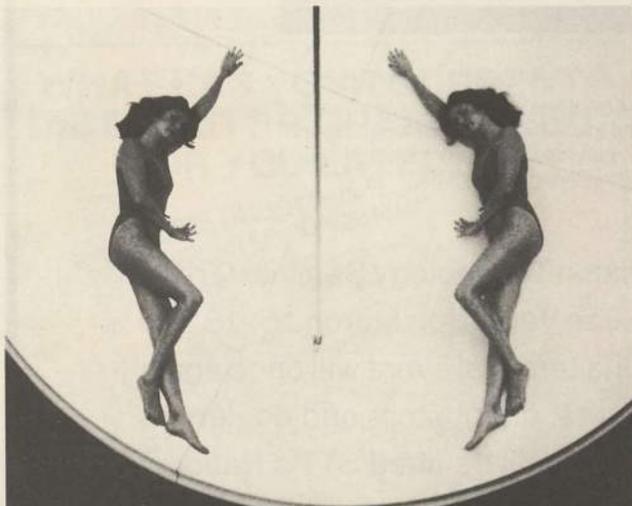
OLD news now but SIN and Galavision have now pulled off of Westar IV in favor of RCA's Satcom 4 bird. SIN is on TR 1 while Galavision is on TR 24 of F4. RCA is making an aggressive pitch to any cable firms still doing business with Western Union (SPN earlier jumped ship to F4) hoping to offset the expected cable support for the W5 satellite coming up during the next several months.

BATTLE still raging over 'direct access' to Intelsat by non-Intelsat/Comsat owned facilities. Intelsat wants to keep the regulations intact, requiring any one transmitting to an Intelsat bird to go through an Intelsat uplink station, or receiving Intelsat come down through an Intelsat 'approved' terminal. The rest of the world wants to own their own up and down links. FCC is pondering.

HBO LEAKING 'inside information' to cable trade publications concerning when it will announce its scrambling plans. Some reporters, apparently unable to separate where the scrambling starts and stops, have written that HBO will soon announce "which supplier will be selected to provide set top descramblers". If that was not a slip of the pen, that would be first indication that HBO may be considering having their signal left scrambled all the way to the subscriber's set. Imagine having to supply over 11,000,000 descramblers in short order!

ON-TV, the Los Angeles based Pay TV firm now says they will begin feeding a 24 hour per day service on COMSTAR D4 (128 west) the last day of this month (28th). ON-TV will scramble, using Oak Orion system and qualified private cable firms can sign up for apartments and other approved multi-set distribution systems for a base fee of \$100 per month plus around \$6.25 per subscriber per month for the basic service. An adult tier of late-late night programming will cost the SMATV operator another \$1 per month. This will be the first regular video on D4, previously used only by ATT for telephone and data. If you are interested in carrying the new pay service to SMATV systems you own or operate or can sell service to, call David Saltman at (619) 485-9880.

INSPIRE of loss of SPN, SIN and Galavision to F4, the average video loading on W4 at 99 west is not going down; it is going up. Latest to sign up for W4 space are CNN for inward bound video to the Atlanta headquarters (two transponders) and TSI of Tulsa (OK) for another pair. TSI will program to cable TV systems and independent broad-



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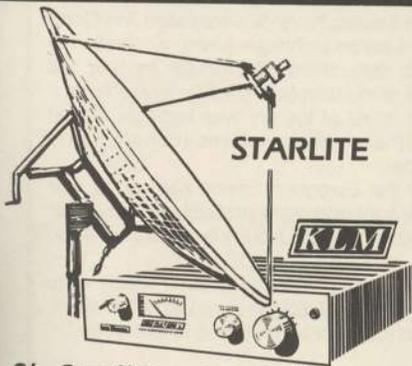


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casters.

BELL LABS and Western Electric have demonstrated, via Comstar D2, a new amplitude modulation technique (using a variation of SSB; single sideband) which they claim will multiply by four the number of simultaneous voice grade telephone circuits available on a single transponder. The prior 'state of the art' was under 800 such circuits, using FM techniques; the new system claims it can cram up to 3,500 into a single transponder.

ARIANE L6, the next for the European Space Agency, is now expected no earlier than late April and more probably early May. A number of 'small errors' were found by the inquiry board convened to investigate the loss of L5.

THE FCC has issued a warning to those 8 firms which were awarded construction permits for early DBS systems last fall; in effect, stay on your projected time schedule or be prepared to lose your CP, and, place in space.

ONE DBS firm, USSI, has begun a task force study of the problems associated with the delivery of high definition TV (HDTV) via 12 GHz satellites directly from a motion picture studio to specially equipped giant screen theaters in the USA. USSI is looking for ways to cover its costs in the planned DBS program and considers HDTV to theaters one possible technique to be explored. USSI says they will 'test' the marketing aspect of the concept as early as this summer, using 525 line (present standards) TV and 4 GHz birds, at perhaps as many as 50 University Campus locations throughout the USA.

THE UNITED NATIONS General Assembly has voted overwhelmingly to place restrictions on DBS broadcasts originating in one nation from being received in another nation, unless the second nation has 'approved' the transmissions. This muddle is created when nations which do not want their citizens to have access to programming from sources outside of their national control begin to 'worry' about citizens gaining access to 'non-approved' information. Contained in the resolution were three salient points: '**International DBS service should not be started** if it will cover a nation other than the country it is intended for, **unless** the non-intended nation has "approved" the service'; '**the government of the originating country** should (must) bear the responsibility for international satellite broadcasts, **even when** the transmissions are originated by a private company'; and, 'international "**program content standards**" should be met by **all** transmission sources'. The US opposed the motion but a surprising number of Latin American countries favored it. Do you still wonder about the problems coming up when you hop off a plane in Santiago with a 12 foot Luly tucked under your arm!

PRESIDENT REAGAN, meanwhile, is adding fuel to the fires that are concerning nations nearby. In a recent address he promised 'far more powerful satellites' containing 'thousands of television channels' would come on line within the next decade.

RECEIVER supplier Microdyne has joined forces with SMATV operator Domesticon of New Orleans to form a new company that will construct and operate SMATV systems. Their first joint project is a 1000 plus room hotel in downtown New Orleans.

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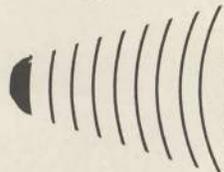
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WOLD COMMUNICATIONS is developing a new satellite radio network dedicated to the feeding of live sports broadcasts (notably baseball and football) for regional and national feed purposes. Wold calls it the 'Satellite Subcarrier Transmission System' and it will be in place by late in March using facilities on Westar 4.

TRINITY Broadcasting, TR17 on F4, is leasing out up to four audio sub-carriers to anyone that can pay then their asking price. Uplink will be from the Trinity facility at Tustin, California.

JUST for the record, it takes two 'Intelsat "1/2 circuits"' to carry on a two-way telephone conversation via Intelsat across the Atlantic. The cost of the two 1/2 circuits, full time, is \$390 per month for the space segment. That means that for \$780 per month, inter-connect and other charges aside, you can hold down an open link between North America and Europe capable of handling a voice grade circuit.

\$500,000 has been set aside for the study of an African regional satellite communications system. Plans call for creation of a satellite system that will allow use of small (as in 5 meter) terminals throughout Africa, up to 10 transponders to be set aside for television distribution. European technology seems to have the inside track on this for the moment and 1988 is being kicked around as a 'launch date'.

FCC re-organization means new entry in you telephone book for emergency information regarding satellites and related activity areas. If you need help in matters relating to satellite video, cable, LPTV, STV or DBS, add **Roy Stewart** at (202) 632-6993 in Washington, DC to your important number listing.

COOPS COMMENTS / continued from page 3

"**Three months?** That's impossible! There are so many strong, differing viewpoints involved here that it will take a year to get a clear direction established. It may take another year to get the standards adopted and before the industry."

"**Three months.** That's all Wolford gives us."

"**Wolford?** SatGuide's Wolford??? What does he have to do with this? He's not even on the Board!"

"**Wolford says** that if the industry doesn't establish its own standards by his March issue, **he** is going to set the standards **for us** and make us look bad".

I stayed out of that discussion, but listened carefully. I knew David had a problem accepting SPACE at face value. I also knew that he had toyed with the concept of starting his own trade association. I don't know that he really **meant** to intimidate the SPACE Board with any type of ultimatum but I do know that several members of the Board he expressed his views to had taken it as an ultimatum.

Obviously the young retired-from-cable millionaire was saying **something** to these Board members. It all, apparently, boiled down to his 'expanded image' for **SatGuide** and his various 'sons of Sat-Guide'. If he wanted people to salute him in the street and at trade shows, that was his hang-up. I decided to forget the whole incident. Getting real standards for the industry (and I joyfully serve on the SPACE standards committee) was far more important than worrying about someone in Idaho telling us how it would be done . . . or else.

Well, that's the background. Now let us look with something of a critical eye at the recent (December) issue of **SatGuide/Orbit**. Page 69 to be exact.

On page 69 for December there appears an advertisement for a firm in Minneapolis, Minnesota. I won't do them the honor of reporting their name here. That advertisement starts off with the semi-headline:

"**Introducing The Latest In Satellite Technology**"

and then it continues:

"**XXXXXXXXX 4 ft. Satellite TV System**".

When I first glanced at the advertisement, I believed I was reading an early advertisement for 12 GHz DBS hardware. The photo that occupies the top half of the page is a **COMSAT** photo, straight out of their press release kit. **You've seen it**; a two story home in a far northern locale with a chimney in the center. On the top of the chimney is a standard deep fringe VHF antenna. Down low on the chimney is a small solid white dish, **2 feet in size**, pointed skyward. Given the use of this particular photo, that the photo is familiar to most of us, and the '4 ft.' terminal headline, I can be excused for not instantly reading the balance of the copy.



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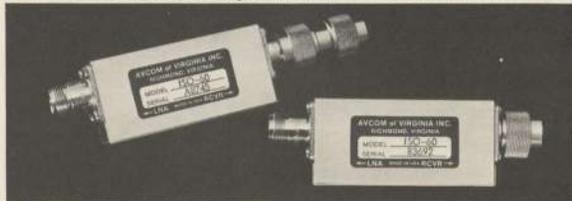
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The Panasonic ENC 16505 RF Modulator module is the same type used in today's video tape recorders. It can easily be installed inside of most satellite receivers. The supply voltage is 9 VDC and current consumption is 60 MA. Video input voltage is 1 VP-P and audio is 0.5 VRMS. RF output is 75 OHMS unbalanced through an RCA type jack. Call NOW for more information and for quantity discounts.

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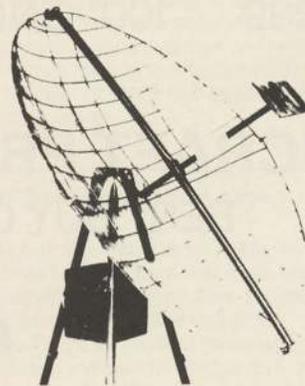
500 Research Road • Richmond VA 23236 • 804-794-2500

One Source for Your Earth Stations Needs

I should have done so. I did, when my telephone started to ring. Several fellow members of the SPACE Technical Committee, and some suppliers who always read the fine print, were on the other end. 'Had I noticed,' they asked, 'this false advertisement?'. After the first call, I could truthfully respond that 'yes, I did.'

As you read the advertisement you learned that this miracle package brought you "more than 100 channels", it is "easy to install", "UPS Shippable" (weight 25 lbs), and, it is "Reasonably Priced".

If 'borrowing' a COMSAT photo was not sufficiently mis-leading (remember that the COMSAT publicity photo has a 2 foot dish while this new 'break through' is pushing a 4 foot antenna), an 'insert' photo shows a separate steel wire (not mesh) dish. It is a commonly available UHF TV wire grid parabolic, complete with the UHF TV wire grid 'splash plate'. Generously, this antenna might form a reflective surface offering 40% efficiency, at best, as high as 800 MHz. At 4,000 MHz the satellite TV signals would pour through the reflector surface like the Dallas Cowboys ripping through your local Pop Warner Football League team. The 'dish' shown would, at most, have a 5% reflection efficiency at the TVRO microwave band.

**Antenna**

- 4 Foot • Electronic Feed

ANTENNA DISPLAYED in insert display is actually UHF television home antenna, 'doctored' into slightly slanted geostationary orbit position.

A receiver 'insert photo' is a non-home receiver product. A photo of a Hong Kong stereo set would have been just as close to a home receiver as the unit shown.

The history of this industry is replete with examples of people offering product for sale before they have all of their engineering completed. This is perhaps the first time anyone has offered a product before ANY of the engineering was completed. That a four foot C band (3.7 to 4.2 GHz) antenna might someday function well enough to be a saleable product in this field is not in question. Given sufficient increases in satellite power, it would happen. Given today's satellites, today's electronics, even a 10 foot dish would have some difficulty realizing the advertisement's claim of "more than 100 channels accessible".

The firm in question is unknown. Their integrity is certainly suspect since no part of what they display in their full page advertisement fits their written 'copy'. Now, how does all of this impact on an industry that has a generous number of ripoff artists running loose?

Wolford can be excused for allowing the advertisement to appear in his publication. If we dismiss the possibility that he might be so hungry for income that he would accept any advertisement for any product, we have to assume this one slipped by. Three well known, respected members of the industry's engineering fraternity were on the telephone to him within minutes of receiving their own December SatGuides. To each he told the story that the advertisement merely 'got by the staff'. There is a counter story, repeated to Arunta's Ed Grotzky by an employee of Wolford, reciting that the advertisement



Videophile Satellite Television

The possibilities of component audio come to satellite video.

Component equipment has become popular in the audio field for a lot of reasons. One reason is that the component philosophy allows a purist to upgrade any piece of a system as technology advances without having to replace the entire system at once. This basic idea has ushered in an era of specialty firms dedicated to advancing the art of a single link in the chain. They succeed because all of their efforts are focused on one discipline, not thinly spread over an entire system. EARTH TERMINALS™ brings this philosophy to satellite television. We concentrate on the single most important, most difficult element—the microwave receiver. No other part of the system has such a dramatic effect on picture quality.

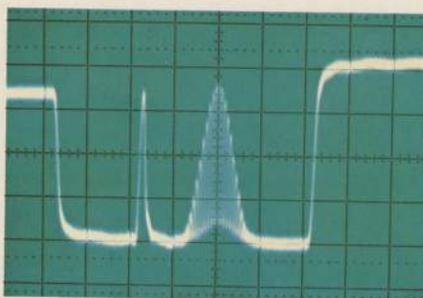
Quality You Can See

An EARTH TERMINALS receiver provides cleaner pictures with less granularity. Truer colors that don't smear. Less sparkling snow on weak programs. Complete absence of herringbones and waves. Superimposed lettering that doesn't tear at the edges. In fact, you haven't seen video this exciting unless you've been in a television studio. If you own a quality video projector, you'll be even more impressed.

Quality You Can Measure

Broadcast engineers are impressed with the accuracy of EARTH TERMINALS receivers too. Our VITS Sin² Pulse and video SNR test results are incom-

parable; actually the equal of most commercial grade receivers. We can also handle tough signals like Reuters data transmissions that give other receivers fits. It's no wonder then, that after exhaustive testing, some cable companies and television stations use EARTH TERMINALS receivers as their main source of satellite program material. They know value when they see it.



Unretouched Off-The-Air Sin² Pulse Test

It's Easy To Live With

All this technical sophistication is really quite easy to get along with. Precise automatic fine tuning tunes every channel the same way every time. You don't have to be an expert to get perfect

pictures. EARTH TERMINALS receivers come with a remote control that selects channels individually, adjusts audio volume at your convenience, and automatically signals the rest of your system to supply the proper antenna polarization through an even/odd channel switch. And it fits in the palm of your hand.

Tips On Value

There are plenty of satellite receivers that cost less than ours, but nearly all of them need bigger antennas and more exotic Low Noise Amplifiers for a picture free of sparkling snow. If you're on a budget, you can save money in other parts of the system by paying more for our receiver and come out even. You get high fidelity video in the bargain. If you're simply after the best picture money can buy, we can make it very affordable. Either way, give us a call or write us for the details.

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EARTH TERMINALS

Amplica's new RC-10: Altogether, the world of TVRO never looked so good.



Because here at last is Amplica's 120°K Model C-10 Low Noise Amplifier/Downconverter in a single rugged housing—plus Model R-10 Satellite Video Receiver, all designed and built by Amplica for optimal interface. The RC-10, all together, a system. Tested. In production.

That makes Amplica's new RC-10 a sure favorite with TVRO buyers since this Satellite Video Receiver System is easy to install and provides unmatched performance and reliability.

Especially since it comes from Amplica—pioneer in the industry. That means the quality that has made Amplica Low Noise Amplifiers standard equipment in Telecommunications and Cable T.V. systems is built into the RC-10's all-important LNA/Downconverter and Receiver. And it means that this one company—stable and respected—now stands behind service and warranty for all the TVRO electronics.

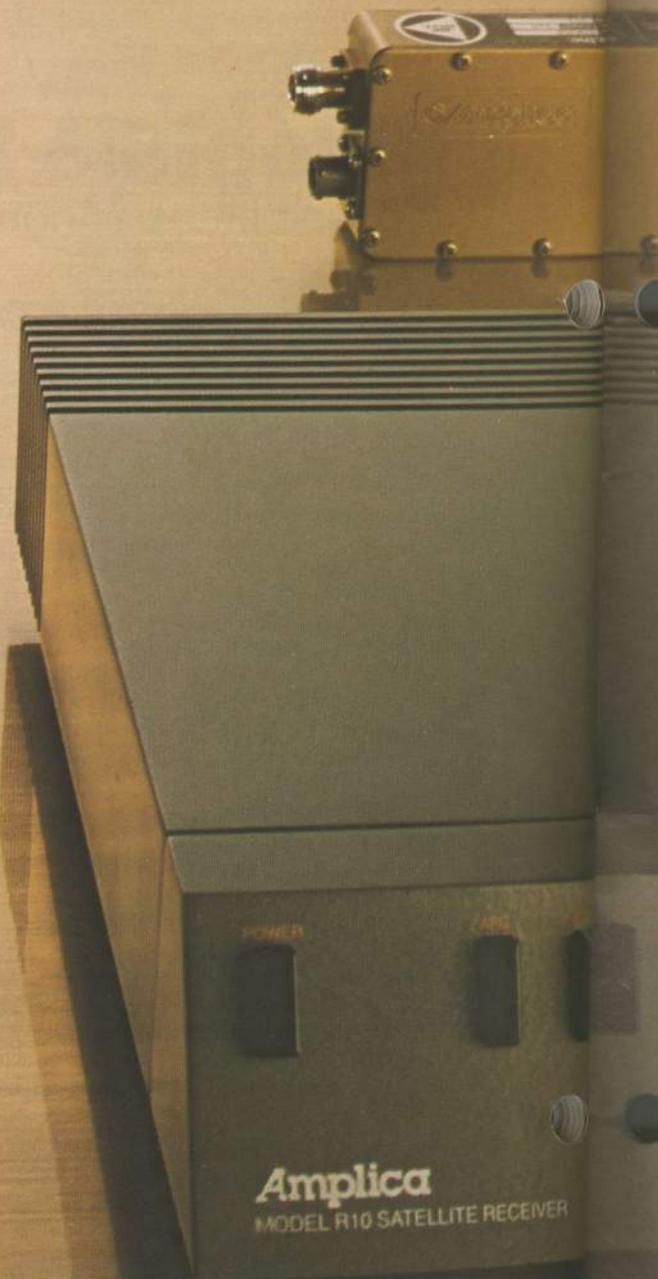
See for yourself how Amplica's new RC-10 improves the outlook for the whole world of TVRO.

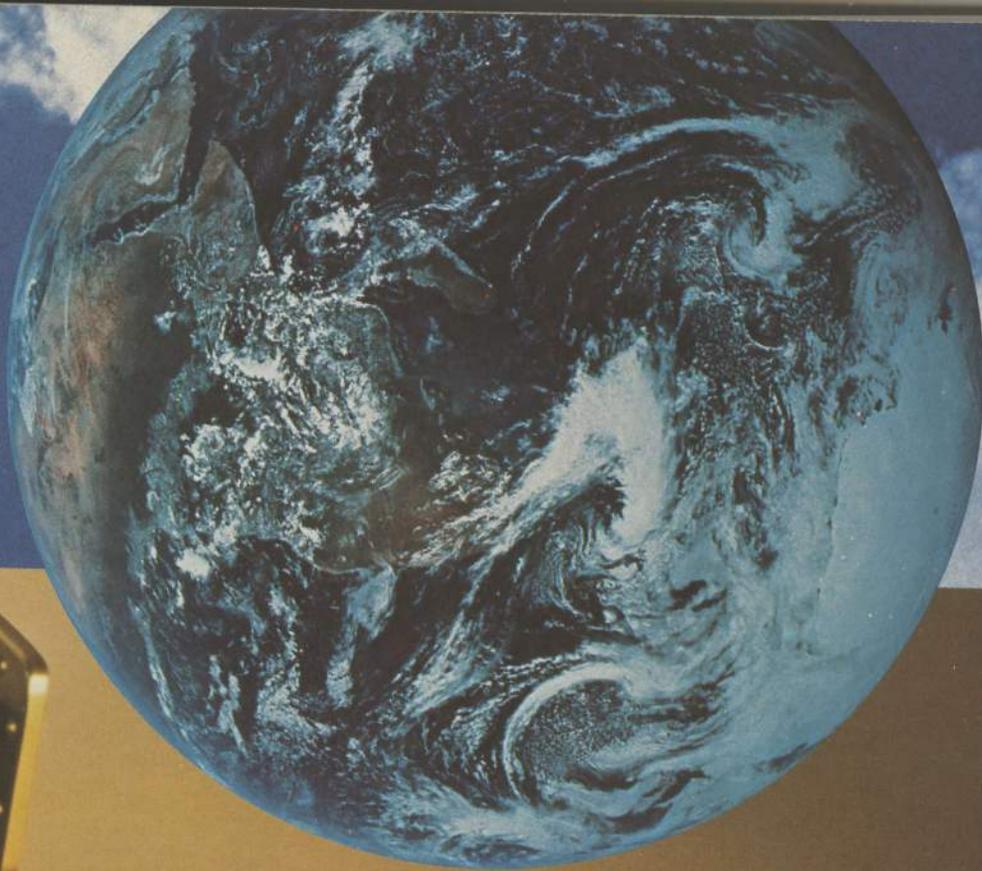
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XL10A's lightweight construction is totally unique, from its universal mount to its precision formed extruded ribs and expanded mesh surface. Even the feed rotation system has been designed for minimum aperture blockage. XL10A will remotely scan all the domestic satellites quickly and accurately, with higher C/N ratios than many larger antennas.

So why not start reducing your installation costs by using the lightweight XL10A. You will love the performance, and you won't miss the weight.

XL10A Dealer Prices

Complete antenna, including feed, motorized polar mount and remote control. UPS Shippable.

1-3	\$1595	10-24	\$1395
4-9	\$1495	25 & up	\$1295

Microsat

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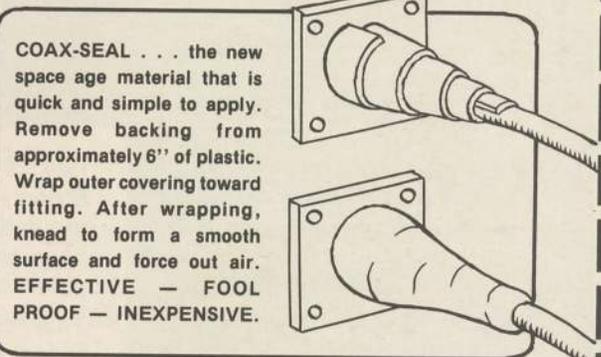
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NEW! Only material that will adhere to poly vinyl or vinyl outer coax jackets!

- Only material that will adhere to poly vinyl or vinyl outer coax jackets.
- Forms and seals over odd shaped and difficult fittings.
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- Wide ambient temperature range (-30°F to +180°F).
- Stays flexible for years thus insuring moisture proof connections.
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- A must for satellite TV - microwave work - wire antenna at solder joints - in the shack.



COAX-SEAL . . . the new space age material that is quick and simple to apply. Remove backing from approximately 6" of plastic. Wrap outer covering toward fitting. After wrapping, knead to form a smooth surface and force out air. EFFECTIVE — FOOL PROOF — INEXPENSIVE.

Packaged in convenient 1/2" x 60" roll. 2 rolls \$6.00 post paid.

DEALER INQUIRIES WELCOME

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END YOUR LNA MOISTURE PROBLEMS / see CSD for JUNE 1982, and recommendations for using COAX-SEAL.

was carefully discussed prior to running by Wolford and a member of the staff, but I tend to dismiss that one as an employee trying to shift blame to the boss.

The real danger in all of this is that by allowing (accidentally or otherwise) a firm offering a rip-off package access to a respected publication, the rip-off firm now has a measure of credibility. They gave no price in the advertisement; they did provide a generous-sized coupon which readers could use to solicit additional information. I'm sure they received thousands of coupons back, and now they have a 'mailing list' to which they can direct even more absurd literature without the scrutiny of knowledgeable industry people.

SatGuide professes to be a 'book' for the ultimate TVRO user. That means that people who receive it are not technical, or barely technical, and they can be expected to be gullible. **Some** of them will send money to this firm, if asked to do so, and **some** will therefore be 'taken'. Thousands, perhaps, will come back to their existing dealers and put the dealers 'on-the-spot' demanding to know why **they** 'had-to-have' a ten foot antenna when a firm in Minnesota offers a four foot package that 'accesses more than 100 channels'. Many dealers will be in a very defensive position over this one. Some dealers, themselves not too technical, will not have an answer for their customers.

I guess the incident amuses me most, however, because Wolford is said to be setting himself and his organization up as an 'industry technical watchdog'. He has advised technically competent members of the industry that if **they** don't adopt industry-wide technical standards by March, he is going to do it for them. His 'threat' never bothered me, personally, as a member of the SPACE Technical Standards Committee. But I **was** concerned that he might coerce other members of the committee. I am now over that 'worry'. Before **SatGuide** can tell the rest of how we ought to operate our business, they need to set a shining example of editorial integrity. Before they can tell us how to clean up our act, they will have to do a little scrubbing up at home. When **SatGuide** matures, we'll all benefit.

DBS HYPE Begins

I made myself a bet that within 90 days of the FCC's final decision

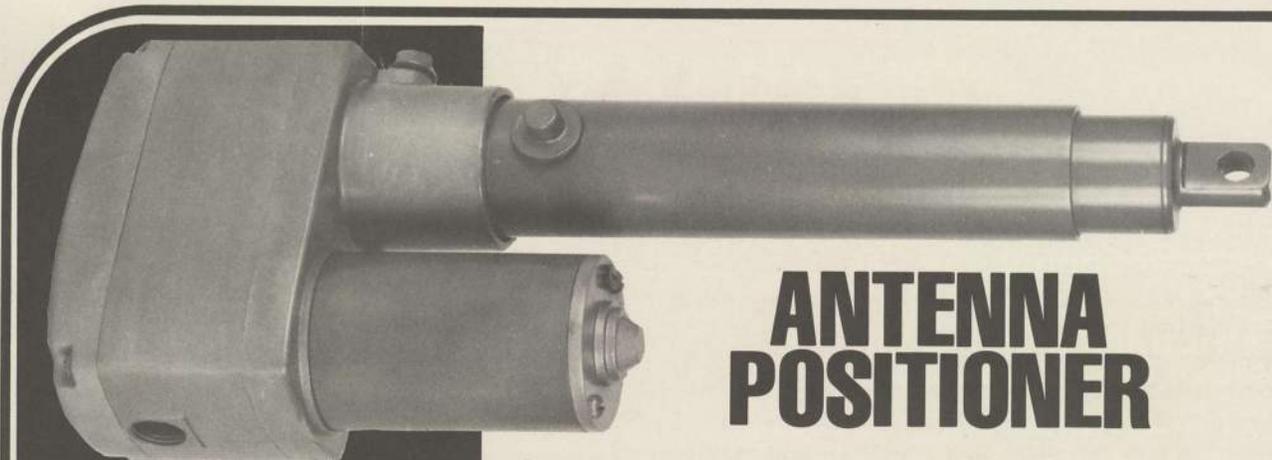
as to which of the many firms applying for 12 GHz DBS would be granted 'construction permits', the new awardees would begin the 'hype' game. I won my bet with myself.

I commend **COMSAT's STC** for only releasing a modest number of press notices alerting the world to their progress to date. It has been four months now since they were given the FCC green light. The most important thing they have done, if one can believe their releases, is settle on the purchase of 39 'prime acres' northwest of Las Vegas for their 'transmission center'. To those who might wonder why Las Vegas is to become the home of STC's version of DBS, I am sure there are many reasons. The one most often cited involves rain; or a lack thereof. Las Vegas is well known for being dry. The 14 GHz uplink signals, that have to find their way to the STC birds, are very sensitive to heavy rainfall. Let it rain hard enough and the signals get severely attenuated on the way to the bird. So you put the uplink in a desert where it doesn't rain, heavily, very often. Or ever. Death Valley would have been a better choice, but then who wants to jet from New York to spend a week in Death Valley 'looking over' the operations. Given the choices, I guess Las Vegas makes some sense.

If STC gets a commendation for not engaging in overt hype, there are others who are in the race for public attention who are not quite so coy. I'll try to be diplomatic.

USSB (United States Satellite Broadcasting) is re-inventing every tool of press agency that has ever been used to pre-hype a major project. They need it; they say they will be spending upwards of \$1,000,000,000 (count the zeros) the first year to produce and distribute their three channels of 12 GHz programming. Mind you this big number has nothing to do with the cost of their satellites, or their transmission system. That's for **programming**. To put that one billion dollar number into perspective, if HBO's 11,000,000 subscribers each pay HBO \$4 per month or \$48 per year, HBO ends up with a **gross** income of \$528,000,000 for the year. About half of what USSB plans to spend on programming.

Since that kind of money does not grow on trees, naturally USSB has to go out and raise it. Keep in mind that have a few dollars to raise to float their **satellites** and their **non-programming overhead** as



ANTENNA POSITIONER

Expanded line features position sensing capability:

- NEW Ten-Turn Potentiometer or Hall effect sensors
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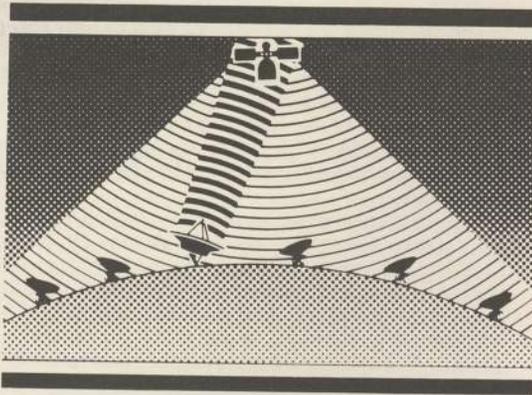
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well. Yes, this is the big time.

USSB: three channels. One will be a 24 hour service which they characterize as 'similar to (existing) network fare.' SITCOMs, sports, news, special events; you name it and USSB plans to 'ape' the presently successful formats of ABC, CBS, and NBC. You don't do this with re-runs of the 1955 version of 'I Love Lucy.'

Another will be a 24 hour per day 'information and news service'. Ted Turner won't like that much, but I doubt he will lose sleep over this new 'threat'.

The third channel will be something called 'specialized programming'. I think that is an euphemism for 'pay TV' but I can't be sure.

Now, USSB plans to create a 'fourth national network'. Ted Turner has been talking up the same concept; he wants to do it in concert with some of the Hollywood producers and studios. USSB has **another** approach; they will 'sell' a 'share' in the new network to each of their affiliates. The affiliates will 'buy in', spend their own money on building their own uplinks to reach the bird, and then many (but not all) of the affiliates will contribute programming to the overall 24 hour broadcast day. The concept of taking network programming **out of** New York or Hollywood, or Chicago, has merit. They produce some good stuff in Reno and Tuscaloosa, I'm sure. They also produce some good stuff in Europe and USSB plans to 'tap' into the European television marketplace for regular program feeds. USSB mentions the United Kingdom in particular but I have doubts that after PBS, The Entertainment Channel, and probably Turner and CBS get done selecting what they want from the U.K. that there will be very much left of any consequence. Anyhow, that is the plan.

USSB is telling people that 'major national advertisers' are beating down their doors trying to work out 'programming deals'. That's encouraging since USSB doesn't expect to start operation until 1986 or so. A fellow should get started early enough to have his schedule filled out before he launches none the less. USSB is already attacking the existing three network's programming in the press and broadcasting media. That's a smooth move; get everyone mad at you before you start trying to raise money 'in the street'.

Since 1986 is still a ways off, USSB apparently believes that they may run out of press agency before they are ready to launch. So to get the ball rolling, they plan to target a 'specials network' to begin service late in 1983. It would work in this way. Using the studios and facilities of some of the larger **major** market independents, such as KTLA in Los Angeles and WNEW in New York City, they plan to produce some programs that existing independent (and network affiliated) stations can distribute. I'd guess Christmas '83 would be a suitable target date. They hope that by staging a series of 'USSB Previews' they can begin to acquaint both the national advertisers **and** the public with the forthcoming arrival of USSB. They'd have 1984, 1985 and part of 1986 to use the **existing** broadcasting systems to hype **their** project. They might even make a few bucks in the process.

How their 'Channel 1' will be distributed is of interest. It will be intended for direct viewing, not scrambled, by anyone with a home (12 GHz) TVRO. I'd **suggest they would be smart to plug in a mere 1 million or so per year to put the same service on 4 GHz** just in case they get to 1986 and discover the public is not that anxious to own and operate 12 GHz terminals. By 1986, Congress the courts and SPACE willing, we may well be looking at 800,000 or some 4 GHz terminals in the hands of the public. Paying a dollar or so a year to reach each of **these** terminals with a 4 GHz feed would not be a stupid idea.

Channel 1 will primarily go to individual TV broadcasters who will plug in their USSB satellite feed for some or major day parts. That means, they say, that something in excess of 75% of all American homes are expected to have 'some' USSB TV programming available to them via local, **terrestrial**, TV. I'd be remiss if I didn't point out that even if they talk **some** stations into carrying **some** of their schedule, **no station** is going to carry their full 24 hour schedule. So a 'USSB-Junkie' would have to invest in a TVRO to get non-stop USSB programming.

Channel 2 will be kind of a 'slide in and slide out' service similar to CNN-2. A station will take a 15 minute or half hour feed, wrap it around a local newscast or whatever, and move onto the 1986 version of Gilligan's Island. On the satellite, the service will not be scrambled and home viewers can have a full day (and night) of news and information. Like I said, Ted Turner won't be crazy about that one, but he won't lose

any sleep over it either.

If channel 3 is premium programming, I would expect it to be scrambled. I would be willing to bet they won't use Oak's Orion system. Beyond that I have no predictions of what is to come with USSB's channel 3. I doubt they know what they really want to do with it.

Raising huge sums of capital is a very specialized business. That's where the next magnitude of hype is coming. USSB says they are about to announce an agreement with a (major) 'Wall Street Company' to help them raise the dough. They claim they will have no problem raising whatever sum they decide they need to get into operation. Personally, I'd hate to be in the position of justifying raising billions of bucks with a balance sheet that shows virtually no equity in anything, and huge contingent liabilities. I wish them well.

MEASURING Your LNAs

By coincidence (I say that so people will know there is no collusion here!) AVANTEK has scheduled a most interesting LNA noise measurement exercise for their booth at the forthcoming STTI Conference in Las Vegas. I wanted you to know about it, and to be prepared to gain maximum advantage from the project.

This issue of CSD takes a rather lengthy look at LNA technology, which is changing, and, a new up-start firm called LOCOM. One of the key factors in LNA viability is the operating noise temperature of the LNA. Most LNA suppliers now routinely provide copies of test data sheets with each LNA shipped so you, the user, can make your own value judgment for the LNAs that you receive.

As the current issue report notes, there are 'tolerance' windows all over the LNA noise temperature measurement game. The test equipment has varying degrees of accuracy, the standards used for reference may also have some variation in repeatability, and the care and precision exercised by the technician making the tests can vary.

AVANTEK is bringing either a Hewlett Packard 8970A or an AIL Tech Precision Automatic Noise Figure (test set) to their Las Vegas booth display. There, an AVANTEK factory engineer will place any line powered LNAs brought to him onto the noise figure test station and determine for you just what your LNA specifications are. If they really plan ahead, they'll have some special forms printed up which allow you to 'take away with you' the hard measured numbers from your particular LNA testing.

Since AVANTEK is measuring only, and not performing any tweaking exercises, the testing sequences should go quite rapidly. Perhaps five minutes per test. I think they will probably have to maintain several 'engineers' at the show to keep up with the demand.

There is no charge for this 'service' and any brand of LNA, as long as it is RF cable powered, is eligible for testing. AVANTEK has not officially set any 'limit' on the number of units they will 'grade' in this test exercise, for any one person or firm, but I would hope that they do keep it to say one or two at a time so that some clown with a wheelbarrow doesn't unload his display booth at their doorstep and ask for a wholesale grading of everything he has in stock!

I have a couple of LNAs that I will be bringing; some that have been spec'd at 85 degrees but with which I have had less than satisfactory results. I hope you figure out some spare room in your suitcase to bring one or a few along as well.

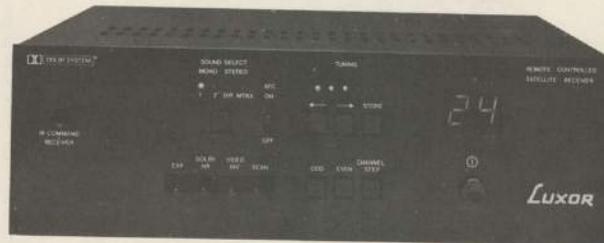
I think this is a super idea. AVANTEK is one of the stellar high tech firms in this field and they have the kind of resources (and integrity) to bring something like this off with a flair. With the relatively new availability of the H-P 8970A automatic noise figure test instruments (see LNA story, this issue), I would hope that from this show forward at least one supplier bring a similar test station so that we can make this a regular feature of our industry gatherings.

One note of caution. Remember, after reading the LNA story in this issue, that 'hard, absolute' numbers are at best plus or minus 10 or 20 degrees accurate. What we will see at the AVANTEK booth is a careful grading of all LNAs brought in for test. There will be a 'best of show,' and, a 'worst of show' someplace in that bunch. But nobody should assume that the numbers written down on the sheet of paper are absolute. They are relative only, and let's not forget that!

SOMETHING DUMB . . . and I Admit It

When I first thought out the concept of an Industry wide Directory, it seemed like a very good idea. Certainly there is an ongoing need for a

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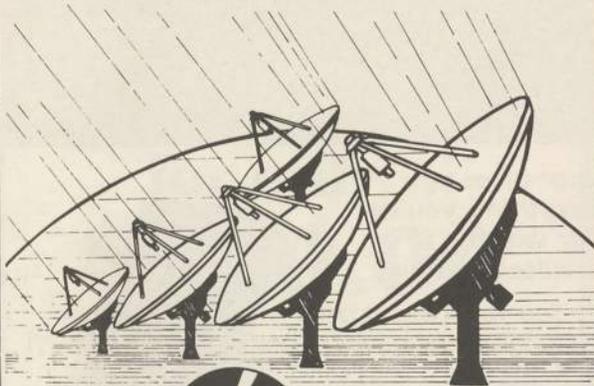
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Contact: Allen Cook (816) 333-0315

single source listing of equipment, manufacturers, distributors and dealers. And I started collecting data for it last spring. That was the first mistake; I gave in too easily when dozens of firms asked for extensions to get their material into us.

The second mistake was to schedule two weeks to work on the Directory, in its final form, during the end of September. That was before I made a quick decision to pack Susan, Tasha and Kevin into a trans-atlantic jet to see why Europe was going to be the next 'satellite frontier'. That took two weeks; the same two weeks that I had set aside to work 18 hours a day on the Directory.

The third mistake I made was to dumbly talk myself into believing that I could 'squeeze' the Directory into the month of November, 'between' (I said to myself) the STTI late October Atlanta show and the Provo Retreat (see CSD for January). I overlooked that I also had to spend a few days in Florida in that same period of time, getting out the December CSD. And I underestimated the amount of time it would take to be thoroughly prepared for the Provo Retreat.

But the biggest mistake of all was to assume, as I did through late December, that data collected in May, June and July (etc.) was going to be relevant in February. No way. I put together the first set of data and started to distribute it to the firms that had originally submitted it to us. It came back marked up with huge amounts of corrections, wholesale replacement of product lines, new addresses and on and on and on. It took me only a few days to realize that if the rest of the data laboriously prepared by me in rough form came back the way the first data did, I'd need about six solid weeks to get it all put into form for publication.

Which left me with a muddled mind. Six weeks, as those who have been here know, is about as rare as Blue Max showing up on F3R's TR8 on a Sunday afternoon. When I am 'home', I average about nine hours each day working on (as in running) West Indies Video. Since we stepped up our local programming, opened a downtown Provo 'News Bureau,' added two new over the air channels on Provo and switched to direct satellite feed on Grand Turk, we are now operating the equivalent of six full time, 24 hour per day 'networks' with a staff of four and one half. We operate and maintain nine transmitters, average several hours per day now of field videotaping and an hour plus per day of local 'live' broadcasting. And this is my 'hobby'! Well, that's a mis-statement of fact since it is a far worse obsession than any hobby could or should be. But it certainly is not out of the red ink column yet.

My non-CSD lifestyle aside, even without WIV to occupy some of my time, there has been a consistent growth of TVRO industry activities to also absorb my limited time. You may have noticed that CSD is now twice as big (as in thick) as it was a year ago. Sure, much (or some) of that is advertising. But there is a balance that I try to maintain and it all requires far more time than it did a year ago. Add to this the onrush of getting us started as an industry in Europe, a planned trip to the Far East sometime before the end of May and a couple quick trips to Europe . . . and, well, six weeks? No way.

A good friend suggested that perhaps we could 'clone' another Coop. I'm working on that. Son Kevin is 13. That's an age where many children present their parents with 'teen age problems'. Dave McClaskey of Intersat told me Kevin is a 'Super Kid' not long ago. Kevin is, but while he can run the whole WIV network as well as his Dad, or better, and does so willingly, it is not fair to intercede on his youth with requests that he spend more than three or four hours per day operating things around here. I figure that if I can hang on for another five or six years, allow him to get his growing over with, then I'll spring our 18 hour days on him!

The Directory. A good idea, but badly executed. I take full responsibility for blowing it. I don't usually tackle something that I can't see through. I could see this through, but I would not be happy with the end result, and if I wasn't happy, then it wouldn't be the useful tool that I envisioned.

For now, it goes 'on ice.' But I do recommend an alternative. Go back and look on page 68 of the January issue of CSD. There, a chap offered free 'Directories' to the first 2001 dealers to write in for a copy. What he has done here is not what I had in mind doing, but it will do until something better comes along. I know some of you are disappointed that I didn't see this one through to completion. So am I, but I am man enough to admit my own defeat in the face of overwhelming odds!

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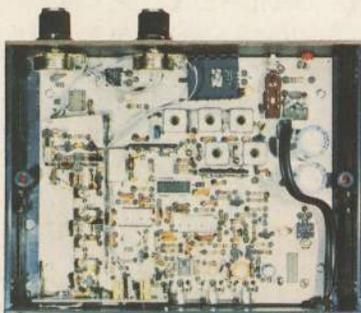
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