# THE ICOM R-9000:
## THE ROLLS ROYCE OF RECEIVERS, OR A PENTAGON TOILET SEAT?

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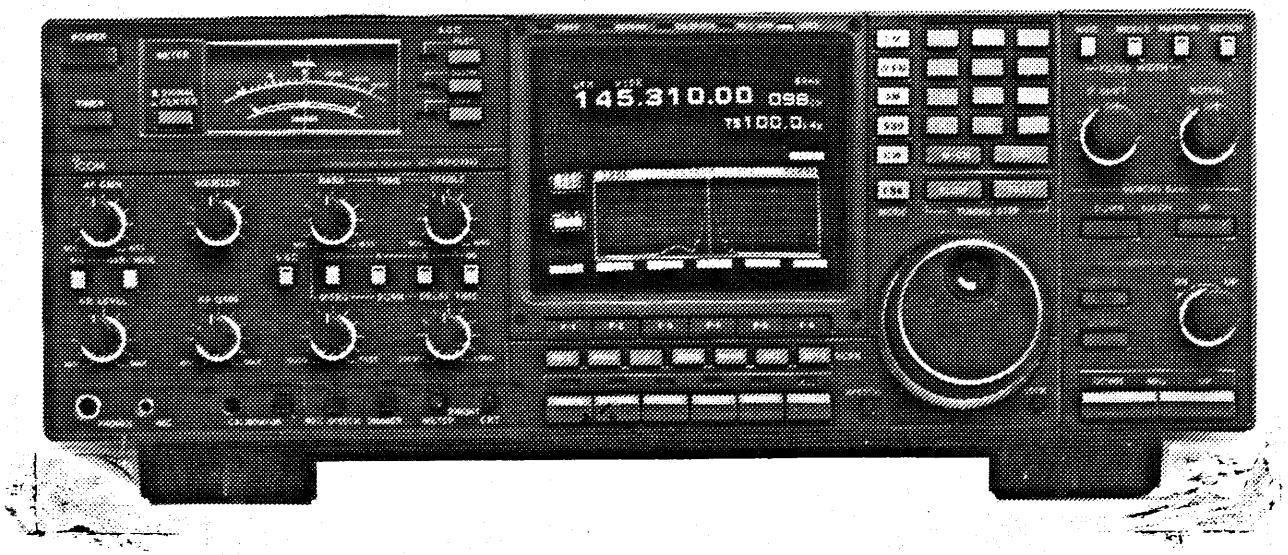
The ICOM IC-R-9000 receiver defines the current state of the art in consumer grade communications receiver technology. It provides exceptionally flexible performance over an enormous frequency range, and it contains the most complete complement of memories, knobs, functions, and gizmos that is now available in a shortwave receiver marketed to the general public. In his White Paper series and in the 1991 *Passport to World Band Radio*, Larry Magne rates the IC-R-9000 as the best receiver that he has ever tested. Universal Shortwave maintains a working display model of the receiver in their Reynoldsburg, OH store, and I have watched several dozen avid DXers drool while fiddling with this radio in the showroom. Virtually every serious DXer would very much like to have an R-9000 in the shack.

Despite the literally fantastic capabilities of this receiver, only a tiny handful of active DXers own an R-9000. Why? Its list price is $5,459.00 US! Even after a normal retail discount is deducted, the unmodified stock version of this radio costs at least $4,500.00 US. The *sales tax* on the R-9000 approaches the price of a new Sony 2010 portable. New *automobiles* with lower sticker prices are currently for sale in Cleveland. Clearly, the R-9000 is too expensive, and the overwhelming majority of DXers simply cannot afford to buy one. This is apparently not the case as far as the United States government is concerned. Several ICOM dealers reported that their retail inventory of the receiver was exhausted in early 1991 because of large orders by government agencies and the military.

However, during 1990 my bank account was unexpectedly (and temporarily) in a healthy condition. I swallowed hard, traded in an ICOM R-7000, chiseled an additional discount from the dealer, administered a full scale anesthetic to my wallet, considered that my single marital status guaranteed that I would not have to dodge flying objects launched by an irate XYL when I got home, and I bought one of these big black boxes with a CRT display on the front panel. During the 1990-1991 DX season, I operated it A-B with my old Japan Radio Corporation NRD-525, which has been modified by the addition of superb 1.9 and 2.9 kHz Collins bandwidth filters. I own no test equipment, but I now have a good idea of the comparative practical DX performance of these two receivers.

Let's get straight to the bottom line. Is the R-9000 worth all that money? The United States military was embarrassed in the late 1980's by press accounts of its $500 hammers and $1,000 toilet seats. After all, even though the Pentagon spent a lot of money on these items when they were procured, the government received goods that really were nothing but hammers and toilet seats. How about the R-9000? Is it a deluxe state-of-the-art receiver, or is it just an overpriced "toilet seat?"

After about a year of heavy use, I still have mixed feelings about this. Despite a few small flaws, the R-9000



is unquestionably a superb HF receiver that somewhat outperforms the NRD-525 in a number of significant DX areas. Its VHF-UHF-GHz scanner is noticeably better than the ICOM R-7000 that I traded in. Its CRT and CPU perform functions that ordinarily require the purchase of an expensive outboard personal computer with DX software. It has a very useful spectrum display that is hard to duplicate, even in the peripheral device market. It also contains a black and white (actually black and amber) TV set with tuner specifications that are unparalleled in the consumer television marketplace.

If you want and need all of these functions, and if you have negotiated consent agreements with your conscience, accountant, and spouse, the R-9000 may actually be worth $4,500.00. But, if you don't want or need all of these capabilities, or if you don't have ironclad agreements with your significant others, then the R-9000 is drastically overpriced. Other modified communications receivers deliver HF DX performance that approaches the level of the R-9000, and these alternatives are sold for about one third as much money. Consequently, the R-9000 cannot be properly evaluated without simultaneous consideration of its excellent performance, the astonishingly broad array of its applications, and its astronomical price tag.

Most serious DXers are by now familiar with the performance characteristics of JRC's NRD-525 (see John Bryant's excellent "Wastegunner on a 525" in *Proceedings* 1989). Larry Magne's White Paper series provides a fine technical review of both the 525 and the 9000. Going beyond lab test specifications, is the R-9000 worth all of that extra cash? After an A-B DX season using both receivers, my unequivocal answer is, "It depends."

## WHAT DO YOU GET FOR YOUR INVESTMENT?

The IC-R-9000 is a quadruple conversion receiver that continuously tunes frequencies between 30 kHz and 2000 MHz. (The owner's manual lists official limits of 100 kHz and 1999.8 MHz). Seven modes (AM, CW, USB, LSB, FSK, and at least two FM bandwidths) are useable on *all* frequencies. The receiver's frequency synthesizer tunes in nine different selectable increments, the smallest of which is 10 Hz. The 10 Hz digit reads out accurately on large frequency indication numbers that are clearly visible at the top of the CRT display. A typo in Magne's R-9000 White Paper incorrectly suggests that the receiver frequency readout is to 1 Hz. Actually, both the frequency synthesizer and the display operate on a 10 Hz standard, unfortunately with no RIT for 1 Hz tuning.

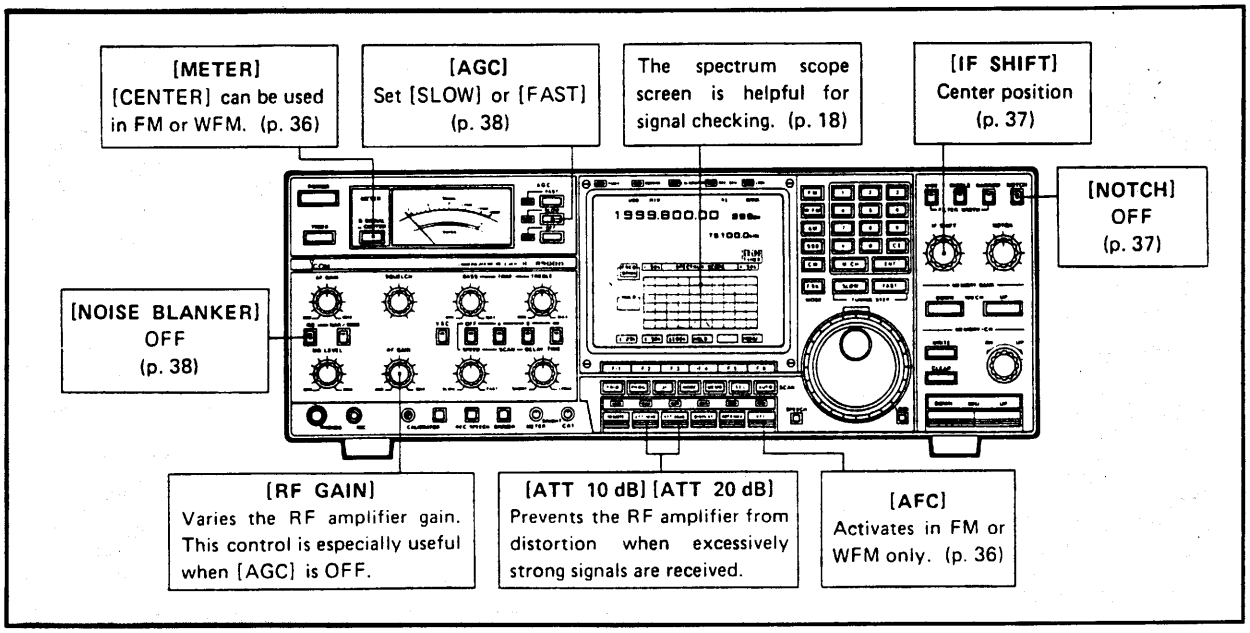
There are 53 knobs, buttons, lights, and jacks on the front panel, including a unique built-in 5"x3" CRT display. The CRT supports twenty display screen menus that are controlled by six buttons beneath the screen. Within the 20 screen display modes, the 6 buttons collectively control 88 functions. Thus, 135 different functions (53+88, minus 6 for an unduplicated count) are user-selectable from the front panel. No other shortwave receiver gives this level of operating flexibility to the listener. An additional 23 jacks, sockets, and connectors are on the back panel, including four antenna inputs (two for HF, one for VHF/UHF, and one for GHz). The HF antennas are user switchable by a front panel button. A couple of additional switches and a clock battery are reached under an ICOM-style trap door. My USA version runs off either 110 volt mains AC current or a "regulated 13.8 volt DC power supply." The owners manual specifically warns that an auto battery is not a regulated DC power source, but except for Hulk Hogan, few people would be muscular and/or crazy enough to take this rig on a DXpedition.

The CRT display is the central feature of the R-9000. It lists frequency and operating modes, functions as a TV set, prints RTTY data from external demodulators, displays memory contents, and indicates settings for literally dozens of control options. In one display mode, the CRT generates a frequency spectrum display of received signals within adjustable bandwidths of ± 25, 50, and 100 kHz around the tuned center frequency. This spectrum display is *extremely useful* for DX purposes.

A description of all functions supported by the R-9000 would require a book, and is therefore beyond the scope of this article. Fortunately, the book is available. The attractively bound R-9000 owners manual is 68 pages long. Universal Shortwave sells the manual (minus the receiver) for $11.50. It makes for interesting reading. Even though this is a complex receiver, the clear manual and the rig's well designed logical software lead to a relatively short user learning curve. In his White Paper review, Larry Magne complains that the R-9000 comes without a schematic diagram. This is no longer the case—I received a full detailed schematic printed on both sides of five large 42½" x 11" sheets of paper.

Compared to the modified NRD-525, how does the R-9000 perform? This is a complex question that does not have a simple answer. The R-9000 supports scores of applications that are beyond the capabilites of the NRD-525, so the question is an apples-to-oranges comparison. Above 34 MHz, the unmodified NRD-525 does not function, so the R-9000 wins by forfeit. Below 34 MHz, the R-9000 wins most (but not all) key A-B battles.

There are a lot of similarities between the 525 and the 9000. Both have battleship front ends, unlike the ICOM R-70 and the Kenwood R-5000. In an urban environment like my home in Cleveland, where local medium wave powerhouses blast away on a 24 hour basis, this is a very important consideration. Both receivers are incredibly stable, sensitive, and selective. They are loaded with features that provide considerable operator flexibility. But, a detailed




look at their *differences* is more useful to the serious DXer.

## VHF-UHF-GHz: THE R-9000 AS A SCANNER AND TELEVISION SET

Unlike the unmodified NRD-525, the R-9000 contains a state-of-the-art scanner that has complete frequency coverage between the HF bands and 1999.8 MHz. The quality of this scanner is outstanding on dimensions like sensitivity, selectivity, image rejection, audio quality, freedom from synthesizer birdies, stability, etc. HF DXers who have no interest in VHF/UHF will certainly want to ignore the R-9000, since this capability is built into the receiver's gigantic purchase price. I have found that the R-9000 scanner is substantially better than the one in my old ICOM R-7000. The R-9000 has 1,000 (sic) memories, 100 of which can be used to automatically scan and store active frequencies, including an indication of the time and date that a signal was initially heard on a particular frequency during a scan. (The R-7000 has 100 memories, only 20 of which support a less comprehensive auto-write function).

The R-9000 scanning speed is both significantly faster and more adjustable than the R-7000. It supports just about every scanning scheme and mode that is known to man. The R-9000 demodulates television video, which can be displayed either on the front panel CRT or on an external black-and-white monitor. (The stock R-7000 does not demodulate TV video.) The TV bandwidth filter skirts are better than any that I have ever seen on commercial television sets. I can watch weak TV-DX signals on channel 2 while the local powerhouse WKYC-TV blasts forth on adjacent channel 3 with zillions of watts from a transmitter less than five miles from my house. I can also watch the Indians game on channel 43 from my DX shack. If the Indians give up another three run homer as usual, I can instantly switch back to 60 meter HF DX with one push of a button.

All of this is impossible on the NRD-525. A detailed review of the R-9000's scanner performance is beyond the scope of this article. But, the R-9000 outperforms the R-7000, which retails for more than $1,000.00. As far as I know, it beats *all* other hobby scanners in receiver quality and overall performance. It also is substantially better than any commercial black and white television set tuner that is on the market; this feature is probably worth in excess of $250.00. So, about one-third of the cost of an R-9000 is tied up in its VHF/UHF/GHz capabilities. The HF part of the radio, which does *not* come separately, costs less than $3,000.00. This narrows the 525/9000 price gap considerably.

## HF: THE GOOD NEWS

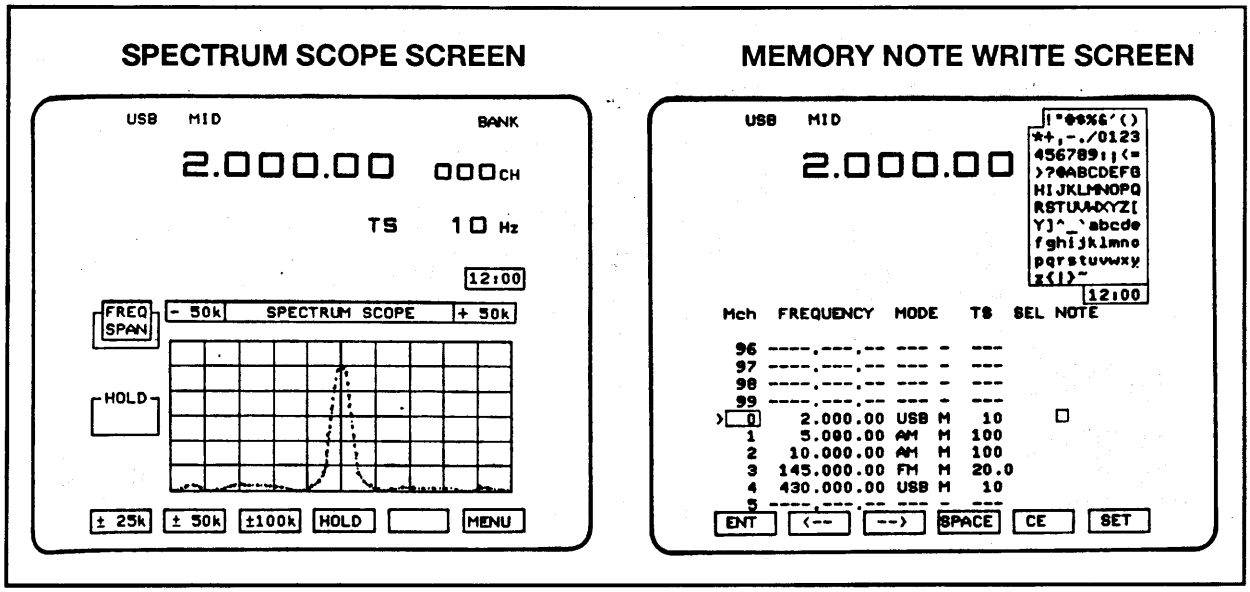
In quite a number of key areas, the R-9000 noticeably outperforms the NRD-525 as a DX receiver. For some functions, this improvement is small. In other areas, the difference is dramatic. The R-9000 exceeds the 525's capabilities in all of the following respects:

1. AUDIO. The NRD-525 generates frustratingly inadequate audio. Cheap $30 walkman radios produce better audio than the muffled junk that comes out of the 525. Even when run through external speakers, the 525 is too bassy. Even worse, it is notorious for a constant high pitched audio hiss that is not unlike the white noise you get on an FM tuner when no station is on frequency. In contrast, the R-9000 generates a quite pleasant wideband audio frequency response. This audio is very quiet, contains no hiss noise, and is adjustable by effective treble and bass con-

trols. The R-9000 audio can be favorably compared to the sound that comes out of old boat anchor tube rigs. This outstanding audio obviates the need for external graphic equalizers, MAP units, etc. that are designed to clean up the mess put out by radios like the 525. The top-mounted internal R-9000 speaker produces acceptable sound, but the audio is much more impressive through a decent outboard speaker. DXers should not minimize the importance of this. Good audio is useful for comfortable program listening, but it also is a great help for fishing the weak DX ID out of the mud. As a very substantial bonus for DXers, a combination of the R-9000's AGC constants and adjustable audio very noticeably minimizes the damage caused by QRN noise, particularly in comparison to the 525. (NOTE: I originally was delighted with my 525, because its audio was much better than the sound from my ICOM R-70, particularly in ECSS with the 2.9 kHz Collins filter in the circuit. Hence, the R-9000's audio is *startlingly* better than that of other ICOM equipment).

2. S METER. The R-9000 has an analog S meter. The NRD-525 does not. Enough said. The S meter in my old ICOM R-70 tended to significantly underread, particularly in SSB. While on a St. Helena DXpedition with Kevin Atkins, I noted that his R-70 has the identical malady. ICOM solved this problem in the R-9000. The S meter reads robustly (and pretty accurately) *in all modes*. It also functions as a center-tune indicator on FM, if desired.

3. MEMORIES. One of the great breakthroughs in the 525 is its 200 tunable memories. The R-9000 raises this ante significantly with 1,000 tunable memories. This huge memory capacity is actually necessary, particularly if a user does much VHF listening in a metropolitan area. On both receivers, the memories store frequency, mode, and bandwidth filter. Unlike the 525, the R-9000 memories also store tuning step settings. This feature is even more valuable when you consider the fact that the 9000 has nine different tuning step settings; the 525 has only two. The 9000 does not store attenuator and AGC settings like the 525 does, but this is not a big deal. The 9000 does, however, display any ten of the stored memories on the CRT, along with a useful eight character note that identifies the station (e.g. TACHIRA, RELOJ, TRISTAN, etc.) These notes are easily entered with a CRT function button and the tuning knob within a user friendly display screen that is illustrated below. This very useful feature is not available on the 525. Both receivers access memories through the keypad, but the R-9000's memory tuning knob is *considerably* more convenient for quick tunes through adjacent memories than the 525's awkward memory slewing buttons. The R-9000 supports convenient internal memory editing functions (such as copy, move, and delete) that are missing on the 525. In the memories battle, the R-9000 wins hands down.




4. NOTCH FILTER. The 525 has an excellent 40db notch filter, which is a major improvement over its notchless predecessor, the Japan Radio NRD-515. The R-9000 has a better one that is rated at over 60db. Magne says that the R-9000's notch filter is the deepest one that he has ever tested. He is right. This filter kills hets, period, in ECSS. However, its range is somewhat limited in AM, so it does not work on AM mode heterodynes at audio frequencies above 1500-2000 Hz or so. The notch is unbelievably deep and effective on the R-9000, but its audio width sometimes seems a little too broad for me. The filter has a slight tendency to notch out some useful audio along with the hets.

5. IF SHIFT. The R-9000's version of passband tuning is labeled as an "IF SHIFT" control. It works in all non-FM modes, and is enormously effective. QRM is eliminated as the IF passband shifts away from the tuned frequency, but the signal retains decent audio after this shift. The NRD-525's "Pass Band Tuning" control is often a little too vigorous for my taste. It does effectively narrow the passband, but it simultaneously squeezes the audio down

to "tin can" levels. I have never used the famous passband tuning circuit on the Drake R-7A, but I have to assume that the R-9000 IF Shift compares very favorably.

6. NOISE BLANKER. The 525 has a decent noise blanker that is somewhat adjustable. But, the R-9000 has an outstanding noise blanker that has a greater adjustment range. In my experience, most noise blankers seem to work about 30% of the time. They can be effective on spark plugs, vacuum cleaners, power line noise, woodpeckers, etc. However, they can be annoyingly ineffective in an urban environment like Cleveland, where noise is a big factor in serious DXing. I find that the R-9000 noise blanker will completely attenuate noise at least half the time. This is way above average for blankers on communications receivers. Furthermore, the noise remains visible on the CRT spectrum display, so it is psychologically uplifting to hear its disappearance. Hallelujah, the wicked noise is gone! This property is not unique to the R-9000; the ICOM R-70 also has an effective (though less adjustable) noise blanker. I conclude that ICOM noise blanker circuits are better than JRC noise blanker circuits. On the R-9000, the noise blanking effect is even more pronounced on longwave than it is on HF. This is really impressive!

7. NOISE FLOOR. The R-9000 is much quieter than the 525. I am not sure why this is true, but it probably is a combination of quiet RF, IF, and AF circuits. Thunderstorm static and other sources of noise are noticeably less bothersome on the R-9000. This is a *major plus*. The advantage can be enhanced by effective manipulation of the notch filter, IF shift, and noise blanker. Under some conditions, static can be drastically attenuated. It is amazing! Unlike the noisy frequency display on the 525 that puts out RF interference to adjacent radios, the R-9000 CRT is well-shielded and quiet. A Sony 2010 lying on top of my 525 is useless because of the loud buzz, but a 2010 lying on top of my 9000 is completely functional. Although I have not tried it, MW DXers could use indoor loop antennas for the 9000 without fear of receiver-generated QRM.

8. TUNING FLEXIBILITY. Again, the R-9000 beats the 525 in this category. The 525 tunes in 10 Hz or 100 Hz increments with a comfortable main knob. The R-9000 has an equally comfortable knob that tunes the same 10 and 100 Hz increments, but it can also be set for 5, 9, 10, 12.5, 20, 25, and 100 kHz steps. A very nice optional "click" function (both audible and palpable with the fingers) adds to the tuning "feel" of the 5+ kHz steps. Slewing buttons and keypad tuning supplement the knob on both rigs, although I personally have little use for slewing buttons. (The R-9000 slewing increments are limited to 1 MHz steps.) Overall, the R-9000 has considerably greater tuning flexibility. The 5 and 10 kHz increments are convenient for bandscanning of HF and MW, respectively.

9. FM DEMODULATION. FM signals are not common on the HF bands, but there are exceptions to this. Many 10 meter hams, some pirates, and a handful of utility stations regularly use FM. In addition, some poorly modulated SWBC stations transmit fundamental frequencies and spurs that have partial or full FM'ing signal components. The FM mode on the NRD-525 is lousy. This receiver's FM detector is pretty flimsy, and its bandwidth is way too wide for effective use on HF. On frequencies below 30 MHz, the R-9000 has two excellent FM bandwidths. (A third wideband FM mode kicks in on higher frequencies for reception of broadcast FM and television audio.) In the FM category, the 9000 beats the 525 by an overwhelming landslide.

10. SPECTRUM DISPLAY. The R-9000 spectrum display is obviously not present in the 525, or in any other quality consumer receiver (with the exception of the vastly inferior offering on the SONY V21 "portable"). Some DXers have speculated that this spectrum scope is a gizmo and frill that does not have significant DX applications. *These people are wrong!* The R-9000 spectrum scope is quite valuable in many DX situations. It must be used to be fully appreciated. The invention of windshield wipers was a big improvement to the level of visibility through automobile windshields. The R-9000 has a similar effect on the mental relationship between a DXer and a receiver. You can *see* a signal's constantly changing strength and bandwidth while listening to it. You can also see the same properties of other signals that are ± 25, 50 or 100 kHz away from the signal that is currently tuned in.

This capability is useful in several situations. First, QRM and QRN are visible on the screen. Adjustments to filter, notch, noise blanker, and other controls have audible effects through the speaker *and* some visible effects on the screen. The process of ear-finger-brain coordination is significantly enhanced by the scope. Second, as signals come and go on adjacent frequencies, they are immediately visible on the screen. This is an exceptionally valuable feature. Multiple pirates who operate simultaneously can be noted and heard; some would probably be missed without a scope. Clandestines (and jammers) that jump frequencies can be instantly followed to their new spot without a lot of tuning guesswork. As a band opens up, new carriers can be visually spotted before a bandscan starts, particularly on relatively quiet bands.

After using the R-9000, I am convinced that built-in spectrum scopes are the best new DX idea since the invention of the digital frequency display. Most DXers should want one. Until they become routine in HF receivers, there should be a reinvigorated market for peripheral spectrum displays. The plusses and minuses of the R-9000 should guide the development of future products. On the positive side, the ± 25 and 50 kHz bandwidths are good choices; the ± 100 kHz range is usually too cramped on HF, but is useful on VHF. The R-9000 display is visually attractive, and is easy to learn effectively. On the negative side, the R-9000 display response is slightly behind real time, and its "pixie-dot" non-analog image "feels" sluggish during tuning. It could use an additional narrow bandwidth (± 5 kHz?) to make

it more useful as a tuning scope for things like FDM RTTY signals, and another wider bandwidth (± 500 kHz or 1 MHz?) for use in some VHF/UHF frequency ranges. But, until more built-in scopes are available in the commercial receiver market, the R-9000 spectrum display is the *only* existing alternative, and is *very* valuable. You should go buy one at once!

11. MODE AND FILTER BUTTONS. On the 525, tuning modes and filters are selected (or lost and confused) by four up-down slewing buttons that cascade through the various available alternatives. AM/FM/USB/LSB/FSK modes and all bandwidth filters are selectable on the R-9000 with individual buttons. This may seem to be a minor point, but it enhances ease of operation on the R-9000. Three cheers for ICOM, and four boos for JRC.

12. MISCELLANEOUS FEATURES. The R-9000 is loaded with capabilities and features that are not present on the 525. Some of these are nice for DXers, and should be noted. The CRT displays a clock at all times. On some screens, this clock shows seconds, day, date, month, and year. The CRT also displays the tuning step setting at all times. Four FSK offsets are user selectable. (The 525 has only two, RTTY and FAX). Although scanning functions have limited utility on HF, the 9000 scanner is much more sophisticated than the one in the 525. Among the extra capabilites is a circuit that stops scanning only when voice signals are detected. The *feel* of the two rigs is also different. The R-9000 weighs 44 pounds, and just looks very solid. The 525 weighs less than half that, and its plastic cabinet does not make you feel like you have a major appliance on your shelf. My experience suggests that the R-9000's complexity does not hinder the ease of routine DXing. The overall receiver design is ergonomically sound, and the extra features need only be used when necessary or appropriate.

## HF: THE BAD NEWS

Alas, everything is not rosy on the R-9000. In a few performance areas, the 525 is marginally superior, despite the enormous price differential between the rigs.

1. FILTERING. The stock bandwidth filters in the NRD-525 leave a lot to be desired, but my 525 has been modified by the installation of absolutely superb 1.9 and 2.9 kHz Collins filters. In some respects, the 2.9 kHz Collins outperforms the stock R-9000 filters. In AM, the R-9000 engineers screwed up. Magne measures the three AM filters at 11.3, 7.8, and 2.6 kHz. The wide one is way too wide, except on local MW stations or for HF blockbusters like WWCR on 7520 kHz. The medium AM filter is also too wide, especially on bands like 49 and 41 meters at night. The narrow AM filter is excellent, but it is narrow, and thus has limited audio fidelity. (Fortunately, the audio quality of the narrow filter can be enhanced by detuning about 1 kHz up or down from the center frequency of a station.) Both the wide and medium AM filters should be narrowed by about 3 or 4 kHz apiece. Suprisingly and inexcusably, the R-9000 filters cannot be selected independent of mode! On SSB/RTTY/CW, three different and narrower filters kick in, including an FL-44A and an FL-52A. The SSB/RTTY filters rate at 2.8 and 2.5 kHz, and the CW filter seems at least as tight as its nominal 500 Hz value. All of these filters are superb, and are nearly up to the Collins standard. (The skirt selectivity of the 9000 SSB filters is slightly worse than that of the Collins filters, sometimes necessitating the use of the attenuator to eliminate slop from loud adjacent signals.) Overall, the R-9000 is an *extraordinarily good* receiver in ECSS. However, if a 4 or 5 kHz filter were available, useable in both AM and SSB, things would be much better. My modified 525 has this multimode filter capability. Remember, the R-9000 costs several kilobucks, so it should not be necessary to add bandwidth filters after you already shelled out a fortune for the stock rig. But, firms like EEB will add a board and a couple of Collins filters for an additional charge of several hundred dollars. Ugh.

2. HEAT. The R-9000 runs thermally HOT. It is a *lot* hotter than the 525. A heat sink in the back right hand corner of the receiver absorbs quite a bit of thermal energy. It's not warm enough to brew coffee, but it might give you a rare steak if you left the meat on there long enough. The heat also generates an audible mechanical "pop" at strange intervals, much like a car engine does if you look under the hood with the engine off after a long ride on a hot day. This heat cooks the top of the cabinet to about 110 degrees, and it makes me nervous. So far, it does not seem to have created any ill effects. But, if this heat creates receiver unreliability down the road, I am going to be furious when I show up at the repair shop with my warranty that expired after one year.

3. PUZZLING ECSS BFO OFFSETS. My 525 can easily and accurately measure AM carrier frequencies down to 10 Hz in ECSS mode by a simple technique that only requires use of the tuning knob and my ears. Using automatic BFO offsets in either LSB or USB mode, I match the pitch of hets about ± 200 Hz or so on both sides of the center frequency of a station, add half of the frequency difference in Hz between the two matched tones to the frequency display reading for the lowest tone, and BINGO. The frequency is precisely measured, and the receiver is tuned on the nose to a station's carrier frequency. This procedure can be tried on the R-9000, but it is usually more complicated. The R-9000 SSB BFO offsets generally produce a loud audible het around off-tuned ECSS signals on only one side of an AM carrier. I am a technical numbskull, so I am not sure why this is true. But, to generate two offset ECSS tones on the R-9000, you often have to take two readings in both LSB and USB after pushing a button to change modes. The 525 will do this in either USB or LSB without the need to fiddle with any mode change controls. While a minor

point, this is a minus for me. I do a lot of frequency measurement, particularly while DXing for pirates.

4. STABILITY. Both the 525 and the R-9000 are absolutely rock stable. It is amazing what they can do in Japan nowadays. When the dial says 5047.13, it means precisely 5047.13. The 525 is instantaneously stable from the moment when the power is switched on. From a cold start, the R-9000 often needs several seconds of warmup before it drifts down to a precisely stable frequency. The spectrum display warms up even more slowly, and takes at least 10 seconds to drift down to an accurate frequency range after a cold start. Hence, when the receivers are turned on, the 525 is more stable than the R-9000 for about 2-10 seconds. This is curious, but it is only a minor inconvenience. On the other hand, both my 9000 and my 525 show a constant frequency variation of about 20-30 Hz that is frequency dependent. On my 525, WWV on 5 MHz accurately reads at 5000.00 KHz on the frequency display. But on 15 MHz, the WWV frequency reads out as 15000.03 kHz. The synthesizer error is about 30 Hz over a 10 MHz range. My R-9000 seems to have a similar 20 Hz error range, but it is adjustable. A tuning callibrator screw on the front panel can set WWV to 15 MHz on the nose, but then it is 20 Hz low on 5 MHz. If I reverse the process, I can set WWV to 5000.00 on 60 meters, but then the synthesizer will be 20 Hz too high on 19 meters. The error seems to be linear on both rigs, and it is quite stable. At least the small synthesizer error is externally adjustable on the R-9000. With the 525, I just have to live with it.

5. AGC. Both fast and slow AGC decay constants are too slow on the R-9000. They can be instantly defeated by hitting the AGC "off" button momentarily, but this situation is a nuisance when the radio is tuned past a powerhouse S9+40db signal toward a weak S3 signal. On the tropical bands, the AGC settings rarely cause any problems. In contrast, I think that the NRD-525 AGC decay settings are more appropriate. On both radios, the AGC attack constants are both rapid and well chosen. (Some DXers think that they are *too* rapid.) On the brighter side, the 9000 has separate buttons for fast, slow, and off AGC settings. The 525 has only one inferior button that cascades through these AGC positions.

6. KEYPADS. The 525 has taken some deserved criticism for its oddly shaped vertical keypad buttons. In *Proceedings* 1989, John Bryant sarcastically called them "dull knives." But, the buttons on the R-9000 are *worse*. They are dinky, flat, slippery, and too squeezed together. This frequently leads to input errors. Give me widely spaced dull knives any day; I'll take them. There is more bad news. The software for keypad frequency input on the R-9000 requires the input of a MHz dot. You cannot enter 7415 kHz or 760 kHz. Instead, it must be 7 dot 4 1 5, and 0 dot 7 6. The 525, which will take either MHz or kHz input on its frequency entry keypad, is considerably more convenient. The R-9000 loses the keypad ergonomic battle to the 525 by a wide margin. On the R-9000, I also find that the six dinky CRT control buttons are located too close to the dinky scan function buttons. My big fingers sometimes start a scan by mistake when I actually wanted to change function settings on the CRT.

7. DIAL-TO-MEMORY FUNCTION. On the 525, a dial frequency can be conveniently stored into any memory channel by pushing a couple of buttons (or actually a few buttons, but the process is logical and easy, and it is easier to do than it is to describe). In stark contrast, *the R-9000 has no dial-to-memory function*, and it lacks a dual VFO capability. You can store the contents of the single VFO into one pretuned memory channel, but you cannot enter another memory channel without losing the frequency being tuned by the VFO. This R-9000 quirk is a serious drawback. It hinders efficient storage of frequencies into memories during bandscans. In addition, blank R-9000 memories default to the FM mode with a 20 kHz tuning step. This further complicates the ease of memory storage on HF frequencies. Here is another area where the ICOM engineers made a significant mistake.

8. BFO NOT TUNABLE. The R-9000 provides seven different fixed BFO offsets in SSB/CW/FSK modes. Aside from this, the frequency of the BFO is not manually tunable by the listener, and the automatic LSB/USB offsets cannot be defeated. The situation is puzzling in a top-of-the-line receiver. The 525 has a tunable BFO frequency knob, its automatic SSB offsets can be turned off, and its bandwidth filters are selectable in all modes. These features, none of which are present in the 9000, permit ECSS reception on frequencies within AM station sidebands that are not restricted to automatic BFO offset settings (see "Getting the Most Out of ECSS" by Gene Pearson in *Proceedings* 1990). The 9000's lack of 1 Hz tuning might create additional anguish for some ECSS purists, but my ears do not detect a problem here.

9. LINE OUT LEVEL. Various "line out" audio levels are unusually low on the R-9000. They certainly are lower than comparable outputs from the 525. The situation complicates A-B input from the two receivers into my audio amplifier, my M-7000 RTTY demodulator, my tape deck, etc. Constant adjustment of the AF gain and audio input levels is necessary when receivers are switched. This is not a serious problem, but it is a nuisance.

## THE JURY IS OUT: USABLE SENSITIVITY

After several months of A-B use, one key question is still unresolved in my mind. Between the R-9000 and the NRD-525, which receiver has more usable sensitivity? The official sensitivity specifications of the R-9000 are slightly better than those for the 525. This, plus the exceptionally quiet noise floor and the excellent audio of the

R-9000, suggests that the R-9000 performs somewhat better on really weak DX than the 525 does. But, this has not always been the case in my actual experience. The *really marginal* het seems to produce more useful audio on the R-9000 about 85% of the time, but I sometimes get a more intelligible signal on the 525. There are two factors that I suspect here. First, the 525 has a function that can disable the RF filters in the front end. In some cases with the AGC off, this can increase the apparent audible gain of a signal by a slight amount. The R-9000 does not support this feature. Second, my old ICOM R-70 seemed to be sensitive to the impedance of my antenna. The 525 has automatic preselection circuits, and this greatly minimizes the suspicion in my mind that I might be losing signal from an impedance mismatch. It is possible that my R-9000 might have a slight "dead spot" or two from impedance mismatch with my antenna, particularly on 90 and 120 meters. I have not experimented with an antenna tuner, so I am not yet sure if my suspicions are justified. Astonishingly, I very occasionally get a more usable signal on my Sony 2010 portable with its whip antenna than I find on either the 9000 or the 525 with an outdoor antenna! This certainly is a result of the 2010's phase-locked loop synchronous detector, which is absent on both of the high priced receivers.

## IS THE ICOM IC-R-9000 WORTH THE BIG BUCKS?

This is a hard question to answer. It depends on the applications that a listener has for the receiver. The R-9000 is an HF receiver that performs significantly (but not overwhelmingly) better than my modified NRD-525 on an overall basis. It is also a VHF/UHF scanner that outperforms the ICOM R-7000. It is a black and white television tuner and monitor that considerably outperforms my regular TV as a DX rig. It is also a spectrum scope; this property is not available in any similar receiver. It is also a small PC that supports memory lists and edits, automatic station logging, and similar DX computer applications.

Let's attempt to tabulate the value-added from all these features, using comparative prices from the current Universal Shortwave catalog. The NRD-525 (with two Collins filters installed) retails for $1,470. The ICOM R-7000 costs $1,030. A new black and white TV with a super tuner is hard to find, but if you could get one, it probably would cost at least $250. So far, the total cost of the equipment exceeds $2,750, which remains about $1,700 below the cost of a new R-9000. For this additional $1,700, the receiver provides a useful spectrum display, which is not available at any price in other stock receivers. It does things that normally would require a PC/software combination that certainly would cost at least $1,000. Most important of all, it outperforms the alternative receivers. All in all, a case can be made that the R-9000 is reasonably priced, *if* you want and need all of these capabilities.

I have found that there are some situations where the 525 outperforms the 9000. So, the best solution is to buy both the 525 *and* the 9000. This can be done for about $6,100.00 US. Obviously, this suggestion moves us into the realm of the absurd. Most DXers have trouble scraping up the $900 for a used 525. Hence, it must be concluded that the list price of a new R-9000 is clearly prohibitive. Because of this enormous cost, the receiver will never have much of an impact in the DX hobby. But, despite a few inadequacies discussed in this article, the R-9000 does provide good value for the money. If a DXer intends to use the R-9000 for serious HF *and* UHF/VHF purposes, and if a large amount of cash is available in the household budget, the extreme cost *can be justified.*

On the other hand, let's be realistic. Very few DXers will ever have 4 or 5 big ones to spend on a receiver. Very few spouses would remain married to DXers who even *tried* to spend that much for a radio. The R-9000's performance is not really dramatically better than that of a JRC NRD-525 or a Kenwood R-5000. So, the challenge to Japan is still there. We need an R-9000 (without the warts) that sells for about $2,500. The new NRD-535 and Drake R-8 receivers have not been thoroughly reviewed in time to meet *Proceedings* 1991 deadlines, but when they are replaced, receiver engineers and manufacturers should shoot for this goal.