

HIGH-FREQUENCY BROADCASTING

High-frequency (*HF*) broadcasting, more commonly known as shortwave broadcasting, employs the long-distance capabilities of skywave propagation for transmissions over long distances. HF is used for international broadcasting. Some international broadcasters additionally use the medium wave broadcast band (standard AM) to reach audiences in nearer target countries. HF is also used for domestic broadcasting in countries with large remotely populated regions (e.g., Russia, China, Canada, Australia) and in tropical countries, where the effectiveness of medium-wave broadcasting is reduced by poor soil conductivity and static from lightning.

International HF broadcast stations generally transmit in a number of languages, including the language of the broadcasting country, plus a selection of major world languages or languages of countries of particular interest to the broadcasting country. For example, the Broadcasting Service of the Kingdom of Saudi Arabia has international HF transmissions in Arabic, Bambara, Bangali, Indonesian, Persian, Somali, Swahili, Turkmen, Turkish, and Urdu—languages of major Islamic populations. Unlike domestic radio which remains on the air throughout the day, international HF broadcasts in a particular language usually have a duration of a half hour to ninety minutes because most international radio stations have a limited number of broadcasters proficient in each language. The fluid nature of the ionosphere also requires that frequencies be changed several times during the day.

History

Early Years. By the 1920s, the establishment of voice modulation and the discovery of the long-distance properties of the HF frequencies enabled the development of HF broadcasting. In 1927 the Philips company in the Netherlands established a permanent high-frequency broadcasting station to send programs to the Dutch colonies (1). Soon after, Britain and France began HF broadcasts to their colonies.

During the 1930s, Italy and Germany conducted the first sustained use of radio for international propaganda. Italy transmitted in Arabic to the Middle East in an attempt to turn opinion in that region against the British. Germany broadcast to German communities abroad, adding Spanish, Portuguese, and English to the Americas, and other languages to other targets. The British Broadcasting Corporation (*BBC*) reacted by supplementing its Empire Service with broadcasts in many of the same languages already transmitted by Germany and Italy (2).

World War II. Axis broadcasting during World War II had two main strategies. One involved attempts to convince neutral countries to remain neutral or to join with the Axis. The second was to demoralize or confuse the civilian populations or armed forces of countries which had already joined the war against the Axis powers (3). The BBC countered the Axis broadcasts with a more factual presentation of news. This was also largely the policy of the Voice of America (*VOA*), created by the United States government in 1942 by consolidating the several private HF broadcast stations which existed in the United States before the war (4).

The Cold War Years. At the end of World War II, there was a sudden reduction in the amount of international HF broadcasting. However, the advent of the Cold War led to a growth of international

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broadcasting that was sustained through the 1980s. The Soviet Union's Radio Moscow set the pace with an increasing number of transmitters, transmission hours, and broadcast languages through the Cold War years. All other communist countries, and even some Republics of the Soviet Union, maintained their own international radio services. China's Radio Peking (later, Radio Beijing, and now Voice of China) and its ally Radio Tirana (Albania) were among the largest HF broadcast operations.

From the West, Voice of America and BBC overseas broadcasts expanded. In 1953, West Germany created its Deutsche Welle, which grew to be one of the major international radio services. Also in the early 1950s, the United States created Radio Liberation, later Radio Liberty, directed to the Soviet Union, and Radio Free Europe directed to the other communist countries of Europe. These stations were later merged to form Radio Free Europe/Radio Liberty, Inc.

The Post-Cold War Period. Radio Moscow, which led the expansion of international broadcasting after World War II, also led the post-Cold War reduction of international broadcasting. In 1990, Radio Moscow broadcast in 61 languages. In 1998, its successor, Voice of Russia, has 33 language services. Western broadcasters also reduced some of their operations and shifted operations from direct HF broadcasts to rebroadcasting within the target country. (Rebroadcasting is described later.) Radio Free Europe/Radio Liberty moved from Munich to Prague. The station closed its Hungarian service and began the privatization of its Czech and Polish services. Voice of America HF broadcasts in Russian were reduced from 16 hours per day in 1989 to six hours per week in 1998.

Many of the HF transmitters active during the Cold War are now leased to religious and other radio program makers. In 1997, BBC sold its UK-based HF broadcast transmitters to Merlin Communications International Ltd., which leases the transmitters back to the BBC. Merlin leases spare transmitter time, as do Deutsche Telekom in Germany, Sentech in South Africa, and the transmission companies in many of the former Soviet republics.

Other countries have been considering the future of their international radio services in the post-Cold War era. In late 1996, the Canadian government announced that Radio Canada International would be closed. Public and political support kept the station on the air. In 1997, the Australian government planned to close Radio Australia, the international service of the Australian Broadcasting Corporation. After much debate, Radio Australia remained on the air but its operations were reduced by about half. Its broadcasts in Cantonese, Thai, and French were dropped, and its main HF transmission site near Darwin was put into mothballs.

The United States has created new international broadcasting services which reflect the shift from the old US-Soviet Cold War theater. Radio Martí to Cuba began broadcasting in 1985. Radio Free Asia was inaugurated in 1997, transmitting to China, Tibet, North Korea, Vietnam, Laos, Cambodia, and Burma. Congress has allocated funds for new Radio Free Europe/Radio Liberty broadcasts to Iran and Iraq and for a new Radio Democracy for Africa to be operated by the Voice of America.

The use of HF for domestic broadcasting has receded in recent decades. For example, the 1973 *World Radio TV Handbook* listed about 250 stations in the 90 meter tropical broadcast band (3200 kHz to 3400 kHz). The 1998 issue of the *Handbook* lists about 150 stations in that same band (5). However, investment in domestic HF broadcasting continues in some countries. In 1994, the Zimbabwe Broadcasting Corporation revived its domestic HF broadcasting by putting the first of four new 100 kW HF transmitters into service.

Present Broadcasting Activity

International radio broadcasting can be divided into three broad types: government-funded, religious, and commercial. Government-financed stations comprise, by far, the largest share. According to the 1998 *World Radio TV Handbook* (5), some 85 national governments operate international radio stations. Most religious international stations are Protestant evangelical, but there are also Catholic and Islamic stations. Commercial HF international broadcasting has not been successful in selling spot advertisements because of a lack of

Table 1. International Radio Broadcasters: Top 40 Stations Ranked by Program Hours per Week^a

	Country	Station	Type	Hours per Week
1	USA	Trans World Radio	R	939
2	United Kingdom	BBC World Service	G	929
3	China	China Radio International	G	893
4	USA	Voice of America	G	870
5	USA	Far East Broadcasting Co	R	809
6	Germany	Deutsche Welle	G	708
7	USA	WWCR	C	672
8	USA	World Harvest Radio	R	665
9	Iran	Voice of the Islamic Republic of Iran	G	637
10	USA	Adventist World Radio	R	618
11	USA	WYFR - Family Radio	R	616
12	Egypt	Radio Cairo/Voice of the Arabs	G	587
13	USA	Radio Free Europe/Radio Liberty	G	553
14	Russia	Voice of Russia	G	539
15	Ecuador	HCJB - Voice of the Andes	R	534
16	India	All India Radio	G	497
17	Japan	NHK World	G	457
18	USA	High Adventure Ministries	R	443
19	France	Radio France Internationale	G	415
20	North Korea	Radio Pyongyang	G	378
21	Turkey	Voice of Turkey	G	375
22	Netherlands	Radio Netherlands	G	369
23	Israel	Kol Israel	G	356
24	USA	WJCR Worldwide	R	336
25	Vatican City	Vatican Radio	R	333
26	Romania	Radio Romania International	G	332
27	South Korea	Radio Korea International	G	322
28	Bulgaria	Radio Bulgaria	G	315
29	USA	WEWN - Worldwide Catholic Radio	R	301
30	Finland	YLE Radio Finland	G	295
31	Australia	Radio Australia	G	280
32	Switzerland	Swiss Radio International	G	270
33	Spain	Spanish Foreign Radio	G	255
34	Taiwan	Radio Taipei International	G	252
35	Greece	Voice of Greece	G	234
36	Vietnam	Voice of Vietnam	G	231
37	Italy	RAI International	G	218
38	Ukraine	Radio Ukraine International	G	203
39	Poland	Polish Radio Warsaw	G	200
40	Cuba	Radio Havana Cuba	G	195

^aThis table shows program hours rather than frequency hours. Many religious broadcasters transmit in a language on only one frequency. Government-funded international broadcasters use more than one HF frequency per language broadcast, and as such they may have a better chance of delivering an audible signal in the target country or countries. Hours per week include medium-wave and HF transmissions. Program hours reflect simultaneous transmission in more than one language. (Source: BBC Monitoring, World Media Unit.)

^b Station types: G-government-funded; R-religious; C-commercial.

audience ratings data, but a number of stations make some profit by selling blocks of time to religious and special-interest organizations.

Table 1 shows the top forty international radio stations by frequency hours.

International Broadcasting from the United States. The United States originates every type of international HF broadcasting. The Voice of America is a government agency (at present part of the US Information Agency) that broadcasts worldwide in 51 languages. Radio Free Europe/Radio Liberty and Radio

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Free Asia (to China and the other communist countries of Asia, plus Burma) are US government financed corporations that focus their programming on the domestic affairs of their target countries. The United States also has more than twenty private HF broadcast stations. Some, such as WEWN, Worldwide Catholic Radio in Birmingham, Alabama, are purely religious operations. Others, such as WWCR in Nashville, sell time to religious and special-interest program producers.

Clandestine Broadcasting. A special category of government-funded HF broadcasting is clandestine broadcasting (6). These are stations which do not reveal the location of their transmitters or studios. Clandestine stations accompany most wars and revolutions and are used by opposition groups (genuine or contrived by unfriendly countries) to provide an alternative to state-controlled domestic media. Often, a clandestine station claims to be operating from within the target country, as the voice of the people of that country, but actually is transmitting across boundaries. During World War II, the Germans transmitted a “Station Debunk” on HF to the United States. The station attempted to represent itself as a voice of disenchanting Americans. In recent years, opposition groups have been relying less on secret transmitters. Instead, they increasingly lease time from commercial shortwave transmission companies or disseminate their messages via the Internet. In addition to political clandestine stations, low-powered hobby pirate HF stations are also active, especially in Europe and North America.

Transmitters and Relays. HF broadcasting requires a significant investment in transmitters and antennas. In the 1990s, HF transmitters typically have power from 100 to 500 kW. Large directional antenna systems are necessary to focus power to the desired target (Fig. 1). Major transmitter manufacturers include Thomcast (France) and Continental (USA, recently merged with Telefunken of Germany).

Despite the long-distance capabilities of HF, attempts to broadcast halfway around the world are generally disappointing. As such, major international radio stations have established relay stations outside their home countries. Until the 1970s, the signals reached the relays by way of HF single-sideband feed transmissions. The signal received by the audience was never better than the weakest HF link. Now, with satellite feeds, transmissions from HF relays begin with a studio-quality signal. A more recent variation of HF relays is transmitter exchanges in which two international stations use each other’s transmitters. China Radio International (Beijing) exchanges transmitter time with Radio Canada International, Radio France International, Spanish Foreign Radio, Swiss Radio International, and Voice of Russia.

Frequency Assignments

Table 2 shows the HF frequencies allocated for broadcasting. Channels within these bands are spaced five kHz apart, that is, 9505, 9510, 9515, etc. Administrations register frequencies with the Radio Communications Bureau of the International Telecommunications Union that HF broadcast stations within their jurisdictions intend to use. The ITU has a number of procedures for resolving interference. Also useful in preventing interference are frequency coordination meetings held periodically among many international HF broadcasting stations.

Many stations escape interference by broadcasting on frequencies outside (but usually near) the allocated HF broadcast bands. This “out-of-band” broadcasting is allowed by a provision of the ITU regulations, if users of communications services for which the frequencies are primarily allocated do not complain of interference.

Program Content

HF broadcasters transmit a variety of programs, including news, current affairs analyses and commentaries, cultural and special interest programs, and music. The most important distinction in programming is propaganda versus a balanced and objective presentation of news and information. One of the pivotal decisions in



Fig. 1. High-frequency broadcast antenna arrays at the Voice of America's Edward R. Murrow transmitting station near Greenville, NC. Guyed masts up to 100 m support arrays of folded dipoles in front of wire reflecting screens. Courtesy USIA International Broadcast Bureau.

international broadcasting was that of the BBC not to follow the Axis broadcasters' propagandistic approach but to maintain the BBC domestic broadcasting policy of (mostly) balanced and factual reportage (7).

A propagandistic approach to international broadcasting would include one-sided news and current affairs reporting in conjunction with commentaries which are direct attempts to persuade the audience to a certain political viewpoint. This approach, created by the Axis broadcasters before and during World War II, was followed by the international broadcasting of the Communist stations through the 1980s. Propaganda continues to exist—Radio Havana and Radio Pyongyang among the notable examples—but it is less prevalent now that many former communist countries and other dictatorships are experimenting with democracy.

The decision to broadcast balanced, objective news corresponds to the main motivation to listen to foreign broadcasts. Generally, persons seek out foreign broadcasts to get the news and information they want, especially about their own countries and regions, which they cannot get in reliable form from their domestic media. The most important evidence that a balanced presentation of news and information has been more successful than propaganda is that Radio Moscow, during its decades of dominance in terms of broadcast hours, number of languages, and kilowattage, generally had audiences no larger than about ten% the size of those for the BBC

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Table 2. HF Frequencies Allocated by the International Telecommunications Union for Broadcasting

Frequencies, kHz	Meter Band	Notes
2300–2495	120	For domestic broadcasting in tropical regions. Actually in the “medium-frequency” (300–3000 kHz) range.
3200–3400	90	For domestic broadcasting in tropical regions.
3900–4000	75	Europe and Asia only.
4750–5060	60	For domestic broadcasting in tropical regions.
5950–6200	49	
7100–7300	41	Eastern Hemisphere only.
9500–9990	31	
11650–12050	25	
13600–13800	22	
15100–15600	19	
17550–17900	16	
21450–21850	13	
25670–26100	11	

World Service or the Voice of America (8). The international broadcasters of the Western democracies have determined that even if news is embarrassing or negative to their own governments, it attracts audiences and counters the misinformation, disinformation, and withheld information of the state-controlled media in authoritarian countries.

The use of HF broadcasting to transmit music has always been a matter of debate. Some maintain that HF is too unreliable for the enjoyment of music. Many listeners, however, have depended on shortwave for the types of music they wish to hear, but cannot receive from radio stations in their own countries. Willis Conover’s jazz programs on the Voice of America are an important example.

One of the most important programming functions of HF broadcasting is to provide news, information, and entertainment to compatriots living abroad. Virtually all international radio station transmit in their own language for emigrants or citizens living or studying in other countries. Often this programming consists of relays of domestic radio programming. This programming fulfills a need—information about the homeland in the language of the homeland—unmet by the domestic broadcasting in the countries where the expatriates live. In 1998, Radio Portugal dropped the last of its foreign-language broadcasts (except for Tetum, a language spoken in former Portuguese East Timor), in favor of a schedule devoted almost exclusively to broadcasts in Portuguese for Lusophone communities worldwide.

The Audience

Most government-funded international radio stations conduct little or no audience research. They exist largely as a matter of national obligation. So the documentation of an audience is not as vital as for a commercial station, which must provide statistics about its audience to sell advertising.

The largest audience research office is operated by the BBC World Service. The Voice of America, Radio Free Europe/Radio Liberty Inc., Deutsche Welle, and Radio France International also have significant audience research offices. No global estimate of the number of all international HF broadcast listeners has been

attempted because of the impossibility of conducting research in all countries. The best benchmark of the size of the international radio audience is the audience size of the most popular international broadcaster. The BBC estimates that 138 million people listen to BBC World Service at least once a week. This is a conservative estimate because it does not include countries where BBC is unable to commission surveys. Although the estimate includes all listening by way of the BBC's own HF, medium-wave, and FM transmitters, most of the World Service audience still listens via HF (9).

In general, the main predictor of audience size is the nature of the domestic media. Countries that have media which are deficient because of government control, poor economies, or both have the largest international radio audiences.

Some international radio stations cite the volume of audience mail as evidence of an audience. However, there is no reliable way to determine the size of an audience from the number of letters received. Audience mail is more useful to determine audience reaction to programming and reception quality.

A statistic commonly cited in the international broadcasting profession is the existence of 600 million shortwave radios worldwide. This originates from a 1986 study by the Academy for Educational Development (10). However, an accurate and up-to-date estimate is difficult because of the many radios and "boom boxes" that contain perfunctory shortwave bands. There is no doubt a high mortality rate among these appliances. Radios with shortwave coverage have become less prevalent in general merchandise stores, even in developing countries (11). In these countries, there is a shift from the number of models with medium-wave and one shortwave band toward those with medium-wave and an FM band.

The quality of shortwave radios varies widely. The typical shortwave available and affordable in a developing country would be a single-conversion model containing a medium-wave band, one or two shortwave bands, and, increasingly, an FM band. Tuning is across large segments of the HF spectrum, from, say, 4 MHz to 12 MHz or 3 MHz to 22 MHz. Broadcast stations are crowded into the small dial spaces that correspond to the HF broadcast bands. A step up in quality and increasingly available in developing countries are multiband radios which tune only the segments of the HF spectrum devoted to broadcasting, plus medium-wave and FM. This affords better band spread and station separation. Portable shortwave radios with digital frequency readout are less available and more expensive in the developing countries, but they are favored among consumers in the industrialized countries. The highest level receiver is the communications receiver, a table top model usually costing from \$700 to more than \$2000. These have digital frequency readout and many technical features which facilitate the reception of marginal signals.

Many of the users of high-end communications receivers are "DXers." DXers are a significant segment of the HF broadcast audience, especially in industrialized countries. The term "DX" comes from the old radiotelegraph abbreviation for "distance." DXing listeners try to receive as many stations as possible in as many countries as possible. They verify their reception of these stations by sending reception reports and receiving a QSL (another radiotelegraph abbreviation for "confirmation") card.

Problems of HF Broadcast Reception

Good, reliable reception of HF broadcasts is limited by the nature of the ionosphere. Conditions of the ionosphere vary day-to-day in weatherlike fashion. They also vary in accordance with the eleven year sunspot cycle. During ebbs in the sunspot cycle, frequencies above, roughly, 12 MHz are less useful for long distance broadcasting. Nearer the peaks of the cycle, the higher HF frequencies become useful, and the lower frequencies remain so. This gives the many international radio broadcasters more room to distribute themselves and avoid interference.

One impediment to good reception is the tendency of many international radio stations to exceed the capabilities of HF. Stations which do not have relay stations or exchange agreements may attempt to send

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their signals to target countries halfway around the world. These attempts generally produce poor results and, in the process, cause interference in areas short of the target.

Most of the problems of HF reception are of human rather than ionospheric origin. There are too many broadcast stations for the number of frequencies available. Despite some ITU regulation, many stations commence use of frequencies with impunity. As already mentioned, shortwave signals are usually heard outside their target areas. They are not causing interference “on paper,” but in reality they are. Interference can be cochannel or adjacent-channel. Theoretically, shortwave stations do not broadcast to the same target on channels less than 10 kHz apart. However, stations 5 kHz apart are heard on any shortwave radio. Often typical inexpensive shortwave radios cannot separate strong signals on adjacent channels.

Jamming. Most interference is not intentional. Intentional interference is known as jamming. Jamming dates back before World War II. During the Cold War, the Soviet Union maintained an intensive program of jamming the broadcasts of Radio Free Europe, Radio Liberty, the Voice of America, the BBC World Service, and other Western stations. The jamming usually consisted of a raucous buzzing noise. This would be accompanied by a Morse code identifier used by Soviet engineers to track the performance of their jamming transmitters. Because of the tendency of HF signals to be heard better over long distances than shorter distances, skywave jamming is not completely effective in blocking transmissions from abroad. The Soviets remedied this by ringing major cities with HF transmitters close enough to propagate ground-wave signals within these cities. Soviet jamming ended in 1989, a manifestation of Mikhail Gorbachev’s *glasnost* policy.

Today, China is the country most actively engaged in jamming. China interferes with the broadcasts of the Voice of America, the US Radio Free Asia, BBC World Service, and transmissions from Taiwan. In addition to noise jamming, China transmits overmodulated audio from its domestic radio programs on the frequencies of these external broadcasts. Cuba, North Korea, Vietnam, and Burma are also presently or recently jamming external broadcasts. Jamming is also often heard from a number of Middle Eastern countries.

Prospects for HF Broadcasting

A number of new media technologies are now vying with HF to transmit broadcasts over long distances and across national boundaries. These media are satellite broadcasting, the Internet, and rebroadcasting. Radio was the original medium of international broadcasting because only radio could travel long distances and across national boundaries. New media allow text, graphics, video, and the traditional audio. Most international broadcasters are maintaining most of their efforts in their traditional radio medium. Nevertheless, they will have to decide which medium is most appropriate for each of their broadcasting missions. International radio broadcasts in recent decades have consisted largely of news, commentaries, and current affairs talks, with a minimum of production. Such content might more efficiently be transmitted as text.

Satellite Broadcasting. With terrestrial broadcasting, radio developed first, then television. In satellite broadcasting, television has already started, but direct satellite *radio* systems for domestic and international use are still in development. WorldSpace Corporation of Washington, DC is planning to launch the first of its three direct radio broadcasting satellites in late 1998. The WorldSpace system will transmit radio broadcasts to small receivers in Africa, the Middle East, Asia, the Caribbean, and Latin America. Each WorldSpace satellite will have three beams, each with a capacity of 96 AM-quality channels. The company plans to provide transmissions services for both international and domestic radio broadcasting.

Many international radio broadcasters are already using audio subcarriers of direct-to-home *television* satellite systems. This is most prevalent on the Astra satellite television system in Europe. World Radio Network of London combines the programs of several international radio stations into 24 hour services, using subcarriers of Astra in Europe and other satellites in other parts of the world.

The Internet. Now the advent of RealAudio® and other audio streaming software it possible for persons to receive foreign broadcasts via the Internet. Audio fidelity is usually not even AM quality, but reception is

more reliable than via HF. An important advantage of Internet audio is that a listener can hear a specific program, say, a weekly half-hour program about science, at any convenient time, rather than having to be at the radio at the scheduled time of the program. Some international broadcasters also present “live” streams of their 24 h schedule. The BBC World Service in English is available via Broadcast.com, a commercial World Wide Web service.

At present, however, computers with Internet access are much less common in homes than shortwave radios, especially in the developing countries, where audiences for international radio are largest. Also, access to certain World Wide Web sets can be interdicted. The Chinese government controls Internet gateways in that country and currently blocks access to some foreign news-oriented sites, including those of the Voice of America and the Cable News Network. Inbound electronic mail is more difficult to stop, and now the Voice of America has a Mandarin-language email news service delivered to computer users in China. This service uses the most popular software in China to convert from ASCII to Chinese characters.

Rebroadcasting. Now many international broadcasters use satellites to feed complete programs or brief reports to radio stations in the target country, which rebroadcast this content to local audiences. When given the choice, listeners certainly prefer to hear foreign broadcasts via a nearby FM or medium-wave transmitter than by way of a distant and unreliable HF signal. Rebroadcasting also facilitates international television because terrestrial television transmission is limited to relatively short distances and direct-to-home satellite opportunities are still limited and expensive.

To some extent, however, rebroadcasting is a self-negating enterprise. The fact that a country would allow foreign broadcasts to be transmitted from its own territory indicates that the country tolerates a free and diverse domestic media environment. This reduces much of the incentive to listen to foreign broadcasts, whether via local or external transmitters. At present, there is no rebroadcasting (at least of news and current-affairs programs) in some of the most important target countries for international radio: China, Nigeria, Indonesia, India, Cuba, etc. During crises, private radio stations are also sometimes banned from rebroadcasting international programs or are themselves taken off the air. The Voice of America, BBC, and Radio France International have recently experienced a temporary loss of local rebroadcasting during turbulent periods in the Democratic Republic of the Congo, Liberia, Niger, and other countries.

Digital HF Broadcasting. In the 1980s, it was widely assumed that satellites would replace HF as the medium for international broadcasting. Two events in the 1990s have caused international broadcasters to temper their optimism about the new technologies. BBC World Service Television was broadcast to East Asia, including China, as part of the Star TV service of the AsiaSat satellite. The English-language television service was accompanied by a Mandarin-language translation on an audio subcarrier. Media entrepreneur Rupert Murdoch purchased Star TV in 1994. Murdoch, pursuing media opportunities in China, yielded to Chinese government pressure and removed BBC World Service Television from the Star TV beam which reached most of China. BBC’s Arabic Television Service was shut down in 1996 when the Saudi-owned Orbit Radio and Television Network, which beamed the service into the Middle East, objected to BBC’s coverage of Saudi domestic affairs.

Therefore, international broadcasters are reconsidering the future of HF for international broadcasting. The main incentive for listening to foreign broadcasts is to get news that the audience wants but cannot get from their domestic state-controlled media. Therefore international broadcasting must rely on noninterdictable, direct-to-home media. HF is not encumbered by the politico-commercial links which affect the owners of satellite transponders. And HF transmissions are not as easy to block as World Wide Web pages.

A coalition of international radio broadcasters and manufacturers of HF transmitters and shortwave receivers have formed Digital Radio Mondial (*DRM*) to develop a system for digital broadcast transmission on HF and in the medium-wave and long-wave broadcast bands (12). The DRM inaugural meeting was held, remarkably, in China at Guangzhou City in March 1998. A DRM statement proclaims that HF digital broadcasting will allow listeners to hear “shortwave programs free of fading and interference.” This will require new and, at least initially, more expensive receivers. It remains to be seen if digital transmission will overcome the

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degradations of HF reception. An important question is whether digital HF transmission will help overcome or facilitate attempts by authoritarian governments to block broadcasts from abroad.

BIBLIOGRAPHY

1. Radio Nederland Wereldomroep, *History in Brief* [Online]. Available [www: http://www.rnw.nl/corporate/his-hist.html](http://www.rnw.nl/corporate/his-hist.html)
2. D. R. Browne, *International Broadcasting: The Limits of the Limitless Medium*, New York: Praeger, 1982, pp. 48–61.
3. P. E. Jacob, The theory and strategy of Nazi short-wave propaganda, in H. L. Childs and J. B. Whitton (eds.), *Propaganda by Short Wave*, Princeton, NJ: Princeton Univ. Press, 1942, pp. 49–108.
4. J. Houseman, *Front and Center*, New York: Simon and Schuster, 1979, pp. 19–104.
5. J. M. Frost (ed.), *World Radio TV Handbook*, 27th ed., New York: Billboard, pp. 366–368; Andrew G. Sennitt (ed.), *World Radio TV Handbook*, 1998 ed., New York: Billboard, pp. 511–512.
6. K. A. Elliott *et al.*, Unofficial broadcasting for politics, profit, and pleasure, *Gazette* **29**: 1982.
7. G. Mansell, *Let Truth Be Told: 50 Years of BBC External Broadcasting*, London: Weidenfeld and Nicolson, 1982, pp. 40–94; A. Walker, *A Skyful of Freedom: 60 Years of the BBC World Service*, London: Broadside Book, 1992, pp. 26–35.
8. G. Mytton, C. Forrester, Audience for international radio broadcasts, *Eur. J. Commun.*, **3**: 457–481, 1988.
9. Telephone interview with Colin Wilding, research services manager, BBC World Service Marketing & Communications, May 14, 1998.
10. R. S. Fortner, *A Worldwide Radio Receiver Population Analysis*, Washington: Academy Educational Development, 1986.
11. A. Dasgupta, Indian receiver survey 1998 [Online], Radio Netherlands Real Radio, Available [www: http://www.rnw.nl/realradio/india.html](http://www.rnw.nl/realradio/india.html)
12. Information about Digital Radio Mondial [Online], Available <http://www.rnw.nl/DRM/>

READING LIST

- A description of international and domestic radio broadcasting in all countries, including schedules for HF broadcasts in all broadcast languages, is in the annual *World Radio TV Handbook*, published until 1998 by Billboard Publications. Beginning with the 1999 issue, the book will be published by WRTH Publications, Milton Keynes, UK (editor@wrth.demon.co.uk).
- Schedules of English-language HF broadcasts, plus reviews of receivers and other information for the listener is in Lawrence Magne (ed.), *Passport to World Bank Radio*, Penns Park, PA: International Broadcasting Services Ltd (<http://www.passport.com>).
- Schedules and general articles about HF broadcasting and other radio topics are contained in *Monitoring Times* magazine, published monthly by Grove Enterprises, Brasstown, NC (<http://www.grove-ent.com>). Schedules and information are also published in the monthly *Journal of the North American Shortwave Association* (<http://www.anarc.org/naswa>). English-language HF broadcast schedules are updated weekly by FineWare (<http://www.crosslink.net/mfine/>).
- A comprehensive compilation of news about and schedules of world broadcasting stations, including HF broadcasting, is contained in the *World Media* and *Schedules* publications of BBC Monitoring, Reading, England (marketing@mon.bbc.co.uk).
- A listing of most of the world's HF broadcast transmitters by country, location, manufacturer, power, date of inauguration and (if applicable) decommission, etc., is in L. Maes, *Transmitter Documentation Project*, 5th ed., Rijkvovorsel, Belgium: Ludo Maes, 1998 <http://www.ping.be/tdp>. A comprehensive discussion of HF receivers is F. Osterman, *Shortwave Receivers Past and Present: Communications Receivers 1942 to 1977*, 5th ed., Reynoldsburg, OH: Universal Radio Research, 1998 (<http://www.universal-radio.com>).
- General descriptions and the history of international broadcasting include D. R. Browne, *International Broadcasting: The Limits of the Limitless Medium*, New York: Praeger, 1982; H. L. Childs and J. B. Whitton (eds.), *Propaganda by Short Wave*, Princeton, NJ: Princeton University Press, 1942; M. Nelson: *War of the Black Heavens: Western Broadcasting in the Cold War*, Syracuse, NY: Syracuse University Press, 1997; C. J. Rolo, *Radio Goes to War: The "Fourth Front,"* New York: Putnam, 1942; J. Wood, *History of International Broadcasting*, London: Peregrinus, 1993.

Several World Wide Web sites contain information for the shortwave listener about international broadcasting. Among the most useful (with links to other sites) are TRS Consultants (<http://www.trsc.com>), Shortwave/Radio Catalog (<http://itre.ncsu.edu/radio/>), Association of North American Radio Clubs (<http://www.anarc.org>), Radio Netherlands Real Radio (<http://www.rnw.nl/realradio/index.html>), and the IBB Monitoring Homepage (<http://voa.his.com/>).

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