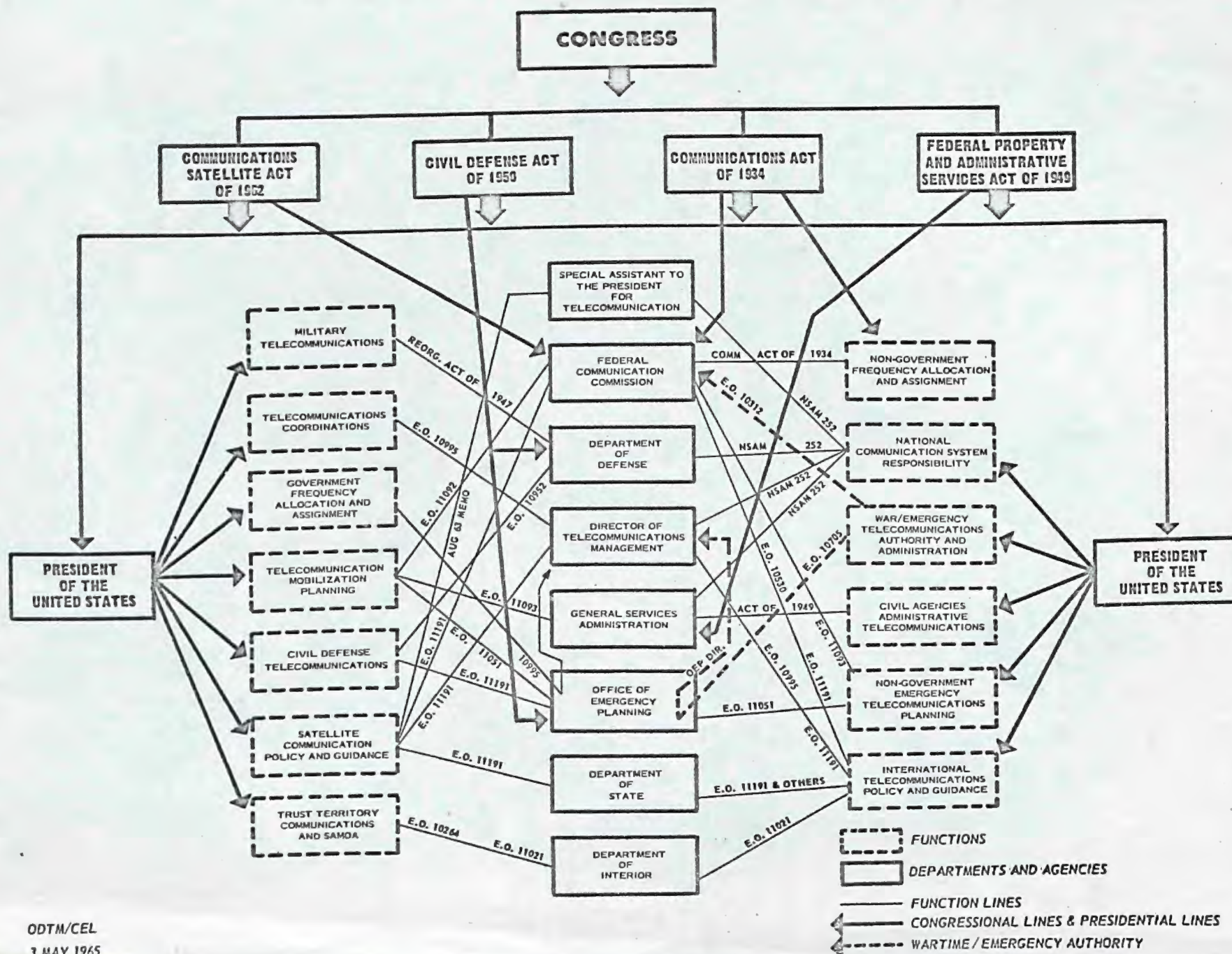


# TELECOMMUNICATION RESPONSIBILITY ASSIGNMENTS





# INTERACTIONS IN THE SATELLITE PROBLEM

## NATIONAL OBJECTIVES

VAST IMPROVEMENT  
IN INTERNATIONAL  
COMMUNICATIONS

IMPROVED COMM-  
UNICATIONS FOR  
DEVELOPING  
NATIONS

EFFICIENT USE  
OF THE FREQ-  
UENCY SPECTRUM

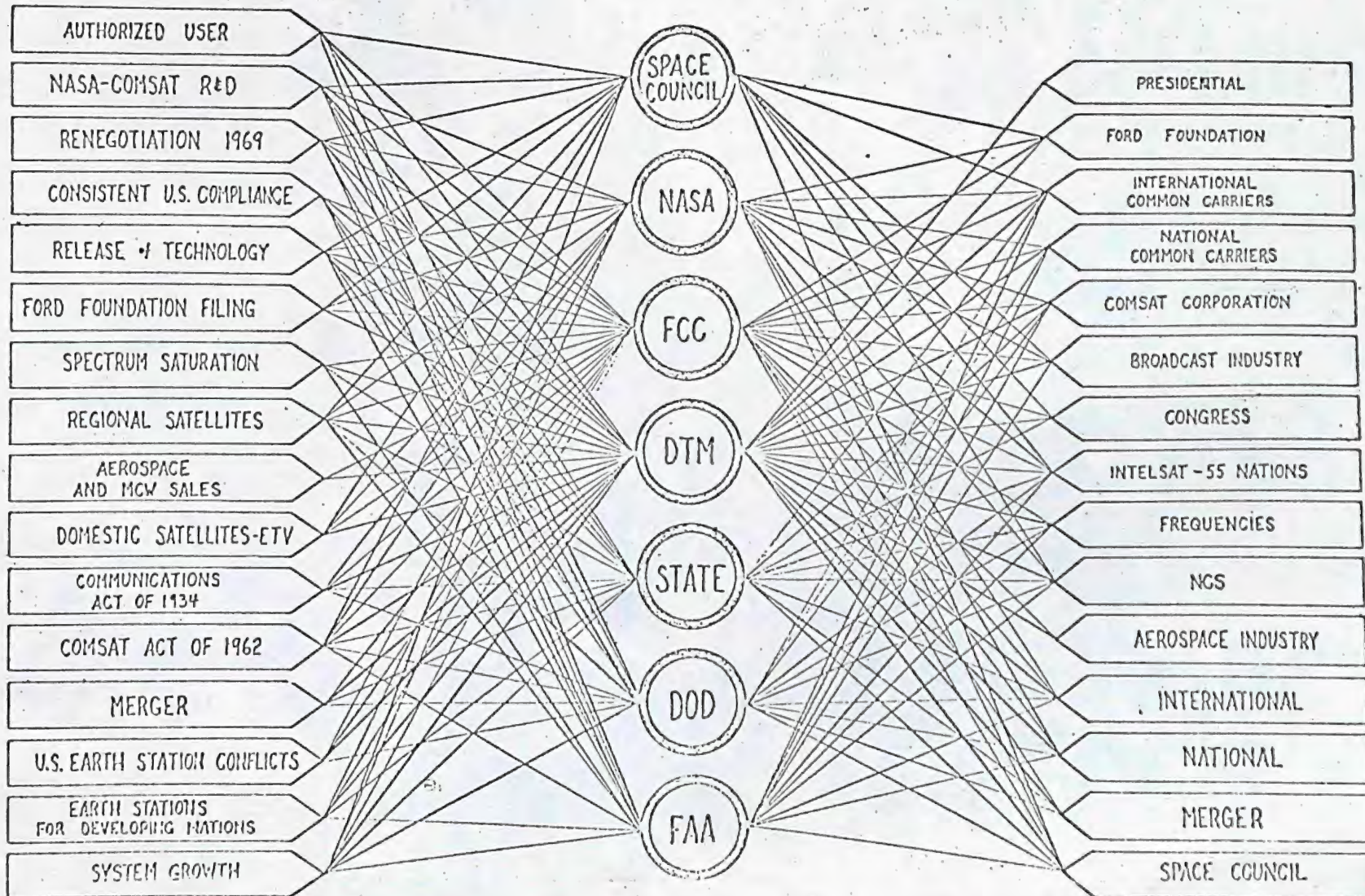
PEACEFUL INTERNA-  
TIONAL COOPERATION  
THROUGH A SUCCESS-  
FUL INTELSAT

RAPID GROWTH AND  
VIABILITY OF  
COMSAT-INTELSAT

APPROPRIATE  
PARTICIPATION BY  
COMMUNICATION  
COMMON-CARRIERS

SATISFACTION OF  
TELECOMMUNICATION  
NEEDS -- U.S. AND  
OTHERS

PROBLEMS



INTERESTS



*Spectrum*

OFFICE OF TELECOMMUNICATIONS POLICY  
EXECUTIVE OFFICE OF THE PRESIDENT  
WASHINGTON, D.C. 20504

September 24, 1973

ASSISTANT DIRECTOR

MEMORANDUM

TO: Tom Whitehead  
FROM: Will Dean  
SUBJECT: Spectrum Actions

In response to your query on subject matter the following is submitted:

o Assignment Actions

FCC -- Based on latest information available, an indication of FCC activity in the spectrum areas is as follows:

- 690  
433  
257
- In 1971, 689,691 applications were processed (432,693 in safety and special service, i.e., low power operations).
  - As of June 1971, the FCC had authorized over 8 million transmitters, 45% of which were Citizens Radio.
  - As of May 1971, the FCC records indicated 515,574 assignments on 9,332 frequencies.

Government --

- By comparison, in 1971, 55,000 applications were processed in IRAC (doubles every 10 years).
- An estimated 2 million Government transmitters (many very high powered) are authorized.
- Approximately 120,000 assignments have been made on 12,500 discrete frequencies; changing at rate of approximately 5000 assignments per month.

o Personnel Support

FCC -- Virtually all FCC Bureaus are involved in the frequency management process. Washington based personnel assigned to these bureaus and actions taken as of 1972 were as follows:



<u>FCC Bureau</u>	<u>Personnel</u>	<u>Licenses</u>
Broadcast	266	27,670
Cable TV	32	408
Common Carrier	117	22,315
Field Engineering	78	3,648,267
Safety & Special Services	143	1,779,931
Chief Engineer (Spectrum only)	35	
Chicago Task Force	<u>55</u>	
TOTALS	<u>726</u>	<u>5,478,591</u>

The above information is gleaned from GAO draft report.

Government --

OTP - 5 professionals, 3 secretaries, 2 consultants	10
IRAC Secretariat	25
Analysis	8
Data Base	7
ITS	<u>8</u>
TOTAL	<u>58</u>

*Will*



October 26, 1971

To: Mr. Averch

From: Judy Morton  
(Secretary to  
Clay T. Whitehead)

Dick Speier has suggested we  
send the attached to you.  
Because this is the only copy  
we have on file, we would  
appreciate having it returned  
when you have finished with it.

Our address: Room 770  
1800 G Street

Attachment: Electromagnetic Spectrum Management: Alternatives  
and Experiments (Copy 6 of 10).

cc: Mr. Dean -- FYI  
Mr. Whitehead



*Spectrum  
allocation*

APR 2 1971

Mr. Cornelius B. Kennedy  
888 Seventeenth Street, N. W.  
Washington, D. C. 20006

Dear Mr. Kennedy:

*Rec'd:*

Thank you for sending me the memorandum,  
"Increased Spectrum Use Resulting from  
Relaxation of the UHF TV Taboos." I have  
passed along a copy to Walt Hinchman and you  
will be hearing from him further.

Sincerely,



Clay T. Whitehead

DChrisman

✓ Mr. Whitehead - 2

Mr. Hinchman: Subj:

RF



Office of Telecommunications Policy  
Route Slip

15 MAR 1971

To

~~Clay T. Whitehead~~ ✓

George F. Mansur

Antonin Scalia

Wilfrid Dean

~~Steve Doyle~~ ✓

Walt Hinchman

Charles Joyce

William Lyons

Eva Daughtrey

Timmie White

Judy Morton

REMARKS

*Mr Hinchman:  
Please draft  
a short  
reply for  
Mr. Whitehead's  
signature*

*We would also  
like your  
comments on*

*the memo  
6-2-71  
100*



LAW OFFICES OF  
CORNELIUS BRYANT KENNEDY  
888 SEVENTEENTH STREET, N.W.  
WASHINGTON, D.C. 20006  
---  
AREA CODE 202  
298-8208

March 11, 1971

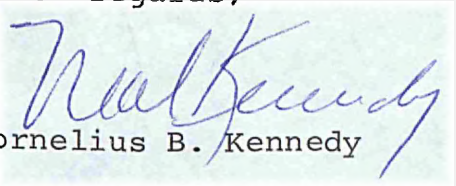
The Honorable Clay T. Whitehead  
Director, Office of Telecommunications Policy  
Federal Office Building  
1800 G Street, N.W.  
Washington, D.C.

Dear Mr. Whitehead:

Enclosed is a copy of a memorandum which  
I basically prepared for another purpose but  
which may be of interest to you.

I am enclosing an extra copy of the  
memorandum in case you wish to pass it on to Walt  
Hinchman.

Best regards,

  
Cornelius B. Kennedy

CBK/ag  
Enclosures







INCREASED SPECTRUM USE RESULTING FROM  
RELAXATION OF THE UHF TV TABOOS

The substantial restriction on the use of UHF frequency spectrum caused by the present UHF TV taboos is clearly shown by the increased use of frequency spectrum which became possible in the New York area when the FCC permitted reductions in the mileage separations required by the UHF TV taboos. By reducing these mileage separations, often by a substantial amount, the FCC was able to permit 8 additional UHF TV stations to be operated in New York City and serve a large portion of the population on Manhattan Island and nearby Connecticut.

Eight New York City TV stations applied for and received FCC permission to use UHF TV channels to provide "duplicate service" to their present audiences located in the area which would receive interference to reception because of the construction of the World Trade Center Building.

In order to grant the applications, the FCC had to approve substantial short spacings of the mileage separations required by the UHF TV taboos, as indicated by the following examples:

<u>Actual Separation (miles)</u>	<u>Required Separation (miles)</u>	<u>Assignment Channel</u>	<u>City</u>	<u>Taboo</u>
<u>CHANNEL 53 (CBS)</u>				
97	155	53	Atlantic City, N.J.	Co-Channel
107	155	53	Norwich, Conn.	Co-channel
49	55	52	Trenton, N.J.	Adjacent ch.
10	75	68	Newark, N.J.	Picture img.
43	60	67	Patchogue, N.Y.	Sound image
<u>CHANNEL 57 (NBC)</u>				
82.7	155	57	Philadelphia	Co-channel
123.7	155	57	Springfield, Mass.	Co-channel
35	55	58	Asbury Park, N.J.	Adjacent ch.
55.6	60	43	Bridgeport, Conn.	Sound image
<u>CHANNEL 64 (METROMEDIA)</u>				
10	20	68	Newark, N.J.	Intermod.
99	155	64	Scranton, Pa.	Co-channel
153	155	64	Providence, R.I.	Co-channel
55	75	49	Bridgeport, Conn.	Pict. Image



<u>Actual</u> <u>Separation</u> <u>(miles)</u>	<u>Required</u> <u>Separation</u> <u>(miles)</u>	<u>Assignment</u> <u>Channel</u>	<u>City</u>	<u>Taboo</u>
<u>CHANNEL 66 (ABC)</u>				
150	155	66	Worcester, Mass.	Co-channel
49	60	52	Trenton, N.J.	Sound image
52	55	67	Patchogue, N.Y.	Adjacent ch.
10	20	68	Newark, N.J.	Intermodulation

CHANNEL 69 (RKO) (ORIGINAL APPLICATION)

78	155	69	Allentown, Pa.	Co-channel
66	75	54	Poughkeepsie, NY	Picture
10	55	68	Newark, N.J.	Adjacent
14	20	77	Glen Ridge, N.J.	IF beat

CHANNEL 71 (RKO GENERAL) (REVISED APPLICATION)

10	20	68	Newark, N.J.	Intermod.
----	----	----	--------------	-----------

CHANNEL 73 (WPIX, Inc.)

35	75	58	Asbury Park, N.J.	Picture Im.
10	20	68	Newark, N.J.	Intermod.
14	20	77	Glen Ridge, N.J.	Intermod.

CHANNEL 75 (Educational Broadcast Corp.) (REVISED APPLICATION)

74	75	60	Bethlehem, Pa.	Picture Im.
10	60	68	Newark, N.J.	Oscillator
14	20	77	Glen Ridge, N.J.	Intermod.

CHANNEL 79 (WNYC)

14	20	77	Glen Ridge, N.J.	Intermod.
----	----	----	------------------	-----------

In support of these substantial short spacings, the engineering departments of the networks, principally CBS and NBC, filed technical data and arguments concerning the lack of impact on the public which would be caused by the short spacings. In summary form, the arguments and data are set out below. Much of this material can be used in connection with comments in docket 19150 which involves geographic sharing of Channels 14-20 by land mobiles and UHF TV.

1. Adjacent Channel Protection

"...for adjacent channel interference, a D/U ratio of -10 dB is most conservative, particularly in the case of interference from an upper adjacent channel station."

2. Propagation Curves

Although AMST and other TV broadcasters objected to the FCC's use of the R-6602 curves in docket 18261, each of the TV applicants uses the R-6602 curves in computing the amount of interference which would result from the short spacing because the R-6602 curves result in a smaller coverage area and, therefore, reduce the theoretical interference potential.

3. Standard of Interference

NBC said that its proposal would not cause "objectionable interference". CBS said that its proposal "is not likely to cause interference", or that the interference caused would be "of negligible consequence".

4. Interference Based on Grade B Contours

CBS urged:

"With respect to co-channel and adjacent channel interference, the Commission has in the past suggested techniques for computing 'equivalent protection' based on protection to the relative high intensity interference-free contours of two full-facility stations separated by the normal minimum distances. In this instance, however, it is deemed more appropriate to base the showing on non-interference to existing, or proposed, Grade B service contours."



2/18/71

#### 5. Equivalent Protection Standard

NBC urged that if any idle assignments became operative and posed actual interference problems, the Commission should switch to the equivalent protection standard because:

"It can be shown that 'equivalent protection' will be provided by virtue of the reduced ERP and directional radiation pattern."

As CBS pointed out, the "equivalent protection" method provides less protection than other methods. Since NBC advocates using actual power and antenna height, as well as actual directional radiation patterns, as a part of the equivalent protection method, this would still further reduce the amount of protection provided to television stations because the "equivalent protection" method appears to be more commonly applied to the power and antenna height of a maximum facility station.

#### 6. Carrier Offset Operation

In order to use a 28 dB co-channel interference ratio, the CBS engineering department proposed a 10 KHz offset operation with respect to the visual carriers of the short spaced co-channel TV stations.

#### 7. Directional Antennas

Although the common approach to TV station protection is based on the need to protect against omnidirectional signals, the

applicants based their arguments on the fact that because they would use directional antennas, the interference in the rest of the circle could be ignored. CBS also argued that a transmitting antenna which has a half-power beam width of  $16^{\circ}$  can be assumed to have a response no less than -20 dB relative to peak of beam in any direction and that this "is believed to be quite conservative."

#### 8. Picture Image Taboo

According to CBS:

"Actually, no precise standards exist for determining the extent of this interference, nor is too much known about the phenomenon."

Thus, CBS urged that in any event if there is no station in operation on the assignment to be protected, this taboo should be ignored.

#### 9. Sound Image Taboo

Where the station to be protected had "a relative modest antenna height of 432' AAT" and any potential sound image interference to its area of operation would be of "negligible consequence", a 25% short spacing of the mileage separation required to protect against sound image interference could be ignored, according to the CBS engineering department.



10. Actual Interference Ignored Where No-Impact  
on Viewers

Where there would be actual interference:

"...it can be ignored because it is in an area  
falling largely over water."

11. Only Operating Stations Need to be Considered

WOND-TV, the holder of the CP for Channel 53 Atlantic City, New Jersey filed objections to the engineering statement of CBS and challenged the contour curve used to show that the proposed Grade B contour of the CBS transmitter on Channel 53 would not overlap WOND-TV's contour. The Commission replied to WOND-TV:

"It is noted that Station WOND-TV has not yet been constructed and there is, therefore, no immediate potential interference. When construction of station WOND-TV has been completed and operation is commenced, you may submit your comments at that time if it develops that interference is, in fact, being caused by operation of CBS translator station [on Channel 53]" : (Underlining added)

Similarly, when Atlantic Video Corporation, CP holder of Channel 68 Newark, asked that ABC's use of Channel 64 be terminated when Atlantic commenced broadcasting, the FCC sent Atlantic the same form of letter it sent to WOND-TV. It is significant to note that the FCC expressly noted that even when the mileage separations were violated, only interference "in fact" would be considered.

12. Impact of Permitted Short Spacing

The net result of the substantial short spacings which the FCC has approved is, in effect, to provide for 8 additional operating television stations in New York City with "negligible" or "no objectionable" interference to television viewers. It is not significant that the 8 new stations are broadcasting the same programming as 8 other stations; they could just as well be transmitting any other programming. The important point is that they are able, according to the television broadcasters and the FCC, to transmit without causing objectionable interference to the signals of other nearby co-channel and adjacent channel television stations, and that the FCC also ignored the potential interference to all idle assignments and CP's.

RELATIONSHIP TO DOCKETS 18261 and 19150

The FCC would not have been able to approve the 8 additional television broadcasting stations under the engineering standards adopted in docket 18261 to protect existing television stations and assignments. As the attached Map A shows, drawing the required 162 mile protection contour around the two co-channel assignments, Channel 53 Atlantic City and Channel 53 Norwich, Connecticut, would completely exclude the use of Channel 53 in New York City. Indeed, the use of Channel



2/18/..

-8-

53 in New York City would be excluded by either of the Atlantic City and Norwich, Connecticut assignments.

Similarly, even considering only the base station protection contour of 67 miles for adjacent channel operation, there could be no use of Channel 53 in New York City because of the Channel 52 assignment at Trenton, N.J.

It should also be noted that the docket 18261 protection contours are based on interference which could be caused by a land mobile transmitter of 1000 watts at 500' AAT, while the TV facilities which the FCC approved for use in New York City were for transmitters of 1000 watts at about 1000' AAT, which should require an increase in the radius of the protection contours over the mileage separations required in docket 18261.

Applying the results of the New York City grants to the use of Channel 15 by land mobile in the Chicago area, covered by docket 19150, would substantially expand the area of permissible land mobile use. Using a co-channel separation of 100 miles, which is substantially greater than the actual separations of 78 miles, 82.7 miles, 97 miles and 99 miles which the FCC approved for the New York City UHF TV stations, it would be possible to place a 1000 watt land mobile

transmitter at an antenna height which is the equivalent of the Empire State Building in Zion, Waukegan, Elgin and DeKalb without causing "objectionable" interference to Channel 15 Madison, particularly if the signal was beamed toward Chicago, which would be the normal land mobile use area. See Map B.

It is significant that reducing the UHF taboo protection by this amount, as permitted in the New York City waivers, in order to increase geographic sharing potential of Channel 15 between UHF television and land mobile in the Chicago area corresponds almost identically with the result of protecting the principal service area of the Channel 15 Madison station as shown by the ARB audience data. This data indicates that the station provides NBC service principally to the area west of Madison because the NBC stations in Chicago, Milwaukee and Rockford provide the principal NBC service to the area east and south of Madison.

Thus, the UHF TV taboos appear to protect the signal of the Channel 15 Madison station in an area in which viewers generally watch NBC programming broadcast on other channels from stations in different cities. The waiver of the UHF TV taboos, to the same extent already permitted by the FCC in the New York City area, would permit land mobile use of



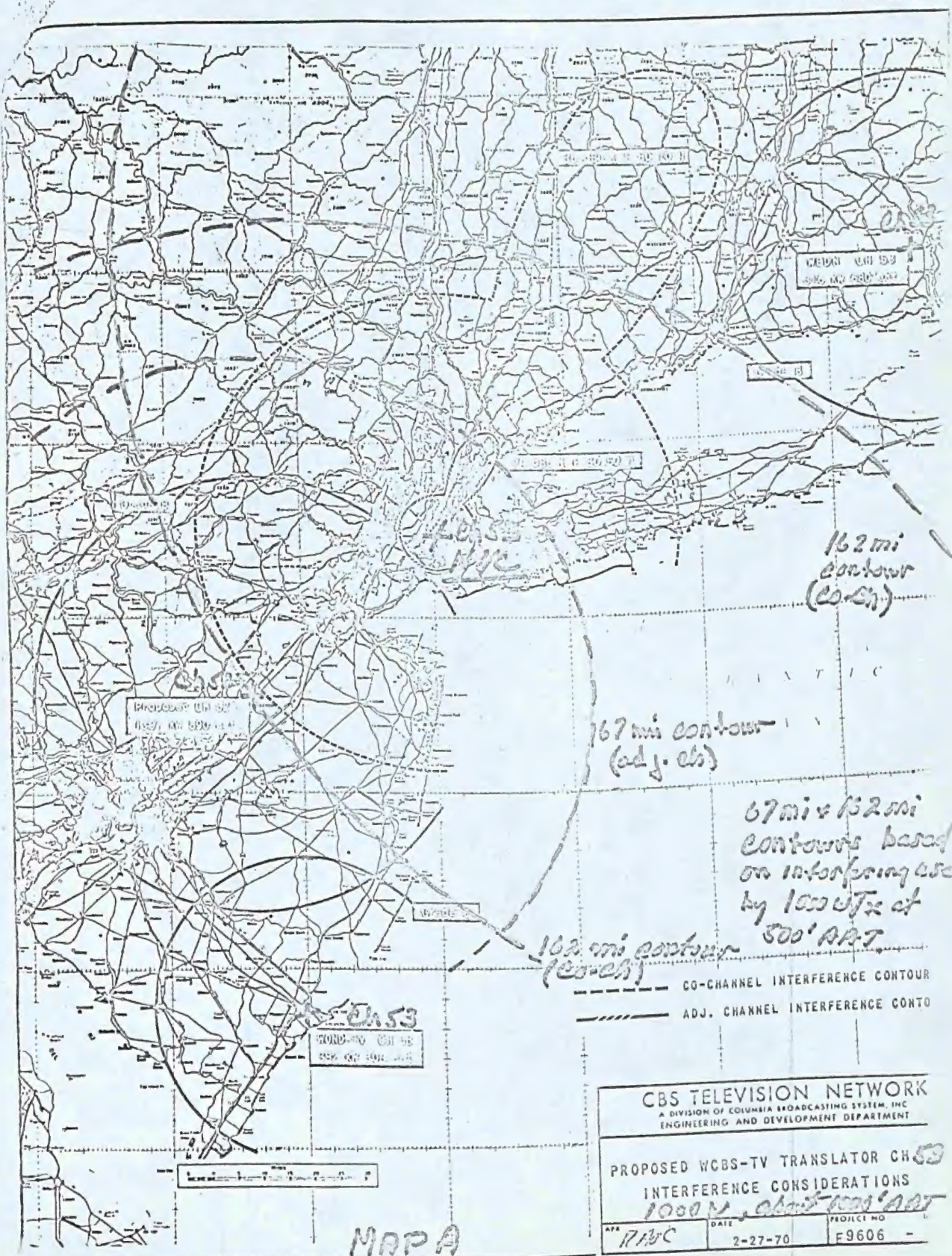
Channel 15 in most of the Chicago area without providing objectionable interference to viewers in the area receiving their principal NBC service from the station operating on Channel 15 at Madison.

While it might be urged that the New York City examples are not relevant to the land mobile problem because they are ostensibly to be in effect only during the construction period of the World Trade Center after which the television antennas will be moved to that building from the Empire State Building, that argument does not hold up because there are operating stations involved today and also because the FCC has taken the position, in replying to complaining CP holders, that even after they place stations in operation only interference, which, in fact, occurs will be considered.

The fact that the additional New York City stations are already in operation also provides a real-life test of whether actual interference can be expected as a result of the substantial short spacings involved. If there is no objectionable interference, then the Chicago Task Force of the FCC should clearly explore the full extent to which land mobile could use Channel 15, as well as Channel 14, without providing objectionable interference to the television stations.



FIGURE 5





Wisconsin—Madison

WMTV

Ch. 15



Facilities: Channel No. 15  
(6.482 MHz). Authorized power:  
100-kw max. and 727-kw hori-  
zontal visual, 95-kw max. and  
7-kw horizontal aural. Anten-  
na 1163-ft. above av. terrain,  
164-ft. above ground, 2222-ft.  
above sea level.

Latitude 43° 03' 01"  
Longitude 89° 29' 15"

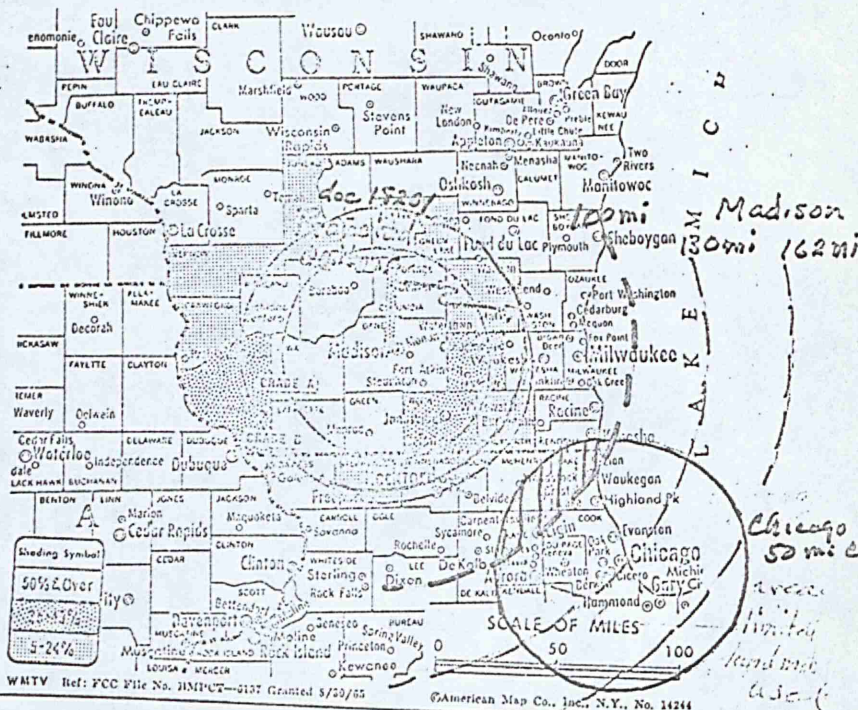
Smaller: W Beltline Hwy.

Network, live, film, slide &  
tape.

Wire Service: UPI.

Facsimile Service: UPI.

Households: 50% & Over  
Market Data as of 1/1/70.  
TVS and Circulation  
American Research Bureau.  
Coverage based on ARI study (see  
page 1-8).



WMTV Ref: FCC File No. 101-1017-0107 Granted 5/25/55

American Map Co., Inc., N.Y., No. 14244

WMTV

Forward Television Inc., 615 Forward Dr., Madison  
53711.

Radio & Business Office: 615 Forward Dr., Box 4269.

Telephone: 608-233-5301. TWX No.: 608-654-8214.

Ownership: Forward Communications Corp. (see WSAU-TV, Wausau,  
Wis.).

Operation: July 8, 1953. Sale to present owner by Forward  
Television Inc. approved May 15, 1963, by FCC (Television Digest,  
Vol. 3:20). Sale to Forward Television by WTVJ interests (Mit-  
chell Wolfson) approved April 2, 1958 by FCC (Television Digest,  
Vol. 14:10, 14). Previous sale to WTVJ interests by founding  
Stralder A. Bartell family approved July 25, 1957 by FCC (Vol.  
13:26, 30).

Presented (sales) by The Meeker Co. Inc.; Harry Hyett & Co.  
Winneconne.

Presented (legal) by McKenna & Wilkinson.

Personnel:

THOMAS E. BOLGER, executive vice president & general manager.

ADISON SPRAGUE, sales manager.

WARD CLYMAN, film & photo director.

ARL AMES, promotion manager.

ON SCHMITT, news director.

ERN FOWLER, women's director.

EMER WEISENSEL, chief engineer.

SE McCLELLAND, operations manager.

DIGEST OF RATE CARD NO. 15—(April 1, 1968)

Win.	15 Min.	5 Min.	Min.	30 Sec.	20 Sec.
Class AA—6:30-10 p.m., daily.	\$185.00	\$150.00	\$75.00*	\$60.00*	\$60.00*
Class A—6:30-10 p.m., daily.					

Combination Rates: Sold in combination with WSAU-TV, Wausau,  
Wis. as members of Central Wisconsin Combination.

NETWORK BASE HOURLY RATE: \$1850.

Net Weekly Circulation	State County	Total Households	TV Homes	%
50% & Over	WISCONSIN			
	Columbia	11,100	10,600	95
	Dane	90,500	86,000	95
	Green	8,000	7,600	96
	Iowa	5,200	4,900	94
	Lafayette	4,900	4,600	95
	Marquette	2,700	2,500	92
Between 25-49%	Richland	4,300	4,000	94
	Sauk	9,500	8,900	94
	Between 5-24%			
	Grant	12,800	11,900	93
	Jefferson	16,400	15,800	97
	Rock	38,700	37,600	97
Between 5-24%	ILLINOIS			
	Stephenson	15,800	15,100	96
	WISCONSIN			
	Crawford	3,700	3,600	95
	Dodge	18,600	17,700	96
	Green Lake	4,800	4,600	95
	Juneau	4,400	4,000	91
Station Totals	Vernon	6,500	6,100	94
	Walworth	17,500	16,900	96
Station Totals		456,900	430,000	96
Net Weekly Circulation (March 1969)				149,075
Average Daily Circulation (March 1969)				86,009

For Group Ownership, see Services Volume

MAP B



EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF TELECOMMUNICATIONS POLICY  
WASHINGTON, D.C. 20504

*Spectrum  
allocation*

Date: March 22, 1971

Subject: Clarification of Spectrum Activities

To: Dr. John Richardson  
Office of Telecommunications  
Department of Commerce

I understand the distinction between various spectrum-related activities being carried out in Commerce, and OTP cognizance thereof, may need some further clarification. I refer particularly to the work Doug Crombie is doing on better defining the spectrum resource and associated use/operating rights.

For the present, those studies being conducted to improve the existing frequency management process (e.g., through better compatibility analysis capabilities) fall under the cognizance of Will Dean. I assume that Stanley Cohn would be the Commerce counterpart.

Those studies which are oriented primarily to new spectrum resource allocation methods, such as "electrospace" and/or spectrum operating rights definitions, are part of the broader policy analyses needed by the OTP. These are currently under my cognizance, and will presumably fall under the proposed Analysis Division in Commerce, rather than Mr. Cohn. Meanwhile, I trust there is no objection to my coordinating directly with Doug Crombie on this.

While the same persons (e.g., Crombie and Hatfield) may work in both these areas, it is clearly desirable that separate projects and accounting be maintained, both now and during the forthcoming transition into the new organizational structure. I understand this has been the case to date, and simply wish to affirm it on the part of the OTP.

*Walt*

Walter R. Hinchman

Mr. Crombie/OT Commerce  
Mr. Whitehead  
Mr. Dean



870  
Spectrum plans  
& policies

**EXECUTIVE OFFICE OF THE PRESIDENT**  
**OFFICE OF TELECOMMUNICATIONS POLICY**  
WASHINGTON, D.C. 20504

**Date:** March 11, 1971

**Subject:** Spectrum Plans and Policy

**To:** Tom Whitehead

As you know, I have for some time wanted to withdraw from any leadership role in the spectrum plans and policy area as soon as its scope and functions could be finalized -- whatever their nature. I feel we have reached that point with yesterday's meeting, which I should like to consider my swan song in this area.

With the simultaneous flowering of activity in the specialized carrier, domestic satellite, CATV, and satellite/cable areas, it is clear that I would be unable to devote any significant attention to the spectrum area in the foreseeable future. With this workload, I feel it would be unfair both to the program and to myself to continue such a tenuous relationship. The same is true, I believe, for most of those persons previously identified as project leaders in this area -- who are also committed to the above crash projects.

I realize you are unwilling to see the program completely dropped -- though I suspect this would be an appropriate move, given our staff limitations. I would, therefore, suggest that Bruce Owen continue with the Allocation Processes project, and that Will Dean (or someone from his staff) take responsibility for the joint OTP/FCC planning activity. In that regard, David Colby (whom I interviewed last week pursuant to Will's suggestion) showed some interest in this area. Since he seems to me a suitable addition to the spectrum management staff, perhaps he could take on the OTP/FCC planning project -- or even the entire program.

If you feel it serves any purpose to leave my name associated with the program in a non-functional capacity, I have no objection. I would like to request, however, that I be relieved of any responsibility

- 2 -

for preparation of program and project plans for this area. I have written several descriptions of the work contemplated already, any one (or all) of which could serve as an interim program description and input to the future program manager.

*Walt*

Walter R. Hinchman

cc:  
Dr. Mansur  
Mr. Dean



5 MAR 1971

Chron  
W.H. Memos  
✓ Ehrlichman  
Articles  
Licensing  
Reporters  
FCC  
CATV  
Gen. Counsel  
Spectrum Allocation

MEMORANDUM FOR

Mr. Tod Hullin  
The White House

Since my memorandum of February 8, 1971, to John Ehrlichman regarding OTP action with respect to the Datran issue, the Commission has now postponed action for probably another two months. With this additional time, I expect that we can develop some credible statements that will encourage the Commission in the direction of more competition. I am currently planning a speech next week, a feature in Business Week, and public correspondence with Senator Baker as ways of making public what positions we can now substantiate.

I can keep John up to date if you wish.

SIGNED

Clay T. Whitehead

cc: Mr. Whitehead  
Mr. Scalia  
Mr. Doyle  
Dr. Lyons  
Mr. Hinchman  
Mr. Owen

CTWhitehead:ed/jm 3/4/71



February 19, 1971

To: Will Dean  
Walt Hinchman  
Bruce Owen

From: Tom Whitehead

Where do you think we are as a result of this effort and where do you think we should go from here?

I would like to have a one-page note from each of you and will plan to have a meeting with you and Dr. Mansur the latter part of next week or early in March.



EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF TELECOMMUNICATIONS POLICY  
WASHINGTON, D.C. 20504

Date: February 12, 1971

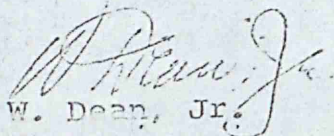
Subject: Government Use of the Radio Frequency Spectrum

To: Mr. C. T. Whitehead

The attached report, approved by the IRAC at its meeting on February 9, 1971, is forwarded in response to your request of December 2, 1970, for a statement on the nature and magnitude of the Government's use of the spectrum.

The report is an unclassified summary for use, as appropriate, in informing higher authority, the Congress, and the public regarding Government spectrum needs. It is also submitted as an initial input to the development of a comprehensive long-range plan for improved management of the radio spectrum.

The Committee is prepared to render further assistance as you may desire.

  
W. Dean, Jr.

Attachment

cc: Dr. G. F. Mansur



## A SUMMARY OF THE FEDERAL GOVERNMENT'S USE OF THE RADIO FREQUENCY SPECTRUM

Innumerable studies, investigations, publications and actions over the past decade have dealt with the problems of Radio Frequency Spectrum Management--many without adequately portraying or taking into account the role of the Federal Government as a major user of the spectrum.

While considerable data on equipment and frequency usage are being collected from the Federal Government agencies under a continuing program, these data include classified information and are in some detail. It is the objective of this summary to present in brief unclassified form, the nature and scope of the Federal Government's use of the radio frequency spectrum including the dominant factors which dictate such use, and the impact of National policies on Government use of the spectrum.

At the onset it should be recognized that "use of the radio frequency spectrum" covers a gamut of radiocommunication and electronic facilities far in excess of the "radio" of by-gone years which meant, for the public at least, primarily broadcasting and wireless communications to ships at sea. The spectrum involved is that intangible resource that allows electromagnetic radiation to be propagated through free space with frequencies from about 30 Hz (1 Hertz is a cycle per second) to those in the order of 3,000,000 MHz (1 Megahertz is a million cycles per second). This represents a range in frequencies of 100 billion to 1, within which one finds many bands of frequencies, each with its own peculiarities and usefulness. As a point of reference, the standard broadcast band in the U. S. is 0.535 to 1.605 MHz. The facilities involved include not only radio stations of many categories but a myriad of electronic devices all characterized by radiation, both desired and undesired, within the radio frequency spectrum.

In understanding the Federal Government's use of the spectrum, one must appreciate the interplay with non-Federal Government use of the same spectrum. This is illustrated by Fig. 1 which shows the relation of Government to non-Government allocations throughout the spectrum. In addition to the shared use of spectrum indicated in Fig. 1 there is a substantial interface between Government and non-Government radio operations. Non-Government ships and aircraft are served by Government radio facilities; Federal law-enforcement agencies have intercommunication with their State and Local Government counterparts; Federal power systems interconnect with non-Federal; Civil Air Patrol stations communicate with the Military--and so forth.

Further, although outside the scope of this paper, it should be recognized that the Government depends heavily (1) on the use of commercial telecommunication facilities in lieu of Government owned



and operated and (2) on the use of landline facilities in lieu of radio where such use is feasible.

U. S. Government radio facilities, supported by a significant research and development complex, fall in the major categories:

1. Conventional radiocommunication facilities--such as high-frequency overseas telegraph and telephone circuits; radiocommunication services to ships and aircraft; land-mobile and microwave communication facilities.
2. Radars (Radiolocation)--such as for the location of aircraft or ships, missile detection, and storm cloud observation.
3. Radionavigation facilities--serving ships and aircraft.
4. Telemetry--radio transmission of measured or sensed quantities or conditions of given physical properties such as hydro/meteorological or stress/strain data including the receipt of such information from spacecraft. Radio astronomy observations may be considered as a form of telemetry in the broad sense where the transmitted signals are of natural origin.

The requirements for conventional radiocommunication facilities are generally understood; those for the multitude of radio stations and electronic devices involved in categories (2) thru (4) above are, however, generally less known. None the less, the latter represent a major portion of the Government's investment in, and use of, the spectrum. Details as to Federal agency responsibilities and commitments having a corresponding impact on the spectrum are given in Appendices 1 and 2.

Two dominant themes are present in the Government's use of radio:

1. The requirement for telecommunication is placed upon the Federal Agencies by virtue of the missions and programs approved by the President consistent with Congressional legislative and funding support, and,
2. The use of radio rather than other forms of communication is dictated by the inescapable elements of time and space.

To elaborate on point (1) above, the acquisition and use of radiocommunication facilities are essential to accomplish the wide variety of missions of the Federal agencies which serve the public in many ways. Furthermore, the essentiality of the facilities themselves is established through the Government's budget and



appropriation procedures pursuant to Congressional approval and Presidential direction. Hence, the basic management question is not whether the spectrum should be used to support these activities but how it may best be used to meet the requirements to which the Agencies are committed--taking into account affected occupants of the same spectrum, present and future, national and international.

The relation between the basic mission of a given Agency, the facilities needed to fulfill this mission, and the requirement for corresponding radio frequency spectrum space must be recognized, for these three are inseparable if the mission is to be accomplished. For example, the fire-fighting responsibilities of Agriculture and Interior, established by Acts of Congress, cannot be effected without mobile communications to those actually fighting the fires; the Federal law-enforcement activities lodged in the Departments of Justice and Treasury would be literally immobilized without radio-communication; the Federal Aviation Administration could not begin to control and protect air traffic, its obligation under Law; U. S. satellites would be useless without radio, negating NASA's mission; and, finally, the Military Services, in meeting their obligations consistent with the appropriations of Congress, would be at the level of Civil-War effectiveness without communications-electronics for all phases of support of their mission to protect U. S. interests throughout the world. A common element of all these activities is that they are not for profit, but are for serving the public in accordance with its needs as expressed by the Congress and as directed by the President.

With reference to point (2) above, one finds the use of radio indispensable to provide for the rapid transfer of information over great distances, across rugged or hostile terrain, and to communicate with, or control, all types of mobile and space vehicles--hand-carried portables, cars, ships, aircraft, missiles, satellites, and so forth.

The variety and depth of involvement of the Government is described in the Appendices. In summary:

- The total U. S. Government investment in communications-electronics equipment is in the billions of dollars (approximately \$50 billion).
- The number of U. S. Government equipments operating throughout the radio spectrum is in the millions.
- The number of U. S. Government radio-frequency assignments is over 120,000 for U. S. and Possessions alone. (These are distributed among the Federal Agencies as shown in Appendix 3. While the number of assignments provides a measure of activity in the radio spectrum, it must be



recognized that one assignment may represent hundreds or even thousands of individual stations or equipments.)

- The variety of the Federal Agency missions which depend on radio is innumerable--the importance incalculable.



Department of Defense

The Department of Defense (DOD) is vitally dependent upon radiocommunications for command and control of dispersed forces world-wide in support of national policies involving defense of the U. S., maintaining freedom of the seas and commitments to our Allies. Defense communications-electronics activities include command and control communications, radar (early warning, surveillance, weapons control), navigational aids, sensing and identification. Military expenditures for communications-electronics equipment run over \$10 billion per year--consuming about 50 per cent of the output of the electronic industry. The military services are the largest Government users of the radio spectrum (approximately 50% of all Government assignments) with a multi-billion dollar investment in communications-electronics.

Radiocommunications for command and control is effected through the facilities of the Defense Communication System (DCS) and those used to support the tactical needs of the Army, Navy, Air Force and Marine Corps.

1. The DCS, which constitutes about 80 per cent of the National Communications System (NCS), is the single, world-wide complex comprising all long haul point-to-point communication facilities in support of the U. S. Military (some 3.0 million personnel). It serves some 2200 locations in the U. S. and 1100 in foreign countries. (The NCS includes, in addition to DOD, the long-haul telecommunication facilities of State, the Federal Aviation Administration (FAA), the National Aeronautics and Space Administration (NASA), and the General Services Administration (GSA). It has, as a basic goal, the interconnection of these facilities to fulfill over-all Government requirements under both normal and emergency conditions.)

The radio facilities of the DCS as of mid-1970 included over 100 high-frequency stations interconnecting with 270 teletype stations and over 1400 data relay stations. The high-frequency facilities alone encompassed 0.5 million channel miles while over 2 million channel miles were provided by tropospheric scatter and microwave facilities. Composite facilities (high frequency and tropospheric/microwave) added another 0.75 million channel miles. Communication satellites provided 290,000 voice channel miles (miles measured on the earth's surface) and 62,000 miles for digital or record traffic.



2. The Department of the Army, with an active force of approximately 1.3 million military personnel has the responsibility to organize, train and equip Army forces (including active, reserve and National Guard) for--
  - a. Prompt and sustained combat operations on land and for joint amphibious and airborne operations.
  - b. Air defense as required for the defense of the United States against air attack, in support of plans for national security.

In addition, the Army is responsible for certain civil works programs for improvement of navigation, flood control, beach erosion control and water resources development in the United States and Possessions.

The accomplishment of the Army's mission is vitally dependent upon use of frequencies throughout the entire electromagnetic spectrum for a wide variety of communications-electronics equipments employed world-wide. Activities involved are:

#### Active Army

In a typical field army more than 75,000 radio transmitters may be employed to support the combat and service forces--concentrated in an area about the size of Utah. Total frequency requirements for combat operations or for extensive training exercises usually exceed those available.

#### Air Defense

The Army Air Defense Command, with missile defense units protecting key defense areas in the Continental United States, employs many high powered radars, missile control systems, and command and control communications.

#### Army Aviation

Approximately 80 Army Airfields in the U. S. provide radiocommunication and radio navigation services for Army aviation. There are about 12,000 fixed and rotary wing aircraft in the Army.



### Civil Works Programs

The Corps of Engineers, Civil Works Division, has approximately 3000 radio stations for communications, together with miscellaneous radar, telemetering and distance measuring facilities to support its civil works projects in the Conterminous United States, Alaska and Puerto Rico. These facilities represent a total investment of approximately \$6.8 million.

### Civil Defense

To support the Nation's civil defense preparedness, the Army operates a network of high-frequency radio-communication stations. These interconnect the Civil Defense regions of the United States for emergency communications.

In total the Army has over 0.5 million transmitters and a like number of receivers.

3. The Department of the Navy, with about a million personnel, has as its mission the organization, training, and maintenance in a state of readiness U. S. Navy and Marine Corps forces for the performance of military missions as directed. This includes support of the other military Departments as required. To perform this task the Navy operates more than 700 ships and submarines in the active fleet and almost 10,000 aircraft which require a vast array of complicated communications-electronics equipment.

The Naval Communication System used to support the DCS and the Fleet is comprised of 27 major communication complexes, made up of 64 transmitting and receiving stations which use over 10,000 transmitters, receivers and transceivers. Additionally, there are 80 Navy and Marine Corps Air Stations, 10 major naval shipyards and 3 major Navy test ranges that are large users of communications-electronics equipments.

Within the fleet the Navy has:

- a. Some 16,000 transmitters with a like number of receivers (for communications).
- b. About 11,000 transmitters and 30,000 receivers (for electronic devices).

For Navy aircraft:

- a. 52,000 transmitters and receivers for communications.
- b. Over 180,000 electronic equipments (such as search radars, navigational aids, weapons control systems and the like).



In total, the Navy (plus the Marine Corps) has about 0.3 million transmitters and a somewhat greater number of receivers of all types.

4. The Department of the Air Force is organized, trained and equipped for prompt and sustained offensive and defensive aerospace operations. To this end, and with almost 0.73 million personnel, it operates:
  - a. The Air Defense Command (ADC), which has more than 100 defense radar sites valued at some \$10 billion using over 600 radars. These installations, including the Space Track Network and Ballistic Missile Early Warning System (BMEWS), are responsible for surveillance of the North American continent to detect and prevent surprise attack and intrusion by enemy missile and aircraft forces.
  - b. The Tactical Air Command (TAC), which uses hundreds of radiocommunication and radar equipments of a mobile or transportable nature. The tropospheric scatter relay equipment alone is valued at \$1.5 million - the radars at about \$40 million. A typical training exercise involves 30,000 men and some 100 aircraft. It is from this Command that quick response forces for contingencies such as the Lebanon, Dominican Republic and similar crises are drawn. Most of the tactical aircrews and tactical support personnel are trained by and obtained from this Command.
  - c. The Strategic Air Command (SAC), which operates airborne and fixed Command Posts and Alert and Readiness facilities. These involve several hundred high-frequency radio transmitting facilities, both airborne and fixed (which are interconnected with over 0.2 million landline circuit miles). This Command provides the United States with a primary retaliatory capability in the event of a surprise nuclear attack.
  - d. The Military Airlift Command (MAC), which provides the majority of the airlift requirements of the Department of Defense. Included in this is aircraft support for the President and other Officials. Additionally, this Command provides emergency airlift of food, medical supplies and the like for catastrophes such as the Pakistan tidal wave and the Peru earthquake. Aircraft of this Command average some 28.8 thousand flying hours per month for a total of 19.6 million miles.



- e. The Air Force Communications Service (AFCS), which is responsible for navigational aids, air traffic control facilities, the Air/Ground common user system and the Air Force portion of the Defense Communications System. These activities support all Air Force major commands and are world-wide in scope. AFCS operates 181 control towers, 800 navigational aid facilities and 19 high-frequency aeronautical stations. The aeronautical stations, in 1970, handled 2.26 million messages and effected 140,000 phone patches. These facilities serve 18 major agencies, not all of them military, as well as the military commands. For air traffic control purposes, AFCS maintains and operates 760 very-high-frequency (VHF) transmitters, 762 VHF receivers and 506 VHF transceivers; and 1657 ultra-high-frequency (UHF) transmitters, 1677 UHF receivers, and 742 UHF transceivers.

Other significant users of the electro-magnetic spectrum in the Air Force are the missile test ranges, the Electronic Systems Division, Special Weapons Center, Aeronautical Systems Division and other activities under the Air Force Systems Command. These research and development activities are all directed toward improving the posture of Air Force operating commands. In addition, there are a number of other Air Force commands and major activities which use the spectrum to a lesser degree.

The Air Force has approximately 0.17 million transmitters and a similar number of receivers. Included in this total are 3000 ground stations and some 15,000 aircraft using 40,000 UHF radio equipments, 20,000 navigation and fire control radars and several thousand high-frequency transmitters.



U. S. Government Civil Agencies

The use of radio by the Government Civil Agencies is characterized by a wide variety of missions distributed among several Departments and Agencies. A brief description for each such Agency follows:

1. The Department of Transportation was established for the purpose of developing national transportation programs conducive to the provision of safe, fast, efficient, and convenient transportation on land, sea, and in the air. The achievement of these objectives, particularly in the air and marine environments, is totally dependent upon the continuing availability of rapid and reliable communications. Since radio is the only practical means of communicating with mobile units, achievement is equally dependent upon the continuing availability of suitable radio frequency spectrum space. Radio spectrum utilization by the several operating administrations of the Department serves numerous and diverse operational and technical functions. Nevertheless, these operations have a common purpose--the enhancement of the safety factor, or one or more of the other important aspects of transportation for the general public.

Within the Department:

- a. The Federal Aviation Administration is responsible for (1) the regulation of air commerce, (2) the control and use of the navigable air space of the U. S., and (3), the development and operation of a common system of air traffic control and navigation for both military and civil aircraft. Radio frequencies are assigned for use at approximately 1100 air/ground communication sites, 300 Instrument Landing Systems, 900 enroute and terminal very-high-frequency omnidirectional ranges, and 200 radar sites. These facilities assure the safe and expeditious movement of some 137,000 registered civil aircraft, making 16 million flights per year. In the fiscal year 1970, approximately 175 million passengers were carried in commercial aircraft, in addition to the thousands of pilots and passengers in privately owned airplanes. Approximately 4.5 million military flights also were served by the FAA common system.

FAA has approximately one-half billion dollars of electronics equipment, operating throughout the spectrum. About 1.4 million miles of wire lines are leased to provide for the control of air traffic with an annual expenditure for these lines running about \$30 million.



A significant research and development program is carried out on spectrum dependent equipments involving aeronautical radiocommunication and navigation. The current annual cost is about \$20 million and is expected to increase to over \$40 million in FY-1972.

- 1b. U. S. Coast Guard responsibilities include (1) merchant marine and recreational boating safety, (2) providing search and rescue facilities and services, (3) port security, (4) providing aids to navigation for marine commerce, recreational boating, and the armed forces, and (5) maritime law enforcement. Related major operations include offshore safety, law and treaty enforcement patrols, ocean station patrols (4 Atlantic, 2 Pacific), domestic and polar icebreaking, and anti-pollution activities. These missions are carried out on behalf of the general maritime community which in 1970 included approximately 44 million U. S. citizens utilizing about 8.6 million recreational water craft and about 54,000 documented commercial vessels. The use of radio is a vital element in the carrying out of these missions.

Radio frequencies are assigned for a variety of U. S. Coast Guard operations including (1) a network of about 270 ship/shore radio stations for safety and distress communications with the general maritime community and for command and control of its own fleet of about 300 vessels and 800 smaller, radio-equipped rescue craft, (2) a network of 24 aeronautical radio stations for operational control of its fleet of about 170 aircraft, (3) a national network of about 215 radiobeacon stations used primarily by small recreational and commercial vessels operating in coastal waters, and (4) an international network of 71 LORAN radionavigation stations used primarily by larger vessels at sea and by air and surface units of the armed forces.

The total Coast Guard investment in communications-electronics installations is about \$0.35 billion. Additionally, the investment in special equipment for use with Coast Guard operated radionavigation systems is about \$0.25 billion.

- c. Other important uses of radio include (1) a communication network of the St. Lawrence Seaway Development Corporation used to expedite and control the safe passage of U. S. and foreign vessels through the St. Lawrence Seaway, (2) telemetering speed measurements, remote control and other technical operations carried out by the Federal Highway Administration and the National Highway Safety Administration in their efforts to improve the safety



- 3 -

aspects of highway travel, and by the Federal Railroad Administration in connection with the development of high speed rail equipment, and (3) vehicle location techniques in programs sponsored by the Urban Mass Transportation Administration.

2. The Department of Justice uses radio to effect its responsibilities for the enforcement of Federal laws. This is accomplished through the land mobile radio facilities of the Immigration and Naturalization Service (which includes the U. S. Border Patrol), the Bureau of Narcotics and Dangerous Drugs, the U. S. Marshals Service, and the Federal Bureau of Investigation (FBI). Communications among investigative and enforcement personnel in the field and with cooperating law-enforcement organizations is an essential tool in the performance of their duties. Frequently safety of life and property is dependent upon the availability of these radio-communications systems which represent an investment in radio base stations, repeaters, mobile units and portable equipment of about \$20 million.
3. The Department of the Interior is custodian of 0.75 billion acres of land and is charged with the conservation and development of the Nation's natural resources. It has a wide variety of radio operations throughout the spectrum and distributed among twelve operating bureaus with diverse missions serving the public and protecting the country's natural resources. The major activities using radio are:
  - a. Point-to-point and mobile radios for land management and protection of natural resources as required by the Bureau of Land Management, which manages one-fifth of the Nation's gross area--some 0.5 billion acres; the National Park Service, which handles 145 million visitors per year; the Bureau of Indian Affairs, responsible for the welfare of some 0.5 million Indians and Alaskan natives on 50 million acres; the Bureau of Sport Fisheries and Wildlife, which manages some 317 National Wildlife Refuge areas, covering 28 million acres; and the Geological Survey for geologic and topographic mapping operations. In these activities the primary use of radio is for fire suppression and protection of property and the public.
  - b. The electric power transmission systems operated by Bonneville Power Administration, Bureau of Reclamation and Southwestern Power Administration, which require radio (microwave and land mobile) for operation and maintenance. A total of 29,000 circuit miles of high voltage transmission lines is involved.



- c. The Government of American Samoa and the Government of the Trust Territory of the Pacific Islands which provide, in their respective areas, public correspondence (including overseas telephone and telegraph); radio-communication services to ships and aircraft; local broadcast, both standard and TV; amateur radio; and utility services incident to the responsibilities of civil government.

The total investment in radio equipment is about \$80 million involving over 40,000 portable/mobile equipments and approximately 2500 land/fixed stations.

4. The Department of Agriculture's use of radio is primarily dedicated to the protection and management of the National forests, which comprise about 200 million acres.

The 20,000 radios of the U. S. Forest Service are used in the programs of timber production, forest firefighting, operation of recreation sites, control of watersheds and water supply areas, control of water and air pollution, wildlife and grassland conservation, and forest research.

Some 1300 additional pieces of electronic equipment are devoted to the support of other agricultural, hydrologic, and research activities.

The Agriculture investment in radio equipment is \$18 million.

5. The Department of Commerce, in its mission to promote full development of the economic resources of the U. S., requires radio to provide essential services to the public and to other agencies of Government. These services are rendered primarily through the agencies of the National Oceanic and Atmospheric Administration:

- a. The National Weather Service (NWS), with more than 400 offices throughout the United States and Possessions, is the most pervasive of the environmental science services. Direct use of the service by the public is second only to the U. S. Postal Service. The NWS is charged with observing and reporting the weather, issuing forecasts and warnings of weather and flood conditions affecting national safety, welfare and economy. These functions depend on radiocommunication facilities and touch virtually every citizen's life through the public weather service and specialized weather/hydrologic services to aviation, maritime activities, agriculture, space operations, and the like. Its National Meteorological Center is a key center in long range and regional forecasting for the



World Meteorological Organization of the United Nations. As an example of the public service rendered on a routine basis by the National Weather Service, its National Hurricane Center tracks hurricanes and forecasts their movement and intensity to provide early warning to populated areas in the storm path. Radio-communication is a vital element in this operation.

The National Weather Service operates almost 100 weather radars, 134 weather balloon stations (radiosonde) and electronically instrumented weather reconnaissance aircraft with a total investment in radio equipment of about \$49 million.

- b. The National Environmental Satellite Service operates meteorological satellites which provide weather and sea forecasting by the use of cloud and sea pictures taken several times daily. These data and other environmental/meteorological data are transmitted to earth by radio. Information from this activity is then distributed to the entire world as a contribution to the World Weather Watch of the World Meteorological Organization. The U. S. portion of this Meteorological Satellite system involves at this time two earth stations and twenty readout stations--an investment of some \$18 million dollars (excluding the cost of the weather satellites now in orbit).
- c. The Environmental Research Laboratories, with sophisticated radio facilities at approximately 55 locations, provide research which enhances our knowledge of the earth and sea, and the atmosphere and outer space. These laboratories develop methods of hurricane de-intensification and weather modification to prevent severe thunderstorm or tornado destruction to life and property. These research activities require scientists and air crews to fly into and around severe storm phenomena on a routine daily basis. Radio-communications is vital to support these projects and for the safety of the personnel involved.
- d. Radiocommunication facilities are also necessary to support some 57 ships engaged in oceanographic/fisheries activities which include direct services to the public. For example, the issuance of tsunami wave warnings (the warning of devastating ocean waves caused by earthquake activity) and the issuance of geodetic survey charts and earthquake risk maps.

In total, Commerce has a \$90 million investment in radio equipment.



6. The Atomic Energy Commission (AEC) is responsible for national programs for research, development, and production of nuclear materials and facilities, and regulates their use by authorized agencies and licensees. In performing this mission, it requires the use of radio for the safety of life and property.

Radio operations range from the use of micro-miniature transmitters surgically implanted in test animals to determine physiological effects of radiation to complex airborne diagnostic systems for research. To support field test activities and protect the public from radiation hazards, AEC and its contractors employ extensive use of all types of radio facilities. These include microwave trunking facilities to allow extended range of communication. In addition, a point-to-point high-frequency radio system links AEC Headquarters and its principal offices, with interconnection to Civil Defense stations. This provides essential back-up communications in times of national emergencies.

AEC's investment in radio transmitters for radiation monitoring in public areas and for the coordination of nuclear testing exceeds \$150 million.

In total, AEC utilizes approximately 2400 fixed/repeater stations and 8000 mobile/portable units. The total investment in radio and telemetry equipment is about \$0.24 billion.

7. The Treasury Department is responsible for major law enforcement activities-- the protection of the President and the Vice President, their families, candidates for those offices; and the detection and arrest of counterfeiters, smugglers, bootleggers and forgers of Government securities. These activities are supported by 300 base and repeater stations; with some 3,500 mobile/portable units throughout the U. S. as required to provide instant communications.

The investment in radio equipment is about \$3.25 million.

8. The U. S. Information Agency (USIA) assists in the achievement of U. S. foreign policy objectives through operation of an international radio broadcast service. The number of listeners, reached in 36 different languages, is estimated to be 43 million. Five stations (40 transmitters) in the U. S. beam programs to selected overseas areas and to 12 overseas relay stations (68



medium/shortwave transmitters). This represents a capital investment of approximately \$134 million.

9. The National Aeronautics and Space Administration (NASA) is charged with the conduct of research on the problems of flight both within and beyond the earth's atmosphere and with the development and test of aeronautical and space vehicles. It is further responsible for the exploration of space with manned and unmanned vehicles. In these activities it depends almost completely on radio for the control of, and for gathering data from, its research spacecraft. In support of the terrestrial facilities, conventional radio is used at ten major research centers and numerous sub-centers for safety, utility and research including aeronautical research operations.

As of January 1971, some 53 spacecraft carrying almost 150 transmitters were in active operation under NASA control. 24-hour tracking and readout is provided for many of these spacecraft of which approximately two-thirds are those of NASA, the remainder being those of Commerce, Department of Defense, or foreign administrations.

The total NASA investment in terrestrial radio facilities in support of space operations (roughly half in U. S. and half overseas) is nearly \$1.0 billion.

10. Other Government agencies, with equally important but diverse responsibilities to serve the public, use radio. However, these are at levels having less impact on the radio-frequency spectrum. Among these are the Department of Health, Education and Welfare, the U. S. Postal Service, the Veterans Administration, the Federal Communications Commission, Department of State, General Services Administration, and the Tennessee Valley Authority. Use of radio in such agencies, as throughout Government, is increasing significantly because of the country's growth as reflected by new legislation; increasing awareness of environmental problems; and the acute need to protect both the public and its property from internal disorders and disturbances unheard of a decade ago.



## SELECTED GOVERNMENT FREQUENCY ASSIGNMENT DATA

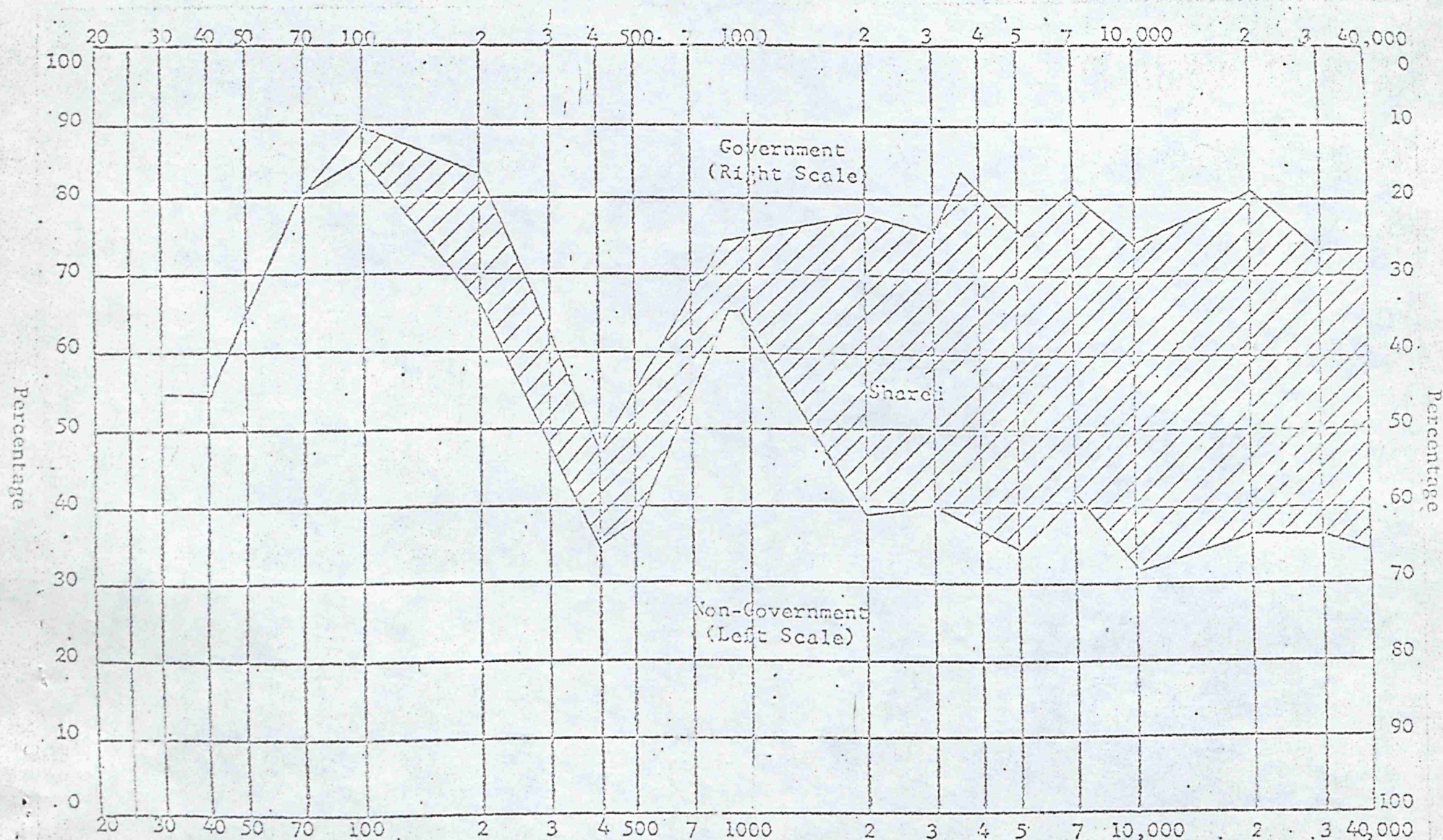
(As of January 1, 1971)

Department or Agency	Freq. Assignments		
	Number	Per Cent	Rank
Agriculture	7,489	6.22	7
Air Force	22,500	18.70	2
Architect of the Capitol	1		
Army	15,586	13.00	4
Atomic Energy Commission	2,422	2.01	9
Bureau of the Budget	1		
Commerce	3,651	3.03	8
Federal Communications Commission	771	.65	
Federal Reserve System	40	.04	
General Services Administration	73	.06	
Health, Education & Welfare	287	.24	
Housing & Urban Development	1		
Interior	7,937	6.59	6
International Boundary & Water Comm.	23	.02	
Joint Assignments	722	.60	
Justice	8,197	6.81	5
Labor	15	.01	
Library of Congress	1		
National Aeronautics & Space Admin.	920	.77	12
National Science Foundation	103	.09	
Navy	21,531	17.00	3
Postal Service	269	.22	
Smithsonian Institution	29	.02	
State	75	.06	
Supreme Court	2		
Tennessee Valley Authority	599	.50	
Transportation			
Coast Guard	(8,561)	(7.11)	
Federal Aviation Administration	(15,033)	(12.50)	
Non-Government/FAA (Common System)	(815)	(0.68)	
Other than CG/FAA/NG	(157)	(0.13)	
Total Transportation	24,566	20.42	1
Treasury	1,129	.94	10
U. S. Capitol Police	3		
United States Information Agency	1,007	.84	11
Veterans Administration	217	.18	
Other	94	.08	
Total	120,261	100.00	
Military Services		49.60	
Transportation		20.42	
Total		70.02	
<u>Distribution with Frequency</u>			
Below 2,505 kHz	6,936	5.8	
2,505 to 24,990 kHz	34,822	29.0	
24,990 kHz to 162 MHz	20,152	16.7	
162 to 174 MHz	21,799	18.1	
174 to 420 MHz	15,616	13.0	
420 MHz and above	20,936	17.4	



# ALLOCATION DIVISION OF THE RADIO SPECTRUM BETWEEN GOVERNMENT AND NON-GOVERNMENT - 1970

(Cumulative--30 MHz to Any Frequency)



LOGARITHMIC FREQUENCY SCALE - MEGAHERTZ



8 FEB 1971

Chron  
✓ Ehrlichman mem  
W.H. Memos  
Articles  
Licensing  
Reporters

MEMORANDUM FOR MR. JOHN EHRLICHMAN

The idea of a free market in radio and TV licenses was first proposed at least as early as the 1950's, and has been extensively explored since.

There, in fact, already exists a flourishing trade in these licenses (about 900 sales per year), although exchanges are subject to FCC approval. The license renewal process which each station faces every three years involves much red tape, but is essentially perfunctory except in rare cases. The trade in licenses has not led to the usual benefits of a free market (as Friedman expects) for two reasons: (1) The number of channels is limited by the FCC; and (2) common ownership of production facilities and channel licenses, together with FCC regulation, make independent program production infeasible.

The kind of genuinely free market which Friedman desires can be achieved with cable TV, but only if our regulatory approach to cable is quite different from what has evolved for over-the-air broadcasting. If that approach is not changed, inflexibility and governmental meddling in communications will doubtless increase over the next decade. The problems extend beyond radio and TV to satellites, microwave, telephone, and commercial systems like Datran. Some market-like mechanism is needed throughout.

We are devoting considerable effort to developing a realistic cable TV policy which will strongly reinforce the President's theme of diversity and localism. We expect to have a major impact in this area even though the technical, economic, and political problems are difficult. I would be pleased to discuss this with you if you are interested in more detail.

Clay T. Whitehead

cc: Mr. Whitehead  
Mr. Scalia

Mr. Hinchman  
Mr. Owen

CTWhitehead:Scalia/jm 2/8/71



OFFICE OF TELECOMMUNICATIONS POLICY  
WASHINGTON

2/8/71

To: Tom Whitehead

From: Bruce Owen

Re: Draft memo for John Erlichman

I would replace the last sentence in the second paragraph with the following:

"The full benefits of this market have not been realized because: (1) The trading takes place only within the FCC block allocation for TV service, which is severely limited, (2) the licenses compel station owners to control content as well as transmission, and (3) the FCC continues to regulate programming content. These restrictions make new services infeasible."



OFFICE OF TELECOMMUNICATIONS POLICY  
WASHINGTON

2/5/71

To: Nino Scalia  
Walt Hinchman  
Bruce Owen ✓

From: Tom Whitehead

May I have your comments,  
please.



DRAFT  
Whitehead:jm  
2/5/71

*Ehrlichman*  
*per*

MEMO FOR JOHN EHRLICHMAN

The attractiveness of a free market in radio and TV licenses is more than superficial. It was first proposed in the early 1950's and has been extensively explored since.

There is now a thriving market in these licenses (about 900 sales per year), although such exchanges are subject to FCC approval. The license renewal process which each station faces every three years involves much red tape, but is essentially perfunctory except for rare cases. We do not see the benefits of this market that Friedman implies for two reasons: (1) The number of channels is limited by the FCC; and (2) the joint ownership of programming sources and channel licenses, together with FCC regulation, make new services infeasible.

The kinds of benefits and market structure Friedman describes could be possible with cable TV, but only if our regulatory approach to cable is quite different than what has evolved for over-the-air broadcasting. We are devoting considerable effort to developing these ideas into a realistic policy proposal. If successful, it also should strongly reinforce the President's theme of diversity and localism.



We have in effect nationalized the radio frequency spectrum with the FCC as the final arbiter of who can use what parts for what purposes. The inflexibility and opportunities for governmental meddling inherent in this philosophy will grow over the next decade. The problems go beyond radio and TV licenses to satellites, microwave, telephone, and commercial systems like Datran. Some market-like mechanism is clearly needed. We hope to have a big impact in this area even though the technical, economic, and political problems are difficult. I would be pleased to discuss this with you if you are interested in more detail.



*Chilton*  
*man*

February 2, 1971

MEMORANDUM FOR MR. JOHN EHRLICHMAN

You inquired about our plans regarding the pending FCC docket in the area of competition in the specialized communications carrier field (e. g., Datran).

A decision by the FCC is expected next week. Dean Burch anticipates that the outcome will be pro-competition, as do we, but we cannot be sure how decisively so. We have decided not to make any statement at this time for two reasons -- (1) We have not yet had time to put together a sufficiently solid case to justify our taking a strong position, and (2) Without solid documentation, we would be unlikely to sway the relevant Commissioners and could well cause them to stiffen their opposition because of resentment at outside pressure.

This particular pending docket is only a partial resolution of the problem. If the FCC action is favorable as expected, we will pursue the other aspects -- such as interconnection policies, restrictions on existing common carriers, and tariff structures. Because of continuing discussions, I must be careful to preserve our credibility with ATT and Western Union on these matters. If the FCC hedges on this docket, we will aggressively pursue the whole matter.

Clay T. Whitehead

cc: Mr. Peter Flanigan  
Mr. Whitehead

CTWhitehead:jm 2/2/71



EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF TELECOMMUNICATIONS POLICY  
WASHINGTON, D.C. 20504

February 4, 1971

MEMORANDUM FOR MR. SCALIA

Re: Comments on Draft Reply to Peter Flanigan

A few thoughts on your comments:

Whether or not we should address the broader question of the whole spectrum in reply to Mr. Flanigan's query, it seems to me that the broadcast spectrum can not usefully be separated from the rest of the spectrum in any investigation of this issue. The broadcast spectrum is an entirely artificial construction of the FCC. Furthermore, I think most people not closely acquainted with the issues here unconsciously equate broadcasting with the entire radio spectrum.

It is exactly the flexibility of the market in splitting up and reallocating the spectrum between alternative uses in an efficient manner which we seek here. In your analogy, it is quite true that the parts of the house could be owned by separate people. That they are not is due to the operation of a free market, and not to a public law which says they shall not be. In the spectrum, if central economic control of some uses were more efficient, then one person would indeed find it profitable to purchase all of those parts which needed to be combined. Thus, the optimal degree of economic integration could be determined automatically by the operation of the market, rather than by dictate. To operate a free market in the spectrum is not to prevent all the parts of a house from being owned jointly, but rather not to prohibit the opposite.

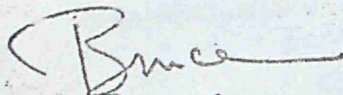
The existence of externalities is due entirely to the imperfections in our definitions of various property rights, and not the operation of markets. Aside from externalities, you raise the question of "merit goods" which it is felt the government should subsidize or provide free. This can still be done in the spectrum context within the overall operation of a free market. The necessity to feed starving children does not logically require nationalization of food production. The necessity of government road-building does not logically require nationalization of all land.



The present power of broadcast licensees in the area of program content is due entirely to the artificial scarcity of such licenses created by the Commission, and not to any inherent power of broadcasters. We do not nationalize the newspaper industry and have Federal allocation of printing presses, despite the considerable monopoly power of daily newspapers. There are fewer daily newspapers available to most people than there are TV stations. Daily newspapers do not (for the most part) find it profitable to push sex and pot; why should broadcast stations? And in any event, should we control the content of those newspapers that do push these things? I think there are overriding first amendment arguments which suggest that we should not, and I think these apply with equal force to broadcasting.

The existence of a free market in land, food, housing, automobiles, steel, and most other commodities has never been used as an argument for selling the Presidency. Why should selling the spectrum suggest such a thing? Finally, I would point out that it was this Administration which decided to "sell" the Post Office, and begin to operate it as a private business firm.

By the way, most of these arguments are given in greater detail in R. Coase, "The Federal Communications Commission, Journal of Law and Economics, v. 2, 1958.

  
Bruce Owen

cc: Tom Whitehead  
Walt Hinchman



EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF TELECOMMUNICATIONS POLICY  
WASHINGTON, D.C. 20504

Date: February 4, 1971

Subject: Memorandum for Peter Flanigan

To: Bruce Owen

I have a few comments concerning the proposed reply to Peter Flanigan.

First of all, is it wise to extend the scope of the discussion beyond the narrow question asked (the sale of TV and radio licenses) to the much broader and difficult question of market allocation of the entire radio spectrum? I would not want to take a position on the latter unless absolutely compelled to, and I do not think Flanigan's inquiry constitutes such a compulsion.

I do not agree that the principal objection to the institution of a private market mechanism has been the "absence of a legal definition" of the private property right involved. To be sure, no legal definition currently exists, but if it were desired that the commodity be bought and sold it would be relatively easy to create one. The real problem is not the narrow legal one of framing the "property right," but the technological and social one of determining what that right ought to include. For the sale of radio and TV licenses alone, this problem is not very acute, but if you enlarge the discussion to embrace the sale of the entire radio spectrum, the problems are enormous. For example, when a particular segment of the spectrum is sold to a user of a different type (e.g., from a TV broadcaster to a mobile radio user) or when it is split up and resold to several other users, the effects of the use upon other portions of the spectrum can be vastly altered. To prevent disruption through restrictions upon transfer for differing uses would destroy the whole purpose of the exercise--i.e., to let economic forces determine most efficient uses. In other words, it may well be that the very nature of the physical element with which we are dealing makes it impractical (though not legally impossible) to split it up into privately "owned" segments. The use of one segment has too much of an effect upon the usability of the others. If I may be permitted an analogy: It is thoroughly possible (indeed, quite simple) to establish an arrangement whereby the walls in a house are owned by one individual, the windows by another, the plumbing by a third, the floors by a fourth, etc. As far as I know, it has never been done. Not



because it is difficult to do, but because it is not intelligent to do. It seems to me that that is the judgment which has been made with respect to the radio spectrum; it must be "owned" and managed as a whole. Perhaps that judgment is wrong--but we lawyers have very little to do with it.

The other principal problem which I see--and this one applies even more strongly to radio and TV licenses than it does to the rest of the spectrum--is the problem of what I believe you would refer to as "externalities." Even in the period of our history when we were most rigidly individualistic, most highly suspicious of government intervention and most heartily content to let economics determine priorities, the area of communications was regarded as something quite special, charged with a public interest which could not be left to the market. Thus it is that our Constitution explicitly provided for a federal post office, which has, since the early days of the Republic, been insulated from private competition. Or to take another example from the same field, third-class postage has (I believe) never "paid its own way"--and there is little chance that it ever will be forced to do so. There has been, I suggest, an enduring social judgment that the dissemination of knowledge (or, for that matter, ignorance) is too important a matter to be governed entirely by people's willingness and ability to pay for it.

Moreover, a broadcast license confers the power not merely to disseminate, but also to determine the content disseminated. At present that power is subtly restrained, not by explicit federal dictation of content nor even by overt censorship, but by the FCC's consideration of the demands of the "public interest, convenience and necessity" when the license is issued and when it comes up for renewal. This restraint would be eliminated if licenses were to be simply sold. At this point, it seems to me, the "externalities" become overwhelming, in view of the ability of television, in particular, to affect the mores of the entire community. Even if the highest bidder has no political or ideological axe to grind, he may simply find it commercially profitable to push sex (short of the legally obscene, whatever that is) or pot or violence. It would be possible to establish a sale system for licenses, and at the same time avoid placing such massive power in one individual's hands, by either (1) lodging the power in the federal government through the establishment of fairly detailed content requirements, or (2) eliminating the power entirely, by making broadcasters common carriers. I will not go into my views on these alternatives, except to say that the first would be more oppressive than the present system, and that the second should not attract an Administration which rejected the Obscenity Commission report and which is concerned about crime, violence, pot and the general deterioration of that thing known as the "social fabric." In any case, unless and until one of these two alternatives is adopted, there is at least some parallel between selling broadcast licenses and selling the



Presidency to the highest bidder. And I doubt that whoever suggested the idea to Ehrlichman had in mind coupling it with either one of the alternatives.

I suspect that the notion of going to a market mechanism is born principally of despair at the FCC's attempts to separate two applicants between whom there is not a dime's worth of difference (to coin a phrase). Perhaps the FCC's procedures are absurd. Perhaps they should instead establish broad grades of desirability, and distinguish between two applicants within the same grade on the basis of a lottery--or, if you wish, on the basis of who will pay the most. But as bad as they are, the FCC's procedures do represent an attempt to take account of factors which I am not prepared to say can safely be ignored--and which the marketplace would ignore.

Antonin Scalia





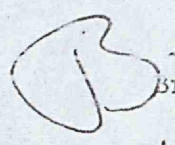
2/3/71

OFFICE OF TELECOMMUNICATIONS POLICY  
WASHINGTON

To; Tom Whitehead

Here is a draft reply to the Rose memorandum on "Milton Friedman's idea." It has been coordinated with Walt Hinchman.

Will Dean suggests that we add the final sentence: "An additional obstacle would be the compendium of court decisions, made since the inception of radio, based on the public's 'interest, convenience, and necessity'."



Bruce Owen

Attachment



DRAFT  
2/3/71  
BMOWen

## MEMORANDUM FOR PETER FLANICAN

Milton Friedman's suggestion that TV and radio licenses be sold at auction and thereafter be left to the forces of the market is not a new idea. It was first suggested in a law review article in 1951, and was fully explored and advocated by Ronald Coase of the University of Chicago in a series of articles beginning in 1958.

Because of their scarcity, certain kinds of broadcast licenses are extremely valuable. This is true, for instance, of VHF TV licenses in major cities, and the more powerful AM radio stations. There is now a thriving market in such licenses (about 900 licenses change hands each year). This exchange is subject to FCC approval. The Commission has for years referred to the practice of selling licenses as "trafficking," and has tried, unsuccessfully, to discourage it.

The history of federal regulation of the radio frequency spectrum can be summarized (and oversimplified) by saying that Congress nationalized the spectrum and ordered the FCC to allocate it in a centralized decision-making process in a manner designed to promote the public interest. There is no fundamental reason why the spectrum could not be subjected to the same market forces which are used to allocate land or other natural resources. However, the absence of a private market mechanism to date has meant that there has developed no legal definition of the private property right which might be used as a unit of ownership. The absence of such a definition has heretofore been the principal objection to the institution of a private market mechanism.

It is our view that market mechanisms should play a greater role in spectrum allocation. However, implementation of such a policy requires development of a workable definition of the property right. There are some serious, but not insuperable, technical difficulties involved in such a definition. Perhaps more serious, implementation would require basic changes in the legislative charter of the FCC.

Broadcast frequencies are only a part of the radio spectrum. It is ironic that suggestions about the insertion of market forces usually turn up in the broadcast context, since it is only in broadcast licenses that there now exists some semblance of a market mechanism. In the remainder of the spectrum there is no formal or informal market at work.



If present broadcast licenses were put up for public auction, their holders would suffer a considerable financial loss. This is so because the economic scarcity rent of the license will have been capitalized in the price of the station, and "paid" by the present owner to the preceding owner. The initial licensee, who was given the license free by the Commission, accrued a windfall profit equal to this scarcity rent. Auctioning of present licenses would, therefore, be in some sense inequitable, and would certainly be met with opposition from the industry. Merely vesting the rights in their present owners, on the other hand, would be seen as a "give away" of public resources. A possible middle ground lies in vesting the right in present licensees, but with a series of payments to the government extending over several years. This could be seen as an extension of the present license fees.

If we were to adopt a gradualist approach to the problem, letting market forces take over allocation in part of the spectrum, it is likely that the most appropriate place to start would be in the <sup>CIVILIAN</sup> non-broadcast UHF spectrum rather than in the broadcast services.

Implementation of a policy of market allocation of the spectrum would be greatly hindered by the traditional opposition of the Federal Communications Commission, and especially its staff, to any such proposal. We might also expect some resistance from the industry.

Clay T. Whitehead



## Office of Telecommunications Policy

Route Slip

1 FEB 1971

1 FEB 1971

To

Clay T. Whitehead

George F. Mansur

William Plummer

Wilfrid Dean

~~Steve Doyle~~

Walt Hinchman

Charles Joyce

William Lyons

*Mr. Linder*

Eva Daughtrey

Timmie White

Judy Morton

## REMARKS

*Judy**A copy to - Bruce Owen  
Will Dean  
Geo. Mansur.**✓ original to COM*



THE WHITE HOUSE

WASHINGTON

January 22, 1971

MEMORANDUM FOR CLAY T. WHITEHEAD

FROM: JON ROSE

John Ehrlichman has asked our office to evaluate the merits of Milton Friedman's suggestion that radio and television licenses be sold in fee simple absolute and thereafter be left to the forces of the free market. Could you, or a member of your staff, write a memorandum for Peter analyzing this proposal and comparing it to our present system of allocating the spectrum among private users.

I appreciate your assistance in this matter.



December 4, 1970

TO: TOD HULLIN

FROM: PETER FLAHLGREN

Re your memorandum of 12/2 concerning the suggestion that we change the television and radio licensing system, we are having a study made of this idea and will let you know the results.



MEMORANDUM

THE WHITE HOUSE

WASHINGTON


DECEMBER 2, 1970

FOR PETER FLANIGAN

I am impressed with the superficial attraction of Milton Friedman's suggestion that we change the television and radio licensing system to sell these licenses in fee simple absolute and let the free market take care of the consequences.


Has this ever been proposed before?

If not, why not?

  
John D. Ehrlichman



## HOW TO FREE TV



In his powerful attack on TV news coverage, Vice President Agnew accurately described the present lack of diversity, but touched only lightly on causes and cures.

The causes are not to be found in the character of the men who present the news or who run the networks. Both groups try to present the news fairly. Yet, with the best of intentions, three collections of men breathing the same intellectual atmosphere and with a strong incentive to appeal to the same audience in the same way will inevitably present a one-sided point of view.

## CAUSES

This narrow range of views has its origins in two related features of TV: first, the requirement of a government license in order to operate a TV station; second, the effective stifling of pay-TV for well over a decade by the Federal Communications Commission under the pressure and influence of the networks.

To see the importance of the second feature, suppose that it were made illegal for any reading matter to be sold directly to the public. Reading matter could be distributed only if it were given away to all comers, financed, as TV programs now are, by advertising, philanthropy or government subsidy.

What would happen to our present variety of reading matter—to which Mr. Agnew referred so aptly? Would advertisers finance newspapers and magazines of the kind we now have? Perhaps a few, but surely not many, and hardly any that would take a strong, independent and unpopular position, or that, like the *New Republic*, *National Review*, *Harper's*, *Atlantic Monthly*, would appeal to very limited audiences.

What kind of books would be published? Some time ago, I bought a magnificent collection of reproductions of Andrew Wyeth's paintings, which sells for \$75. Can you conceive of an advertiser finding it in his interest to use so expensive a book with such limited appeal as a vehicle for selling his product? No, the books published would be mostly the kind that are now printed by the millions in paperback—the kind we "effete snobs" call "trash."

The books published would appeal to the masses—in this sense the advertisers could say that they were giving

the public what it wants, just as the TV networks now claim. Yet the public would not get what it wants in the meaningful sense of getting everything that it was willing to pay for. It would get only those items that could be produced cheaply enough to serve as fillers between the advertisements.

This is precisely the situation in TV today. The insistence that programs must be "given away"—that is, paid for by the public through its purchase of advertised products—has led to precisely the results that it would lead to with reading matter: deadening uniformity; limited choice; low-cost, low-quality programs. It has also fostered the dominance of networks and their geographical concentration, because their special advantage is in merchandising nationwide advertising. That is why they have bitterly opposed pay-TV.

The networks have been able to maintain their monopoly position because of the requirement of a government license to operate a TV station. Without this requirement, it would have been impossible for them to have prevented the development of pay-TV on a large scale—and, for all I know, of still other alternatives to present-day commercial TV.

The FCC supposedly regulates the radio and TV industry in the public interest. But like just about every other regulatory agency—ICC, CAB, FCC, and so on through the dreary alphabet—it has in fact become an instrument of the industry it supposedly regulates. It has been used by that industry to preserve monopoly and to prevent competition. Its abolition is essential if we are to have truly free TV.

## CURE

But, you will say, the number of TV channels is limited—not to three but to a fairly small number. Surely, government must decide who is to use them. That is a non sequitur. Gold mines are limited. Must the government therefore decide who is to operate them? Land is limited. That may call for zoning requirements, but does it require the licensing of the use of particular parcels to particular people? Precisely the same solution is available for the allocation of TV channels as for the allocation of land. Just as the U.S. sold much of its public land a century ago, let the FCC sell now to the highest bidder the

rights now covered by a license (to broadcast at a specified frequency and power in a specified way during specified hours of the day, from a particular location). And then let it go out of business.

The owners of these rights would have private property in them, which they would protect from trespass as you and I protect our land from trespass, through the courts. They could buy and sell the rights, subdivide them, recombine them, as you and I do with our land.\* They would have the full protection of the Bill of Rights just as the press now does.

Monopolies, if any developed, would be subject to the antitrust laws, not, as now, protected by a government agency. And they would be far less likely to develop because advertisers and networks would be denied the special privileges that they are now granted.

## CONSEQUENCES

What kind of TV system would emerge from the free and unfettered operation of market forces? No one can say in detail. The market is most ingenious and always produces surprises. But certain things are clear. First, there would still be programs supported entirely by advertising—as giveaway newspapers are now. Second, there would be many programs supported partly by advertising, partly by fees—as many newspapers and magazines are now. Third, there would be many programs supported entirely by fees—as so many books and other publications are now. Fourth, the TV bill of fare would be far richer than it now is. It would cater to all viewers, not just those influenced by advertising. It would provide expensive programs for limited audiences as well as low-cost programs for mass audiences.

Here, Mr. Agnew, is a far better road to a cure than asking listeners to write and telephone TV stations. Give the viewer the power that makes the consumer the boss in other areas, the power to buy from whom he wants what he wants to buy. That is the way to a truly free TV.

\*The technical feasibility of this proposal is examined and demonstrated in R.H. Coase, "The Federal Communications Commission," *Journal of Law and Economics*, October 1959, and in Arthur S. DeVany, Ross D. Eckert, Charles J. Meyers, Donald J. O'Hara, Richard C. Scott, "A Property System for Market Allocation of the Electro-magnetic Spectrum: A Legal-economic engineering Study," *Stanford Law Review*, June 1969.



EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF TELECOMMUNICATIONS POLICY  
WASHINGTON, D.C. 20504

*Spectrum  
allocation*

January 27, 1971

MEMORANDUM FOR TOM WHITEHEAD

Re: Spectrum Allocation

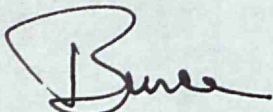
It seems to me that there is a serious danger, on the basis of our recent meeting on this subject, that OTP can get bogged down in another iteration of what is apparently cyclical history in this area.

If you are willing to accept the basic premise that market incentives should dominate the allocation process, then the only possible next step is the actual implementation of such a market. This is not a subject which needs extensive long-term investigation. The Stanford Law Review version of the G. E. TEMPO report asked, and largely answered, the question of implementation. Academic reception of that paper was very favorable. The two objections which have been raised are (1) the definition of the property right was not perfected and (2) implementation would be politically difficult.

On the first objection, Walt is quite right in saying that there is need for further study of the property right definition. The crucial issue here is that externalities be eliminated, since any "arbitrary" initial property right definition will be quickly corrected by market forces. All that really matters is that all the relevant dimensions be exactly defined.

On the second point, political impracticality, it seems to me that given your acceptance of the idea there remains only a question of timing and degree. The issue is not what to say, but how and when to say it.

In each of these cases further study is indicated, but not really long-term or difficult study. If we go back to first principles again, it seems unlikely that we will come up with answers which are better than the results of the literature which is available to us now. We will in addition risk having no time to implement the basic policy decision.



Bruce Owen



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*Mr. Whitehead*

ABSTRACT

THE RELATIVE VALUE INDEX APPROACH  
TO  
IMPROVED SPECTRUM MANAGEMENT

A PRESENTATION  
FOR  
OTP OFFICIALS

January 20, 1971

L. E. Hoxie  
S. J. Bernstein



## TABLE OF DISCUSSION

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## AN INTRODUCTORY ABSTRACT:

### The Relative Value Index Approach to Improved Spectrum Management

#### 1. Introduction

This abstract summarizes OTP research efforts to date in developing a methodology for aiding spectrum management. This methodology is called The Relative Value Index Approach to Spectrum Management. It includes: a short restatement of the research objectives; an identification of the basic premises or assumptions which set the guidelines for the formulation of the RVI approach to measuring the value of spectrum uses; an abridged presentation of the theory of relative value measurement as it is to be employed in the spectrum management decision process; a discussion of the utility of this approach (as well as its advantages) to contemporary spectrum management; and an outline of a proposed experimental application of the RVI methodology within a specific spectrum/geographic portion of the United States and for a selected radio service.

#### 2. Objectives

The objective of OTP's research efforts has been to develop a computer-based model which: 1) serves spectrum managers as a decision tool for improving the frequency assignment and allocation process; and 2) provides spectrum managers with the foundation for building a more self regulating spectrum management process. To accomplish this objective:



- . The essential technical, economic and socio-political performance characteristics common to various spectrum usages (which determine the importance of such usages to society) have been specified.
- . The indicators with which to measure these technical, economic and socio-political performance characteristics have been identified, shown to be quantifiable, amenable to mathematical manipulation, and made comparable through applied social science measurement techniques.
- . The model which combines these measures into an index of relative social value has been formulated.
- . The description of how the model may be used by spectrum managers in the assignment and allocation process has been specified.

### 3. Premises

The RVI approach is based on the premise that, a decision to commit spectrum resources for one purpose is simultaneously a commitment not to use the same resource for alternative purposes at a given time. The assignment/allocation of spectrum resources is therefore a matter of determining the relative, as opposed to the absolute, value of presently complementing and competing spectrum uses.



The decision problem of spectrum assignment/allocation may thus be conceptualized as having the following characteristics:

- . Spectrum is a limited natural resource.
- . Spectrum must be allocated to a set of uses each having some value to society.
- . All potential spectrum users can not be completely satisfied, although perhaps accommodated.
- . The value to society of a given spectrum use may be conceived as a vector having several dimensions of measurement.
- . Any one dimension, for example, price, is considered by itself an insufficient criteria for the measurement of value in the spectrum management process.
- . Several measurement dimensions must, and can, thus be considered in combination by representing them in the form of an overall index score.
- . The index score may be said to be a measure of a respective spectrum use's value to society when it is compared to the value index of one or more competing or complementary spectrum uses. The difference between the value indices is further conceived as the relative value accruing to society.

#### 4. Theory

##### A. Model

The relative value theory states that, common performance characteristics of various spectrum uses can be measured by a



technical ( $I_T$ ), economic ( $I_E$ ), and socio-political ( $I_S$ ) index; these are then combined in a model format.

The technical index embraces the following values, among others:

- . effective radiated power
- . antenna gain and suppression
- . receiver sensitivity

The relationship between these variables is depicted in the proposed model as,  $(1/S)$ , indicating the technical suitability of a particular spectrum use.

The economic index embraces such variables as:

- . annual contribution to GNP
- . operating costs
- . spectrum user and public investment

The relationship between these variables is depicted in the proposed model as  $\frac{Y(I_u + IP)}{C}$ , indicating the economic efficiency related to a particular spectrum use.

The socio-political index embraces such variables as

- . population service
- . service coverage
- . urgency of need

The relationship between these variables is depicted in the proposed model as  $(P_{T_a} \sum_{i=1}^N \frac{(1/U_p \cdot T_p/T)}{B})$ , indicating the social importance of this particular use to society.



In order to make the indices more realistic measures, each may be modified by a social discount and or a probability of success factor when relevant.

The combination of these indices through the proposed model is said to form a value index which indicates a spectrum uses' over-all importance to society compared to another use(s). The general form of this model is:

$$(1) \quad RVI = f(I_T) \quad (I_E) \quad (I_S)$$

where

$I_T = (1/S)$ , the technical suitability quotient

$I_E = \left( \frac{Y(Iu + Ip)}{C} \right)$ , the economic efficiency measure

$$I_S = \left( \frac{PTa \sum_{i=1}^n \left( \frac{1}{U_p} \cdot \frac{Tp}{T} \right)}{B} \right)$$

the social importance measure

where  $i = (1 \dots n)$   
radio uses)

Substituting into the general equation, we get the expanded format:

$$(2) \quad RVI = f \left[ (1/S) \quad \left( \frac{Y(Iu+Ip)}{C} \right) \quad \left( \frac{PTa \sum_{i=1}^n (1/U_p \cdot Tp/T)}{B} \right) \right]$$

As formulated, the relative value index model provides spectrum managers with a computer-based decision tool for comparing and evaluating complementary and competing spectrum uses through an organized informational format.



The evaluation of a particular spectrum use through the use of the RVI is based on the following rationale. Given two or more competing or complementary spectrum uses, each is assigned an RVI score. The score itself is not meaningful except in comparison with other RVIs: where, the greater relative value index is considered to make the greater comparative contribution to the realization of spectrum goals. It is assumed that, barring legislative or administrative requirements to the contrary, the use with the higher relative value index score should be assigned or allocated the bandwidth it needs vis-a-vis other users. This procedure clearly conforms to one of the primary aims of spectrum management, "of most efficiently allocating the available spectrum space to present users" while maintaining the necessary flexibility for considering and accommodating future spectrum needs.

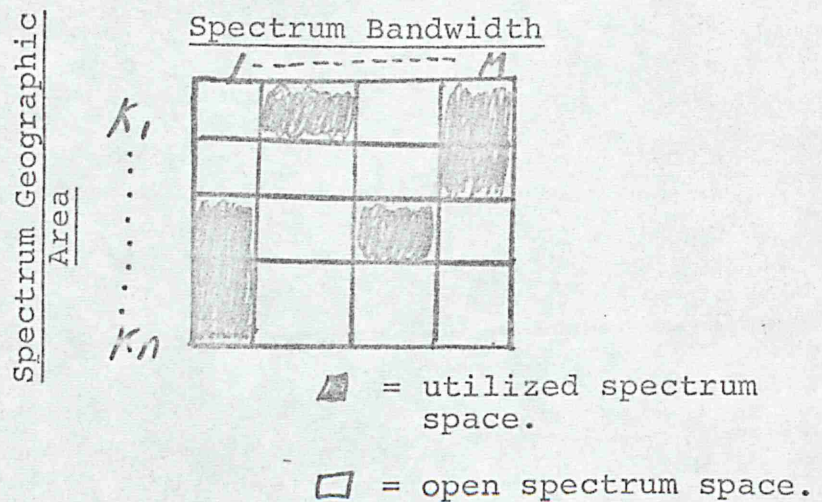
B. The Assignment Procedure

Spectrum allocations and assignments, given the RVI, is therefore conceptualized as a standard linear assignment with the aim of maximizing the sum of all assignments made,  $\text{Max} \sum_{i=1}^n \text{RVI}_i$ , where  $i=(1..n \text{ users})$ , as constrained by the amount of available spectrum. To accomplish this:

1. The nation is divided into  $k$  spectrum/geographic regions, (1 to  $K$ ).
2. Each request for spectrum is for  $K$  units of spectrum bandwidth, crossing 1 to  $k$  regions, with  $M$  units of spectrum available in each region. In this regard the spectrum to be allocated may be conceptualized as a



matrix  $[KM]$  as below: where the light matrix cells indicate available space not requiring any accommodation and where the dark cells indicate occupied space, the re-allocation of which means conflict, requiring effective accommodation.



3. Each request for spectrum has an  $RVI_i$
4. The Assignment aim is to maximize the use of spectrum within each region and for the nation as a whole.
5. The general algorithm for the computer based program is:

a) Max  $\sum_{i=1}^N RVI_i$ , subject to the constraints, that:

1) total units of spectrum assigned in

each region  $\leq N$ :  $\sum_{i=1}^N K_i \leq M$

2) total units of spectrum assigned

for the nation  $\leq KN$ :  $\sum_{i=1}^{KN} K_i \leq KM$



$$3) \quad K_{i \min} \leq K_i \leq K_{i \max},$$

(where  $i = 1, 2, \dots, N$  uses)

#### 5. Advantages of Proposed Approach

The following advantages may be said to accrue to both the OTP and the FCC from the employment of the RVI approach.

- . A comprehensive informational analysis
- . Consistency of application
- . A data format for more organized knowledge to improve decision making
- . Increased speed and reduced cost of processing applications
- . A base for a more self-regulating administrative spectrum assignment/allocation process.
- . Rapid review
  - individual cases being contested
  - periodic recalibration and continuous updating
- . Dynamic feedback and graphic representation
- . Spillover applications to other allocation problems

#### 6. Application of the RVI Model Within the Present Spectrum Management Process

Use of the RVI model in the spectrum assignment/allocation process would be through a computer facility with remote access terminals providing for two levels of man-machine interaction. The purpose being to modify present spectrum management procedures whereby the spectrum assignment/allocation process can assume the



posture of a self-regulating mechanism. The first level of man-machine interaction through the use of the RVI model is that of "inquiry". In this mode of operation, potential users of the radio spectrum can "inquiry" the computer data banks for specific information on particular frequency assignments currently existing in that portion of the spectrum which the potential spectrum applicant would like for his own use.\* Through the use of the model, this potential spectrum applicant is thus able to compare his potential technical, economic and socio-political performance against those users currently holding existing spectrum space. The results of this inquiry would provide the potential users with a comparative report, i.e., the information indicating his chances of receiving the particular spectrum assignment desired; and who in that particular portion of the spectrum competes, complements or may coordinate with him to insure a compatible frequency assignment. Use of this information by potential users at this initial inquiry stage avoids extensive and sometimes expensive interfaces with OTP spectrum managers.

The second level of man-machine interaction, through the use of the RVI model, would be in terms of a manager's specific frequency assignment/allocation decision. In particular the spectrum manager when faced with a key decision in a particular portion of the radio spectrum, would query the data bank, to determine which of the users in that portion of the spectrum should

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In this regard security data is to be adequately guarded.



be considered for possible replacement by a competing spectrum application. The spectrum manager would be able to compare the relative performance of existing, as well as, potential spectrum users in terms of technical, economic and socio-political factors. Further, he would be able to trace the impact of a particular spectrum user on a given geographic region, cross region, or on a cross country basis. He would be able to further evaluate a potential applicant with all users currently in contested portions of the spectrum. Armed with this information he would be able to make a more informed decision as to who should retain or release portions of the nation's spectrum resource.

It is anticipated that the "decision" mode of operation, described above, would be used only in rare instances: i.e., only when the RVI<sub>i</sub>s of more than one user are closely ranked and cannot be effectively distinguished. It is expected that most existing, as well as, potential spectrum users would rely on the "inquiry" man-machine interaction to determine, in advance, their chances of success in receiving authorization for a particular frequency in a particular geographic region. Through this type of facility, therefore it is anticipated that the self-regulating nature of the frequency assignment/allocation process could be enhanced and developed.

A sample illustration or experimental application of the RVI approach follows in the next section.



A PILOT STUDY OF THE RVI MODEL

The procedures to test the viability and the feasibility of the RVI approach as a decision tool for spectrum managers may be divided into three stages.

- . Stage 1 - Pre test: Model Refinement Application
- . Stage 2 - Test: Pilot Study
- . Stage 3 -Post test: Evaluation

A. Stage 1 - Pre Test

1. Select the specific radio service to be studied.
2. Select and define the particular spectrum/geographic setting for that radio service.
3. Determine the bandwidth parameter, within the specified spectrum/geographic setting for testing the RVI.
4. Define three test environments: historical, current, hypothetical.
5. Calibrate the RVI model to fit the peculiarities of the selected radio service within the specific spectrum/geographic setting. This task includes the following sub-tasks:
  - a. identifying representative users of this radio service which are in and which cross the specific spectrum/geographic region selected.



- b. refining the present technical, economic and socio-political performance characteristics in the selected radio service for the spectrum/geographic region under study.
- c. identifying additional characteristics necessary for but not necessarily included in the general RVI base-statement model.
- d. determining the appropriate units for measuring the performance characteristics.
- e. validating the performance characteristics to be included in the model in terms of their applicability to the specific radio service and spectrum/geographic setting selected including the applicability of social discount and probability of success factors.
- f. validating the relationships or combinations of the model to represent the viability of the characteristics selected for the particular service and spectrum/geographic setting.

6. Writing the computer algorithm for running the above validity tests of the calibrated RVI model.

B. Stage 2 - Test

- 1. Collect test data. This task requires that for each of the test environments (historical, current and hypothetical):
  - a. data which is currently available for testing purposes be identified.



- b. additional data to be used for test purposes be defined.
- c. data conversion mechanisms, capable of putting desired data into acceptable model format, be defined.

2. Test RVI model on sample cases within the time, radio service and spectrum/geographic region previously defined.

C. Stage 3 - Post Test Evaluation

1. Analyze and evaluate the results of initial test case experiments.

2. Study the necessary recalibration of the RVI so as to better depict the performance characteristics and relationships which exist for the various test environments, and achieve greater model application.

3. Document model assignment procedures including necessary constraints and algorithms.

4. Indicate the additional representative tests, if any, on different groups of test cases to further substantiate the reliability of the recalibrated RVI model and assignment procedure.

5. Evaluate and explain: (1) the findings of the pilot test by using expert opinion as an evaluation criteria in comparison with actual allocations and assignments; (2) the effectiveness of the model as a tool to assist in the spectrum management process; and (3) the ability of the model to speed and reduced costs of processing frequency applications.



It is hoped that this test of the RVI model will reveal the validity of the relative value approach as a decision tool for helping solve spectrum assignment/allocation problems. If in fact test results do confirm these expectations, additional experiments and calibration of the general RVI base statement model would be anticipated in other radio services for general application.

8. An Afterword on Budget and Time

It is expected that an experiment of the nature outlined above will require nine to twelve calendar months to complete, depending upon the availability of required data, expert personnel, etc. It will cost approximately \$50,000. Additional support in the way of a computer keyboard-type terminal will be required on a leased basis together with either a subscription to a local time-sharing service, or a hook up to the office's computer. This is needed to provide the working flexibility for effectively developing algorithms and for testing the model on actual spectrum decision cases. Out of pocket expenses are anticipated not to exceed 5% of the estimated contract fee of \$50,000.



EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF TELECOMMUNICATIONS POLICY  
WASHINGTON, D.C. 20504

*Spectrum  
allocation*

Date: January 19, 1971

Subject: FY 71 ADP Development for Spectrum Management

Via: G. F. Mansur

To: C. T. Whitehead

My January 4 memo requested authority to proceed with the two ADP development contracts for which \$200K has been allotted in FY 71 planning; one contract to be an extension of the HRB-Singer support of the present ADP system, the other contract to be for initial work on the development of a time-sharing system capability.

HRB-Singer support, which is required for day-to-day operations, cannot be extended until the cost of the time-sharing contract is known. A minimum of two months will be required to execute the contract. This period of time will extend beyond March 1, the expiration date of the current HRB-Singer contract.

In order not to jeopardize the support of day-to-day operations, it is urged that the expenditure of \$200K for these contracts be authorized now.

*Will*  
W. Dean, Jr.

cc: Mr. Urbany

*Eva - I believe there have been previous recommendations re this topic. Can you attach them to this and forward to Tom for his comments. Thanks.*

*gm*



EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF TELECOMMUNICATIONS POLICY  
WASHINGTON, D.C. 20504

CTW

GFM

S&D

File

Spectrum  
allocation

Date: October 7, 1970

Subject: Spectrum Allocation Alternatives

To: Bruce Owen

Following are some preliminary comments relative to your spectrum allocation paper (first draft).

First, I fully agree with your analysis on pp. 1-7 of various schemes previously proposed for improving the process -- i. e., they all fail to provide adequate incentives to both users and managers to economize, and provide no quantitative basis for evaluating the relative merit of alternative uses.

Your proposed reforms on pp. 8-16 are definitely an improvement, and merit much discussion. My initial reaction is that there are other options which might avoid some of the political and bureaucratic impediments to change while still providing significant improvement as well as leading toward the type of ultimate solution you envisage. I have some concern that lease or license fees alone -- however administered -- may be inadequate to bring about optimum allocation among individual users. Also, I question the implication that a profit-maximizing incentive of the RFAA monopolist would bring about the greatest net social benefit.

On the first point, it seems to me there must be a mechanism whereby individual users of the radio resource can buy out one another's rights, make direct compensation for interference, etc. Unless the RFAA included such options, I doubt that a uniform set of lease/license fees would ever extract the maximum benefit from this resource.

On the second point, it seems to me the complexity and difficulties involved in identifying noninterfering rights packages and carrying out sophisticated compatibility analyses might well convince the RFAA monopolist to minimize the number of entities with whom he dealt. In the extreme, it might well be most profitable for him to lease the entire spectrum to AT&T (for example) and establish no capability for compatibility/interference/rights analysis. While this drastic a



measure could likely be avoided by antitrust action, milder versions (e. g. dividing the spectrum pot among a small number of very large users) might well prevail. I suppose that one can always envision that one of these large interests might sublet spectrum rights, but the proliferation of middleman profits does not seem to me particularly conducive to maximizing social benefit. Also, I feel the small, individual user would really suffer under this situation.

Finally, it is important to recognize that, no matter what ultimate allocation mechanism one might contemplate, there is a long and painful road to reaching it. This leads me to conclude that the most important immediate task is to develop concepts and techniques which will be useful in quantitative spectrum management no matter what its ultimate form. For example, there is presently no widely accepted definition of what institutes the "radio resource," nor any system of units for measuring its use. I contend that such information is essential to any quantitative allocation method -- be it administrative, shadow pricing, lease/license, or free market. Furthermore, there is no capability or methodology for routine electromagnetic compatibility analysis. Again, since spectrum rights cannot be made sufficiently discrete or noninteracting, I feel such a capability is essential for any allocation system, and even for a pilot operation. It is probably true that private initiative would have developed such a capability if a different approach to spectrum management had been adopted earlier. However, the fact that the government has allowed such large investments to be made in spectrum uses under its administered, highly conservative approach to compatibility makes it virtually imperative that the government develop this capability now prior to the adoption of any new allocation system.

I suppose my comments can best be summarized as follows:

- 1) The reforms you propose are certainly worthy of serious consideration.

- 2) I have some concern over the efficacy of the lease/license fee as the sole method of determining value of alternative uses, and the potential actions of a profit-maximizing RFAA monopolist.



3) I suspect there are other alternatives involving direct interactions among users -- but short of a free market -- which should be explored.

4) I feel there are interim steps which must and can be taken to develop a quantitative measure of spectrum use and methods for handling the compatibility problem, which are common to any quantitative spectrum management approach.

5) The road to a better spectrum management system is long and tortuous, and many interests will have to be carefully orchestrated throughout its course. Thus, we should be very discreet in laying out what we think the ultimate objectives (or alternatives) are, and concentrate our public activities on those efforts which are noncontroversial (e. g., items under 4 above).

Walt Hinchman

cc: Mr. Hinchman  
Mr. Whitehead ✓

WHinchman:jm



Spectrum Allocation: A Proposal for Reform

Bruce M. Owen

Brookings Economic Policy Fellow  
Office of Telecommunications Policy  
Executive Office of the President

First Draft: 9/14/70

Second Draft: 9/22/70

Third Draft: 9/30/70

NOTE:

This is a draft circulated for discussion and comment. It should not be quoted or referred to without permission. Views expressed herein are those of the author, and should not be associated either with the Office of Telecommunications Policy or with the Brookings Institution.



## Abstract

The proposal made in this paper is designed to constitute a compromise solution to the spectrum allocation problem. In the discussion, both a decentralized free market mechanism and a fully centralized bureaucratic allocation mechanism are considered and rejected.

Instead, it is proposed to retain centralized decision-making while at the same time inserting economic incentives and a feedback loop into the allocation process. This is accomplished by transferring allocation authority into the hands of a private, profit-motivated, manager under contract to the government. The government retains ownership and ultimate control of the radio spectrum; no private property rights are established.

Adoption of the proposal implies a basic policy decision in favor of the use of economic incentives as the dominant force in spectrum allocation, and it assumes the existence of sufficient executive and legislative vigilance to ensure that ancillary anti-social results of this policy, if any, can be corrected.



## INTRODUCTION

There have been in recent years a number of proposals for reform of the radio spectrum allocation procedure.<sup>1</sup>

The very number of these proposals suggests that there is a widespread belief that the allocation process needs to be improved. In spite of this, no one has demonstrated that the present procedure is bad, nor has anyone proposed an objective standard by which to judge the efficiency of present decisions. Most of the proposals for reform are designed to insert into the decision-making process more reliance on economic and social factors, and less on engineering considerations. They do this at one extreme by advocating the institution of a full-fledged market in spectrum rights.<sup>2</sup> This position requires that property rights in the spectrum be defined ab novo, since current definitions of private property are not readily applicable to the physical characteristics of the electromagnetic spectrum. At another extreme, it is proposed to modify the present system by making spectrum managers aware of economic and social factors.<sup>3</sup>

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1

See Bibliography.

2

See references 9 and 22.

3

See reference 41.



The essence of the present allocation system is that a centralized Federal bureaucratic decision procedure is used to assign spectrum to various uses and users in a manner consistent with the "public interest." This is a necessarily vague criterion, and lends itself to various abuses.<sup>4</sup>

This paper proposes a new structure for spectrum allocation which lies somewhere in between the bureaucratic and the market extremes. It has some of the merits and some of the deficiencies of both, as with any compromise solution. It breaks at certain points with existing law and existing philosophy, but not so radically as the market proposals do. It is nevertheless a basic premise of this proposal that economic incentives ought to play a dominant role in spectrum allocation, while non-economic considerations should be allowed to override only in special cases and then only as a result of specific legislative initiative. This premise is not consistent with existing practice and therefore requires an explicit policy choice.

It is true that use of the spectrum has significant social implications. However, the social role of the spectrum resource

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For a discussion of the motivations of a bureaucracy, see William A. Niskanen, "The Economics of Bureaucracy," American Economic Review, May, 1968.



is certainly not much different from the social role of other scarce and valuable national resources. With other resources we are able through social policy to make special modifications of the basic Free Enterprise economic structure of incentives when such modifications will serve the public interest. The same sorts of arrangements can be made, if necessary, with spectrum. One advantage of the proposed reform structure is that the social costs of such decisions will be made explicit, giving legislative and executive decision-makers better information about the real costs and benefits of various social policy choices.

A second major premise of this proposal is that the economic incentives have to be made explicit. Even the best-intentioned bureaucratic allocation procedure, if it lacks an incentive-feedback mechanism by which the decisions it makes have direct economic effects on itself, can fall into inefficient choices. The absence of a feedback mechanism means that the well-intentioned bureaucratic decision maker must gather very large amounts of information. This is an expensive procedure; it is not always clear which information is required, and some will be unavailable.

Finally, the essence of this proposal is that a centralized ("monopolistic") allocation mechanism is superior to a de-



centralized ("free market") allocation mechanism, but that the centralized allocation authority needs to be provided with a set of direct economic incentives in order to operate efficiently. If one is willing to assume that the legislative or executive branches of the government will be effective in overriding antisocial actions, if any, of such a central economically motivated authority, then there is a presumption that the proposal here will be at least not inferior to the present mechanism.

In sum, adoption of the proposal made herein presupposes the following basic policy decisions: (1) Economic incentives should dominate the spectrum allocation procedure; (2) A centralized, non-market approach is required by the nature of the physical characteristics of the spectrum; (3) Social results of the economic incentive structure can be effectively reviewed and, if necessary, corrected, by the government, as they are in other areas of the economy; (4) Bureaucratic decisions, however well intentioned, can not in this area achieve the same level of efficiency at commensurate or lower cost as can be achieved by an economically motivated decision maker.

The particular institutional structure proposed here is not the only one which could effectuate these policy decisions. In particular, the regional agencies and the separate national



authority are not essential features of the proposal. The same general result could in principle be obtained by proper legislative instructions to the FCC, and that approach might well be the only practical political means of implementing this proposal. However, a new institutional structure does possess the advantage of emphasizing the substance of the proposed change.

The precedent for a change of the type proposed here exists in the Postal Reform Act and in the spin-off of the Federal National Mortgage agency and the Land Bank, as well as other quasi-official financial intermediaries. Other precedents include the use of private concessionaires in national parks and the procurement of defense material from private contractors. Thus, if the basic policy goal is adopted, implementation of the proposal can take any of several institutional forms (only one of which is presented below) each of which has some sort of historical-legal precedent.



## PREVIOUS PROPOSALS FOR REFORM

### Establishing a Market in Spectrum

The contribution of economists to the problem of spectrum allocation has taken the form of advocating the establishment of a market or quasi-market in spectrum assignments. This proposal was for a long time advocated by Professor Coase,<sup>5</sup> and later examined by Professor Levin.<sup>6</sup> The proposal was given extensive analysis in a study for the President's Task Force on Communications Policy.<sup>7</sup>

The principal objections to a market mechanism for spectrum allocation are: (1) The definition of the property right is extremely difficult; (2) Some sort of "zoning" requirement would be needed to protect the rights of those who have invested in receiving equipment; (3) The establishment of a market is, in practical terms, a political impossibility; and (4) The adjudicatory process such a market would require could be very costly.

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See references 4 through 8.

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See references 32 through 38.

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See references 22, 9, and President's Task Force on Communications Policy Staff Paper 7.



Perhaps the most serious objection from an economic standpoint is that interference is cumulative rather than bilaterally separable and identifiable.<sup>8</sup> This fact leads to the presumption that a market would be seriously inefficient due to the presence of uncorrectable externalities.

#### Shadow Prices and License Fees

Other reformers have proposed that the spectrum be allocated by calculating "shadow prices" and making assignments on the basis of comparative scarcity value as indicated by these calculations. There is also some suggestion that license fees be charged which simulate shadow pricing; a shadow price is the scarcity value of the frequency assignment.

The objection to the use of shadow pricing is that even in principle it is extremely difficult to make the proper calculations -- and in practice the amount of information required is enormous. The cost of calculating such values might well outweigh the benefits derived

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W. R. Hinchman, "Appendix A" to Staff Paper 7 of the President's Task Force, Federal Clearinghouse volume PB 184 421 (1968).



thereform. License fees, if used properly, can succeed in extracting the monopoly profits gained by users as a result of spectrum scarcity, but they are no help in allocation as between alternative uses of a given spectrum right. Calculating the "correct" license fees for purposes of allocation (as opposed to redistribution of monopoly profit) is just as difficult as calculating shadow prices.

Management by Committee of Experts or by Formulae

Several studies have proposed that the solution to spectrum management efficiency problem lies in the construction of a mathematical index to reflect economic, social and technical values of alternative uses, or in a committee of experts in several disciplines to make decisions on the same basis.<sup>9</sup> These proposals are designed mainly for use by the Director of the Office of Telecommunications Policy, and are made partly in reaction to the emphasis on engineering and technical standards heretofore dominant.<sup>10</sup>

The principal objection to either approach is that there still exists no standard measure of performance and no presumption that the new approach is better than the old (or at least worth its cost),

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See reference 41, and L. Hoxie and S. J. Bernstein, "Spectrum Management: The Relative Value Approach." draft. Office of Telecommunications Management, 1970.

10

See Reference 30.



due to the absence of an incentive structure responsive to the effects of the decisions. The formulae or index numbers suffer from the standard index number problem: a single number can never convey the information required for a multidimensional decision. The Committee of experts must still be told what to do and how to do it; their expertise is useless in the absence of an objective decision rule.

#### The Regional Approach

The block allocation procedure leads to certain gross inefficiencies which can be corrected by decentralizing part of the allocation authority. The case of New York is often cited, where certain police and taxi frequencies were very crowded, while assignments reserved for the forestry service remained idle. The FCC is experimenting in Chicago with a regional manager to solve such obvious inefficiencies. However, the regional approach does not solve the fundamental problem of efficient allocation. The regional manager still has no objective decision rule, and no sweeping authority to reallocate between broad spectrum uses. Users still have no incentive to conserve spectrum.

#### Summary of Criticisms of Present Structure

Even though we have no concrete evidence that the present allocation procedure results in inefficiencies, there are a number of reasons to suppose that it must. Among these, critics have drawn attention to the following: (1) the separation of authority between the FCC and the OTP;



(2) the absence of an economic incentive for users to conserve spectrum either through use of efficient equipment or time sharing or non-hoarding of assignments not yet needed; (3) the rigidity of the block-allocation process; (4) the necessarily arbitrary interference standards resulting from the specification of input rights; (5) the absence of a mechanism for users to negotiate, make side payments, or compromises; (6) the slowness of the FCC decision-making process; (7) the allegedly excessive weight given to national security users of the spectrum; (8) the fact that FCC and OTM have emphasized sunk costs of existing users as an important decision-making input.

Most of the proposals for reform attempt to solve one or more of these problems. From an economic point of view, there are two extremes to which one can resort in achieving efficiency: the decentralized market mechanism or full integration and internalization. It is reasonably clear that a market mechanism would be both operationally awkward and politically unacceptable. We are left with internalization, or the containment of all the effects of the decision-making process in the body which makes the decisions. Except for the split between FCC and OTP, the decision process is now internalized, but its effects are not; that is, there is no feedback loop by which the decision-maker is made to feel the economic impact of his decisions. The proposal below attempts to put such a feedback loop into the present structure.



## A PROPOSAL FOR REFORM

Any realistic proposal for reform must satisfy certain criteria. Among these are the necessity to create some sort of measuring device so that spectrum managers can evaluate the relative worth of the spectrum in different uses, the necessity to preserve federal control at some stage over the qualifications of users, and the need to instill an appropriate incentive structure in both the management and usage processes.

To this end, it is proposed that there be established a number of non-profit public corporations organized on a regional basis.<sup>11</sup> Each such organization would be called a Regional Frequency Allocation Authority (RFAA), and would have the power (subject to the qualifications below) to allocate and to assign frequencies within its geographical region. This power of each RFAA would be limited to frequencies of 50 MHz and above and to transmitters within its region.<sup>12</sup> Each RFAA would charge fees for use of the frequencies under its control, using these fees to determine the most valuable uses of the spectrum. The revenues of each RFAA in excess of costs would be payable to the United States Treasury.

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<sup>11</sup>

The exact number is a matter for careful study. The regional aspect of this proposal is not crucial; the optimal number may be one, although this seems unlikely.

<sup>12</sup>

This frequency range, like the number of regions, is not crucial to the instant proposal.



Each RFAA would be managed by a private contractor whose term of contract would be ten years. At the end of each ten-year period, the RFAA management position would be the object of competitive bidding by any private corporation or partnership qualified to act as manager. The Federal Communications Commission would set standards and determine the qualifications of competing management organizations. Each managing group would receive 10% of the net revenues of its RFAA as a management fee. The proceeds of the decennial auction of the management contract would be payable to the United States Treasury.

The fee structure of the RFAA would be determined by the manager, subject to certain conditions set forth below. Each manager would have an incentive to maximize the revenue of its RFAA, after costs, and therefore to find the most valuable uses of spectrum. This is the crucial feedback mechanism.

No firm would be allowed to manage more than one RFAA at a time or to engage in other businesses related to use of the spectrum.

The manager of each RFAA would have authority to set such interference standards and input or output requirements as it wished within its region, provided that interference levels at the border of each region could not exceed those in effect at the time of creation of the RFAA except by mutual arrangement with the neighboring RFAA.



Each RFAA in effect leases the spectrum in its region above 50 MHz from the FCC and then subleases it to individual users. Its authority would be limited by all relevant laws and by the FCC and the Central Frequency Allocation Authority.

The Central Frequency Allocation Authority would be a non-profit corporation operating on a national scale. It would have authority to allocate and assign frequencies below 50 MHz for appropriate fees. It would also serve as the central coordinating authority for uses of the spectrum requiring national standardization (e.g., air mobile, safety).<sup>13</sup> In addition, the CFAA would be responsible for RFAA compliance with such ITU regulations and other international agreements as are relevant to the operation of individual RFAs.

The CFAA would be controlled by a board of directors made up of one representative from each RFAA and an equal number of Presidential appointees, including, ex officio, the Chairman of the FCC, the Director of Telecommunications Policy, the Secretary of Commerce, and the Secretary of Defense. (Presidential power in this area is preserved both by these appointments and by OTP control of national security uses of the spectrum, discussed below).

Each RFAA would be empowered to lease spectrum to both government and non-government users, with the exception that spectrum assignments requested by the Director of the Office of

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The issue of standardization will be involved in the determination of the optimal number of regional authorities. Some engineers place enormous emphasis on the need for and economies of standardization of equipment.



Telecommunications Policy, on the advice of the National Security Council, for national security use would be made by the CFAA. The fee for use of such assignments as are required for national security purposes would be negotiated by the CFAA with the Director of the Office of Telecommunications Policy and the appropriate security agency. The CFAA would have authority to preempt all RFAA power with regard to national security uses, except that fees received therefrom would be allocated to the RFAA concerned, after costs.

Non-security government users of the spectrum would negotiate directly with the relevant RFAA, paying appropriate fees. Except for national security uses, the distinction between government and non-government use would be dissolved.

The Federal Communications Commission would continue to have the power to (a) negate decisions of any RFAA or the CFAA which violated any international agreement of the United States, (b) set standards of fitness for spectrum users, or classes of users, and to negate decisions of any RFAA or the CFAA which violated those standards or which led to the use of the spectrum in a manner not in the public interest, (c) set standards of fitness for managers of each RFAA, (d) impose allocations and assignments for public safety uses if and when it determines that the public interest is not



served by RFAA or CFAA decisions affecting such use. The FCC would also have the power to remove for cause any RFAA manager found not to be operating lawfully.

Individual RFAAs would be prohibited from discriminating among competing users on any basis other than ability to pay, subject to the fitness standards set by the FCC. No RFAA would be empowered to control or censure the content of any communication, and could not deny sublease renewal on the basis of such content. The RFAA would, in each case, be responsible for a reasonable determination that each user apparently met the standards of fitness set by the FCC. The FCC could then determine after due process that the standards are not met. There would be no automatic review of individual users' fitness by the FCC. However, the FCC could on its own initiative, on the basis of a complaint, or on request by any RFAA make such a determination.

The decisions of the CFAA with regard to compatibility and other matters affecting the relations between different RFAAs should be appealable to the FCC and then to the Courts. Individual RFAAs could make payments to the agreements with other RFAAs subject to review by the CFAA. In the event that the revenues from allocations and assignments below 50 MHz did not cover the costs of the CFAA, the deficit could be made up by uniform percentage contributions from each RFAA. The FCC might be similarly financed.



Assignment subleases by any RFAA would be for a period to be agreed upon by the RFAA and the user, but not longer than 10 years or less than 3 years. Any assignment would be pre-emptible by the CFAA under the national security clause. For legal purposes, assignment contracts would be made by the RFAA as an institution, rather than by its manager, and would be binding on subsequent managers. Neither any RFAA nor its manager would be subject to the antitrust laws, except for violation of the prohibition on engaging in other spectrum-related activities. No RFAA manager would be allowed to accept payment or favor in any form from any user, except the 10% after cost management fee. No RFAA would be subject to state or Federal taxes, but RFAA managers would be subject to the same taxes as any private corporation.

RFAA assignments would be made to common carriers who are otherwise subject to regulation by state or Federal regulatory authority, subject to the usual regulatory approval. Common carriers newly created who are customers of the RFAA would not be regulated by it as to rates or other matters unrelated to the spectrum assignment.<sup>14</sup>

#### Discussion

The purpose of the framework proposed here is to provide the manager of the RFAA with an incentive to maximize the economic value in use of the spectrum in his region by tying his compensation

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The point here is that the RFAA may maximize net revenue by granting monopolies -- for instance to land mobile common carriers. If it thus creates new monopolies, these may be regulated -- but not by the RFAA.



directly to the revenues of the RFAA (and the Treasury) from subleases. The RFAA and its manager are monopolists and can be expected to charge high prices for the spectrum.<sup>15</sup> The ten-year contract bidding process in turn is meant to extract grossly excessive profits of managers. The RFAA has an incentive to take into account interference and to make allocations on an efficient basis with regard to such interference. Nevertheless, monopolists do charge too much for too little. I see no way around this; surely any attempt to regulate the prices charged by the manager would be self-defeating. At least the outcome of monopoly pricing is predictable (and in our economy not unusual), whereas the efficiency implications of present practice are unknown. The FCC has the power under this proposal to make public safety assignments. The 3 to 10 year period for leases provides some stability.

That the FCC retain some control over the qualifications of users is inevitable and perhaps beneficial, since there is no way to predict the outcome of a completely unregulated system. Users themselves would, of course, be subject to the antitrust laws and/or common carrier regulation, so that the profit of the RFAA manager can not be maximized by creating uncontrollable monopolies. There

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The limits to its monopoly power are the existence of more or less close substitutes for spectrum use: wire, cable, transport, manpower.



may be some difficulty with the transfer prices between regulated utilities and the RFAAs, but no more than at present with any supplier of a regulated entity.

The special national security arrangements are obviously necessary in any such scheme, but there is no reason why government users should not pay for spectrum the way they pay for pencils or battleships. The CFAA control below 50 MHz is required by the ionospheric propagation characteristics in these frequencies, which do not lend themselves to regional boundaries and which are important internationally. Some degree of national coordination with regard to highly mobile users is clearly necessary. Since neither the CFAA nor the RFAAs have any plant or need for extensive working capital, no special arrangements for these are required. The managers of the RFAAs can spend money on monitoring up to the point of efficiency in preventing violations from reducing the value of -- and revenue from -- the spectrum.

This is, in sum, a second-best sort of proposal. It will not result in perfectly efficient allocation even in a partial equilibrium framework, except on the highly unlikely supposition that RFAA managers practice perfect price discrimination.<sup>16</sup> But the proposal

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Which ought not, by the way, to be prohibited.



does have the virtue of resulting in an allocation which is predictably (and possibly calculably) different from efficiency, and it does result in objective allocation criteria. Furthermore, it lends itself to testing, since one experimental RFAA could be established and observed. The newly installed license fee structure of the FCC provides an instrument of transition. Most important, the proposal results in the establishment of an appropriate set of incentives for spectrum conservation by both users and managers.

#### Implementation

Full implementation of this proposal might necessitate enabling legislation. However, both OTP and the FCC probably have the power to try it experimentally. As emphasized above, the crucial feature of the plan is the private manager. Other features, such as the regional organization, the range of frequencies falling under its control, and the degree of central coordinating power, are less crucial. If an experiment is attempted, one promising possibility is the assignment of a private firm to manage land mobile assignments in some large metropolitan area. The next step would be to delegate to such a manager similar authority over the broadcast and microwave frequencies, removing the block allocation barriers. At that point sufficient evidence should be available to judge the basic merits of the proposal.



## SUMMARY TABLE OF ORGANIZATIONAL ASSIGNMENTS

### Regional Frequency Allocation Authorities:

- Nonprofit public corporations
- Leases all frequencies above 50 MHz from FCC
- Collects license fees from users
- Pays excess income to Treasury
- Makes reasonable determination that users appear to meet FCC standards, but otherwise assigns on basis of ability to pay.
- Prohibited from controlling content or making any censorship rules.
- Subject to authority of CFAA in some matters and to authority of FCC in all matters.

### RFAA Managers:

- Private, profit-making corporations
- Manages each RFAA under a 10-year contract
- Contract awarded to highest qualified bidder
- Sets all license fees and determines allocations and assignments on a three to ten year basis
- Removable by FCC for cause
- May not operate more than one RFAA at one time or engage in other spectrum-related activities
- Receives 10% of net (after cost) revenues of RFAA as management fee.

### Central Frequency Allocation Authority:

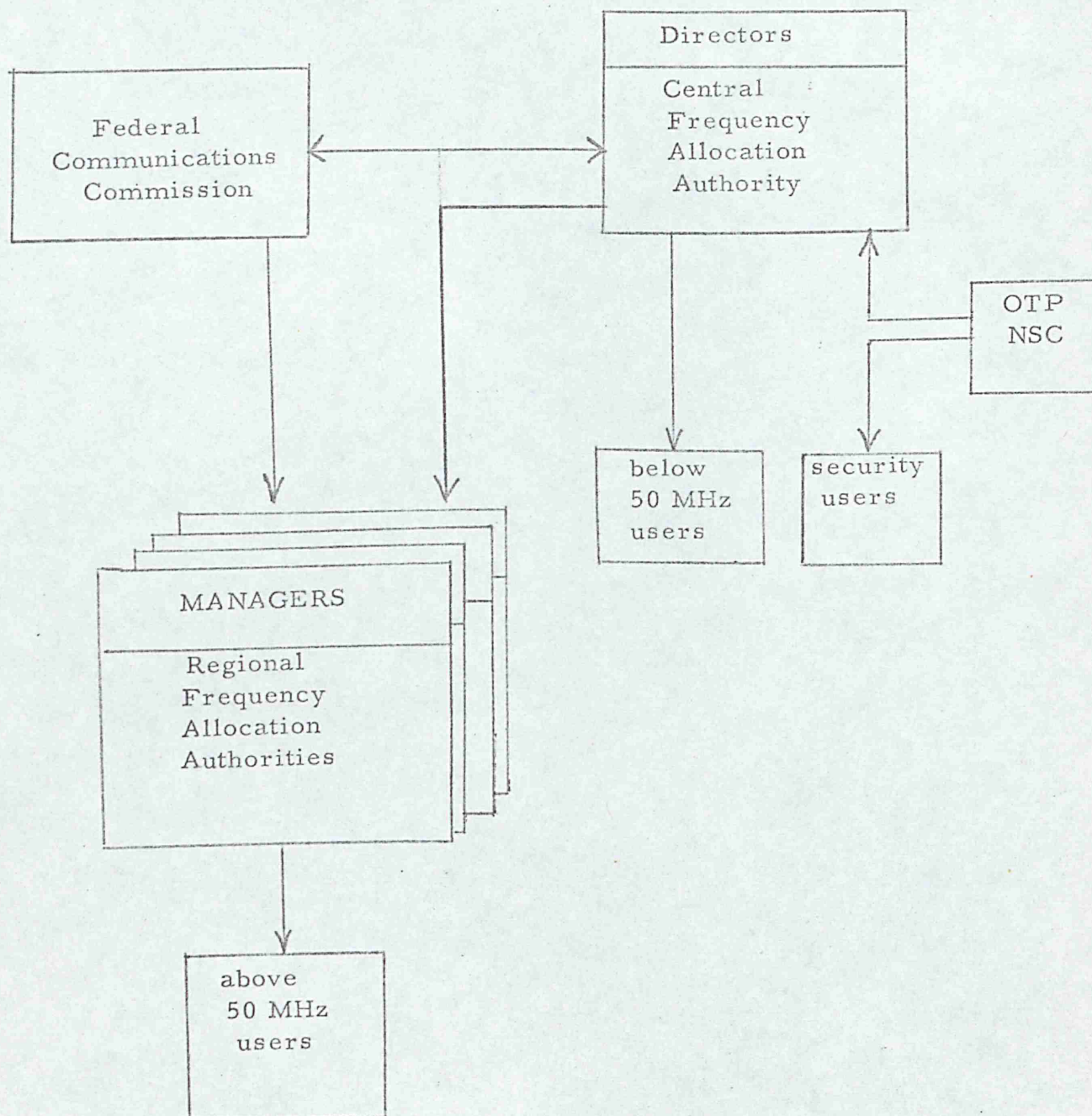
- Board of directors: half RFAA representatives, half Presidential appointees
- Allocates and assigns frequencies below 50 MHz
- Assigns frequencies for national security use on request of DOTP and NSC.
- Coordinates activities of RFAAs for mobile and other uses requiring national standardization
- Ensures compliance with international agreements

### Federal Communications Commission:

- All present allocation and assignment functions delegated to RFAAs and CFAA
- Retains right to set standards of qualification for users and to veto any RFAA decision found not to be in the public interest
- Sets standards of fitness for RFAA managers
- Retains responsibility for international matters through CFAA
- Prohibited from making domestic non-safety block allocations or any generic restriction on spectrum use.



## DIAGRAM OF MAJOR INSTITUTIONS





## APPENDIX

Note: These comments of frequency management were based on an earlier draft of the paper. The present draft omits some of the points addressed in these comments, but no deliberate attempt has been made to respond to them. They are included here as an Appendix because they are germane to the problem of implementation rather than to the intrinsic merits of the proposal per se.



23

EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF TELECOMMUNICATIONS POLICY  
WASHINGTON, D.C. 20504

Date: September 24, 1970

Subject: Comments on "Spectrum Allocation: A Proposal for Reform"

To: Mr. B. Owen

The subject paper has been reviewed by Frequency Management interests of OTP and the following comments are submitted in the interest of being helpful:

a. Current Situation - The subject study is based on the premise that the current situation is bad and "is in large part due to a series of historical accidents". This is not considered to be valid since, while there is no denying that there are problems requiring attention in the spectrum allocation area, there are no known requirements vital to the nation which are going unfilled. The President's Task Force on Communications Policy explored this item in depth and could cite no instance wherein critical requirements were not being met. As a related matter, the recent National Academy of Engineering Study on the "Application of Social and Economic Values to Spectrum Management" contains the statement that:

"We believe however that a full review of the past in the light of such considerations leads one to conclude that the net results of spectrum management have not been too bad, but also suggests that advances in technology have played a dominant part in making the judgment valid."

It is suggested that a more correct approach would be to state that the present system has produced useful results but improvements are necessary in order to meet the foreseen increasing needs of the future.

b. Legal Aspects - The subject proposal assumes that a procedure which maximizes the economic value of the spectrum is in the best interest of the nation. This assumption is subject to serious question and certainly is contrary to the intent of the Congress in establishing the Federal Radio Commission and later the FCC. The underlying incentive for such measures was that the use of the spectrum among competing



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applicants should be in a manner responsive to the public "convenience, interest or necessity". In this regard, it is interesting to note that before 1927 the allocation of frequencies was left entirely to the private sector and the result was chaos. This chaos dictated a need for a series of National Radio Conferences between 1922 and 1925 at which time it was resolved that regulation of the radio spectrum by the Federal Government was essential and that regulatory powers should be utilized to ensure that allocation of this limited resource would be made only to those who would serve the public interest. It is also observed it was not long-distance communications frequencies, as indicated in subject report, which brought pressure to bear for regulation of the spectrum resource, but rather medium range broadcast frequencies. It was considered by those knowledgeable that without Government control the medium would be of little use because of the cacaphony of competing voices, none of which could be clearly or predictively heard. The following statement by Congressman White, a sponsor of the Bill enacted as the Radio Act of 1927, bears on the need for legislation:

"We have reached the definite conclusion that the right of all our people to enjoy this means of communication can be preserved only by the repudiation of the idea underlying the 1912 Law that anyone who will may transmit and by the assertion in its stead of the Doctrine that the right of the public to service is superior to the right of any individual . . . The recent radio conference met this issue squarely. It recognized that in the present state of scientific development there must be a limitation upon the number of broadcasting stations and it is recommended that licenses should be issued only to those stations whose operations would render a benefit to the public, are necessary in the public interest, or would contribute to the development of the art. This principle was approved by every witness before your Committee. We have written it into the Bill. If enacted into law, the broadcasting privilege will not be a right of selfishness. It will rest upon an assurance of public interest to be served."



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It is also interesting to note that the Supreme Court of the United States recently supported the philosophy underlying the establishment of the Communications Act, as witness their decision on the Red Lion Broadcasting Company Inc. vs. the Federal Communications Commission under date of June 9, 1969. The Court quoted a 1959 Senate report on amending the Communications Act that:

"Broadcast frequencies are limited and, therefore, they have been necessarily considered a public trust. Every licensee who is fortunate in obtaining a license is mandated to operate in the public interest and it is assumed the obligation of presenting important public questions fairly and without bias."

The Court also went on to state that:

"It was this fact (problem of interference), and the chaos which ensued from permitting anyone to use any frequency at whatever power level he wished, which made necessary the enactment of the Radio Act of 1927 and the Communications Act of 1934. It was this reality which, at the very least, necessitated first the division of the radio spectrum in the portions reserved respectively for public broadcasting and for other important uses such as amateur operation, aircraft, police, defense and navigation; and then the subdivision of each portion, and assignment of specific frequencies to individual users or groups of users."

The Court also observed:

"It is the right of the viewers and listeners, not the right of broadcasters, which is paramount."

The Court also stated that:

"The first amendment confers no right on licensees to prevent others from broadcasting on "their" frequencies and no right to an unconditional monopoly of a scarce resource which the Government has denied others the right to use."



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The Court went on that:

"Licenses to broadcast do not confirm ownership of designated frequencies, but only the temporary privilege of using them."

In another case (FCC vs. Pottsville Broadcasting Co., 1940), the Supreme Court noted that:

"The statutory standard was a supple instrument to effect Congressional desires to maintain a grip on the dynamic aspects of radio transmission and to allay fears that in the absence of Governmental control the public interest might be subordinated to monopolistic domination in the broadcasting field."

In the Red Lion Case, the Court also noted that:

"Scarcity is not entirely a thing of the past. Advances in technology, such as microwave transmission, have led to more efficient utilization of the frequency spectrum but uses for that spectrum have also grown apace. Portions of the spectrum must be reserved for vital uses unconnected with human communication, such as radionavigational aids used by aircraft and vessels. Conflicts have even emerged between such vital functions as defense preparedness and experimentation in methods of averting mid-air collisions through radio warning devices. Land mobile services such as police, ambulance, fire departments, public utility, and other communications systems have been occupying an increasingly crowded portion of the frequency spectrum and there are, apart from licensed amateur radio operators' equipment, 5,000,000 transmitters operated on the "Citizens Band", which is also increasingly congested. Among the various users of radio frequency space, including marine, aviation, amateur, military and common carrier users, there are easily enough claimants to permit use of the whole with an even smaller allocation to broadcast radio and television uses that now exist."



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Comparative hearings between competing applicants for broadcast spectrum space are by no means a thing of the past. The radio spectrum has become so congested at times it has been necessary to suspend new applications. The very high frequency television spectrum is, in the country's major markets, almost entirely occupied, although space reserved for ultra high frequency television transmission, which is a relatively recent development as a commercially viable alternative, has not yet been completely filled.

The rapidity with which technological advances succeed one another to create more efficient use of spectrum space on the one hand, and create new uses for that space by ever growing numbers of people on the other, make it unwise to speculate on the future allocation of that space. It is enough to say that the resource is one of considerable and growing importance whose scarcity impelled its regulation by an agency authorized by Congress. Nothing in this record, or in our researches, convinces us that the resource is no longer one for which there are more immediate or potential uses than can be accommodated, and for which wise planning is essential."

The Court therefore concluded that:

"In view of the prevalence of scarcity of broadcast frequencies, the Government's role in allocating these frequencies, and the legitimate claims of those unable without Government assistance to gain access to those frequencies for expression of their views, we hold the regulations and ruling at issue here are both authorized by statute and constitutional."

The foregoing is cited to indicate the nature of the posture in which we find ourselves in proposing "A Proposal for Reform".

As a related matter, it is noted that Black's Law Dictionary defines Private Property as:

"Protected from being taken for public uses, is such property as belongs absolutely to an individual, and of which he has the exclusive right of disposition;



property of a fixed, specific, and tangible nature, capable of being had in possession and transmitted to another, such as houses, land, and chattels."

Frequency spectrum fails in at least 3 out of 4 elements of the definition of private property. Even the 4th, i.e. tangible nature, is debatable.

Also, from the policy standpoint it is submitted that the proposal would render the FCC "all powerful" and would not maintain the balance envisaged in the Communications Act between the President, as Chief Executive and Commander in Chief on the one hand, and the Federal Communications Commission on behalf of the non-Government entity on the other.

c. Technical Problems - The proposal for reform does not take into account sufficiently the national and international requirements for standardization in many uses of radio, e.g., amateur, radio navigation, radio astronomy, meteorology, aeronautical and maritime communications, etc.

The subject proposal would split the cognizance of procedures for the spectrum at 50 MHz. This does not take into account the fact that above 50 MHz there are propagation conditions, particularly during portions of high solar activity, where frequencies up to 150-200 MHz may be subject to long distance propagation. Also, there is no recognition of the fact that space technology has now been injected into major portions of the spectrum (VHF, UHF, EHF, etc.), which were considered formerly as being line-of-sight and local in nature. By virtue of placing antennas at altitudes in the vicinity of 22,300 miles above the earth's surface in synchronous orbit, such frequencies, from a technical standpoint, become comparable to frequencies below 50 MHz.

No recognition is made in the proposal under consideration for the need for production line standardization. It is inconceivable that standardization throughout the United States, and even internationally to a significant extent, would not be effected for such services as television broadcasting, FM broadcasting, AM broadcasting and certain mobile applications. While it is agreed that sub-allocation to the degree of refinement such as evidenced in certain non-Government bands under cognizance of the FCC at the present time is unduly restrictive, conversely, it is considered that a major portion of the present allocation structure should not be destroyed in order to remedy what is considered to be a minor difficulty by comparison.



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d. Social Aspects - Any concept based only on "ability to pay" will certainly be challenged by the Congress as being not responsive to the needs of today's society. For example, if the law of economic survival were to be brought to bear with respect to the spectrum, it is difficult to conceive how needs such as those in support of small business, education, municipal police, fire, telemetering of water resources, telemetering of electrical power distribution systems, etc., would be met. It is submitted that the basic philosophy of saving or making money is to a large extent accountable for the prostitution of the ecology with which we find ourself grasping at the present time, i.e., it is cheaper to pour sewage into rivers than to make disposal by other means.

e. General - As evidenced by sub-paragraph a. above, there is a considerable background and experience which went into developing the structure with which we find ourselves today with respect to the use and management of the radio spectrum. It is noted that on page 6 the subject paper states that:

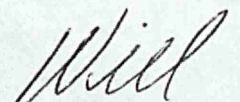
"The principal objection to either approach is that there still exists no standard measure of performance and no presumption that the new approach is better than the old (or at least worth its cost)."

This same comment is considered to be applicable to "A Proposal For Reform", i.e., there is no assurance that, even if other obstacles could be overcome and such a system brought into being, conditions would be any better than they are under the present arrangement. In fact, in the view of the undersigned it is a virtual certainty that conditions would be worse. More dollars would be involved in setting up the structure envisaged, there would be less order, little standardization, and it is incongruous for the taxpayer to be forced to pay for services provided freely (from a spectrum standpoint) by the Government to the public, and upon which the public is increasingly dependent (National defense, safety of public officials, air navigation, maritime navigation, management of land, etc.).



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f. Alternatives - It is recommended that, instead of pressing the concept envisaged in the subject proposal, ~~there~~ a more realistic means be found for improving the present mechanism of frequency management by developing measures wherein economic and social values can be taken into account.

  
W. Dean, Jr.



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Note: This bibliography was prepared by Douglas W. Webbink under the title "Bibliography on FCC Frequency Spectrum Allocation and Assignment" (August 1970).



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Congressional Authority for Fees Proportional  
to Value in Use

The following quotation from Title V of the Independent Offices Appropriations Act of 1952 (31 U.S.C. at 483 (a)) was quoted by the F.C.C. in its Report and Order in Docket 18802 in the matter of Amendment of the Commission's Rules Relating to the Schedule of Fees, FCC 70-694 (23 FCC 2d 880) released July 2, 1970.

→ It is the sense of the Congress that any work, service publication, report, document, benefit, privilege, authority, use, franchise, license, permit, certificate, registration, or similar thing of value or utility performed, furnished, provided, granted, prepared, or issued by any Federal agency (including wholly owned Government corporations as defined in the Government Corporation Control Act of 1945) to or for any person (including groups, associations, organizations, partnerships, corporations or businesses), except those engaged in the transaction of official business of the Government, shall be self-sustaining to the full extent possible and the head of each Federal agency is authorized by regulation (which, in the case of agencies in the Executive Branch, shall be as uniform as practicable and subject to such policies as the President may prescribe) to prescribe therefor such fee, charge, or price, if any, as he shall determine, in case none exists, or redetermine in case of an existing one, to be fair and equitable taking into consideration direct and indirect cost to the Government, value to the recipient, public policy or interest served, and other pertinent facts, and any amount so determined or redetermined shall be collected and paid into the Treasury as miscellaneous receipts: *Provided*, That nothing contained in this Title shall repeal or modify existing statutes prescribing basis for calculation of any fee, charge or price, but this provision shall not restrict the redetermination or recalculation in accordance with the prescribed bases of the amount of any such fee, charge or price. [Italic supplied.]



The new FCC fee schedule includes among its provisions that:

§ 1.1111 Schedule of fees for Radio Broadcast Services.

(a) Except as provided in paragraph (b) of this section, the fees prescribed below are applicable to applications and operations in the Radio Broadcast Services:

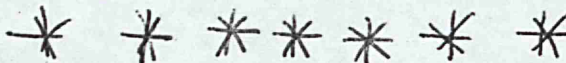
*Construction Permits*

Application for construction permit for new station or for major changes in existing station:

	Filing fee	Grant fee
VHF—top 50 markets <sup>1</sup> .....	\$5,000	\$45,000
UHF—top 50 markets.....	2,500	22,500
VHF—next 50 markets.....	2,000	18,000
UHF—next 50 markets.....	1,000	9,000
VHF—balance.....	1,000	9,000
UHF—balance.....	500	4,500
FM—class A.....	100	900
FM—class B and C.....	200	1,800
AM—day-50 kw.....	500	4,500
AM—day-25 kw.....	400	3,600
AM—day-10 kw.....	300	2,700
AM—day-5 kw.....	200	1,800
AM—day-1 kw.....	100	900
AM—day-500 w.....	50	450
AM—day-250 w.....	25	225
AM—unlimited 50 kw.....	1,000	9,000
AM—unlimited 25 kw.....	800	7,200
AM—unlimited 10 kw.....	600	5,400
AM—unlimited 5 kw.....	400	3,600
AM—unlimited 1 kw.....	200	1,800
AM—unlimited 500 w.....	100	900
AM—unlimited 250 w.....	50	450
AM—class IV.....	100	900
For directional antenna in addition to the above.....	50	450

<sup>1</sup> The market size shall be determined by the rating of the American Research Bureau, on the basis of the net weekly circulation for the most recent year.

<sup>2</sup> The fee for major changes in 100-w. operations is the same as for 250-w. operations.



*Assignments and Transfers*

Application for assignment of license or transfer of control, exclusive of FCC Form 316 applications (where more than one broadcast station license is involved, the total amount of fees prescribed for each license so involved will be paid in the manner set forth below):

Application Filing Fee..... \$1,000.  
Assignment and Transfer fee to be paid immediately following consummation of the assignment or transfer..... 2% of consideration for assignment or transfer.

← N.B.

*Annual License Fees*

Each broadcast station shall pay an annual license fee to the Commission that is based on the station's rate card as of June 1 of each year.<sup>1</sup>

← N.B.

For AM and FM radio stations:

The annual fee will be a payment equal to 24 times the station's highest single "one-minute" spot announcement rate, but in no event shall the annual payment for each AM and each FM station be less than \$52.00;

For television broadcast stations:

The annual fee will be a payment equal to 12 times the station's highest "30-second" spot announcement rate, but in no event shall the annual payment be less than \$144.00.

(b) Fees are not required in the following instances:

- (1) Applications filed by tax exempt organizations for the operation of stations providing noncommercial educational broadcast services, whether or not such stations operate on frequencies allocated for noncommercial educational use.
- (2) Applications in the AM service requesting only authority to determine antenna power by direct measurement.
- (3) All television translator applications.



Monday 10/5/70

MEETING  
10/8/70  
3 p.m.

3:10 We have scheduled the meeting to discuss  
Bruce Owens' paper -- Spectrum allocation: a proposal  
for reform -- for Thursday (10/8) at 3 p.m.

Will Dean, Bruce Owen, Mr. Hoxie will attend.

cc: Dr. Mansur



MR. Whitehead  
Mg

EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF TELECOMMUNICATIONS POLICY  
WASHINGTON, D.C. 20504

Date: October 2, 1970

Subject: Spectrum Allocation

To: Will Dean

Herewith, a revised draft of the manuscript which proposes another compromise plan for spectrum allocation. I have attempted to incorporate the substance of our verbal discussion of 9/28/70 in the Introduction; otherwise the changes are minor and designed merely to bring out more clearly those points which are crucial to the proposal, and to separate them from such subsidiary questions as the degree of regional authority or the range of frequencies involved.

No attempt has been made to respond to specific points raised in your memorandum of 9/24/70. However, that memorandum has been added as an Appendix to the paper (for internal discussion purposes), because I think it brings out very clearly the difficulties likely to be encountered in implementing this proposal should the requisite policy decision be favorable to it.

I think that we have agreed that the basic approach suggested here (e.g., the direct incentive for the allocational authority) is superior to a "market" solution as well as shadow pricing and other schemes designed to insert economic considerations provided that we are prepared to make the basic policy decision that economic incentives should dominate.

To avoid misunderstanding, it may be appropriate to repeat here the point that no "private property" or "free market in spectrum rights" is included in this proposal. The crucial (and controversial) feature of the proposal involves the use of direct monetary incentives for the allocating agent (whoever that is.) Thus, provided that the institutional arrangements are made



properly (e.g., the degree of centralization vs. regionalization) there is a presumption that both economic and technical goals will be met by this scheme. We agree that there is no such presumption with regard to social goals. We disagree on the question of the extent to which disagreeable social effects would result, and on the likelihood that these effects would be properly corrected by other government agencies if they did develop.

Our discussion has been extremely useful in isolating the exact nature of the policy decisions required and in suggesting the feasible range of policy options. These are:

1. Do nothing to alter the present system.
2. Revise the present system by making spectrum managers aware of economic and social effects.
3. Retain centralized allocation, but make managers' rewards directly contingent on economic performance.
4. Go to a decentralized free market system.

There are several possibilities, of course, within each of these general options. I hope that my proposal will be useful at least in providing a middle ground between options 2 and 4. This should at least have a stimulating effect on the policy discussion.

Bruce M. Owen

cc: ✓Mr. Whitehead  
Dr. Mansur  
Mr. Hinchman

Attached: Draft of 9/30/70



*OTR*  
*other papers' Spectrum allocation*

OFFICE OF TELECOMMUNICATIONS POLICY

**ROUTE SLIP**

TO Bruce Owen  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

ACTION	<input type="checkbox"/>
Concurrence	<input type="checkbox"/>
Signature	<input type="checkbox"/>
Comments	<input type="checkbox"/>
For reply	<input type="checkbox"/>
Information	<input type="checkbox"/>
Per conversation	<input type="checkbox"/>
Discuss with me	<input type="checkbox"/>

FROM Tom Whitehead

DATE 9/23/70

**REMARKS**

I would like to see more internal discussion before you distribute this outside. We can have a meeting with Will Dean, Walt Hinchman, and Dr. Mansur some time next week to discuss it.



EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF TELECOMMUNICATIONS POLICY  
WASHINGTON, D.C. 20504

Date: September 17, 1970

Subject: Spectrum Allocation: A Proposal for Reform

To: Mr. Whitehead

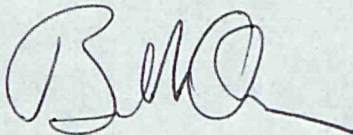
This paper presents what I hope is a new idea for spectrum allocation. It reviews and rejects the present structure and several of the heretofore proposed reform measures, such as establishment of a market mechanism and the NAE approach.

Instead, I propose to set up a number of regional authorities with full power to allocate and assign frequencies and to charge license fees. Each such regional authority would be privately managed, with a built-in incentive structure which leads to maximization of the economic value of the spectrum in use.

The regional authorities are subject to FCC oversight and review, in a sort of "legislative oversight" framework. There is, in addition, a central authority with responsibility for areas involving decisions of national scope. There are special provisions for national security matters, but otherwise the government is treated exactly the same as any private user of the spectrum.

I believe that the proposed structure provides a felicitous combination of incentives to use the spectrum efficiently and sufficient federal control to ensure that the spectrum is used in the public interest.

If you believe that the idea has merit, it may be appropriate to send it to the FCC and other interested agencies for comment.



Bruce M. Owen

Attachment



Office of Telecommunications Policy  
Route Slip

✓ \_\_\_\_\_ Clay T. Whitehead \_\_\_\_\_

\_\_\_\_\_ George F. Mansur \_\_\_\_\_

\_\_\_\_\_ William Plummer \_\_\_\_\_

\_\_\_\_\_ Wilfrid Dean \_\_\_\_\_

\_\_\_\_\_ Ray O'Connell \_\_\_\_\_

~~\_\_\_\_\_ Steve Doyle \_\_\_\_\_~~

\_\_\_\_\_ William Lyons \_\_\_\_\_

\_\_\_\_\_ Eva Daughtrey \_\_\_\_\_

\_\_\_\_\_ Timmie White \_\_\_\_\_

\_\_\_\_\_ Judy Morton \_\_\_\_\_

REMARKS

*Copies went to Will Dean &  
Walt Hinchman.*

9/17  
②



Spectrum Allocation: A Proposal for Reform

Bruce M. Owen

Brookings Economic Policy Fellow  
Office of Telecommunications Policy  
Executive Office of the President

September 1970

NOTE:

This is a draft circulated for discussion and comment. It should not be quoted or referred to without permission.



DRAFT/OWEN  
September 1970

Introduction

*true?*

The spectrum allocation problem is in large part due to a series of historical accidents. In the early days of radio, when competing transmitters interfered with each other in a chaotic way, the Federal Government reacted by nationalizing the radio spectrum. This step was unprecedented in a free enterprise economy dedicated to the principle of private property. The alternative -- to apply the principles of law and custom developed over the centuries for private ownership of land -- evidently did not occur to public decision-makers. A private property solution would, it is true, have resulted in an exceedingly imperfect market, with many difficult adjudicatory problems. But most markets are imperfect, and the problems of the radio spectrum are by no means unique. The decision to nationalize the spectrum can be understood only in the context of the uses of radio in those early days. Radio was first used for communication over international distances and particularly for maritime and safety purposes. The international implications of radio use, combined with the public safety aspects of that use, seemed to indicate federal control.

Once the spectrum was nationalized, it of course became necessary that it be used to augment the commonweal. The federal authority was therefore used to control not merely standards of interference



but the particular uses to which radio could be put. In practice, the Federal Communications Commission first allocated blocks of spectrum, each of which could only be used for some particular function, or class of user, and then granted monopoly transmission rights to individual users within each allocation. Arbitrary interference standards were met by specification of the "input rights" of each licensee (power, antenna height and location, etc.).

Finally, having granted monopoly rights to use particular assignments without payment, the FCC held each licensee responsible for the content of his transmissions, thereby creating a vertically integrated monopoly of content as well as transmission. Because the number of assignments in each use was made -- artificially -- scarce by the block allocation procedure, this led to considerable concentration of control of content, and particularly broadcast content. Since such monopolistic control lent itself to abuses of the commonweal, the FCC then asserted its power to control the content of broadcasts through such devices as the equal time, personal attack, and fairness doctrines.<sup>1</sup>

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1

The Communications Act of 1934, as amended: 47 USC 391.  
See also: Fairness Doctrine 13 FCC 1246 (1949), 29 Fed. Reg. 10416 (1964).



In addition to federal intervention in broadcast content -- which was at first generic, but which has gradually become increasingly specific<sup>2</sup> -- the FCC has felt it necessary to protect the economic viability of the monopolies it has created. Thus, the Carroll Doctrine and the long containment of cable television.<sup>3</sup>

The FCC assigns about half of the radio spectrum. The other half is assigned by the Director of Telecommunications Policy, and is used by the Federal Government and particularly the Department of Defense.

Neither DOTP nor FCC has a clear and objective set of criteria for spectrum allocation. The assignments have, as a result, been largely ad hoc, with each decision heavily circumscribed by precedent and established interests.

In spite of the fact that there exists no objective criterion by which to judge the overall performance of federal spectrum allocation, there have been numerous proposals for reform. Most

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2

See for instance "Eleven United States Senators Against National Broadcasting Company, Inc." FCC 70-938 (52279) Released Aug. 31, 1970; FCC letter to Mr. W. S. Dodson, FCC 70-915 (49328) of August 26, 1970.

3

Carroll Broadcasting Co. v. FCC, 258 F. 2d 440 (D. C. Cir.) 1958. In re Carter Mountain Transmission Corp., 32 FCC 459 (1962), 321 F. 2d 359 (D. C. Cir., 1963).



students of the field appear to believe that it would be the merest coincidence if current procedures have achieved their goal of maximizing the value to society of the radio resource. (If that is a reasonable interpretation of the public interest.)

After a brief review of some of the proposals which have been made for reform of the allocation process, this paper will present a new proposal which embodies some of the features of each preceding proposal. There exists some reasonable expectation that use of the spectrum under the reformed institutional structure proposed here would serve the public interest at least as well as the present structure.

## PREVIOUS PROPOSALS FOR REFORM

### Establishing a Market in Spectrum

The contribution of economists to the problem of spectrum allocation has taken the form of advocating the establishment of a market in spectrum assignments. This proposal was for a long time advocated by Professor Coase,<sup>4</sup> and later examined by Professor Levin.<sup>5</sup> The proposal was given extensive analysis in a study for the President's Task Force on Communications Policy.<sup>6</sup>

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4

See references 4 through 8.

5

See references 32 through 38.

6

See references 22, 9, and President's Task Force on Communication Policy Staff Papers.



The principal objections to a market mechanism for spectrum allocation are: (1) The definition of the property right is extremely difficult; (2) Some sort of "zoning" requirement would be needed to protect the rights of those who have invested in receiving equipment; (3) The establishment of a market is, in practical terms, a political impossibility; and (4) The adjudicatory process such a market would require could be very costly.

Perhaps the most serious objection from an economic standpoint is that interference is cumulative rather than bilaterally separable and identifiable.<sup>7</sup> This fact leads to the presumption that a market would be seriously inefficient.

#### Shadow Prices and License Fees

Other reformers have proposed that the spectrum be allocated by calculating "shadow prices" and making assignments on the basis of comparative scarcity value as indicated by these calculations. There is also some suggestion that license fees be charged which simulate shadow pricing.

The objection to the use of shadow pricing is that even in principle it is extremely difficult to make the proper calculations -- and in practice the amount of information required is enormous.. The cost of calculating such values might well outweigh the benefits derived

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<sup>7</sup> W. R. Hinchman, "Appendix A" to Staff Paper 7 of the President's Task Force, Federal Clearinghouse volume PB 184 421 (1968).



therefrom. License fees, if used properly, can succeed in extracting the monopoly profits gained by users as a result of spectrum scarcity, but they are no help in allocation as between alternative uses of a given spectrum right. Calculating the "correct" license fees for purposes of allocation (as opposed to redistribution of monopoly profit) is just as difficult as calculating shadow prices.

Management by Committee of Experts or by Formulae

Several studies have proposed that the solution to spectrum management efficiency problem lies in the construction of a mathematical index to reflect economic, social and technical values of alternative uses, or in a committee of experts in several disciplines to make decisions on the same basis.<sup>8</sup> These proposals are designed mainly for use by the Director of the Office of Telecommunications Policy, and are made partly in reaction to the emphasis on engineering and technical standards heretofore dominant.<sup>9</sup>

The principal objection to either approach is that there still exists no standard measure of performance and no presumption that the new approach is better than the old (or at least worth its cost).

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8

See reference 41.

9

Reference 30.



The formulae or index numbers suffer from the standard index number problem: a single number can never convey the information required for a multidimensional decision. The committee of experts must still be told what to do and how to do it; their expertise is useless in the absence of an objective decision rule.

#### The Regional Approach

The block allocation procedure leads to certain gross inefficiencies which can be corrected by decentralizing part of the allocation authority. The case of New York is often cited, where certain police and taxi frequencies are very crowded, while assignments reserved for the forestry service remain idle. The FCC is experimenting in Chicago with a regional manager to solve such obvious inefficiencies. However, the regional approach does not solve the fundamental problem of efficient allocation. The regional manager still has no objective decision rule, and no sweeping authority to reallocate between broad allocations. Users still have no incentive to conserve spectrum.

#### A PROPOSAL FOR REFORM

Any realistic proposal for reform must satisfy certain criteria. Among these are the necessity to create some sort of measuring device so that spectrum managers can evaluate the relative worth of the spectrum in different uses, the necessity to preserve federal control at some stage over the qualifications of users, and the need to instill an appropriate incentive structure in the management and usage processes.



To this end, it is proposed that there be established a number (about 10) of non-profit public corporations on a regional basis. Each such organization would be called a Regional Frequency Allocation Authority (RFAA), and would have the power (subject to the qualifications below) to allocate and to assign frequencies within its geographical region. This power of each RFAA would be limited to frequencies of 50 MHz and above and to transmitters within its region. Each RFAA would charge fees for use of the frequencies under its control, using these fees to determine the most valuable uses of the spectrum. The revenues of each RFAA in excess of costs would be payable to the United States Treasury.

Each RFAA would be managed by a private contractor whose term of contract would be ten years. At the end of each ten-year period, the RFAA management position would be the object of competitive bidding by any private corporation or partnership qualified to act as manager. The Federal Communications Commission would set standards and determine the qualifications of competing management organizations. Each managing group (hereafter "Manager") would receive 10% of the net revenues of its RFAA as a management fee. The proceeds of the decennial auction of the management contract would be payable to the United States Treasury.



The fee structure of the RFAA will be determined by the manager, subject to certain conditions set forth below. Each manager would have an incentive to maximize the revenue of its RFAA, after costs, and therefore to find the most valuable uses of spectrum.

No firm would be allowed to manage more than one RFAA at a time or to engage in other businesses related to use of the spectrum.

The manager of each RFAA would have authority to set such interference standards and input or output requirements as it wished within its region, provided that interference levels at the border of each region could not exceed those in effect at the time of creation of the RFAA except by mutual arrangement with the neighboring RFAA.

Each RFAA in effect leases the spectrum in its region above 50 MHz from the FCC and then subleases it to individual users. Its authority would be limited by all relevant laws and by the FCC and the Central Frequency Allocation Authority.

The Central Frequency Allocation Authority would be a non-profit corporation operating on a national scale. It would have authority to



allocate and assign frequencies below 50 MHz for appropriate fees. It would also serve as the central coordinating authority for uses of the spectrum requiring national standardization (e.g., air mobile, safety). In addition, the CFAA would be responsible for RFAA compliance with such ITU regulations and other international agreements as are relevant to the operation of individual RFAAs.

The CFAA would be controlled by a board of directors made up of one representative from each RFAA and an equal number of Presidential appointees, including, ex officio, the Chairman of the FCC, the Director of Telecommunications Policy, the Secretary of Commerce, and the Secretary of Defense.

The board of the CFAA would hire appropriate management personnel. Excess revenues of the CFAA would be payable to the Treasury.

Each RFAA would be empowered to lease spectrum to both government and non-government users, with the exception that spectrum assignments requested by the Director of the Office of Telecommunications Policy, on the advice of the National Security Council, for national security use would be made by the CFAA. The fee for use of such assignments as are required for national security



purposes would be negotiated by the CFAA with the Director of the Office of Telecommunications Policy and the appropriate security agency. The CFAA would have authority to preempt all RFAA power with regard to national security uses, except that fees received therefrom would be allocated to the RFAA concerned, after costs.

Non-security government users of the spectrum would negotiate directly with the relevant RFAA, paying appropriate fees to the RFAA.

The Federal Communications Commission would continue to have the power to (a) negate decisions of any RFAA or the CFAA which violated any international agreement of the United States, (b) set standards of fitness for spectrum users, or classes of users, and to negate decisions of any RFAA or the CFAA which violated those standards or which led to the use of the spectrum in a manner not in the public interest, (c) set standards of fitness for managers of each RFAA, (d) impose allocations and assignments for public safety uses if and when it determines that the public interest is not served by RFAA or CFAA decisions affecting such use. The FCC would also have the power to remove for cause any RFAA manager found not to be operating lawfully.



Individual RFAAs would be prohibited from discriminating among competing users on any basis other than ability to pay, subject to the fitness standards set by the FCC. No RFAA would be empowered to control or censure the content of any communication, and could not deny sublease renewal on the basis of such content. The RFAA would, in each case, be responsible for a reasonable determination that each user apparently met the standards of fitness set by the FCC. The FCC could then determine after due process that the standards are not met. There would be no automatic review of individual users' fitness by the FCC. However, the FCC could, on its own initiative, on the basis of a complaint, or on request by any RFAA make such a determination.

The decisions of the CFAA with regard to compatibility and other matters affecting the relations between different RFAAs should be appealable to the FCC and then to the Courts. Individual RFAAs may make payments to and agreements with other RFAAs subject to review by the CFAA. In the event that the revenues from allocations and assignments below 50 MHz do not cover the costs of the CFAA, the deficit would be made up by uniform percentage contributions from each RFAA.



Assignment subleases by any RFAA would be for a period to be agreed upon by the RFAA and the user, but not longer than 10 years or less than 3 years. Any assignment would be preemptible by the CFAA under the national security clause. Assignments are made by the RFAA and are binding on subsequent managers. Neither any RFAA nor its manager would be subject to the antitrust laws, except for violation of the prohibition on engaging in other spectrum-related activities. No RFAA manager can accept payment or favor in any form from any user, except the 10% after cost management fee. No RFAA would be subject to state or Federal taxes, but RFAA managers would be subject to the same taxes as any private corporation.

RFAA assignments can be made to common carriers who are otherwise subject to regulation by state or federal regulatory authority. Common carriers newly created who are customers of the RFAA would not be regulated by it as to rates or other matters unrelated to the spectrum assignment.

#### Discussion

The purpose of the framework proposed here is to provide the manager of the RFAA with an incentive to maximize the economic value in use of the spectrum in his region by tying his compensation



directly to the revenues of the RFAA (and the Treasury) from subleases. The RFAA and its manager are monopolists and can be expected to charge high prices for the spectrum. The ten-year contract bidding process in turn is meant to extract grossly excessive profits of managers. The RFAA has an incentive to take into account interference and to make allocations on an efficient basis with regard to interference. Nevertheless, monopolists do charge too much for too little. I see no way around this; surely any attempt to regulate the prices charged by the manager would be self-defeating. At least the outcome of monopoly pricing is predictable (and in our economy not unusual), whereas the efficiency implications of present practice are unknown. The FCC has the power under this proposal to make public safety assignments. The 3 to 10 year period for leases provides some stability.

That the FCC retain some control over the qualifications of users is inevitable and perhaps beneficial, since there is no way of predicting the outcome of a completely unregulated system. Users themselves would, of course, be subject to the antitrust laws and/or common carrier regulation, so that the profit of the RFAA manager can not be maximized by creating uncontrollable monopolies. There



may be some difficulty with the transfer prices between regulated utilities and the RFAAs,, but no more than at present with any supplier of a regulated entity.

The national security arrangements are obviously necessary in any such scheme, but there is no reason why government users should not pay for spectrum the way they pay for pencils or battleships. The CFAA control below 50 MHz is required by the ionospheric propagation characteristics in these frequencies, which do not lend themselves to regional boundaries and which are important internationally. Some degree of national coordination with regard to highly mobile users is clearly necessary. Since neither the CFAA nor the RFAAs have any plant or need for extensive working capital, no arrangements for these are required. The managers of the RFAAs can spend money on monitoring up to the point of efficiency in preventing violations from reducing the value of -- and revenue from -- the spectrum.

This is, in sum, a second-best sort of proposal. It will not result in perfectly efficient allocation even in a partial equilibrium framework, except on the highly unlikely supposition that RFAA managers practice perfect price discrimination. But the proposal does have the virtue of resulting in an allocation which is predictably (and possibly calculably) different from efficiency, and it does result



in objective allocation criteria. Furthermore, it lends itself to testing, since one experimental RFAA could be established and observed. The newly installed license fee structure of the FCC provides an instrument of transition. Most important, the proposal results in the establishment of an appropriate set of incentives for spectrum conservation by users.



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SUMMARY TABLE OF  
ORGANIZATIONAL ASSIGNMENTS

Regional Frequency Allocation Authorities:

- Nonprofit public corporations
- Leases all frequencies above 50 MHz from FCC
- Collects license fees from users
- Pays excess income to Treasury
- Makes reasonable determination that users appear to meet FCC standards, but otherwise assigns on basis of ability to pay.
- Prohibited from controlling content or making any censorship rules.
- Subject to authority of CFAA in some matters and to authority of FCC in all matters.

RFAA Managers:

- Private, profit-making corporations
- Manages each RFAA under a 10-year contract
- Contract awarded to highest qualified bidder
- Sets all license fees and determines allocations and assignments on a three to ten year basis
- Removable by FCC for cause
- May not operate more than one RFAA at one time or engage in other spectrum-related activities
- Receives 10% of net (after cost) revenues of RFAA as management fee.

Central Frequency Allocation Authority:

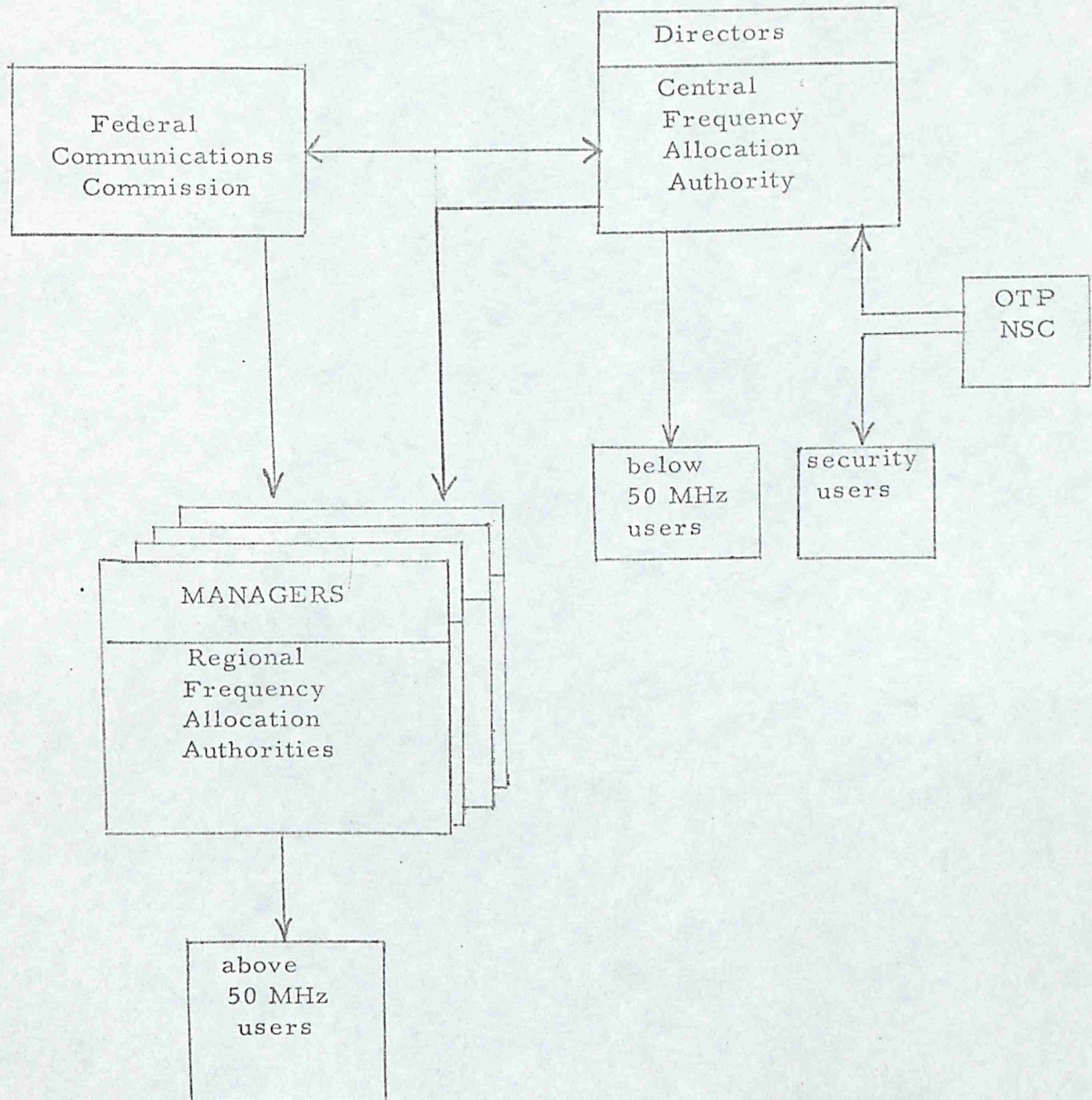
- Board of directors: half RFAA representatives, half Presidential appointees
- Allocates and assigns frequencies below 50 MHz
- Assigns frequencies for national security use on request of DOTP and NSC.
- Coordinates activities of RFAAs for mobile and other uses requiring national standardization
- Ensures compliance with international agreements

Federal Communications Commission:

- All present allocation and assignment functions delegated to RFAAs and CFAA
- Retains right to set standards of qualification for users and to veto any RFAA decision found not to be in the public interest
- Sets standards of fitness for RFAA managers
- Retains responsibility for international matters through CFAA
- Prohibited from making domestic non-safety block allocations or any generic restriction on spectrum use.



## DIAGRAM OF MAJOR INSTITUTIONS





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Note: This bibliography was prepared by Douglas W. Webbink under the title "Bibliography on FCC Frequency Spectrum Allocation and Assignment" (August 1970).



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