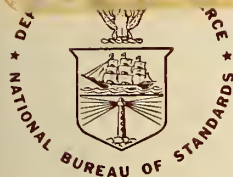


REFERENCE
NBS



NBS TECHNICAL NOTE 674

U.S. DEPARTMENT OF COMMERCE/National Bureau of Standards

Report On The 1975 Survey of Users of the Services of Radio Stations WWV and WWVH

QC

100

.45753

no. 674

1975

NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards¹ was established by an act of Congress March 3, 1901. The Bureau's overall goal is to strengthen and advance the Nation's science and technology and facilitate their effective application for public benefit. To this end, the Bureau conducts research and provides: (1) a basis for the Nation's physical measurement system, (2) scientific and technological services for industry and government, (3) a technical basis for equity in trade, and (4) technical services to promote public safety. The Bureau consists of the Institute for Basic Standards, the Institute for Materials Research, the Institute for Applied Technology, the Institute for Computer Sciences and Technology, and the Office for Information Programs.

THE INSTITUTE FOR BASIC STANDARDS provides the central basis within the United States of a complete and consistent system of physical measurement; coordinates that system with measurement systems of other nations; and furnishes essential services leading to accurate and uniform physical measurements throughout the Nation's scientific community, industry, and commerce. The Institute consists of the Office of Measurement Services, the Office of Radiation Measurement and the following Center and divisions:

Applied Mathematics — Electricity — Mechanics — Heat — Optical Physics — Center for Radiation Research; Nuclear Sciences; Applied Radiation — Laboratory Astrophysics² — Cryogenics² — Electromagnetics² — Time and Frequency².

THE INSTITUTE FOR MATERIALS RESEARCH conducts materials research leading to improved methods of measurement, standards, and data on the properties of well-characterized materials needed by industry, commerce, educational institutions, and Government; provides advisory and research services to other Government agencies; and develops, produces, and distributes standard reference materials. The Institute consists of the Office of Standard Reference Materials, the Office of Air and Water Measurement, and the following divisions:

Analytical Chemistry — Polymers — Metallurgy — Inorganic Materials — Reactor Radiation — Physical Chemistry.

THE INSTITUTE FOR APPLIED TECHNOLOGY provides technical services to promote the use of available technology and to facilitate technological innovation in industry and Government; cooperates with public and private organizations leading to the development of technological standards (including mandatory safety standards), codes and methods of test; and provides technical advice and services to Government agencies upon request. The Institute consists of the following divisions and Centers:

Standards Application and Analysis — Electronic Technology — Center for Consumer Product Technology; Product Systems Analysis; Product Engineering — Center for Building Technology: Structures, Materials, and Life Safety; Building Environment; Technical Evaluation and Application — Center for Fire Research: Fire Science; Fire Safety Engineering.

THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY conducts research and provides technical services designed to aid Government agencies in improving cost effectiveness in the conduct of their programs through the selection, acquisition, and effective utilization of automatic data processing equipment; and serves as the principal focus within the executive branch for the development of Federal standards for automatic data processing equipment, techniques, and computer languages. The Institute consists of the following divisions:

Computer Services — Systems and Software — Computer Systems Engineering — Information Technology.

THE OFFICE FOR INFORMATION PROGRAMS promotes optimum dissemination and accessibility of scientific information generated within NBS and other agencies of the Federal Government; promotes the development of the National Standard Reference Data System and a system of information analysis centers dealing with the broader aspects of the National Measurement System; provides appropriate services to ensure that the NBS staff has optimum accessibility to the scientific information of the world. The Office consists of the following organizational units:

Office of Standard Reference Data — Office of Information Activities — Office of Technical Publications — Library — Office of International Relations — Office of International Standards.

¹ Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D.C. 20234.

² Located at Boulder, Colorado 80302.

Report On the 1975 Survey of Users of the Services of Radio Stations WWV and WWVH

to: [unclear] [unclear] [unclear] no. 674

NATIONAL BUREAU
OF STANDARDS
LIBRARY

DEC 31 1975

not [unclear] [unclear]
QC100

45753

no. 674

1975

J.A. Barnes
R.E. Beehler

Time and Frequency Division
Institute for Basic Standards
National Bureau of Standards
Boulder, Colorado 80302



U.S. DEPARTMENT OF COMMERCE, Rogers C. B. Morton, Secretary
John K. Tabor, Under Secretary
Dr. Betsy Ancker-Johnson, Assistant Secretary for Science and Technology

U.S. NATIONAL BUREAU OF STANDARDS, Ernest Ambler, Acting Director
Issued October 1975

NATIONAL BUREAU OF STANDARDS TECHNICAL NOTE 674
Nat. Bur. Stand. (U.S.), Tech Note 674, 91 pages (Oct. 1975)

CODEN: NBTNAE

For sale by the Superintendent of Documents, U.S. Government Printing Office , Washington, D.C. 20402
(Order by SD Catalog No. C13.46:674) \$1.50

Contents

	Page
1. Introduction	1
2. General Features of Results	6
3. Specific Results	14
4. Some Frequently Expressed Suggestions/Comments	16
Appendix - Responses from Users of WWV/WWVH	A1

Figures

Figure 1 Letter from Time & Frequency Div. Transmitting Questionnaire . .	2
Figure 2 Questionnaire, side 1	3
Figure 3 Questionnaire, side 2	4
Figure 4 GEOGRAPHICAL DISTRIBUTION OF RESPONSES	8
Figure 5 NUMBER OF RESPONSES FOR EACH USER CATEGORY	9
Figure 6 USE OF FACILITIES	10
Figure 7 WEEKLY CALLING RATE TO (303) 499-7111	11
Figure 8 FRACTIONAL USE OF TELEPHONE (303-499-7111) BY GEOGRAPHICAL REGION	12
Figure 9 USE OF THE BROADCAST FREQUENCIES	13
Figure 10 USE OF SERVICES FOR EACH USER CATEGORY	15

REPORT ON
THE 1975 SURVEY OF USERS OF THE SERVICES
OF RADIO STATIONS WWV AND WWVH

J. A. Barnes
R. E. Beehler

The users of the National Bureau of Standards (NBS) radio stations WWV and WWVH were surveyed by means of a questionnaire. The questionnaire was distributed to the station mailing list, published in some periodicals, and its availability was announced on the stations themselves and publicized in other periodicals. More than 12,000 completed questionnaires were returned, which revealed, among other things, that the 5, 10, and 15 MHz transmissions were the most used frequencies; 25 MHz was the least used. Of the information contained on the broadcasts, the voice time-of-day announcement was the most important, and the DUT1 values the least important. In general the returns were very supportive of the services, with only two of the more than 12,000 responses advocating a complete shutdown of the broadcasts.

Key Words: Frequency; questionnaire; standard frequency and time broadcasts; time.

1. Introduction

For over 50 years now the National Bureau of Standards has broadcast from its standard frequency and time signal station, WWV, and for over 25 years from station WWVH. Since 1966, WWV has been located near Ft. Collins, Colorado, and broadcasts on the frequencies of 2.5, 5, 10, 15, 20, and 25 MHz, while WWVH has been located on the island of Kauai, Hawaii, since 1971 and broadcasts on the frequencies of 2.5, 5, 10, 15, and 20 MHz.

In addition to providing standard time and frequency information, radio stations WWV and WWVH provide weather announcements, propagation forecasts, geophysical alerts, and other information. A detailed description of the services provided can be found in reference [1].

With the advent of the energy crisis in the fall of 1973, the monthly costs of electricity to power the Hawaiian radio station more than doubled in the course of a few months. In early 1974, power costs were estimated at about \$100,000 per year for WWVH alone.

As a consequence of this state of affairs, it was proposed to reduce the power radiated from WWVH by 50 percent on the frequencies of 5, 10, and 15 MHz. These frequencies were selected because the greatest savings could be realized with them--not because they were the least used. Comments concerning this proposal were solicited by inserting announcements on the broadcasts themselves.

There were several hundred responses purporting to represent "hundreds of thousands" of users of the broadcast services, and many letters were sent directly to U. S. Congressmen and Senators. Almost every letter received objected strongly to the proposed power reduction.

As a result of this exercise, two decisions were made: (1) We would not (at that time) reduce power by 50 percent at WWVH on 5, 10, and 15 MHz; and (2) we would explore more broadly the question of cost and energy savings at both stations WWV and WWVH.

In order to understand what parts of our services were used and who was using them and for what purposes, it was decided to sample the users by means of a questionnaire. By this means it was hoped that it would be possible to identify some parts of the services which could be discontinued at a net savings in both cost and energy and yet have little impact on the users. Of course, it was also recognized that the questionnaire provided an opportunity to learn other things about our services and the users of our services.

A questionnaire was designed (see Figs. 1, 2, and 3), and much of its analysis was built into computer programs before its availability was announced. Significant features in the design of the questionnaire were taken to be:



U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards
Boulder, Colorado 80302

January 8, 1975

Dear Participant:

In response to government-wide efforts to reduce operating costs and conserve energy, we are considering various alternatives for operating radio stations WWV and WWVH. Interested listeners to these stations are being asked to provide information, via the enclosed questionnaire, which will help us set priorities and guide our decision-making processes with respect to these services. Examples of possible changes include the elimination of some broadcast frequencies from WWV and/or WWVH or reductions in transmitted power on some frequencies.

As a result of greatly increased energy costs at our Hawaiian radio station, WWVH, we have already solicited comments from users regarding a proposed 50 percent reduction of power at 5, 10, and 15 MHz from WWVH only. We have received so many objections to this proposal that we have decided to explore other possible means of cost and energy reductions. It is hoped that the responses to this questionnaire will allow us to provide the services needed most within our financial constraints and at an efficient level of energy use. Thus, it is very desirable that you provide us with thoughtful responses to the enclosed questions. Please fold the questionnaire in thirds with the return address on the outside and staple or tape it closed and mail. No postage is necessary if mailed within the U. S. However, a postage stamp is necessary if a reproduced copy of this questionnaire is mailed.

Your help is greatly appreciated.

Sincerely,

James A. Barnes
James A. Barnes, Chief
Time and Frequency Division

Enclosure

NBS QUESTIONNAIRE FOR USERS OF WWV, WWWH SERVICES

NBS/BL-97

Form Approved
OMB No. 41-574125
REVISED

1. TO WHAT EXTENT DO YOU USE THE FOLLOWING FREQUENCIES?

	FREQUENTLY	SOMETIMES	RARELY	NEVER
2.5 MHZ				
5				
10				
15				
20				
25				

2. HOW IMPORTANT ARE THE FOLLOWING FREQUENCIES FOR YOUR OPERATION?

	VERY IMPORTANT	SOMEWHAT IMPORTANT	RELATIVELY UNIMPORTANT	VERY UNIMPORTANT
2.5 MHZ				
5				
10				
15				
20				
25				

3. HOW OFTEN DO YOU USE THE FOLLOWING?

	FREQUENTLY	SOMETIMES	RARELY	NEVER
WWV				
WWVH				
TELEPHONE NO. (303) 439-7111				

4. HOW OFTEN DO YOU EXPERIENCE HARMFUL INTERFERENCE BETWEEN NBS BROADCASTS AND OTHER TIME/FREQUENCY TRANSMISSIONS?

CHECK ONE: ☐ NEVER ☐ Seldom ☐ OFTEN ☐ FREQUENTLY

5. IN WHAT APPROXIMATE GEOGRAPHICAL AREA DO YOU MAKE USE OF

WWV/WWVH SIGNALS? _____

6. TO WHAT EXTENT DO YOU USE THE FOLLOWING INFORMATION?

	FREQUENTLY	SOMETIMES	RARELY	NEVER
TIME OF DAY, VOICE				
TIME OF DAY, BCD CODE				
ONE-SECOND TICKS				
STANDARD FREQUENCY				
OUT 1 VALUES				
WEATHER				
GEOLALERTS				
PROPAGATION FORECASTS				

7. HOW IMPORTANT FOR YOUR OPERATION IS EACH OF THE FOLLOWING CATEGORIES OF INFORMATION AS SUPPLIED BY WWV/WWVH?

	VERY IMPORTANT	SOMEWHAT IMPORTANT	RELATIVELY UNIMPORTANT	VERY UNIMPORTANT
TIME OF DAY, VOICE				
TIME OF DAY, BCD CODE				
ONE-SECOND TICKS				
STANDARD FREQUENCY				
OUT 1 VALUES				
WEATHER				
GEOLALERTS				
PROPAGATION FORECASTS				

8. HOW WOULD YOU CHARACTERIZE THE SIGNAL WHICH IS TYPICAL FOR YOU?

	MORE THAN ADEQUATE	ADEQUATE	MARGINAL	USELESS
SIGNAL STRENGTH				
ACCURACY OF TIME AND/OR FREQUENCY				

(OVER)



U.S. DEPARTMENT OF COMMERCE
COM-219
POSTAGE AND FEES PAID

National Bureau of Standards Time and Frequency Division Boulder, Colorado 80302

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards
Boulder, Colorado 80302
OFFICIAL BUSINESS
Penalty for Private Use, \$300

9. PLEASE CHECK THE CATEGORIES IN THE TWO LISTS BELOW WHICH MOST ACCURATELY CHARACTERIZE YOUR USE OF NBS FREQUENCY AND TIME SERVICES.

USER CLASSIFICATION

- ___ GOV'T, MILITARY
- ___ GOV'T, CIVILIAN
- ___ EQUIP. MANUFACTURING
- ___ NAVIGATION
- ___ AVIATION/AEROSPACE
- ___ TELEPHONE INDUSTRY
- ___ ELECTRIC POWER INDUSTRY
- ___ STANDARDS LAB
- ___ SHIPPING/BOATING INDUSTRY
- ___ PLEASURE BOATING
- ___ UNIVERSITY
- ___ COMMUNICATIONS INDUSTRY
- ___ SEISMOLOGY/GEOPHYSICS
- ___ OTHER (PLEASE SPECIFY): _____

PRINCIPAL USE

- ___ HOBBY (OTHER THAN AMATEUR RADIO)
- ___ AMATEUR RADIO
- ___ CALIBRATION OF WATCHES/CLOCKS
- ___ NAVIGATION/POSITION LOCATION
- ___ COMMUNICATIONS SYSTEMS
- ___ SCIENTIFIC DATA MONITORING
- ___ INSTRUMENT CALIBRATION
- ___ ROCKET/SATELLITE TRACKING
- ___ STORM WARNINGS
- ___ GEOLERTS
- ___ PROPAGATION FORECASTS
- ___ ASTRONOMY
- ___ OTHER (PLEASE SPECIFY): _____

10. ARE THERE OTHER SERVICES WE SHOULD ADD? YES ☐ NO ☐ IF YES, WHAT SERVICES? _____

11. DO YOUR RESPONSES TO THE ABOVE OFFICIALLY REPRESENT MORE THAN YOUR OWN PERSONAL INVOLVEMENTS? YES ☐ NO ☐
IF YES, PLEASE EXPLAIN _____

12. COMMENTS: _____

Figure 3

1. Meaningful information content,
2. Explicit statements concerning the vulnerability of services if inadequate support is received,
3. Ease of computer processing,
4. Self-addressed, postage-free mailing.

The distribution of the questionnaire was handled by four general means, which are considered separately below.

1. Mailing lists

The Time and Frequency Division maintains an active mailing list of people who are expressly interested in any impending changes in our services. Copies of the questionnaire were mailed to this mailing list as well as to those who wrote to us concerning the proposed 50 percent power reduction at WWVH. The total from these lists was about 1,500.

In addition, we were able to use mailing lists compiled by the North American Yacht Racing Union (10,000), the National Weather Service (2,600 U. S. ships), and the Cruising Club of America (900).

2. Announcements of availability of the questionnaire

The availability of the questionnaire and its importance were announced on both stations WWV and WWVH three times each hour from January 20, 1975, to May 1, 1975. Thus, the stations themselves were used to sample their own users.

The availability of the questionnaire and its importance were also publicized in various editorials and comments in several magazines and journals.

It is known that such announcements appeared in the following publications:

<u>Publication</u>	<u>Date</u>	<u>Circulation</u>
Science Trends	2-75	7,000
Pacific Shipper	3-75	5,000
Electronic Design	3-75	77,500
Boulder Daily Camera (story/editorial)	3-75	22,000
IEEE Spectrum	3-75	155,000
Sea Secrets	3-75	1,500
Ham Radio	3-75	44,000
NBS Standard (story/editorial)	3-75	1,300
American Horologist & Jeweler	3-75	12,000
Electromechanical Design	3-75	32,600
Sea Technology	4-75	30,500
Society of Broadcast Engineers Signal	4-75	Unknown
Wiliki o Hawaii (Hawaiian engineering publication)	4-75	2,135

3. Publication of the questionnaire itself

Several periodicals agreed to publish the questionnaire directly as a separate page. Unfortunately, several of these periodicals elected not to use the self-addressed, postage-free aspects of the questionnaire, and the percentage of responses from those publications was significantly smaller than from those which published the complete questionnaire. It is known that the questionnaire appeared in the following periodicals:

<u>Publication</u>	<u>Date</u>	<u>Circulation</u>
Industrial Communications	1-75	1,300
QST	3-75	114,000
CQ	3-75	81,000
Surgical Business	3-75	10,000
IEEE Grid	3-75	9,000
NBS Dimensions	3-75	10,000
Independent Jeweler	3-75	7,300
Geophysics	4-75	8,600
New Zealand DX Times	4-75	350
Notice to Mariners	4-75	12,000

4. Other

Questionnaires were also distributed by several other miscellaneous methods, including handouts at the NBS display at IEEE Intercon in New York (1,000 copies), handouts at four different offices of the American Radio Association AFL-CIO (700 copies), and mailings to Department of Commerce Labs employees in the local Boulder, Colorado, area (1,750 copies). All in all, a total of 12,050 completed questionnaires have been returned.

It is perhaps worth noting that 23 percent of the returned questionnaires indicated that they "officially" represented more than their own personal use of the services. Most of these participants merely indicated that they were representing the interests of the company which employed them. In a few cases actual numerical estimates of those officially represented were given. If one assumes that these numbers are representative of the entire 23 percent indicating "official" representation, then one obtains a figure many times greater than the 12,050 number of returned questionnaires.

2. General Features of Results

In this Section, the general features of the questionnaire are discussed. Many of these general features could have been predicted fairly well in advance; and, thus, one of the major consequences of this Section should be an establishment of confidence in the results. More specific and detailed results are provided in the next Section.

An examination of the questionnaire (Figs. 2 and 3) reveals that many of the questions provide a four-level response format. A high level of use, importance, or generally favorable response is always to the left on the questionnaire, while low levels or unfavorable responses are toward the right. For much of the analysis which follows it is useful to provide a single numerical value which in some sense reveals the consensus response for a given population (e.g., a specific user group) responding to one of the questions. This numerical score is computed by assigning the weights 3, 2, 1, 0, to the four levels of response in sequence from left to right and averaging the weighted responses to a given question relative to the specific population.

Within any population (e.g., user group) there are questionnaires for which no response is made to a given question, although this was not frequent. For example, it appears that occasionally a respondent might simply check that he uses, say, 10 MHz frequently but not bother to check a use rate for any of the other frequencies. In the analysis a non-response is normally (for questions 1, 2, 3, 6, and 7) taken to be equivalent to a check at the extreme right (weight zero) of a given question in the four-level response area. Such assumptions do not appear reasonable in questions dealing with interference (question 4), signal strength, and accuracy (question 8).

Thus, when a single numerical score is reported relative to questions 1, 2, 3, 6, and 7, its numerical value must lie between zero and three. Values near zero imply little use or importance of the service, while values near 3 imply high use or importance.

For a specific user group the smallest numerical value assigned was 0.24, while the largest was 2.86. It is clear that in both of these examples a strong consensus (since they are near the extremes) has been revealed, negative in the first case and positive in the second.

The fact that there is a wide range of responses from question to question, yet a good level of agreement on a specific question, provides significant confidence in the results and suggests that the questionnaire was taken seriously by the participants. Indeed, it was the purpose of the cover letter accompanying the questionnaire (Fig. 1) to stimulate concern over the important services and ensure a discriminating response. The questionnaire appears to be successful in this regard.

Out of the total of 12,050 returned questionnaires, only two encouraged a total discontinuation of all services.

It is worth mentioning that the correlation of "use" responses (questions 1 and 6) is so close to "importance" responses (questions 2 and 7) that this analysis is confined principally to the "use" aspects. This procedure minimizes potential distortions in the analysis that could have resulted from use of an erroneous version of the questionnaire early in the survey in which the option "Standard Frequency" was inadvertently omitted from the list of terms under "Importance" in question 7.

A. Geographical Distribution of Responses

Figure 4 reveals the geographical distribution of the completed responses (question 5). It is interesting to note that every continent is represented (including Antarctica) in the list. Thus, this adds credence to the idea that WWV and WWVH provide a world-wide service. As one would expect, of course, most of the users are in the Western Hemisphere, near the stations where reliability is much higher.

B. User Classification

In question 9, the participant was asked to classify himself into one of 14 categories. In retrospect it is now obvious that there were three important categories which were overlooked: (1) private citizen, (2) watchmaker/jeweler, and (3) amateur radio operator. Unfortunately, most of these have been grouped together under the heading of "other."

Figure 5 shows how the users classified themselves. It should be noted that several participants checked more than one category, and thus the sum of the classifications is greater than the number of responses. Also, it should be noted that a maximum of three user categories was transcribed to punched cards for analysis. Relatively few responses contained more than three user categories.

C. Relative Use of WWV, WWVH, and Telephone Time

Figure 6 shows the relative use of WWV, WWVH, and the telephone number (303) 499-7111.* The numerical values were computed on the 0 to 3 basis as applied to question 3 and discussed above. While it is obvious that WWV is the most-used service which is provided, it is interesting to look at the actual use rate of the telephone time-of-day service--the least-used service. Figure 7 shows the growth in calling rate (in thousands of calls per week) to telephone number (303) 499-7111. The present calling rate is nearly equivalent to one million calls per year and according to Fig. 6 should be small in its use relative to either WWV or WWVH.

While on the subject of the telephone time-of-day service, it is interesting to look at the percentage of respondents within a given geographical area who make either "sometimes" or "frequent" use of the telephone time service. These results are shown in Fig. 8; and, as one would expect, the Mountain Standard Time Zone has the highest percentage use, since it includes the toll-free Boulder-Denver local area. Nonetheless, there is a significant long-distance use of this service.

D. Relative Use of the Various Broadcast Frequencies

As one could easily predict from various considerations, Fig. 9 shows that the broadcasts at 5, 10, and 15 MHz are the most used. This is predictable on the basis of three considerations: (1) during the present, low sunspot phase, propagation at these frequencies is more reliable; (2) the greatest transmitted power from the radio stations is at these frequencies; and (3) many commercial receivers receive only these frequencies.

If one were to curtail any of the carrier frequencies, Fig. 9 would strongly suggest 25 MHz and possibly 20 MHz. One might, however, want to retain a flexible position when we again approach a period of sunspot maxima. Also, the 20 MHz from WWVH is unique in the Pacific Basin, since JJY, Japan, broadcasts on 2.5, 5, 10, and 15 MHz only.

E. Interference

Users were asked to indicate how often they experience "harmful interference between NBS broadcasts and other time/frequency transmissions." Of the total responses to this question (11480) about 3 percent checked "frequently," and about 9 percent checked "often." As expected, problems are much less severe within the U. S., although 14 percent of users in the Eastern Time Zone reported harmful interference either "frequently" or "often." This compares with the 19-25 percent for users giving their geographical locations as either the entire

*This regular commercial telephone number is connected directly to the WWV format generation equipment at Ft. Collins, Co. Users thus have direct access to the complete WWV broadcast format without needing a radio receiver.

GEOGRAPHICAL DISTRIBUTION OF RESPONSES

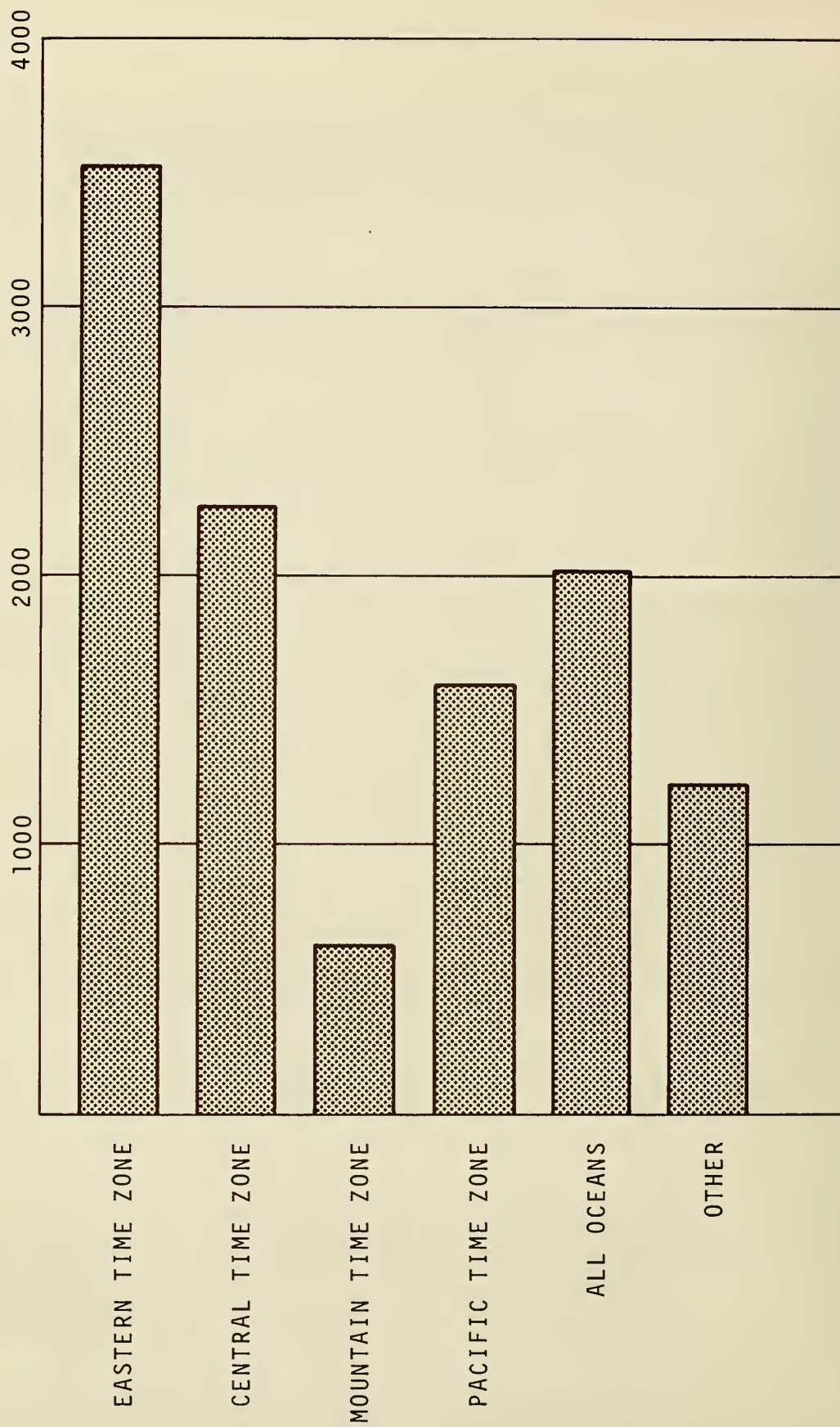


Figure 4

NUMBER OF RESPONSES FOR EACH USER CATEGORY

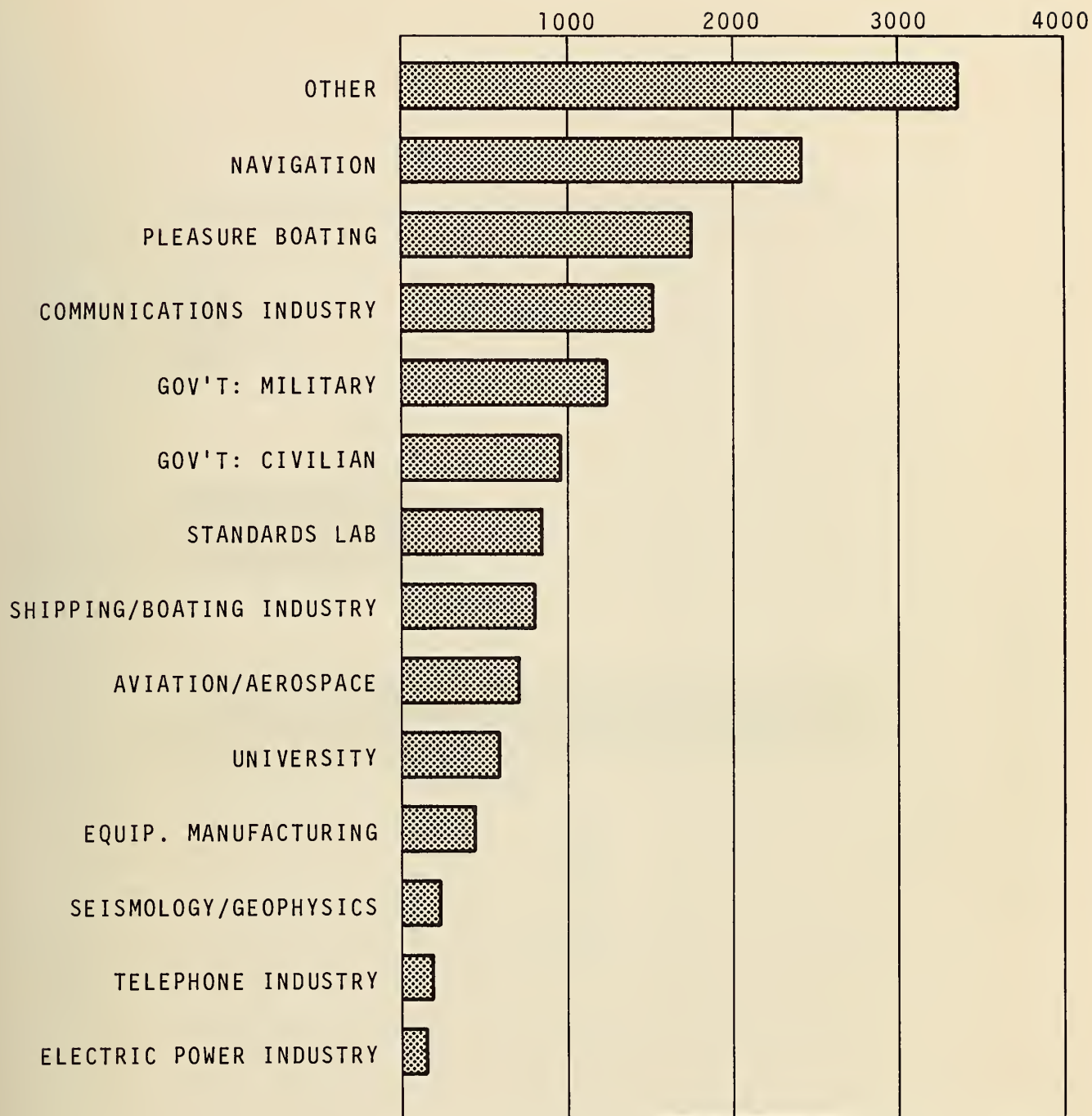


Figure 5

USE OF FACILITIES

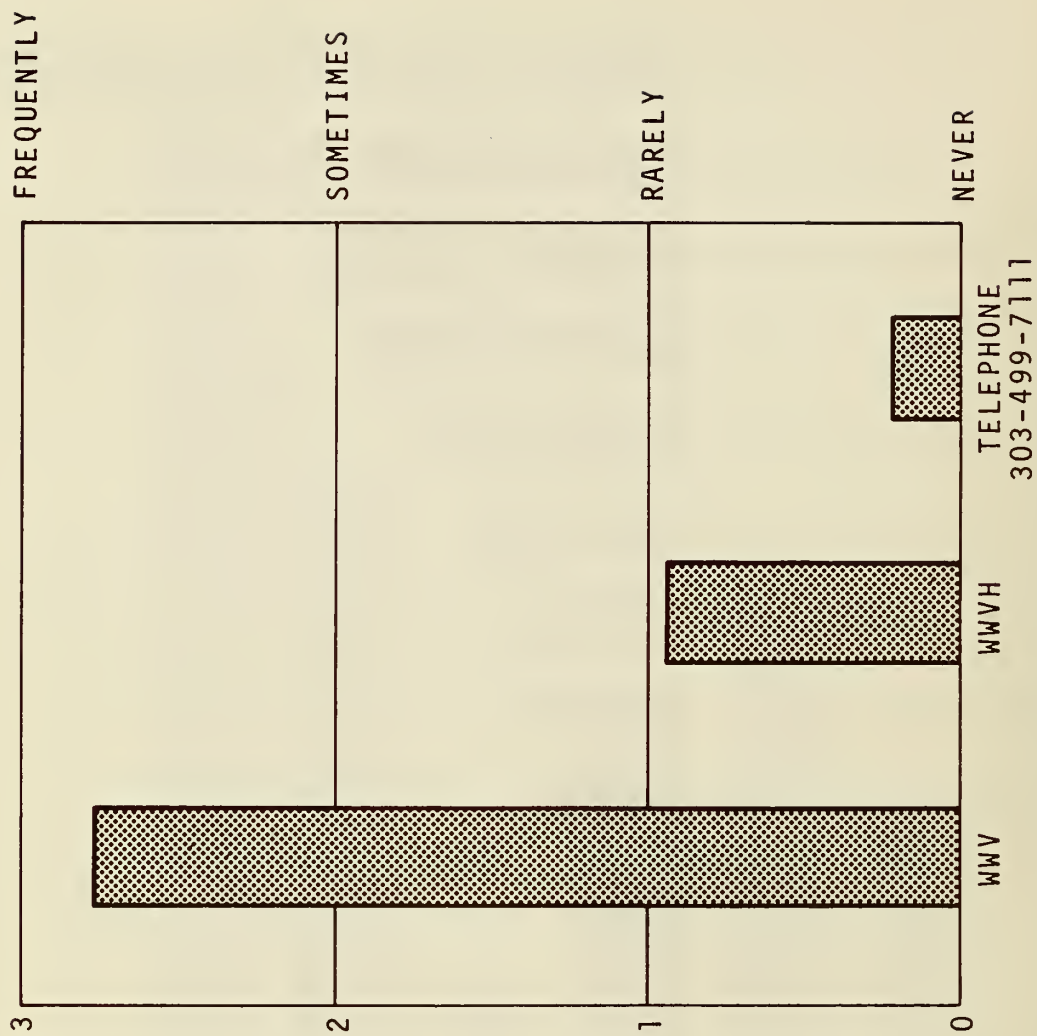
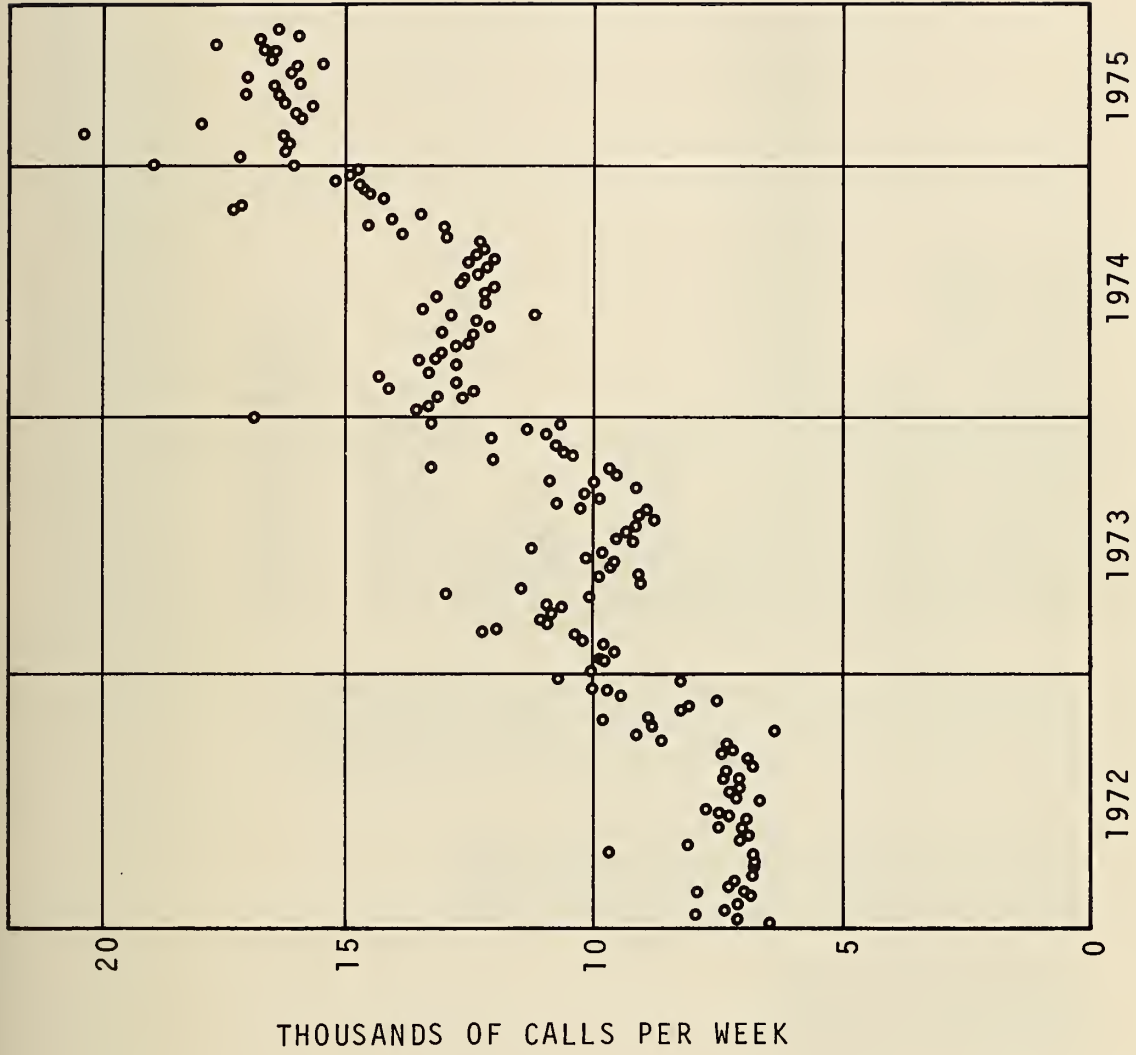


Figure 6



WEEKLY CALLING RATE TO (303) 499-7111

Figure 7

FRACTIONAL USE OF TELEPHONE (303-499-7111)
BY GEOGRAPHICAL REGION

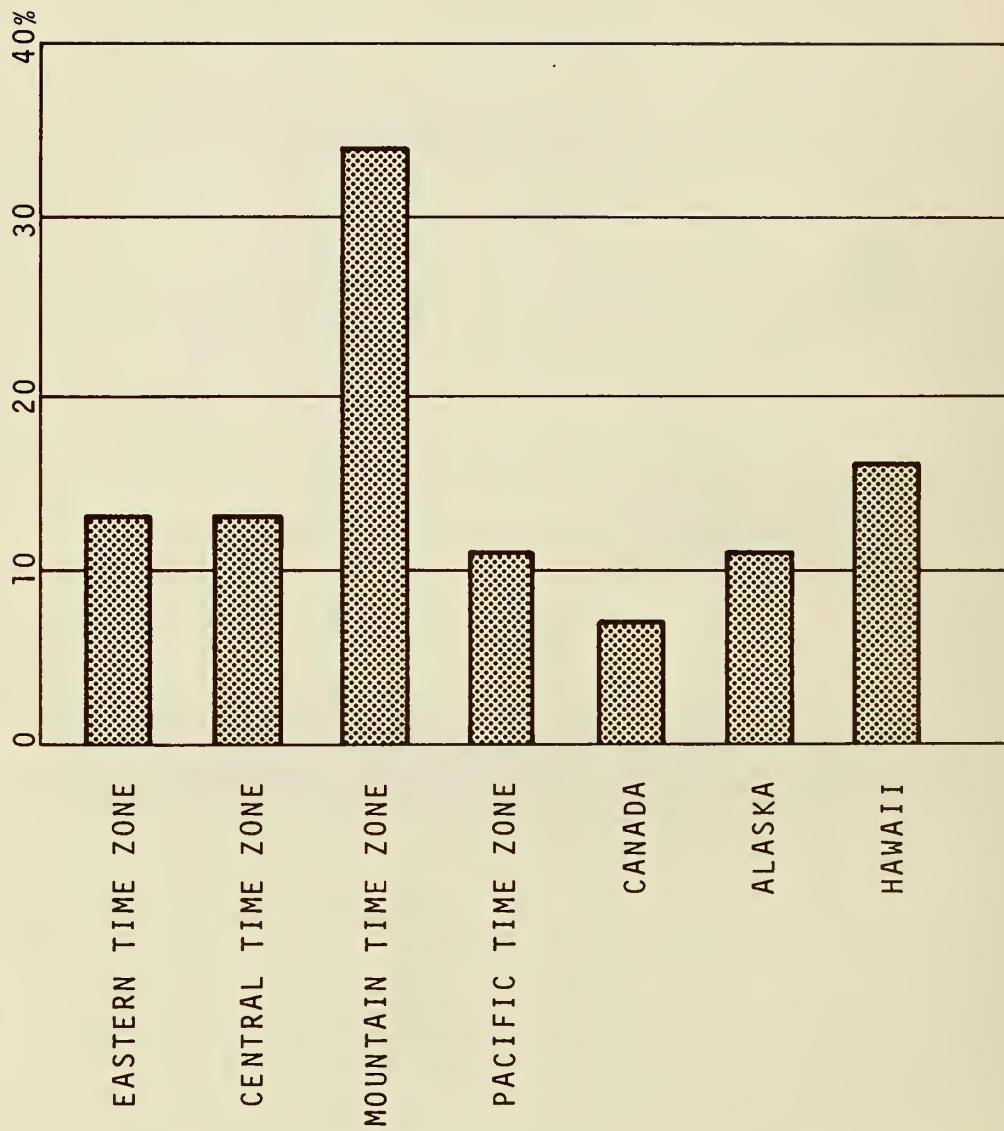


Figure 8

USE OF THE BROADCAST FREQUENCIES

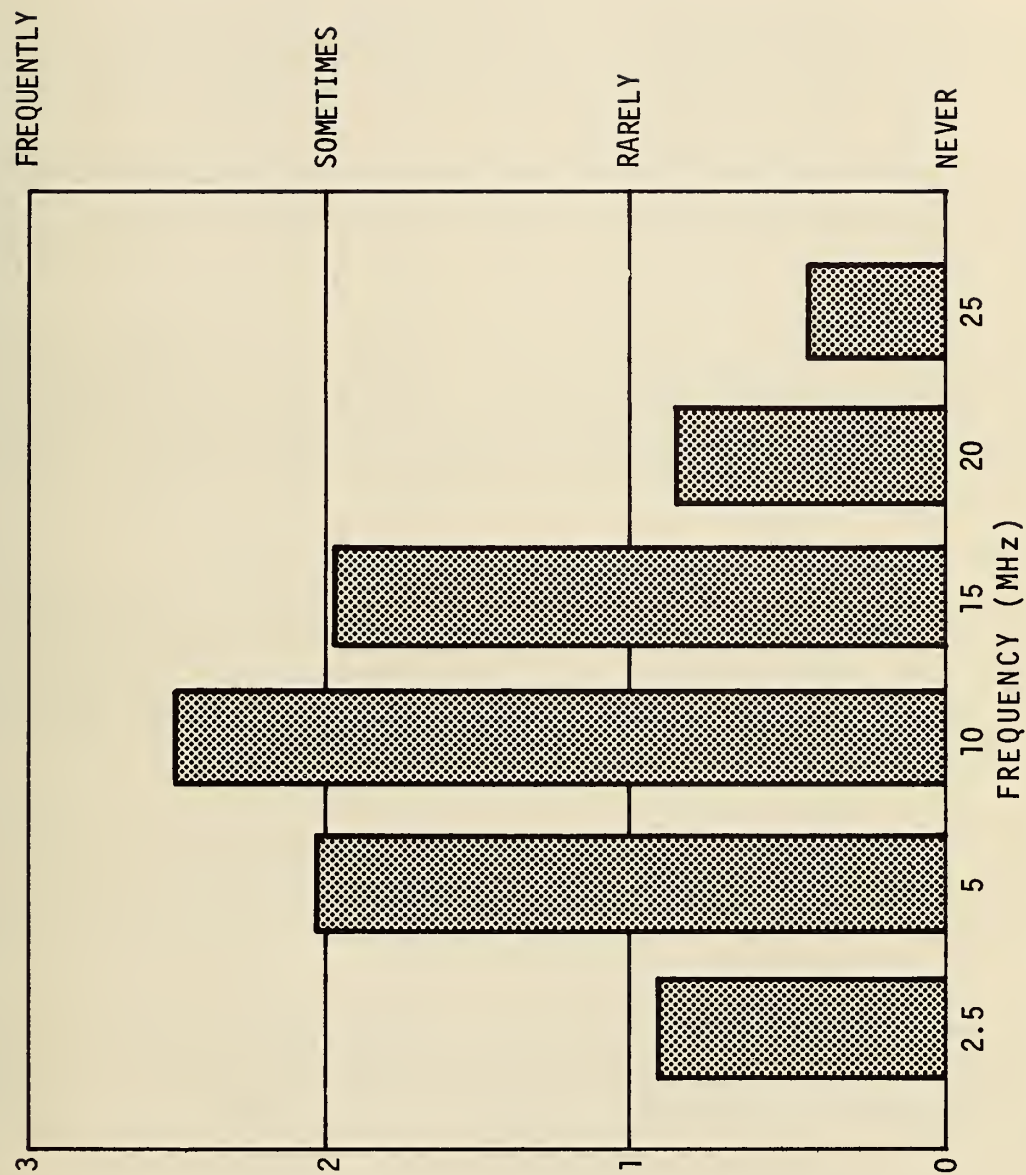


Figure 9

world or on all oceans. From user comments which were written in on many of the questionnaire forms, it is clear that conditions are particularly bad in the Eastern Atlantic, the Mediterranean area, and the Western Pacific. It is also apparent from some of the comments that at least some users interpreted "harmful interference" more broadly than just that resulting from other time/frequency broadcasts. There is no way to determine to what extent such misinterpretations might be influencing the results.

3. Specific Results

Figure 10 displays the scores (on the zero-to-three scale) for each of the 14 user categories and for each of the eight services provided by WWV and WWVH. Also shown on the matrix are the overall scores and the sizes of each of the user categories. Again, use has been considered rather than importance because there is very little difference between the two matrices.

The most obvious features of the matrix are that voice time-of-day announcements are uniformly the most used aspect of the broadcasts, and the DUT1 values are uniformly the least used. In fact, the highest use of the DUT1 values (university category) is still lower than the lowest use of any other aspect of the services for any category of user.

Voice Time of Day

It is perhaps interesting to note that the categories of seismology, university, aviation, and pleasure boating rate voice time of day as the most used service of any of the user categories. On the other hand, standards labs and the electric power industry are relatively low in their use of this service. This is probably because standard frequency references are important to much of their work rather than time, and most of them use the WWVB broadcasts for their calibration work rather than WWV or WWVH.

DUT1 Values

At the time that the DUT1 values were proposed for inclusion into the UTC system of time dissemination [2] by the CCIR, strong emphasis was placed on the need for real-time corrections to obtain the time scale UT1. Specifically, corrections allowing UT1 to be determined to 0.1 seconds which were available every minute of the broadcast were thought to be essential for navigation purposes. Because of this history a very special effort was undertaken to sample the needs of navigators by the various mailing lists, publications, and announcements which were discussed above.

It is apparent from the matrix (Fig. 10) that navigators, boaters, and shippers display a particularly low use of DUT1. Similarly, for importance, the navigation interests in DUT1 are as low as any. Indeed, one should note that a score of zero could be attained only if every respondent checked the "never" box, and one must recognize that there will always be some "noise" or spurious responses to questions. Thus, one could ask the question of whether or not a total score of 0.3 is as near to zero as one can measure with the questionnaire.

In an attempt to answer this question, one could note that the telephone industry, electric power industry, and standards labs probably have no real interest in DUT1 values, since they are not critically dependent on earth position. Nonetheless, their responses are about the same as (actually slightly larger than) the navigation-related categories. Unfortunately, the sample sizes are not great, and some uncertainty remains. It is safe to say, however, that the DUT1 values represent the least important and used service provided by WWV and WWVH.

Of course, some respondents did check "frequent" use of DUT1 values or rated it "very important." It is of interest to explore this further and see if there is some correlation with the principal use (question 9, second list) made of the broadcasts. Not surprising, "Astronomy" was high, with 6.3 percent of these people rating DUT1 values as very important; and "Rocket/Satellite Tracking" was second at 4.8 percent. All others less, with "Navigation/ position location" at 1.8 percent. Thus, one can conclude that what little use is made of the DUT1 values is mainly for space and astronomy, and it is not particularly used or needed for (terrestrial) navigation.

User Category (No. of responses)		Services											
		Over-all rating											
		Other (3318)	Navigation (2385)	Pleasure Boating (1714)	Communications (1492)	Gov't. Military (1227)	Gov't. Civilian (955)	Standards Labs (817)	Shipping/Boating Industry (791)	Aviation/Aerospace (693)	University (577)	Equip. Manufacturing (424)	Seismology/Geophysics (220)
		Electric Power Industry (148)	Telephone Industry (174)										
Time-of-Day: Voice (2.79)	2.84	2.78	2.72	2.81	2.67	2.76	2.60	2.81	2.85	2.86	2.77	2.85	2.68
One-Second Ticks (1.97)	1.98	2.07	1.91	2.13	1.83	2.15	2.28	2.27	2.19	2.32	2.27	2.45	1.90
Standard Frequency (1.74)	1.82	1.18	1.11	2.48	1.32	1.92	2.36	1.37	1.67	1.93	2.31	1.68	2.42
Propagation Forecasts (1.40)	1.52	1.04	.99	1.88	1.02	1.36	1.44	1.19	1.40	1.51	1.55	1.57	1.64
Weather (1.35)	1.24	1.82	1.93	1.41	.87	1.15	1.17	1.85	1.53	1.33	1.32	1.54	1.18
Geolerts (.92)	1.02	.77	.80	1.20	.64	.92	.96	.73	.98	1.23	1.05	1.68	1.04
Time-of-Day: BCD (.67)	.55	.83	.63	.83	.76	.82	.75	1.06	.88	.81	.75	1.13	.67
DUT1 Values (.28)	.25	.25	.21	.41	.29	.34	.47	.24	.38	.47	.42	.45	.31
													.38

Figure 10
USE OF SERVICES FOR EACH USER CATEGORY

Marine Weather Information

At regular spots each hour, weather information is broadcast from radio stations WWV and WWVH. This weather information is supplied by the National Weather Service, and its coverage areas include appropriate areas of the Atlantic and Pacific Oceans. It was intended to be of main value to navigators on the oceans who also use the standard time broadcasts.

From the matrix (Fig. 10), it is easy to see that this weather information is well received by its intended audience. The analysis revealed that 33 percent of the respondents who use WWV/WWVH for navigation consider the weather information to be "very important." AT least for the navigators this weather information is easily the third most important service supplied on the broadcasts.

It is probably worth noting that a frequent suggestion for additional services was to provide weather information for the Continental U. S. as well.

Propagation Forecasts

As one would expect, the "Communications Industry" category uses the propagation forecasts more than any of the other user categories. From the analysis one finds that 34 percent of the amateur radio operations find this information "very important." Indeed, amateur radio operators were easily the largest group numerically which found these forecasts to be "important" or "very important."

Geoalerts

It is easy to see from the matrix that the geoalerts are used primarily by seismologists and geophysicists.

BCD Time Code

The interest in the BCD time code was a complete surprise. One might speculate this could be a confusion with the WWVB broadcast services at 60 KHz, but from several of the comments there does seem to be a real interest in the code from WWV/WWVH. Most surprising of all, however, is the high interest in the BCD time code shown by seismologists and geophysicists. It was thought that this group was very dependent on WWVB and not WWV/WWVH.

Standard Frequency

The results show that the standard frequencies provided by WWV/WWVH are the third most popular service offered by these stations. The matrix suggests above-average dependence on the standard frequencies by the communications segment (which includes many amateur radio operators), standards labs, equipment manufacturers, and the telephone industry. Especially low use is indicated, as is reasonable, for the shipping/boating-related categories, where timekeeping is the more important aspect. Since propagation effects limit the useful frequency accuracy of most HF transmissions as received to about 1×10^{-4} , the responses to this survey do not include most applications requiring greater accuracy.

One-Second Ticks

This service turned out to be the second most popular service on WWV/WWVH, being exceeded only by the voice time-of-day announcements. Greatest use was reported in the seismology/geophysics, university, shipping and boating (as distinct from pleasure boating), standards lab, and aviation/aerospace categories.

4. Some Frequently Expressed Suggestions/Comments

The questionnaire provided space for responders to make suggestions for new/revised services or more general comments. While an accurate count of how many times particular comments appeared is not available, it was apparent to those examining the returned questionnaires that certain suggestions occurred over and over again. Following is a brief summary (in no particular order) of some of the more frequent suggestions expressed by many different users and/or organizations. A fairly extensive listing of individual comments can be found in the Appendix.

- a. Add weather information for the Continental U. S.
- b. Add NBS time signals to the VHF weather station broadcasts to achieve more reliable coverage in some areas.
- c. Reinstate time signals in Morse Code at least occasionally in the format. The rationale is that such signals are much easier to receive than voice in the presence of noise.
- d. Provide more time in the format when only the carrier is transmitted.
- e. Increase radiated power on 5, 10, and 15 MHz.
- f. Eliminate some transmitted frequencies (most often mentioned were 2.5, 20, and 25 MHz).
- g. Do not reduce any radiated powers--reception is too marginal in some areas now. If necessary, part-time operation at full power is preferable to lower power.
- h. Transmit 2.5 MHz only at night and 20 MHz only during the day, with 5, 10, 15 MHz left on all the time.
- i. Increase reliable coverage by adding one or more low-power repeater stations in the Eastern U. S.
- j. Make the WWV-by-phone service a toll-free number from anywhere in the U. S.
- k. Have announcers pronounce each digit of a number separately--e.g., "five-nine" instead of "fifty-nine."
- l. Work out a cooperative agreement with CHU, Canada, which would effectively improve reliability of time signals received in the Eastern U. S.
- m. Provide more detailed marine weather, geoalert, and radio propagation information.
- n. Provide the weather, geoalert, and radio propagation information more often--at least twice per hour.
- o. Adjust broadcast format to put propagation forecasts and geoalerts closer together in time, since they are often of interest to the same people.

REFERENCES

- [1] U. S. National Bureau of Standards (revised annually), Special Publication 236.
- [2] C.C.I.R. Recommendation 460 (Rev. 74).

APPENDIX

RESPONSES FROM USERS OF WWV/WWVH

Only about 17 percent of all comments have been reproduced in what follows. Deleted were the very short comments, such as, "Keep up the good work," or "You're doing a great job," etc. Any comments with significantly different or controversial content have been included; thus, those comments which were critical of the services are found in what follows.



U.S. DEPARTMENT OF COMMERCE
POSTAGE AND FEES PAID
COM-218

National Bureau of Standards Time and Frequency Division Boulder, Colorado 80302

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards
Boulder, Colorado 80302
OFFICIAL BUSINESS
Penalty for Private Use, \$300

9. PLEASE CHECK THE CATEGORIES IN THE TWO LISTS BELOW WHICH MOST ACCURATELY CHARACTERIZE YOUR USE OF NBS FREQUENCY AND TIME SERVICES.

USER CLASSIFICATION	PRINCIPAL USE
1227 <u>GOV'T, MILITARY</u>	1813 <u>HOBBY (OTHER THAN AMATEUR RADIO)</u>
955 <u>GOV'T, CIVILIAN</u>	3995 <u>AMATEUR RADIO</u>
424 <u>EQUIP. MANUFACTURING</u>	7149 <u>CALIBRATION OF WATCHES/CLOCKS</u>
2385 <u>NAVIGATION</u>	2513 <u>NAVIGATION/POSITION LOCATION</u>
693 <u>AVIATION/AEROSPACE</u>	1810 <u>COMMUNICATIONS SYSTEMS</u>
174 <u>TELEPHONE INDUSTRY</u>	641 <u>SCIENTIFIC DATA MONITORING</u>
148 <u>ELECTRIC POWER INDUSTRY</u>	3358 <u>INSTRUMENT CALIBRATION</u>
817 <u>STANDARDS LAB</u>	287 <u>ROCKET/SATELLITE TRACKING</u>
791 <u>SHIPPING/BOATING INDUSTRY</u>	2468 <u>STORM WARNINGS</u>
1714 <u>PLEASURE BOATING</u>	1170 <u>GEALERTS</u>
577 <u>UNIVERSITY</u>	2793 <u>PROPAGATION FORECASTS</u>
1492 <u>COMMUNICATIONS INDUSTRY</u>	842 <u>ASTRONOMY</u>
220 <u>SEISMOLOGY/GEOPHYSICS</u>	
3318 <u>OTHER (PLEASE SPECIFY):</u>	260 <u>OTHER (PLEASE SPECIFY):</u>

10. ARE THERE OTHER SERVICES WE SHOULD ADD? YES ☐ NO ☐ IF YES, WHAT SERVICES
(1516)

11. DO YOUR RESPONSES TO THE ABOVE OFFICIALLY REPRESENT MORE THAN YOUR OWN PERSONAL INVOLVEMENTS? YES ☐ NO ☐
IF YES, PLEASE EXPLAIN (2695)

12. COMMENTS: (5070)

NBS QUESTIONNAIRE FOR USERS OF WWV, WWWH SERVICES

NBS/BL-97

Form Approved
048 No. 41-574125
REVISED

1. TO WHAT EXTENT DO YOU USE THE FOLLOWING FREQUENCIES?

	FREQUENTLY	SOMETIMES	RARELY	NEVER
2.5 MHZ	1371	2246	2653	3428
5	5478	3120	1125	995
10	8172	1952	462	566
15	5371	2798	1152	1222
20	1074	2023	2647	3783
25	321	836	2272	5729

2. HOW IMPORTANT ARE THE FOLLOWING FREQUENCIES FOR YOUR OPERATION?

	VERY IMPORTANT	SOMEWHAT IMPORTANT	RELATIVELY UNIMPORTANT	VERY UNIMPORTANT
2.5 MHZ	1280	2098	2725	3234
5	4840	3204	1373	1028
10	7100	2629	701	557
15	4813	2783	1436	1213
20	1409	1864	2785	3431
25	370	943	2638	4818

A4

3. HOW OFTEN DO YOU USE THE FOLLOWING?

	FREQUENTLY	SOMETIMES	RARELY	NEVER
WWV	9997	1108	197	201
WWVH	1819	1841	1976	4273
TELEPHONE NO. (303) 499-7111	303	499	848	6687

4. HOW OFTEN DO YOU EXPERIENCE HARMFUL INTERFERENCE BETWEEN NBS BROADCASTS AND OTHER TIME/FREQUENCY TRANSMISSIONS?

CHECK ONE:	NEVER	SELDOM	OFTEN	FREQUENTLY
	2594	5490	1053	843

5. IN WHAT APPROXIMATE GEOGRAPHICAL AREA DO YOU MAKE USE OF

WWV/WWVH SIGNALS? (11267)

6. TO WHAT EXTENT DO YOU USE THE FOLLOWING INFORMATION?

	FREQUENTLY	SOMETIMES	RARELY	NEVER
TIME OF DAY, VOICE	10039	1200	188	158
TIME OF DAY, BCD CODE	1273	1222	1611	5163
ONE-SECOND TICKS	5450	2780	1237	1212
STANDARD FREQUENCY	4931	2276	1041	1951
OUT 1 VALUES	225	584	1409	6225
WEATHER	2444	3220	2088	2591
GEALERTS	1592	2058	1921	3971
PROPAGATION FORECASTS	3242	2616	1478	2784

7. HOW IMPORTANT FOR YOUR OPERATION IS EACH OF THE FOLLOWING CATEGORIES OF INFORMATION AS SUPPLIED BY WWV/WWVH?

	VERY IMPORTANT	SOMEWHAT IMPORTANT	RELATIVELY UNIMPORTANT	VERY UNIMPORTANT
TIME OF DAY, VOICE	8165	2592	552	215
TIME OF DAY, BCD CODE	1098	1277	2271	4523
ONE-SECOND TICKS	4459	3031	1851	1235
STANDARD FREQUENCY	2988	1595	1079	1593
OUT 1 VALUES	189	563	2012	5777
WEATHER	1796	2767	2825	2824
GEALERTS	1202	1916	2516	3824
PROPAGATION FORECASTS	2490	2724	2007	2771

8. HOW WOULD YOU CHARACTERIZE THE SIGNAL WHICH IS TYPICAL FOR YOU?

	MORE THAN ADEQUATE	ADEQUATE	MARGINAL	USELESS
SIGNAL STRENGTH	1433	6819	1529	35
ACCURACY OF TIME AND/OR FREQUENCY	5509	5503	280	42

(OVER)

Comments - NBS Questionnaire for Users of WWV, WWVH Services

1. All personnel concerned with train operations rely on accurate time in order to operate trains safely. Their watches are calibrated by making comparisons to a standard clock which had been previously calibrated to WWV.
2. Normally we use WWVB - 60 KHz.
3. Correct time is of the utmost importance in operating a Railroad and we are responsible for supplying a receiver to provide that time, also for frequency calibration.
4. Weather in more areas including great lakes.
5. My only recommendation would be a temporary suspension of transmission on 20 and 25 MHz until propagation conditions warrant the use of these frequencies. I hope that my response to the questions will not reduce the services rendered by your stations since the answers do not take into account intended future use. Please accept my thanks and appreciation for the excellent services you provide.
6. If you want to cut costs, you might discontinue the telephone number. I don't know or have ever read of anyone who uses it.
7. If a cutback of services is necessary, it seems to me that cutting back on the higher frequencies would be the best course of action (at least during this portion of the sunspot cycle). Note: Would it be possible to run some transmissions SSB at lower power?
8. Propagation forecasts each hour - 6 hours is a long time to wait.
9. For myself and friends who are WWV listeners, frequencies 5 and 10 are adequate PROVIDED that there is no curtailment of power (signal strength).
10. Services very useful. WWVH not used much because signals overlap. Cutting WWV power would be a big handicap. Signals are sometimes marginal.
11. WWV/WWVH/WWVB are pretty good the way they are at this moment.
12. On net control for search and rescue mission need CUT time. Feel this is good for time and frequency check.
13. Get FCC to clear your frequencies!
14. It would be good to eliminate some of the words used over and over again every minute. The listing of frequencies used could be once an hour for example. Everybody knows the frequencies.
15. I believe WWV and WWVH are important to aviation, navigation, aerospace, government, military, meteorology, etc. and should not reduce your output power.
16. Please increase your signal to overcome local spurious radiation (Utah).

17. The services of WWV are so fundamental to the physical sciences in the United States, I cannot conceive of any cutting back in operations. These broadcast standards will be used more in the years ahead--not less!
18. Voice broadcast fades excessively.
19. The ideal is not always possible--a statement of fact, not a complaint. How I wish that the signal in Houston over WWV 5 MHz were stronger, and did not keep fading away into "static land". However, even this is better than none.
20. As you are aware nearly all the private vessel (pleasure, fishing com.) operators use "RDF"--with only 2.5 MHz as a receiver capability.
21. Very useful convenient service not available in any other way.
22. A 50% reduction in power would render your signal worthless in my area. Seems to me that there are many other ways to conserve energy without depriving users of the only accurate source of time signals.
23. Have propagation forecasts and storm warning updates more often. In order to conserve energy a power cut on 20 and 25 MHz wouldn't cause too many objections.
24. Suggest removal of Audio Tone Modulation except one second ticks and at start of each minute. Reduce WWVH power or change antennas to cut interference with WWV in this area. (Santa Barbara, CA)
25. NBS should broadcast time signals which could be used to drive digital clock displays.
26. The time of day (voice), one-second ticks, propagation forecast, and weather are very important to amateur radio operators. The principal use is the calibration time. Cutting back on your power could make WWV and WWVH unreadable in many parts of the country.
27. While now only interested in Ham Radio useage I have been in Industry and U.S. Navy Communications. To them the calibrations and navigational time checks are all important.
28. Provide time and communications services for railroad.
29. I would like to see the propagation forecasts extended to other paths and specific forecasts for different frequency bands (i.e., mf., hf - 3-10, 10-15, 15-25, 25-30 MHz).
30. Expanded propagation forecast and information. Propagation is very important.
31. Probably every sports car club in U.S.A. uses your time tones to calibrate watches to time of day. It is essential to have accurate timing to 1/100th minute in a rally. Synchronization of watches is made possible by WWV.

32. Represent the 100 ± membership and users of sport events in Maine and New England - specifically the (County) sports car Club and local members of the thousands of SCCA (Sports Car Clubs of America) members in New England. Events are timed to nearest 0.01 minute, and the event-mark of each full minute is the necessary signal. The full hour signal is also most important.
33. Railway - Other departments on our Railroad use WWV time signals.
34. Having spent 15 years at sea on the far east run between New York and Hong Kong from 1952/1967 we depended on WWVH for navigation clock corrections and any reduction in power for that station should be investigated quite thoroughly.
35. The unit, FAA, has Air Traffic control tower, recorded time source - WWV, and counters requiring calibration periodically. (FAA field unit,)
36. I wish you would increase the frequency of propagation forecasts and geo-alert announcements during your broadcast schedule. (Minnesota)
37. Meteor shower predictions should be added. HF spectrum generally in bad shape.
38. We publish information on WWV for the use of surveyors and other workers in the field. (Time Department, Observatory. England).
39. FAA- . I am an electronic technician with the FAA and have to rely on your time signals to set our clocks and sync. circuits.
40. I would like to see you revert to the old system of tone for four minutes & ticks for the fifth, with voice and MCW time announcement of fifth minute. (Represent the in Macao, as well as associates in Japan, Thailand, etc.)
41. It would be very difficult to do my work correctly as I service accutrons and high grade of watches; and I need correct time signals (watchmaker).
42. Provide propagation forecasts twice each hour.
43. Add VLF time signals such as Loran-C. Stn.TX.
44. WWV is very useful, especially as a time base to synchronize radio stations all trying to join a radio network. (Louisiana Radio Network)
45. Add general weather reports for the U.S. broken down into six areas, i.e. Northeast-southeast-upper midwest-lower midwest-northwest-southwest.
46. Use signals to keep the standard clock set correctly in compliance with the railroad industry rules. We must operate on correct time. Also use standard frequency to check out the two way radios used by the Railroad.

47. The end users of the products produced by my facility are dependent upon the presence of standard carrier frequency broadcasts for calibration purposes.
48. Radio stations throughout Indiana depend on our time accuracy. Commercial radio network, to synchronize clocks.
49. Add more frequency propagation forecasts.
50. I operate a Commercial Frequency Measurement Service for Broadcast and Communications radio services and also use NBS material in engineering work at four radio stations. The primary use indicated in answers I have marked are for use in Standard Frequency Measurements. I am now starting to use the transmissions from WWVB for calibration of the measurement equipment used in my Lab.
51. My company uses WWV for signal generation calibration for lab use.
52. Astronomy Club sometimes does grazing occultations - a dozen persons are then using WWV/WWVH.
53. We run as an isolated utility at times so your signal is needed.
(Public Utility, MN)
54. Perhaps two frequencies would be adequate if ensured of reception. My area (atlantic seaboard) is a poor reception area. A more local transmitter would be helpful.
55. Increase propagation forecasts to twice each hour.
56. Fly on crew aircraft--time information essential to mission accomplishment.
57. This unit has three each HP cesium standards equiped with clock functions, therefore we have very accurate, time and frequency always available.
(Commanding Officer, ,)
58. A large sector of our industry MUST have a good standard. Lets get rid of those damn politicians who continually screw up the works.
()
59. Our great government can better economize by reducing waste than by curtailing essential services: NBS is such a service. At least the seafaring men of the world will thank us.
60. If you could give the propagation quality forecast at 44 minutes past the hour as well as 14 minutes past, I would not miss it so often.
61. Our firm and others use the time and weather in the performance of our business. We would like to have the use of these stations continued, frankly, this is a service I feel IS the RESPONSIBILITY of our government, unlike considerable programs that cost considerable more.
(Surveying)

62. In addition to the propagation forecasts broadcast at 14 min. past the hour, I also use the transmissions themselves as indicators of propagation conditions - as beacons might be used.
63. Use more detailed weather reports.
64. USCG using service for communications and navigation.
65. Since the maximum useable frequency during the evening hours is below 20 MHz, I suggest you shut down WWV 25 MHz and 20 MHz transmitters during those times.
66. We are a Coast Guard Ship. We rely wholly on the correct time and frequency for operations while at sea.
67. This particular transmitting system uses WWVH as its time standard. (Radio Transmitting Facility, , FPO San Francisco)
68. Of all the radio and television broadcasting in the United States, it seems ridiculous to cut back the already modest schedules of WWV and WWVH. Fifty KW could be cut so easily from, say, the VOA (who notices the difference between their 250 KW and 500 KW transmitters anyway). You are doing a lot for a little right now; any cutbacks would represent more tokenism as an attempt to avoid dealing with the real problem of energy and government spending.
69. A worldwide program (in existence for at least the last 25 years) to time occultations of stars (primarily) by the moon, has been (and will continue) relying fully on the time services of the NBS and others. I strongly object to any elimination or reduction of power in the 2.5, 5.0, or 10. MC frequencies.
70. We noted no mention of WWVB, and assume this service is not going to be affected. Power reduction or elimination of 5, 10, 15, or 20 MHz would be the worst possibilities from our viewpoint. (equip. man. Standards Lab - TX)
71. Would not two frequencies be adequate? 5 and 15 MHz.
72. Strongly urge the WWV broadcasts be maintained at full strength on 5-10-15 MHz. (Broadcasting)
73. Perhaps you could expand on your propagation forecasts.
74. Receivers marginal at times at present wattage.
75. We are interested in all aspects of worldwide weather patterns including earthquakes and volcanic eruptions and especially those affecting North and Central American countries. We would like to suggest that in STORM WARNINGS, the nearest land area be mentioned.

76. I am the business manager of a larger-than-average cattle operation and find that WWV is the most reliable long-term weather prognosticator. I am a cattle exporter and find your services invaluable for navigational purposes (as well as weather). I am an amateur radio CQer and CBer (and find your data useful in that area) I am an accuracy fiend...I pay about \$500 the annum for time-keeping and devises to augment same.
77. I make extensive use of telephone access (via 303-499-7111) for time of day and standard audio-frequency tone whenever reception conditions for WWV are marginal.
78. If cutback is necessary I would suggest either reduction of Time/Freq. accuracy or reduction in WWV power.
79. The high quality service is expected world wide and should be maintained without modification.
80. As a retired Naval officer and sometime navigator and an ex-ham () I have found your services extremely useful and a first rate expentiture of my tax dollar to say the very least.
81. More frequent propagation forecasts.
82. I use WWV to calibrate and rate precision clocks, both mechanical and quartz. I use WWV for chronometer adjustment in restorational work.
83. Many persons that I talk to including New Zealand and Australia seem to think as I do. We do NOT need WWVH.
84. I use WWV mainly in the acquisition of astronomical data. Primary uses; occultation and positional work. Secondary; equipment calibration.
85. Our Regional office of Defense Civil Preparedness Agency uses time signal.
86. Reinstitute morse code propagation forecasts and geoalerts as part of each minute time statement. Like the new 14-after propagation up-dates. would like additional satellite/space-craft information up-dates.
87. I use standard audio frequency broadcasts to calibrate or check calibration of precision audio measuring equipment.
88. Time of Day as broadcast by WWV is very important to Sport Car Clubs in the North East Area. They can not hold competion without accurate time.
89. The personal involvments involve the entire Avalon St. Bernard Search and rescue operations. We use NBS time of day and frequency time interval to designate exact positions of our search parties. The NBS time of day and frequency time interval along with other services is imperative to our saving lives and locating people.

90. WWVH is depended upon by myriads of people in the Pacific regions for time, weather and all other information it provides. Many Islands, hobby people, ships-at-sea and many others would be lost especially if WWV or WWVH cut power down. The same applies to thousands of us here in North America and other areas where these signals and announcements can be heard.
91. WWV time standard and frequency standard used throughout the Railroad. These checks are made daily at frequent intervals.
92. I have personally depended on WWV for about 35 years as part of my profession as Certified Master Watchmaker.
93. Compared to other Government operational costs it would seem that this service is of enough importance to disregard any cost cuts. Less important services such as TV and A.M. broadcast stations would easily reduce power enough to more than off-set the energy consumed by the NBS services.
93. NBS is used by the Aviation Dept. for corporate jet Aircraft Services and is valuable to us.
94. The idea of lowering transmitting power sounds fine... however, I feel that the strength of the signal would be involved. I keep weather records and put everything in. coordinated U.T. for easy conversion to other times.
95. Recently a Weather-Radio Station NOAA Radio 162.40 MHz started to broadcast here. Their signal is hardly audible across the city 90% of the time while WWV is audible here all day and up to 9:00 p.m. If NBS could take over these stations and combine NBS operations with Weather-Radio and with Civil Defense I believe we would reap quite a savings in energy. Do not reduce power on WWV as this would render your service here useless. (Houston,TX)
96. All at work need the time but could get along by getting it at less time intervals. 2 minutes out of 5 minutes would be fine. (FAA Air Traffic Control)
97. WWV and WWVH perform one of the most important technological functions, that of supplying a basic standard for many measurements, and of supplying a common time base that aids cooperative work all over our nation.
98. Use for synchronization of times for Municipal Dept. & Services. In Crime and Emergency situations precise times are increasingly important; we keep our battery powered quartz clocks within 5 sec at all times and encourage checking rates to allow adjustment. Past power interruptions caused serious problems.
99. This is one of the few government services I appreciate. It is comforting to know that honest seconds and Hz still exist.

100. Responses cover our company use of time checks to check clocks used by 50 radio operating positions, and frequency calibration checks of frequency counters used by 55 technicians in the aviation service.
101. Greensboro, to my knowledge, has no other reliable time of day agency. None is even provided by phone, a service which is not always reliable.
102. Obviously, consistant to information supplied in NBS Pub. 236, a tremendous amount of that went into setting up this Government service. Don't blow it by doing something rash. I can think of several more significant ways to save money.
103. I'd like to have the "propagation Forecasts" more often, maybe twice an hour. I think you could reduce your power by a factor of ten and still have a good signal here. (Southern Nevada)
104. I am an amateur astronomer and one of the principal contributors of lunar occultation timings to Greenwich/US Naval Observatories. I am also a radio amateur and have been using WWV for a frequency standard since 1946. I find CHU (Ottawa) to be a much more reliable time source during the day but prefer WWV format. Would like to see return of at least one transmitter to East Coast (2.5 MHz?).
105. I find it hard to believe that you are considering cutting back on what appears to me to already be a bare operation.
106. The Company uses Time Check for watch and clock calibration from the Telephone (499-7111) universally. The Communications Dept. in addition, uses frequency standards for instrument calibration. (RR Company).
107. Time Services used extensively throughout engineering divisions within SRI. Services of WWV, WWVH are critical. ()
108. Accurate time and its coordination are essential to car rallyes! (Corvette Association, Inc.)
109. We feel that savings could more appropriately be effected by some means other than curtailment of these valuable services. (Telecommunications Manager, Co., Houston)
110. Add inland weather warnings.
111. As an educational officer for the U. S. Power Squadrons and Instructor in boating navigation, I consider WWV broadcasting very important as a nationwide function. While I can receive the same service from Canadian sources I prefer WWV's type of operation.
112. Have no use for these services. I can always get a time check from local AM Radio Stations.

113. We have installed WWV receiver at a remote location for better reception and return audio via wireline to telephone interconnect system. Many people in our company dial up time to coordinate company electrical system and other activities. (Gas & Electric Co.)
114. Railroad monitors NBS once each 24 hours to establish agreement of standard clock at Sacramento used as a Standard for the railroad.
115. Give more detailed weather forecasts for Pacific, like you do during some yacht races. There are a great number of people relying on your time signals for navigational purposes. Step up the power not down on these signals.
116. Would like expansion of the propagation forecasts. More often than once an hour and over paths to all continents.
117. I feel that cutbacks should be made in many other areas prior to any reductions in WWV frequencies/power.
118. A Time Standard is very important for safe operation of trains. (RR) (Southeast USA)
119. Source of accurate time signal must be available. Since Western Union Telegraph has discontinued time signals, WWV is a prime source of time information for the Railroad Industry. (Midwest-West-Southwest)
120. The Railroad has nine locations receiving time information from Station WWV and depends upon this accurate time information in the daily safe operations of Freight and Passenger trains over five Southeastern States.
- Rather than reduce power and number of frequencies it would be of great benefit to our service if the radiated power was increased rather than reduced, or a repeater station placed in service somewhere in the Southeastern part of the United States.
121. We use your time signal to synchronize our timing clocks. If we can't receive on one frequency we can always pick up on another one. Use weather at flying time to try to keep birds out of storms. (Pigeon Racer Club).
122. WWV is useful to keep our school buses on schedule. While it is a service we could do without, it is extremely useful and convenient. What we question is the significance of saving a few dollars in energy costs when we squander billions in Foreign Aid. We give to those who hate us! It is commendable but stupid!

123. Add more detailed weather reports, i.e. position of lows, projected movements--twice per hour.
124. Add weather over USA in three or four general areas.
125. The Standard Frequency is used at radio station , , Oregon--and occasionally for other stations in the area--to set transmitter frequency and to make the required frequency measurements.
126. Used for pleasure boating navigation , for navigation/position location and storm warnings for sixty-six members of Squadron of United States Power Squadron. These uses are of vital importance to us as small boat navigators.
127. Technicians from the Police Radio Division rely hourly on WWV for certification of radar units calibration of electronic test equipment before making RF emission checks.
128. In many parts of the world, especially Atlantic Ocean, Western Hemisphere, Pacific Ocean, WWV and WWVH are the only useable time of day services available and are essential to accurate navigation, especially celestial navigation. (Air National Guard).
129. It is important to me to be able to receive on some frequency. I use this service to manually record a blip on the seismogram. Perhaps a single frequency for WWV and another for WWVH with increased power for both?
130. Add more weather information. Please don't cut down operations--I make use of your service daily. My life and many others sailing small boats for a living depend on time and weather services. Try aksing for public donations--I'll be glad to help.
131. Add weather and propagation reports in the 2nd 1/2 hour of each hour.
132. In some of the remote mountain areas of Central America yours is the only U.S. station we could bring in.
133. I would like to see weather for U. S. in four parts.
134. If the government would ground all those S.A.C. Bombers for a couple of weeks, they would REALLY be saving money!!
135. I would favor a decrease in power of operation and I think it would be appropriate to decrease the hours of operation to either intermittent operation throughout each 24 hours or limiting operations to the generally most useful hours for any given transmission location site. You cannot please everyone--no matter what you do. I personally am willing to give up the convenience of 24 hr. operation.
136. Safety at sea is highly dependent on accurate navigation and good weather information. Please don't strand the mariner. Expand weather information.

137. Compare the budget of the Time and Frequency Division with some of the "dum dum" projects of the U.S. Government. This economy "kick" is typical of government bureaucracy
138. Reduction of signal strength would wipe out reception here in Florida for all but those with sophisticated equipment (at least more sophisticated than mine.)
139. We use VLF as standard frequency--not WWV at 10 MHz.
140. I sail in the North and South Pacific and depend upon WWVH for time of day and the storm warnings. In a small boat it is extremely important to know storm locations.
141. Weather information should be increased. I would like output increased on 5 and 10 MHz.
142. WWV and WWVH in conjunction with other National Time Services are used daily to maintain N.Z. time. The broadcasts are also used by seismographs at outstations in N.Z., Pacific and Antarctic stations.
143. The hurrican warnings are of utmost importance for all vessels (merchant) under 1600 gross tons who carry no radio-operator.
144. If the Government is so hard up they can't afford to operate these stations at their present power I would suggest that they get rid of about a million or so demogogs and other bureaucrats that contribute NOTHING to the economy.
145. I should like to point out that many ordinary citizens use WWV for such things as amateur astronomy, and that they should get as much consideration as your institutional users. I consider WWV one of the most important services my government performs for me.
146. All railroads in this area now depend on WWV (via short wave) for accurate time--especially the _____, R.R., _____ Line and other lines associated with _____. All our local watch inspectors have learned to depend on your time/frequency broadcast.
147. We have no interest in receiving the WWV and WWVH standard frequency and time signal emission. (Germany)
148. Restore 440 Hz transmission. We have certainly missed this service. There is too much talk and not enough technical transmission now.
149. How about single sideband with reduced carrier, then full carrier at specified times to allow frequency checks? More economical.
150. WWV adds to the prestige and image of the USA throughout the world and ranks on the radio waves with the Voice of America and AFRS as a symbol of our scientific and social contributions to mankind.
151. We rely absolutely on your signal for accurate time as we do not have a chronometer. Present strength is adequate but should not be reduced.

152. Would like time in code to be restored. QRM sometimes makes voice hard to read.
153. I suggest a dipole directional beam antenna aimed in all directions would increase radiated power.
154. We feel that standard time and frequency broadcasts are an absolute essential. They should be above pure research. Such services should be considered first above all other budget categories.
155. The mere suggestion of reducing power levels is idiotic! These broadcasts are used world-wide! The energy saved in proportion to the total nation's consumption is infinitesimally small. Their worth world-wide is far more important than the trivial amount of energy that will be saved!
156. Give storm warnings at least twice an hour instead of just once.
157. There are other areas and non-sensical programs where money and energy can be conserved without curtailing WWV's and WWVH's very important mission. Should be increased not decreased.
158. We depend heavily on the day and night availability of signals of known origin, stable frequency and simple modulation character. (Research Institute-- , TX)
159. Since the Time and Frequency Service has operated for years at the lowest possible cost to the public, I believe it is foolish to risk a reduction in the service just to save a few KW in primary power.
160. Since energy needs to be saved, why does the FCC not power down some of the FICTION on the air? Please leave us the FACTS - they are a scarce item!
161. Our Radio/TV National Network () should be able to furnish accurate time signals to us on the network so we would not have to use NBS Time Signals. This should be true for all Radio/TV stations that are network affiliated.
162. USGS and Univ. maintain seismic network. University does local earthquake study with portable units. Can we work out something with Canadian system?
163. 3dB power decrease probably would not hurt. It would be preferable to dropping frequencies most of the time. Would it be possible to tailor hours of operation to time of day, e.g. 25 MHz rarely useful around midnight MST.
164. The Atmospheric Research--Field Observing Facility-- provides research support to scientific programs throughout the world on an aperiodic basis. Time Signals are required to monitor satellite schedules and coordinate other activities.

165. High efficient non-linear final amplifiers with high level modulation would reduce over-all transmitter power requirements.
166. Have geoalerts and propagation forecasts every 1/2 hour..
167. Increase, do not decrease ERP output on 5, 10, and 15 MHz channels.
168. I feel there is a large number of Government Services I could do without but WWV isn't one of them.
169. If energy is a high priority why is FCC Docket 20292 (97.61) considering a new 2000 watt out for max pwr limits for Amateurs. It should be the other way. Your service is far more important to everybody.
170. If you can't eliminate some frequencies, what about shutting the whole thing down at certain hours?
171. We manufacture, install and maintain Time-of-Day announcing equipment via telephone. We have seven precision time installations at various locations across the country, all in major cities. Each of these installations set their time directly to WWV by means of HF receivers and oscilloscopes.
172. Why not broadcast time signals at set periods of time during the day instead of continuous 24 hours--in order to save money.
173. If electricity in Hawaii is now so expensive, I suggest WWVH be relocated to the Kenai peninsula of Alaska, South Eastern Alaska, or the Washington state coast. Cheap hydroelectric power is available in all these places.
174. A 3-dB reduction for HF signals is not a very great sacrifice. I think all HF services of all licensees should reduce 3 dB.
175. Severe weather information enables advance preparation for protection of personal property. Warnings for Hurricane Lorreen Sept. 23, 1974 which came ashore near Culican, Sonora were the only accurate source of information received in this area.
176. It is refreshing indeed to have a government agency present a thorough inquiry of this nature. We rely primarily on the signal from WWVB on 60 KHz but use 10 and 15 MHz on occasion.
177. For Honolulu and Hawaii, 2.5 and 5 MHz don't cover well. Unless needed at night at great distances, drop them. We get more out of 10 and 15 MHz.
178. We also have Station CHU available here, but fewer services are provided by it. (Ottawa, Canada)
179. In the interest of energy savings, I would agree to WWV reducing its power on 10, 15, and 2.5 MHz during times when the signal does not reach far (night). The other frequencies might be shut down completely at regularly scheduled intervals. I would also like to see more detailed propagation forecasts.

180. I wouldn't mind if one frequency were discontinued--say 5, and increased output in signal was given to another--say 10--to thwart interference by shortwave stations, hams & CBers, who make it inaudible.
181. I am an airline pilot who uses WWV to calibrate my watch, which I then use for airline navigation and record-keeping purposes. I would be very disappointed if I could no longer receive it at 10 or 5 MHz.
182. We use only the Navy VLF station.
183. WWV/WWVH are the principle reference stations used in the CONUS area for radio research. Transmissions for oblique ionograms are especially important for R & D studies.
183. There must be some other way to cut expenses. I would have been willing to pay the postage on this!
184. It is a responsibility of the U. S. government to maintain Time Signal Service! I am appalled at any suggestions to diminish this service. It could turn one to anarchy.
185. Your 25 MHz transmitter could be shutdown during the low point of the sun spot cycle.
186. About 60 area broadcast radio stations depend on my monthly frequency measurements to keep their transmitters within FCC tolerances.
187. Conserve energy in some other agency not providing a scientific basis that will effect world wide operation of all types of communication and related subjects.
188. This office provides a 3-minute pattern of second ticks daily over telegraph and telephone circuits to approximately 200 designated standard clocks on Railway system.
189. This nation needs to reduce the number of cars in High School parking lots before reducing quality of its scientific and communication standards!
190. I think reduction in power would greatly increase the number of times when we can't pick up the signals.
191. My principal concern is that cost reductions for WWVH will eventually lead to reduced services from WWV.
192. Add a better weather watch Gulf of California North end as well as Mexican waters in Pacific.
193. I realize the energy crisis and implications but a facility such as NBS and WWV, etc., is not an area to cut until all other possibilities are explored first! WWV is too important to suffer.

194. Your signal has always been weak and most of the times we cannot receive it all. I seemed to receive the signal a lot better along the gulf coast than I do here.
- It is my opinion that the signal should be increased in strength because you keep the United States on correct time. There is not a more important service performed by the U. S. Government than yours. What a backward nation we would become without your service.
195. Power consumption of your transmitters must surely be infinitesimal in the overall energy situation. Reduction of power in these vital services is indefensible to anyone but a bureaucrate!
196. Add even more detailed solar data and propagation.
197. On East Coast/Gulf run sometimes have difficulty with WWV on any frequency (5,10,or 15) due to weak signal--depending on ship's location. Therefore any reduction of power would aggravate condition.
198. If power was reduced from Station WWV it would make it very hard to receive with inferior receivers such as the one I use. I hope you are successful in cutting down costs and energy consumption without sacrificing the quality of your broadcasts.
199. Power should be increased to provide better reception. I use WWV often, and find it usually weak with interference.
200. My personal opinion is that surely the Federal Government and NBS could find other areas for instituting economy measures than a service which is so widely used by both Government and industry and which is a relatively low cost program to start with.
201. The time signals and accurate weather/storm warnings form the basis for my sailing schedule here in the South Pacific. WWVH is the only reliable source.
202. The energy used by your stations must be insignificant relative to its importance. Do not curtail.
203. There are many many other energy consuming government activities that consume much more and provide far less than WWV. We should put conservation of energy in the proper prospective.
204. Send propagation warnings in Morse Code. When they are of most interest signal (voice) is sometimes unreadable due to distressed CX.
205. I miss the old coded time announcements which could be better read through static!
206. If energy is to be saved, have all commercial establishments eliminate illuminating the outside of their building walls and signs when closed.
207. If any changes are made, I hope the excellent standards are retained.

208. But far more importantly, and putting to one side my parochial interests, Federal Law, 15 U.S.C. sec. 272 authorizes the Secretary of Commerce "to undertake . . . (11) the broadcasting of radio signals of standard frequency" I believe that Congress enacted this legislation (by same I mean also the lineal progression of laws beginning with 31 Stat. sec. 1449 that on 3 March 1901 established the National Bureau of Standards, including 72 Stat. sec. 1711 (1958) and others) to insure the availability of standards, knowing how important they are to the technological strenght of the United States. See also 15 U.S.C. (Chapter 23), secs. 1151 et seq.; 15 U.S.C. (Chapter 7A, secs. 290 et seq.

While there is elasticity of the Congressional Mandate, I am convinced that if the restrictions are too severe they will run afoul of both spirit and letter of the Law.

209. I think that there are many ways to avoid the reduction and sustain your budget. I and many such as I would be happy to support your continued broadcast by a use tax or any other feasible and fair means of support.
210. But in the greater sense, of the Worth of The Bureau of Standards broadcasts, must be the consideration that Ham Radio, is not just a Hobby. Having been an instructor in electronics at the Community College I see the lack of prior preparation of the students, an amateur is heads and shoulders above the average student. In essence, the study of amateur radio and the concurrent use of WWV and the Standards, the student has his own actual Laboratory in his Ham station. Of what value is this to the Nation? - it is from these ranks come the trained electronic personnel so badly needed in the future years, no more--interesting way, has ever been devised to painlessly interest students in the pursuit of Knowledge than Ham radio.
211. Please don't cut back too far
For you are my link with the star (trite)
Sorry, your questionnaire can't reach my habitation,
Because Polynesia is my destination.
Just add me to the number of those who listen,
For without your service--I'd be reported "missin'".
212. Though I certainly know nothing of the cost of your operations, I cannot see how they can be severe enough that you would consider crippling this urgently needed safety service. Perhaps the independent small fishermen and yachtsmen who are so totally dependent upon it for their very survival have no strong political group to protect our interests. I would urge you strongly to leave your broadcasts at their current level. Often enough in making passages we have had difficulty tuning you in as it is. surely the savings anticipated in such a reduced service could not be valued more than a single human life.
213. Our Simplex Clock System, with a built-in radio receiver, uses the WWV signals to automatically keep the master clock accurate. The master clock then sends hourly pulses to about 70 "slave" clocks. Any major change in the timing format of WWV would certainly create problems for us.

214. I have purchased over the years, two short wave radios for the sole purpose of checking my watch sometime during the day or night each day, to be sure I have the exact time. I know of no other way to do this except through Station WWV.
- I am a Locomotive Engineer, and like all the other thousands of Railroad operating men, I am required to purchase and maintain an approved watch. This is quite expensive, especially so if you still do not have the correct time and nowhere to get it.
- If you wonder why I am raising so much Hell, I'll tell you. To start with, I'm in the tax paying group that pays for most of the country's needs. Those above me are too smart to pay, and those below me are too poor to pay. I would suggest that if we can affort energy to heat President Ford's outside pool in the middle of the winter, and the energy to fly Dr. Kissinger's armored car around, we can afford to keep WWV on the air!
215. Return to Morse Code for at least four time hacks per hour.
Press for nuclear power source on Kauai!
Standardize propagation boradcasts.
216. The propagation voice announcement phonetics are confusing. Why say "uniform" when you mean "unstable"--or "november" when you mean "normal"? Personal preference is for the C.W. data but probably not general preference.
217. I am an amateur astronomer, my telescope is not equipped with a clock drive, nor is the hour circle independently adjustable. Consequently, when I am observing I repeatedly have to work the "sidereal time" problem, and to do this I need to know my mean local time very accurately.
218. Too often I must rely on CHU rather than WWV.
219. I rely on WWV for calibration of receivers and would sorely miss any of the frequencies if cancelled. I can use CHU for time signals.
220. Unofficially, I represent directly 200+ members of a yacht club in the Los Angeles area. To my knowledge at least 1/4 of these make regular use of WWV/WWVH in their boating activities.
221. Daytime signal strength should be improved.
222. I estimate that my needs would be served by operation from 1200 to 2400 MST at something between 10% and 25% of WWV present power. I also suggest that many protesters against 50% of WWVH power do not know how little this would hurt them.
223. I stopped collecting money once and I set the clocks at Easter Seal Sheltered Workshop here in town. They said "now that the clocks are straight, you're fired."
224. Sincerely appreciate the solar flux and K-index data broadcast at 14 minutes after the hour. Also use the data broadcast at 18 after.

225. I supervise a small work crew engaged in forest road maintenance and find the weather forecasts helpful in planning work priorities.
226. WWV most times is received with good signal. However, if the power is reduced, signal would fade.
227. Energy conservation and cost cutting can be taken too far.
228. If the Government wants to cut expenses, then eliminate salary of each Congressmans wife who are just a joke as far as doing any work is concerned!!!
229. Please do not reduce WWV power on 2.5, 5, 10 or 15 MHz; we use all of these frequencies throughout a 24-hour day, selecting the most useable depending on the time of day, season, and position of the sunspot cycle.
230. Certainly there must be better ways of saving energy and money than by reducing this very necessary service.
231. Existing services should be maintained. The small cost and energy use could be recovered by elimination of one of the other (useless) government depts. Your service is too valuable.
232. Please add inland weather and storm warnings in the U. S.
233. I find the WWV signal most useful in aligning instruments for calibrating watches, clocks, and radios I use in DX-ing, and other usages. I find most accurate information there; some place in the spectrum, on one of the frequencies when I need it. Having learned to rely on it, I would not like to see the day it is gone, or diminished in either radiation power or information.
234. You might try spacing the wx reports so that you can use two minutes and give more detail. Lately the enunciation has been excellent... I do not miss the southern accents.
235. Add general U. S. weather and emergency warning for severe weather, earthquakes etc. I am a flight instructor for major airline. Use time service frequently. Also light aircraft user. I believe WWV could be of great service with generalized U. S. weather for pilots, farmers, etc. Also alert for unusual conditions, weather, floods, earthquakes, blackouts, etc.
236. During July and August 1974 I was navigating a small sail boat from Rio De Janerio to the Caribbean. I was unable to receive NBS time signals below about Lat 10°S. Fortunately we got an excellent BBC signal, but it was only available on the hour. When we began picking up NBS signals we switched to them as they were much more convenient. When this service is needed at sea, it is VERY IMPORTANT.
237. WWV 5 MHz and 10 MHz very valuable here. No other time and frequency standard can be used. Hope power on these frequencies, atleast, is not reduced.

238. As there are occasional severe fading on either or both 10 and 15 MHz, recommend no decrease of power these frequencies.
239. Add extended propagation and solar activity--updated hourly. Your geoalert and propagation forecasts should be updated more frequently. Please do not decrease any services.
240. There are plenty of other places to save energy before cutting down on WWV and WWVH, seems to me.
241. I think WWV is a great, and well recognized, demonstration of the technical advancement of the USA. In all countries and strata of technical efforts of the world it is regarded as the last word as to time and frequency measurements. It is worth keeping at its present level of efficiency regardless of the efforts to make it another Government Activity which can be budgeted out of existence or usefulness.
242. Accurate time signals are vitally important for safe navigation of shipping.
243. Besides driving, I also use the other two means of transport (boating and flying). Also as an amateur radio operator much is important to me. I tune WWV on 10 and 15 KHz almost daily.
244. The signal is usually adequate on either 10 MHz or 5 MHz, but seldom on both at the same time. Occasionally it is difficult to get a usable signal on either frequency. If either of these frequencies is reduced in power there will be times when it is unusable.
245. Cut out 2.5 MHz and 25 MHz but please do not reduce strength on the others.
246. I consider any reduction in NBS services false economy and a reduction of scientific prestige of USA.
247. Use time signals to determine true bearings of property survey (including public land subdivisions) which are officially filed with Public Agencies.
248. Rather than cut power--would prefer some such energy saving plan as, for example, broadcasting every other hour if practical.
249. Signals are used for calibration and checking of primary frequency standard and other equipment by Frequency Measuring and Monitor Service. This provides service to many commercial radio stations, TV stations and communications services. If any thing, the power on WWV should be increased on 10 and 15 MHz.
250. At many AF Bases where I've been stationed WWV or WWVH are used to hack our clocks and it is very important we have exact time as I work in Radar Operations. Without exact time we simply could not function. In many areas WWV/H can be heard by dialing a certain number--depending on location. I honestly feel that transmission power should be maintained as well as the three frequencies, 5, 10, 15 MHz. I have not found the other frequencies useful in my own experience.

251. Electronic as well as meteorological units find WWV/WWVH essential to most functions of our service. A reduction in output power would possibly be detrimental as our area suffers greatly from man-made noise interference.
252. Add twice hourly propagation forecasts. Propagation forecast is fairly new service and considerable interest shown in amateur ranks with initial articles beginning to appear in publications indicating methods of using forecast information. This will contribute to general knowledge of Hams which in general should lead to greater commercial use of propagation forecasts.
253. Make more complete weather forecasts. The accurate time and weather (storm) warnings are absolutely indispensable to the cruising yachtsman. Their discontinuation would endanger many lives.
254. Add weather for continental U. S.; by region (forecasts).
255. Elimination or reduction in services of WWV or WWVH would handicap the safe navigation of our vessel and, in some unusual circumstances, could conceivably jeopardize the existence of the vessel as well as that of ourselves.
256. As operations officer of _____, Cap, RAFB, TX, it is squadron policy to accurately set watches and clocks--and --to have a receiver capable of receiving WWV on all practice missions.
257. The years and expertise it has taken to bring this all important service to "WORLD WIDE" use and dependancy would be one of the greatest misfortunes if it were discontinued in any way.

As for me personally, my family (wife and 12 year old son) and I will be heading out to the South Pacific soon. If I thought that your "solid" dependable service were to be interrupted, it would have a definite effect on all our planning.

258. We here in the local (Mid-South) region of the Sports Car Club of America, and, in fact, all car rallies across the country that are conducted on an orderly basis use WWV for the exact time of day for all contestants and for all control crews.

WWV is a very important requirement for the Divisional Level Rallies that we put on since we have people from all over the country competing and exact time is what Rallying is all about.

259. I would like to see an increase in transmitting power. Would prefer elimination of some broadcast frequencies.
260. Add North Pacific radio propagation forecast; also resume 5 minute announcement of propagation.
261. To me your propagation reports are most important of all. I listen to it before listening to my short wave. Next important would be the one-second ticks by which I set my clocks. I don't think cutting power would be a good idea at all.

262. WWV performs extremely worthwhile public service which should be retained.
263. I have found weather forecasts extremely useful at Sea. Only good frequency calibration source available to me--only personal source for propagation forecasts. Canadian CHU only good for time signal. PLEASE CONTINUE!!
264. Over 50% of my earnings is taken by US Government as taxes. I do not want to see US curtail services such as NBS WWV/WWVH broadcasts that I now pay more than my share for!
265. I think the 25 MHz and possibly the 2.5 MHz service could be discontinued in an energy conservation move, but the other services and frequencies are essential.
266. Heavily depend on accuracy of frequency for calibration of amateur radio equipment. Wish the C.W. time identification were again utilized.
267. Recent K index and Flux data at 14 minutes after very valuable.
268. Would like propagation forecast twice hourly. Addition of K index and 2800 MHz solar flux report to propagation forecasts is appreciated.
269. Would like to see the propagation forecasts given more than once an hour. CW would be fine.
270. I find the time/frequency services are very good, but would like propagation forecast announcements more often.
271. I am communications engineer with electric utility--WWV frequency and time very important to utility communications system.
272. Add Morse code on time when propagation poor. Have you ever considered a directional antennae setup with each segment reinforced at some part of the hour?
273. Cut power on Broadcasting Stations would save more energy. Broadcasting stations use much more power than WWV and are only for pleasure and news. Their power far exceeds the need today with the modern BC receivers. WWV is an essential need and is absolutely necessary if the FCC expects us to keep our equipment on frequency calibration. WWV is a must, don't decrease power--increase if anything.
274. Morse code time should have been retained. That is a MUST.
275. We the People of the U. S. need WWV and appreciate the propagation forecasts very much.
276. If you reduce power--people on other continents will not be able to use your services.
277. Very important for navigation when sailing to Mexico, Bahamas, etc. where Gulf Stream drastically affects position. I would have to be out there without WWV and have my life depend on it.

278. I believe that WWV is a very poor place to "bore into" for energy conservation.
279. Would not object to power cuts of 50% on 5, 15, and 20 MHz. No services should be cancelled--especially propagation forecasts. Would be interested in the daily sunspot count (if possible to obtain.)
280. Surely the Government can find other methods to economize rather than reducing the effectiveness of a vitally needed service.
281. I am satisfied!! May be a first for a government agency!!!
282. Would like to see more time of carrier only without tone or voice modulation, for purpose of equipment calibrations.
283. Time should also be sent in CW as occasionally interference is of sufficient strength to make the voice time announcements unintelligible.
284. Excellent service--monitor daily--would like to see more power in your 5 and 10 MHz transmissions even at the expense of giving up your transmissions on 2.5, 20, and 25 MHz.
285. Because telegraphy is much more readable under marginal receiving conditions, its reinstatement by NBS is now more important than ever.
286. Existence of WWV frequency service saves amateur operators and probably many other services considerable expense for individual station frequency standards and/or meters for calibrating receivers and transmitters.
287. WWV is something we (U.S. Citizens) can be very proud of. Try to maintain it.
288. More frequent propagation reports and hourly MUF report.
289. Several frequencies are important because of propagation changes--when propagation is poor, CW is easier to hear than voice.
290. As a United States citizen and taxpayer, I thoroughly believe that this service should continue.
291. If necessary to cut back, please cut back on frequencies--not on power. Hard to predict how a power decrease would affect ability to use service.
292. I think eliminating 25 MHz transmission in darkness hours would help cut cost.
293. Resume the MCW broadcasts every five minutes. Voice doesn't always get through. At PD we use the time signals especially. We need a standard as the phone company time has been as much as 4 minutes off.
294. This is one place I'm glad to see my taxes support!

295. A longer tone transmission without superimposed modulation - say 45 sec/hour.
296. Weather & Geoalerts more often
297. In the area north of Reno and east of Redding, CA there is no weather information available. This is about the only radio or TV giving some indication of weather for this area.
298. Cannot receive weather reports on 160 MHz - wish reports could be given on lower frequency for this area - West Virginia.
299. SW reception for different areas of the globe.
300. If operating costs should be cut, it should not be power out-put of station WWV, it may allow jamming stations to interfere with people who need it.
301. CW time of day
302. Weather for areas VHF doesn't reach.
303. Suggest WWV eliminate or reduce operation on 2.5 MHz and 25 MHz to save energy.
304. Place indices broadcast @ 18 past the hour closer to propagation forecasts @ 14 past the hour or vice versa. Enumeration of numbers could improve; "seventy-six (i.e.) should be "seven-six" etc and A indexes of single numbers should be prefixed with "zero".
305. You may on one weather report give some darn good info and then on the next several updates give absolutely nothing. No follow-up is my complaint there. Please include the millibar low center readings. I feel expanded time should be given North Pacific weather info...
306. How about a low frequency service with better East Coast coverage than WWVB?
307. Calibrate time encoders for medical research.
308. Increase the storm warnings to every ten minutes. The only source of offshore weather for yachtsmen - very important.
309. Info on MUF would be helpful.
310. Perhaps, you might give the equation of time at the moment.
311. Propagation forecasts every 30 minutes would be very helpful.
312. Monthly averaged sunspot count (propagation forecasts).
313. Change standard tone to 1000 Hz. Discontinue 2.5, 5.20 and 25 MHz operations; the low frequencies are only good during rare periods

- 313.(cont) of the day and the higher ones are only good "locally", I'm 2000 miles away. Increase power of WWV. Interference from off frequency sources is sometimes present.
314. It would be helpful if other than marine forecasting could be done at designated periods, throughout your broadcast schedule.
315. I would like to see the 14 and 18 minute after the hour propagation information put on WWV more frequently (2 or 3 times hourly); more detailed data on current or expected MUFs would also be very useful.
316. Past use has included coarse time set for Loran-C. Precise time keeping systems.
317. Propagation forecasts to WWVH. I would like to see a 100 watt WWV at 50 MHz.
318. Voice frequently doesn't "carry" as well as code. Could the time also be given in code every so often during the hour? I frequently have trouble with the weather broadcasts: "too much said too quickly".
319. Tallahoma, TENN - I think WWV should more frequently include weather, etc. More reports such as weather, rocket/satellite tracking, etc.
320. 10 MHz is most reliably received but is frequently interfered with by unknown broadcasts. 5MHz is often unreceivable (too weak). 15 MHz used when 5 and 10 MHz are unsatisfactory but is often too weak.
321. More variety of standard tones for tuning various musical instruments. Once an hour, broadcast the Greenwich Hour angle of Polaris and the sun on the last hr for surveyors so a current ephemeris is not needed for azimuths.
322. Some of your announcers have bad speech problems and listening becomes unpleasant. Clarity is most essential to convey your messages.
323. Would like OTF and LUHF given.
324. Weather forecasts for various parts of country would be helpful.
325. C major scale last 8 seconds of minute. Use loud ticks to indicate seconds but use soft clicks to partition t into $\Delta t = 1/2$ sec. $1/3$, $1/5$, $1/7$, $1/11$, $1/13$, $1/17$sec. Publish schedule telling when in a given minute these events occur in sequence.
326. Toll-free telephone number.
327. Skip conditions.
328. Do not drop or reduce power of the 2.5 MHz service - often it is the only WWV signal available at night as this area seems to be in a skip zone of the 5 MHz transmitter (Springville, IA)

- 329. Suggest reduction of power during nighttime when better propagation increases skip distance and signal strength.
- 330. I would like to see the solar flux and K index info given twice an hour.
- 331. More frequent announcements of weather.
- 332. Standard frequencies on 3.5, 7.0, 14.0, 21.0, 28.0 for amateur radio use. How about prop. C and X for Asia and Australia?
- 333. Please repeat coordinates of storms location.
- 334. More complete synoptic weather briefing for S. Pacific.
- 335. Radio propagation cond. San Francisco to Tokyo (or Denver).
- 336. Possibly some kind of "sky watch" (satellites, meteor showers, eclipses, etc.).
- 337. A time signal within the broadcast band would increase the citizens use many fold.
- 338. Area-coded emergency weather warning information using a selective two-tone alerting system.
- 339. General inland U. S. weather for the country - i.e., storm alerts and forecasts.
- 340. Add HELL - you should cut!! (from Abused Taxpayer)
- 341. Morse code GMT time - every 5 minutes. Transmit 440-600 Hz tones less often. Also delete 600 Hz tone and transmit 1000 Hz tone in its place.
- 342. Let's have Morse Code time signals!! Voice gets distorted too often!
- 343. Relay station in Indian Ocean.
- 344. Give date as well as time - very important.
- 345. BCD time code with tones 5, 10, 15 MHz.
- 346. Daily sunspot count.
- 347. Propagation forecasts more frequently than once per hour would be useful. The 25 MHz signal cannot be received reliably at this location (Washington, D.C. area).
- 348. Single sideband service on 2.5 or 15 MHz.
- 349. Long letter: return CW time announcement, audio announcement wasn't strong enough to determine the time, minute announcement difficult to understand as some numbers sound alike.

- 350. Start transmitting on medium wave also.
- 351. Unmodulated carrier in short wave band for use as a frequency standard.
- 352. Expand weather forecasts including solar forecasts.
- 353. More propagation reports.
- 354. In addition to voice broadcast of time in terms of Coordinated Universal Time, translate into standard U. S. time zone time.
- 355. Atmospheric pressure.
- 356. Frequency in AM or FM broadcast band.
- 357. The date at hourly intervals.
- 358. 440 Hz tone more often (every 15 min).
- 359. Astronomical phenomena (eclipses, meteor showers, etc.)
- 360. 2 ticks @ 30 sec and 3 ticks @ 45 sec. (closely spaced).
- 361. Position of stars in astronomy.
- 362. Weather synopsis and short term weather forecast (6 to 18 hours) for USA by principal regions. Reactivate 2.5 MHz at night in Wash. DC to serve eastern USA.
- 363. A monthly sunspot count.
- 364. Toll-free phone time service.
- 365. Transmit time in Morse Code and voice.
- 366. The 7 and 27 day solar forecast-Solar Geophysical should be read at least twice weekly, preferably twice daily. This would replace the SESC-PRF publ.
- 367. More information on Geoalerts
- 368. Day and date.
- 369. Regional weather, particularly when readicall changes in prospect or forecast.
- 370. Introduce service which would eliminate Doppler other than WWVL (Satellite).
- 371. Length of days (e.g. vernal equinox, etc.)
- 372. OMNI

373. It seems that most of these services represent a nominal monetary commitment. Given that facilities must already exist for these purposes, some of which must be useful to other agencies, any discontinuance seems of questionable savings.
374. I use WWV for (1) calibration of frequency standard (daily) (2) calibration of electronic time-keeper (daily) (3) Propagation and geoalerts (4 or more times/week). 10 MHz and 15 MHz WWV goes out in OH at sundown.
375. I consider the correct time of day just as important as the correct measure of all other expendable commodities. I hope the NBS is not downgraded.
376. Energy should be no factor where such important standards are concerned.
377. WWV renders a service of basic necessity. There are frills in other aspects of the Dept. of Commerce that could be reduced without being missed except by the Bureau Chief that would lose status!
378. Surely the power bill for WWVH is miniscule compared to the other expenditures for the Department of Commerce, and nothing at all compared to the monumental waste of money in many Government Branches.
379. I feel the N.E. PAC weather is sadly neglected..in that you will on occasion give a very good low center and the coordinates for the fronts and troughs and then completely leave any further reference out of your next successive broadcasts. No attempt at follow-up is made. I feel expanded time should be given North Pacific weather info since weather moves west to east. I feel a more sincere effort should be made to carry out what you have started.
380. Having access to exact time is vitally important to amateur radio and it is self evident that many other phases such as navigation, are extremely important to our country.
381. Don't lessen your operation as the government wastes more money a day than you people spend in a year.
382. Reduce foreign aid and use the money saved to support WWV and WWVH.
383. Thank you for this opportunity to comment. Your signals are of vital importance to the safety of we few who sail the seas in small vessels.
384. Time signals are essential to the small boat sailor who does not, now can he afford expensive navigational gear and who relies on the time signals and his sextant to navigate the seas. Without WWV/WWVH what would we do?
385. As I understand the WWV program--it is used by a small minority who will take anything that is offered to them as long as its FREE. Reduce nonsensical government expenditures and MAYBE our taxes will be reduced!!!
386. In my opinion the National Bureau of Standards in general and your Time and Frequency Division in particular provide more valuable service--world wide--than any other U. S. Government agency.

387. You have very fine services and I believe if you must restructure your service it should be done gradually (after proper announcement in each category).
388. What I'd really like to see would be Pacific propagation announcements by WWV. As to WWVH cuts, I'd think your objectives could be met with little loss of benefit by having WWVH on 15 MHz by daytime only and on 5 MHz by nighttime only.
389. The undersigned writes to you as a representative of the Mountain Radio League, an organization of some 150 radio amateurs, some of us having been licensed for a number of years. It is our position that ANY reduction in the services offered by WWV and WWVH would be misplaced effort, most particularly at this point in time, and with special regard for the position of the United States on the world's political stage.
390. There are some government services which are so valuable and so much used, that we take their presence for granted. How many of us have ever written NBS and thanked you for WWV? We cannot afford to lose these broadcasts and it is hoped that this letter will add encouragement toward continuing WWV in its full format.

The application at _____, and in my personal pursuits, leans heavily upon the frequency calibration provided by WWV's standard-frequency transmissions. In fact, I know of no alternative source, should WWV be discontinued. Time signals are also most-necessary, and I will be placing a greater emphasis upon propagation forecasts in my work, thus requiring continuation of this information, as supplied by WWV.

You will note that under section 10 of the questionnaire, I have requested a return to Morse-code time announcements. These telegraphic signals always seemed to be audible during marginal propagation, while the voice announcements are sometimes not.

391. DON'T CUT BACK! Fight for money and support. Let the users know your problem.
392. I feel the loss of any of these valuable services would be greater than the benefit derived by saving energy.
393. I am at a loss that the Government wants to cut back on your services to the entire country. Let's shut off some of the light in Washington so that your entire operations and staff can keep up the fine job that you have done in the past/and present.
394. Please return to sending tone modulated code on air. I don't see how a 50% reduction in WWVH power will give you much saving!
395. I would hate to see services from WWV and WWVH diminished due to the present "energy shortage". Perhaps a way could be found to convert the enormous amount of "hot-air" from the D.C. politicians to help overcome your shortage!

396. As a Special Forces Radio operator, I, along with virtually every other Special Forces operator, has relied extensively on WWV/WWVH during our world wide committments, and still rely upon it during our training and actual operations.
397. One of the few government services I don't mind paying taxes for! I could find sufficient availability of WWV during the ten minutes before and after the hour for my purposes. Don't see how we could get along without the frequency service.
398. Please include CW time signals at least once each hour. Ship operators say WWV lost much value when you discontinued CW time signals.
399. WWV/WWVH are so vital to so many different fields I feel that NBS should continue the service as it now exists for optimum reliability and service.
400. What little energy that is used by WWV is negligible. I feel the power should be increased. This government facility is and always has been a tremendous asset to the entire world.
401. WWVL is relied upon heavily for the calibration of our frequency/time standard which in turn provides frequency and time data for use throughout the power generating, transmission, and associated communication systems. It is hoped that no curtailment of WWVL services is contemplated.
402. I regret your dropping the CW in favor of voice. I remember hearing the announcement of the change from WIAW via CW and I was not able to copy the voice. CW always cuts through the hash long after voice is unintelligible. I'm for more info via CW.
403. Would like to see the Morse code started again for the time.
404. I think the NBS is a very essential service and is not worthy of a great cutback. I do agree that some services could be modified or changed to help the situation.
405. Although I am sure only a very small percentage of users will participate in the survey, any curtailment in services will have a major and far reaching effect on numerous services. For example, although we make extensive use of WWV transmissions at the Research Laboratory, Washington, D.C. where I work, I know of no efforts to get an official response (input) to the survey.
406. WWV/H is a damn poor place to economize. It is a service vital to the scientific community, and to the public, whether they know it or not. Economies in government can be more sensibly effected by eliminating bureaucracies in Washington that accomplish nothing more than self perpetration.
407. There is no real justification at all in any energy cut-backs in your broadcasts. How can there be any reason to reduce a 2.5 kw use of power of, say, your 2.5 MHz signal when just ironing a shirt consumes 1.2 kw? I strongly object to any curtailments.

408. I feel WWV/WWVH is very important to me because through the time ticks, and weather bulletins, it enables me to navigate my ship with safety.
409. Every navigator on sea-going, commercial fishing boats that I know or have met, uses the time of day broadcasts and weather information from WWV/WWVH. The same probably applies to most merchant marine deck officers, so speaking for all of them I can say that these services are essential.
410. The constant availability of accurate one-second ticks (or better $\frac{1}{2}$ sec. ticks) is essentially required in recording occultation observations. Stronger signals on the east coast either from a more powerful WWV or a separate station, would be very desirable.
411. This vessel (m.v.), is a freighter on a round the world service Eastward. WWV/WWVH services are used continually, with the exception of an area of approx. Greenwich longitude to 80E when for time signal purposes only, Capetownradio/ZSC is used. The service is very much appreciated, and a reduction in power or withdrawal of any frequency would prove a great loss.
412. As one of more than 300,000 HAMS I would be glad to contribute \$1.00 to your service, If 1/2 of us did, you would have \$150,000. I'm sure we'd be only a small segment of service benefactors.
413. Add daily voice description of Western Hemisphere (North) weather patterns and trends. Location and tendency of extra-tropical cyclones and major air masses.
414. I was very pleased when you changed the format to one similar to CHU. It is much more practical for astronomical work. The power your radio station uses is a drop in the ocean compared to the megawatts of commercial lighting which elimination would not be a loss to anyone. Please do not compromise the usefulness of WWV for the satisfaction of the naive.
415. I feel that no curtailment of services should occur, but the elimination of the least used frequencies and/or services would be acceptable if no budget relief is forthcoming.
416. Perhaps hourly, give month and day (Greenwich) for inexperienced mariners at sea who have not learned yet how to keep Greenwich dates straight.
417. I have used the time/frequency signal from WWV for a number of years and possibly it has become more of a convenience than a necessity. Train service employees are required to have the correct time within 30 seconds at any time. It is more convenient to set my watch at home than at work by the standard clock.
418. Would like to see propagation forecasts and geoalert info given much frequently than once an hour. Would like to see four to six times an hour.
419. It is a disgrace to this nation to curtail so vital a function as the NBS calibration/time broadcast for the reason that cost of electricity has risen.

420. Any reduction in these frequencies (5, 10, 15, 20 MHz) or reduction in power would hamper our work ((legal) survey crew) as our surveys are conducted in quite remote areas of British Columbia, Canada.
421. We urge that the essential, very important and excellent services furnished by WWV not be tampered with. (Seismograph Net)
422. Storm warnings should be read more often, say four times each hour, Lat. and Lon. of center should be repeated. Missing this can be deadly if station fades at critical time, e.g.: I listened for four hours off Yucatan one night last summer before finding that I had run directly into the center of a tropical disturbance instead of away from it. Warnings should be read slowly enough to write down.
423. This is ONE business the Federal Government belongs in. The NBS is providing an essential service for many industries so let's economize some other way.
424. I would like to see no reduction in any services provided by WWV as it is too important a function for its users to lose. There are many other areas of Government spending from which funds could be made available.
425. Too much interference from WWVH in this area (West Coast of Florida). Suggest the six frequencies be divided between WWV and WWVH.
426. I am delighted to get this questionnaire so that I can tell you what a (expletive deleted) outfit you are. I use to use your signals when available from the Naval Observatory on ocean races and offshore passages on the Northern Atlantic. Then, cravenly succumbing to OMB you moved to Colorado, where your signals help skiers navigate giant solaloms in Aspen so now we are dependent on Ottawa. But what the hell, with Accutrons, quartz clocks, and AM commercial beeps you're no longer necessary. I hope Jerry abolishes you completely.
427. Prefer the former CW indication of time to the present use of Voice. CW more legible.
428. Glad you've included current solar flux reporting.
429. The services of WWV/WWVH are recognized world wide and should not be reduced.
430. Importance of this service increased by reduction of SSB frequency tolerance on Army MARS circuits to 20 Hz.
431. Add time in code. We have missed the time in code, at times WWV/H voice transmission is unreadable during certain hours of the day.
432. One use of tax dollar I firmly approve of.
433. Prefer time announcement via CW code when propagation conditions are poor.

434. I believe we could get along without studying the sex life of frogs in Russia (and save \$60,000) rather than curtail any of the very important WWV/WWVH NBS activities.
435. I consider WWV/WWVH one of the most worth while services furnished by Government. I was especially happy to see the addition of hourly reports on solar flux and geomagnetic activity levels to assist in propagation forecasting.
436. The Railroad must rely on WWV for time signal as this service is no longer available by the Western Union Telegraph Company.
437. Our Company, Bell, places one phone call each week to 303-499-7111 to check the accuracy of time of day announcement machines located in each major city.
438. Any major curtailment of WWV operations would definitely be detrimental to the usefulness and reliability of this station. Our equipment includes single purpose receivers specifically channelized for WWV/WWVH frequencies. We frequently crosscheck with Loran-C and VLF receivers but WWV/WWVH is our primary time/frequency standard. (Tracking and Data Network Station, , Alaska).
439. Suggest SSB mode might increase coverage with less input power.
440. I think that curtailing any of NBS WWV Services is false economy. There are so many wasteful operations that NBS is just a spit in the ocean.
441. If you need funds; the FAA is wasting enough annually to more than pay for your operations, so we think the savings on your operations would be very insignificant by comparison.
442. Since the move to Boulder, CO I seldom am able to receive the 25 MHz transmissions. These are desirable for instrument calibration when available. Instead of a high-power WWV in Boulder, how about a third station again located in the East?
443. I would not care to see WWV or WWVH cut their transmitted power, because in the mid-Atlantic and mid-Pacific they are usually the only means of obtaining accurate times. WWV and WWVH are generally clearer on the radio than either CHU, Canada; or JJY, Tokyo.
444. Over the years we have found your service most excellent and we would abhor any cutting of this important function. It is felt there are other lesser important areas that savings can be made... such as duplicate governmental agency functions!
445. Arrangements in the past have been made to provide transpacific race participants with mid-Pacific and local Hawaiian weather (current and forecast) from WWVH. It is hoped that at 50% power, the "reach" of these broadcasts will still be adequate.

446. The time service in particular is vital. I can get accurate time with one radio and one backup radio for \$60.00. A chronometer for navigation would cost \$300.00.
447. It almost makes me retch to think that your humanitarian services are being subjected to nit picking economy while at the same time our government can afford to spend thousands of dollars to destroy one life in S.E. Asia. Ugh!
448. Navigation use involves WWV calibrated time code generators/checks on surface craft and submarines, with TCG's initiating underwater acoustic pulses to provide submarine with information as to distance from surface craft transmitting acoustic pulse.
449. We need as strong a signal as possible, especially for calibration. The Federal Communications Commission specifically states in Volume 3, Sect. 73.60, page 32--that "The primary standard of frequency for radio frequency measurements shall be the National Standard of Frequency maintained by the National Bureau of Standards, Dept. of Commerce."
450. Increase propagation forecasts to include prominent solar flares and sunspot groups--cooperate with Kitt Peak.
451. WWV/WWVH provide the only accurate time checks available at sea and as such must be maintained.
452. Miss your Morse code time. I now have to wait through two or three minute ticks to be sure of minute because of voice fading. If you could reinstate this and just put on the individual minute it would be great.
453. Add additional storm warnings. This service is excellent and should be improved and enlarged. Any cutback would be detrimental and I oppose such proposals.
454. NBS should concentrate its efforts on a smaller number of frequencies and broadcast with more strength and content. Add better (more reliable and articulate) weather announcements.
455. In ocean navigation WWV and WWVH are necessary for accuracy of navigation, time checks, determination of propagation conditions, satellite usage and calibration of electronic instruments. Weather broadcasts are necessary adjunct to meteorological broadcasts from other sources. For operational conditions at sea.
456. I certainly hope that you are at least able to maintain your current level of service.
457. I would vote for more power rather than less. Sometimes I have to use a Russian or Chinese Station--mostly Russian. 15 MHz is used mostly, but 10 MHz can be heard when 15 cannot, in darkness. Believe me! We appreciate WWV and WWVH. Sometimes we can hear one but not the other. I have to get at least one time signal daily throughout the world for the radio room clock and for the bridge for navigation.

458. Reconstitue Morse code time announcement. Very useful for those users who do not understand English. Also able to read better than voice under marginal conditions.
459. You could drop 2.5 and 25 MHz, and increase power on 10, 15, and 20 with merit. Storm warnings are too hurried. Better if more complete, and sent more slowly, even if we lose one or two "minute" ticks. After all, we got long fine on a "once-every-five-minute" basis for years.
460. Request continuance of present format plus increased weather reports for interior U.S.
461. 20 and 25 MHz almost useless for us. We use 10 mostly. Almost all boats are equiped to receive 2.5, some 5 and 10.
462. The Clock System (about 80 clocks) are referenced to WWV time signals, and are used to coordinate with programs from NBC and remotes. Any changes in your format or power would probably create problems and expense for us at Channel Television Co. (-TV). (, Texas)
463. The time signal service has always been excellent. It commands respect. We need some of that in international fields.
464. Would like propagation and geoalerts added at 44 minutes past hour in addition to 14 minutes past hour.
465. The small amount of energy which can be saved by reducing transmitter power can be conserved in far less important uses. This signal may mean life or death.
466. On our European exercises we are unable to copy WWV due to interference and no signal from WWV.
467. Principal uses are in support of persons observing total and grazing lunar occultations and reducing timings for report to USNO and HMNAO. Ticks and announcements must be received clearly on a variety of portable radios. Other uses are in check-out and calibration of radios and other equipment.
468. Signal strength into this area (San Francisco) is primarily dependent on propagation conditions. A reduction in power would only shorten the length of time (daily) that WWV/WWVH has a suitable signal strength by a short amount. The Morse code time announcements were readable for a considerably longer daily period than the voice announcements--please resume this service.
469. Add earth quake/tidal wave warnings for Pacific Ocean basin.
470. Your service is vital to ships in order for us to maintain our chronometers. Conceivably we could use time signals from other countries, but your standards of accuracy have always been so high that we would be reluctant to trust others whose reliability is less.
471. All in all WWV and WWVH provide an invaluable service to shipping and in all respects should maintain the high quality which they now have.
472. Add more weather, especially during hurricane season.

473. Naturally you'll receive many many objections. So by all means be completely objective. You'll probably discontinue!
474. Add a more comprehensive taped weather report sent every two hours or maybe even every hour. Every ships officer would like to keep ahead of bad weather and if they could get it regularly from WWV and in the Pacific from WWVH it would fill a very important need. I feel that this would render a very needed service since the weather is so important today with faster ships and higher labor costs. The Captain always needs the weather and WWV sending it every one or two hours would be a big help that could be depended on *that is most important* to send up to date weather at exactly the same time. The need is there. The tapes could be changed every four or six hours. Give some thought to this idea and keep the power up. It is wiser to make better use of energy than reduce the power in some places.
475. It is ludicrous to consider cutting your power or services, as your modest total costs are such a miniscule part of Federal expenses--propose that they cut out some of the boondoggling etc., etc., etc., in Washington--Europeans are more realistic about Standards.
476. How many dollars and cents would actually be saved by reducing number of frequencies and/or reducing x'mtr power?
477. Add weather by area.
478. It is inconceivable that a vital service such as this could even be considered for reduction. The costs here are trivial compared to (a) their values (b) the ridiculous throwing away of money in many other areas.
479. WWV transmissions are most important. This is a ridiculous area to conserve energy and cut cost. WWV weather transmissions save lives. This program is one of the few Government Services the public needs and can feel!
480. WWV and WWVH need substantially more detailed weather information.
481. In my experience CHU Canada comes in louder and clearer and can be used within one minute of turning on receiver. It fades around the Azores at which point I switch to WWV.
482. WWV/WWVH is the most useful time signal in all the world, we (Japanese radio officers) think so.
483. The voice of the woman at WWVH does not carry like a man's voice. WWV at Colorado does not cover the globe like it did from Washington--now the Russian Time tick covers Europe.
484. The operating costs of WWV/WWVH are very low when set against the number of users and the benefit obtained. The ratio of cost to utility is probably one of the lowest in Government!!
485. I use WWV to set the Standard clock in the Railway office where I work. It is available through a phone extension of the Union Pacific Railroad Company. How they have WWV patched in I don't know.

486. FAA control tower has receiver from which we National Weather Service employees get signals to check time for Public Weather Broadcasts.
487. I strongly object to any reduction of power or services from these stations. Time checks and weather information are critically important to marine navigation.
488. The idea of cutting down national power consumption by reducing power output of WWV and WWVH seems ridiculous in the extreme. It isn't even a drop in the bucket and it could be important to quite a few people.
489. In order to comply with FCC regulations it is most essential to receive good signals at various odd times. I hope costs can be cut in other ways that will not affect signal or time of operation.
490. Keep the real time propagation, flux, and K index broadcasts at 14 minutes after the hour. How about propagation, solar flux, and K index from WWVH.
491. When Greenbelt, Md. was in service on 2.5 (and 5.0 MHz) reception in our area very satisfactory. How about getting together with Canada and have a powerful CHU located on East Coast (say Cape Sable) to serve both nations Atlantic Coast's?
492. Personally I feel WWV has done an excellent job over the years. My experience in the Navy plus being employed by industries find your services without equal. I suggest the government find other ways to cut the budget. I for one would be willing to contribute towards your support.
493. Thank you for consistent good service and assistance when needed. Other Government services should copy NBS.
494. With modern watches the jeweler must have the correct time to the fraction of a second. I use a 5 MHz and 10 MHz receiver to set accutron and Quartz watches but a lot of the time interference prevents my use of WWV on 5 and 10 MHz.
495. Extend the cutoff of your telephone answering device by one more minute.
496. The time/frequency broadcasts of the NBS are so central to many of the operations of industry and government that it would appear to me that this would be a poor place to attempt economies.
497. Lets turn off a half million or so unnecessary street lights which have been oversold as a safety device in our better days.
498. Service has been much more satisfactory since your move to Boulder than it was from Washington.
499. NBS T & F signals are an essential part of this ship's navigation and communication procedures throughout those areas listed (Caribbean, W. Coast of U.S., North Pacific, South China Sea, Malacca Straits). Our great problem with WWV/WWVH signals is that of interference from other stations on or adjacent the frequency, including S.W. broadcast stations.

500. For centuries, men struggled with the problem of finding longitude at Sea. So critical was the problem that in 1714 Parliament authorized a payment of £20,000 to the person who developed a means to keep longitude error within 30' after a voyage to the West Indies and back. This amount would be a fortune then. In 1735 John Harrison submitted his chronometer and was eventually awarded the prize. Time signals were investigated in the U.S. at the end of the Civil War by telegraph to ports when ships checked chronometers by Time Ball Signals. Previously the Navy's standard chronometer was carried from Port to Port to allow comparison. In 1904 the first official wireless transmission of time signals began from the Naval Station at Navesink, NJ. The signals could be heard for 50 miles. Now 70 years later we have World Wide Coverage. Now you want to scrap all this, it would appear. As far as I am concerned this is one of the legitimate functions of government--Radio time signals enable a person with a sextant and portable radio to navigate accurately and at minimum cost. We can't all afford Loran etc. Lets not set the clock back to 1741 just in the name of Economy.
501. Required by Federal and International Law to provide time ticks to navigation bridge for the safe navigation of vessel. Required by Federal Law (FCC) to maintain high order of frequency stability and accuracy.
502. "Brochure" to aid in public awareness of the present facilities and for education of students.
503. NBS time signals are used at this Federal Reserve Facility for:
1. Synchronization of computer communications processors at 14 Federal Reserve locations throughout the USA.
 2. Continuous calibration of the building clock system using 15 MHz.
 3. Telephone number 303-499-7111 is used daily except Saturday/Sunday.
504. Please reinstate time in Morse code! When reception is marginal with time of day-voice, the Morse code signal could always be heard. Please reconsider this very functional service.
505. Reinstall CW time. This can be copied when voice is no good due to propagation. Twelve years of deep arctic experience, CW would get us a good time hack when voice would not. When CW was dropped we had to depend more on other services, like JJY and CHU.
506. My company is an U.S. ERDA contractor and our standards lab and electronics department depends on WWV.
507. Federal Aviation Administration required accurate calibration of test equipment to NBS frequencies at radar facility where I work.
508. Of the few nice things this government does... and does it correctly is the Time and Frequency service which I have listened to for many months since I knew that it existed.
- Cast my vote to KEEP this service... for once in my lifetime (age 67) all the clocks in our house (4) ALL have the correct time... again, thanks to you and your coordinated universal time signals.

509. The US Army

has been testing unattended ground sensors for the US Army. The bulk of our data gathering and recording was accomplished by interfacing all of our instrumentation to a minicomputer and then recording the data on magnetic tape. To allow the correlation of these entries from different items of instrumentation which were physically separated, a common clock was required. The selected standard was the WWV time of day, voice, and one second ticks broadcast from Boulder, Colorado.

The Board is also actively involved in personnel and material airdrop testing. Our tracking system for this mission consists of television and motion picture photography and three digital recording theodolites. To allow accurate triangulation from theodolite data required the use of a standard time, and based on our previous success, the WWV broadcast was again selected as the standard for this airdrop testing.

In our experience, the WWV broadcast has been a reliable, accurate source of standard time available to all of our test locations simultaneously. In our continued testing mission, we will utilize this broadcast whenever the need for a standard time arises.

510. Over 2,000 members with interests in navigation, shipping and boating, and pleasure yachts.

For the East Coast the reduction in signal strength, which is already marginal, would render this service useless. While we consider this service vital today it could well be that the advent of the quartz crystal timepiece, which is just now starting to come on the market at reasonable prices, would make this service unnecessary in a year or two.

511. The Sport Car Club of America (SCCA) has a very active rally program. Last year the 100 regions (clubs) of SCCA sponsored approximately 620 Regional rallies, 56 events counting toward the SCCA National Rally Championship and one internationally listed World Rally Championship event.

Since rallying is an automotive sport that demands accurate time keeping, each of these 683 events made use of radio station WWV. The SCCA only sponsors a small percentage of rallies held annually in the United States as rallying is probably the most common automotive sport today.

On every weekend there are probably thousands of rallyist across the country who use WWV to synchronize their watches for the rally in which they are entered. All checkpoints along the rally route must also have their watches synchronized with WWV.

512. This letter is in response to yours of January 8 in regard to power reduction at WWV and WWVH. Of the billions of dollars that the federal government spends, the money it spends on primary power to operate the above radio stations most likely represents one of the better values the government is getting for its money. If anything, the power of these stations should be increased.

For example, on a recent trip on my private yacht along the China Coast it was only possible to obtain a time fix for less than an hour a day due to interference from what I presumed were oriental services on the same frequency.

As we could not make head nor tail of these alternate services, they were useless.

513. Domestic weather reports & forecasts for pilots would ease FSS workloads- at least identify IFR areas.
514. "I think that your service should be kept on for IT does a good job for the group that use it."
515. If we must cut back (which I doubt) why not give signals on 1/4 hour?
516. Lengthen UTL correction double pulses to make more audible, vis-a-vis CHU, Canada.
517. I find WWV extremely useful. I think a small power reduction and elimination of 20 and 25 MHz would be fine.
518. I use the time signal to check electronic timepieces for accuracy - this is our only means of getting the accurate time.
519. May I suggest that the 14 min. propagation forecast and 18 min. geoalert be placed at adjoining minutes for convenience since these two services are similar.
520. "Of the many places the 'Great Uncle' can save money, dropping WWV services is stupid. One load of unnecessary bombs to Cambodia would pay for all of WWV services you might wish to drop.
521. Put K&A index on at the same time (18 min. after the hour).
522. The signal is not always usable. Approximately 10% of the time even a carrier is not detectable. However, the need for this type of information far outweighs any inconvenience this (poor signal strength) causes. Instead of WWVH, I would like to see a new, lower powered station in Greenbelt, MD again. (This letter came from Southeastern Virginia)
523. I'd suggest that 15, 20, and 25 Megahertz be used during daylight only. They won't propagate at night.
524. Obtain a toll free area code 800 phone number.
525. A weekly short wave transmission of perhaps 1/2 hour duration, giving latest scientific discoveries and inventions, that can safely be given to the public.
It is the principal function of government to provide for its citizenry, that which the citizens alone cannot provide for himself. Your transmission provides information, which I cannot obtain elsewhere.
526. Increase your electrical power or volume when speaking or when you give the time. What good is all this if your power is weak or you fade a little on the minute.
527. Possible propagation for ham bands 80 through 10 meters. Could sure use this.
528. I would like to have the coded propagation forecast sent more than once per hour. For my purposes, it could be sent in Morse code as it was

formerly. In this way, it could take little time. The full voice announcement could still be given hourly.

- 529. Signal usually fades during voice portion of transmission - use more power then!
- 530. Poor reception on 20 MHz may be due to relatively bad propagation at this frequency. For cost and energy savings, transmissions at 15 MHz and higher could be curtailed when these bands are dead.
- 531. No (additions) but please stay on the air. Let the government cut down on something else. Such as "Sex life of African Spider" and other nonsense.
- 532. You give Pacific storm warnings - how about fair wx high pres areas, Arctic fronts coming down over Northwest from Canada
- 533. My flying is incidental to my work but safety in the air is closely related to an accurate knowledge of the time.
- 534. Short voice broadcasts of any known ship/aircraft distress situation giving position, name and nature of distress to continue until assistance arrives.
- 535. Silent carrier periods for easier zero beat.
- 536. The only correct time we have available to us. We are Railroad time inspection.
- 537. Give more info about WWV-WWVH about services & meanings for use of beginners.
- 538. Propagation other than North Atlantic.
- 539. Too many freqs used - cut out ones known to be limited use and if needed, increase power on most used.
- 540. "I am 13 and I am planing to become a well established ham."
- 541. I use your 440 Hz audio tone frequently and was quite annoyed when you stopped broadcating it every other minute and started providing it only once an hour. Let's have it 3 or 6 times an hour at least!
- 542. Our 3 observatories must rely heavily upon time standardization provided by WWV for accurate data exchange to exist between them.
- 543. Time signals and weather forecasts are essential information - especially here in the South Pacific wherein exact location is very important.
- 544. A toll free 800 WATS line would be more convenient than short wave (if a 2-3 minute connection were assured).
- 545. I would like to see you return to using CW time announce at least part of the time.

546. Back before you dropped the CW time signals there were many times when voice announcements were unreadable but CW could still be read. I feel possibly alternate CW and voice time announcements every other minute or so.
547. Daily sunspot count - rough or hot.
548. Strongly oppose reduction in transmission power. I think that the 2.5, 20.0 and 25.0 MHz frequencies could be eliminated with increase of transmission power for the 5 and 10 MHz frequencies.
549. Storm warnings of the Sea of Cortez (Caribbean Sea), Gulf of Mexico, and the Indian Ocean. Also mediterranean Sea.
550. Details on what astronomical bodies are visible.
551. In 18 years at sea as a Merchant Marine Radio Officer I have found WWV/WWVH most useful. One of the main reasons is that when within normal ranges (and often well beyond!) of either station, I can tune in to the frequencies at any time of day or night to obtain the information required. Reduction in power on 10 and 15 MHz would be a disservice to mariners.
552. The US Geological Survey, Division makes continued use of WWV broadcasts and feels that present procedure and frequencies are adequate. Please do not reduce the power nor change the voice.
553. Add more and more frequent weather. There are many acceptable ways for the U.S. government to conserve energy and reduce expense. This proposal to reduce signal power for WWV/WWVH would be a serious loss of one of the very important services our tax dollars buy.
554. Safety and welfare of small boats at sea depend on strong signals from WWV and WWVH.
555. I like both WWV and WWVH but I could "live" without them. CHU on East Coast Atlantic is great.
556. Reception has deteriorated since station was moved to Boulder, Colorado. So, all frequencies are required as all must be tried in order to get one that will come through and sometimes none will come through. My receiver is a Zenith Trans-oceanic in excellent condition.
557. When giving weather information please repeat Lat. and Long. because some operators go so fast we have to wait an hour and try again. Some operators do repeat but it should be standard practice.
558. WWV and WWVH both received here--sometimes with equal strength--alternating at times, and only one at other times. Could "tone" be eliminated during ALL voice announcements. The tone from WWV often obscures WWVH station ID here, at least. It is annoying. We would like to avoid pointing this out in our program--but could not--but WOULD, if it is to be eliminated.

559. Military electronics technicians are required to utilize WWV for accuracy checks.
560. I am operating the official seismograph station here in , S. Dak. The WWV time signal is used at least twice daily for the purpose of correcting the quartzmatic clock. This clock marks off the minutes on the seismograph chart so that the first motion of an earth quake can be determined to the one tenth of a second. Sometimes it is hard to receive the WWV time signal so I would say do not reduce the power.
561. Can't afford Loran. Therefore, would be impossible to get an accurate position without a reliable time hack. Crashing around in the middle of the Gulf is scary enough as it is.
562. WWV broadcasts are critical for accurate navigation, and are the standard for sailors in the Atlantic and Pacific basins. Surely there are other ways to conserve energy and money than eliminating this unique and vital service.
563. The control tower at the airport I manage requires accurate time information. WWV is the only source. WWV/WWVH services are essential. Reduction in service would be false economy.
564. Suggest 100% mod. of voice. My bulletin (1972) says ticks are 100% and voice 75%.
565. More detailed weather forecasts. In my opinion reduction of power would little effect reception here. I am in favor of decreasing power and keeping or adding to the information currently being broadcast.
566. We very strongly urge that you do NOT discontinue the Honolulu telephone number 471-6363 to reach the WWVH receiver auto-patch. This office, as well as all of the Broadcast industry (AM, FM, TV) relies heavily on this phone-in capability to synchronize clocks, especially for the Civ-Alert Emergency Broadcast mission of all stations.
567. The former broadcasts by international Morse code were more reliable as to reception than the voice broadcasts.
568. These responses reflect the requirements for all timing systems comprising the complex. This includes a fleet of nine aircraft working world-wide on telemetry support for manned and unmanned space systems as well as Range instrumented ships operating in the Atlantic and Pacific Oceans. Time correlated data is of prime concern to aircraft operations.
569. I would be at a great loss without the services your department renders especially for time signals. As a student in Navigation, and an amateur astronomer, the loss of time signals would be very serious matter as there are no accurate signals that I know of available in British Columbia.

570. I would find it almost impossible to be a complete shortwave listener without your standard frequency broadcasts for accurate receiver calibration, and time standard for clock calibration. Both used a number of times each day.
571. Some other Governments provide Time and Frequency Services. IF service must be cut why not allow them to share frequencies and keep the service going as sort of a combined nations affair.
572. Would like the propagation information now presented at :14 and :18 past the hour to be given during adjacent minutes.
573. I would be unable to navigate, particularly over water, without a good time hack. Yours is the only time hack.
574. The USAF is totally dependent on WWV to meet timing criteria for all aircraft flights. As a USAF navigator where would I get accurate time information without WWV?
575. The control tower at the airport I manage requires accurate time information. WWV is the only source. WWV/WWVH services are essential. Reduction in service would be a false economy.
576. 1. Go single-sideband, or single-sideband with vestigial carrier. Certainly, the receiving equipment becomes slightly more complicated, but after the initial howls, I cannot imagine that SSB would really be a handicap to any serious user of WWV's services.
2. Operate on a reduced duty-cycle, say, one hour on the air followed by one hour off, rotating the broadcast frequencies (such as simultaneous transmission of 2.5, 10, and 20 MHz for one period followed by 5.0, 15, and 25 MHz for the other rotation period.) A fairly large percentage of the time, two or more frequencies are simultaneously receivable here in Maryland, and presumably elsewhere. From the user's standpoint, the availability of more than one frequency is really an unnecessary redundancy. And I certainly would not object to waiting an hour (or less) in order to catch WWV on a particularly suitable frequency.
3. Is 2.5 MHz really worthwhile during daylight hours? And, depending on the sunspot cycle, how useful is 25 MHz? (That's the purpose behind the questionnaire, of course.)
577. In the airline business your stations WWV are very helpful to us in obtaining accurate time and checking our HF radios.
578. Here in Iran--time/frequency standards are non-existent. I've been using USSR time-freq. stations--which are very strong here. On occasion WWV can be heard very weakly under the USSR stations on 15 MHz. During winter months November-December I believe WWVH on 15 MHz could be copied here.
- For operations in U.S. your service is a must--both for U.S. Government communications center operations and amateur radio.
- Please provide RESULTS of SURVEY and your INTENTIONS to CQ Magazine and ARRL for Publication.

579. Electronics Help Line

"Since the NOAA VHF weather stations may be re-broadcasted by permission of the FCC and the National Bureau of Standards WWV time signals are also of use to the mariner, why not have WWV time signals rebroadcast too on the VHF/FM weather channels, WX-1 and WX-2, eliminating the need for two receivers?"

, Castro Valley

What a great idea! I like it so well I will join you in some letters to my local congressman as well as to NOAA and the National Bureau of Standards.

580. Tone modulation frequently confuses measurements requiring Zero beats.

581. I furnish maintenance and technical assistance for the Institute for Military Assistance (USAIMA) and other subordinate and units.

582. We of Corp. are engaged in Military, Public Safety and Computer Communications applications. WWV provides a valid scientific service to users of accurate timing.

583. Operate military communications and NBS traceable standards laboratory. Services are indispensable.

584. Survey not known well enough. Will probably only scratch the surface of actual users and listeners. Services provided by WWV are great.

585. This represents the Communications Section of the State Div. of Military and Naval Affairs, Office of Disaster Preparedness. Your signals are essential to keep radio transmitters on their assigned frequency by calibration of our frequency standards.

586. This is the only time tick available to ships in the Western Atlantic and Eastern Pacific.

587. What we seem to lack in this day and age is a realistic evaluation of priorities for essential services of our government. Your universal time service is vital not alone to the many individuals who use it but to our national security as well.

588. Stations such as WWVH, JJY, BPV, etc., which furnish the same information, operate on the same frequencies and cover the same geographical/inter-national areas, could be a joint coordinated international operation, managed and financed by all beneficiaries. Suggested ID: 1 ITU, 1 UT or 0 UT.

589. WWV transmissions essential for calibrating measurement equipment which is used for enforcement of FCC rules and regulations.

590. Add world weather patterns--perhaps once or twice per day or at least periodically.

I keep as continuous a plot of the sun's position as weather permits as a reference for observing local crustal motions or earth's axial wobble. This is additionally used to create interest among school people in geophysics, astronomy, and related topics.

591. More detailed data should be published on BCD code reception and use. An article on BCD clocks, specifically how to build one, similar to the article on digital-crystal clocks (QST-Nov 1974) would promote wider use of BCD time code.
592. We use WWV basically for rating chronometers. I find it preferable to other stations because: (a) it's 24 hour service (b) it's spoken recording of each minute.
593. I am a radio officer on a merchant vessel and utilize your stations for frequency calibration, calibration of comm. clocks. The bridge utilizes your time signal for chronometer rate checks, WX warnings.
594. The weather broadcast information is excellent especially in waters of the South Pacific, specifically the waters off the South American continent. These broadcasts could be more enhanced by updating the information on a four hour basis. Time signals are a must; the program should not be altered.
594. I am _____ for National Research Council --we depend on WWV.
595. I am a Watch Repairman. Use almost four or five times in a day to set and check how the Pulsar and Accutron watches are doing.
596. Coast Guard Aux. uses WWV to synchronize watches at start of patrols. WWV is a valuable aid. It should not be eliminated. It is a must for taking celestial sights.
597. Airline pilots constantly relay on WWV and WWVH for the ultimate last-word, superlatively accurate time hack. Bon Travail.
598. Operating 715 buses on a two to three minute headway and later we will operate the Rapid Rail System. It is necessary that we have the correct time.
599. _____ Inc. is a manufacturer of medical electronics and depends upon your services.
600. We are designers and maintainers of precision visual and audible aids to navigation equipment for the offshore oil industry and the U. S. Coast Guard and for that reason your very accurate time signals are most important to our business.
601. Approximately 20 people in this area have purchased or/and build time equipment for astronomical observations with our organization. This includes University instructors.
602. We of the New Zealand Radio DX League need all the time signals, geo-alerts and propogation forecasts we can get. Especially for BCB and SW reception here in New Zealand.

603. We have no local time information accurate enough for regulation and timing of Quartz Crystal watches. Discontinuance of this service would create almost complete inability to supply the public with accurate time on our more accurate time pieces.
604. Weather warnings highly appreciated as they are mostly more recent than fax-charts and/or regular weather transmissions. However, positions sometimes missed due to atmospheric interference--slower speech could possibly prevent this.
605. The reduction of WWV/WWVH power and frequencies would seriously hamper the safety of ships at sea in regard to its communication and navigation. It is vitally important that full and complete power and allocation of frequencies from 2.5 MHz to 20 MHz be rigidly maintained.
606. To reduce operating cost and conserve energy I suggest that you switch your transmission mode from A3 to A3H, single sideband full carrier. Also you could drop your 20 and 25 MHz OPS between sunset and sunrise.
607. I teach celestial navigation to an average of 100 students per year at two universities who rely on and need good time signal broadcasts.
608. Power Cruiser Association--representing 27 Yacht Clubs and several hundred interested boaters. We are happy to find you are not reducing power output on the 5, 10, and 15 MHz on WWVH, for there are times when, due to interference on WWV, we rely on WWVH.
609. It would be useful if there was some way for NBS time signals to be broadcast for a 2 to 5 minute period on the National Weather Service VHF/FM Weather broadcasts on a regularly scheduled basis.
610. It would be retrograde to lower power of WWVH transmitter, alter voice time checks or accuracy of frequency calibration. Weather details and storm warnings are essential.
611. From Radio Officer SS --I am on an intercoastal voyage Pacific/US Gulf coast. Its important you maintain normal operating power. WWV and WWVH is used daily for Star-Time to check Chronometers because around the tropics your signal is weak at certain times.
612. West Coast to 180 Dateline, and 40 Degree N to 60 Degree No. Also WWVH 180 Degree to 165 Degree East, then JJY. Some interference experienced between WWVH and JJY.
613. I believe that a satellite relay would make possible the elimination of most earthbound transmitters.
614. To conserve energy have carrier on/off times throughout the hour, use directive array to alternate North South, East West every five minute interval.
615. There are many amateur astronomers as well as professionals who make frequent use of your services. I am an officer of such an organization of "amateurs" (though very professional in outlook and competence) group: ASLI (Astronomical Society of Long Island). Your services are invaluable

in timing events such as Solar and Lunar eclipses, occultations, etc. we are able to predict auroral displays from your geoalerts and solar condition reports on occasion.

616. Time signals from WWV/WWVH are constantly used for starting off-line communications equipment/computers. There is presently no acceptable substitute for the accuracy and major importance of signals from WWV/WWVH aboard this aircraft carrier (US.S. CVA-)
617. As a user of your stations for time checks on several different ships, I implore you not to reduce power to cut costs. A large percentage of the worlds navy use your station and rely on it daily.
618. Expanded weather information. It would seem that more weather information such as existance of cold fronts and their rate and direction of movement could more economically be handled as a combined service of WWV rather than relying on Coast Guard or NOAA Stations. During inclement weather, when information is needed the most, even WWV is difficult to pick up at times. Any distance from land NOAA-VHF of course is useless. If WWV came in strong giving weather information, many navigators would be appreciative.
619. Our Four County Watchmakers Guild is very interested and depend on this time.
620. Types of questions seem to imply citizen usage is not considered as important as commercial/industrial/research usage. This implication if offensive to this citizen.
621. I am a Radio Officer on a U.S. Ship traveling to the Far East and South Seas Constantly. Without WWVH far out in the Pacific or WWV approaching the U.S. we would have little way to get the right time, and the ship's clocks including the chronometer used for navigating the ship are all set according to the GMT time announced on WWV and WWVH.
622. I have been working on and directing U.S. Government funded (AEC/ERDA, USAF, NSF) research in Alaska and the Aleutians for five years. It is important to retain several frequencies since weeks can go by when 15 MHz eg, maybe useless and then, perhaps, 20 MHz will drop out. Very occasionally a week can go by when no usable signal is available.
623. WWV is used to check accuracy of time recorders which my company manufactures. some jobs are dependent on WWV.
624. WWV, VB imperative in other seismological endeavors in Alberta regions.
625. Yachts crossing the Atlantic (and there are many of them), from the Canary Islands to the West Indies, for example, depend upon BBC for navigation time signals. When about two-thirds of the way across, the Voice of America blocks BBC and WWV is still not within reception range, at least not on 15 MHz and below. At this point the navigator is left with nothing.

626. I am a part time Skipper and Celestial Navigator returning Race Yachts from Tahiti, Hawaii and Mexico. Occasionally I serve as Race Navigator. These yachts have crews ranging from 8 to 12 people. Precise navigation is an extremely important safety factor.
627. I speak for other Ships' Officers and Yacht Navigators, Fishermen etc. We often use portable receivers so, the various frequencies and signal strength is important. Also, your storm warnings are very helpful on small boats.
628. I do Accutron service for a large number of other retail jewelers as well as my own work. The time signals to the second are very important to my operation.
629. Company uses WWV for time coordination between utilities.
630. Obtaining accurate NBS time/frequency information and weather information is one of the few government services I gladly pay taxes for.
631. WWV frequency quoted as time standard on Canadian Amateur Radio Nets. WWV can be heard in this area on at least one frequency at any hour of the day or night at S9 signal strength. Hope you don't have to curtail your operations.
632. WWV/WWVH time signals are completely vital to shipboard navigation. Frequency standards are vital to calibration and maintenance of shipboard electronic equipment and instruments. Weather information is an aid to larger vessels and a vital necessity to small boats.
633. These comments represent the official business of standardizing measurements of time for Power Corp.; the measurements are also used in the calibration of instruments used in nuclear plants in our system. This time broadcast is used in the calibration of primary standards through which other devices are calibrated.
634. We run a chart recording of WWVB reception and use it to maintain visual TV transmitter carrier frequency to ± 0.2 Hz @ 193.25 MHz.
635. Decreasing effective radiating power of WWV would severely cripple my communications and standards lab operations.
636. Simplex timerecorder has a radio-master calibrated to NBS, at the University of
637. University--Instrumentation. I've used WWV for many years. I consider this service vital and would be much hurt if I were cut too severely. However, I do not use all of your services.
638. Accuracy of tuning of hundreds of radio receivers built and serviced by us is based on the WWV signals. These radios are in use by most of the Tuna seiners of American and Mexican registry.
639. Federal Aviation Administration use for , MI Airway facilities.

640. If the FCC is so concerned about "Energy Conservation", why are they considering the increase of the Amateur Radio Legal Power Limit to 2000 watts PEP OUTPUT or more than DOUBLE!!!
641. We make measurements for approximately 30 AM, FM, TV Stations.
642. WWV is necessary for this station to coordinate its Loran net. We have six different Loran stations that require precise timing.
643. There are many times throughout the day and night when there are heard foreign voices speaking on the, or near the WWV frequencies, some of them we can tell that they are Mexican and other times, we do not know what language is being spoken. Also, we think that the Gals voice giving the times is very nice to hear, plus a Gals voice giving the different weather reports...it is much appreciated.
644. The company I work for--" R.R."--receives your signal on a radio and puts it on the company phone line--but most of the time I can get a better signal on my own short wave radio set.
645. Amplitude of one minute tone is higher than voice and second marks. Either one minute tone mark should be lowered to voice amplitude or the voice amplitude should be raised to the amplitude of the one minute tone.
646. I suggest converting your transmission mode from AM to SSB with a reduced (to 210%) power pilot carrier in order to be compatible with present AM receivers. This would drastically reduce input power while retaining the same level of received information at the receivers output. No sense in waisting power in the extra sideband also.
647. The majority of your porposed cuts in my opinion, is an example of over reaction to energy conservation!
648. What a stupid way to save energy!
649. Propagation forecasts would be more helpful with more information. I am certain I speak for all of the other navigators and pilots flying the Atlantic. We here at Airlines use WWV quite a bit during our pre-flight and during the flight itself. There are so many other Gov't. projects that are not as valuable as WWV and WWVH. Don't let them cut your service. We need it.
650. , Federal Communications Commission.
651. How can anyone consider reducing power on WWV/WWVH when one can time across the broadcast band and hear mostly 50,000 watt stations playing Rock and Roll? Lit's conserve energy where it is wasted!
652. Combined involvements of Technical Center and Institute, Phoenix.
653. Power plant computer systems.

654. We are Railroad watch inspectors and need this source for setting the timepieces we service to correct time.
655. Use of signals from WWV and WWVH provide a 100% accuracy method of calibrating and standardizing our Heart Rate Monitors, Electro Cardiographs, and other time and rate related equipment.
656. WWV is an excellent system. Without it my research lab (geophysics) would be very hampered.
657. Several departments at State University use your services.
658. Ocean weather allows us to plan our most advantageous pressure pattern. Propagation allows us to anticipate some RF interference. Operation of our aircraft without an accurate time service would be, in my opinion, unthinkable.
659. WWV and WWVH are a great service to us. Though we be only yachtsman this service helps and enables us to travel the waters of the world. We certainly feel that budgets can be cut in other areas so that NBS can continue to operate at its present capacity.
660. The total operational costs in dollars and energy is so minimal for your services compared to many other Government programs, many of which are less essential, one should not even consider a reduction. Keep service as is.
661. WWV's signals are vital to the proper conduct of the Federal Communications Commission's regulatory responsibilities. WWV's signals are necessary to maintain the accuracy and integrity of the FCC-equipment.
662. This Department maintains Sperrys Frequency Standards.
663. I became very aware of your time signal services in 1962, when I was stationed in Viet Nam and our intercept group used the signal from WWVH as our time-base standard. In that part of the world, the Morse code time identification was a necessity, as voice transmissions would not "cut through." In using the signal from WWV, I notice that the Morse identification has been dropped. Has it also been dropped from WWVH? We needed it then, is it still needed now?
664. We use your services every week, usually Fridays through Sundays, to calibrate watches and eliminate any question about the time of day that would certainly arise in the absence of a standard we could all receive and agree to accept. The elimination of this service would be felt keenly by thousands of enthusiasts. We prefer your services to those of CHU, which needs a new program director.
665. When cruising in open sea, or off unfamiliar coasts, time broadcast is indispensable for our navigation. We don't cruise often, but when we do WWV is very important.

666. Besides the Radioroom clock which by law must be kept accurate, the Deck Officers require an accurate Chronometer for navigation purposes and is checked daily from your sigs for accuracy
667. Daily time signals are received in Radioroom and relayed to Chartroom to check chronometers--WWV time signals most important to this vessel.
668. Signals on 2.5 MHz in our area, from Fort Collins, conflict with San Francisco Marine Operator's transmissions on 2506 KHz during periods of darkness.
669. I speak as a ship's Master and represent all uses to which these services are utilized within the vessel. Addition of storm warnings to the time signal has been very, very useful.
670. Save 66 2/3% pwr.--Broadcast from H + 45, to H + 05.
671. On ship it is my custom to get time ticks in the AM, rather than in PM, which I believe would be easier, but want to get started right time-wise first thing. On present run use WWVH almost entirely, but foreign time ticks take over on same frequencies at about 160E going westbound. Can use them, whoever they are, and some may be 1/2 second off, but to make sure check WWVH whenever possible, and then I know I have the right time, and right frequencies. (The big two)
672. Under adverse atmospheric conditions, voice time announcements are sometimes difficult to understand. The previously used International Morse code could always be copied.
673. I own a small mfg. company and we use the frequencies for calibration purposes.
674. Time signal carried in some form on the Weather stations around the country would assure reception at all locations. NYC is one area of poor 24 hour reception of any one of your frequencies. Accuracy to .1 sec is adequate.
675. I am only one of six at a commercial TV station, which use WWV continually.
676. WWV is used by University Seismology/Geophysics Dept. of which I am part.
677. Maintain correct time in computer used to dispatch natural gas. Am investigating pipeline induced current activity.
678. Consider reduction in power of WWVH a possible tragic decision, as it is utilized in an area where navigational accuracy could be a life or death matter.
679. In American Samoa, my home, the electric generators are poorly run and have no adequate frequency control. No two electric wall clocks say the same time. Short wave radios are widespread and the use of WWV to set wrist watches is common and important.

680. Civilian A.M. stations and time service numbers vary as much as 2-3 minutes. With out WWV I would be hard pressed to find a reasonable replacement if this service is curtailed.
681. Use WWV for calibration of FCC monitoring and inspection instrumentation.
682. Many long distance yachtsmen and professional delivery Skippers such as myself live by "WWV"! "CHU" does not give weather while "WWV" weather is the most comprehensive for mid ocean storm information. There are many yachtsmen who probably use "WWV" only twice a year and are not aware of the present situation.
682. Suggest a test period 3dB power reduction on all frequencies with a voice request for impact data. Suggest that results and conclusions from this survey be released for publication by the IEEE, Amateur Radio Periodicals, etc.
683. The total energy use of WWV/WWVH is so infinitesimal compared to our national energy deficit that partial reductions of service are totally unjustified on that basis. We oppose power reductions or curtailment of hours. The services rendered fully justify the energy consumed.
684. Accuracy in timing of seismic records is the most important function for WWV as concerns observatory. We are also now monitoring the total earth's magnetic field and therefore need geomagnetic alerts.
685. All FAA facilities in New England.
686. The WWV time signal broadcast signals are essential to competent repairers of high accuracy time pieces such as Railroad Grade watches and tuning fork/quartz crystal watches or clocks. There is no other time standard of sufficient accuracy available to us for calibration of these items.
687. The time/accuracy of all of the company time clocks depend on receiving the time signal daily for the setting of the master clock. Due to a slight frequency variation of our power generators a standard electric clock will not keep accurate time so we depend on the time signal for the daily setting of the pendulum/escapement of the master clock.
688. Broadcast 3.579545 MHz network offsets via WWV/WWVH.
689. Since relocation in Boulder reception has been very poor with 5, 10, and 15 MHz the only useable frequencies and these rendered useless most of the time due to severe fading and interference by local broadcasts. Would suggest more rather than less power and a restricted band on both sides of WWV carrier to reduce commercial interference.
690. As president of the VHF Society, I know for a fact that everyone of our 137 members use WWV in a very similar manner as I do!
691. Most U.S. Navy Navigators rather enjoy knowing where they are during a mission.
692. Accurate knowledge of time is important to me for astronomical observations used in land surveying.

693. These responses represent the views of our Astronomy Group. (two faculty and eleven students). I believe that it would make us have difficulty in using your signals if you reduced power on 5 or 10 MHz. These signals are vital to our work.
694. Am looking forward to development of cheap secondary frequency comparitors using WWVB and/or WWVL similiar to 3.58 MHz color TV comparitor.
695. Radio stations Louisville, KY-- -FM, Vevay, Indiana-- ,
Carrollton, Kentucky. Corp., Jeffersontown, KY. We
use WWV at 5 mcs every day and hear WWVH in the background just before
WWV gives the time. Frequency checks are used to calibrate monitors,
every month.
696. One change that could be made to the present program is the manner in which the time is given. At times due to heterodyning or poor propagation, it is difficult to understand the minutes as presently broadcast. for example; fifty-six and fifty-seven sound very similar under poor reception conditions. They should be pronounced as five-six and five-seven for easier understanding under adverse conditions, as should all numbers.
697. Despite the size of our company, we pay many thousands of dollars per year in taxes, and in my personal capacity as a radio amateur, I pay many thousands more. In several days of contemplation, I have been unable to divine anything I or my company derives to our benefit from these taxes with the paltry exception of some wispy RF signals from WWV. I'd sure hate to lose any of them. I am sending a letter and copy of this survey to my congressman.
698. Primary use is for time synchronization for world wide navigation use in Lockheed C-141 (Military cargo - Military Airlift Command). Please do not cut strength on 5-10-and 15,000 Hz.
699. Many times the propagation reports at XX14 can not be read, even though time announcements are OK. Depth of modulation poor on propagation reports! Try CW at 10 wpm or even 5 wpm.
700. Alignment of 2 way radio, electronic clocks, receivers for customers. Alignment of my own test instruments, signal gen's., counters, etc. with WWV, time and standard frequencies.
701. The time service rendered by the US Navy (NAA/NSS) is unsatisfactory in all respects. Our suggestion is the Navy time be discontinued and the funds transferred to you.
702. The time and frequency references derived tuilizing these WWV signals are the most important variables used in the automatic generation control system. Continued reception of accurate and better than adequate WWV signals is very important to our real-time computer driven control system.
703. We operate on Universal Time on scheduled nets and make all reports using this time. Also field reports. Nets are coordinated for different states.

704. Sight reduction requires accurate time. Best available is WWV. Am sure official USPS membership (approximately 80,000) will concur in the opinion offered here.
705. WWV-WVH broadcasts are a vital factor in world wide navigation. It demonstrates our country's interest in scientific/industrial leadership. A cut back would be politically disastrous.
706. As an accurate measure to time, my accutron provides data for flight plan activation, which is critical for safe navigation and quick emergency location of downed aircraft. Instrument procedures require accuracy and coordinated timepieces between controller and pilot.
707. Represents uses of Radio in Los Angeles.
708. Thanks for accompanying material on the values of geolert and propagation forecast coding--but the explanatory material itself suffers from obscurity, as the explanations are given in terms of other units of measure or values which are themselves not clearly explained.
709. Commodore, Yacht Club--over 2000 members with interests in navigation, shipping and boating and pleasure yachts. For the East Coast the reduction in signal strength, which is already marginal, would render this service useless. While we consider this service vital today it could well be that the advent of the quartz crystal timepiece, which is just now starting to come on the market at reasonable prices, would make this service unnecessary in a year or two.
710. Enunciate seconds more carefully. At times 21 sounds like 29, etc. Perhaps saying two one sec, etc would be better. It is due in part to lack of fidelity and in part by propagation distortion, that makes it difficult to understand at times.
711. Large magnetometer arrays are used in study of conductive structure in the earth. These studies rely on WWV time signals. They form part of Research Programs of this Institute of Earth and Planetary Physics, Univ. of
712. Due to skip conditions, the signal strength is quite variable, without both 5 MHz and 10 MHz there will be times when no standard signal can be received. CHU, Canada, can only be received part of the day and cannot fill the gap. Suggestion: Reduce transmitter power at WWV (eliminate 20 MHz and 25 MHz if you have to) and re-establish a transmitter (5 MHz and 10 MHz) at the old site in Greenbelt, Maryland.
713. This is a very necessary and worthwhile service and should be maintained as is at least in my opinion. There are so many other areas which can absorb cost and energy reductions without detriment of this magnitude.
714. I am a member of Army MARS and it is very important that we operate on correct time--also propagation reports are very important to us. We appreciate your information very much.

715. What is this crap about the goddamn Federal Government wanting to screw up WWV because of the so-called energy shortage? Let one good thing come out of all the Washington, D.C. clap-trap and, sure as hell, some jackass, for one half-baked reason or another, will do his best to kick into nothing.
- I use the radio time, WWV, all the time! I use it at least three times a week! Why? No damn reason in the world other than I like to have the exact and correct time. I set my Pulsar...my son sets his Accutron... we set all the electric clocks in the house...all--by WWV!
- Energy shortage, my ass! The only energy shortage we have in this country is the result of the inane politicians in Washington! Carry on, you are doing a fine job and giving a wonderful service--right now and as is!
716. Your services mainly utilized for time ticks/calibration of chronometers clocks and occasionally propagation condition used. We are a container vessel of the United States Lines on the North Atlantic Run.
717. This is one of the very few Government services that I use. In light of the huge amount of waste in Government operations, the idea of saving a few dollars by cutting back on the services of WWV seems laughable.
718. I consider these services are essential to all users of the frequency spectrum, world wide. Stand fast, and don't give up any of your frequencies. In fact, put out a louder signal. Keep the Pirates Out. you'll know who I mean up north of us here in Aussie.
719. NBS provides valuable information to the private radio listeners such as standard frequency for calibration purposes and propagation forecasts which would otherwise be difficult to obtain.
720. I cannot emphasize too much the importance of the time hack to the pilots of or all other Air Carriers for that matter. We always sync our cockpit clocks by WWV before starting our flights and as you probably know, any change of more than three minutes in ETA for a check point requires a revised estimate be given to Air Traffic Control.
- This becomes especially important on the North Atlantic and foreign flying where there is no or little radar separation and time is the only thing that keeps aircraft from colliding on the same route at the same altitude.
721. Suggest you ask users to post financial contributions to help defray increased costs. Increased power output would be very great importance. Minute voice announcement much appreciated. (Jamaica)
722. Time & weather are like zink fertilizer--unless you have enough you don't get much benefit.
723. I believe you are correct in reducing service and urge you to do so for the reasons you state.

724. As a professional Yacht Captain operating off the Eastern Seaboard, Bahama and Caribbean waters, rely on WWV for time and weather. Would like to see more complete weather information and forecasts. Must keep present power levels as few yachts have adequate receivers--just a portable Zenith or a ROF of some sort.
725. I think the time signals and storm warnings are very important and should be continued on an adequate basis. They are services the individual is unable to obtain otherwise. Power should be adequate to provide full geographic coverage.
726. An excellent and irreplaceable service for small craft navigation.
727. This unit uses the FTS #303-499-3300 to set clocks once a week.
728. Exact times needed for Loran and Radio logs as per USCG Regs.
729. WWV is necessary broadcast system for purposes of calibration. Not only for time but for frequency standards and propagation forecasts. Without it aids to navigation accuracy would be minimal.
730. Altho many foreign countries, Hongkong/Tokyo, Vladivostock, etc. send navigational type time signals, most American navigators prefer those from WWV or WWVH, and as Radio Officer, one of my duties is to supply the Navigator with a daily time signal at sea on which he can faithfully rely.
731. Make them turn out the lights in Las Vegas before cutting power or services of something this important.
732. WWV represents a valuable source and should remain a reliable source of time and frequency standards. Please do not compromise the present service. There are no practical alternatives.
733. Experienced heavy interference by JJY and BPV particularly in the Far East/ Indian Ocean areas, relating to the time of the day.
734. Adding a CW signal at specific times would be very beneficial as too often the voice is unintelligible and the minute not heard. Also feel 25 mc could be eliminated entirely. Have sailed all over the world and the few times I've heard WWV on 25 mc, you could also hear better on other frequencies.
735. The above services are desired, adequate and useful. They are one of the STANDARDS of our nation, I wish them continued and not curtailed due to political-financial excess in other areas. P.S. Letters sent to my Senators and Rep. concerning this matter.
736. Excellent service. Please don't let it go down the tube. Much improved since move to Boulder.
737. This may be considered the official position of the Offshore Division--about 5,000 Yacht owners--of the United States Yacht Racing Union.
738. Your North Atlantic weather synoptics are invaluable (as in the time service) and the best information available. Please don't curtail either!

- 739. A format similar to station CHU would seem to be most useful for calibration of shipboard clocks.
- 740. WWV/WWVH not usually heard in Oman/Persian Gulf.
- 741. Add--more frequent weather (storm) warnings.
- 742. My land survey firm use voice time announcements for Azimuth determination as well as position calculations. Usually we are only concerned with accuracies of ± 0.5 secs of time.
- 743. Consider adding a time tick to the NOAA weather broadcasts on VHF 162.55 and 162.400 MHz. Once each 5 minutes would be sufficient.
- 744. Some additional weather would be helpful.
- 745. The radio time signals are of great importance to all small boat navigators.
- 746. Time signals very important to small vessel navigation Multiple frequencies needed because reception varies from day to day on different frequencies.
- 747. We do not think that energy conservation should interfere with a national and world wide standard service as important as WWV. Reception with moderately priced equipment is difficult enough already.
- 748. Through one of our Air Traffic Control facilities we have learned of the announcements on station WWV that reductions in service are under consideration.

Station WWV is the sole source of recorded time signals at most of our Air Traffic facilities. The signals are much more accurate than time information supplied by commercial telephone companies and are considerably less expensive to obtain. Accurate time signals are extremely important in correlating radio communications, especially during accident and incident investigations.

- 749. Cut power by 3 DB (50%) and identify minutes with slow Morse. This will result in increased coverage with a 50% power savings.
- 750. The services provided by WWV/WWVH should not be reduced. To reduce services of direct benefit to so many when the cost is so small would be foolish. The government should seek to economize on those items which represent a significant fraction of the national budget (perhaps reduction of over government management levels) rather than reduction of valuable services which even if entirely eliminated would not affect the total budget.
- 751. Official response of Field Office of the Federal Communications Commission.
- 752. Restricting WWV and WWVH denies the scientist an important scientific tool which can't be measured in cost effectiveness because of its so broad need and usage.

753. To curtail the operation of WWV/WWVH to conserve money and energy is similar to flicking a gnat off an elephant to rid him of bugs. In the face of the daily expenditure of millions of dollars and God knows what in terms of energy in the Far East and Asia, this proposed cutback is nothing short of incredible.
754. Amateur radio- - 50,000 Hams check your signals for frequency check ET correct time & WX . Pse give us your frequencies. Exact - on 5 es 10 MHz--what happened to the CW signals??
755. If you are trying to cut your costs, you might consider broadcasting for only 20 minutes out of the hour, 10 minutes before the hour to 10 minutes after the hour. You could give more weather at that time.
756. United States Coast Guard Auxiliary. The accuracy of time pieces are important to us in our search and rescue at sea.
757. Offer for the asking a single sheet schedule of WWV/WWVH signals. Cutting back on NBS services to save energy that will be wasted by other Government organizations indicates fuzzy-headed thinking on someone's part. Let's save energy where it does no harm!
758. Member of the U. S. Coast Guard Auxiliary--accuracy of time is important in search & rescue at sea.
759. I use your service to calibrate my electronic clock from which I set my wristwatch. As a Police Officer, accurate timekeeping and chronological recordkeeping is essential. A 5 or 10 minute error can create inconsistencies that lose a case in court.
760. Services of WWV and WWVH essential to proper/safe vessel operation--presently very good--Let's "economize" with useless "services".
761. This is one of the most valuable services that I know of. Who can afford expensive quartz chronometer on sailing vessels where time is so important for accurate navigation.
762. The market for our product would be seriously reduced if WWV/WWVH power were reduced.
763. This is the official position of the Naval Security Group Division, USS (CV-). The frequency standard provided by WWV is invaluable in the calibration and maintenance communications receivers. Additionally, precise time information provided is used on a continuing basis in connection with setting communications ancillary equipment.
764. I get better time and frequency service from Canada than I do from the U.S.
765. Affects all agency offices (FCC) in U.S. and Hawaii. This service is a must for accurate enforcement work.
766. Used in boating classes taught for United States Power Squadron.
767. The correct time, determined by WWV is used by our (6) Civil Engineering Field Survey office

768. Do not cut back on WWV. Let HEW cut back on some of their damn fool wasteful programs--such as feeding loafers who refuse to work and who will never work as long as they are fed at taxpayer expense. Cut out Congressional taxpayer paid unnecessary travel and vacationing.
769. Add major storm warnings: land (hurricane and tornado force) continental US and Canada. Your service is very important and could very possibly be life saving. WWV/WWVH should not be restricted by energy saving projects.
770. I use the time frequency station as a guide to timing and setting all of my new watches and watches repaired. I am not an official or a large concern, but the station is a part of my everyday business and without it it would be difficult to set the now very accurate wrist timepieces.
771. Your announcer does not enunciate the "minute" clearly--kind of lets his voice drop at the end of a sentence. I would think all your listeners know the time almost to the minute. Since that's what they are all listening for--the minute--let's emphasize it!
772. CHU is not a viable alternate. We have tried it.
773. For navigation about all U.S. Navy ships where time signals are extensively used for comparing chronometers and for celestial navigation (which must be very accurate). Reducing transmitted power would probably have the most serious affect restricting coverage in certain parts of the worlds oceans. If changes must be made, possibly the elimination of frequencies 2.5, 20 and 25 MHz would be the better choice.
774. WWV and WWVH are the sole means I have to calibrate my receiver crystal calibrator which I use to ensure my transmitter stays within the prescribed amateur bands. The time signal is used to set the station clock.
775. Frequency and time service are extremely important in shipboard duties.
776. WWV is used to set IRIG time of test bed. We have 2nd test bed that uses WWV to set IRIG time code generators.
777. All squadron radio operators, this squadron-Civil Air Patrol (A private non-profit corp.-auxiliary of U.S.Air Force). Interference usually in morning hours from foreign stations.
778. We use this service for certain TV maintenance functions.
779. Time signal is a common source for several related and associated facilities around USA, assuring identical accurate info to all! Why is this great, technically advanced country of ours allowed to be outdone by the smaller European and Asian technologically productive countries. The time systems offered overseas make our archaic.
780. My wife and I sailed the So. Pacific for a year and utilized the voice time signals several times daily and couldn't have gone without them. Please continue the excellent service.

781. Geophysical Institute, Univ. of --many programs use WWV/H. Propagation-wise, we hear WWVH 10-15-20 90% of using time.
782. We need current readings of solar flux and geomagnetic activity.
783. The words "GMT" consumes less energy than "coordinated universal time".
784. This service is an important one to the communications industry. It should me maintained.
785. Time checks are essential for the Weather Service functions in tracking and receiving satellite pictures.
786. We at Corp. use NBS frequency/time sources for NBS traceability to time/frequency domain applications.
787. The voice storm warning tapes should be read more slowly--with much better enunciation and repetitions of locations of distrubances. Extremely difficult (often) to tell difference between "Torby and hivby" for example and this confusion is completely unnecessary and easily eliminated.
788. To the extent services used in Alaskan Field Work of U.S.G.S.
789. Involvement of a compnay thermal and hydro power system of 300 Mw capacity located in a region of South America where no other power systems exist.
790. Though not officially directed to respond to this questionnaire, I believe this represents the opinion of most all members of the Cruising Association of which I am Rear Commadore.
791. communications department and radio overhaul shops have used WWV for many years. Suggest you seek their opinion and support.
792. Thousands of yachtsmen depend upon your services for accurate time for navigation.
793. Station operation for dewline.
794. Since your move from Washington to Colorado, the reception in the Philadelphia, PA area is of variable quality and cannot always be relied upon. To save on transmitter power, perhaps you could arrange for distribution through telephone lines. The telephone time signals in Philadelphia are frequently off by one or two sec. Or, the telephone company might provide an 800 number in return for your providing the time signals. Or, perhaps some cooperative arrangement can be made with CHU to cover Eastern US and WWV to cover Western Canada.
795. Your storm warning bulletins are excellent, there is practically no other way for hurricanes to be tracked from so far away, as by your station--however, your service would be much more helpful if you updated the warnings more than every 6 hours.
796. Use WWV to perform required FCC frequency measurements. Plan soon to phase lock station operating frequencies to WWVB.

797. As a member of , it was brought to my attention that VOA maintains carriers long after transmission time. This too presents an energy waste. I recognize a complete shut down of these facilities brings more waste when time comes again to transmit, but undoubtedly some waste does exist at this facility. Cost cutting waste as the above, would prevent any cut-back of NBS services or would help!
798. Time standard is critical for my performance of NORAD assigned mission-- vital to our detachment as well as entire MWS (missile warning sq.)
799. I received good signals before the bonehead move from Maryland to Colorado. A return to a broadcast center nearer the center of population would make sense, but that may be too much to ask of Federal policy-makers. From Colorado, the present vestigial usefulness would disappear altogether with reductions in power. Already Montreal is much more useful on the East Coast. Possibly the best solution is to combine with the Canadians, who are already doing a much more effective job for this country. As matters stand we ought to be paying Montreal and getting out of the business. Further comment: I gather from the categories listed under user classification that the operation is conducted with specialty users exclusively in mind, and private citizens ignored. This is precisely the policy against which the Revolution of 1776-82 was fought. Question 11 supports the assumption that the individual taxpayer and his "personal involvements" is left out of consideration.
800. Lets face it, WWV does not serve New England!
801. I view a reduction of signal strength as a very detrimental move for marine navigational purposes.
802. WWV accurate time reports are essential to accurate navigation. With the advent of inexpensive receivers (Re- time cube \$29.95-Freq. 5-10-15) expensive chronometers are unnecessary.
803. The Geophysics Group of the University of presently makes extensive use of some of the services the Time and Frequency Division provides. The most used service is the 60 kHz WWVB which is recorded at remote unmanned stations with other geophysical data. Any change in this service would probably cause severe financial difficulties for these geophysical studies. I hope that you do not contemplate any reduction of power or service on this frequency.
- Over the last several years, I have made frequent use of other services between 2.5 and 20 MHz, both in Alaska and the Canadian north. Generally I have found 2.5 MHz to be unreceivable. Under varying propagation conditions the ability to select the best signal from 5, 10, or 15 MHz was extremely useful. Please note, in this regard that in Alaska under poor propagation conditions (e.g. auroral ionization) that WWV was almost never heard, but WWVH was sometimes copied.
804. Telephone line very useful for those w/o short wave. However, line is frequently busy, disconnects caller abruptly, often before he has had time to utilize message.

805. I believe in God and WWV.
806. There is no inexpensive time/frequency service available in Alaska. The Telecommunications (RCA Alascom and DCS White Alice) do not provide time or audio tone standards. Bush residents, amateur operators, and technicians at field sites depend on WWVH and WWV due to absence of alternate sources of standards.
807. Our fleet of aircraft have the now highly accurate clocks that all flight logs, schedules and records are based on. Update of these clocks is based on radio time checks.
808. Your service is one of the few good things left in a generally declining picture. It would not be a good commentary on our pride as a nation to have to rely on CHU for time service. This will happen to the eastern third of the U. S. if you cut the power.
809. I am responsible for the training of Navigators in precise navigation and mission timing. Accurate time is imperative for our military missions. Reduction of power for WWVH would sometimes prevent obtaining accurate time for celestial navigation in the Pacific Area.
810. I suggest that the power be cut in half on one frequency at a time and see if there are many reports about bad reception. Most people don't realize how little a power reduction of 50% would make in reception. The resulting decrease in received signal strength would be only 3 db. This is about $\frac{1}{2}$ of an 'S' Unit. Most people could not detect the difference. The average person probably would expect a power reduction of 50% to result in a reduction of service area by 50%. Re WWVH
- I suggest that the 25 MHz transmissions be eliminated completely. Leave 5, 10 and 15 MHz the way they are. Operate on 20 MHz only in the daytime. Operate on 2.5 MHz only at night. Re WWV
811. I think one of the Synchronous Orbit Satellites should be utilized for time and frequency broadcast on one of the VHF frequencies. Such line of sight conditions should clear up many of the problems encountered in receiving WWV.
812. WWV is Never interfered with--WWVH is Always interfered with by Russian Time/Frequency transmissions and others.
813. We are a 24 hour a day watchkeeping shipboard station of a large passenger carrying liner where precise navigation is required and time accuracy is vitally important to such requirements.
814. Time of day BCD code will soon be used.
815. The FCC has dropped the requirements that broadcast stations have a frequency monitor in operation at all times. However, they have NOT released the requirements that transmitters have to be maintained at correct frequency. The FCC permits the engineers to use external measuring equipment but this equipment must be calibrated with WWV.

816. While my marks show I use the time signal sometimes while ocean cruising they are absolutely indispensable. My opinion is that they are one of the best services available from the Government. A 50% reduction in power would probably make the signal inaudible to the user of an ordinary portable radio.
817. The worst feature is the interference between time signals of several nations all on the same frequencies with WWV/WWVH. This is especially bad in the Western North Pacific where Russian, Japanese and Red Chinese time signals compete with WWVH.
818. The WWV/WWVH Stations should stick to time and frequency transmissions only. There are enough agencies broadcasting weather/propagation etc. A system suitable for regular navigation and other navigation systems time, plus frequency stability is all your stations should really be providing. All the rest is just so much noise and actually makes the primary time usage of the station difficult.
819. Aboard ship traveling world wide the continuous service of WWV/WWVH is heavily relied upon and would consider a reduction of power on 5, 10, and 15 MHz most detrimental.
820. As Chief of Training in a flying unit, I can assure you that the loss of WWV, WWVH would seriously degrade unit navigation capability.
821. The questionnaire is rather ridiculous since your broadcast strength to the North Atlantic is so poor that it is only marginally useful close to the U.S. coast. Mostly at night, and not ordinarily receivable over the North and South Atlantic that we cover. We must use Canadian time ticks, BBC, Radio South Africa, etc. in lieu of WWV reception. If you wish to save power just abandon the whole thing as a ocean navigation aid, at least in the Atlantic. If you intend it to be a reliable service transmit from an east coast station. Why not take over some of VOA propaganda stations to do something usefull?
822. If you reduce signal strength we in South Africa will not receive WWVH at all. WWVH is the main transmission we receive. We very rarely get WWV. Please do not reduce signal strength on WWVH.
823. Since navigation has increasingly fewer uses for the 200-400 KHz long wave band and many receivers are equiped to receive it, establish a one megawatt transmitter on 300 KHz. That could blanket North America reliably all the time providing all the services currently offered on WWV. The FCC could locate this without even batting an eyelash!
824. I am primarily responding to seismic data recording requirements. We would like very much to receive the BCD code but the signal strength is not sufficient for this.
825. WWV provides a very necessary service in a very professional way.
826. This is the only way we can calibrate highly accurate watches without investing \$2500 in a timing machine.
827. Fleet of 17 tankers, 80 Ocean tugs and barges. This is a vital service to our fleet.

828. (U.S. Air Force Manual AFM-100-15 Requirement for Time and Frequency)
There is no other way! I am secondary frequency standard for about 100 other stations, daily.
829. Insofar as Merchant Marine use is concerned, the weather broadcasts are replicated lavishly by other Federal Agencies. The geomagnetic material is useless and so are propagation forecasts in the kind of practical work we do. As far as the Merchant Marine is concerned, you could operate 5 minutes each hour and fill every need we have from NBS for navigation and communications.
830. Without your program, each watchmaker would have to lay our approximately \$3000 for a machine to time out certain watches.
831. As a member of a SAC Air Refueling Sqdn. my answers should be representative of the use of WWV by all members of this flying unit. However, others in this unit often fly into other geographic areas and need frequent time signals there.
832. We learned of the 303 499 7111 telephone service from this questionnaire. We plan to use it frequently in the future.
833. Don't change--we love you as is!
834. The signal from WWV is used to regulate the time for the Canal Co. and the Republic of .
835. We check our aircraft clocks at the beginning of EVERY flight against your time signal.
836. On the European side of North Atlantic WWV this half year has been somewhat weak and not able to take on 10 mc/s but have been able to get time signals on 5 mc/s.
837. This is one of the few tax dollars I don't mind paying.
838. To save money why not have a joint effort with CHU-Canada-for example you cover the West Coast and let them cover the East Coast.
839. Some sections within 3 miles of each other will blackout at times--will "come back" after a while--stay strong and then fade--this time is not regular and complete fade out results frequently in Potomac River area.
840. At sea WWV is virtually the voice of God. Please do not reduce service or signal strength.
841. We need better reception in the South Florida-Cuba Bahamas area.
842. You folks need some P.R! Did not know about weather, geoalerts, propagation forecasts, etc.
843. I consider the services rendered by WWV/WWVH the best and most reliable of all Government Services that my tax dollars pay for. Please don't scrimp.

844. Response officially represents the primary extent of utilization of NBS (WWV) service by FCC District and Sub-Office, , Fla. Keep up the good work. In my opinion it is vital to our functions.
845. Time ticks, weather and chronometer rates most useful in conjunction with US Power Squadron instruction and navigation.
846. For safety and navigation of thousands of sail and power boats on both coasts and at sea continued WWV and WWVH broadcasts are essential.
847. WWV provides an extremely valuable service--I feel there are other areas of government where cuts should be made that would be more effective.
848. It has seemed to me that the operation of WWV might be modified to operate less expensively while not causing inconvenience to anybody.
- If the NOAA broadcasts, which are available all over the country to extremely inexpensive receivers, were to carry time signals, time would be even more available than it is. WWV might reasonably reduce its power substantially, then, for anybody far enough away so that he couldn't get WWV or NOAA broadcasts would certainly be carrying receiving equipment capable of receiving time signals broadcast by other nations.
849. I work for . use WWV for setting standard clocks and watches. Deep water cruising--WWV and WWVH are the cheapest and most reliable chronometer I have aboard.
850. The time available to the navigator should continue to be more precise than the navigational data in The Nautical Almanac.
851. All of Atlantic and Pacific Oceans have had WWVH QRM'ing WWV WX broadcasts in Pacific runs. Russian QRM during Atlantic runs..10 and 15 MC.
852. Handicap sail yacht--based on elapsed time. Crystal clocks are set and checked against WWV approximately 3 times weekly --December through May.
853. Wish we had a similar radio station here in New Zealand!
854. Fleet Captain for Yacht Club Council--representing 16 Yacht Clubs approximately 180 ocean cruising sailboats using WWV for time signals/navigation.
855. Must use CHU Canada mostly. Signal strength of WWV extremely poor in New York City area.
856. Suspect cost of this survey would pay for three years operations.
857. I would like more A-440!
858. This report filed by USS (SSNE) WWV plays an important part in submarine operations in that it allows a submarine to check clocks without difficulty.

859. This is one of the few areas in which we are still World leaders. We must maintain leadership wherever possible, if not in politics, at least in science. WWV and WWVH are services that benefit every one in the World, directly or indirectly.
860. Use WWV for calibration and setting of industrial time in/out clocks.
861. Field techniques and instrumentation have been devised which rely on time signals received on portable SW receivers to set, check, and control hydrologic data collection operations of instruments positioned at remote field sites. U.S. Geological Survey
862. Represents use of personnel and equipment aboard NOAA ship .
863. In the future out time must be more accurate. With the coming of the Quartz time pieces we must have an accurate source of time.
864. There are many others in my class that you will probably not hear from and too, this particular need is increasing in surveying.
865. My self and numerous others who I have worked with over the last four years at our present operating location, have had many problems receiving WWVH, due to weak signal and interference. We have tried different types of receivers and antenna's, with the same results.
866. Light background music added would get my wife off my back.
867. Doubt sensibility of reducing power--Russian and Chinese override WWV and WWVH in Far East and Indian Ocean already. "Safety of Life at Sea" considerations.
868. Navigator of a SAC EC-135 with four crew members. Requested survey because was concerned about possible curtailing of present broadcasts and signal strength. Primary means of time hack is from WWV while aboard aircraft (ground or airborne).
869. I appreciate time service. I am a watch and clock repairman and precision time is necessary. Where else could I get it.
870. No reduction of power!!! The service now available is needed for the safety of my Vessel--crew, and accompanying boats. For safety and life, in no way can this service be cut. It also grows each day.
871. Easiest to use of all time ticks/the only one which broadcasts the hour and minute with no need to decode. The only one readily available on all Oceans. An absolutely essential service for all who use the seas Worl Wide. Please Please continue full power--all frequency service.
872. On this trade route, mainland U.S. to Hawaii we find the present service to be more than adequate.

873. In Pacific JJY-BPM-RTA-RKM anywhere stronger than WWVH. In Mediterranean WWV QSA Ø-RTA-RKM and E. Med. early morning hours BPM being heard and signal strong on 5 Mc/s, 15 Mc/s RTA-RKM-RWM very good. WWV halfway Atlantic to east useless. If this questionnaire put out earlier one would find out that signal was inadequate in strength almost anywhere. Request stronger signals.
874. Most of our use is within range of VHF. A combined weather service and time service would make sense.
875. WWV and WWVH have served as flags of U.S. World leadership in science and technology for many years. Any weakening of service now will serve notice to the World of a general weakening and deterioration of the U.S. World position of leadership--all for saving the cost of a few lousy kilowatts of power. Furthermore, any weakening or partial abandonment of channels will leave a vacuum which will immediately be appropriated by potential U.S. adversaries.
876. I strongly object to any cut backs in power and service. This is a legitimate function of the Federal government and a very necessary one.
877. Believe this service, used by navigators and others world wide, represents a part of the image of the United States as the foremost contributor to global understanding and technology. It would seem a matter of American prestige is involved in maintaining WWV and WWVH to the present high standards. If retrenchment is necessary, let it begin with some Washington boondoggles!
878. We appreciate your services very much and hope that the required cost and energy savings can be achieved through curtailment of less essential services elsewhere.
879. Since 1948 I have regularly listened to and used WWV. The energy of power used is slight in comparison with international broadcasting. Yet WWV presents an objective universally accepted service that may actually be more positive in World public opinion than many propaganda oriented voice of America programs.
- 880.

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET		1. PUBLICATION OR REPORT NO. NBS Technical Note 674	2. Gov't Accession No.	3. Recipient's Accession No.
4. TITLE AND SUBTITLE Report on the 1975 Survey of Users of the Services of Radio Stations WWV and WWVH			5. Publication Date October 1975	
			6. Performing Organization Code Div. 277	
7. AUTHOR(S) J. A. Barnes, R. E. Beehler			8. Performing Organ. Report No. NBS TN-674	
9. PERFORMING ORGANIZATION NAME AND ADDRESS NATIONAL BUREAU OF STANDARDS DEPARTMENT OF COMMERCE WASHINGTON, D.C. 20234			10. Project/Task/Work Unit No. 2776128	
			11. Contract/Grant No.	
12. Sponsoring Organization Name and Complete Address (Street, City, State, ZIP) Same as Item 9.			13. Type of Report & Period Covered	
			14. Sponsoring Agency Code	
15. SUPPLEMENTARY NOTES				
16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.) The users of the National Bureau of Standards (NBS) radio stations WWV and WWVH were surveyed by means of a questionnaire. The questionnaire was distributed to the station mailing list, published in some periodicals, and its availability was announced on the stations themselves and publicized in other periodicals. More than 12,000 completed questionnaires were returned, which revealed, among other things, that the 5, 10, and 15 MHz transmissions were the most used frequencies; 25 MHz was the least used. Of the information contained on the broadcasts, the voice time-of-day announcement was the most important, and the DUT1 values the least important. In general the returns were very supportive of the services, with only two of the more than 12,000 responses advocating a complete shutdown of the broadcasts.				
17. KEY WORDS (six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons) Frequency; questionnaire; standard frequency and time broadcasts; time				
18. AVAILABILITY <input checked="" type="checkbox"/> Unlimited <input type="checkbox"/> For Official Distribution. Do Not Release to NTIS <input checked="" type="checkbox"/> Order From Sup. of Doc., U.S. Government Printing Office Washington, D.C. 20402, SD Cat. No. C13 :46:674 <input type="checkbox"/> Order From National Technical Information Service (NTIS) Springfield, Virginia 22151			19. SECURITY CLASS (THIS REPORT) UNCLASSIFIED	21. NO. OF PAGE 91
			20. SECURITY CLASS (THIS PAGE) UNCLASSIFIED	22. Price \$1.50

NBS TECHNICAL PUBLICATIONS

PERIODICALS

JOURNAL OF RESEARCH reports National Bureau of Standards research and development in physics, mathematics, and chemistry. It is published in two sections, available separately:

• **Physics and Chemistry (Section A)**

Papers of interest primarily to scientists working in these fields. This section covers a broad range of physical and chemical research, with major emphasis on standards of physical measurement, fundamental constants, and properties of matter. Issued six times a year. Annual subscription: Domestic, \$17.00; Foreign, \$21.25.

• **Mathematical Sciences (Section B)**

Studies and compilations designed mainly for the mathematician and theoretical physicist. Topics in mathematical statistics, theory of experiment design, numerical analysis, theoretical physics and chemistry, logical design and programming of computers and computer systems. Short numerical tables. Issued quarterly. Annual subscription: Domestic, \$9.00; Foreign, \$11.25.

DIMENSIONS/NBS (formerly Technical News Bulletin)—This monthly magazine is published to inform scientists, engineers, businessmen, industry, teachers, students, and consumers of the latest advances in science and technology, with primary emphasis on the work at NBS. The magazine highlights and reviews such issues as energy research, fire protection, building technology, metric conversion, pollution abatement, health and safety, and consumer product performance. In addition, it reports the results of Bureau programs in measurement standards and techniques, properties of matter and materials, engineering standards and services, instrumentation, and automatic data processing.

Annual subscription: Domestic, \$9.45; Foreign, \$11.85.

NONPERIODICALS

Monographs—Major contributions to the technical literature on various subjects related to the Bureau's scientific and technical activities.

Handbooks—Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

Special Publications—Include proceedings of conferences sponsored by NBS, NBS annual reports, and other special publications appropriate to this grouping such as wall charts, pocket cards, and bibliographies.

Applied Mathematics Series—Mathematical tables, manuals, and studies of special interest to physicists, engineers, chemists, biologists, mathematicians, computer programmers, and others engaged in scientific and technical work.

National Standard Reference Data Series—Provides quantitative data on the physical and chemical properties of materials, compiled from the world's literature and critically evaluated. Developed under a world-wide

program coordinated by NBS. Program under authority of National Standard Data Act (Public Law 90-396).

NOTE: At present the principal publication outlet for these data is the Journal of Physical and Chemical Reference Data (JPCRD) published quarterly for NBS by the American Chemical Society (ACS) and the American Institute of Physics (AIP). Subscriptions, reprints, and supplements available from ACS, 1155 Sixteenth St. N. W., Wash. D. C. 20056.

Building Science Series—Disseminates technical information developed at the Bureau on building materials, components, systems, and whole structures. The series presents research results, test methods, and performance criteria related to the structural and environmental functions and the durability and safety characteristics of building elements and systems.

Technical Notes—Studies or reports which are complete in themselves but restrictive in their treatment of a subject. Analogous to monographs but not so comprehensive in scope or definitive in treatment of the subject area. Often serve as a vehicle for final reports of work performed at NBS under the sponsorship of other government agencies.

Voluntary Product Standards—Developed under procedures published by the Department of Commerce in Part 10, Title 15, of the Code of Federal Regulations. The purpose of the standards is to establish nationally recognized requirements for products, and to provide all concerned interests with a basis for common understanding of the characteristics of the products. NBS administers this program as a supplement to the activities of the private sector standardizing organizations.

Federal Information Processing Standards Publications (FIPS PUBS)—Publications in this series collectively constitute the Federal Information Processing Standards Register. Register serves as the official source of information in the Federal Government regarding standards issued by NBS pursuant to the Federal Property and Administrative Services Act of 1949 as amended, Public Law 89-306 (79 Stat. 1127), and as implemented by Executive Order 11717 (38 FR 12315, dated May 11, 1973) and Part 6 of Title 15 CFR (Code of Federal Regulations).

Consumer Information Series—Practical information, based on NBS research and experience, covering areas of interest to the consumer. Easily understandable language and illustrations provide useful background knowledge for shopping in today's technological marketplace.

NBS Interagency Reports (NBSIR)—A special series of interim or final reports on work performed by NBS for outside sponsors (both government and non-government). In general, initial distribution is handled by the sponsor; public distribution is by the National Technical Information Service (Springfield, Va. 22161) in paper copy or microfiche form.

Order NBS publications (except NBSIR's and Bibliographic Subscription Services) from: Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

BIBLIOGRAPHIC SUBSCRIPTION SERVICES

The following current-awareness and literature-survey bibliographies are issued periodically by the Bureau:

Cryogenic Data Center Current Awareness Service

A literature survey issued biweekly. Annual subscription: Domestic, \$20.00; foreign, \$25.00.

Liquefied Natural Gas. A literature survey issued quarterly. Annual subscription: \$20.00.

Superconducting Devices and Materials. A literature

survey issued quarterly. Annual subscription: \$20.00. Send subscription orders and remittances for the preceding bibliographic services to National Technical Information Service, Springfield, Va. 22161.

Electromagnetic Metrology Current Awareness Service Issued monthly. Annual subscription: \$100.00 (Special rates for multi-subscriptions). Send subscription order and remittance to Electromagnetics Division, National Bureau of Standards, Boulder, Colo. 80302.

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

OFFICIAL BUSINESS

Penalty for Private Use, \$300

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE
COM-215

FOURTH CLASS MAIL

